

Electrical Sector Solutions

# Volume 6: Solid-State Motor Control

**EATON**

*Powering Business Worldwide*

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**Volume 2—Commercial Distribution**

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**Volume 3—Power Distribution and Control Assemblies**

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## Dimensions, Weights and Ratings

Dimensions, weights and ratings given in this catalog **are approximate and should not be used for construction purposes**. Drawings containing exact dimensions are available upon request. All listed product specifications and ratings are subject to change without notice. Photographs are representative of production units.

## Terms and Conditions

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## Technical and Descriptive Publications

This catalog contains brief technical data for proper selection of products. Further information is available in the form of technical information publications and illustrated brochures. If additional product information is required, contact your local Eaton Products Distributor, call **1-800-525-2000** or visit our website at **www.eaton.com**.

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## WARNING

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These catalog pages do not purport to cover all details or variations in equipment, nor to provide for every possible contingency to be met in connection with installation, operation or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the local Eaton Products Distributor or Sales Office. The contents of this catalog shall not become part of or modify any prior or existing agreement, commitment or relationship. The sales contract contains the entire obligation of Eaton's Electrical Sector. The warranty contained in the contract between the parties is the sole warranty of Eaton. Any statements contained herein do not create new warranties or modify the existing warranty.



Powering Business Worldwide

**Eaton is a global leader in power distribution, power quality, control and automation, and monitoring products.**

At Eaton, we believe a reliable, efficient and safe power system is the foundation of every successful enterprise. Through innovative technologies, cutting-edge products and our highly skilled services team, we empower businesses around the world to achieve a powerful advantage.

In addition, Eaton is committed to creating and maintaining powerful customer relationships built on a foundation of excellence. From the products we manufacture to our dedicated customer service and support, we know what's important to you.

## Solutions

Eaton takes the complexity out of power systems management with a holistic and strategic approach, leveraging our industry-leading technology, solutions and services. We focus on the following three areas in all we do:

- Reliability—maintain the appropriate level of power continuity without disruption or unexpected downtime
- Efficiency—minimize energy usage, operating costs, equipment footprint and environmental impact
- Safety—identify and mitigate electrical hazards to protect what you value most

## Using the Eaton Catalog Library

As we grow, it becomes increasingly difficult to include all products in one or two comprehensive catalogs. Knowing that each user has their specific needs, we have created a library of catalogs for our products that when complete, will contain 15 volumes. Since the volumes will continuously be a work in progress and updated, each volume will stand alone. Refer to our volume directory, MZ08100001E, for a quick glance of where to look for the products you need. The 15 volumes include:

- Volume 1—Residential and Light Commercial (CA08100002E)
- Volume 2—Commercial Distribution (CA08100003E)
- Volume 3—Power Distribution and Control Assemblies (CA08100004E)
- Volume 4—Circuit Protection (CA08100005E)
- Volume 5—Motor Control and Protection (CA08100006E)
- Volume 6—Solid-State Motor Control (CA08100007E)
- Volume 7—Logic Control, Operator Interface and Connectivity Solutions (CA08100008E)
- Volume 8—Sensing Solutions (CA08100010E)
- Volume 9—Original Equipment Manufacturer (CA08100011E)
- Volume 10—Enclosed Control (CA08100012E)
- Volume 11—Vehicle and Commercial Controls (CA08100013E)
- Volume 12—Aftermarket, Renewal Parts and Life Extension Solutions (CA08100014E)
- Volume 13—Counters, Timers and Tachometers (CA08100015E)—Available in electronic format only
- Volume 14—Fuses (CA08100016E)—Available in electronic format only
- Volume 15—Solar Inverters and Electrical Balance of System (CA08100018E)

These volumes are not all-inclusive of every product, but they are meant to be an overview of our product lines. For our full range of product solutions and additional product information, consult [Eaton.com/electrical](http://Eaton.com/electrical) and other catalogs and product guides in our literature library. These references include:

- The Consulting Application Guide (CA08104001E)
- The Eaton Power Quality Product Guide (COR01FYA)

If you don't have the volume that contains the product or information that you are looking for, not to worry. You can access every volume of the catalog library at [Eaton.com/electrical](http://Eaton.com/electrical) in the Literature Library.

By installing our Automatic Tab Updater (ATU), you can be sure you always have the most recent version of each volume and tab.



## Icons



### Green Leaf

Eaton Green Solutions are products, systems or solutions that represent Eaton benchmarks for environmental performance. The green leaf symbol is our promise that the solution has been reviewed and documented as offering exceptional, industry-leading environmental benefits to customers, consumers and our communities. Though all of Eaton's products and solutions are designed to meet or exceed applicable government standards related to protecting the environment, our products with the Green Leaf designation further provide "exceptional environmental benefit."



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### Drawings Online

When you see the Drawings Online icon, go to [Eaton.com/electrical](http://Eaton.com/electrical) and find the products page. There you will find a tab that includes helpful product drawings and illustrations.

## Contact Us

If you need additional help, you can find contact information under the Customer Care heading of [Eaton.com/electrical](http://Eaton.com/electrical).

## Soft Start Controllers



## DS7 Soft Starter Controller



## S611 Soft Starters



## S811+ Soft Starters



## 1.1 Solid-State Controllers

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**Soft Start Controllers**



**Product Overview**

**DS7**

Eaton’s DS7 line of reduced voltage solid-state soft start controllers is very compact, multi-functional, easy to install and easy to commission. Designed to control the acceleration and deceleration of three-phase motors with the ability to adjust initial torque, ramp up and down time, the device is available for current ranges from 4 to 32 A in four frame sizes.

**Type S701**

The S701 device is a reduced voltage soft start controller designed to control acceleration and deceleration of three-phase motors. The S701 provides the user with the ability to adjust initial torque, ramp up and down time, and also select kick start for high inertial loads.

**Type S701 with Auxiliary Contact**

The S701 device is a reduced voltage soft start controller designed to control acceleration and deceleration of three-phase motors. With the auxiliary contact, it is possible to control an external bypass to reduce heating and increase acceleration and deceleration times.

The unit provides the user with the ability to adjust initial torque, ramp up and down time and also select kick start for high inertia loads.

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**Type S701 with Brake**

The S701 soft start controller with DC injection brake is designed to control acceleration and deceleration of three-phase motors. Brake current is adjustable from 0–50 A DC. The ramp-up feature is adjustable from 0.5–10 seconds. Torque adjustment is adjustable with or without break loose (kick start) function.

**Type S511 Semiconductor Reversing Contactor**

The S511 device is a semiconductor reversing contactor designed to switch three-phase motors forward and reverse. Unicore electronics and thermal design ensures high switching capacity and long lifetime.



### DS7 Soft Start Controllers



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## DS7 Soft Start Controllers

### Product Description

The DS7 is available in standard and SmartWire-DT® communications configurations.

#### Standard (Non SmartWire-DT)

Eaton's DS7 line of reduced voltage solid-state soft start controllers is very compact, multi-functional, easy to install and easy to commission. Designed to control the acceleration and deceleration of three-phase motors, the device is available for current ranges from 4 to 200 FLA in four frame sizes. It is available with 24 Vdc, 24 Vdc/24 Vac, or 110/230 Vac control voltage options. A low temperature version is available with 24 Vac/Vdc control voltage with operation ambient temperature minimum of -40 °C.

#### SmartWire-DT

Our SmartWire-DT interface completely eliminates the need for conventional control wiring. This has several advantages:

- No incorrect wiring
- Faster wiring
- Cost saving

The interface can be used to send control commands to the DS7 SmartWire-DT and change and diagnose its parameter configuration; in addition, the control electronics can be powered via the SmartWire-DT cable. The device is controlled with one of the selectable profiles:

- A "start/stop" profile
- An 8 bit-wide profile for the soft starter, which is provided the same way for the variable frequency drive and features more options

Regardless of the profile chosen, the DS7 SmartWire-DT's parameters can be read and written to at any time by using acyclic communications services.

DS7 SmartWire-DT makes it possible to read and write to all device parameters. It is also possible to overwrite the potentiometer settings on the DS7 SmartWire-DT, which can come in handy, for instance, when a change made to the machine needs to be performed remotely.

The DS7 SmartWire-DT comes with a detailed diagnostic system with options that extend far beyond those of wired devices. In addition to having an error log, the DS7 SmartWire-DT can detect and report nine different device faults. A warning parameter reports any present warning messages. Moreover, the response to each individual fault can be customized. Finally, there are 35 additional messages for communication errors. Using the DS7 SmartWire-DT in connection with the PKE series motor protective circuit breakers opens up new functionalities that were previously thought impossible to implement with a low-cost soft starter and that were reserved to significantly more expensive devices. Combining a PKE unit and a DS7 SmartWire-DT makes it possible to completely protect the DS7 SmartWire-DT device against overloads. In addition, it provides a current limiting function and can report thermal capacity utilization levels to higher level controllers.

## Application Description

With its small size, it can easily fit in place of existing soft starters, wye-delta starters, or across-the-line NEMA® and IEC starters. This feature allows easy upgrades to existing systems. The product is designed to be wired in the three-phase line feeding the three motor input leads as is done for normal across-the-line starting. The starter uses silicon controlled rectifiers (SCRs) to ramp the voltage to the motor, providing smooth acceleration and deceleration of the load. After the motor is started, the internal run bypass relay closes, resulting in the motor running directly across-the-line. Internal run bypass significantly reduces the heat generated as compared to non-bypass starters. The soft stop option allows for a ramp stop time that may be longer than the coast-to-stop time. An external overload protection relay or circuit breaker is needed.

## Operation

### Voltage Ramp Start

This start method provides a voltage ramp to the motor, resulting in a constant torque increase. This most commonly used form of soft start mode allows you to set the initial voltage value and the duration of the ramp to full voltage conditions.

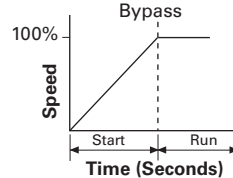
- Adjustable initial voltage 30–92% of full voltage (120/230 Vac control voltage)
- Adjustable initial voltage 30–100% of full voltage (24 Vac/Vdc control voltage)
- Adjustable initial voltage 30–92% of full voltage (24 Vdc control voltage—SmartWire-DT)
- Adjustable ramp time 1–30 seconds
- Bypass relays close at the end the ramp time (TOR)

### Soft Stop

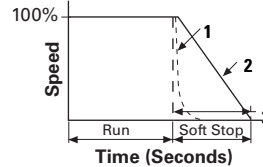
Allows for a controlled stopping of load. Used when a stop-time that is greater than the coast-to-stop time is desired. Often used with high friction loads where a sudden stop may cause system or product damage. Setting the soft stop time to a value of 0 turns off this feature.

- Soft stop time = 0–30 seconds

### Start Ramp



### Stop Ramp



- 1 = Coast to Stop (Speed)
- 2 = Soft Stop Ramp (Voltage)
- 3 = Soft Stop Time

### Auxiliary Contacts

Auxiliary contacts are provided to indicate soft start controller status.

### Frame Size 1 (4A to 12A)—One Relay

The auxiliary relay indicates when the soft starter is at Top-of-Ramp (TOR).

### Frame Size 2, 3 and 4 (16A to 200A)—Two Relays

One auxiliary relay indicates when the soft starter is at Top-of-Ramp (TOR).

One auxiliary relay indicates that a RUN command is present, including start ramp, bypass, and stop ramp times.

### Features and Benefits

- Run bypass mode greatly reduces internal heating created by the power dissipation across the SCRs. The bypass relay directly connects the motor to the line and improves system efficiency by reducing internal power losses
- Less heat minimizes enclosure size and cooling requirements, and maximizes the life of all devices in the enclosure
- LED displays device status and provides fault indication
- Variable ramp times and voltage control (torque control) settings provide unlimited starting configurations, allowing for maximum application flexibility
- Soft stop control suits applications where an abrupt stop of the load is not acceptable. Soft acceleration and deceleration reduces wear on belts, gears, chains, clutches, shafts, and bearings
- Minimizes the peak inrush current's stress on the power system. Peak starting torque can be managed to diminish mechanical system wear and damage.
- 24 Vac/Vdc control voltage enhances personnel and equipment safety. 110/230 Vac control voltage is also available
- Auxiliary relays indicate status of the soft start controllers
  - The TOR relay is active until motor stop command is received and/or the soft start controller detects a fault condition
  - RUN relay is active during the start ramp, bypass, and stop ramp

### Single-Phase Applications

All DS7 frame sizes can be configured for single-phase operation at 200–480 Vac main voltages in accordance to the single-phase application note AP039006EN.

### Standards and Certifications

- IEC 60947-4-2
- EN 60947-4-2
- UL® listed
- CSA certified
- CE marked
- C-Tick



### Instructional Leaflets

- Instruction Leaflet IL03901001E

### Protective Features

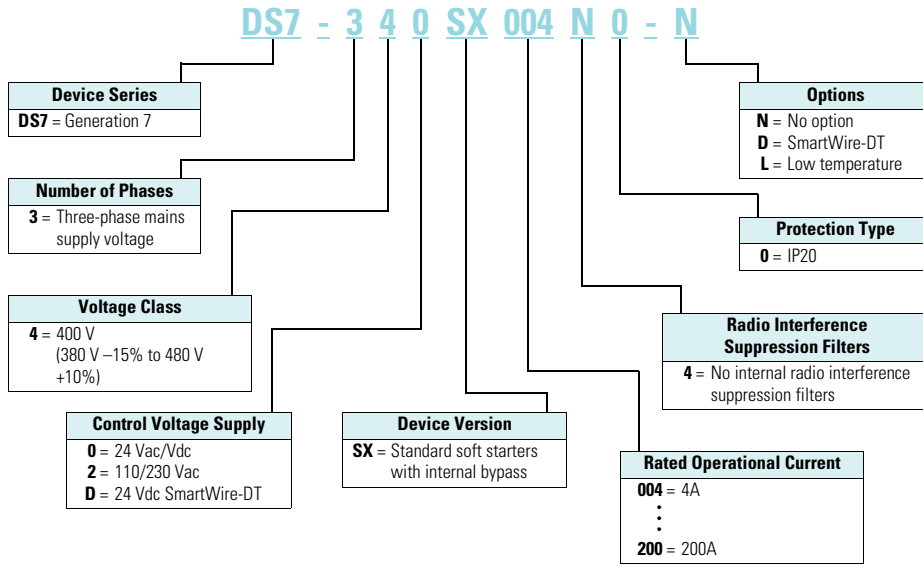
- Mains connection—The mains connection is monitored for a phase loss and/or undervoltage during ramp up
- Motor connection—The motor connection is monitored for an open condition during the ramp
- SCR faults—SCR performance is monitored during the ramp cycle for proper operation
- Heat sink over/under temperature—High ambient temperatures, extended ramp times, and high duty cycle conditions may cause the DS7 to exceed its thermal rating. When temperature goes under  $-5\text{ }^{\circ}\text{C}$  ( $-40\text{ }^{\circ}\text{C}$  for low temperature units), unit will trip as well. The DS7 is equipped with sensors that monitor the temperature of the device as well. The soft starter will trip in over/under temperature conditions, preventing device failure
- Warning is indicated for an over temperature condition for the next start
- Bypass relay
  - The DS7 can detect if the bypass relay fails to close after the ramp start or opens while the motor is running
  - The DS7 will also detect a condition whereas the bypass relay is closed when the RUN command is given
  - The DS7 will trip on a bypass dropout fault if either of these conditions occur



#### 1

### Catalog Number Selection

#### DS7 Soft Start Controllers



### Product Selection

#### DS7 Soft Start Horsepower Ratings

Please refer to Application Note AP039004EN for additional information on proper size selection.

DS7 Soft Start Controller—  
Frames 1 and 2



#### DS7 Soft Start Controllers—Horsepower Ratings— 10 Second Ramp, One Start per Hour, 300% Current Limit at 40 °C ①

Rated Current (A)	Motor Power (hp)			Maximum Allowable Breaker Size	Maximum Allowable Fuse Size	Recommended XTOB Overload (Direct Connect) ②	Recommended XTOE Overload ②	PKE MMP	MMP ②	Connection Kit to MMP	Catalog Number
	200 V	230 V	480 V								
3.7	0.75	0.75	2	HFD3015	15A Class RK5	XTOB004BC1	XTOE005BCS	XTPE012BCS	XTPR004BC1	XTPAXTPCB	DS7-340SX004N0-N ④⑤
											DS7-342SX004N0-N ⑥
											DS7-34DSX004N0-D ⑦
6.9	1.5	2	3	HFD3015	15A Class RK5	XTOB006BC1 ③	XTOE020BCS	XTPE012BCS	XTPR06P3BC1	XTPAXTPCB	DS7-340SX007N0-N ④⑤
											DS7-342SX007N0-N ⑥
											DS7-34DSX007N0-D ⑦
7.8	2	2	5	HFD3020	20A Class RK5	XTOB010BC1	XTOE020BCS	XTPE012BCS	XTPR010BC1	XTPAXTPCB	DS7-340SX009N0-N ④⑤
											DS7-342SX009N0-N ⑥
											DS7-34DSX009N0-D ⑦
11	3	3	7.5	HFD3030	20A Class RK5	XTOB012BC1	XTOE020BCS	XTPE032BCS	XTPR012BC1	XTPAXTPCB	DS7-340SX012N0-N ④⑤
											DS7-342SX012N0-N ⑥
											DS7-34DSX012N0-D ⑦
15.2	3	5	10	HFD3035	25A Class RK5	XTOB016CC1	XTOE020CCS	XTPE032BCS	XTPR016BC1	XTPAXTPCC	DS7-340SX016N0-N ④⑤
											DS7-342SX016N0-N ⑥
											DS7-34DSX016N0-D ⑦
22	5	7.5	15	HFD3060	40A Class RK5	XTOB024CC1	XTOE045CCS	XTPE032BCS	XTPR025BC1	XTPAXTPCC	DS7-340SX024N0-N ④⑤
											DS7-342SX024N0-N ⑥
											DS7-34DSX024N0-D ⑦
32	7.5	10	20	HFD3070	50A Class RK5	XTOB032CC1	XTOE045CCS	XTPE032BCS	XTPR032BC1	XTPAXTPCC	DS7-340SX032N0-N ④⑤
											DS7-342SX032N0-N ⑥
											DS7-34DSX032N0-D ⑦

#### Notes

- ① Actual motor FLAs vary. Verify these devices cover the motor specific FLA.
- ② Selections are based on motor FLA value at 480 V.
- ③ Not to be used with 230 V.
- ④ 24 Vac/Vdc device.
- ⑤ -40 °C rated low temperature version available in 24 Vac/Vdc, change to "N0-L."
- ⑥ 110/230 Vac device.
- ⑦ 24 Vdc for SmartWire-DT device.

#### Considerations

1. Either XTOB, C306 or C440 series or equivalent overload protection devices may be selected.
2. Contactor is optional for normal applications. It is recommended for mains isolation.

#### Power Supply

Eaton's PSG and ELC power supplies are recommended as a compact and low-cost source for 24 Vdc power. The lightweight, DIN rail mounted devices have a wide input voltage range, and robust screw terminals make these power supplies easy to install and use. These power supplies are available in 1A and 2A models.

#### Power Supply Selection

Description	Catalog Number
85–264 V input and 24 Vdc output	ELC-PS01
100–240 V input and 24 Vdc output	PSG60E
400–500 V input and 24 Vdc output	PSG60F24RM

Please refer to Application Note AP039004EN for additional information on proper size selection.

DS7 Soft Start Controller—  
Frames 3 and 4



### DS7 Soft Start Controllers—Horsepower Ratings— 10 Second Ramp, One Start per Hour, 300% Current Limit at 40 °C

Rated Current (A)	Motor Power (hp)			Maximum Allowable Breaker Size ①	Maximum Allowable Fuse Size ①	Recommended XTOB Overload	Recommended C440 Overload	Catalog Number
	200 V	230 V	460 V					
40	10	10	30	HFD3150L	150A Class RK5	XTOB040DC1 ②	C440A1A045SAX	DS7-340SX041N0-N ⑤⑥
								DS7-342SX041N0-N ⑦
								DS7-34DSX041N0-D ⑧
52	15	20	40	HFD3200L	200A Class RK5	XTOB057DC1 ②	C440B1A100SAX	DS7-340SX055N0-N ⑤⑥
								DS7-342SX055N0-N ⑦
								DS7-34DSX055N0-D ⑧
65	20	25	50	HJD3250	200A Class RK5	XTOB065DC1 ②	C440B1A100SAX	DS7-340SX070N0-N ⑤⑥
								DS7-342SX070N0-N ⑦
								DS7-34DSX070N0-D ⑧
77	25	30	60	HKD3300	300A Class RK5	XTOB100GC1S	C440B1A100SAX	DS7-340SX081N0-N ⑤⑥
								DS7-342SX081N0-N ⑦
								DS7-34DSX081N0-D ⑧
96	30	30	75	HKD3350	350A Class RK5	XTOB100GC1S	C440B1A100SAX	DS7-340SX100N0-N ⑤⑥
								DS7-342SX100N0-N ⑦
								DS7-34DSX100N0-D ⑧
124	40	50	100	HKD3400	500A Class RK5	XTOB125GC1S	C440A1A005SAX ④	DS7-340SX135N0-N ⑤⑥
								DS7-342SX135N0-N ⑦
								DS7-34DSX135N0-D ⑧
156	50	60	125	HLD3450	500A Class RK5	XTOB160LC1 ③	C440A1A005SAX ④	DS7-340SX160N0-N ⑤⑥
								DS7-342SX160N0-N ⑦
								DS7-34DSX160N0-D ⑧
180	60	75	150	HLD3500	500A Class RK5	XTOB220LC1 ③	C440A1A005SAX ④	DS7-340SX200N0-N ⑤⑥
								DS7-342SX200N0-N ⑦
								DS7-34DSX200N0-D ⑧

#### Notes

- ① Maximum values may be higher than allowed per NEC® 430.52 and UL 508A 31.1.
- ② XTOBXDIND Panel Mounting Adapter must be used with this overload.
- ③ XTOBXTLL line and load lugs must be used with this overload.
- ④ ZEB-XCT300 current transformer must be used with this overload.
- ⑤ 24 Vac/Vdc device.
- ⑥ -40 °C rated low temperature version available in 24 Vac/Vdc, change to "N0-L."
- ⑦ 110/230 Vac device.
- ⑧ 24 Vdc for SmartWire-DT device.

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100–240 V input and 24 Vdc output	PSG60E
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Please refer to Application Note AP039004EN for additional information on proper size selection.

**DS7 Soft Start Controller—  
Frames 1 and 2**



**DS7 Soft Start Controllers—Horsepower Ratings—  
10 Second Ramp, One Start per Hour, 400% Current Limit at 40 °C ①**

Rated Current (A)	Motor Power (hp)			Maximum Allowable Breaker Size	Maximum Allowable Fuse Size	Recommended XTOB Overload (Direct Connect) ②	Recommended XTOE Overload ②	PKE MMP	MMP ②	Connection Kit to MMP	Catalog Number
	200 V	230 V	480 V								
3	0.5	0.5	1.5	HFD3015	15A Class RK5	XTOB004BC1	XTOE005BCS	XTPE012BCS	XTPR004BC1	XTPAXTPCB	DS7-340SX004N0-N ④⑤
											DS7-342SX004N0-N ⑤
											DS7-34DSX004N0-D ⑥
4.8	1	1	3	HFD3015	15A Class RK5	XTOB006BC1 ③	XTOE020BCS	XTPE012BCS	XTPR6P3BC1	XTPAXTPCB	DS7-340SX007N0-N ④⑤
											DS7-342SX007N0-N ⑤
											DS7-34DSX007N0-D ⑥
6.9	1.5	2	3	HFD3020	20A Class RK5	XTOB006BC1	XTOE020BCS	XTPE012BCS	XTPR6P3BC1	XTPAXTPCB	DS7-340SX009N0-N ④⑤
											DS7-342SX009N0-N ⑤
											DS7-34DSX009N0-D ⑥
9	2	2	5	HFD3030	20A Class RK5	XTOB010BC1	XTOE020BCS	XTPE032BCS	XTPR010BC1	XTPAXTPCB	DS7-340SX012N0-N ④⑤
											DS7-342SX012N0-N ⑤
											DS7-34DSX012N0-D ⑥
11	3	3	7.5	HFD3035	25A Class RK5	XTOB016CC1	XTOE020CCS	XTPE032BCS	XTPR016BC1	XTPAXTPCC	DS7-340SX016N0-N ④⑤
											DS7-342SX016N0-N ⑤
											DS7-34DSX016N0-D ⑥
17.5	5	5	10	HFD3060	40A Class RK5	XTOB016CC1	XTOE045CCS	XTPE032BCS	XTPR016BC1	XTPAXTPCC	DS7-340SX024N0-N ④⑤
											DS7-342SX024N0-N ⑤
											DS7-34DSX024N0-D ⑥
22	5	7.5	15	HFD3070	50A Class RK5	XTOB024CC1	XTOE045CCS	XTPE032BCS	XTPR025BC1	XTPAXTPCC	DS7-340SX032N0-N ④⑤
											DS7-342SX032N0-N ⑤
											DS7-34DSX032N0-D ⑥

**Notes**

- ① Actual motor FLAs vary. Verify these devices cover the motor specific FLA.
- ② Selections are based on motor FLA value at 480 V.
- ③ Not to be used with 230 V.
- ④ 24 Vac/Vdc device.
- ⑤ -40 °C rated low temperature version available in 24 Vac/Vdc, change to "N0-L."
- ⑥ 110/230 Vac device.
- ⑦ 24 Vdc for SmartWire-DT device.

**Considerations**

1. Either XTOB, C306 or C440 series or equivalent overload protection devices may be selected.
2. Contactor is optional for normal applications. It is recommended for mains isolation.

**Power Supply**

Eaton's PSG and ELC power supplies are recommended as a compact and low-cost source for 24 Vdc power. The lightweight, DIN rail mounted devices have a wide input voltage range, and robust screw terminals make these power supplies easy to install and use. These power supplies are available in 1A and 2A models.

**Power Supply Selection**

Description	Catalog Number
85–264 V input and 24 Vdc output	ELC-PS01
100–240 V input and 24 Vdc output	PSG60E
400–500 V input and 24 Vdc output	PSG60F24RM

Please refer to Application Note AP039004EN for additional information on proper size selection.

**DS7 Soft Start Controller—  
Frames 3 and 4**



**DS7 Soft Start Controllers—Horsepower Ratings—  
10 Second Ramp, One Start per Hour, 400% Current Limit at 40 °C**

Rated Current (A)	Motor Power (hp)			Maximum Allowable Breaker Size ①	Maximum Allowable Fuse Size ①	Recommended XTOB Overload	Recommended C440 Overload	Catalog Number
	200 V	230 V	460 V					
27	7.5	10	20	HFD3150L	150A Class RK5	XTOB040DC1	C440A1A045SAX	DS7-340SX041N0-N ④⑤
								DS7-342SX041N0-N ⑥
								DS7-34DSX041N0-D ⑦
34	10	10	30	HFD3200L	200A Class RK5	XTOB040DC1	C440A1A045SAX	DS7-340SX055N0-N ④⑤
								DS7-342SX055N0-N ⑥
								DS7-34DSX055N0-D ⑦
40	15	15	30	HJD3250	200A Class RK5	XTOB057DC1 ②	C440A1A045SAX	DS7-340SX070N0-N ④⑤
								DS7-342SX070N0-N ⑥
								DS7-34DSX070N0-D ⑦
52	15	20	40	HKD3300	300A Class RK5	XTOB057DC1 ②	C440B1A100SAX	DS7-340SX081N0-N ④⑤
								DS7-342SX081N0-N ⑥
								DS7-34DSX081N0-D ⑦
65	20	25	50	HKD3350	350A Class RK5	XTOB100GC1S	C440B1A100SAX	DS7-340SX100N0-N ④⑤
								DS7-342SX100N0-N ⑥
								DS7-34DSX100N0-D ⑦
80	30	30	75	HKD3350	500A Class RK5	XTOB100GC1S	C440B1A100SAX	DS7-340SX135N0-N ④⑤
								DS7-342SX135N0-N ⑥
								DS7-34DSX135N0-D ⑦
96	30	40	75	HLD3450	500A Class RK5	XTOB100GC1S	C440B1A100SAX	DS7-340SX160N0-N ④⑤
								DS7-342SX160N0-N ⑥
								DS7-34DSX160N0-D ⑦
124	40	50	100	HLD3500	500A Class RK5	XTOB150GC1S	C440A1A005SAX ③	DS7-340SX200N0-N ④⑤
								DS7-342SX200N0-N ⑥
								DS7-34DSX200N0-D ⑦

**Notes**

- ① Maximum values may be higher than allowed per NEC® 430.52 and UL 508A 31.1.
- ② XTOBXDIND Panel Mounting Adapter must be used with this overload.
- ③ ZEB-XCT300 current transformer must be used with this overload.
- ④ 24 Vac/Vdc device.
- ⑤ -40 °C rated low temperature version available in 24 Vac/Vdc, change to "NO-L."
- ⑥ 110/230 Vac device.
- ⑦ 24 Vdc for SmartWire-DT device.

**Considerations**

1. Either XTOB, C306 or C440 series or equivalent overload protection devices may be selected.
2. Contactor is optional for normal applications. It is recommended for mains isolation.

**Power Supply**

Eaton's PSG and ELC power supplies are recommended as a compact and low-cost source for 24 Vdc power. The lightweight, DIN rail mounted devices have a wide input voltage range, and robust screw terminals make these power supplies easy to install and use. These power supplies are available in 1A and 2A models.

**Power Supply Selection**

Description	Catalog Number
85–264 V input and 24 Vdc output	ELC-PS01
100–240 V input and 24 Vdc output	PSG60E
400–500 V input and 24 Vdc output	PSG60F24RM

### DS7 Soft Start kW Ratings

Please refer to Application Note AP039004EN for additional information on proper size selection.

DS7 Soft Start Controller—  
Frames 1 and 2



### DS7 Soft Start Controllers—kW Ratings According to IEC 60947-4-2— 10 Second Ramp, One Start per Hour, 300% Current Limit at 40 °C ①

Rated Current (A)	Motor Power (kW)		Maximum Allowable Breaker Size	Maximum Allowable Fuse Size	Recommended XTOB Overload (Direct Connect) ②	Recommended XTOE Overload ②	PKE MMP	MMP ②	Connection Kit to MMP	Catalog Number
	230 V	400 V								
3.8	0.75	1.5	HFD3015	15A Class RK5	XTOB004BC1	XTOE005BCS	XTPe012BCS	XTPR004BC1	XTPAXTPCB	DS7-340SX004N0-N ④⑤
										DS7-342SX004N0-N ⑥
										DS7-34DSX004N0-D ⑦
7	1.5	3	HFD3015	15A Class RK5	XTOB006BC1 ③	XTOE020BCS	XTPe012BCS	XTPR6P3BC1	XTPAXTPCB	DS7-340SX007N0-N ④⑤
										DS7-342SX007N0-N ⑥
										DS7-34DSX007N0-D ⑦
9	2.2	4	HFD3020	20A Class RK5	XTOB010BC1	XTOE020BCS	XTPe012BCS	XTPR010BC1	XTPAXTPCB	DS7-340SX009N0-N ④⑤
										DS7-342SX009N0-N ⑥
										DS7-34DSX009N0-D ⑦
12	3	5.5	HFD3030	20A Class RK5	XTOB012BC1	XTOE020BCS	XTPe032BCS	XTPR012BC1	XTPAXTPCB	DS7-340SX012N0-N ④⑤
										DS7-342SX012N0-N ⑥
										DS7-34DSX012N0-D ⑦
16	4	7.5	HFD3035	25A Class RK5	XTOB016CC1	XTOE020CCS	XTPe032BCS	XTPR016BC1	XTPAXTPCC	DS7-340SX016N0-N ④⑤
										DS7-342SX016N0-N ⑥
										DS7-34DSX016N0-D ⑦
24	5.5	11	HFD3060	40A Class RK5	XTOB024CC1	XTOE045CCS	XTPe032BCS	XTPR025BC1	XTPAXTPCC	DS7-340SX024N0-N ④⑤
										DS7-342SX024N0-N ⑥
										DS7-34DSX024N0-D ⑦
32	7.5	15	HFD3070	50A Class RK5	XTOB032CC1	XTOE045CCS	XTPe032BCS	XTPR032BC1	XTPAXTPCC	DS7-340SX032N0-N ④⑤
										DS7-342SX032N0-N ⑥
										DS7-34DSX032N0-D ⑦

#### Notes

- ① Actual motor FLAs vary. Verify these devices cover the motor specific FLA.
- ② Selections are based on motor FLA value at 480 V.
- ③ Not to be used with 230 V.
- ④ 24 Vac/Vdc device.
- ⑤ -40 °C rated low temperature version available in 24 Vac/Vdc, change to "N0-L."
- ⑥ 110/230 Vac device.
- ⑦ 24 Vdc for SmartWire-DT device.

#### Considerations

1. Either XTOB, C306 or C440 series or equivalent overload protection devices may be selected.
2. Contactor is optional for normal applications. It is recommended for mains isolation.

#### Power Supply

Eaton's PSG and ELC power supplies are recommended as a compact and low-cost source for 24 Vdc power. The lightweight, DIN rail mounted devices have a wide input voltage range, and robust screw terminals make these power supplies easy to install and use. These power supplies are available in 1A and 2A models.

#### Power Supply Selection

Description	Catalog Number
85–264 V input and 24 Vdc output	ELC-PS01
100–240 V input and 24 Vdc output	PSG60E
400–500 V input and 24 Vdc output	PSG60F24RM



Please refer to Application Note AP039004EN for additional information on proper size selection.

DS7 Soft Start Controller—  
Frames 3 and 4



### DS7 Soft Start Controllers—kW Ratings According to IEC 60947-4-2— 10 Second Ramp, One Start per Hour, 300% Current Limit at 40 °C

Rated Current (A)	Motor Power (kW)		Maximum Allowable Breaker Size <sup>①</sup>	Maximum Allowable Fuse Size <sup>①</sup>	Recommended XTOB Overload	Recommended C440 Overload	Catalog Number
	230 V	400 V					
41	11	22	HFD3150L	150A Class RK5	XTOB057DC1 <sup>②</sup>	C440A1A045SAX	DS7-340SX041N0-N <sup>⑤⑥</sup>
							DS7-342SX041N0-N <sup>⑦</sup>
							DS7-34DSX041N0-D <sup>⑧</sup>
55	15	30	HFD3200L	200A Class RK5	XTOB057DC1 <sup>②</sup>	C440B1A100SAX	DS7-340SX055N0-N <sup>⑤⑥</sup>
							DS7-342SX055N0-N <sup>⑦</sup>
							DS7-34DSX055N0-D <sup>⑧</sup>
68	15	37	HJD3250	200A Class RK5	XTOB070GC1 <sup>②</sup>	C440B1A100SAX	DS7-340SX070N0-N <sup>⑤⑥</sup>
							DS7-342SX070N0-N <sup>⑦</sup>
							DS7-34DSX070N0-D <sup>⑧</sup>
81	22	45	HKD3300	300A Class RK5	XTOB100GC1S	C440B1A100SAX	DS7-340SX081N0-N <sup>⑤⑥</sup>
							DS7-342SX081N0-N <sup>⑦</sup>
							DS7-34DSX081N0-D <sup>⑧</sup>
99	30	55	HKD3350	350A Class RK5	XTOB100GC1S	C440B1A100SAX	DS7-340SX100N0-N <sup>⑤⑥</sup>
							DS7-342SX100N0-N <sup>⑦</sup>
							DS7-34DSX041N0-D <sup>⑧</sup>
134	30	75	HKD3400	500A Class RK5	XTOB150GC1S	C440A1A005SAX <sup>④</sup>	DS7-340SX135N0-N <sup>⑤⑥</sup>
							DS7-342SX135N0-N <sup>⑦</sup>
							DS7-34DSX135N0-D <sup>⑧</sup>
160	45	90	HLD3450	500A Class RK5	XTOB160LC1 <sup>③</sup>	C440A1A005SAX <sup>④</sup>	DS7-340SX160N0-N <sup>⑤⑥</sup>
							DS7-342SX160N0-N <sup>⑦</sup>
							DS7-34DSX160N0-D <sup>⑧</sup>
196	55	110	HLD3500	500A Class RK5	XTOB220LC1 <sup>③</sup>	C440A1A005SAX <sup>④</sup>	DS7-340SX200N0-N <sup>⑤⑥</sup>
							DS7-342SX200N0-N <sup>⑦</sup>
							DS7-34DSX200N0-D <sup>⑧</sup>

#### Notes

- ① Maximum values may be higher than allowed per NEC 430.52 and UL 508A 31.1.
- ② XTOBXDIND Panel Mounting Adapter must be used with this overload.
- ③ XTOBXTLL line and load lugs must be used with this overload.
- ④ ZEB-XCT300 current transformer must be used with this overload.
- ⑤ 24 Vac/Vdc device.
- ⑥ -40 °C rated low temperature version available in 24 Vac/Vdc, change to "NO-L."
- ⑦ 110/230 Vac device.
- ⑧ 24 Vdc for SmartWire-DT device.

#### Considerations

1. Either XTOB, C306 or C440 series or equivalent overload protection devices may be selected.
2. Contactor is optional for normal applications. It is recommended for mains isolation.

#### Power Supply

Eaton's PSG and ELC power supplies are recommended as a compact and low-cost source for 24 Vdc power. The lightweight, DIN rail mounted devices have a wide input voltage range, and robust screw terminals make these power supplies easy to install and use. These power supplies are available in 1A and 2A models.

#### Power Supply Selection

Description	Catalog Number
85–264 V input and 24 Vdc output	ELC-PS01
100–240 V input and 24 Vdc output	PSG60E
400–500 V input and 24 Vdc output	PSG60F24RM

Please refer to Application Note AP039004EN for additional information on proper size selection.

**DS7 Soft Start Controller—  
Frames 1 and 2**



**DS7 Soft Start Controllers—kW Ratings According to IEC 60947-4-2—  
10 Second Ramp, One Start per Hour, 400% Current Limit at 40 °C ①**

Rated Current (A)	Motor Power (kW)		Maximum Allowable Breaker Size	Maximum Allowable Fuse Size	Recommended XTOB Overload (Direct Connect) ②	Recommended XTOE Overload ②	PKE MMP	MMP ②	Connection Kit to MMP	Catalog Number
	230 V	400 V								
2.5	0.33	1	HFD3015	15A Class RK5	XTOB004BC1	XTOE005BCS	XTPE012BCS	XTPR004BC1	XTPAXTPCB	<b>DS7-340SX004N0-N</b> ④⑤
										<b>DS7-342SX004N0-N</b> ⑥
										<b>DS7-34DSX004N0-D</b> ⑦
3.8	0.75	1.5	HFD3015	15A Class RK5	XTOB006BC1 ③	XTOE020BCS	XTPE012BCS	XTPR6P3BC1	XTPAXTPCB	<b>DS7-340SX007N0-N</b> ④⑤
										<b>DS7-342SX007N0-N</b> ⑥
										<b>DS7-34DSX007N0-D</b> ⑦
7	1.5	3	HFD3020	20A Class RK5	XTOB006BC1	XTOE020BCS	XTPE012BCS	XTPR6P3BC1	XTPAXTPCB	<b>DS7-340SX009N0-N</b> ④⑤
										<b>DS7-342SX009N0-N</b> ⑥
										<b>DS7-34DSX009N0-D</b> ⑦
9	2.2	4	HFD3030	20A Class RK5	XTOB010BC1	XTOE020BCS	XTPE032BCS	XTPR010BC1	XTPAXTPCB	<b>DS7-340SX012N0-N</b> ④⑤
										<b>DS7-342SX012N0-N</b> ⑥
										<b>DS7-34DSX012N0-D</b> ⑦
12	3	5.5	HFD3035	25A Class RK5	XTOB016CC1	XTOE020CCS	XTPE032BCS	XTPR016BC1	XTPAXTPCC	<b>DS7-340SX016N0-N</b> ④⑤
										<b>DS7-342SX016N0-N</b> ⑥
										<b>DS7-34DSX016N0-D</b> ⑦
16	4	7.5	HFD3060	40A Class RK5	XTOB016CC1	XTOE045CCS	XTPE032BCS	XTPR016BC1	XTPAXTPCC	<b>DS7-340SX024N0-N</b> ④⑤
										<b>DS7-342SX024N0-N</b> ⑥
										<b>DS7-34DSX016N0-D</b> ⑦
24	5.5	11	HFD3070	50A Class RK5	XTOB024CC1	XTOE045CCS	XTPE032BCS	XTPR025BC1	XTPAXTPCC	<b>DS7-340SX032N0-N</b> ④⑤
										<b>DS7-342SX032N0-N</b> ⑥
										<b>DS7-34DSX032N0-D</b> ⑦

**Notes**

- ① Actual motor FLAs vary. Verify these devices cover the motor specific FLA.
- ② Selections are based on motor FLA value at 480 V.
- ③ Not to be used with 230 V.
- ④ 24 Vac/Vdc device.
- ⑤ -40 °C rated low temperature version available in 24 Vac/Vdc, change to "N0-L."
- ⑥ 110/230 Vac device.
- ⑦ 24 Vdc for SmartWire-DT device.

**Considerations**

1. Either XTOB, C306 or C440 series or equivalent overload protection devices may be selected.
2. Contactor is optional for normal applications. It is recommended for mains isolation.

**Power Supply**

Eaton's PSG and ELC power supplies are recommended as a compact and low-cost source for 24 Vdc power. The lightweight, DIN rail mounted devices have a wide input voltage range, and robust screw terminals make these power supplies easy to install and use. These power supplies are available in 1A and 2A models.

**Power Supply Selection**

Description	Catalog Number
85–264 V input and 24 Vdc output	<b>ELC-PS01</b>
100–240 V input and 24 Vdc output	<b>PSG60E</b>
400–500 V input and 24 Vdc output	<b>PSG60F24RM</b>

Please refer to Application Note AP039004EN for additional information on proper size selection.

DS7 Soft Start Controller—  
Frames 3 and 4



### DS7 Soft Start Controllers—kW Ratings According to IEC 60947-4-2— 10 Second Ramp, One Start per Hour, 400% Current Limit at 40 °C

Rated Current (A)	Motor Power (kW)		Maximum Allowable Breaker Size ①	Maximum Allowable Fuse Size ①	Recommended XTOB Overload	Recommended C440 Overload	Catalog Number
	230 V	400 V					
28.8	7.5	11	HFD3150L	150A Class RK5	XTOB040DC1	C440A1A045SAX	DS7-340SX041N0-N ⑤⑥
							DS7-342SX041N0-N ⑦
							DS7-34DSX041N0-D ⑧
37.5	11	18.5	HFD3200L	200A Class RK5	XTOB040DC1	C440A1A045SAX	DS7-340SX055N0-N ⑤⑥
							DS7-342SX055N0-N ⑦
							DS7-34DSX055N0-D ⑧
46	11	22	HJD3250	200A Class RK5	XTOB057DC1 ②	C440B1A100SAX	DS7-340SX070N0-N ⑤⑥
							DS7-342SX070N0-N ⑦
							DS7-34DSX070N0-D ⑧
56	15	30	HKD3300	300A Class RK5	XTOB065DC1 ②	C440B1A100SAX	DS7-340SX081N0-N ⑤⑥
							DS7-342SX081N0-N ⑦
							DS7-34DSX081N0-D ⑧
68	18.5	37	HKD3350	350A Class RK5	XTOB100GC1S	C440B1A100SAX	DS7-340SX100N0-N ⑤⑥
							DS7-342SX100N0-N ⑦
							DS7-34DSX100N0-D ⑧
90	22	45	HKD3350	500A Class RK5	XTOB100GC1S	C440B1A100SAX	DS7-340SX135N0-N ⑤⑥
							DS7-342SX135N0-N ⑦
							DS7-34DSX135N0-D ⑧
106	30	55	HLD3450	500A Class RK5	XTOB160LC1 ③	C440A1A005SAX ④	DS7-340SX160N0-N ⑤⑥
							DS7-342SX160N0-N ⑦
							DS7-34DSX160N0-D ⑧
134	37	75	HLD3500	500A Class RK5	XTOB160LC1 ③	C440A1A005SAX ④	DS7-340SX200N0-N ⑤⑥
							DS7-342SX200N0-N ⑦
							DS7-34DSX200N0-D ⑧

#### Notes

- ① Maximum values may be higher than allowed per NEC 430.52 and UL 508A 31.1.
- ② XTOBXDIND Panel Mounting Adapter must be used with this overload.
- ③ XTOBXTLL line and load lugs must be used with this overload.
- ④ ZEB-XCT300 current transformer must be used with this overload.
- ⑤ 24 Vac/Vdc device.
- ⑥ -40 °C rated low temperature version available in 24 Vac/Vdc, change to "N0-L."
- ⑦ 110/230 Vac device.
- ⑧ 24 Vdc for SmartWire-DT device.

#### Considerations

1. Either XTOB, C306 or C440 series or equivalent overload protection devices may be selected.
2. Contactor is optional for normal applications. It is recommended for mains isolation.

#### Power Supply

Eaton's PSG and ELC power supplies are recommended as a compact and low-cost source for 24 Vdc power. The lightweight, DIN rail mounted devices have a wide input voltage range, and robust screw terminals make these power supplies easy to install and use. These power supplies are available in 1A and 2A models.

#### Power Supply Selection

Description	Catalog Number
85–264 V input and 24 Vdc output	ELC-PS01
100–240 V input and 24 Vdc output	PSG60E
400–500 V input and 24 Vdc output	PSG60F24RM

### Accessories

#### Device Fans

#### DS7-FAN-032



Description	For Use With ...	Std. Pack	Catalog Number
Device fan for increasing the load cycle (more starts per hour higher or longer ramp times exceeding 10 seconds.	DS7-34...SX004...	1 off	<b>DS7-FAN-032</b> ①
	DS7-34...SX007...		
	DS7-34...SX009...		
	DS7-34...SX012...		
	DS7-34...SX016...		
	DS7-34...SX024...		
	DS7-34...SX032...		

**Note**

① NA Certification. Request filed for UL and CSA.



## Technical Data and Specifications

### DS7 Soft Start Controllers

#### Rated Control Circuit

Voltage 24 Vac/Vdc  
Voltage 110/230 Vac  
Voltage 24 Vdc

Unit	DS7-340SX004N0-N DS7-342SX004N0-N DS7-34DSX004N0-D	DS7-340SX007N0-N DS7-342SX007N0-N DS7-34DSX007N0-D	DS7-340SX009N0-N DS7-342SX009N0-N DS7-34DSX009N0-D	DS7-340SX012N0-N DS7-342SX012N0-N DS7-34DSX012N0-D
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#### General

Standards		IEC/EN 60947-4-2; GB14048.6; UL508; CSA-C22.2 No 0-M91; CSA-C22.2 No 14-05 CE marking	IEC/EN 60947-4-2; GB14048.6; UL508; CSA-C22.2 No 0-M91; CSA-C22.2 No 14-05 CE marking	IEC/EN 60947-4-2; GB14048.6; UL508; CSA-C22.2 No 0-M91; CSA-C22.2 No 14-05 CE marking	IEC/EN 60947-4-2; GB14048.6; UL508; CSA-C22.2 No 0-M91; CSA-C22.2 No 14-05 CE marking
Certifications/markings		UL/CE/CSA/C-Tick	UL/CE/CSA/C-Tick	UL/CE/CSA/C-Tick	UL/CE/CSA/C-Tick
Ambient temperature (operation)	°C	0 to 40 °C, above 40 °C de-rate linearly by 1% of rated current per Celsius to 60 °C -40 to +40 °C for low temperature version	0 to 40 °C, above 40 °C de-rate linearly by 1% of rated current per Celsius to 60 °C -40 to +40 °C for low temperature version	0 to 40 °C, above 40 °C de-rate linearly by 1% of rated current per Celsius to 60 °C -40 to +40 °C for low temperature version	0 to 40 °C, above 40 °C de-rate linearly by 1% of rated current per Celsius to 60 °C -40 to +40 °C for low temperature version
Ambient temperature (storage)	°C	-25 to 55 °C	-25 to 55 °C	-25 to 55 °C	-25 to 55 °C
Altitude		0–1000m, above 1000m de-rate linearly by 2.5% of rated current per 100m to a maximum of 2000m	0–1000m, above 1000m de-rate linearly by 2.5% of rated current per 100m to a maximum of 2000m	0–1000m, above 1000m de-rate linearly by 2.5% of rated current per 100m to a maximum of 2000m	0–1000m, above 1000m de-rate linearly by 2.5% of rated current per 100m to a maximum of 2000m
Installation		Vertical	Vertical	Vertical	Vertical
Protection class		IP20	IP20	IP20	IP20
Protection class applies to the front and operator control and display elements. Protection type from all sides is IP00.		With optional covers from the NZM range, protection type IP40 from all sides can be achieved	With optional covers from the NZM range, protection type IP40 from all sides can be achieved	With optional covers from the NZM range, protection type IP40 from all sides can be achieved	With optional covers from the NZM range, protection type IP40 from all sides can be achieved
Busbar tag shroud		Back of hand and finger-proof (from front face)	Back of hand and finger-proof (from front face)	Back of hand and finger-proof (from front face)	Back of hand and finger-proof (from front face)
Overvoltage category/pollution degree		II/2	II/2	II/2	II/2
Shock resistance		8g/11ms	8g/11ms	8g/11ms	8g/11ms
Vibration resistance according to EN 60721-3-2		2M2	2M2	2M2	2M2
Mean heat dissipation at rated duty cycle	W	0.2	0.35	0.35	0.6
Radio interference		B	B	B	B
Dimensions (W x H x D)					
DS7-340... and DS7-342...	in (mm)	1.77 x 5.12 x 3.74 (45 x 130 x 95)	1.77 x 5.12 x 3.74 (45 x 130 x 95)	1.77 x 5.12 x 3.74 (45 x 130 x 95)	1.77 x 5.12 x 3.74 (45 x 130 x 95)
DS7-34D...	in (mm)	1.77 x 5.31 x 3.74 (45 x 135 x 95)	1.77 x 5.31 x 3.74 (45 x 135 x 95)	1.77 x 5.31 x 3.74 (45 x 135 x 95)	1.77 x 5.31 x 3.74 (45 x 135 x 95)
Weight					
DS7-340...	lb (kg)	0.77 (0.35)	0.77 (0.35)	0.77 (0.35)	0.77 (0.35)
DS7-342...	lb (kg)	0.88 (0.40)	0.88 (0.40)	0.88 (0.40)	0.88 (0.40)
DS7-34D...	lb (kg)	0.90 (0.41)	0.90 (0.41)	0.90 (0.41)	0.90 (0.41)
<b>Main Circuit</b>					
Rated operational voltage	V	230–460 Vac	230–460 Vac	230–460 Vac	230–460 Vac
Mains frequency	Hz	50/60 Hz	50/60 Hz	50/60 Hz	50/60 Hz
Rated operation current AC 53	I <sub>e</sub>	4	7	9	12
<b>Motor Power Ratings</b>					
200 V	hp	0.75	1.5	2	3
230 V	hp	0.75	2	2	5
480 V	hp	2	3	5	10
230 V	kW	0.75	1.5	2.2	3
400 V	kW	1.5	3	4	5.5
Overload cycle according to EN 60947-4-2		4A: AC53a; 3-5; 75-10	7A: AC53a; 3-5; 75-10	9A: AC53a; 3-5; 75-10	12A: AC53a; 3-5; 75-10

### DS7 Soft Start Controllers, continued

#### Rated Control Circuit

Voltage 24 Vac/Vdc Voltage 110/230 Vac Voltage 24 Vdc	Unit	DS7-340SX004N0-N DS7-342SX004N0-N DS7-34DSX004N0-D	DS7-340SX007N0-N DS7-342SX007N0-N DS7-34DSX007N0-D	DS7-340SX009N0-N DS7-342SX009N0-N DS7-34DSX009N0-D	DS7-340SX012N0-N DS7-342SX012N0-N DS7-34DSX012N0-D
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#### Wire Specifications

Power terminals					
Single conductor—solid or stranded	AWG	18–10	18–10	18–10	18–10
Terminal torque	lb-in	11	11	11	11
Control signals					
Single conductor—solid or stranded	AWG	18–10	18–10	18–10	18–10
Terminal torque	lb-in	11	11	11	11

#### Power Section

Rated impulse withstand voltage	$U_{imp}$ 1.2/50 s	4 kV	4 kV	4 kV	4 kV
Rated insulation voltage		500	500	500	500

#### Control Commands—Vac/Vdc

Supply voltage control board $U_s$ nominal	Vac/Vdc	20.4–26.4	20.4–26.4	20.4–26.4	20.4–26.4
Current consumption at 24 Vac/Vdc	mA	1.6	1.6	1.6	1.6
Pick-up voltage		+17.3–+27	+17.3–+27	+17.3–+27	+17.3–+27
Drop-out voltage		+3–0	+3–0	+3–0	+3–0

#### Relay Outputs

Number of relays		1 (TOR)	1 (TOR)	1 (TOR)	1 (TOR)
Maximum voltage	Vac	250	250	250	250
Maximum current	A	1A	1A	1A	1A

#### Soft Start Functions

Ramp times					
Start ramp	s	1–30	1–30	1–30	1–30
Stop ramp	s	0–30	0–30	0–30	0–30
Initial voltage % line voltage					
DS7-342...		30–92%	30–92%	30–92%	30–92%
DS7-340...		30–100%	30–100%	30–100%	30–100%
DS7-34D...		30–92%	30–92%	30–92%	30–92%

#### Control Commands—Vac

Supply voltage control board $U_s$ nominal	Vac	102–253	102–253	102–253	102–253
Current consumption at 24 Vac/Vdc	mA	4	4	4	4
Pick-up voltage	Vac	102–230	102–230	102–230	102–230
Drop-out voltage	Vac	0–28	0–28	0–28	0–28

#### Relay Outputs

Number of relays		1 (TOR)	1 (TOR)	1 (TOR)	1 (TOR)
Maximum voltage	Vac	250	250	250	250
Maximum current	A	3A	3A	3A	3A

#### Soft Start Functions

Ramp times					
Start ramp	s	1–30	1–30	1–30	1–30
Stop ramp	s	0–30	0–30	0–30	0–30
Initial voltage % line voltage		30–92%	30–92%	30–92%	30–92%

## DS7 Soft Start Controllers, continued

## Rated Control Circuit

Voltage 24 Vac/Vdc  
Voltage 110/230 Vac  
Voltage 24 Vdc

DS7-340SX016N0-N  
DS7-342SX016N0-N  
DS7-34DSX016N0-D

DS7-340SX024N0-N  
DS7-342SX024N0-N  
DS7-34DSX024N0-D

DS7-340SX032N0-N  
DS7-342SX032N0-N  
DS7-34DSX032N0-D

Unit

## General

Standards		IEC/EN 60947-4-2; GB14048.6; UL508; CSA-C22.2 No 0-M91; CSA-C22.2 No 14-05 CE marking	IEC/EN 60947-4-2; GB14048.6; UL508; CSA-C22.2 No 0-M91; CSA-C22.2 No 14-05 CE marking	IEC/EN 60947-4-2; GB14048.6; UL508; CSA-C22.2 No 0-M91; CSA-C22.2 No 14-05 CE marking
Certifications/markings		UL/CE/CSA/C-Tick	UL/CE/CSA/C-Tick	UL/CE/CSA/C-Tick
Ambient temperature (operation)	°C	0 to 40 °C, above 40 °C de-rate linearly by 1% of rated current per Celsius to 60 °C –40 to +40 °C for low temperature version	0 to 40 °C, above 40 °C de-rate linearly by 1% of rated current per Celsius to 60 °C –40 to +40 °C for low temperature version	0 to 40 °C, above 40 °C de-rate linearly by 1% of rated current per Celsius to 60 °C –40 to +40 °C for low temperature version
Ambient temperature (storage)	°C	–25 to 55 °C	–25 to 55 °C	–25 to 55 °C
Altitude		0–1000m, above 1000m de-rate linearly by 2.5% of rated current per 100m to a maximum of 2000m	0–1000m, above 1000m de-rate linearly by 2.5% of rated current per 100m to a maximum of 2000m	0–1000m, above 1000m de-rate linearly by 2.5% of rated current per 100m to a maximum of 2000m
Installation		Vertical	Vertical	Vertical
Protection class		IP20	IP20	IP20
Protection class applies to the front and operator control and display elements. Protection type from all sides is IP00.		With optional covers from the NZM range, protection type IP40 from all sides can be achieved	With optional covers from the NZM range, protection type IP40 from all sides can be achieved	With optional covers from the NZM range, protection type IP40 from all sides can be achieved
Busbar tag shroud		Back of hand and finger-proof (from front face)	Back of hand and finger-proof (from front face)	Back of hand and finger-proof (from front face)
Oversvoltage category/ pollution degree		II/2	II/2	II/2
Shock resistance		8g/11ms	8g/11ms	8g/11ms
Vibration resistance according to EN 60721-3-2		2M2	2M2	2M2
Mean heat dissipation at rated duty cycle	W	0.8	1.1	1.5
Radio interference		B	B	B
Dimensions (W x H x D)				
DS7-340... and DS7-342...	in (mm)	1.77 x 5.91 x 4.65 (45 x 150 x 118)	1.77 x 5.91 x 4.65 (45 x 150 x 118)	1.77 x 5.91 x 4.65 (45 x 150 x 118)
DS7-34D...	in (mm)	1.77 x 5.91 x 4.65 (45 x 150 x 118)	1.77 x 5.91 x 4.65 (45 x 150 x 118)	1.77 x 5.91 x 4.65 (45 x 150 x 118)
Weight				
DS7-340...	lb (kg)	0.88 (0.40)	0.88 (0.40)	0.88 (0.40)
DS7-342...	lb (kg)	0.99 (0.45)	0.99 (0.45)	0.99 (0.45)
DS7-34D...	lb (kg)	0.90 (0.41)	0.90 (0.41)	0.90 (0.41)
<b>Main Circuit</b>				
Rated operational voltage	V	230–460 Vac	230–460 Vac	230–460 Vac
Mains frequency	Hz	50/60 Hz	50/60 Hz	50/60 Hz
Rated operation current AC 53	I <sub>e</sub>	16	24	32
<b>Motor Power Ratings</b>				
200 V	hp	3	5	10
230 V	hp	5	7.5	10
480 V	hp	10	15	25
230 V	kW	4	5.5	7.5
400 V	kW	7.5	11	15
Overload cycle according to EN 60947-4-2		16A: AC53a; 3-5; 75-10	24A: AC53a; 3-5; 75-10	32A: AC53a; 3-5; 75-10

### DS7 Soft Start Controllers, continued

#### Rated Control Circuit

Voltage 24 Vac/Vdc  
Voltage 110/230 Vac  
Voltage 24 Vdc

Unit	DS7-340SX016N0-N DS7-342SX016N0-N DS7-34DSX016N0-D	DS7-340SX024N0-N DS7-342SX024N0-N DS7-34DSX024N0-D	DS7-340SX032N0-N DS7-342SX032N0-N DS7-34DSX032N0-D
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#### Wire Specifications

Power terminals				
Single conductor—solid or stranded	AWG	18–6	18–6	18–6
Terminal torque	lb-in	11	11	11
Control Signals				
Single conductor—solid or stranded	AWG	18–10	18–10	18–10
Terminal torque	lb-in	11	11	11

#### Power Section

Rated impulse withstand voltage	$U_{imp}$ 1.2/50 s	4 kV	4 kV	4 kV
Rated insulation voltage		500	500	500

#### Control Commands—Vac/Vdc

Supply voltage control board $U_s$ nominal	Vac/Vdc	20.4–26.4	20.4–26.4	20.4–26.4
Current consumption at 24 Vac/Vdc	mA	1.6	1.6	1.6
Pick-up voltage		+17.3–+27	+17.3–+27	+17.3–+27
Drop-out voltage		+3–0	+3–0	+3–0

#### Relay Outputs

Number of relays		2 (TOR, Ready)	2 (TOR, Ready)	2 (TOR, Ready)
Maximum voltage	Vac	250	250	250
Maximum current	A	1A	1A	1A

#### Soft Start Functions

Ramp times				
Start ramp	s	1–30	1–30	1–30
Stop ramp	s	0–30	0–30	0–30
Initial voltage % line voltage				
DS7-342...		30–92%	30–92%	30–92%
DS7-340...		30–100%	30–100%	30–100%
DS7-34D...		30–92%	30–92%	30–92%

#### Control Commands—Vac

Supply voltage control board $U_s$ nominal	Vac	102–253	102–253	102–253
Current consumption at 102–253 Vac	mA	4	4	4
Pick-up voltage	Vac	102–230	102–230	102–230
Drop-out voltage	Vac	0–28	0–28	0–28

#### Relay Outputs

Number of relays		2 (TOR, Run)	2 (TOR, Run)	2 (TOR, Run)
Maximum voltage	Vac	250	250	250
Maximum current	A	3A	3A	3A

#### Soft Start Functions

Ramp times				
Start ramp	s	1–30	1–30	1–30
Stop ramp	s	0–30	0–30	0–30
Initial voltage % line voltage		30–92%	30–92%	30–92%

## DS7 Soft Start Controllers, continued

## Rated Control Circuit

Voltage 24 Vac/Vdc Voltage 110/230 Vac Voltage 24 Vdc	Unit	DS7-340SX041N0-N DS7-342SX041N0-N DS7-34DSX041N0-D	DS7-340SX055N0-N DS7-342SX055N0-N DS7-34DSX055N0-D	DS7-340SX070N0-N DS7-342SX070N0-N DS7-34DSX070N0-D	DS7-340SX081N0-N DS7-342SX081N0-N DS7-34DSX081N0-D
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## General

Standards		IEC/EN 60947-4-2; GB14048.6; UL508; CSA-C22.2 No 0-M91; CSA-C22.2 No 14-05 CE marking	IEC/EN 60947-4-2; GB14048.6; UL508; CSA-C22.2 No 0-M91; CSA-C22.2 No 14-05 CE marking	IEC/EN 60947-4-2; GB14048.6; UL508; CSA-C22.2 No 0-M91; CSA-C22.2 No 14-05 CE marking	IEC/EN 60947-4-2; GB14048.6; UL508; CSA-C22.2 No 0-M91; CSA-C22.2 No 14-05 CE marking
Certifications/markings		UL/CE/CSA/C-Tick	UL/CE/CSA/C-Tick	UL/CE/CSA/C-Tick	UL/CE/CSA/C-Tick
Ambient temperature (operation)	°C	0 to 40 °C, above 40 °C de-rate linearly by 1% of rated current per Celsius to 60 °C -40 to +40 °C for low temperature version	0 to 40 °C, above 40 °C de-rate linearly by 1% of rated current per Celsius to 60 °C -40 to +40 °C for low temperature version	0 to 40 °C, above 40 °C de-rate linearly by 1% of rated current per Celsius to 60 °C -40 to +40 °C for low temperature version	0 to 40 °C, above 40 °C de-rate linearly by 1% of rated current per Celsius to 60 °C -40 to +40 °C for low temperature version
Ambient temperature (storage)	°C	-25 to 55 °C	-25 to 55 °C	-25 to 55 °C	-25 to 55 °C
Altitude		0–1000m, above 1000m de-rate linearly by 2.5% of rated current per 100m to a maximum of 2000m	0–1000m, above 1000m de-rate linearly by 2.5% of rated current per 100m to a maximum of 2000m	0–1000m, above 1000m de-rate linearly by 2.5% of rated current per 100m to a maximum of 2000m	0–1000m, above 1000m de-rate linearly by 2.5% of rated current per 100m to a maximum of 2000m
Installation		Vertical	Vertical	Vertical	Vertical
Protection class		IP20	IP20	IP20	IP20
Protection class applies to the front and operator control and display elements. Protection type from all sides is IP00.		With optional covers from the NZM range, protection type IP40 from all sides can be achieved	With optional covers from the NZM range, protection type IP40 from all sides can be achieved	With optional covers from the NZM range, protection type IP40 from all sides can be achieved	With optional covers from the NZM range, protection type IP40 from all sides can be achieved
Busbar tag shroud		Back of hand and finger-proof (from front face)	Back of hand and finger-proof (from front face)	Back of hand and finger-proof (from front face)	Back of hand and finger-proof (from front face)
Overvoltage category/ pollution degree		II/2	II/2	II/2	II/2
Shock resistance		8g/11ms	8g/11ms	8g/11ms	8g/11ms
Vibration resistance according to EN 60721-3-2		2M2	2M2	2M2	2M2
Mean heat dissipation at rated duty cycle	W	7	10	13	18
Radio interference		B	B	B	B
Dimensions (W x H x D)					
DS7-340... DS7-342... and DS7-34D...	in (mm)	3.66 x 6.89 x 5.47 (93 x 175 x 139)	3.66 x 6.89 x 5.47 (93 x 175 x 139)	3.66 x 6.89 x 5.47 (93 x 175 x 139)	3.66 x 6.89 x 5.47 (93 x 175 x 139)
Weight					
DS7-340... DS7-342... and DS7-34D...	lb (kg)	3.97 (1.8)	3.97 (1.8)	3.97 (1.8)	3.97 (1.8)
<b>Main Circuit</b>					
Rated operational voltage	V	230–460 Vac	230–460 Vac	230–460 Vac	230–460 Vac
Mains frequency	Hz	50/60 Hz	50/60 Hz	50/60 Hz	50/60 Hz
Rated operation current AC 53	I <sub>e</sub>	41	55	70	81
<b>Motor Power Ratings</b>					
200 V	hp	10	15	20	25
230 V	hp	10	20	25	30
480 V	hp	30	40	50	60
230 V	kW	11	15	15	22
400 V	kW	22	30	37	45
Overload cycle according to EN 60947-4-2		41A: AC53a; 3-5; 75-10	55A: AC53a; 3-5; 75-10	70A: AC53a; 3-5; 75-10	81A: AC53a; 3-5; 75-10



### DS7 Soft Start Controllers, continued

#### Rated Control Circuit

Voltage 24 Vac/Vdc Voltage 110/230 Vac Voltage 24 Vdc	Unit	DS7-340SX041N0-N DS7-342SX041N0-N DS7-34DSX041N0-D	DS7-340SX055N0-N DS7-342SX055N0-N DS7-34DSX055N0-D	DS7-340SX070N0-N DS7-342SX070N0-N DS7-34DSX070N0-D	DS7-340SX081N0-N DS7-342SX081N0-N DS7-34DSX081N0-D
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#### Wire Specifications

Power terminals					
Single conductor—solid or stranded	AWG	12–2/0	12–2/0	12–2/0	12–2/0
Terminal torque	lb-in	53–80	53–80	53–80	53–80
Control signals					
Single conductor—solid or stranded	AWG	18–10	18–10	18–10	18–10
Terminal torque	lb-in	11	11	11	11

#### Power Section

Rated impulse withstand voltage	$U_{imp}$ 1.2/50 s	4 kV	4 kV	4 kV	4 kV
Rated insulation voltage		500	500	500	500

#### Control Commands—24 Vac/Vdc

Supply voltage control board $U_s$ nominal	Vac/Vdc	20.4–26.4	20.4–26.4	20.4–26.4	20.4–26.4
Current consumption at 24 Vac/Vdc	mA	65	65	65	65
Pick-up voltage		+17.3–+27	+17.3–+27	+17.3–+27	+17.3–+27
Drop-out voltage		+3–0	+3–0	+3–0	+3–0

#### Relay Outputs

Number of relays		2 (TOR)	2 (TOR)	2 (TOR)	2 (TOR)
Maximum voltage	Vac	250	250	250	250
Maximum current	A	1A	1A	1A	1A

#### Soft Start Functions

Ramp times					
Start ramp	s	1–30	1–30	1–30	1–30
Stop ramp	s	0–30	0–30	0–30	0–30
Initial voltage % line voltage					
DS7-342...		30–92%	30–92%	30–92%	30–92%
DS7-340...		30–100%	30–100%	30–100%	30–100%
DS7-34D...		30–92%	30–92%	30–92%	30–92%

#### Control Commands—110–230 Vac

Supply voltage control board $U_s$ nominal	Vac	102–253	102–253	102–253	102–253
Current consumption at 24 Vac/Vdc	mA	14	14	14	14
Pick-up voltage	Vac	102–230	102–230	102–230	102–230
Drop-out voltage	Vac	0–28	0–28	0–28	0–28

#### Relay Outputs

Number of relays		2 (TOR)	2 (TOR)	2 (TOR)	2 (TOR)
Maximum voltage	Vac	250	250	250	250
Maximum current	A	3A	3A	3A	3A

#### Soft Start Functions

Ramp times					
Start ramp	s	1–30	1–30	1–30	1–30
Stop ramp	s	0–30	0–30	0–30	0–30
Initial voltage % line voltage		30–92%	30–92%	30–92%	30–92%

## DS7 Soft Start Controllers, continued

## Rated Control Circuit

Voltage 24 Vac/Vdc  
Voltage 110/230 Vac  
Voltage 24 Vdc

Unit	DS7-340SX100N0-N DS7-342SX100N0-N DS7-34DSX100N0-D	DS7-340SX135N0-N DS7-342SX135N0-N DS7-34DSX135N0-D	DS7-340SX160N0-N DS7-342SX160N0-N DS7-34DSX160N0-D	DS7-340SX200N0-N DS7-342SX200N0-N DS7-34DSX200N0-D
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## General

Standards		IEC/EN 60947-4-2; GB14048.6; UL508; CSA-C22.2 No 0-M91; CSA-C22.2 No 14-05 CE marking	IEC/EN 60947-4-2; GB14048.6; UL508; CSA-C22.2 No 0-M91; CSA-C22.2 No 14-05 CE marking	IEC/EN 60947-4-2; GB14048.6; UL508; CSA-C22.2 No 0-M91; CSA-C22.2 No 14-05 CE marking	IEC/EN 60947-4-2; GB14048.6; UL508; CSA-C22.2 No 0-M91; CSA-C22.2 No 14-05 CE marking
Certifications/markings		UL/CE/CSA/C-Tick	UL/CE/CSA/C-Tick	UL/CE/CSA/C-Tick	UL/CE/CSA/C-Tick
Ambient temperature (operation)	°C	0 to 40 °C, above 40 °C de-rate linearly by 1% of rated current per Celsius to 60 °C -40 to +40 °C for low temperature version	0 to 40 °C, above 40 °C de-rate linearly by 1% of rated current per Celsius to 60 °C -40 to +40 °C for low temperature version	0 to 40 °C, above 40 °C de-rate linearly by 1% of rated current per Celsius to 60 °C -40 to +40 °C for low temperature version	0 to 40 °C, above 40 °C de-rate linearly by 1% of rated current per Celsius to 60 °C -40 to +40 °C for low temperature version
Ambient temperature (storage)	°C	-25 to 55 °C	-25 to 55 °C	-25 to 55 °C	-25 to 55 °C
Altitude		0–1000m, above 1000m de-rate linearly by 2.5% of rated current per 100m to a maximum of 2000m	0–1000m, above 1000m de-rate linearly by 2.5% of rated current per 100m to a maximum of 2000m	0–1000m, above 1000m de-rate linearly by 2.5% of rated current per 100m to a maximum of 2000m	0–1000m, above 1000m de-rate linearly by 2.5% of rated current per 100m to a maximum of 2000m
Installation		Vertical	Vertical	Vertical	Vertical
Protection class		IP20	IP20	IP20	IP20
Protection class applies to the front and operator control and display elements. Protection type from all sides is IP00.		With optional covers from the NZM range, protection type IP40 from all sides can be achieved	With optional covers from the NZM range, protection type IP40 from all sides can be achieved	With optional covers from the NZM range, protection type IP40 from all sides can be achieved	With optional covers from the NZM range, protection type IP40 from all sides can be achieved
Busbar tag shroud		Back of hand and finger-proof (from front face)	Back of hand and finger-proof (from front face)	Back of hand and finger-proof (from front face)	Back of hand and finger-proof (from front face)
Overvoltage category/pollution degree		II/2	II/2	II/2	II/2
Shock resistance		8g/11ms	8g/11ms	8g/11ms	8g/11ms
Vibration resistance according to EN 60721-3-2		2M2	2M2	2M2	2M2
Mean heat dissipation at rated duty cycle	W	25	24	30	42
Radio interference		B	B	B	B
Dimensions (W x H x D)					
DS7-340... DS7-342... and DS7-34D...	in (mm)	3.66 x 6.89 x 5.47 (93 x 175 x 139)	4.25 x 8.46 x 7.01 (108 x 215 x 178)	4.25 x 8.46 x 7.01 (108 x 215 x 178)	4.25 x 8.46 x 7.01 (108 x 215 x 178)
Weight					
DS7-340... DS7-342... and DS7-34D...	lb (kg)	3.97 (1.8)	8.16 (3.7)	8.16 (3.7)	8.16 (3.7)
<b>Main Circuit</b>					
Rated operational voltage	V	230–460 Vac	230–460 Vac	230–460 Vac	230–460 Vac
Mains frequency	Hz	50/60 Hz	50/60 Hz	50/60 Hz	50/60 Hz
Rated operation current AC 53	I <sub>e</sub>	100	135	160	200
<b>Motor Power Ratings</b>					
200 V	hp	30	40	50	60
230 V	hp	30	50	60	75
480 V	hp	75	100	125	150
230 V	kW	30	30	45	55
400 V	kW	55	75	90	110
Overload cycle according to EN 60947-4-2		100A: AC53a; 3-5; 75-10	135A: AC53a; 3-5; 75-10	160A: AC53a; 3-5; 75-10	200A: AC53a; 3-5; 75-10

### DS7 Soft Start Controllers, continued

#### Rated Control Circuit

Unit	DS7-340SX100N0-N DS7-342SX100N0-N DS7-34DSX100N0-D	DS7-340SX135N0-N DS7-342SX135N0-N DS7-34DSX135N0-D	DS7-340SX160N0-N DS7-342SX160N0-N DS7-34DSX160N0-D	DS7-340SX200N0-N DS7-342SX200N0-N DS7-34DSX200N0-D
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#### Wire Specifications

Power terminals					
Single conductor—solid or stranded	AWG	12–2/0	12–350 kcmil	12–350 kcmil	12–350 kcmil
Terminal torque	lb-in	53–80	44–123	44–123	44–123
Control signals					
Single conductor—solid or stranded	AWG	18–10	18–10	18–10	18–10
Terminal torque	lb-in	11	11	11	11

#### Power Section

Rated impulse withstand voltage	$U_{imp}$ 1.2/50 s	4 kV	4 kV	4 kV	4 kV
Rated insulation voltage		500	500	500	500

#### Control Commands—24 Vac/Vdc

Supply voltage control board $U_s$ nominal	Vac/Vdc	20.4–26.4	20.4–26.4	20.4–26.4	20.4–26.4
Current consumption at 24 Vac/Vdc	mA	65	65	65	65
Pick-up voltage		+17.3–+27	+17.3–+27	+17.3–+27	+17.3–+27
Drop-out voltage		+3–0	+3–0	+3–0	+3–0

#### Relay Outputs

Number of relays		2 (TOR)	2 (TOR)	2 (TOR)	2 (TOR)
Maximum voltage	Vac	250	250	250	250
Maximum current	A	1A	1A	1A	1A

#### Soft Start Functions

Ramp times					
Start ramp	s	1–30	1–30	1–30	1–30
Stop ramp	s	0–30	0–30	0–30	0–30
Initial voltage % line voltage					
DS7-342...		30–92%	30–92%	30–92%	30–92%
DS7-340...		30–100%	30–100%	30–100%	30–100%
DS7-34D...		30–92%	30–92%	30–92%	30–92%

#### Control Commands—110–230 Vac

Supply voltage control board $U_s$ nominal	Vac	102–253	102–253	102–253	102–253
Current consumption at 24 Vac/Vdc	mA	14	14	14	14
Pick-up voltage	Vac	102–230	102–230	102–230	102–230
Drop-out voltage	Vac	0–28	0–28	0–28	0–28

#### Relay Outputs

Number of relays		2 (TOR)	2 (TOR)	2 (TOR)	2 (TOR)
Maximum voltage	Vac	250	250	250	250
Maximum current	A	3A	3A	3A	3A

#### Soft Start Functions

Ramp times					
Start ramp	s	1–30	1–30	1–30	1–30
Stop ramp	s	0–30	0–30	0–30	0–30
Initial voltage % line voltage		30–92%	30–92%	30–92%	30–92%

# 1.1

## Reduced Voltage Motor Starters

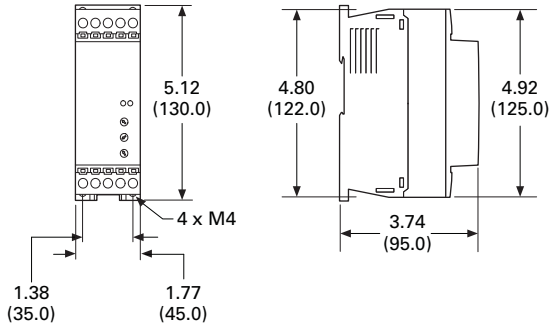
### Solid-State Controllers

1

#### Dimensions

Approximate Dimensions in Inches (mm)

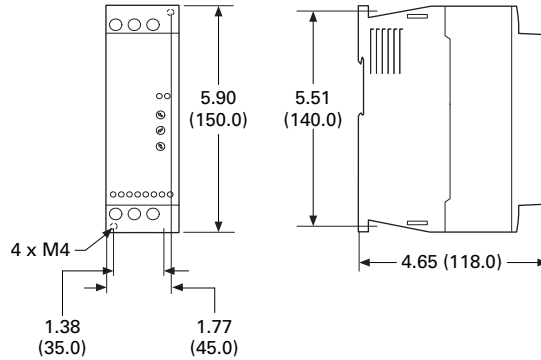
##### Frame 1



##### Catalog Numbers

DS7-340SX004N0-N	DS7-342SX004N0-N
DS7-340SX007N0-N	DS7-342SX007N0-N
DS7-340SX009N0-N	DS7-342SX009N0-N
DS7-340SX012N0-N	DS7-342SX012N0-N

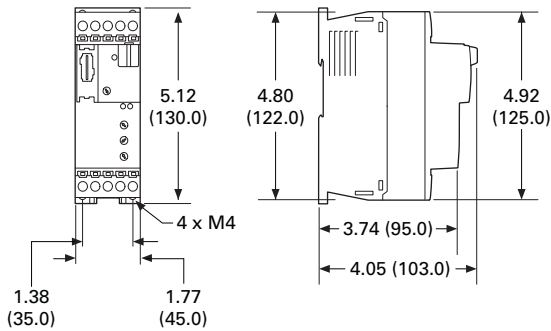
##### Frame 2



##### Catalog Numbers

DS7-340SX016N0-N	DS7-342SX016N0-N
DS7-340SX024N0-N	DS7-342SX024N0-N
DS7-340SX032N0-N	DS7-342SX032N0-N

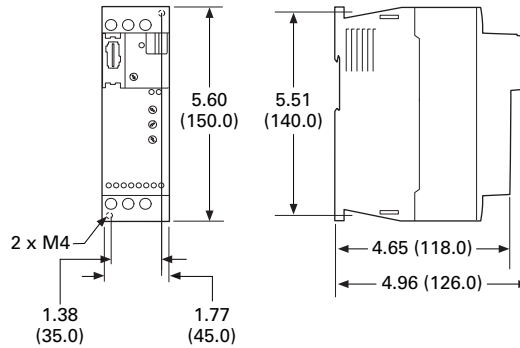
##### Frame 1—SmartWire-DT



##### Catalog Numbers

DS7-34DSX004N0-D	DS7-34DSX009N0-D
DS7-34DSX007N0-D	DS7-34DSX012N0-D

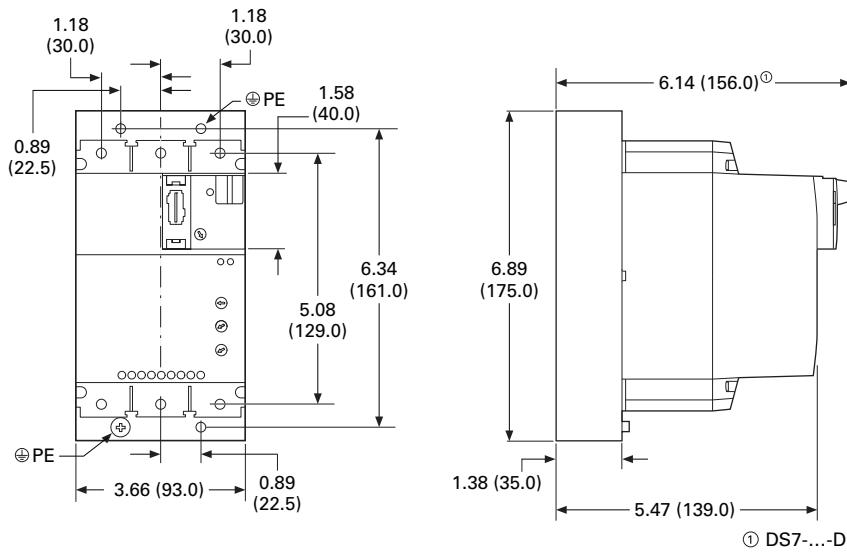
##### Frame 2—SmartWire-DT



##### Catalog Numbers

DS7-34DSX016N0-D
DS7-34DSX024N0-D
DS7-34DSX032N0-D

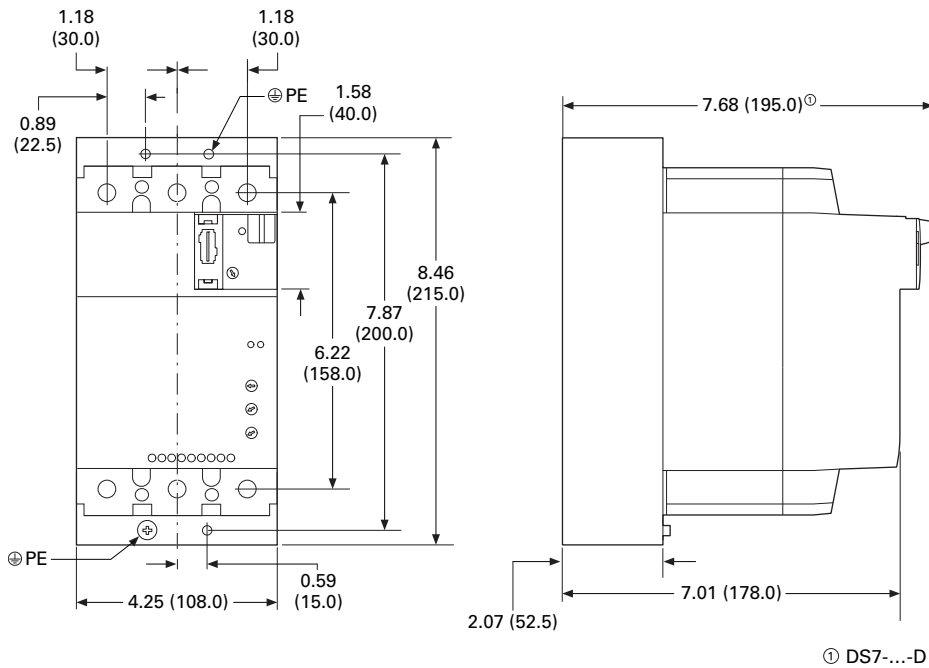
### Frame 3—SmartWire-DT and Standard (Non SmartWire-DT)



#### Catalog Numbers

DS7-340SX041N0-N	DS7-342SX041N0-N	DS7-34DSX041N0-D
DS7-340SX055N0-N	DS7-342SX055N0-N	DS7-34DSX055N0-D
DS7-340SX070N0-N	DS7-342SX070N0-N	DS7-34DSX070N0-D
DS7-340SX081N0-N	DS7-342SX081N0-N	DS7-34DSX081N0-D
DS7-340SX100N0-N	DS7-342SX100N0-N	DS7-34DSX100N0-D

### Frame 4—SmartWire-DT and Standard (Non SmartWire-DT)



#### Catalog Numbers

DS7-342SX135N0-N	DS7-340SX135N0-N	DS7-34DSX135N0-D
DS7-342SX160N0-N	DS7-340SX160N0-N	DS7-34DSX160N0-D
DS7-342SX200N0-N	DS7-340SX200N0-N	DS7-34DSX200N0-D



#### Type S701, Soft Start Controllers



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### Type S701, Soft Start Controllers

#### Product Description

The S701 device is a reduced voltage soft start controller designed to control acceleration and deceleration of three-phase motors. The S701 provides the user with the ability to adjust initial torque, ramp up and down time, and also select kick start for high inertial loads.

#### Application Description

The S701 line of soft start controllers is specifically designed to be a low cost option for soft starting small (15 hp and down) three-phase motors. The S701 unit controls current on two of three motor phases to control the torque being applied to the motor, allowing for smooth starting of a motor. The S701 is designed to be used with a manual motor starter or a full voltage starter. These devices provide the necessary overload protection for the motor and also provide line isolation for the motor. Short-circuit protection can be provided by fuses or circuit breakers.

#### Features

- Rated operational voltage up to 600 Vac
- Control voltage range from 24–480 Vac/Vdc
- Adjustable ramp times (0.5–10 seconds)
- Adjustable initial torque control (0–85%)
- Kick start feature
- Soft stop (0.5–10 seconds)
- Unlimited number of START/STOP operations per hour
- IP20 finger protection
- Fractional to 15 hp motors at 480 V (20 hp at 600 V)

#### Benefits

- Reduced wear on belts, gears, chains, clutches, shafts and bearings
- Allows for controlling the inrush current to the motor
- Reduced water-hammer in pumping applications
- Less shock to product on conveyor lines and material handling gear

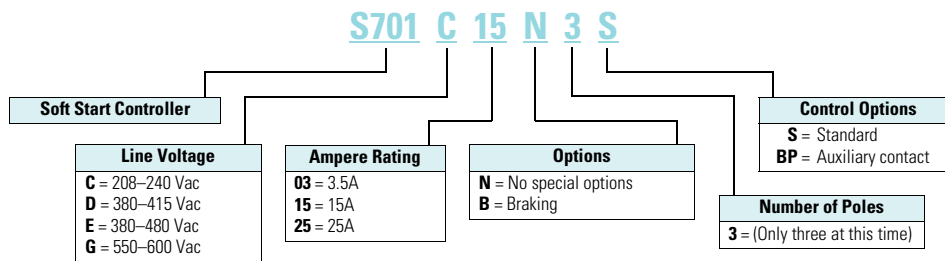
### Standards and Certifications

- IEC 947 compliant
- EN 60947-4-2
- CE marked
- CSA certified
- UL listed (E108212)
- cUL listed



### Catalog Number Selection

#### S701 Soft Starters



### Product Selection

#### S701E15N3S

#### Soft Start Controllers



#### S701E25N3S



Rated Current	Line Voltage	Control Voltage (Vac/Vdc)	Three-Phase Motor												Catalog Number	
			kW Rating (50 Hz)			hp Rating (60 Hz)										
			230 V	380–400 V	440 V	200 V	230 V	460 V	575 V	1.0 SF	1.15 SF	1.0 SF	1.15 SF			
3.5	208–240	24–230	7.5	N/A	N/A	1	1	1	1	N/A	N/A	N/A	N/A	N/A	N/A	<b>S701C03N3S</b>
3.5	380–415	24–415	N/A	1.1	N/A	N/A	N/A	N/A	N/A	N/A	1-1/2	1-1/2	N/A	N/A	N/A	<b>S701D03N3S</b>
3.5	440–480	24–480	N/A	N/A	1.5	N/A	N/A	N/A	N/A	N/A	2	2	N/A	N/A	N/A	<b>S701E03N3S</b>
3.5	500–600	24–480	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2	2	N/A	<b>S701G03N3S</b>
15	208–240	24–230	4	N/A	N/A	3	3	3	3	N/A	N/A	N/A	N/A	N/A	N/A	<b>S701C15N3S</b>
15	380–480	24–480	N/A	5.5	7.5	N/A	N/A	N/A	N/A	10	7-1/2	N/A	N/A	N/A	N/A	<b>S701E15N3S</b>
15	500–600	24–480	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	10	10	N/A	N/A	<b>S701G15N3S</b>
25	208–240	24–230	7.5	N/A	N/A	5	5	7-1/2	5	N/A	N/A	N/A	N/A	N/A	N/A	<b>S701C25N3S</b>
25	380–480	24–480	N/A	11	12.5	N/A	N/A	N/A	N/A	15	15	N/A	N/A	N/A	N/A	<b>S701E25N3S</b>
25	500–600	24–480	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	20	20	N/A	N/A	<b>S701G25N3S</b>

## Technical Data and Specifications

### Soft Starters—S701...03N3S

Description	S701C03N3S	S701D03N3S	S701E03N3S	S701G03N3S
Maximum current capacity	3.5	3.5	3.5	3.5
Trip Class				
10A	3.5	3.5	3.5	3.5
10	3.5	3.5	3.5	3.5
20	2.8	2.8	2.8	2.8
30	2.1	2.1	2.1	2.1
<b>Electrical Characteristics</b>				
Line voltage (Vac)	208–240	380–415	440–480	500–600
Operating frequency (Hz)	50/60	50/60	50/60	50/60
Leakage current	5 mA AC max.	5 mA AC max.	5 mA AC max.	5 mA AC max.
Minimum operational current	50 mA	50 mA	50 mA	50 mA
Control voltage (Vac/Vdc)	24–230	24–415	24–480	24–480
Pickup voltage max.	20.4 Vac/Vdc	20.4 Vac/Vdc	20.4 Vac/Vdc	20.4 Vac/Vdc
Dropout voltage min.	5 Vac/Vdc	5 Vac/Vdc	5 Vac/Vdc	5 Vac/Vdc
Max. control current for no operation	1 mA	1 mA	1 mA	1 mA
Response time max.	70 ms	70 ms	70 ms	70 ms
<b>Control Characteristics</b>				
Ramp time (secs)	0.5–10	0.5–10	0.5–10	0.5–10
Ramp settings (% LRT)	85%	85%	85%	85%
Kick start settings (% LRT)	85%	85%	85%	85%
Soft stop (secs)	0.5–10	0.5–10	0.5–10	0.5–10
<b>Environment Characteristics</b>				
Temperature—operating (no derating)	–30 ° to 40 °C	–30 ° to 40 °C	–30 ° to 40 °C	–30 ° to 40 °C
Current rating 50 °C	N/A	N/A	N/A	N/A
Limited duty cycle 50 °C	N/A	N/A	N/A	N/A
Current rating 60 °C	N/A	N/A	N/A	N/A
Limited duty cycle 60 °C	N/A	N/A	N/A	N/A
Temperature—storage	–30 ° to 80 °C	–30 ° to 80 °C	–30 ° to 80 °C	–30 ° to 80 °C
Altitude (meters)—no derating	2000	2000	2000	2000
Humidity	95% noncondensing	95% noncondensing	95% noncondensing	95% noncondensing
Operating position (no derating)	Vertical ±30 °	Vertical ±30 °	Vertical ±30 °	Vertical ±30 °
Impulse withstand voltage IEC 947-4-1	4000 V	4000 V	4000 V	4000 V
Rated insulation voltage (Ui)	660 V	660 V	660 V	660 V
Installation category	III	III	III	III
Vibration	IEC 68-2-6 5g 10–150 Hz	IEC 68-2-6 5g 10–150 Hz	IEC 68-2-6 5g 10–150 Hz	IEC 68-2-6 5g 10–150 Hz
Power dissipation for intermittent operation	4 W/A x duty cycle	4 W/A x duty cycle	4 W/A x duty cycle	4 W/A x duty cycle
Power dissipation for continuous operation	4 W/A x duty cycle	4 W/A x duty cycle	4 W/A x duty cycle	4 W/A x duty cycle
Cooling method	Natural convection	Natural convection	Natural convection	Natural convection
Degree of protection	IP20	IP20	IP20	IP20
Pollution degree	3	3	3	3
Agency approvals	UL, cUL, CE	UL, cUL, CE	UL, cUL, CE	UL, cUL, CE

## Soft Starters—S701...15N3S

Description	S701C15N3S	S701E15N3S	S701G15N3S
Maximum current capacity	15	15	15
Trip Class			
10A	15	15	15
10	15	15	15
20	12	12	12
30	10	10	10
<b>Electrical Characteristics</b>			
Line voltage (Vac)	208–240	380–480	500–600
Operating frequency (Hz)	50/60	50/60	50/60
Leakage current	5 mA AC max.	5 mA AC max.	5 mA AC max.
Minimum operational current	50 mA	50 mA	50 mA
Control voltage (Vac/Vdc)	24–230	24–480	24–480
Pickup voltage max.	20.4 Vac/Vdc	20.4 Vac/Vdc	20.4 Vac/Vdc
Dropout voltage min.	5 Vac/Vdc	5 Vac/Vdc	5 Vac/Vdc
Max. control current for no operation	1 mA	1 mA	1 mA
Response time max.	70 ms	70 ms	70 ms
<b>Control Characteristics</b>			
Ramp time (secs)	0.5–10	0.5–10	0.5–10
Ramp settings (% LRT)	85%	85%	85%
Kick start settings (% LRT)	85%	85%	85%
Soft stop (secs)	0.5–10	0.5–10	0.5–10
<b>Environment Characteristics</b>			
Temperature—operating (no derating)	–30 ° to 40 °C	–30 ° to 40 °C	–30 ° to 40 °C
Current rating 50 °C	12.5A	12.5A	12.5A
Limited duty cycle 50 °C	15A on-time max. 15 min. duty cycle max. 0.8	15A on-time max. 15 min. duty cycle max. 0.8	15A on-time max. 15 min. duty cycle max. 0.8
Current rating 60 °C	10A	10A	10A
Limited duty cycle 60 °C	15A on-time max. 15 min. duty cycle max. 0.65	15A on-time max. 15 min. duty cycle max. 0.65	15A on-time max. 15 min. duty cycle max. 0.65
Temperature—storage	–30 ° to 80 °C	–30 ° to 80 °C	–30 ° to 80 °C
Altitude (meters)—no derating	2000	2000	2000
Humidity	95% noncondensing	95% noncondensing	95% noncondensing
Operating position (no derating)	Vertical ±30 °	Vertical ±30 °	Vertical ±30 °
Impulse withstand voltage IEC 947-4-1	4000 V	4000 V	4000 V
Rated insulation voltage (Ui)	660 V	660 V	660 V
Installation category	III	III	III
Vibration	IEC 68-2-6 5g 10–150 Hz	IEC 68-2-6 5g 10–150 Hz	IEC 68-2-6 5g 10–150 Hz
Power dissipation for intermittent operation	2 W/A x duty cycle	2 W/A x duty cycle	2 W/A x duty cycle
Power dissipation for continuous operation	2 W/A	2 W/A	2 W/A
Cooling method	Natural convection	Natural convection	Natural convection
Degree of protection	IP20	IP20	IP20
Pollution degree	3	3	3
Agency approvals	UL, CSA, CE	UL, CSA, CE	UL, CSA, CE

## Soft Starters—S701...25N3S

Description	S701C25N3S	S701E25N3S	S701G25N3S
Maximum current capacity	25	25	25
Trip Class			
10A	25	25	25
10	25	25	25
20	20	20	20
30	15	15	15
<b>Electrical Characteristics</b>			
Line voltage (Vac)	208–240	380–480	500–600
Operating frequency (Hz)	50/60	50/60	50/60
Leakage current	5 mA AC max.	5 mA AC max.	5 mA AC max.
Minimum operational current	50 mA	50 mA	50 mA
Control voltage (Vac/Vdc)	24–230	24–480	24–480
Pickup voltage max.	20.4 Vac/Vdc	20.4 Vac/Vdc	20.4 Vac/Vdc
Dropout voltage min.	5 Vac/Vdc	5 Vac/Vdc	5 Vac/Vdc
Max. control current for no operation	1 mA	1 mA	1 mA
Response time max.	70 ms	70 ms	70 ms
<b>Control Characteristics</b>			
Ramp time (secs)	0.5–10	0.5–10	0.5–10
Ramp settings (% LRT)	85%	85%	85%
Kick start settings (% LRT)	85%	85%	85%
Soft stop (secs)	0.5–10	0.5–10	0.5–10
<b>Environment Characteristics</b>			
Temperature—operating (no derating)	–30 ° to 40 °C	–30 ° to 40 °C	–30 ° to 40 °C
Current rating 50 °C	20A	20A	20A
Limited duty cycle 50 °C	25A on-time max. 15 min. duty cycle max. 0.8	25A on-time max. 15 min. duty cycle max. 0.8	25A on-time max. 15 min. duty cycle max. 0.8
Current rating 60 °C	17A	17A	17A
Limited duty cycle 60 °C	25A on-time max. 15 min. duty cycle max. 0.65	25A on-time max. 15 min. duty cycle max. 0.65	25A on-time max. 15 min. duty cycle max. 0.65
Temperature—storage	–30 ° to 80 °C	–30 ° to 80 °C	–30 ° to 80 °C
Altitude (meters)—no derating	2000	2000	2000
Humidity	95% noncondensing	95% noncondensing	95% noncondensing
Operating position (no derating)	Vertical ±30 °	Vertical ±30 °	Vertical ±30 °
Impulse withstand voltage IEC 947-4-1	4000 V	4000 V	4000 V
Rated insulation voltage (Ui)	660 V	660 V	660 V
Installation category	III	III	III
Vibration	IEC 68-2-6 5g 10–150 Hz	IEC 68-2-6 5g 10–150 Hz	IEC 68-2-6 5g 10–150 Hz
Power dissipation for intermittent operation	2 W/A x duty cycle	2 W/A x duty cycle	2 W/A x duty cycle
Power dissipation for continuous operation	2 W/A	2 W/A	2 W/A
Cooling method	Natural convection	Natural convection	Natural convection
Degree of protection	IP20	IP20	IP20
Pollution degree	3	3	3
Agency approvals	UL, CSA, CE	UL, CSA, CE	UL, CSA, CE

**Dimensions**

Approximate Dimensions in Inches (mm)

**Soft Starters—S701...N3S**

<b>Catalog Number</b>	<b>W</b>	<b>H</b>	<b>D</b>	<b>Weight in Lbs (kg)</b>
<b>S701C03N3S</b>	0.89 (22.5)	3.94 (100)	5.01 (127)	0.6 (270)
<b>S701D03N3S</b>	0.89 (22.5)	3.94 (100)	5.01 (127)	0.6 (270)
<b>S701E03N3S</b>	0.89 (22.5)	3.94 (100)	5.01 (127)	0.6 (270)
<b>S701G03N3S</b>	0.89 (22.5)	3.94 (100)	5.01 (127)	0.6 (270)
<b>S701C15N3S</b>	1.77 (45)	3.94 (100)	5.04 (128)	1.52 (690)
<b>S701E15N3S</b>	1.77 (45)	3.94 (100)	5.04 (128)	1.52 (690)
<b>S701G15N3S</b>	1.77 (45)	3.94 (100)	5.04 (128)	1.52 (690)
<b>S701C25N3S</b>	3.54 (90)	3.94 (100)	5.04 (128)	2.53 (1150)
<b>S701E25N3S</b>	3.54 (90)	3.94 (100)	5.04 (128)	2.53 (1150)
<b>S701G25N3S</b>	3.54 (90)	3.94 (100)	5.04 (128)	2.53 (1150)



Type S701, Soft Start Controllers with Auxiliary Contact



### Contents

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### Type S701, Soft Start Controllers with Auxiliary Contact

#### Product Description

The S701 device is a reduced voltage soft start controller designed to control acceleration and deceleration of three-phase motors. With the auxiliary contact, it is possible to control an external bypass to reduce heating and increase acceleration and deceleration times.

The unit provides the user with the ability to adjust initial torque, ramp up and down time and also select kick start for high inertia loads.

#### Application Description

The S701 line of soft start controllers is specifically designed to be a low cost option for soft starting small (15 hp and down) three-phase motors. The auxiliary contact is designed to work in conjunction with an across-the-line contactor. The purpose of the contactor is to provide a parallel current path once the soft starter has brought the motor up to speed. Once the soft start controller reaches end of ramp, the auxiliary contact will close and send a signal to close the bypass contactor, thus providing a low impedance path for the current to the motor. The S701 unit controls current on two of three motor phases to control the torque being applied to the motor, allowing for smooth starting of a motor. The S701 is designed to be used with a manual motor protector or a full voltage starter. These devices provide the necessary overload protection for the motor and also provide line isolation for the motor. Short-circuit protection can be provided by fuses or circuit breakers.

#### Features

- Rated operational voltage up to 600 Vac
- Control voltage range from 24–300 Vac/Vdc
- Adjustable ramp times (0.5–20 seconds)
- Adjustable initial torque control (0–85%)
- Kick start feature (0–85% adjustment)
- Kick start for 200 ms
- Soft stop (0.5–20 seconds)
- IP20 finger protection
- Available up to 30A (with Bypass installed)
- Auxiliary contact for up-to-speed indication

#### Benefits

- Reduced wear on belts, gears, chains, clutches, shafts and bearings
- Bypass option allows for greater current capacity in the unit
- Bypass option helps to reduce heat in the enclosure
- Allows for controlling the inrush current to the motor
- Reduced water-hammer in pumping applications
- Less shock to product on conveyor lines and material handling gear

#### Standards and Certifications

- IEC 947 compliant
- EN 60947-4-2
- CE marked
- UL listed (E108212)
- cUL listed



### Product Selection

For S701 catalog number selection, see **Page V6-T1-27**.

S701

### Soft Start Controllers with Auxiliary Contact



Rated Current	Line Voltage	Control Voltage (Vac/Vdc)	Three-Phase Motor kW Rating (50 Hz)			hp Rating		230 V		460 V		575 V		Catalog Number
			230 V	380–400 V	440 V	200 V	1.15 SF	1.0 SF	1.15 SF	1.0 SF	1.15 SF	1.0 SF	1.15 SF	
<b>Ratings without Bypass</b>														
25	208–240	24–230	5.5	N/A	N/A	5	5	7-1/2	5	N/A	N/A	N/A	N/A	<b>S701C25N3BP</b>
25	380–480	24–480	N/A	12.5	12.5	N/A	N/A	N/A	N/A	15	15	N/A	N/A	<b>S701E25N3BP</b>
25	500–600	24–480	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	20	20	<b>S701G25N3BP</b>
<b>Ratings with Bypass</b>														
30	208–240	24–230	7.5	N/A	N/A	7-1/2	7-1/2	10	7-1/2	N/A	N/A	N/A	N/A	<b>S701C25N3BP</b>
30	380–480	24–480	N/A	15	15	N/A	N/A	N/A	N/A	20	15	N/A	N/A	<b>S701E25N3BP</b>
30	500–600	24–480	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	25	20	<b>S701G25N3BP</b>

### Technical Data and Specifications

#### Soft Starters with Auxiliary Contact—S701...25N3BP

Description	S701C25N3BP	S701E25N3BP	S701G25N3BP
Maximum current capacity with bypass (without bypass)	30 (25)	30 (25)	30 (25)
Trip Class			
10A	30 (25)	30 (25)	30 (25)
10	30 (25)	30 (25)	30 (25)
20	24 (20)	24 (20)	24 (20)
30	19.5 (15)	19.5 (15)	19.5 (15)
<b>Electrical Characteristics</b>			
Line voltage (Vac)	208–240	380–480	500–600
Operating frequency (Hz)	50/60	50/60	50/60
Leakage current	5 mA AC max.	5 mA AC max.	5 mA AC max.
Minimum operational current	50 mA	50 mA	50 mA
Control voltage (Vac/Vdc)	24–230	24–480	24–480
Pickup voltage max.	20.4 Vac/Vdc	20.4 Vac/Vdc	20.4 Vac/Vdc
Dropout voltage min.	5 Vac/Vdc	5 Vac/Vdc	5 Vac/Vdc
Max. control current for no operation	1 mA	1 mA	1 mA
Response time max.	70 ms	70 ms	70 ms

## Soft Starters with Auxiliary Contact—S701...25N3BP, continued

Description	S701C25N3BP	S701E25N3BP	S701G25N3BP
<b>Control Characteristics</b>			
Ramp time (secs)	0.5–20	0.5–20	0.5–20
Ramp settings (% LRT)	85%	85%	85%
Kick start settings (% LRT)	85%	85%	85%
Soft stop (secs)	0.5–20	0.5–20	0.5–20
<b>Environmental Characteristics</b>			
Temperature—operating (no derating)	–30 ° to 40 °C	–30 ° to 40 °C	–30 ° to 40 °C
Current rating 50 °C	20A	20A	20A
Limited duty cycle 50 °C	25A on-time max. 15 min. duty cycle max. 0.8	25A on-time max. 15 min. duty cycle max. 0.8	25A on-time max. 15 min. duty cycle max. 0.8
Current rating 60 °C	17A	17A	17A
Limited duty cycle 60 °C	25A on-time max. 15 min. duty cycle max. 0.65	25A on-time max. 15 min. duty cycle max. 0.65	25A on-time max. 15 min. duty cycle max. 0.65
Temperature—storage	–30 ° to 80 °C	–30 ° to 80 °C	–30 ° to 80 °C
Altitude (meters)—no derating	2000	2000	2000
Humidity	95% noncondensing	95% noncondensing	95% noncondensing
Operating position (no derating)	Vertical ±30 °	Vertical ±30 °	Vertical ±30 °
Impulse withstand voltage IEC 947-4-1	4000 V	4000 V	4000 V
Rated insulation voltage (Ui)	660 V	660 V	660 V
Installation category	III	III	III
Vibration	IEC 68-2-6 5g 10–150 Hz	IEC 68-2-6 5g 10–150 Hz	IEC 68-2-6 5g 10–150 Hz
Power dissipation for continuous operation	2 W/A without bypass	2 W/A without bypass	2 W/A without bypass
Power dissipation with semiconductor bypassed	5 W/A max. with bypass	5 W/A max. with bypass	5 W/A max. with bypass
Cooling method	Natural convection	Natural convection	Natural convection
Degree of protection	IP20	IP20	IP20
Pollution degree	3	3	3
Agency approvals	UL, cUL, CE	UL, cUL, CE	UL, cUL, CE

## Dimensions

Approximate Dimensions in Inches (mm)

## Soft Starters with Auxiliary Contact—S701...25N3BP

Catalog Number	W	H	D	Weight in Lbs (kg)
S701C25N3BP	3.54 (89.9)	3.94 (100.1)	5.04 (128.0)	2.53 (1150)
S701E25N3BP	3.54 (89.9)	3.94 (100.1)	5.04 (128.0)	2.53 (1150)
S701G25N3BP	3.54 (89.9)	3.94 (100.1)	5.04 (128.0)	2.53 (1150)

Type S701, Soft Start Controllers with Brake



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## Type S701, Soft Start Controllers with Brake

### Product Description

The S701 soft start controller with DC injection brake is designed to control acceleration and deceleration of three-phase motors. Brake current is adjustable from 0–50A DC. The ramp-up feature is adjustable from 0.5–10 seconds. Torque adjustment is adjustable with or without break loose (kick start) function.

### Application Description

The S701 line of soft start controllers is specifically designed to be a low cost option for soft starting small (15 hp and down) three-phase motors. The braking option is a DC injection system, allowing for fast stopping of a three-phase motor. The S701 unit controls current on two of the three phases to control the torque being applied to the motor, allowing for smooth starting of a motor. The S701 is designed to be used with a manual motor starter or a full voltage starter. These devices provide the necessary overload protection for the motor and also provide line isolation for the motor. Short-circuit protection can be provided by fuses or circuit breakers.

### Features

- Rated operational voltage up to 480 Vac
- Control voltage range from 24–300 Vac/Vdc
- Adjustable ramp times (0.5–20 seconds)
- Adjustable initial torque control (0–85%)
- Kick start feature (0–85% adjustment)
- Kick start for 200 ms
- IP20 finger protection
- Braking control adjustable from 0–50A DC
- Slow speed: 75% or 10% of nominal speed

### Standards and Certifications

- IEC 947 compliant
- EN 60947-4-2
- CE marked
- UL listed (E108212)
- cUL listed



### Benefits

- Reduced wear on bolts, gears, chains, clutches, shafts and bearings
- Braking option allows for quick stopping of loads
- Brake control can help eliminate expensive mechanical brakes
- Allows for controlling the inrush current to the motor
- Reduced water-hammer in pumping applications
- Less shock to product on conveyor lines and material handling gear

**Product Selection**For S701 catalog number selection, see **Page V6-T1-27**.**S701E25B3S****Soft Start Controllers with Brake**

Rated Current	Line Voltage	Control Voltage (Vac/Vdc)	Three-Phase Motor kW Rating (50 Hz)			hp Rating 200 V		230 V		460 V		Catalog Number
			230 V	380–400 V	440 V	1.0 SF	1.15 SF	1.0 SF	1.15 SF	1.0 SF	1.15 SF	
25	208–240	24–230	5.5	N/A	N/A	5	5	7-1/2	5	N/A	N/A	<b>S701C25B3S</b>
25	380–480	24–480	N/A	12.5	12.5	N/A	N/A	N/A	N/A	15	15	<b>S701E25B3S</b>

**Technical Data and Specifications****Soft Starters with Brake—S701...25B3S**

Description	S701C25B3S	S701E25B3S
Maximum current capacity	25	25
Trip Class		
10A	25	25
10	25	25
20	20	20
30	15	15
<b>Electrical Characteristics</b>		
Line voltage (Vac)	208–240	380–480
Operating frequency (Hz)	50/60	50/60
Leakage current	5 mA AC max.	5 mA AC max.
Minimum operational current	1A	1A
Control voltage (Vac/Vdc)	24–230	24–480
Pickup voltage max.	20.4 Vac/Vdc	20.4 Vac/Vdc
Dropout voltage min.	5 Vac/Vdc	5 Vac/Vdc
Max. control current for no operation	1 mA	1 mA
Response time max.	100 ms	100 ms
<b>Control Characteristics</b>		
Ramp time (secs)	0.5–10	0.5–10
Ramp settings (% LRT)	85%	85%
Kick start settings (% LRT)	85%	85%
Soft stop (secs)	0.5–10	0.5–10
Brake current	0–50 Vdc	0–50 Vdc

**Soft Starters with Brake—S701...25B3S, continued**

Description	S701C25B3S	S701E25B3S
<b>Environmental Characteristics</b>		
Temperature—operating	–30 ° to 40 °C	–30 ° to 40 °C
Current rating 50 °C	20A	20A
Limited duty cycle 50 °C	25A on-time max. 15 min. duty cycle max. 0.8	25A on-time max. 15 min. duty cycle max. 0.8
Current rating 60 °C	17A	17A
Limited duty cycle 60 °C	25A on-time max. 15 min. duty cycle max. 0.65	25A on-time max. 15 min. duty cycle max. 0.65
Temperature—storage	–30 ° to 80 °C	–30 ° to 80 °C
Altitude (meters)—no derating	2000	2000
Humidity	95% noncondensing	95% noncondensing
Operating position	Vertical ± 0 °	Vertical ± 0 °
Impulse withstand voltage IEC 947-4-1	4000 V	4000 V
Rated insulation voltage (Ui)	660 V	660 V
Installation category	III	III
Vibration	IEC 68-2-6 5g 10–150 Hz	IEC 68-2-6 5g 10–150 Hz
Power dissipation for intermittent operation	2 W/A x duty cycle	2 W/A x duty cycle
Power dissipation for continuous operation	2 W/A	2 W/A
Cooling method	Natural convection	Natural convection
Degree of protection	IP20	IP20
Pollution degree	3	3
Agency approvals	UL, cUL, CE	UL, cUL, CE

**Dimensions**

Approximate Dimensions in Inches (mm)

**Soft Starters with Brake—S701...25B3S**

Catalog Number	W	H	D	Weight in Lbs (kg)
<b>S701C25B3S</b>	3.54 (89.9)	3.94 (100.1)	5.04 (128.0)	2.53 (1150)
<b>S701E25B3S</b>	3.54 (89.9)	3.94 (100.1)	5.04 (128.0)	2.53 (1150)



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### Type S511, Semiconductor Reversing Contactors

#### Product Description

The S511 device is a semiconductor reversing contactor designed to switch three-phase motors forward and reverse. Unicore electronics and thermal design ensures high switching capacity and long lifetime.

#### Application Description

The S511 line of solid-state reversing contactors is specifically designed for high speed operations or when long contactor life is required. The reversing contactors are intended for small motor applications (5 hp and below). The S511 unit can be used in a variety of applications including fans, pumps, conveyors, doors, hoists, cranes, etc. It is designed to be used with a manual motor starter or a full voltage starter. These devices provide the necessary overload protection for the motor and also provide line isolation for the motor. Short-circuit protection can be provided by fuses or circuit breakers.

#### Features

- Rated operational voltage up to 480 Vac
- Control voltage ranges of 5–24 Vdc and 24–240 Vac/Vdc
- Unlimited number of START/STOP operations per hour
- IP20 finger protection
- AC-3 current rating of 10A
- AC-4 current rating of 8A

#### Benefits

- Extremely high switching rates possible
- Very long life expectancy and no contacts or movable parts to replace
- Compact design (45 mm wide) leads to significant panel savings

#### Standards and Certifications

- IEC 947 compliant
- EN 60947-4-2
- CE marked
- CSA certified
- UL listed



## Product Selection

### Reversing Solid-State Contactors

Rated Current	Line Voltage	Control Voltage	Three-Phase Motor kW Rating (50 Hz)			hp Rating		230 V		460 V		Catalog Number
			230 V	380–400 V	440 V	200 V 1.0 SF	1.15 SF	1.0 SF	1.15 SF	1.0 SF	1.15 SF	
10	208–480	5–24 Vdc	2.2	4	4	2	2	3	2	5	5	S511E10N3D
10	208–480	24–240 Vac/Vdc	2.2	4	4	2	2	3	2	5	5	S511E10N3S

## Technical Data and Specifications

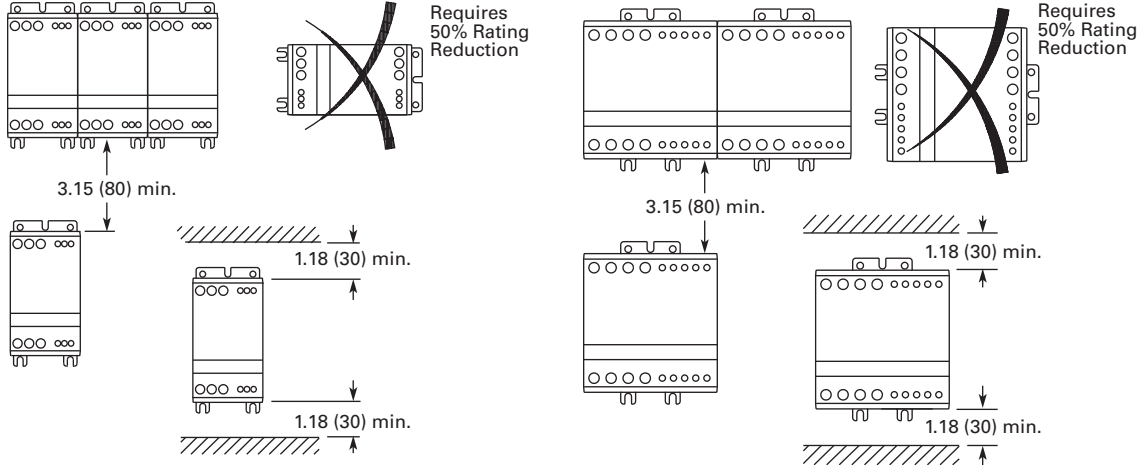
### Semiconductor Reversing Contactors—S511E10N3...

Description	S511E10N3D	S511E10N3S
Maximum current capacity	10	10
Trip Class		
10A	10	10
10	10	10
20	8	8
30	6.5	6.5
<b>Electrical Characteristics</b>		
Line Voltage (Vac)	208–480	208–480
Operating frequency (Hz)	50/60	50/60
Control voltage	5–24 Vdc	24–240 Vac/Vdc
Pickup voltage max.	4.25 Vdc	20.4 Vac/Vdc
Dropout voltage min.	1.5 Vdc	7.2 Vac/Vdc
Max. control voltage	26.4 Vdc	253 Vac/Vdc
Response time max.	1/2 cycle	1 cycle
Interlock time max.	80 ms	150 ms
<b>Control Characteristics</b>		
Operation current AC-3	10	10
Operation current AC-4	8	8
Duty cycle	Continuous operation	Continuous operation
Leakage current	1 mA AC max.	1 mA AC max.
Minimum operation current	10 mA AC	10 mA AC
<b>Environmental Characteristics</b>		
Temperature—operating	0 ° to 60 °C	0 ° to 60 °C
Temperature—storage	–20 ° to 80 °C	–20 ° to 80 °C
Altitude (meters)	2000	2000
Humidity	95% noncondensing	95% noncondensing
Operating position	Vertical ±30 °	Vertical ±30 °
Impulse withstand voltage IEC 947-4-1	4000 V	4000 V
Rated insulation voltage (Ui)	660 V	660 V
Installation category	III	III
Vibration	IEC 68-2-6 5g 10–150 Hz	IEC 68-2-6 5g 10–150 Hz
Power dissipation for intermittent operation	2.2 W/A x duty cycle	2.2 W/A x duty cycle
Power dissipation for continuous operation	2.2 W/A	2.2 W/A
Cooling method	Natural convection	Natural convection
Degree of protection	IP20	IP20
Pollution degree	3	3
Agency approvals	UL, CSA, CE	UL, CSA, CE

#### Mounting Instructions

**IMPORTANT:** The controller is designed for vertical mounting in free air. If the controller is mounted horizontally, the load current must be reduced to 50% of rated current.

#### Recommended Mounting Distances



#### Dimensions

Approximate Dimensions in Inches (mm)

#### Semiconductor Reversing Contactors—S511E10N3...

Catalog Number	W	H	D	Weight in Lbs (kg)
S511E10N3D	1.77 (45.0)	3.94 (100.1)	5.04 (128.0)	1.52 (690)
S511E10N3S	1.77 (45.0)	3.94 (100.1)	5.04 (128.0)	1.52 (690)

Also refer to dimension drawings on **Page V6-T1-41**.

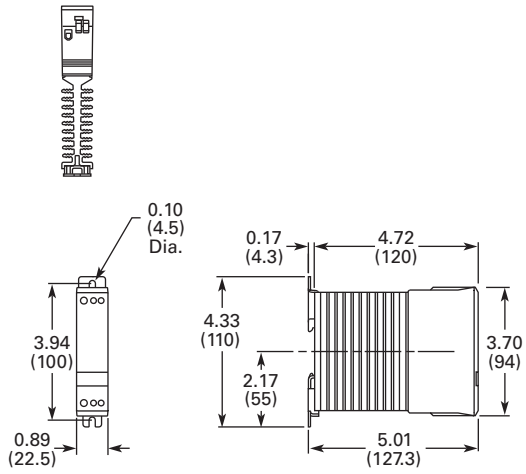
#### Cable Requirements and Sizing

75 °C	AWG (mm <sup>2</sup> )	AWG (mm <sup>2</sup> )
	18–12 (0.75–4)	20–16 (0.5–1.5)
	2–18 (2 x 1)	2 x 20–18 (2 x 0.5–0.75)
	18–10 (0.75–4)	20–16 (0.5–1.5)
	2 x 18–14 (2 x 0.75–2.5)	2 x 20–16 (2 x 0.5–1.5)
	18–10 (0.75–4)	20–16 (0.5–1.5)
	2 x 18–16 (0.75–6)	2 x 20–16 (2 x 0.5–1.5)
	Posidrive 1 4.4 in-lb. max. 0.5 Nm max.)	N/A
	4 mm 4.4 in-lb. max. (0.5 Nm max.)	3 mm 3.5 in-lb. max. (0.4 Nm max.)

Approximate Dimensions in Inches (mm)

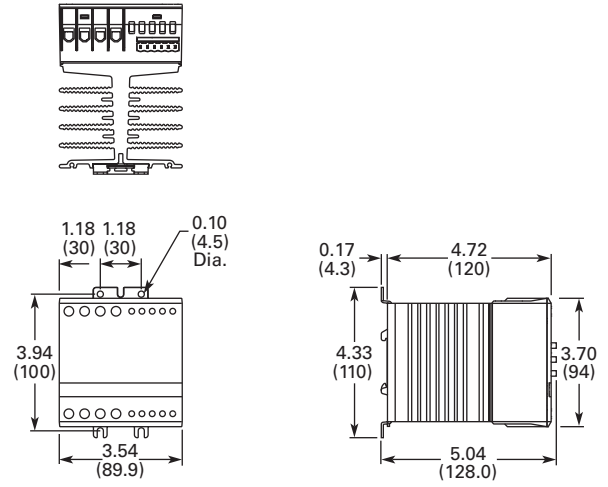
### 22.5 mm Frame

S511E10N3D, S511E10N3S



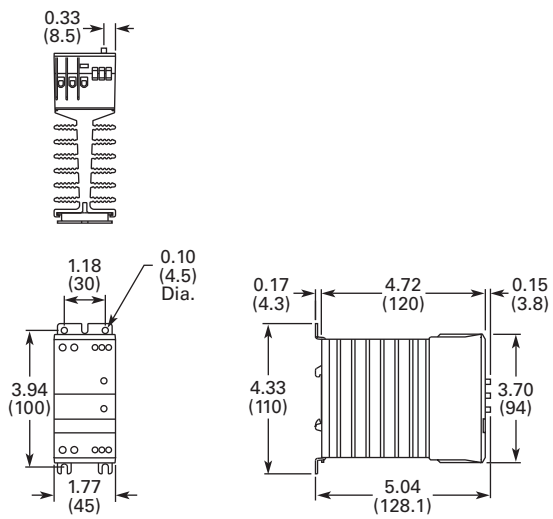
### 90 mm Frame

S511E10N3D, S511E10N3S



### 45 mm Frame

S511E10N3D, S511E10N3S



**Solid-State Starters**



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**Product Overview**

**Type S611**

The S611 soft starter is a powerful combination of performance capability, application flexibility, and the industry's best user interface experience.

Designed to control acceleration and deceleration of three-phase motors, the line is available for current ranges from 26A through 414A applications.

The S611 has integrated bypass and overload protection. The S611 is available as a component for panel mounting or in enclosed control—NEMA Type 1, 12, 3R, 4, 4X.

**Type S801+**

Eaton's S801+ line of reduced voltage soft starters is very compact, multi-functional, easy to install and easy to program. Designed to control acceleration and deceleration of three-phase motors, the line is available for current ranges from 11A to 1000A applications, and is suitable for mounting in motor control centers or in enclosed control (NEMA Type 1, 4, 4X and 12) applications.

**Type S811+**

Eaton's S811+ offers all the popular features of the S801+ and adds enhanced functionality with the new DIM (Digital Interface Module), communications, metering, monitoring and diagnostics capabilities.

Eaton's line of S811+ reduced voltage soft starters is very compact, multi-functional, easy to install and easy to set operating parameters. Designed to control the acceleration and deceleration of three-phase motors up to 690 V, the line is available from 11A to 1000A.

The S811+ is designed to be a complete package, combining the silicon controlled rectifiers (SCRs), bypass contactor and overload in one, very compact unit. The S811+ is available as a component for panel mounting, in motor control centers or in enclosed control (NEMA Type 1, 3R, 4, 4X, 7/9 and 12).

Type S611, Soft Starter



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## Type S611, Soft Starters

### Product Description

Eaton revolutionized the reduced voltage control marketplace with its advanced feature set and user-friendly user interface module to enhance system performance and reduce commissioning times. The S611 adds enhanced functionality with network communications, metering, monitoring and diagnostics capabilities.

The Eaton line of S611 reduced voltage soft starters is multi-functional, easy to install and easy to program. Designed to control the acceleration and deceleration of three-phase motors up to 600 V, the line is available from 26 amps through 414 amps.

The S611 is designed to be a complete package combining the SCRs, bypass contactor and overload in one unit.

### Application Description

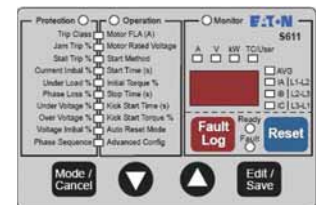
Designed to control the acceleration and deceleration of three-phase motors, the S611 soft starter uses Silicon Controlled Rectifiers (SCRs) to control the voltage to soft start and soft stop the motor. After the motor is started, internal run bypass contactors close, resulting in the motor running directly across-the-line. The built-in solid-state overload protects the motor from overload conditions with sophisticated algorithms that model true motor heating, resulting in better motor protection and fewer nuisance trips. Advanced protective and diagnostic features reduce downtime.

A voltage ramp start or current limit start is available. Kick start is available in either starting mode. The soft stop option allows for a ramp stop time that is longer than the coast to stop time. The pump control option provides a smooth transition for starting and stopping a motor and eliminating the “water-hammer” effect that can damage pipes, valves and pumps.

The S611 offers an impressive array of advanced protective features. Not only are the protective features selectable, but many offer variable settings allowing the user to fine tune the soft starter to meet specific system requirements.

The S611 has an easy to use User Interface Module (UI) that allows the user to configure the device and to read system parameters and values. The UI includes an LED display and keypad to scroll through the various parameters. The UI allows the user to modify control parameters, enable or disable protections, set communication variables, monitor system values such as line voltages and currents, and access the fault queue.

### User Interface Module (UI)



The UI can be removed from the S611 and remote mounted. Kits are available to door mount the UI, enabling users to safely configure, commission, monitor and troubleshoot the system at the electrical panel without opening the enclosure door. This will help eliminate the possibility of an arc flash incident.

### Standards and Certifications

- IEC 60947-4-2
- UL listed
- CSA certified (3211 06)



### Features and Benefits

- The User Interface Module (UI) provides an intuitive, easy-to-use human interface with powerful configuration capabilities to maximize system performance
- Door or device mounted UI enables users to safely configure, commission, monitor and troubleshoot the system at the electrical panel without opening the enclosure door, eliminating the possibility of an arc flash incident
- System operating parameters can be monitored enterprise-wide through a communications network. Increase uptime by providing data for process management and preventive diagnostics
- Run bypass mode greatly reduces internal heating created by the greater power dissipation in the SCRs. Bypass contactors directly connect the motor to the line and improves system efficiency by reducing internal power losses
- Internal solid-state overload protection provides accurate current measurement and trip settings. Sophisticated algorithms solve a series of differential equations that model true motor heating and cooling, resulting in superior motor overload protection while minimizing nuisance trips. Advanced selectable protective features safeguard the motor and system against a variety of system faults
- Internal run bypass contactors and overload protection eliminate the need for additional devices, reducing enclosure sizes minimizing installation and wiring time and reducing overall assembly size and cost
- Wide range of overload FLA settings (50–100% of rated frame current) and a selectable trip class (5–30) offers users the flexibility to fine tune the starter to match specific application requirements
- Variable ramp times and torque control settings provide unlimited starting configurations, allowing for maximum application flexibility
- Kick-start feature enables soft starting of high friction loads
- Soft stop control for applications where an abrupt stop of the load is not acceptable
- Pump control option with sophisticated pump algorithms on both starting and stopping that minimize the pressure surges that cause water hammer. The pump control option will maximize the life of the pump and piping systems while minimizing the downtime caused by system failure
- Six SCRs control all three motor phases, providing smooth acceleration and deceleration performance
- Soft acceleration and deceleration reduces wear on belts, gears, chains, clutches, shafts and bearings
- Reduce the peak inrush current's stress on the power system
- Minimize peak starting torque to diminish mechanical system wear and damage
- 120 Vac control voltage enhances ease of connections
- The S611 lends itself to serviceability. The printed circuit boards (PCBs) and contactors can be replaced in the field
- The S611 has built-in communication capabilities through two communications ports to connect the soft starter to a variety of networks, including Modbus (resident), DeviceNet™, PROFIBUS®, and Ethernet

### Protective Features

All protective features can be configured, enabled or disabled with the UI or through the communications network.

#### Motor Overload

The S611 includes electronic overload protection as standard. The overload meets applicable requirements for a motor overload protective device. The overload protects the motor from over heat conditions with the use of sophisticated algorithms that model true motor heating, resulting in superior motor protection and fewer nuisance trips.

The S611 calculates a thermal memory value. A 100% value represents the maximum safe temperature of the motor. When the thermal memory value reaches 100%, an overload trip will occur removing power to the motor.

Upon trip, the S611 stores the calculated motor heating value and will not allow a motor re-start until the motor has cooled. This feature ensures the motor will not be damaged by repeated overload trip, reset and re-start cycles.

The thermal memory value can be monitored through the UI or the communications network. The thermal memory value can be of great use in determining an impending overload trip condition. Alarms can be implemented in the process monitoring system warning of an impending trip before a trip occurs halting the process. Costly system downtime can be avoided.

The trip current is adjusted to match the specific application requirements by entering the motor nameplate full load current rating and trip class. The FLA adjustment includes a 2 to 1 adjustment range. The overload trip class is adjustable from class 5 through class 30. The overload is ambient temperature compensated - meaning its trip characteristics will not vary with changes in ambient temperature. The overload protection can be enabled, disabled, or disabled on start.

#### Short Circuit

The use of a short circuit protective device in coordination with the S611 is required in branch motor circuits by most electrical codes. Short circuit coordination ratings with both fuses and Eaton molded case circuit breakers are available providing customers with design flexibility. The S611 has short circuit coordination ratings as an open component, an enclosed starter, and in a motor control center. The short circuit ratings can go up to 100 kA depending on application configuration.



**Jam**

Excessive current and torque up to locked rotor levels can occur in a jam condition. The condition can result in stress and damage to the motor, load, mechanical system, and the electrical distribution system. Jam protection prevents the stress and damage from a jam during normal run. After the motor is started, a current greater than 300% FLA setting will cause the starter to trip on a jam fault.

**Stall**

Excessive current and torque up to locked rotor levels can occur in a stall condition. The condition can lead to an overload trip and result in stress and damage to the motor, load, mechanical system, and the electrical distribution system. Stall protection prevents stress and damage to a motor that has not come up to speed, or stalled after the soft start time. The S611 will trip to protect the system in the event that the motor did not get to the rated speed in the defined soft start period. A current greater than 200% FLA at the end of the soft start period will cause the starter to trip on a stall fault.

**Pole Over Temperature**

High ambient temperatures, extended ramp times and high duty cycle conditions may cause the S611 power pole conductors to reach a temperature that exceeds their thermal rating. The S611 is equipped with sensors that monitor the temperature of the power poles. Over temperature protection occurs if the device's thermal capacity is exceeded. The soft starter will trip in over temperature conditions, preventing device failure.

The device pole temperature value can be monitored through the UI or the communications network. This feature can be of use in determining an impending over temperature trip condition. Alarms can be implemented in the process monitoring system warning of an impending trip before a trip occurs, halting the process. Costly system shutdown can be avoided.

**Phase Loss**

Loss of a phase can cause a significant increase in the current drawn in the remaining two phases. Phase loss can lead to motor damage before an eventual overload trip occurs. Phase loss is typically an indication of a failure in the electrical distribution system. The S611 will detect a phase loss and trip if any phase current drops below a preset value. The phase loss trip level is adjustable from 0% to 100% of the average of the other two phase levels with an adjustable trip delay of 0.1 to 60 seconds.

**Phase Imbalance**

Phase current or voltage imbalance can cause a significant increase in the current drawn in the remaining two phases. Phase imbalance can lead to motor damage before an eventual overload trip. Phase imbalance is typically an indication of a failure in the electrical distribution system or the motor. The S611 will detect both current and voltage phase imbalances and trip if any phase becomes imbalanced as compared to the average of the other two phases.

The phase current imbalance trip level is adjustable from 0% to 100% of the average of the current in the other two phases with an adjustable trip delay of 0.1 to 60 seconds.

The phase voltage imbalance trip level is adjustable from 0% to 100% of the average of the voltage in the other two phases with an adjustable trip delay of 0.1 to 60 seconds.

**Reset Mode**

The S611 can be set up for automatic or manual reset on trip. The manual reset mode requires the operator to physically press the RESET button located on the soft starter. The overload can be manually reset through the UI or through the communications network.

The automatic reset mode allows the soft starter to be automatically reset as soon as the trip condition is no longer present. With the automatic reset mode, after the fault is no longer present, the motor will be restarted as soon as a valid start signal is present.

**Phase Reversal**

The S611 can determine if the proper line phase sequence is present by default. The device will trip if the line phase sequence is something other than A-B-C. The S611 can be configured to operate under reversed phase conditions (A-C-B).

**Shorted SCR Detection**

The S611 monitors the operation of the power poles and will trip under a shorted SCR condition.

**Open SCR Detection**

The S611 monitors the operation of the power poles and will trip under an open SCR condition.

**Low Current**

Low current conditions can be a result of a loss of load or a failure in the mechanical system. The S611 has low current protection that will trip if the average RMS current falls below a preset value. The low current protection can be programmed as a percent of motor FLA from 0% to 100%.

**Low Voltage**

Low voltage conditions can result from disturbances in the electrical power distribution system. Low voltage conditions can cause a malfunction and damage to electrical equipment. The S611 has low voltage protection that will trip if the average RMS voltage falls below a preset value. The low voltage protection can be programmed as a percent of nominal voltage from 1% to 99% with a trip delay of 0.1 to 60 seconds.

**High Voltage**

High voltage conditions can result from disturbances in the electrical power distribution system. High voltage conditions can cause malfunctions or failures of electrical equipment. The S611 has high voltage protection that will trip if the average RMS voltage is greater than a preset value. The high voltage protection can be programmed as a percent of nominal voltage from 101% to 120% with a trip delay of 0.1 to 60 seconds.



**Monitoring Capabilities**

The S611 has an impressive array of system monitoring capabilities that allow users to access real time process and diagnostic data. This data can be viewed at the device with the UI or through a communications network. Data over a communications network can provide valuable insight into the condition of the equipment and processes. Maintenance and production personnel can monitor critical operational and maintenance data from a central control station that can be located far away from the production facility. Process data can be monitored to determine system anomalies that may indicate a need for preventive maintenance or an impending failure.

Adjustments made through the communications network can reduce costs by minimizing the time traveling to the location where the motor controls are located. When faults do occur, real time fault data can assist maintenance in troubleshooting and planning repair resources. Remote reset signals can be given to tripped devices without the need for manual intervention by maintenance personnel.

**Average Line Current**

Provides the average of the three phase RMS line currents in amps, accurate to within 2%. Current data can be used to indicate a need for maintenance. Increased currents in a fixed load application can indicate a reduction in system efficiencies and performance, signifying system maintenance is due.

**Average Pole Current**

Provides the average of the three phase RMS pole currents in amps, accurate to within 2%. The pole current is the current through the soft starter. The line and pole current will be identical in in-line applications, and will differ in inside-the-delta applications.

**Average Line Current as a % FLA**

Provides the average RMS line current as a percentage of the S611 FLA setting.

**Three-Phase Line Currents**

Provides three RMS phase line currents in amps, accurate to within 2%. Imbalances or changes in the relative phase current to one another can indicate anomalies in the motor or electrical distribution system.

**Three-Phase Pole Currents**

Provides three RMS phase pole currents in amps, accurate to within 2%. The pole current is the current through the soft starter. The line and pole current will be identical in in-line applications.

**Three-Phase Line Voltages**

Provides the individual RMS three phase line voltages. Imbalances or changes in the relative phase voltage to one another can indicate anomalies in the motor or electrical distribution system. Voltage can be used to monitor electrical distribution system performance. Warnings, alarms and system actions to low or high voltage conditions can be implemented.

**Percent Thermal Memory**

Provides the real time calculated thermal memory value. The S611 calculates thermal memory value. A 100% value represents the maximum safe temperature of the motor. When the thermal memory value reaches 100%, an overload trip will occur, removing power to the motor.

The thermal memory value can be of great use in determining an impending overload trip Condition. Alarms can be implemented in the process monitoring system warning of an Impending trip before a trip occurs, halting the process. Costly system downtime can be avoided.

**Pole Temperature**

Increases in pole temperature are caused by increases in ambient temperature, start/stop times and start duty cycles. Changes in pole temperatures represent a change in system operating conditions. Identifying unexpected operating conditions or changes can prompt maintenance and aid in process evaluation activities.

**Power Monitoring**

S611 can monitor power and it can be displayed on the UI.

**Start Count**

Number of starts are stored in the device and can be displayed using field bus.

**Diagnostics****Fault Queue**

Current fault and a fault queue containing the last nine system faults can be read through the UI or communications network. Fault identification can minimize troubleshooting time and cost and prevent arc flash incidents. The fault queue can be remotely accessed through a communications network to assist in planning maintenance resources. 30 different faults can be identified by the S611.

**Control Status**

The S611 provides data that represents system conditions that can be read through the UI or the communications network. This data identifies the status of the system and the control commands the system is requesting of the S611. This can be used for advanced Troubleshooting and system integration activities.

**Field Serviceability**

In the case of maintenance, the S611 provides easy access and replacement of key components including control board and internal bypass contactors—significantly increasing its service life. If a component ever needs to be replaced, this straightforward operation can be completed by an end-user without the need to call in an outside service technician or engineer. These components are stocked and available for order and quick fulfillment—ensuring your operation continues with minimal downtime.

### Operation

#### Instructional Leaflets

- Instruction Manual: MN03902011E
- Quick Start Guide: MN03901003E

#### Starting and Stopping Modes

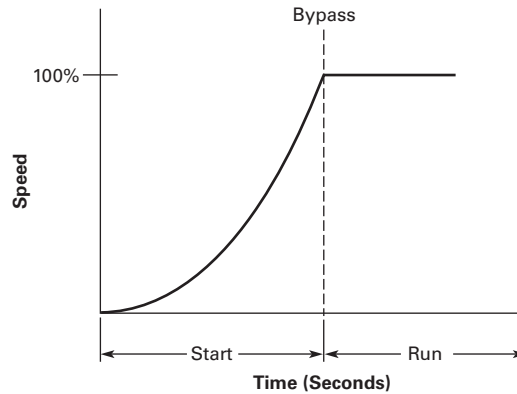
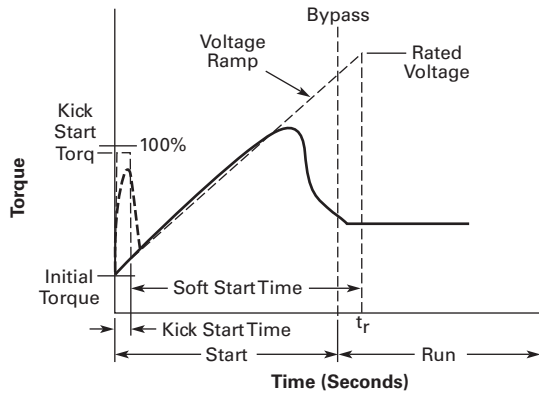
The S611 has a variety of starting and stopping methods to provide superior performance in the most demanding applications. The motor can be started in either Voltage Ramp Start or Current Limit Start mode. Kick Start and Soft Stop are available within both starting modes.

#### Voltage Ramp Start

Provides a voltage ramp to the motor resulting in a constant torque increase. The most commonly used form of soft start, this start mode allows you to set the initial torque value and the duration of the ramp to full voltage conditions. Bypass contactors close after ramp time.

- Adjustable initial torque 0–85% of locked rotor torque
- Adjustable start ramp time 0.5–180 seconds (can be extended with factory modification)

#### Starting Characteristics—Ramp Start



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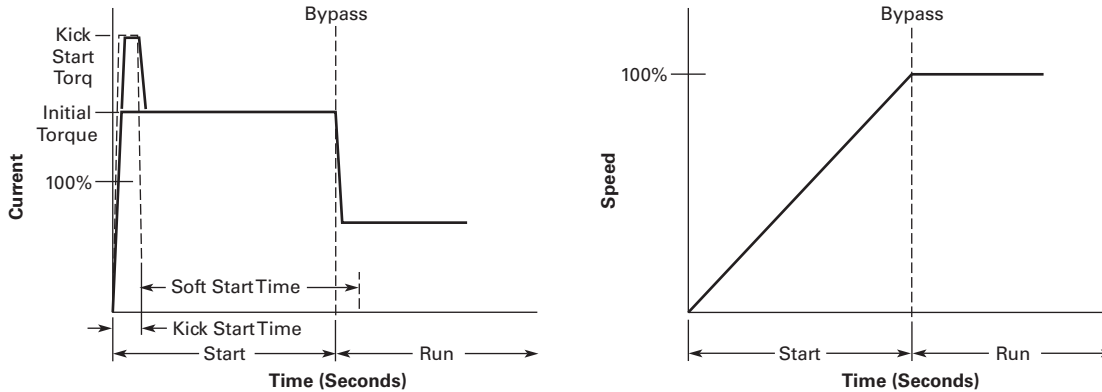
#### Current Limit Start

Limits the maximum current available to the motor during the start phase. This mode of soft starting is used when it becomes necessary to limit the maximum starting current due to long start times or to protect the motor. This start

mode allows you to set the maximum starting current as a percentage of locked rotor current and the duration of the current limit. Bypass contactors close after current limit time.

- Maximum current of 0–85% locked rotor current
- Adjustable start ramp time 0.5–180 seconds (can be extended with factory modification)

#### Starting Characteristics—Current Limit Start

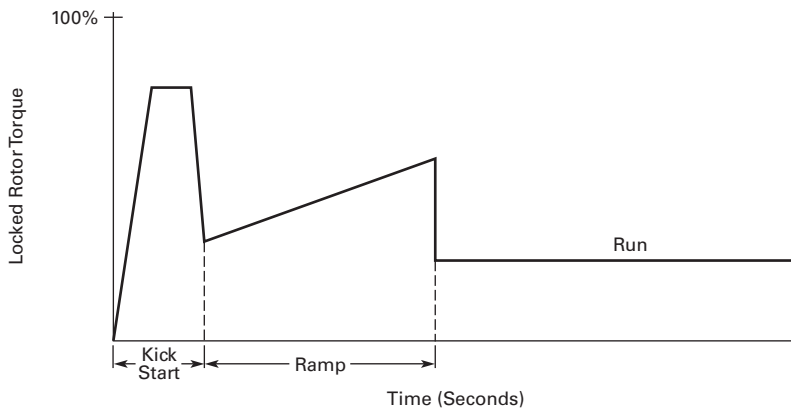


#### Kick Start

Selectable feature in both Voltage Ramp Start and Current Limit Start modes. Provides a current and torque “kick” for 0 to 2.0 seconds. This provides greater initial current to develop additional torque to breakaway a high friction load.

- 0–85% of locked rotor torque
- 0–2.0 seconds duration

#### Starting Characteristics—Kick Start

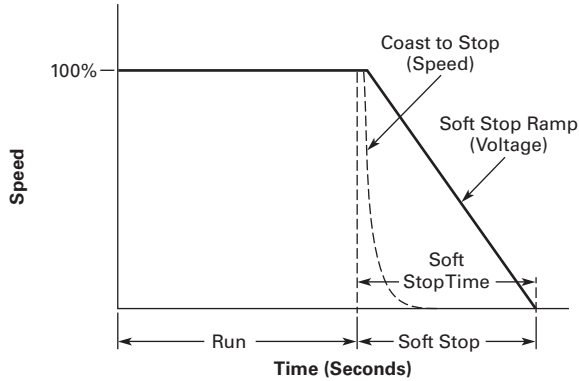


### Soft Stop

Allows for a controlled stopping of a load. Used when a stop-time that is greater than the coast-to-stop time is desired. Often used with high friction loads where a sudden stop may cause system or load damage.

- Stop time = 0–60 seconds

### Starting Characteristics—Soft Stop



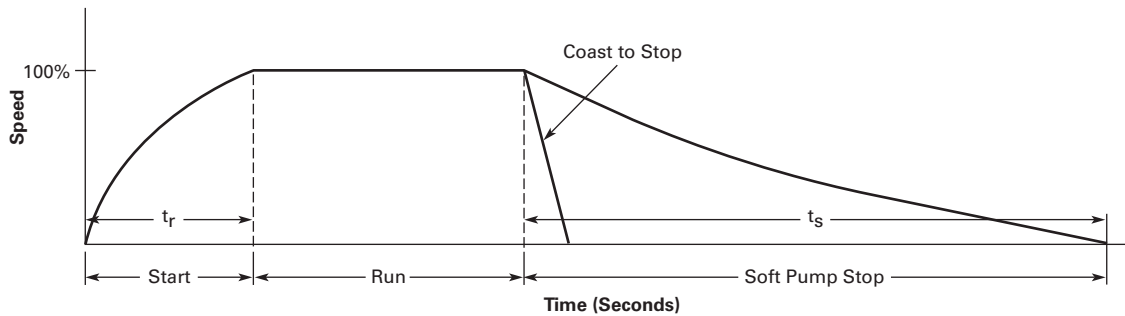
### Pump Control Option

This option is intended to reduce the potential for water hammer in a centrifugal pump system by using a starting and stopping algorithm developed for pump control. Upon a start command, the speed of the motor is

increased, under the control of the S611 soft starter microprocessor, to achieve a gentle start. After the speed has reached its nominal value, the bypass contactors close and the pump operates as with any other starter.

Upon a stop command, the bypass contactors are opened and the motor speed is decreased in a tapered manner, to gradually slow the flow until the motor is brought to a stop.

### Pump Control Option



#### 1

#### Edge and Level Sensing Control

Edge or Level Sensing is selected with the Start Control parameter in the Advanced Configuration Menu. Factory default is Level Sensing.

##### Edge Sensing

Edge sensing requires 120 Vac power be momentarily applied to the Start terminal (with the Permissive terminal 120 Vac) to initiate a start under all conditions. After a stop or fault occurs, the 120 Vac must be reapplied to the start terminal before another start can occur. This control configuration should be used when restarting of the motor after a fault or stop must be supervised manually or as a part of a control scheme. The cycling of 120 Vac power to the Permissive terminal before starting is required regardless of the position of the auto reset parameter.

##### Level Sensing

Level sensing will enable a motor to restart after a fault is cleared without cycling 120 V AC to the Permissive terminal as long as:

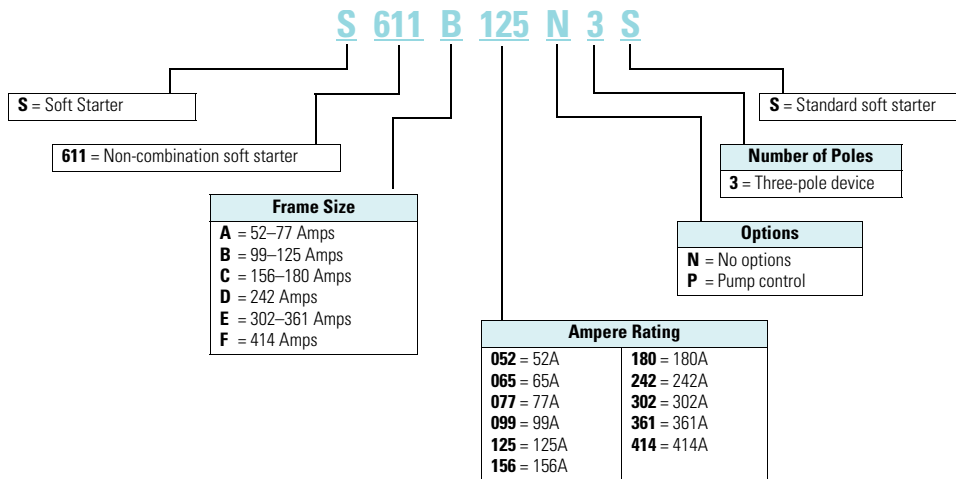
- Permissive terminal is supplied with 120 Vac
- The auto reset parameter is set to enabled
- All faults have cleared or have been reset

This control configuration should be used where it is desirable to restart a motor after a fault without additional manual or automatic control. An example of this condition would be on a remote pumping station where it is desirable to automatically restart a pump after a power outage without operator intervention.

**Note:** If the auto reset feature is used, CAUTION must be exercised to assure that any restart occurs in a safe manner.

#### Catalog Number Selection

##### S611 Soft Starters



### Product Selection

Motor applications and customer needs come in many different varieties. With the standard and severe duty rating tables, we have attempted to provide

guidelines on what the soft starter is capable of. If the application falls under these categories, you can use these charts. For other applications, or when a question arises,

consult with your local Eaton Representative or call the Eaton Technical Resource Center.

### Pump Control Option

For pump control option, change the **8th** digit in the Catalog Number to **P**, as in S611XXX**P**3S.

### Horsepower Ratings

**Note:** Always refer to motor plate FLA and ensure that the motor plate FLA is equal to or lower than the maximum current value in the tables.

#### S611



#### Standard Duty—300% Current for 15 Seconds, 115% Continuous

Rated Current (Amps)	Horsepower Rating				Catalog Number
	208V	240 V	480 V	600 V	
52	15	15	40	50	S611A052N3S
65	20	20	50	60	S611A065N3S
77	25	25	60	75	S611A077N3S
99	30	30	75	100	S611B099N3S
125	40	40	100	125	S611B125N3S
156	50	60	125	150	S611C156N3S
180	60	60	150	150	S611C180N3S
242	75	75	200	250	S611D242N3S
302	100	100	250	300	S611E302N3S
361	125	150	300	350	S611E361N3S
414	150	150	350	450	S611F414N3S

#### Standard Duty Plus—350% FLA for 30 Seconds, 115% Continuous

Rated Current (Amps)	Horsepower Rating				Catalog Number
	208V	240 V	480 V	600 V	
52	15	15	40	50	S611A052N3S
65	20	20	50	60	S611A065N3S
71	20	25	60	75	S611A077N3S
99	30	30	75	100	S611B099N3S
119	40	40	100	125	S611B125N3S
156	50	60	125	150	S611C156N3S
180	60	60	150	150	S611C180N3S
242	75	75	200	250	S611D242N3S
302	100	100	250	300	S611E302N3S
361	125	150	300	350	S611E361N3S
407	150	150	350	400	S611F414N3S

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**Note:** Always refer to motor plate FLA and ensure that the motor plate FLA is equal to or lower than the maximum current value in the tables.

**S611****Heavy Duty—500% FLA for 30 Seconds, 125% Continuous**

Rated Current (Amps)	Horsepower Rating				Catalog Number
	208V	240 V	480 V	600 V	
49	15	15	40	50	<b>S611A052N3S</b>
83	25	30	60	75	<b>S611B099N3S</b>
142	40	60	125	150	<b>S611C156N3S</b>
225	75	75	200	200	<b>S611D242N3S</b>
256	75	100	200	250	<b>S611E361N3S</b>
285	100	125	250	300	<b>S611F414N3S</b>

**Severe Duty—600% FLA for 30 Seconds, 125% Continuous**

Rated Current (Amps)	Horsepower Rating				Catalog Number
	208V	240 V	480 V	600 V	
41	10	15	30	40	<b>S611A052N3S</b>
69	20	30	60	60	<b>S611B099N3S</b>
117	30	50	100	125	<b>S611C180N3S</b>
187	60	75	150	200	<b>S611D242N3S</b>
213	75	75	150	200	<b>S611E361N3S</b>
238	75	100	200	250	<b>S611F414N3S</b>

**Accessories****Optional Accessory Kits**

Description	S611 Current Rating	Accessory Kit Part Number
User interface remote mounting kit—3.28 ft (1 m)	52–414A	<b>S611-RMK-100</b>
User interface remote mounting kit—6.56 ft (2 m)	52–414A	<b>S611-RMK-200</b>
User interface remote mounting kit—9.84 ft (3 m)	52–414A	<b>S611-RMK-300</b>
User interface communication cable—3.28 ft (1 m)	52–414A	<b>D77E-QPIP100</b>
User interface communication cable—6.56 ft (2 m)	52–414A	<b>D77E-QPIP200</b>
User interface communication cable—9.84 ft (3 m)	52–414A	<b>D77E-QPIP300</b>
Lug kit—mechanical	52–77A	<b>S611-LUG-M01</b>
	99–125A	<b>S611-LUG-M02</b>
	156–242A	<b>S611-LUG-M03</b>
	302–414A	<b>S611-LUG-M04</b>

### Communications

The S611 is equipped with native Modbus RTU communication capabilities and may be connected to a variety of networks, including DeviceNet, Modbus TCP, EtherNet/IP and PROFIBUS using the C441 series communication modules for easy integration into any PLC or DCS system.

The modules come standard with four inputs and two relay outputs. C441 communication modules can also be used independently for standalone I/O applications.



### C441 Communication Card Options

Designed for use with soft starters ...



Protocol	Catalog Number	Input Signal Type	S611	General Purpose I/O ①	Mounting Options
Modbus RTU	C441NS	120 Vac	■	■	Standalone—DIN rail/panel mount
	C441PS	24 Vdc	■	■	Standalone—DIN rail/panel mount
DeviceNet	C441KS	120 Vac	■	■	Standalone—DIN rail/panel mount
	C441LS	24 Vdc	■	■	Standalone—DIN rail/panel mount
PROFIBUS	C441SS	120 Vac	■	■	Standalone—DIN rail/panel mount
	C441QS	24 Vdc	■	■	Standalone—DIN rail/panel mount
Modbus TCP, EtherNet/IP	C441U	120 Vac	■	■	Standalone—DIN rail/panel mount
	C441V	24 Vdc	■	■	Standalone—DIN rail/panel mount

**Note:** Refer to Volume 5—Motor Control and Protection, CA08100006E, tab 5.4 for additional details and BR042002EN brochure for C441 communication module accessories for overload relays and soft starters.

Recommended Power Supply	Catalog Number
85–264 Vac single-phase input, 24 Vdc output	PSG240E24RM
360–575 Vac three-phase input, 24 Vdc output	PSG240F24RM

### Replacement Parts

#### S611 Replacement Components

Description	Part Number
User interface	S611-KEYPAD
User interface communication cable—0.25m (0.82 ft)	D77E-QPIP25
Control board assembly—52A standard	S611-PCB-052S
Control board assembly—65A standard	S611-PCB-065S
Control board assembly—77A standard	S611-PCB-077S
Control board assembly—99A standard	S611-PCB-099S
Control board assembly—125A standard	S611-PCB-125S
Control board assembly—156A standard	S611-PCB-156S
Control board assembly—180A standard	S611-PCB-180S
Control board assembly—242A standard	S611-PCB-242S
Control board assembly—302A standard	S611-PCB-302S
Control board assembly—361A standard	S611-PCB-361S
Control board assembly—414A standard	S611-PCB-414S
Control board assembly—52A pump	S611-PCB-052P
Control board assembly—65A pump	S611-PCB-065P
Control board assembly—77A pump	S611-PCB-077P
Control board assembly—99A pump	S611-PCB-099P
Control board assembly—125A pump	S611-PCB-125P
Control board assembly—156A pump	S611-PCB-156P
Control board assembly—180A pump	S611-PCB-180P
Control board assembly—242A pump	S611-PCB-242P
Control board assembly—302A pump	S611-PCB-302P
Control board assembly—361A pump	S611-PCB-361P
Control board assembly—414A pump	S611-PCB-414P
Frame A/B CT	S611-CT-AB
Frame C/D CT	S611-CT-CD
Frame E/F CT	S611-CT-EF
Contact assembly—52–180A	C25DNY172
Contact assembly—242–414A	C25DNY173



## Technical Data and Specifications

### Soft Starters—S611

Description		S611 Soft Starter (Partial Catalog Number)			
		S611A052...	S611A065...	S611A072...	S611B099...
Max. current capacity	A	52	65	77	99
FLA range	A	26–52	32.5–65	38.5–77	48–99
<b>Dimensions</b>					
Width	inch (mm)	11.58 (294)	11.58 (294)	11.58 (294)	11.58 (294)
Height	inch (mm)	19.45 (494)	19.45 (494)	19.45 (494)	19.45 (494)
Depth	inch (mm)	7.46 (189)	7.46 (189)	7.46 (189)	7.46 (189)
Weight	lb (kg)	24 (11)	24 (11)	24 (11)	24 (11)
<b>General Information</b>					
Bypass mechanical lifespan		10M	10M	10M	10M
Insulating voltage	V	660	660	660	660
Ramp time range	Seconds	0.5–180	0.5–180	0.5–180	0.5–180
Vibration resistance—non-operating	g	3g up to 242A units, 2g on 302A to 414A units	3g up to 242A units, 2g on 302A to 414A units	3g up to 242A units, 2g on 302A to 414A units	3g up to 242A units, 2g on 302A to 414A units
Vibration resistance—operating	g	1	1	1	1
Shock resistance	g	15g up to 242A units, 5g on 302A to 414A units	15g up to 242A units, 5g on 302A to 414A units	15g up to 242A units, 5g on 302A to 414A units	15g up to 242A units, 5g on 302A to 414A units
<b>Electrical Information</b>					
Operating voltage	V	130–600	130–600	130–600	130–600
Operating frequency	Hertz	47–63	47–63	47–63	47–63
Overload setting (frame)	% FLA	50–100	50–100	50–100	50–100
Trip class		5, 10, 20, 30	5, 10, 20, 30	5, 10, 20, 30	5, 10, 20, 30
<b>Cabling Capacity (IEC 947)</b>					
Number of conductors		1	1	1	1
Wire sizes	AWG	14–2/0	14–2/0	14–2/0	14–2/0
Type of connectors		Lug	Lug	Lug	Lug
<b>Control Wiring</b>					
Wire sizes	AWG	22–12	22–12	22–12	22–12
Number of conductors		2 (or one 12–14 AWG)	2 (or one 12–14 AWG)	2 (or one 12–14 AWG)	2 (or one 12–14 AWG)
Torque requirements	lb-in	3.5	3.5	3.5	3.5
Maximum size	AWG	12	12	12	12
<b>Control Power Requirements</b>					
Voltage range (120 V ±10%)	V	108–132	108–132	108–132	108–132
Steady state current	A	0.375	0.375	0.375	0.375
Inrush current	A	0.5	0.5	0.5	0.5
Ripple	%	1	1	1	1
<b>Relays (1) Class A and C</b>					
Voltage AC—maximum	V	120	120	120	120
Voltage DC—maximum	V	24	24	24	24
Amps—maximum	A	3	3	3	3
<b>Environment</b>					
Temperature—operating	°C	–20° to 50°C	–20° to 50°C	–20° to 50°C	–20° to 50°C
Temperature—storage	°C	–40° to 85°C	–40° to 85°C	–40° to 85°C	–40° to 85°C
Altitude	Meters	<2000m, derate 0.5% per 100m >2000m	<2000m, derate 0.5% per 100m >2000m	<2000m, derate 0.5% per 100m >2000m	<2000m, derate 0.5% per 100m >2000m
Humidity	%	<95% non-condensing	<95% non-condensing	<95% non-condensing	<95% non-condensing
Operating position		Vertical, line side up	Vertical, line side up	Vertical, line side up	Vertical, line side up
Pollution degree IEC947-1		3	3	3	3
Impulse withstand voltage IEC947-4-1	V	6000	6000	6000	6000

## Soft Starters—S611, continued

Description		S611 Soft Starter (Partial Catalog Number)			
		S611B125...	S611C156...	S611C180...	S611D242...
Max. current capacity	A	125	156	180	242
FLA range	A	62.5–125	78–156	90–180	120–242
<b>Dimensions</b>					
Width	inch (mm)	11.58 (294)	11.58 (294)	11.58 (294)	11.58 (294)
Height	inch (mm)	19.45 (494)	20.83 (529)	20.83 (529)	20.83 (529)
Depth	inch (mm)	7.46 (189)	8.37 (213)	8.37 (213)	8.37 (213)
Weight	lb (kg)	24 (11)	33 (15)	33 (15)	38 (17)
<b>General Information</b>					
Bypass mechanical lifespan		10M	10M	10M	10M
Insulating voltage	V	660	660	660	660
Ramp time range	Seconds	0.5–180	0.5–180	0.5–180	0.5–180
Vibration resistance—non-operating	g	3g up to 242A units, 2g on 302A to 414A units	3g up to 242A units, 2g on 302A to 414A units	3g up to 242A units, 2g on 302A to 414A units	3g up to 242A units, 2g on 302A to 414A units
Vibration resistance—operating	g	1	1	1	1
Shock resistance	g	15g up to 242A units, 5g on 302A to 414A units	15g up to 242A units, 5g on 302A to 414A units	15g up to 242A units, 5g on 302A to 414A units	15g up to 242A units, 5g on 302A to 414A units
<b>Electrical Information</b>					
Operating voltage	V	130–600	130–600	130–600	130–600
Operating frequency	Hertz	47–63	47–63	47–63	47–63
Overload setting (frame)	% FLA	50–100	50–100	50–100	50–100
Trip class		5, 10, 20, 30	5, 10, 20, 30	5, 10, 20, 30	5, 10, 20, 30
<b>Cabling Capacity (IEC 947)</b>					
Number of conductors		1	1	1	1
Wire sizes	AWG	2–600 kcmil	2–600 kcmil	2–600 kcmil	2–600 kcmil
Type of connectors		Lug	Lug	Lug	Lug
<b>Control Wiring</b>					
Wire sizes	AWG	22–12	22–12	22–12	22–12
Number of conductors		2 (or one 12–14 AWG)	2 (or one 12–14 AWG)	2 (or one 12–14 AWG)	2 (or one 12–14 AWG)
Torque requirements	lb-in	3.5	3.5	3.5	3.5
Maximum size	AWG	12	12	12	12
<b>Control Power Requirements</b>					
Voltage range (120 V ±10%)	V	108–132	108–132	108–132	108–132
Steady state current	A	0.375	0.375	0.375	0.375
Inrush current	A	0.5	0.5	0.5	0.5
Ripple	%	1	1	1	1
<b>Relays (1) Class A and C</b>					
Voltage AC—maximum	V	120	120	120	120
Voltage DC—maximum	V	24	24	24	24
Amps—maximum	A	3	3	3	3
<b>Environment</b>					
Temperature—operating	°C	–20° to 50°C	–20° to 50°C	–20° to 50°C	–20° to 50°C
Temperature—storage	°C	–40° to 85°C	–40° to 85°C	–40° to 85°C	–40° to 85°C
Altitude	Meters	<2000m, derate 0.5% per 100m >2000m	<2000m, derate 0.5% per 100m >2000m	<2000m, derate 0.5% per 100m >2000m	<2000m, derate 0.5% per 100m >2000m
Humidity	%	<95% non-condensing	<95% non-condensing	<95% non-condensing	<95% non-condensing
Operating position		Vertical, line side up	Vertical, line side up	Vertical, line side up	Vertical, line side up
Pollution degree IEC947-1		3	3	3	3
Impulse withstand voltage IEC947-4-1	V	6000	6000	6000	6000

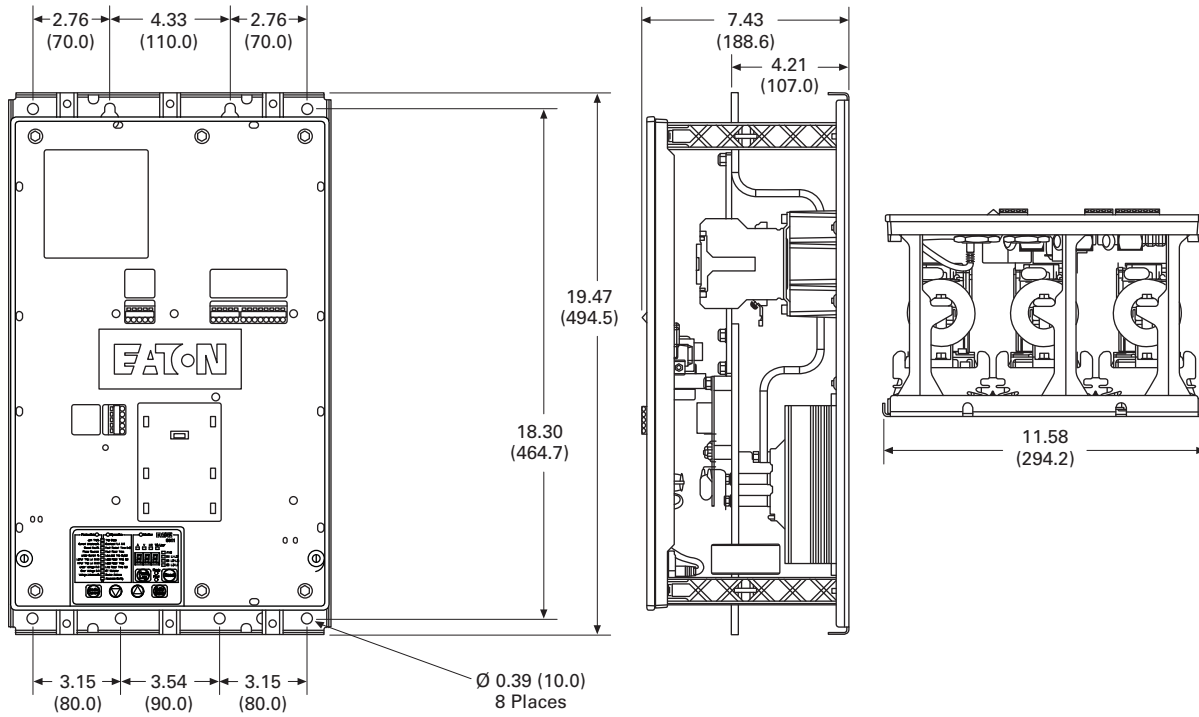
## Soft Starters—S611, continued

Description		S611 Soft Starter (Partial Catalog Number)		
		S611E302...	S611E361...	S611F414...
Max. current capacity	A	302	361	414
FLA range	A	151–302	180.5–361	207–414
<b>Dimensions</b>				
Width	inch (mm)	17.56 (446)	17.56 (446)	17.56 (446)
Height	inch (mm)	31.15 (791)	31.15 (791)	31.15 (791)
Depth	inch (mm)	9.54 (242)	9.54 (242)	9.54 (242)
Weight	lb (kg)	86 (39)	86 (39)	102 (46)
<b>General Information</b>				
Bypass mechanical lifespan		10M	10M	10M
Insulating voltage	V	660	660	660
Ramp time range	Seconds	0.5–180	0.5–180	0.5–180
Vibration resistance—non-operating	g	3g up to 242A units, 2g on 302A to 414A units	3g up to 242A units, 2g on 302A to 414A units	3g up to 242A units, 2g on 302A to 414A units
Vibration resistance—operating	g	1	1	1
Shock resistance	g	15g up to 242A units, 5g on 302A to 414A units	15g up to 242A units, 5g on 302A to 414A units	15g up to 242A units, 5g on 302A to 414A units
<b>Electrical Information</b>				
Operating voltage	V	130–600	130–600	130–600
Operating frequency	Hertz	47–63	47–63	47–63
Overload setting (frame)	% FLA	50–100	50–100	50–100
Trip class		5, 10, 20, 30	5, 10, 20, 30	5, 10, 20, 30
<b>Cabling Capacity (IEC 947)</b>				
Number of conductors		2	2	2
Wire sizes	AWG	2–600 kcmil	2–600 kcmil	2–600 kcmil
Type of connectors		Lug	Lug	Lug
<b>Control Wiring</b>				
Wire sizes	AWG	22–12	22–12	22–12
Number of conductors		2 (or one 12–14 AWG)	2 (or one 12–14 AWG)	2 (or one 12–14 AWG)
Torque requirements	lb-in	3.5	3.5	3.5
Maximum size	AWG	12	12	12
<b>Control Power Requirements</b>				
Voltage range (120 V ±10%)	V	108–132	108–132	108–132
Steady state current	A	0.75	0.75	0.75
Inrush current	A	1	1	1
Ripple	%	1	1	1
<b>Relays (1) Class A and C</b>				
Voltage AC—maximum	V	120	120	120
Voltage DC—maximum	V	24	24	24
Amps—maximum	A	3	3	3
<b>Environment</b>				
Temperature—operating	°C	–20° to 50°C	–20° to 50°C	–20° to 50°C
Temperature—storage	°C	–40° to 85°C	–40° to 85°C	–40° to 85°C
Altitude	Meters	<2000m, derate 0.5% per 100m >2000m	<2000m, derate 0.5% per 100m >2000m	<2000m, derate 0.5% per 100m >2000m
Humidity	%	<95% non-condensing	<95% non-condensing	<95% non-condensing
Operating position		Vertical, line side up	Vertical, line side up	Vertical, line side up
Pollution degree IEC947-1		3	3	3
Impulse withstand voltage IEC947-4-1	V	6000	6000	6000

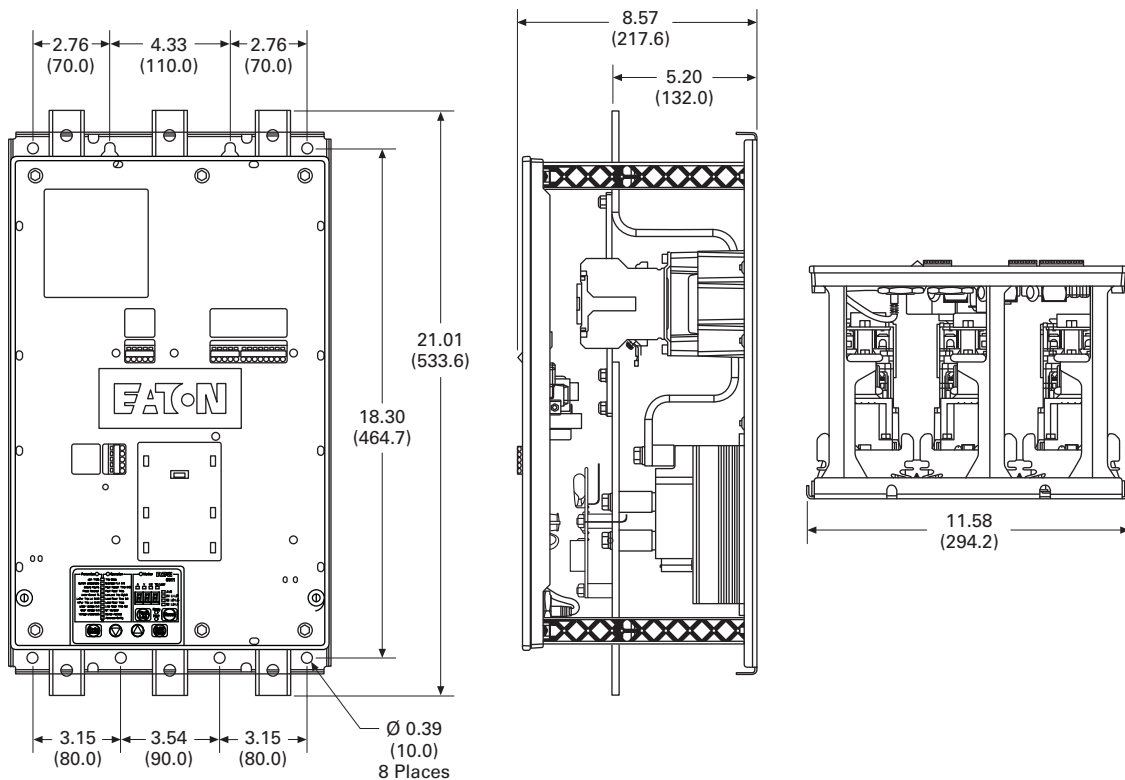
### Dimensions

Approximate Dimensions in inches (mm)

#### S611A..., S611B...



#### S611C..., S611D...



# 1.2

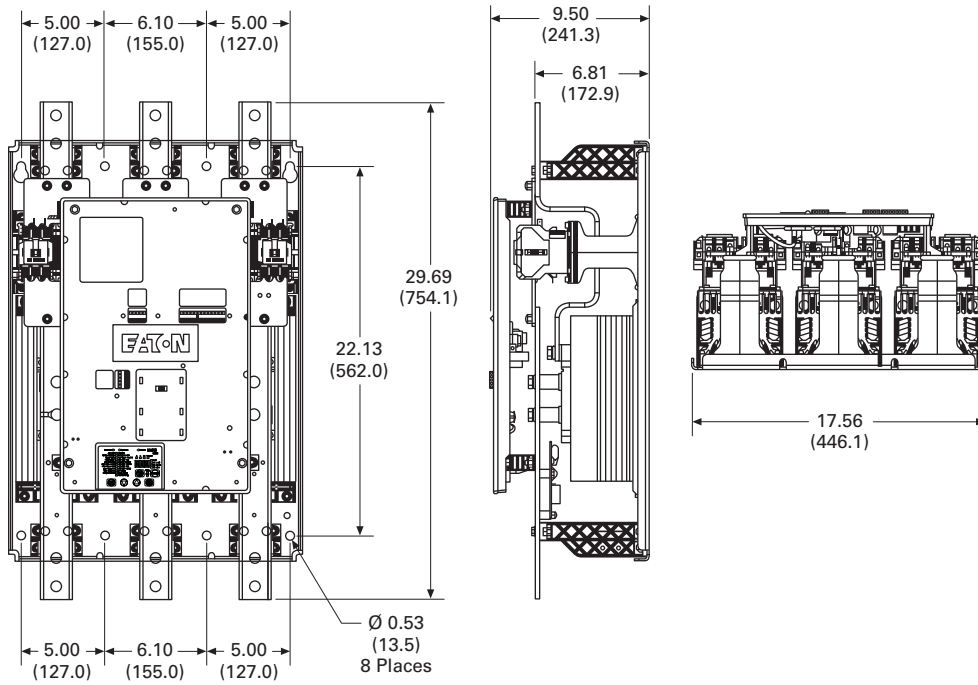
## Reduced Voltage Motor Starters

### Solid-State Starters

1

Approximate Dimensions in inches (mm)

S611E..., S611F...



Type S801+, Soft Starters



### Contents

#### Description

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### Type S801+, Soft Starters

#### Product Description

Eaton's S801+ line of reduced voltage soft starters is very compact, multi-functional, easy to install and easy to program. Designed to control acceleration and deceleration of three-phase motors, the line is available for current ranges from 11A all the way through 1000A applications, and is suitable for mounting in motor control centers or in enclosed control (NEMA 1, 4, 4X and 12) applications.

#### Application Description

The S801+ line of soft starters is designed to be the smallest, most compact soft starter in the market today. With this small size, it can easily fit in place of existing soft starter designs, wye-delta starters or across-the-line NEMA and IEC starters. This feature allows easy retrofits of existing motor control centers or enclosures, and saves the expense of replacing existing structure or adding a new one to house a soft starter.

The product is designed to work with three-phase motors in a delta (three-lead) configuration. The S801+ works with all motors from fractional horsepower up to motors requiring 1000A of steady-state current. The built-in overload (in ranges from 11–1000A) and run bypass contactor make installation and setup quick and easy. The overload also offers some advanced protective functions to give additional motor protection.

#### 1

### Operation

#### Overload Functionality

##### Overtemperature

Protects the device from overheating. Starter will shut down at 100°C.

##### Stall

Selectable protective feature, unit trips to protect system in event motor can not get to rated speed in the defined ramp period.

##### Jam

Selectable protective feature, unit trips to prevent damage to motor during normal run.

##### Phase Loss

Selectable protective feature, trips under voltage loss condition to any phase.

##### Phase Reversal

Selectable protective feature, trips when phase rotation is something other than A-B-C.

##### Kick Start

Selectable feature that provides a current "kick" of up to 550% of full load current for 0 to 2.0 seconds. This provides the additional torque required at startup to break free a motor.

##### Ramp Start

Provides a constant increase in torque to the motor.

##### Current Limit Start

Limits the maximum current available to the motor during the startup phase.

##### Soft Stop

Allows for a controlled stopping of a frictional load.

##### Shorted SCR Detection

Monitors for shorted SCR in the power poles.

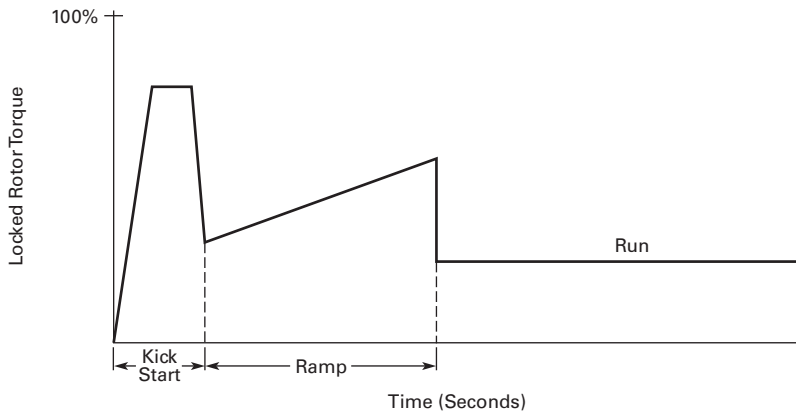
#### Starting Characteristics

##### Kick Start

Provides an initial boost of current to the motor to help overcome motor inertia and begin motor rotation.

- 0–85% of locked rotor torque
- 0–2.0 seconds duration

#### Starting Characteristics—Kick Start

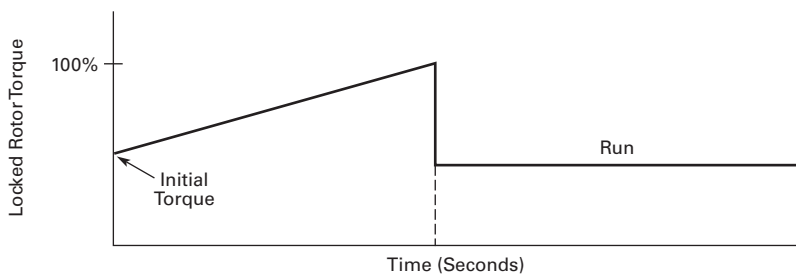


##### Ramp Start

The most commonly used form of soft start. This allows you to set the initial torque value (of the ramp) and then raises it to full voltage conditions.

- Adjustable initial torque = 0–85% of locked rotor torque
- Adjustable ramp time = 0.5–180 seconds

#### Starting Characteristics—Ramp Start

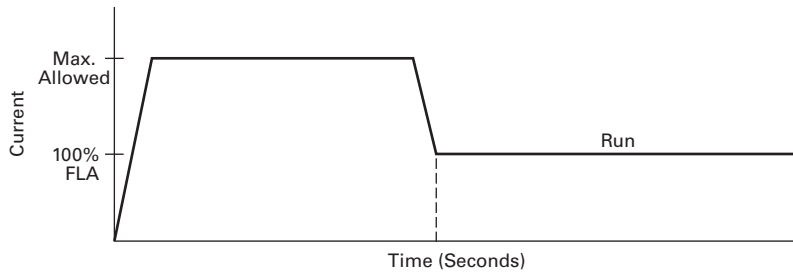


### Current Limit

This mode of soft starting is used when it becomes necessary to limit the maximum starting current due to long start times or to protect the motor.

- Maximum current of 0–85% locked rotor current
- Adjustable ramp time = 0.5–180 seconds

### Starting Characteristics—Current Limit

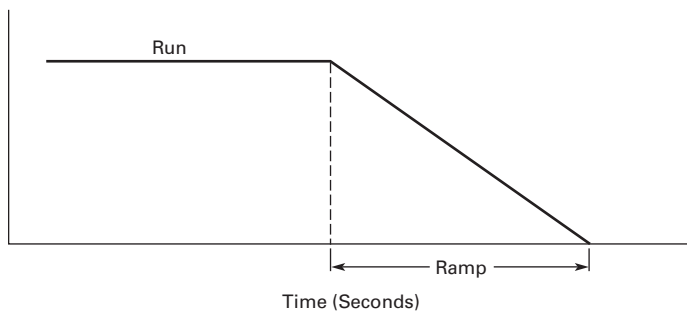


### Soft Stop

Used when an extended coast-to-rest period is desired. Often used with high friction loads where a sudden stop may cause system or product damage.

- Stop time = 0–60 seconds

### Starting Characteristics—Soft Stop





#### 1

#### Features

- Built-in overload protection
- Built-in run bypass contactor
- Adjustable ramp times
- Adjustable torque control
- Adjustable kick start control
- Programmable overload settings, 31–100% (3.2:1) of rated current for the unit
- Physically fits in place of most NEMA and IEC starters
- Easy to use control interface module
- Soft stop control
- Multiple trip class settings (5, 10, 20 and 30)
- Six SCR control
- Optional CIM door mount kit for safety
- Optional IP20 protection

#### Benefits

- Reduced wear on belts, gears, chains, clutches, shafts and bearings
- Allows for controlling the inrush current to the motor
- Reduced inrush current leads to more stable power grid and can lower peak demand charges
- Less shock to product on conveyor lines and material handling gear
- 24 Vdc control enhances personnel and equipment safety

#### Standards and Certifications

- IEC 947 compliant
- EN 60947-4-2
- CSA certification
- cULus listed (File No. E202571)
- CE marked
- CSA elevator (2411 01)

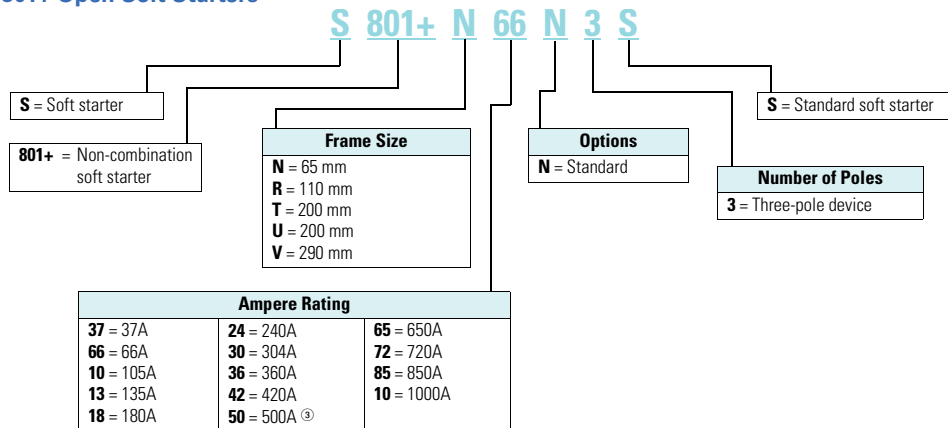


#### User Manuals

A comprehensive user manual is available and can be downloaded free of charge from [www.eaton.com](http://www.eaton.com) by performing a document search for MN03900002E.

#### Catalog Number Selection

##### S801+ Open Soft Starters <sup>①②</sup>



#### Notes

- ① S801+T..., S801+U..., and S801+V... units require lug kits found on **Page V6-T1-65**.
- ② All units require a 24 Vdc power supply found on catalog **Page V6-T1-65**, or equivalent.
- ③ S801+U50N35 unit does not have IEC certification.

### Product Selection

#### Standard Duty Ratings

The table below is the base ratings for the soft starter. The tables included in this catalog are meant to be a reference table for different applications, but to match a unit to your exact application, consult with your local Eaton representative or call our Technical Resource Center.

#### Standard Duty Ratings

Starting Method	Ramp Current % of FLA	Ramp Time Seconds	Starts per Hour	Ambient Temperature
Soft start	300%	30 sec.	3	50°C
Full voltage	500%	10 sec.	3	50°C
Wye-delta	350%	20 sec.	3	50°C
80% RVAT	480%	20 sec.	2	50°C
65% RVAT	390%	20 sec.	3	50°C
50% RVAT	300%	20 sec.	4	50°C

Motor applications and customer needs come in many different varieties. With the standard and severe duty rating tables, we have attempted to provide

guidelines on what the soft starter is capable of. If the application falls under these categories, you can use these charts. For other applications, or when a

question arises, consult with your local Eaton representative or call our Technical Resource Center.

S801+



#### Standard Duty—15 Second Ramp, 300% Current Limit at 40°C, Inline Connection

Rated Current	Three-Phase Motors kW Rating (50 Hz)			hp Rating (60 Hz)						Catalog Number		
	230V	380–400V	440V	200V		230V		460V			575–600V	
				1.0SF	1.15SF	1.0SF	1.15SF	1.0SF	1.15SF		1.0SF	1.15SF
<b>Frame Size N</b>												
37	10	18.5	18.5	10	10	10	10	25	20	30	30	S801+N37N3S
66	18.5	30	37	20	15	20	20	50	40	60	50	S801+N66N3S
<b>Frame Size R</b>												
105	30	55	59	30	25	40	30	75	60	100	75	S801+R10N3S
135	40	63	80	40	30	50	40	100	75	125	100	S801+R13N3S
<b>Frame Size T</b>												
180	51	90	110	60	50	60	60	150	125	150	150	S801+T18N3S
240	75	110	147	75	60	75	75	200	150	200	200	S801+T24N3S
304	90	160	185	100	75	100	100	250	200	300	250	S801+T30N3S
<b>Frame Size U</b>												
360	110	185	220	125	100	150	125	300	250	350	300	S801+U36N3S
420	129	220	257	150	125	175	150	350	300	450	350	S801+U42N3S
500	150	257	300	150	150	200	150	400	350	500	450	S801+U50N3S ①
<b>Frame Size V</b>												
360	110	185	220	125	100	150	125	300	250	350	300	S801+V36N3S
420	129	220	257	150	125	175	150	350	300	450	350	S801+V42N3S
500	150	257	300	150	150	200	150	400	350	500	450	S801+V50N3S
650	200	355	425	250	200	250	200	500	450	600	500	S801+V65N3S
720	220	400	450	—	—	300	250	600	500	700	600	S801+V72N3S
850	257	475	500	—	—	350	300	700	600	900	700	S801+V85N3S
1000	277	525	550	—	—	400	350	800	700	900	800	S801+V10N3S

**Note**

① S801+U50N3S does not have IEC certification.

#### Severe Duty Ratings

The table below is the base ratings for the soft starter. The tables included in this catalog are meant to be a reference table for different applications, but to match a unit to your exact application, consult with your local Eaton representative or call our Technical Resource Center.

#### Severe Duty Ratings

Starting Method	Ramp Current % of FLA	Ramp Time Seconds	Starts per Hour	Ambient Temperature
Soft start	450%	30 sec.	4	50°C
Full voltage	500%	10 sec.	10	50°C
Wye-delta	350%	65 sec.	3	50°C
80% RVAT	480%	25 sec.	4	50°C
65% RVAT	390%	40 sec.	4	50°C
50% RVAT	300%	60 sec.	4	50°C

Severe duty ratings are defined as any combination of parameters that exceed the standard duty ratings where

the ramp time is over 30 seconds, and/or the number of starts per hour exceeds 4, and/or the current limit set is

over 300%. *Example:* 35-second ramp, 5 starts per hour, 350% current limit at 40°C ambient.

S801+



#### Severe Duty —>30 Second Ramp, >300% Current Limit

Rated Current	Three-Phase Motor kW Rating (50 Hz)			hp Rating (60 Hz)								Catalog Number
	230V	380-400V	440V	200V		230V	460V		575V			
				1.0SF	1.15SF	1.0SF	1.15SF	1.0SF	1.15SF	1.0SF	1.15SF	
<b>Frame Size N</b>												
22	5.5	10	11	5	5	7-1/2	5	15	10	20	15	S801+N37N3S
42	11	18.5	22	10	10	15	10	30	25	40	30	S801+N66N3S
<b>Frame Size R</b>												
65	15	30	33	15	15	20	15	50	40	50	50	S801+R10N3S
80	22	40	45	25	20	30	25	60	50	75	60	S801+R13N3S
<b>Frame Size T</b>												
115	33	59	63	30	30	40	30	75	75	100	100	S801+T18N3S
150	45	80	90	50	40	50	50	100	100	150	125	S801+T24N3S
192	55	100	110	60	50	75	60	150	125	200	150	S801+T30N3S
<b>Frame Size U</b>												
240	75	110	147	75	60	75	75	200	150	200	200	S801+U36N3S
305	90	160	185	100	75	100	100	250	200	300	250	S801+U42N3S
365	110	185	220	125	100	150	125	300	250	350	300	S801+U50N3S ①
<b>Frame Size V</b>												
240	75	110	147	75	60	75	75	200	150	200	200	S801+V36N3S
305	90	160	185	100	75	100	100	250	200	300	250	S801+V42N3S
365	110	185	220	125	100	150	125	300	250	350	300	S801+V50N3S
420	129	220	257	150	125	150	150	350	300	450	350	S801+V65N3S
480	147	257	295	150	150	200	150	400	350	500	450	S801+V72N3S
525	160	280	335	150	150	200	150	450	350	500	450	S801+V85N3S
600	185	315	375	200	150	250	200	500	450	600	500	S801+V10N3S

**Note**

① S801+U50N3S unit does not have IEC certification.

### Accessories

#### Lug Kits

S801+T..., S801+U... and S801+V... soft starters each have different lug options based on your wiring needs.

Each lug kit contains three lugs that can be mounted on either the load or line side.

#### Lug Kit



#### Lug Kits

S801+ Catalog Number	Description	Kits Required	Catalog Number
S801+T..., S801+U...	2 cable connections, 4 AWG to 1/0 cable	2	<b>EML22</b>
	1 cable connection, 4/0 to 500 kcmil cable		<b>EML23</b>
	2 cable connections, 4/0 to 500 kcmil cable		<b>EML24</b>
	1 cable connection, 2/0 to 300 kcmil cable		<b>EML25</b>
	2 cable connections, 2/0 to 300 kcmil cable		<b>EML26</b>
S801+V...	2 cable connections, 4/0 to 500 kcmil cable	2	<b>EML28</b>
	4 cable connections, 4/0 to 500 kcmil cable		<b>EML30</b>
	6 cable connections, 4/0 to 500 kcmil cable		<b>EML32</b>
	4 cable connections, 2/0 to 300 kcmil cable		<b>EML33</b>

#### Power Supplies

24 Vdc power supply that can be used with the S801+ SSRV or as a stand-alone device.

#### Power Supplies

Description	Catalog Number
85–264 Vac input 24 Vdc output	<b>PSG240E</b>
360–575 Vac input 24 Vdc output	<b>PSG240F</b>
600 Vac input 24 Vdc output	<b>PSS55D</b>

#### Lug Cover Kits

Replacement covers for the S801+T... and S801+U... soft starters are available in case of damage to the existing covers.

#### Lug Cover Kits

Description	Catalog Number
Lug cover S801+T..., S801+U...	<b>EML27</b>
Lug cover S801+V...	<b>EML34</b>

#### IP20 Kits

#### IP20 Kits

Description	Catalog Number
S801+N...	<b>SS-IP20-N</b>
S801+R...	<b>SS-IP20-R</b>
S801+T... and S801+U...	<b>SS-IP20-TU</b>
S801+V...	<b>SS-IP20-V</b>

#### Surge Suppressors

The surge suppressor can mount on either the line or load side of the soft starter. It is designed to clip the line voltage (or load side induced voltage).

#### Surge Suppressor



#### Surge Suppressors

Description	Catalog Number
600 V MOV for S801+... units	<b>EMS39</b>
690 V MOV for S801+... units	<b>EMS41</b>

**Mounting Plates**

The mounting plates are designed to help make it easy to install or retrofit the soft starter into enclosures and MCCs. The soft starter can be mounted onto the plate prior to installation. The mounting plate is designed with tear drop mounting holes for easier installation.

**Mounting Plates**

Description	Catalog Number
S801+N...	<b>EMM13N</b>
S801+R...	<b>EMM13R</b>
S801+T... and S801+U...	<b>EMM13T</b>
S801+V...	<b>EMM13V</b>

**Vibration Plates**

The vibration plates allow the soft starter to be applied in high shock and vibration applications. The vibration plate allows vibration up to 5g and shock in up to 40g. The soft starter is mounted onto the vibration plate prior to installation in the panel.

**Vibration Plates**

Description	Catalog Number
S801+N...	<b>EMM14N</b>
S801+R...	<b>EMM14R</b>
S801+T... and S801+U...	<b>EMM14T</b>
S801+V...	<b>EMM14V</b>

**Adapter Plates**

The adapter plate allows customers to retrofit a S801+V... soft starter with the S801+U... soft starter.

**Adapter Plates**

Description	Catalog Number
Adapter plates	<b>EMM13U</b>

**Control Wire Connector****Control Wire Connector**

Description	Catalog Number
12-pin, 5 mm pitch connector for control wiring	<b>EMA75</b>

**Control Interface Module**

The Control Interface Module (CIM) is available as a replacement part.

**CIM**

Description	Catalog Number
Blank cover (filler)	<b>EMA68</b>
CIM for standard unit	<b>EMA71</b>
Panel mounting kit	
3 ft cable	<b>EMA69A</b>
5 ft cable	<b>EMA69B</b>
8 ft cable	<b>EMA69C</b>
10 ft cable	<b>EMA69D</b>

**Options****Cooling Fan Kit**

The EMM18 cooling fan kit mounts on either side of any frame size S801+ soft starter to provide additional printed circuit board cooling in high ambient operating temperatures.

**Cooling Fan Kit**

Description	Catalog Number
Fan kit	<b>EMM18</b>

## Technical Data and Specifications

### Soft Starters—S801+

Description	S801+N37N3S	S801+N66N3S	S801+R10N3S	S801+R13N3S
Max. current capacity	37	66	105	135
<b>General Information</b>				
Bypass mechanical lifespan	10M	10M	10M	10M
Insulating voltage Ui	660 V	660 V	660 V	660 V
Ramp time range	0.5–180 seconds	0.5–180 seconds	0.5–180 seconds	0.5–180 seconds
Resistance to vibration	3g	3g	3g	3g
Resistance to shock	15g	15g	15g	15g
<b>Electrical Information</b>				
Operating voltage	200–600 V	200–600 V	200–600 V	200–600 V
Operating frequency	47–63 Hz	47–63 Hz	47–63 Hz	47–63 Hz
Overload setting	30–100%	30–100%	30–100%	30–100%
Trip class	5, 10, 20 and 30	5, 10, 20 and 30	5, 10, 20 and 30	5, 10, 20 and 30
<b>Cabling Capacity (IEC 947)</b>				
Number of conductors	1	1	1	1
Wire sizes	14–2	14–2	14–4/0	14–4/0
Type of connectors	Box lug	Box lug	Box lug	Box lug
<b>Control Wiring (12-Pin)</b>				
Wire sizes in AWG	22–14	22–14	22–14	22–14
Number of conductors (stranded)	2 (or one AWG 12)	2 (or one AWG 12)	2 (or one AWG 12)	2 (or one AWG 12)
Torque requirements in lb-in	3.5	3.5	3.5	3.5
Solid, stranded or flexible max. size in mm <sup>2</sup>	3.31	3.31	3.31	3.31
<b>Control Power Requirements</b>				
Voltage range (24V ±10%)	21.6–26.4	21.6–26.4	21.6–26.4	21.6–26.4
Steady-state current amps	1.0	1.0	1.0	1.0
Inrush current amps	10	10	10	10
Ripple	1%	1%	1%	1%
<b>Relays (1) Class A and C</b>				
Voltage AC—maximum	240	240	240	240
Voltage DC—maximum	120	120	120	120
Amps—maximum	3	3	3	3
<b>Environment</b>				
Temperature—operating	–30° to 50°C (no derating) consult factory for operation >50°C	–30° to 50°C (no derating) consult factory for operation >50°C	–30° to 50°C (no derating) consult factory for operation >50°C	–30° to 50°C (no derating) consult factory for operation >50°C
Temperature—storage	–50° to 70°C	–50° to 70°C	–50° to 70°C	–50° to 70°C
Altitude	<2000m—consult factory for operation >2000m	<2000m—consult factory for operation >2000m	<2000m—consult factory for operation >2000m	<2000m—consult factory for operation >2000m
Humidity	<95% noncondensing	<95% noncondensing	<95% noncondensing	<95% noncondensing
Operating position	Any	Any	Any	Any
Pollution degree IEC947-1	3	3	3	3
Impulse withstand voltage IEC947-4-1	6000 V	6000 V	6000 V	6000 V

## Soft Starters—S801+, continued

Description	S801+T18N3S	S801+T24N3S	S801+T30N3S	S801+U36N3S ①②
Max. current capacity	180	240	304	360
<b>General Information</b>				
Bypass mechanical lifespan	10M	10M	10M	10M
Insulating voltage $U_i$	660 V	660 V	660 V	660 V
Ramp time range	0.5–180 seconds	0.5–180 seconds	0.5–180 seconds	0.5–180 seconds
Resistance to vibration	3g	3g	3g	3g
Resistance to shock	15g	15g	15g	15g
<b>Electrical Information</b>				
Operating voltage	200–600 V	200–600 V	200–600 V	200–600 V
Operating frequency	47–63 Hz	47–63 Hz	47–63 Hz	47–63 Hz
Overload setting	30–100%	30–100%	30–100%	30–100%
Trip class	5, 10, 20 and 30	5, 10, 20 and 30	5, 10, 20 and 30	5, 10, 20 and 30
<b>Cabling Capacity (IEC 947)</b>				
Number of conductors	1 or 2	1 or 2	1 or 2	1 or 2
Wire sizes	4 AWG to 500 kcmil	4 AWG to 500 kcmil	4 AWG to 500 kcmil	4 AWG to 500 kcmil
Type of connectors	Add-on lug kit	Add-on lug kit	Add-on lug kit	Add-on lug kit
<b>Control Wiring (12-Pin)</b>				
Wire sizes in AWG	22–14	22–14	22–14	22–14
Number of conductors (stranded)	2 (or one AWG 12)	2 (or one AWG 12)	2 (or one AWG 12)	2 (or one AWG 12)
Torque requirements in lb-in	3.5	3.5	3.5	3.5
Solid, stranded or flexible max. size in mm <sup>2</sup>	3.31	3.31	3.31	3.31
<b>Control Power Requirements</b>				
Voltage range (24V ±10%)	21.6–26.4	21.6–26.4	21.6–26.4	21.6–26.4
Steady-state current amps	1.0	1.0	1.0	1.0
Inrush current amps	10	10	10	10
Ripple	1%	1%	1%	1%
<b>Relays (1) Class A and C</b>				
Voltage AC—maximum	240	240	240	240
Voltage DC—maximum	120	120	120	120
Amps—maximum	3	3	3	3
<b>Environment</b>				
Temperature—operating	–30° to 50°C (no derating) consult factory for operation >50°C	–30° to 50°C (no derating) consult factory for operation >50°C	–30° to 50°C (no derating) consult factory for operation >50°C	–30° to 50°C (no derating) consult factory for operation >50°C
Temperature—storage	–50° to 70°C	–50° to 70°C	–50° to 70°C	–50° to 70°C
Altitude	<2000m—consult factory for operation >2000m	<2000m—consult factory for operation >2000m	<2000m—consult factory for operation >2000m	<2000m—consult factory for operation >2000m
Humidity	<95% noncondensing	<95% noncondensing	<95% noncondensing	<95% noncondensing
Operating position	Any	Any	Any	Any
Pollution degree IEC947-1	3	3	3	3
Impulse withstand voltage IEC947-4-1	6000 V	6000 V	6000 V	6000 V

**Notes**

① 801+U50N3S unit does not have IEC certification.

② UL recognized component.

## Soft Starters—S801+, continued

Description	S801+U42N3S	S801+U50N3S ①	S801+V36N3S	S801+V42N3S
Max. current capacity	420	500	360	420
<b>General Information</b>				
Bypass mechanical lifespan	10M	10M	10M	10M
Insulating voltage $U_i$	660 V	660 V	660 V	660 V
Ramp time range	0.5–180 seconds	0.5–180 seconds	0.5–180 seconds	0.5–180 seconds
Resistance to vibration	3g	3g	3g	3g
Resistance to shock	15g	15g	15g	15g
<b>Electrical Information</b>				
Operating voltage	200–600 V	200–600 V	200–600 V	200–600 V
Operating frequency	47–63 Hz	47–63 Hz	47–63 Hz	47–63 Hz
Overload setting	30–100%	30–100%	30–100%	30–100%
Trip class	5, 10, 20 and 30	5, 10, 20 and 30	5, 10, 20 and 30	5, 10, 20 and 30
<b>Cabling Capacity (IEC 947)</b>				
Number of conductors	1 or 2	1 or 2	2, 4 or 6	2, 4 or 6
Wire sizes	4 AWG to 500 kcmil	4 AWG to 500 kcmil	2/0 to 500 kcmil	2/0 to 500 kcmil
Type of connectors	Add-on lug kit	Add-on lug kit	Add-on lug kit	Add-on lug kit
<b>Control Wiring (12-Pin)</b>				
Wire sizes in AWG	22–14	22–14	22–14	22–14
Number of conductors (stranded)	2 (or one AWG 12)	2 (or one AWG 12)	2 (or one AWG 12)	2 (or one AWG 12)
Torque requirements in lb-in	3.5	3.5	3.5	3.5
Solid, stranded or flexible max. size in mm <sup>2</sup>	3.31	3.31	3.31	3.31
<b>Control Power Requirements</b>				
Voltage range (24V ±10%)	21.6–26.4	21.6–26.4	21.6–26.4	21.6–26.4
Steady-state current amps	1.0	1.0	1.4	1.4
Inrush current amps	10	10	10	10
Ripple	1%	1%	1%	1%
<b>Relays (1) Class A and C</b>				
Voltage AC—maximum	240	240	240	240
Voltage DC—maximum	120	120	120	120
Amps—maximum	3	3	3	3
<b>Environment</b>				
Temperature—operating	–30° to 50°C (no derating) consult factory for operation >50°C	–30° to 50°C (no derating) consult factory for operation >50°C	–30° to 50°C (no derating) consult factory for operation >50°C	–30° to 50°C (no derating) consult factory for operation >50°C
Temperature—storage	–50° to 70°C	–50° to 70°C	–50° to 70°C	–50° to 70°C
Altitude	<2000m—consult factory for operation >2000m	<2000m—consult factory for operation >2000m	<2000m—consult factory for operation >2000m	<2000m—consult factory for operation >2000m
Humidity	<95% noncondensing	<95% noncondensing	<95% noncondensing	<95% noncondensing
Operating position	Any	Any	Any	Any
Pollution degree IEC947-1	3	3	3	3
Impulse withstand voltage IEC947-4-1	6000 V	6000 V	6000 V	6000 V

**Note**

① 801+U50N3S unit does not have IEC certification.



## Soft Starters—S801+, continued

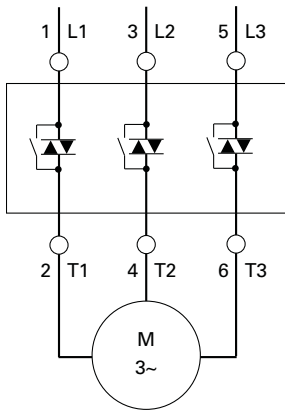
Description	S801+V50N3S	S801+V65N3S	S801+V72N3S	S801+V85N3S	S801+V10N3S <sup>②</sup>
Max. current capacity	500	650	720	850	1000
<b>Dimensions</b>					
Width in inches (mm)	11.03 (280.2)	11.03 (280.2)	11.03 (280.2)	11.03 (280.2)	11.03 (280.2)
Height in inches (mm)	16.57 (420.8)	16.57 (420.8)	16.57 (420.8)	16.57 (420.8)	16.57 (420.8)
Depth in inches (mm)	7.23 (183.7)	7.23 (183.7)	7.23 (183.7)	7.23 (183.7)	7.23 (183.7)
Weight in lbs (kg)	103 (46.8) with lugs 91 (41.4) without lugs	103 (46.8) with lugs 91 (41.4) without lugs	103 (46.8) with lugs 91 (41.4) without lugs	103 (46.8) with lugs 91 (41.4) without lugs	103 (46.8) with lugs 91 (41.4) without lugs
<b>General Information</b>					
Bypass mechanical lifespan	10M	10M	10M	10M	10M
Insulating voltage U <sub>i</sub>	660 V	660 V	660 V	660 V	660 V
Ramp time range	0.5–180 seconds	0.5–180 seconds	0.5–180 seconds	0.5–180 seconds	0.5–180 seconds
Resistance to vibration	3g	3g	3g	3g	3g
Resistance to shock	15g	15g	15g	15g	15g
<b>Electrical Information</b>					
Operating voltage	200–600 V	200–600 V	200–600 V	200–600 V	200–600 V
Operating frequency	47–63 Hz	47–63 Hz	47–63 Hz	47–63 Hz	47–63 Hz
Overload setting	30–100%	30–100%	30–100%	30–100%	30–100%
Trip class	5, 10, 20 and 30	5, 10, 20 and 30	5, 10, 20 and 30	5, 10, 20 and 30	5, 10, 20 and 30
<b>Cabling Capacity (IEC 947)</b>					
Number of conductors	2, 4 or 6	2, 4 or 6	2, 4 or 6	2, 4 or 6	2, 4 or 6
Wire sizes	2/0 to 500 kcmil	2/0 to 500 kcmil	2/0 to 500 kcmil	2/0 to 500 kcmil	2/0 to 500 kcmil
Type of connectors	Add-on lug kit	Add-on lug kit	Add-on lug kit	Add-on lug kit	Add-on lug kit
<b>Control Wiring (12-Pin)</b>					
Wire sizes in AWG	22–14	22–14	22–14	22–14	22–14
Number of conductors (stranded)	2 (or one AWG 12)	2 (or one AWG 12)	2 (or one AWG 12)	2 (or one AWG 12)	2 (or one AWG 12)
Torque requirements in lb-in	3.5	3.5	3.5	3.5	3.5
Solid, stranded or flexible max. size in mm <sup>2</sup>	3.31	3.31	3.31	3.31	3.31
<b>Control Power Requirements</b>					
Voltage range (24V ±10%)	21.6–26.4	21.6–26.4	21.6–26.4	21.6–26.4	21.6–26.4
Steady-state current amps	1.4	1.4	1.4	1.4	1.4
Inrush current amps	10	10	10	10	10
Ripple	1%	1%	1%	1%	1%
<b>Relays (1) Class A and C</b>					
Voltage AC—maximum	240	240	240	240	240
Voltage DC—maximum	120	120	120	120	120
Amps—maximum	3	3	3	3	3
<b>Environment</b>					
Temperature—operating	–30° to 50°C (no derating) consult factory for operation >50°C	–30° to 50°C (no derating) consult factory for operation >50°C	–30° to 50°C (no derating) consult factory for operation >50°C	–30° to 50°C (no derating) consult factory for operation >50°C	–30° to 50°C (no derating) consult factory for operation >50°C
Temperature—storage	–50° to 70°C	–50° to 70°C	–50° to 70°C	–50° to 70°C	–50° to 70°C
Altitude	<2000m—consult factory for operation >2000m	<2000m—consult factory for operation >2000m	<2000m—consult factory for operation >2000m	<2000m—consult factory for operation >2000m	<2000m—consult factory for operation >2000m
Humidity	<95% noncondensing	<95% noncondensing	<95% noncondensing	<95% noncondensing	<95% noncondensing
Operating position	Any	Any	Any	Any	Any
Pollution degree IEC947-1	3	3	3	3	3
Impulse withstand voltage IEC947-4-1	6000 V	6000 V	6000 V	6000 V	6000 V

**Note**

② UL recognized component.

### Wiring Diagram

#### Line Connected Soft Starter



### Dimensions

Approximate Dimensions in Inches (mm)

#### Soft Starters—S801+

Catalog Number	W	H	D	Weight in Lbs (kg)
S801+N37N3S	2.66 (67.6)	7.37 (187.2)	6.45 (163.9)	5.8 (2.6)
S801+N66N3S	2.66 (67.6)	7.37 (187.2)	6.45 (163.9)	5.8 (2.6)
S801+R10N3S	4.38 (111.3)	7.92 (201.1)	6.64 (168.6)	10.5 (4.8)
S801+R13N3S	4.38 (111.3)	7.92 (201.1)	6.64 (168.6)	10.5 (4.8)
S801+T18N3S	7.65 (194.4)	12.71 (322.9)	6.47 (164.4)	48 (21.8) with lugs 41 (18.6) without lugs
S801+T24N3S	7.65 (194.4)	12.71 (322.9)	6.47 (164.4)	48 (21.8) with lugs 41 (18.6) without lugs
S801+T30N3S	7.65 (194.4)	12.71 (322.9)	6.47 (164.4)	48 (21.8) with lugs 41 (18.6) without lugs
S801+U36N3S	7.73 (196.3)	12.72 (323.1)	7.16 (181.8)	48 (21.8) with lugs 41 (18.6) without lugs
S801+U42N3S	7.73 (196.3)	12.72 (323.1)	7.16 (181.8)	48 (21.8) with lugs 41 (18.6) without lugs
S801+U50N3S	7.73 (196.3)	12.72 (323.1)	7.16 (181.8)	48 (21.8) with lugs 41 (18.6) without lugs
S801+V36N3S	11.05 (280.6)	16.57 (420.8)	7.39 (187.8)	103 (46.8) with lugs 91 (41.4) without lugs
S801+V42N3S	11.05 (280.6)	16.57 (420.8)	7.39 (187.8)	103 (46.8) with lugs 91 (41.4) without lugs
S801+V50N3S	11.05 (280.6)	16.57 (420.8)	7.39 (187.8)	103 (46.8) with lugs 91 (41.4) without lugs
S801+V65N3S	11.05 (280.6)	16.57 (420.8)	7.39 (187.8)	103 (46.8) with lugs 91 (41.4) without lugs
S801+V72N3S	11.05 (280.6)	16.57 (420.8)	7.39 (187.8)	103 (46.8) with lugs 91 (41.4) without lugs
S801+V85N3S	11.05 (280.6)	16.57 (420.8)	7.39 (187.8)	103 (46.8) with lugs 91 (41.4) without lugs
S801+V10N3S	11.05 (280.6)	16.57 (420.8)	7.39 (187.8)	103 (46.8) with lugs 91 (41.4) without lugs

Also refer to dimension drawings on **Pages V6-T1-72 through V6-T1-74.**

# 1.2

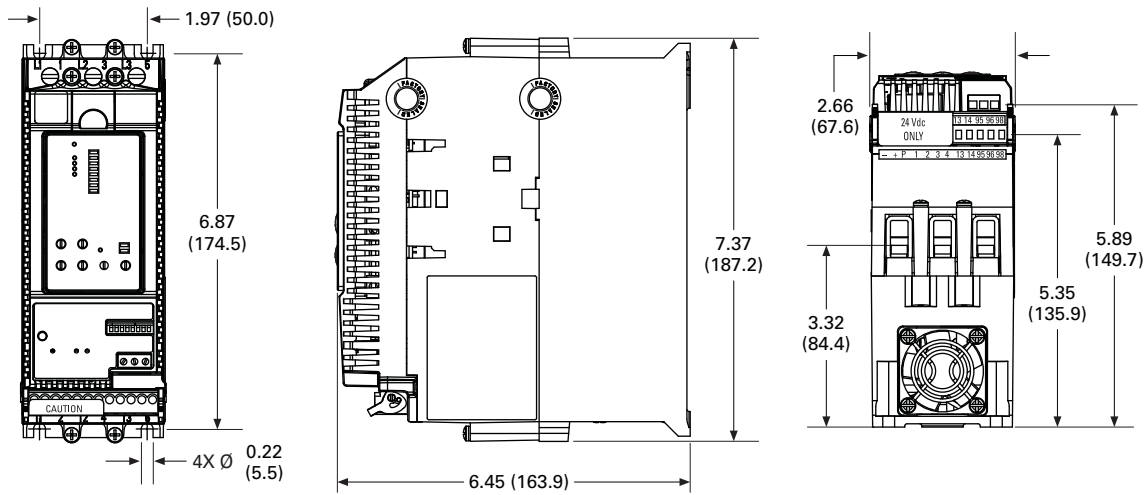
## Reduced Voltage Motor Starters

### Solid-State Starters

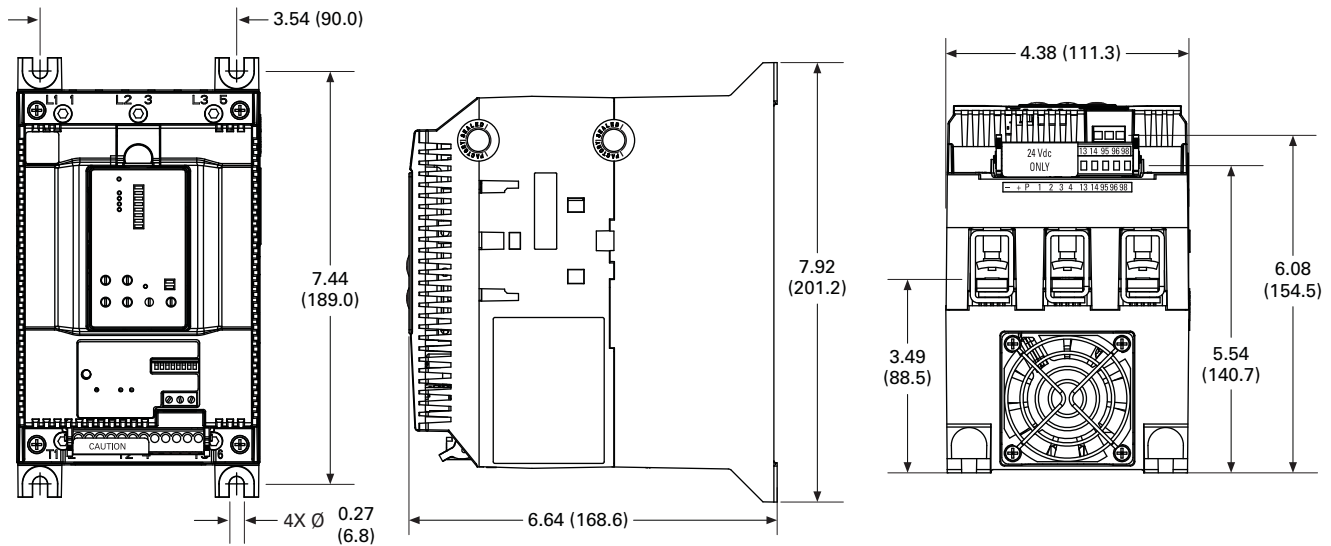
1

Approximate Dimensions in Inches (mm)

#### S801+N...

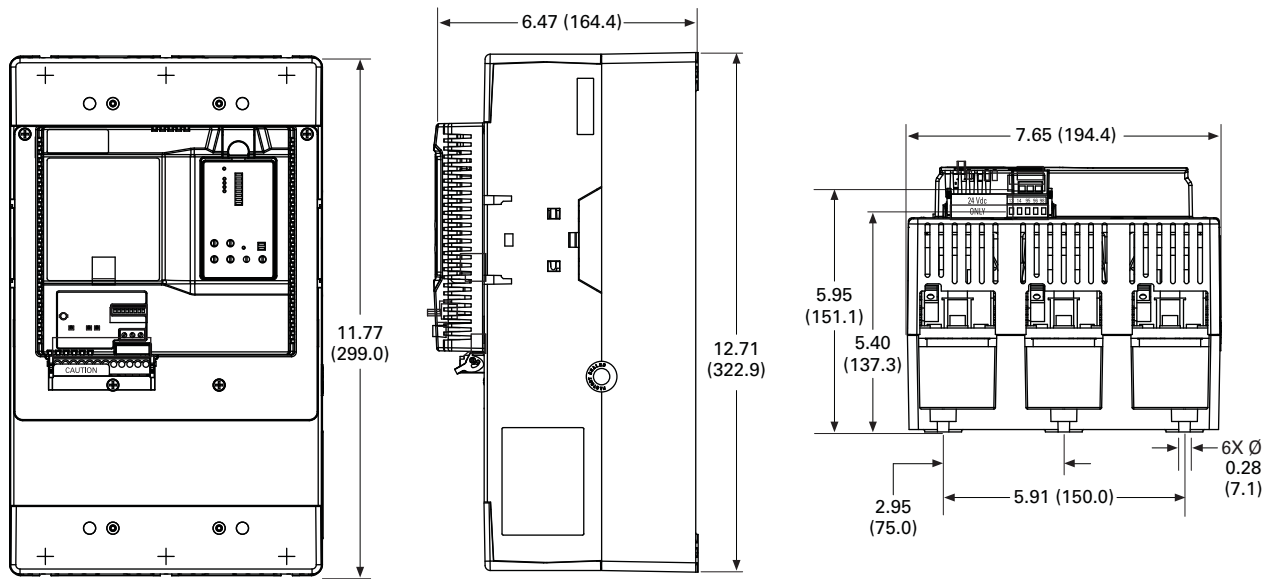


#### S801+R...

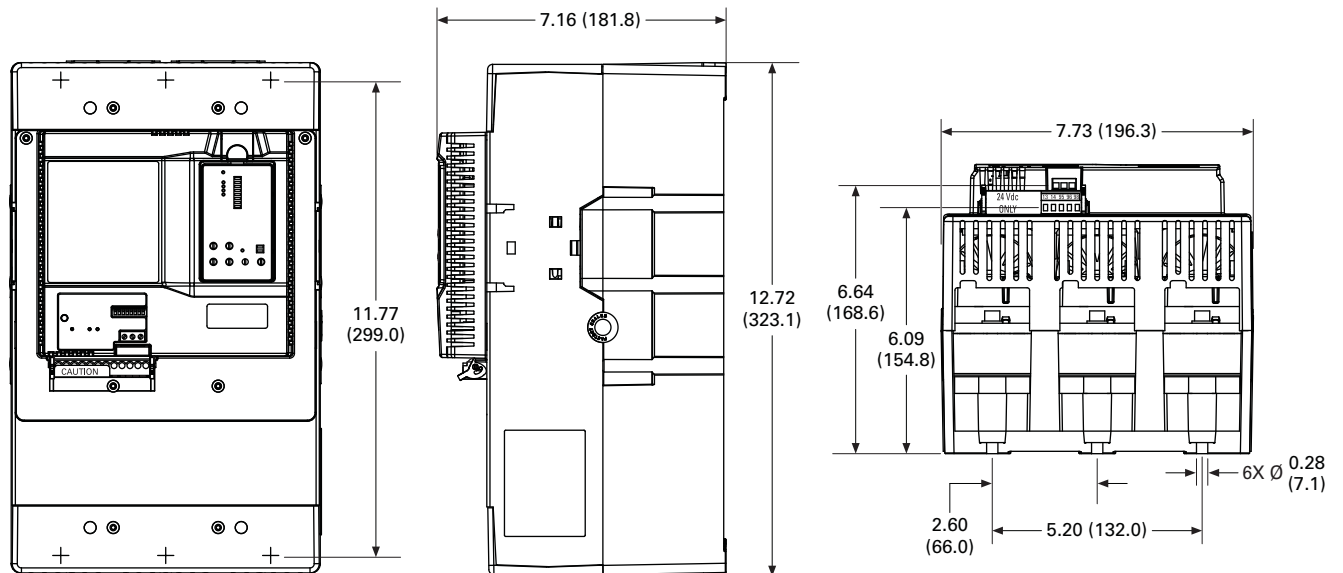


Approximate Dimensions in Inches (mm)

### S801+T...



### S801+U...



# 1.2

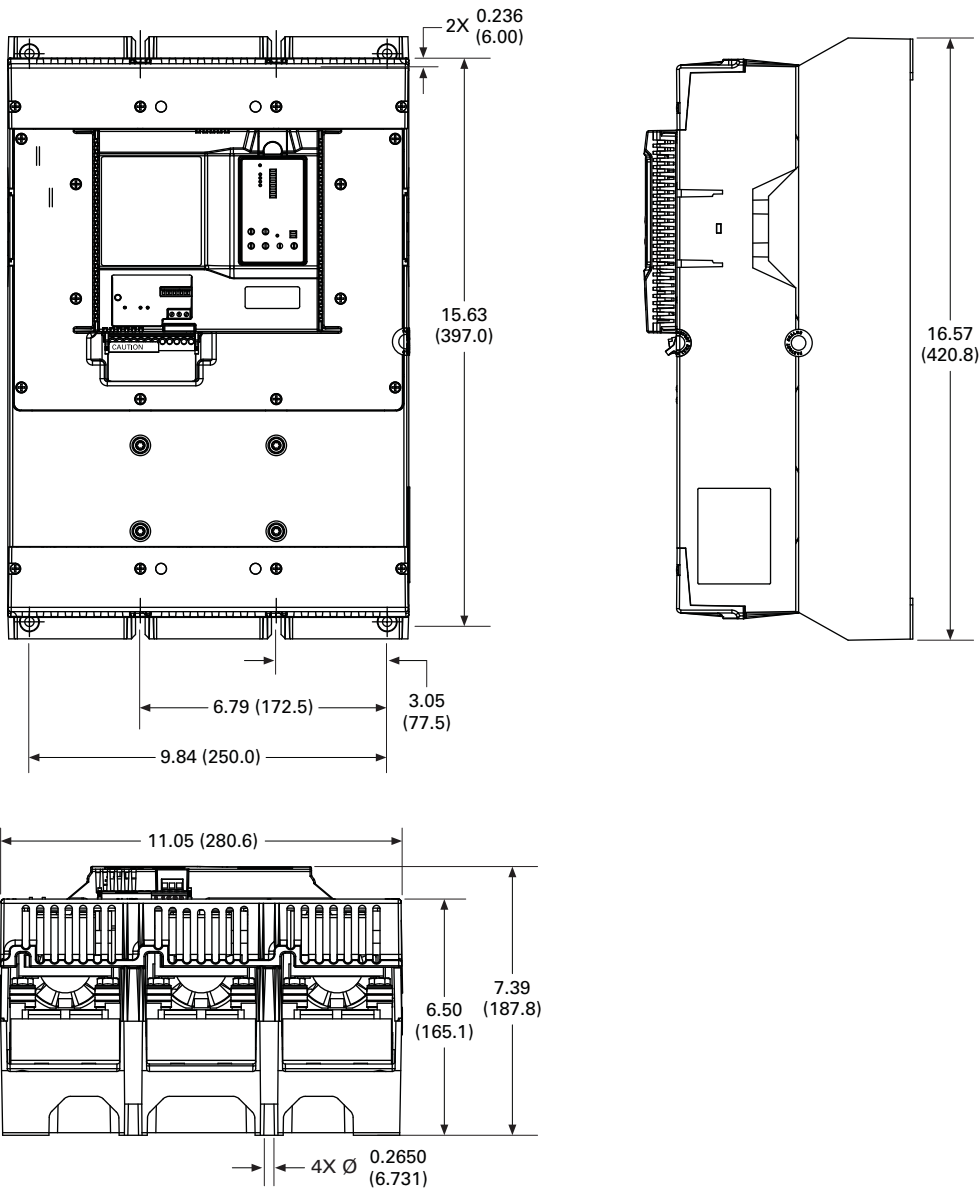
## Reduced Voltage Motor Starters

### Solid-State Starters

1

Approximate Dimensions in Inches (mm)

S801+V...



**Type S811+, Soft Starters with Digital Interface Module (DIM)**



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## Type S811+, Soft Starters with DIM

### Product Description

Eaton’s S811+ offers all the popular features of the S801+ and adds new enhanced functionality with the new Digital Interface Module (DIM), communications, metering, monitoring and diagnostics capabilities.

Eaton’s line of S811+ reduced voltage soft starters is very compact, multi-functional, easy to install and easy to set operating parameters. Designed to control the acceleration and deceleration of three-phase motors up to 690 V, the line is available from 11A to 1000A.

The S811+ is designed to be a complete package, combining the silicon controlled rectifiers (SCRs), bypass contactor and overload in one, very compact unit. The S811+ is available as a component for panel mounting, in motor control centers or in enclosed control (NEMA Type 1, 3R, 4, 4X, 7/9 and 12).

### Application Description

Designed to control the acceleration and deceleration of three-phase motors, the S811+ soft starter uses SCRs to control the voltage to soft start and soft stop the motor. After the motor is started, internal run bypass contactors close, resulting in the motor running directly across-the-line. The built-in solid-state overload protects the motor from overload conditions with sophisticated algorithms that model true motor heating, resulting in better motor protection and fewer nuisance trips. Advanced protective and diagnostic features reduce downtime.

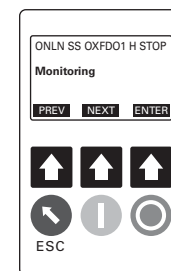
A voltage ramp start or current limit start is available. Kick start is available in either starting mode. The soft stop option allows for a ramp stop time that is longer than the coast to stop time. The pump control option in the S811+ Premium provides a smooth transition for starting and stopping a motor and eliminating the “water-hammer” effect that can damage pipes, valves and pumps.

The S811+ offers an impressive array of advanced protective features. Not only are the protective features selectable, but many offer variable settings and adjustable time delays to ride through system discrepancies. Protective features may also be set to Warning status to avoid nuisance trips.

The S811+ has an easy to use Digital Interface Module (DIM) that allows the user to configure the device and to read system parameters and monitor system values. The DIM includes an LCD display and keypad to scroll through the various menus. The DIM allows the user to modify control parameters, enable or disable protections, set communication variables, monitor system parameters such as line voltages and currents, and access the fault queue.

The DIM can be removed from the S811+ and be remote mounted. Kits are available to door mount the DIM, enabling users to safely configure, commission, monitor and troubleshoot the system at the electrical panel without opening the enclosure door. This will help eliminate the possibility of an arc flash incident.

### Digital Interface Module (DIM)



1

#### Communications

The S811+ is equipped with native Modbus RTU communication capabilities and may be connected to a variety of networks, including DeviceNet, Modbus TCP, EtherNet/IP and PROFIBUS using the C441 series communication modules for easy integration into any PLC or DCS system.

The modules come standard with four inputs and two relay outputs. C441 communication modules can also be used independently for standalone I/O applications.



#### C441 Communication Card Options

Designed for use with soft starters ...



Protocol	Catalog Number	Input Signal Type	S811+	General Purpose I/O ①	Mounting Options
Modbus RTU	<b>C441NS</b>	120 Vac	■	■	Standalone—DIN rail/panel mount
	<b>C441PS</b>	24 Vdc	■	■	Standalone—DIN rail/panel mount
DeviceNet	<b>C441KS</b>	120 Vac	■	■	Standalone—DIN rail/panel mount
	<b>C441LS</b>	24 Vdc	■	■	Standalone—DIN rail/panel mount
PROFIBUS	<b>C441SS</b>	120 Vac	■	■	Standalone—DIN rail/panel mount
	<b>C441QS</b>	24 Vdc	■	■	Standalone—DIN rail/panel mount
Modbus TCP, EtherNet/IP	<b>C441U</b>	120 Vac	■	■	Standalone—DIN rail/panel mount
	<b>C441V</b>	24 Vdc	■	■	Standalone—DIN rail/panel mount

**Note:** Refer to Volume 5—Motor Control and Protection, **CA08100006E**, tab 5.4 for additional details and **BR042002EN** brochure for C441 communication module accessories for overload relays and soft starters.

Recommended Power Supply	Catalog Number
85–264 Vac single-phase input, 24 Vdc output	<b>PSG240E24RM</b>
360–575 Vac three-phase input, 24 Vdc output	<b>PSG240F24RM</b>

#### Operation

##### Starting and Stopping Modes

The S811+ has a variety of starting and stopping methods to provide superior performance in the most demanding applications. The motor can be started in either voltage ramp start or current limit start mode. Kick start and soft stop are available within both starting modes. The user has the option to configure two independent start ramp profiles to accommodate variations in starting requirements.

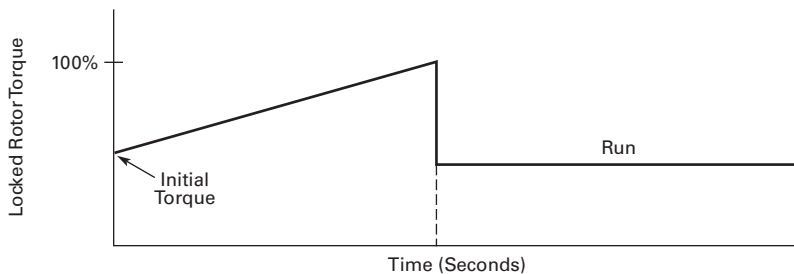
##### Voltage Ramp Start

Provides a voltage ramp to the motor resulting in a constant torque increase. The most commonly used form of soft start, this start mode allows

you to set the initial torque value and the duration of the ramp to full voltage conditions. Bypass contactors close after ramp time.

- Adjustable initial torque 0–85% of locked rotor torque
- Adjustable ramp time 0.5–180 seconds (0.5–360 seconds with the S811+ Premium)

##### Starting Characteristics—Ramp Start



#### Note

① C441 standalone communication modules can be used as general purpose I/O. This allows a customer to monitor the status of any non-communicating product over the selected protocol by wiring fault or auxiliary contacts from that product to the C441 communication module on-board I/O.

### Current Limit Start

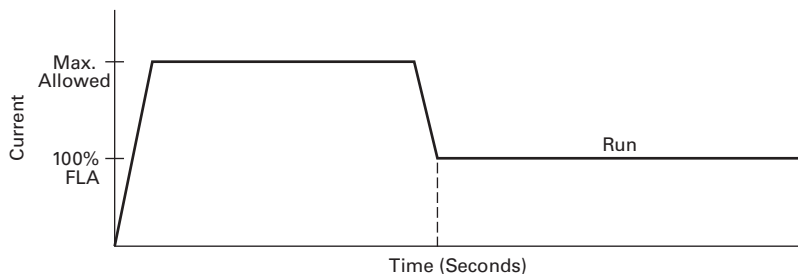
Limits the maximum current available to the motor during the start phase. This mode of soft starting is used when it becomes necessary to limit

the maximum starting current due to long start times or to protect the motor. This start mode allows you to set the maximum starting current as a

percentage of locked rotor current and the duration of the current limit. Bypass contactors close after current limit time.

- Maximum current of 0–85% locked rotor current
- Adjustable ramp time 0.5–180 seconds (0.5–360 seconds with the S811+ Premium)

### Starting Characteristics—Current Limit Start



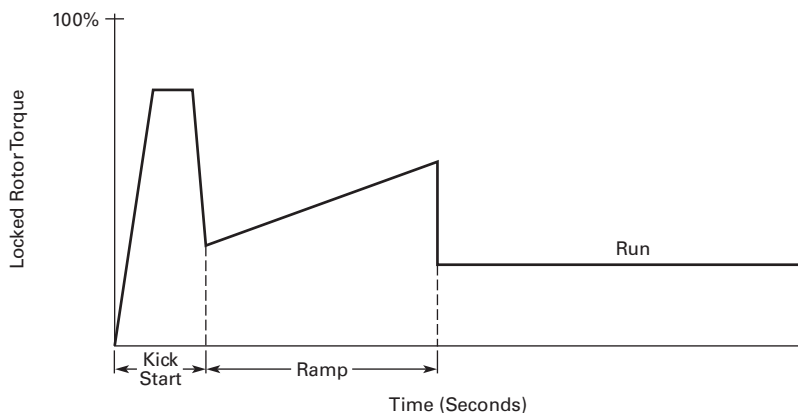
### Kick Start

Selectable feature in both voltage ramp start and current limit start modes. Provides a current and torque “kick” for 0 to 2.0 seconds.

This provides greater initial current to develop additional torque to breakaway a high friction load.

- 0–85% of locked rotor torque
- 0–2.0 seconds duration

### Starting Characteristics—Kick Start



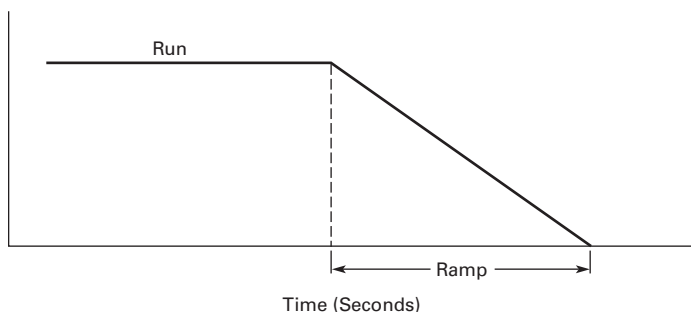
### Soft Stop

Allows for a controlled stopping of a load. Used when a stop-time that is greater than the coast-to-stop

time is desired. Often used with high friction loads where a sudden stop may cause system or load damage.

- Stop time = 0–60 seconds

### Starting Characteristics—Soft Stop





**Edge and Level Sensing Control****Edge Sensing**

Edge sensing requires +24 Vdc power be momentarily applied to Control Terminal Block Pin 1 (with Terminal P at +24 Vdc) to initiate a start under all conditions. After a stop or fault occurs, the +24 Vdc must be removed, then reapplied to Terminal Pin 1 before another start can occur. This control configuration should be used when restarting of the motor after a fault or stop must be supervised manually or as a part of a control scheme. The cycling of +24 Vdc power to Terminal 1 Pin before starting is required regardless of the position of the auto reset switch on the DIM.

**Level Sensing**

Level sensing will enable a motor to restart after a fault is cleared without cycling +24 Vdc power to Terminal Pin 1 as long as:

- Terminal Pin P is supplied with +24 Vdc (to start from Control Terminal Block, Terminal Pin 3 must also be enabled)
- The auto reset switch on the DIM is set to enabled
- All faults have been reset

This control configuration should be used where it is desirable to restart a motor after a fault without additional manual or automatic control. An example of this condition would be on a remote pumping station where it is desirable to automatically restart a pump after a power outage without operator intervention.

**Note:** If the auto reset feature is used, CAUTION must be exercised to ensure that any restart occurs in a safe manner.

### Features and Benefits

- Communication capabilities with various protocols
- The Digital Interface Module (DIM) provides an intuitive, easy-to-use human interface with powerful configuration capabilities to maximize system performance
- Door or device mounted DIM enables users to safely configure, commission, monitor and troubleshoot the system at the electrical panel without opening the enclosure door, eliminating the possibility of an arc flash incident
- System operating parameters can be monitored enterprise-wide through a communications network. Increase uptime by providing data for process management and preventive diagnostics
- Run internal bypass mode greatly reduces internal heating created by the greater power dissipation in the SCRs. Bypass contactor directly connects the motor to the line and improves system efficiency by reducing internal power losses
- Internal solid-state overload protection provides accurate current measurement and trip settings. Sophisticated algorithms solve a series of differential equations that model true motor heating and cooling, resulting in superior motor overload protection while minimizing nuisance trips. Advanced selectable protective features safeguard the motor and system against a variety of system faults
- Internal run bypass contactors and overload protection eliminate the need for additional devices, reducing enclosure sizes, minimizing installation and wiring time, and reducing overall assembly size and cost
- Wide range of overload FLA settings (31–100% of rated current) and a selectable trip class (5–30) offers users the flexibility to fine tune the starter to match specific application requirements
- Variable ramp times and torque control settings provide unlimited starting configurations, allowing for maximum application flexibility
- Kick-start feature enables soft starting of high friction loads
- Soft stop control for applications where an abrupt stop of the load is not acceptable
- The S811+ Premium with sophisticated pump control algorithms on both starting and stopping that minimize the pressure surges that cause water hammer. The pump control feature will maximize the life of the pump and piping systems while minimizing the downtime caused by system failure
- Six SCRs control all three motor phases, providing smooth acceleration and deceleration performance
- Soft acceleration and deceleration reduces wear on belts, gears, chains, clutches, shafts and bearings
- Reduce the peak inrush current's stress on the power system
- Manage peak starting torque to diminish mechanical system wear and damage
- 24 Vdc control voltage enhances personnel and equipment safety
- Removable, lockable control terminal block reduces maintenance costs. Also provides the opportunity for OEMs to reduce assembly and test costs by utilizing pre-assembled wire harnesses

### Motor Wiring Configuration User Selectable Inline or Inside-the-Delta

Mains Motor Wiring Configuration is accomplished by simply selecting the required configuration from a menu. This feature allows adaptability from one configuration to another without any additional programming operations and reduces inventory levels by not having to stock both configurations.

### Modbus Native Communications Protocol

Modbus RTU communications is now standard on all S811+ units. This allows users to quickly configure the unit for network communications using a common protocol. Adapters are available for users who prefer to use EtherNet/IP or Modbus TCP protocols.

### Programmable Control Terminal Block Functionality

Four programmable terminals on the S811+ enable the user to expand functionality with options such as a second start ramp profile, externally triggered trip or warning functions, analog inputs, and others, in addition to the normal start, stop, reset, and so on, functions.

### Second Start Ramp Profile Capability

A second start ramp profile may be configured for the soft starter. This profile is independent of the primary profile and retains all the parameter options such as start time and initial torques. With a signal at a terminal programmed for this feature, the second profile may be selected by a pushbutton station or a network.

### Alarm-No-Trip Functionality

Some applications require the ability to effectively disable most protections with the intent of enabling the RVSS unit to control a motor under the most severe operating conditions characterized by current or voltage imbalances, high or low value deviations, or other fault conditions. This function causes the S811+ to ignore most fault trip conditions and continue operation of the application.

### Digital Interface Module (DIM) Cloning

For OEMs or other users that desire to load identical parameter settings into multiple RVSS units, the DIM may be used to extract and duplicate parameter settings from one RVSS and loaded into other units, saving time, effort, and reducing chances for errors while programming.

**Protective Features**

All protective features can be configured, enabled or disabled with the DIM or through the communications network.

**Motor Overload**

The S811+ includes electronic overload protection as standard. The overload meets applicable requirements for a motor overload protective device. The overload protects the motor from over heat conditions with the use of sophisticated algorithms that model true motor heating, resulting in superior motor protection and fewer nuisance trips.

The S811+ calculates a thermal memory value based on the heat energy introduced into the motor during the start process. A 100% value represents the maximum safe internal temperature of the motor.

When the thermal memory value reaches 100%, an overload trip will occur removing power to the motor. Upon trip, the S811+ stores the calculated motor heating value and will not allow a motor re-start until the motor has a thermal memory value of less than 100%. This feature ensures the motor will not be damaged by repeated overload trip, reset and re-start cycles.

The thermal memory value can be monitored through the DIM or the communications network. The thermal memory value can be of great use in determining an impending overload trip condition. Alarms can be implemented in the process monitoring system warning of an impending trip before a trip occurs halting the process. Costly system downtime can be avoided.

The trip current is adjusted to match the specific application requirements by entering the motor nameplate full load current rating and trip class. The FLA parameter is adjustable from 32% to 100% of the unit's rated current. The overload trip class is adjustable from class 5 through class 30. The overload is ambient temperature compensated—meaning its trip characteristics will not vary with changes in ambient temperature. The overload protection can be enabled, disabled, or disabled on start.

**Short Circuit**

The use of a short-circuit protective device in coordination with the S811+ is required in branch motor circuits by most electrical codes. Short-circuit coordination ratings with both fuses and Eaton molded case circuit breakers are available providing customers with design flexibility. The S811+ has short-circuit coordination ratings as an open component, an enclosed starter, and in a motor control center.

**External E-Stop**

Emergency Stop functionality may be triggered from an external source. Removal of the 24 Vdc signal from a terminal configured for E-Stop will initiate an E-Stop action. The External E-Stop option is useful in applications where it is desirable to accomplish a motor shutdown in the event that an external condition(s) exist that will damage system components and/or product flows or operations.

**External Trip**

External Trip functionality may be triggered from an external source. Removal of the 24 Vdc signal from a terminal configured for External Trip will initiate an External Trip action. The External Trip option is useful in applications where it is desirable to accomplish a motor stop in the event that an external condition(s) exist that will damage system components and/or product flows or operations.

**Fault Warning Functionality**

Selected protection parameters may be assigned to provide a Fault Warning instead of a Fault Trip with user adjustable set points. When a Fault Warning condition is detected, the fault condition is reported via the DIM, network connection, or an auxiliary relay configured for this function. The soft starter remains in operation. At such time the fault condition no longer exists, the Fault Warning message will be extinguished.

**External Warning**

The S811+ will accept a Warning signal from an external source or device. In a fashion similar to the Fault Warning, the fault condition is reported via the DIM, network connection, or an auxiliary relay configured for this function. The soft starter remains in operation. At such time the fault condition no longer exists, the Fault Warning message will be extinguished.

**Custom Fault/Warning Auxiliary Relays**

Up to three fault and/or warning codes may be selected to operate an auxiliary relay configured to operate when any of these codes are detected. This option enables the user to provide external warnings or fault indications to increase monitoring effectiveness and to provide additional system control.

**Motor Power**

Motor Power can be not only be monitored, but trip levels can be adjusted to provide indications of system malfunctions or operating discrepancies. Both High and Low Power thresholds can be set to provide Fault Warning or Fault Trip functions. Additionally, fault delays times may be set to up to 60 seconds.

**Analog Input**

An input control terminal may be configured to accept a 0–20 mA DC signal with range scaling. This feature enables the S811+ to respond to an external device that may be monitoring a critical component or process and provides Fault Trip or Fault Warning capability to protect operating systems and processes.

**Start Delay**

Three start delay timers are available to enhance motor protection or to provide simple logic functions to coordinate motor control with other devices in the system. The timers will allow delays from 24 Vdc power up, receipt of a valid START command, or a delay in switch from one start ramp profile to another.

**Jam**

Excessive current and torque up to locked rotor levels can occur in a jam condition. The condition can result in stress and damage to the motor, load, mechanical system, and the electrical distribution system. Jam protection prevents the stress and damage from a jam during normal run. After the motor is in bypass, a current greater than 300% FLA setting will cause the starter to trip on a jam fault.

**Stall**

Excessive current and torque up to locked rotor levels can occur in a stall condition. The condition can lead to an overload trip and result in stress and damage to the motor, load, mechanical system, and the electrical distribution system. Stall protection prevents stress and damage to a motor that has not come up to speed during the soft start time. The S811+ will trip to protect the system in the event that the motor did not get to the rated speed in the defined soft start period. A current greater than 200% FLA at the end of the soft start period will cause the starter to trip on a stall fault.

**Pole Over Temperature**

High ambient temperatures, extended ramp times and high duty cycle conditions may cause the S811+ power pole conductors to reach a temperature that exceeds their thermal rating. The S811+ is equipped with sensors that monitor the temperature of the power poles. Over temperature protection occurs if the power pole's thermal capacity is exceeded. The soft starter will trip in over temperature conditions, preventing device failure.

Each power pole temperature value can be monitored through the DIM or the communications network. This feature can be of use in determining an impending over temperature trip condition.

When using a communications network, alarms can be implemented in the process monitoring system warning of an impending trip before the trip occurs, halting the process.

**Phase Loss**

Loss of a phase can cause a significant increase in the current drawn in the remaining two phases. Phase loss can lead to motor damage before an eventual overload trip occurs. Phase loss is typically an indication of a failure in the electrical distribution system. The S811+ will detect a phase loss and trip if any phase current drops below a preset value. The phase loss trip level is adjustable from 0% to 100% of the average of the other two phase levels with an adjustable trip delay of 0.1 to 60 seconds.

**Phase Imbalance**

Phase current or voltage imbalance can cause a significant increase in the current drawn in the remaining two phases. Phase imbalance can lead to motor damage before an eventual overload trip. Phase imbalance is typically an indication of a failure in the electrical distribution system or the motor. The S811+ will detect both current and voltage phase imbalances and trip if any phase becomes imbalanced as compared to the average of the other two phases.

The phase current imbalance trip level is adjustable from 0% to 100% of the average of the current in the other two phases with an adjustable trip delay of 0.1 to 60 seconds.

The phase voltage imbalance trip level is adjustable from 0% to 100% of the average of the voltage in the other two phases with an adjustable trip delay of 0.1 to 60 seconds.

**Reset Mode**

The S811+ can be set up for automatic or manual reset on trip. The manual reset mode requires the operator to physically press the RESET button located on the soft starter. The trip can be manually reset through the DIM or through the communications network. The trip can also be electrically reset by energizing a 24 Vdc input on the control terminal block.

The automatic reset mode allows the soft starter to be automatically reset as soon as the trip condition is no longer present. With the automatic reset mode, after the fault is no longer present, the motor will be restarted as soon as a valid start signal is present.

**Phase Reversal**

The S811+ can determine if the proper line phase sequence is present by default. The device will trip if the line phase sequence is something other than A-B-C. The S811+ can be configured to operate under reversed phase conditions (A-C-B).

**Shorted SCR Detection**

The S811+ monitors the operation of the power poles and will trip under a shorted SCR condition.

**Open SCR Detection**

The S811+ monitors the operation of the power poles and will trip under an open SCR condition.

**Ground Fault Protection**

The S811+ Premium and 690 V versions meet the IEC Ground Fault trip thresholds. Reference Application Note AP039007EN for more information.

**Low Current**

Low current conditions can be a result of a loss of load or a failure in the mechanical system. The S811+ has low current protection that will trip if the average rms current falls below a preset value. The low current protection can be programmed as a percent of motor FLA from 0% to 100%.

**Low Voltage**

Low voltage conditions can result from disturbances in the electrical power distribution system. Low voltage conditions can cause a malfunction and damage to electrical equipment. The S811+ has low voltage protection that will trip if the average rms voltage falls below a preset value. The low voltage protection can be programmed as a percent of nominal voltage from 1% to 99% with a trip delay of 0.1 to 60 seconds to accommodate short temporary voltage drops during the start process.

**High Voltage**

High voltage conditions can result from disturbances in the electrical power distribution system. High voltage conditions can cause malfunctions or failures of electrical equipment. The S811+ has high voltage protection that will trip if the average rms voltage is greater than a preset value. The high voltage protection can be programmed as a percent of nominal voltage from 101% to 120% with a trip delay of 0.1 to 60 seconds.

**Monitoring Capabilities**

The S811+ has an impressive array of system monitoring capabilities that allows users to access real time process and diagnostic data. This data can be viewed at the device with the DIM or through a communications network. Data over a communications network can provide valuable insight into the condition of the equipment and processes. Maintenance and production personnel can monitor critical operational and maintenance data from a central control station that can be located far away from the production facility. Process data can be monitored to determine system anomalies that may indicate a need for preventive maintenance or an impending failure. Adjustments made through the communications network can reduce costs by minimizing the time traveling to the location where the motor controls are located. When faults do occur, real time fault data can assist maintenance in troubleshooting and planning repair resources. Remote reset signals can be given to tripped devices without the need for manual intervention by maintenance personnel.

**Average Line Current**

Provides the average of the three-phase rms line currents in amps, accurate to within 2%. Current data can be used to indicate a need for maintenance. Increased currents in a fixed load application can indicate a reduction in system efficiencies and performance, signifying system maintenance is due.

**Average Pole Current**

Provides the average of the three-phase rms pole currents in amps, accurate to within 2%. The pole current is the current through the soft starter. The line and pole current will be identical in inline applications, and will differ in inside-the-delta applications.

**Average Line Current as a % FLA**

Provides the average rms line current as a percentage of the S811+ FLA setting.

**Three-Phase Line Currents**

Provides three rms phase line currents in amps, accurate to within 2%. Imbalances or changes in the relative phase current to one another can indicate anomalies in the motor or electrical distribution system.

**Three-Phase Pole Currents**

Provides three rms phase pole currents in amps, accurate to within 2%. The pole current is the current through the soft starter. The line and pole current will be identical in in-line applications, and will differ in inside-the-delta applications.

**Three-Phase Line Voltages**

Provides the individual rms three-phase line voltages. Imbalances or changes in the relative phase voltage to one another can indicate anomalies in the motor or electrical distribution system. Voltage can be used to monitor electrical distribution system performance. Warnings, alarms and system actions to low or high voltage conditions can be implemented.

**Percent Thermal Memory**

Provides the real time calculated thermal memory value. The S811+ calculates thermal memory value. A 100% value represents the maximum safe internal temperature of the motor. When the thermal memory value reaches 100%, an overload trip will occur, removing power to the motor.

The thermal memory value can be of great use in determining an impending overload trip condition. When using a communications network, alarms can be implemented in the process monitoring system warning of an impending trip before the trip occurs, halting the process. Costly system downtime can be avoided.

**DC Control Voltage**

Monitors level of the 24 Vdc control voltage. Fluctuations in control voltage can cause component malfunction and failure. System control voltage data can be used to implement warnings, alarms and system actions to low or high voltage conditions.

**Pole Temperature**

Increases in power pole temperature are caused by increases in ambient temperature, start/stop times and start duty cycles. Changes in pole temperatures represent a change in system operating conditions. Identifying unexpected operating conditions or changes can prompt maintenance and aid in process evaluation activities.

**PCB Device Temperature**

An increase in printed circuit board (PCB) device temperature is a strong indication of an increase in ambient temperature. High ambient temperature operation can be identified with the device temperature data. Device temperature increases can be due to undersized enclosures, failure of cooling fans or blocked venting. High operating temperatures will reduce the life of all electrical equipment in the enclosure.

**Start Count**

Start count data can be used to monitor system output, schedule preventative maintenance, identify system anomalies and identify changes in system operation.

**Average Line Power**

Provides the average of the three-phase line power in kilowatts, accurate to 5%. Power data may be used to monitor power transmitted to the load. Increased power demand may indicate degraded system components or connections. Additionally, such data is useful in determine power utilization in branch circuits consisting of multiple loads.

**Power Factor**

Provides the three-phase power factor value, accurate to 5%. The power factor of the circuit may be used to identify circuit conditions that may need to be corrected due to low power factor indications. Low circuit power factor can indicate improper or degraded components.



### Diagnostics

#### Fault Queue

Current fault and a fault queue containing the last nine system faults can be read through the DIM or communications network. Fault identification can minimize troubleshooting time and cost, and prevent arc flash incidents. The fault queue can be remotely accessed through a communications network to assist in planning maintenance resources. Thirty (30) different faults can be identified by the S811+.

#### Control Status

The S811+ provides data that represents system conditions that can be read through the DIM or the communications network. This data identifies the status of the system and the control commands the system is requesting of the S811+. This can be used for advanced troubleshooting and system integration activities.

#### Breaker Status

The S811+ has provisions to read and display circuit breaker status. Eaton communicating cover control or other communicating protective device is required to take advantage of this feature.

### Standards and Certifications

- IEC 60947-4-2
- EN 60947-4-2
- UL listed (NMFT-E202571) S811+N37... through S811+V85...
- UL recognized (NMFT2) S811+V10...
- CE marked
- CSA certified (3211 06)
- CSA elevator (2411 01)

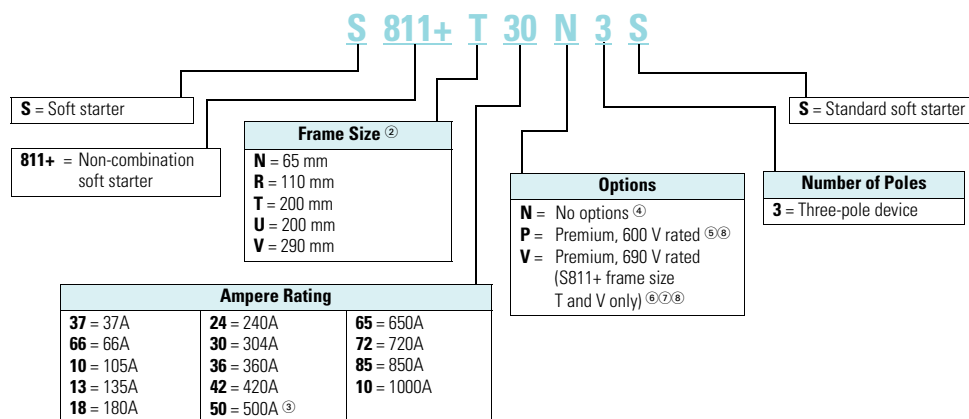


### Instructional Leaflets

- User manual MN03900001E
- Outline drawings:
  - S811+N...: 10-8574
  - S811+R...: 10-8575
  - S811+T...: 10-8576
  - S811+U...: 10-8857
  - S811+V...: 10-8577

### Catalog Number Selection

#### S811+ Open Soft Starters ①



### Notes

- ① All units require a 24 Vdc power supply found on catalog **Page V6-T1-88**, or equivalent.
- ② S811+T..., S811+U... and S811+V... units require lug kits found on **Page V6-T1-88**.
- ③ S811+U50... unit does not have IEC certification.
- ④ Level/Edge Sense, Inline or Inside-the-Delta wiring configuration.
- ⑤ Level/Edge Sense, Inline or Inside-the-Delta wiring configuration, pump control and extended ramp.
- ⑥ Not available in S811+U....
- ⑦ Level/Edge Sense, Inline wiring configuration, pump control, extended ramp.
- ⑧ Ground fault protection included.

## Product Selection

### Standard Duty Ratings

Starting Method	Ramp Current % of FLA	Ramp Time Seconds	Starts per Hour	Ambient Temperature
Soft start	300%	30 sec.	3	50°C
Full voltage	500%	10 sec.	3	50°C
Wye-delta	350%	20 sec.	3	50°C
80% RVAT	480%	20 sec.	2	50°C
65% RVAT	390%	20 sec.	3	50°C
50% RVAT	300%	20 sec.	4	50°C

Motor applications and customer needs come in many different varieties. With the standard and severe duty rating tables, we have attempted to provide

guidelines on what the soft starter is capable of. If the application falls under these categories, you can use these charts. For other applications, or when a

question arises, consult with your local Eaton representative or call our Technical Resource Center.

#### S811+



### Standard Duty—15 Second Ramp, 300% Current Limit at 40°C, Inline Connection

Rated Current	Three-Phase Motors kW Rating (50 Hz)			hp Rating (60 Hz)				575–690 V				Catalog Number <sup>①</sup>
	230 V	380–400 V	440 V	200 V		230 V		460 V		575–690 V		
				1.0SF	1.15SF	1.0SF	1.15SF	1.0SF	1.15SF	1.0SF	1.15SF	
<b>Frame Size N</b>												
37	10	18.5	18.5	10	10	10	10	25	20	30	30	<b>S811+N37N3S</b>
66	18.5	30	37	20	15	20	20	50	40	60	50	<b>S811+N66N3S</b>
<b>Frame Size R</b>												
105	30	55	59	30	25	40	30	75	60	100	75	<b>S811+R10N3S</b>
135	40	63	80	40	30	50	40	100	75	125	100	<b>S811+R13N3S</b>
<b>Frame Size T</b>												
180	51	90	110	60	50	60	60	150	125	150	150	<b>S811+T18N3S</b>
240	75	110	147	75	60	75	75	200	150	200	200	<b>S811+T24N3S</b>
304	90	160	185	100	75	100	100	250	200	300	250	<b>S811+T30N3S</b>
<b>Frame Size U</b>												
360	110	185	220	125	100	150	125	300	250	350	300	<b>S811+U36N3S</b>
420	129	220	257	150	125	175	150	350	300	450	350	<b>S811+U42N3S</b>
500	150	257	300	150	150	200	150	400	350	500	450	<b>S811+U50N3S<sup>②</sup></b>
<b>Frame Size V</b>												
360	110	185	220	125	100	150	125	300	250	350	300	<b>S811+V36N3S</b>
420	129	220	257	150	125	175	150	350	300	450	350	<b>S811+V42N3S</b>
500	150	257	300	150	150	200	150	400	350	500	450	<b>S811+V50N3S</b>
650	200	355	425	250	200	250	200	500	450	600	500	<b>S811+V65N3S</b>
720	220	400	450	—	—	300	250	600	500	700	600	<b>S811+V72N3S</b>
850	257	475	500	—	—	350	300	700	600	900	700	<b>S811+V85N3S</b>
1000	277	525	550	—	—	400	350	800	700	900	800	<b>S811+V10N3S</b>

#### Notes

- ① Replace N3S with P3S for premium/pump option.
- ② S811+U50... rating does not have IEC certification.

### Severe Duty

#### Severe Duty Ratings

Starting Method	Ramp Current % of FLA	Ramp Time Seconds	Starts per Hour	Ambient Temperature
Soft start	450%	30 sec.	4	50°C
Full voltage	500%	10 sec.	10	50°C
Wye-delta	350%	65 sec.	3	50°C
80% RVAT	480%	25 sec.	4	50°C
65% RVAT	390%	40 sec.	4	50°C
50% RVAT	300%	60 sec.	4	50°C

Severe duty ratings are defined as any combination of parameters that exceed the standard duty ratings where

the ramp time is over 30 seconds, and/or the number of starts per hour exceeds 4, and/or the current limit set is

over 300%. *Example:* 35-second ramp, 5 starts per hour, 350% current limit at 40°C ambient.

#### S811+



#### Severe Duty—30 Second Ramp and/or 450% Current Limit at 50°C, Inline Connection

Rated Current	Three-Phase Motors kW Rating (50 Hz)			hp Rating (60 Hz)				575–690 V				Catalog Number <sup>①</sup>
	230 V	380–400 V	440 V	200 V		230 V		460 V		575–690 V		
				1.0SF	1.15SF	1.0SF	1.15SF	1.0SF	1.15SF	1.0SF	1.15SF	
<b>Frame Size N</b>												
22	5.5	10	11	5	5	7-1/2	5	15	10	20	15	<b>S811+N37N3S</b>
42	11	18.5	22	10	10	15	10	30	25	40	30	<b>S811+N66N3S</b>
<b>Frame Size R</b>												
65	15	30	33	15	15	20	15	50	40	50	50	<b>S811+R10N3S</b>
80	22	40	45	25	20	30	25	60	50	75	60	<b>S811+R13N3S</b>
<b>Frame Size T</b>												
115	33	59	63	30	30	40	30	75	75	100	100	<b>S811+T18N3S</b>
150	45	80	90	50	40	50	50	100	100	150	125	<b>S811+T24N3S</b>
192	55	100	110	60	50	75	60	150	125	200	150	<b>S811+T30N3S</b>
<b>Frame Size U</b>												
240	75	110	147	75	60	75	75	200	150	200	200	<b>S811+U36N3S</b>
305	90	160	185	100	75	100	100	250	200	300	250	<b>S811+U42N3S</b>
365	110	185	220	125	100	150	125	300	250	350	300	<b>S811+U50N3S<sup>②</sup></b>
<b>Frame Size V</b>												
240	75	110	147	75	60	75	75	200	150	200	200	<b>S811+V36N3S</b>
305	90	160	185	100	75	100	100	250	200	300	250	<b>S811+V42N3S</b>
365	110	185	220	125	100	150	125	300	250	350	300	<b>S811+V50N3S</b>
420	129	220	257	150	125	150	150	350	300	450	350	<b>S811+V65N3S</b>
480	147	257	295	150	150	200	150	400	350	500	450	<b>S811+V72N3S</b>
525	160	280	335	150	150	200	150	450	350	500	450	<b>S811+V85N3S</b>
575	172	303	370	200	150	250	200	500	450	600	500	<b>S811+V10N3S</b>

#### Notes

- ① Replace N3S with P3S for premium/pump option.
- ② S811+U50... rating does not have IEC certification.



#### Inside-the-Delta Standard Duty Ratings

S811+



#### Standard Duty— 15 Second Ramp, 300% Current Limit at 40°C, Inside-the-Delta Connection

Rated Motor Line Current	Three-Phase Motor kW Rating (50 Hz)			hp Rating (60 Hz)								Catalog Number <sup>①</sup>
	230 V	380–400 V	440 V	200 V		230 V		460 V		575 V		
				1.0SF	1.15SF	1.0SF	1.15SF	1.0SF	1.15SF	1.0SF	1.15SF	
<b>Frame Size N</b>												
65	10	18.5	18.5	15	15	15	15	40	30	50	50	<b>S811+R37N3S</b>
114	18.5	30	37	30	25	30	30	75	60	100	75	<b>S811+N66N3S</b>
<b>Frame Size R</b>												
182	30	55	59	50	40	60	50	125	100	150	125	<b>S811+R10N3S</b>
234	40	63	80	60	50	75	60	150	125	200	150	<b>S811+R13N3S</b>
<b>Frame Size T</b>												
311	51	90	110	100	75	100	100	250	200	250	250	<b>S811+T18N3S</b>
415	75	110	147	125	100	125	125	300	250	300	300	<b>S811+T24N3S</b>
526	90	160	185	150	125	150	150	400	300	400	400	<b>S811+T30N3S</b>
<b>Frame Size U</b>												
623	110	185	220	200	150	250	200	450	400	550	450	<b>S811+U36N3S</b>
727	129	220	257	250	200	300	250	550	450	700	550	<b>S811+U42N3S</b>
865	150	257	300	250	250	300	250	600	550	750	700	<b>S811+U50N3S</b> <sup>②③</sup>
<b>Frame Size V</b>												
623	110	185	220	200	150	250	200	450	400	550	450	<b>S811+V36N3S</b>
727	129	220	257	250	200	300	250	550	450	700	550	<b>S811+V42N3S</b>
865	150	257	300	250	250	300	250	600	550	750	700	<b>S811+V50N3S</b>
1125	200	355	425	400	300	400	300	750	700	900	750	<b>S811+V65N3S</b>
1246	—	—	—	—	—	—	—	—	—	—	—	<b>S811+V72N3S</b>
1471	—	—	—	—	—	—	—	—	—	—	—	<b>S811+V85N3S</b>
—	—	—	—	—	—	—	—	—	—	—	—	<b>S811+V10N3S</b>

**Notes**

- ① Replace N3S with P3S for premium/pump option.
- ② S811+U50... unit does not have IEC certification.
- ③ 15 sec. start, 300% inrush, 40 °C, 1 start every 15 minutes. If these start parameters are exceeded, please refer to S811+V50... Catalog numbers also represent P3S and V3S units.

### Inside-the-Delta Severe Duty Ratings

Severe duty ratings are defined as any combination of parameters that exceed the standard duty ratings where the ramp time is over 30 seconds, and/or the number of starts per hour exceeds 4, and/or the current limit set is over 300%.

Example: 35-second ramp, 5 starts per hour 350% current limit at 40°C ambient.

S811+



### Severe Duty—30 Second Ramp and/or 450% Current Limit at 50°C, Inside-the-Delta Connection

Rated Motor Line Current	Three-Phase Motor												Catalog Number ①
	kW Rating (50 Hz)			hp Rating (60 Hz)									
	230 V	380–400 V	440 V	200 V		230 V		460 V		575 V			
			1.0SF	1.15SF	1.0SF	1.15SF	1.0SF	1.15SF	1.0SF	1.15SF			
<b>Frame Size N</b>													
39	5.5	10	11	7-1/2	7-1/2	10	7-1/2	25	15	30	25	<b>S811+N37N3S</b>	
73	11	18.5	22	15	15	25	15	50	40	60	50	<b>S811+N66N3S</b>	
<b>Frame Size R</b>													
111	15	30	33	25	25	30	25	75	60	75	75	<b>S811+R10N3S</b>	
138	22	40	45	40	30	50	40	100	75	120	100	<b>S811+R13N3S</b>	
<b>Frame Size T</b>													
199	33	59	63	50	50	60	50	125	125	150	150	<b>S811+T18N3S</b>	
257	45	80	90	75	60	75	75	150	150	250	200	<b>S811+T24N3S</b>	
324	55	100	110	100	75	100	100	250	200	300	250	<b>S811+T30N3S</b>	
<b>Frame Size U</b>													
415	75	110	147	125	100	125	125	300	250	300	300	<b>S811+U36N3S</b>	
526	90	160	185	150	120	150	150	400	300	450	400	<b>S811+U42N3S</b>	
623	110	185	220	200	150	250	200	450	400	550	450	<b>S811+U50N3S ②</b>	
<b>Frame Size V</b>													
415	75	110	147	125	100	125	125	300	250	300	300	<b>S811+V36N3S</b>	
526	90	160	185	150	120	150	150	400	300	450	400	<b>S811+V42N3S</b>	
623	110	185	220	200	150	250	200	450	400	550	450	<b>S811+V50N3S</b>	
727	129	220	257	250	200	250	250	550	450	700	550	<b>S811+V65N3S</b>	
816	147	257	295	250	250	300	250	600	550	750	700	<b>S811+V72N3S</b>	
908	160	280	335	250	250	300	250	700	550	750	700	<b>S811+V85N3S</b>	
—	—	—	—	—	—	—	—	—	—	—	—	<b>S811+V10N3S</b>	

**Notes**

- ① Replace N3S with P3S for premium/pump option.
- ② S811+U50... unit does not have IEC certification.

#### Accessories

##### Lug Kits

S811+T..., S811U... and S811+V... soft starters each have different lug options based on your wiring needs. Each lug kit contains three lugs that can be mounted on either the load or line side.

##### Lug Kit



##### Lug Kits

S811+ Catalog Number	Description	Kits Required	Catalog Number
S811+T..., S811+U...	2 cable connections, 4 AWG to 1/0 cable	2	<b>EML22</b>
	1 cable connection, 4/0 to 500 kcmil cable		<b>EML23</b>
	2 cable connections, 4/0 to 500 kcmil cable		<b>EML24</b>
	1 cable connection, 2/0 to 300 kcmil cable		<b>EML25</b>
	2 cable connections, 2/0 to 300 kcmil cable		<b>EML26</b>
S811+V...	2 cable connections, 4/0 to 500 kcmil cable	2	<b>EML28</b>
	4 cable connections, 4/0 to 500 kcmil cable		<b>EML30</b>
	6 cable connections, 4/0 to 500 kcmil cable		<b>EML32</b>
	4 cable connections, 2/0 to 300 kcmil cable		<b>EML33</b>

##### Power Supplies

24 Vdc power supply that can be used with the S811+ SSRV or as a stand-alone device.

##### Power Supplies

Description	Catalog Number
85–264 Vac input 24 Vdc output	<b>PSG240E</b>
360–575 Vac input 24 Vdc output	<b>PSG240F</b>
600 Vac input 24 Vdc output	<b>PSS55D</b>

##### Lug Cover Kits

Replacement covers for the S811+T..., S811+U... and S811+V... soft starters are available in case of damage to the existing covers.

##### Lug Cover Kits

Description	Catalog Number
Lug cover S811+T..., S811+U...	<b>EML27</b>
Lug cover S811+V...	<b>EML34</b>

##### IP20 Kits

##### IP20 Kits

Description	Catalog Number
S811+N...	<b>SS-IP20-N</b>
S811+R...	<b>SS-IP20-R</b>
S811+T... and S811+U...	<b>SS-IP20-TU</b>
S811+V...	<b>SS-IP20-V</b>

##### Surge Suppressors

The surge suppressor can mount on either the line or load side of the soft starter. It is designed to clip the line voltage (or load side induced voltage).

##### Surge Suppressor



##### Surge Suppressors

Description	Catalog Number
600 V MOV for S811+... units	<b>EMS39</b>
690 V MOV for S811+... units <sup>Ⓢ</sup>	<b>EMS41</b>

##### Note

<sup>Ⓢ</sup> S811+T... only.

### Mounting Plates

The mounting plates are designed to help make it easy to install or retrofit the soft starter into enclosures and MCCs. The soft starter can be mounted onto the plate prior to installation. The mounting plate is designed with tear drop mounting holes for easier installation.

### Mounting Plates

Description	Catalog Number
S811+N...	EMM13N
S811+R...	EMM13R
S811+T... and S811+U...	EMM13T
S811+V...	EMM13V

### Vibration Plates

The vibration plates allow the soft starter to be applied in high shock and vibration applications. The vibration plate allows vibration up to 5g and shock in up to 40g. The soft starter is mounted onto the vibration plate prior to installation in the panel.

### Vibration Plates

Description	Catalog Number
S811+N...	EMM14N
S811+R...	EMM14R
S811+T... and S811+U...	EMM14T
S811+V...	EMM14V

### Adapter Plates

The adapter plate allows customers to retrofit a S811+V... soft starter with the S811+U... soft starter.

### Adapter Plates

Description	Catalog Number
Adapter plates	EMM13U

### Control Wire Connector

### Control Wire Connector

Description	Catalog Number
12-pin, 5 mm pitch connector for control wiring	EMA75

### Digital Interface Module

The Digital Interface Module (DIM) is available as a replacement part.

### DIM

Description	Catalog Number
Blank cover (filler)	EMA68
DIM for standard unit	EMA91
Panel mounting kit	
3 ft cable	EMA69A
5 ft cable	EMA69B
8 ft cable	EMA69C
10 ft cable	EMA69D

## Options

### S811+ Premium

In addition to what is already there in the S811+ standard, these devices offer pump control and extended ramp functions.

### S811+ Premium

Current Range	Catalog Number
11–37	S811+N37P3S
20–66	S811+N66P3S
32–105	S811+R10P3S
42–135	S811+R13P3S
56–180	S811+T18P3S
75–240	S811+T24P3S
95–304	S811+T30P3S
112–360	S811+U36P3S
131–420	S811+U42P3S
156–500	S811+U50P3S ①
112–360	S811+V36P3S
131–420	S811+V42P3S
156–500	S811+V50P3S
203–650	S811+V65P3S
225–720	S811+V72P3S
265–850	S811+V85P3S
312–1000	S811+V10P3S

### Note

① S811+U50... unit does not have IEC certification.

### S811+ Premium 690 V Option

In addition to what is already there in S811+ standard, this product offers 690 V, pump control and extended ramp functions.

### S811+ Premium 690 V Option

Current Range	Catalog Number
56–180	S811+T18V3S
75–240	S811+T24V3S
95–304	S811+T30 V3S
112–360	S811+V36V3S
131–420	S811+V42V3S
156–500	S811+V50 V3S
203–650	S811+V65V3S
225–720	S811+V72V3S
265–850	S811+V85V3S

### Cooling Fan Kit

The EMM18 cooling fan kit mounts on either side of any frame size S811+ soft starter to provide additional printed circuit board cooling in high ambient operating temperatures.

### Cooling Fan Kit

Description	Catalog Number
Fan kit	EMM18

## Technical Data and Specifications

### Soft Starters—S811+

Description	S811+N37...	S811+N66...	S811+R10+...	S811+R13...
Max. current capacity	37	66	105	135
FLA range	11–37	20–66	32–105	42–135
<b>General Information</b>				
Bypass mechanical lifespan	10M	10M	10M	10M
Insulating voltage U <sub>i</sub>	660 V	660 V	660 V	660 V
Ramp time range	0.5–180 seconds (0.5–360 seconds S811+ Premium)	0.5–180 seconds (0.5–360 seconds S811+ Premium)	0.5–180 seconds (0.5–360 seconds S811+ Premium)	0.5–180 seconds (0.5–360 seconds S811+ Premium)
Resistance to vibration	3g	3g	3g	3g
Resistance to shock	15g	15g	15g	15g
<b>Electrical Information</b>				
Operating voltage	200–600 V	200–600 V	200–600 V	200–600 V
Operating frequency	47–63 Hz	47–63 Hz	47–63 Hz	47–63 Hz
Overload setting	30–100%	30–100%	30–100%	30–100%
Trip class	5, 10, 20 and 30	5, 10, 20 and 30	5, 10, 20 and 30	5, 10, 20 and 30
<b>Cabling Capacity (IEC 947)</b>				
Number of conductors	1	1	1	1
Wire sizes	14–2	14–2	14–4/0	14–4/0
Type of connectors	Box lug	Box lug	Box lug	Box lug
<b>Control Wiring (12-Pin)</b>				
Wire sizes in AWG	22–14	22–14	22–14	22–14
Number of conductors (stranded)	2 (or one AWG 12)	2 (or one AWG 12)	2 (or one AWG 12)	2 (or one AWG 12)
Torque requirements in lb-in	3.5	3.5	3.5	3.5
Solid, stranded or flexible max. size in mm <sup>2</sup>	3.31	3.31	3.31	3.31
<b>Control Power Requirements</b>				
Voltage range (24V ±10%)	21.6–26.4	21.6–26.4	21.6–26.4	21.6–26.4
Steady-state current amps	1.0	1.0	1.0	1.0
Inrush current amps	10	10	10	10
Ripple	1%	1%	1%	1%
<b>Relays (1) Class A and C</b>				
Voltage AC—maximum	240	240	240	240
Voltage DC—maximum	120	120	120	120
Amps—maximum	3	3	3	3
<b>Environment</b>				
Temperature—operating	–30° to 50°C (no derating) consult factory for operation >50°C	–30° to 50°C (no derating) consult factory for operation >50°C	–30° to 50°C (no derating) consult factory for operation >50°C	–30° to 50°C (no derating) consult factory for operation >50°C
Temperature—storage	–50° to 70°C	–50° to 70°C	–50° to 70°C	–50° to 70°C
Altitude	<2000m—consult factory for operation >2000m	<2000m—consult factory for operation >2000m	<2000m—consult factory for operation >2000m	<2000m—consult factory for operation >2000m
Humidity	<95% noncondensing	<95% noncondensing	<95% noncondensing	<95% noncondensing
Operating position	Any	Any	Any	Any
Pollution degree IEC947-1	3	3	3	3
Impulse withstand voltage IEC947-4-1	6000 V	6000 V	6000 V	6000 V

## Soft Starters—S811+, continued

Description	S811+T18...	S811+T24...	S811+T30...	S811+U36...
Max. current capacity	180	240	304	360
FLA range	56–180	75–240	95–304	112–360
<b>General Information</b>				
Bypass mechanical lifespan	10M	10M	10M	10M
Insulating voltage $U_i$	660 V	660 V	660 V	660 V
Ramp time range	0.5–180 seconds (0.5–360 seconds S811+ Premium)	0.5–180 seconds (0.5–360 seconds S811+ Premium)	0.5–180 seconds (0.5–360 seconds S811+ Premium)	0.5–180 seconds (0.5–360 seconds S811+ Premium)
Resistance to vibration	3g	3g	3g	3g
Resistance to shock	15g	15g	15g	15g
<b>Electrical Information</b>				
Operating voltage	200–600 V	200–600 V	200–600 V	200–600 V
Operating frequency	47–63 Hz	47–63 Hz	47–63 Hz	47–63 Hz
Overload setting	30–100%	30–100%	30–100%	30–100%
Trip class	5, 10, 20 and 30	5, 10, 20 and 30	5, 10, 20 and 30	5, 10, 20 and 30
<b>Cabling Capacity (IEC 947)</b>				
Number of conductors	1 or 2	1 or 2	1 or 2	1 or 2
Wire sizes	4 AWG to 500 kcmil	4 AWG to 500 kcmil	4 AWG to 500 kcmil	4 AWG to 500 kcmil
Type of connectors	Add-on lug kit	Add-on lug kit	Add-on lug kit	Add-on lug kit
<b>Control Wiring (12-Pin)</b>				
Wire sizes in AWG	22–14	22–14	22–14	22–14
Number of conductors (stranded)	2 (or one AWG 12)	2 (or one AWG 12)	2 (or one AWG 12)	2 (or one AWG 12)
Torque requirements in lb-in	3.5	3.5	3.5	3.5
Solid, stranded or flexible max. size in mm <sup>2</sup>	3.31	3.31	3.31	3.31
<b>Control Power Requirements</b>				
Voltage range (24V ±10%)	21.6–26.4	21.6–26.4	21.6–26.4	21.6–26.4
Steady-state current amps	1.0	1.0	1.0	1.0
Inrush current amps	10	10	10	10
Ripple	1%	1%	1%	1%
<b>Relays (1) Class A and C</b>				
Voltage AC—maximum	240	240	240	240
Voltage DC—maximum	120	120	120	120
Amps—maximum	3	3	3	3
<b>Environment</b>				
Temperature—operating	–30° to 50°C (no derating) consult factory for operation >50°C	–30° to 50°C (no derating) consult factory for operation >50°C	–30° to 50°C (no derating) consult factory for operation >50°C	–30° to 50°C (no derating) consult factory for operation >50°C
Temperature—storage	–50° to 70°C	–50° to 70°C	–50° to 70°C	–50° to 70°C
Altitude	<2000m—consult factory for operation >2000m	<2000m—consult factory for operation >2000m	<2000m—consult factory for operation >2000m	<2000m—consult factory for operation >2000m
Humidity	<95% noncondensing	<95% noncondensing	<95% noncondensing	<95% noncondensing
Operating position	Any	Any	Any	Any
Pollution degree IEC947-1	3	3	3	3
Impulse withstand voltage IEC947-4-1	6000 V	6000 V	6000 V	6000 V

## Soft Starters—S811+, continued

Description	S811+U42...	S811+U50... <sup>①</sup>	S811+V36...	S811+V42...
Max. current capacity	420	500	360	420
FLA range	131–420	156–500	112–360	131–420
<b>General Information</b>				
Bypass mechanical lifespan	10M	10M	10M	10M
Insulating voltage $U_i$	660 V	660 V	660 V	660 V
Ramp time range	0.5–180 seconds (0.5–360 seconds S811+ Premium)	0.5–180 seconds (0.5–360 seconds S811+ Premium)	0.5–180 seconds (0.5–360 seconds S811+ Premium)	0.5–180 seconds (0.5–360 seconds S811+ Premium)
Resistance to vibration	3g	3g	3g	3g
Resistance to shock	15g	15g	15g	15g
<b>Electrical Information</b>				
Operating voltage	200–600 V	200–600 V	200–600 V	200–600 V
Operating frequency	47–63 Hz	47–63 Hz	47–63 Hz	47–63 Hz
Overload setting	30–100%	30–100%	30–100%	30–100%
Trip class	5, 10, 20 and 30	5, 10, 20 and 30	5, 10, 20 and 30	5, 10, 20 and 30
<b>Cabling Capacity (IEC 947)</b>				
Number of conductors	1 or 2	1 or 2	2, 4 or 6	2, 4 or 6
Wire sizes	4 AWG to 500 kcmil	4 AWG to 500 kcmil	2/0 to 500 kcmil	2/0 to 500 kcmil
Type of connectors	Add-on lug kit	Add-on lug kit	Add-on lug kit	Add-on lug kit
<b>Control Wiring (12-Pin)</b>				
Wire sizes in AWG	22–14	22–14	22–14	22–14
Number of conductors (stranded)	2 (or one AWG 12)	2 (or one AWG 12)	2 (or one AWG 12)	2 (or one AWG 12)
Torque requirements in lb-in	3.5	3.5	3.5	3.5
Solid, stranded or flexible max. size in mm <sup>2</sup>	3.31	3.31	3.31	3.31
<b>Control Power Requirements</b>				
Voltage range (24V ±10%)	21.6–26.4	21.6–26.4	21.6–26.4	21.6–26.4
Steady-state current amps	1.0	1.0	1.4	1.4
Inrush current amps	10	10	10	10
Ripple	1%	1%	1%	1%
<b>Relays (1) Class A and C</b>				
Voltage AC—maximum	240	240	240	240
Voltage DC—maximum	120	120	120	120
Amps—maximum	3	3	3	3
<b>Environment</b>				
Temperature—operating	–30° to 50°C (no derating) consult factory for operation >50°C	–30° to 50°C (no derating) consult factory for operation >50°C	–30° to 50°C (no derating) consult factory for operation >50°C	–30° to 50°C (no derating) consult factory for operation >50°C
Temperature—storage	–50° to 70°C	–50° to 70°C	–50° to 70°C	–50° to 70°C
Altitude	<2000m—consult factory for operation >2000m	<2000m—consult factory for operation >2000m	<2000m—consult factory for operation >2000m	<2000m—consult factory for operation >2000m
Humidity	<95% noncondensing	<95% noncondensing	<95% noncondensing	<95% noncondensing
Operating position	Any	Any	Any	Any
Pollution degree IEC947-1	3	3	3	3
Impulse withstand voltage IEC947-4-1	6000 V	6000 V	6000 V	6000 V

**Note**

① S811+U50... unit does not have IEC certification.

### Soft Starters—S811+, continued

Description	S811+V50...	S811+V65...	S811+V72...	S811+V85...	S811+V10... <sup>①</sup>
Max. current capacity	500	650	720	850	1000
FLA range	156–500	203–650	225–720	265–580	320–1000
<b>General Information</b>					
Bypass mechanical lifespan	10M	10M	10M	10M	10M
Insulating voltage U <sub>i</sub>	660 V	660 V	660 V	660 V	660 V
Ramp time range	0.5–180 seconds (0.5–360 seconds S811+ Premium)	0.5–180 seconds (0.5–360 seconds S811+ Premium)	0.5–180 seconds (0.5–360 seconds S811+ Premium)	0.5–180 seconds (0.5–360 seconds S811+ Premium)	0.5–180 seconds (0.5–360 seconds S811+ Premium)
Resistance to vibration	3g	3g	3g	3g	3g
Resistance to shock	15g	15g	15g	15g	15g
<b>Electrical Information</b>					
Operating voltage	200–600 V	200–600 V	200–600 V	200–600 V	200–600 V
Operating frequency	47–63 Hz	47–63 Hz	47–63 Hz	47–63 Hz	47–63 Hz
Overload setting	30–100%	30–100%	30–100%	30–100%	30–100%
Trip class	5, 10, 20 and 30	5, 10, 20 and 30	5, 10, 20 and 30	5, 10, 20 and 30	5, 10, 20 and 30
<b>Cabling Capacity (IEC 947)</b>					
Number of conductors	2, 4 or 6	2, 4 or 6	2, 4 or 6	2, 4 or 6	2, 4 or 6
Wire sizes	2/0 to 500 kcmil	2/0 to 500 kcmil	2/0 to 500 kcmil	2/0 to 500 kcmil	2/0 to 500 kcmil
Type of connectors	Add-on lug kit	Add-on lug kit	Add-on lug kit	Add-on lug kit	Add-on lug kit
<b>Control Wiring (12-Pin)</b>					
Wire sizes in AWG	22–14	22–14	22–14	22–14	22–14
Number of conductors (stranded)	2 (or one AWG 12)	2 (or one AWG 12)	2 (or one AWG 12)	2 (or one AWG 12)	2 (or one AWG 12)
Torque requirements in lb-in	3.5	3.5	3.5	3.5	3.5
Solid, stranded or flexible max. size in mm <sup>2</sup>	3.31	3.31	3.31	3.31	3.31
<b>Control Power Requirements</b>					
Voltage range (24V ±10%)	21.6–26.4	21.6–26.4	21.6–26.4	21.6–26.4	21.6–26.4
Steady-state current amps	1.4	1.4	1.4	1.4	1.4
Inrush current amps	10	10	10	10	10
Ripple	1%	1%	1%	1%	1%
<b>Relays (1) Class A and C</b>					
Voltage AC—maximum	240	240	240	240	240
Voltage DC—maximum	120	120	120	120	120
Amps—maximum	3	3	3	3	3
<b>Environment</b>					
Temperature—operating	–30° to 50°C (no derating) consult factory for operation >50°C	–30° to 50°C (no derating) consult factory for operation >50°C	–30° to 50°C (no derating) consult factory for operation >50°C	–30° to 50°C (no derating) consult factory for operation >50°C	–30° to 50°C (no derating) consult factory for operation >50°C
Temperature—storage	–50° to 70°C	–50° to 70°C	–50° to 70°C	–50° to 70°C	–50° to 70°C
Altitude	<2000m—consult factory for operation >2000m	<2000m—consult factory for operation >2000m	<2000m—consult factory for operation >2000m	<2000m—consult factory for operation >2000m	<2000m—consult factory for operation >2000m
Humidity	<95% noncondensing	<95% noncondensing	<95% noncondensing	<95% noncondensing	<95% noncondensing
Operating position	Any	Any	Any	Any	Any
Pollution degree IEC947-1	3	3	3	3	3
Impulse withstand voltage IEC947-4-1	6000 V	6000 V	6000 V	6000 V	6000 V

**Note**

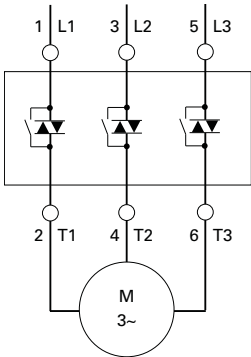
① UR recognized product.



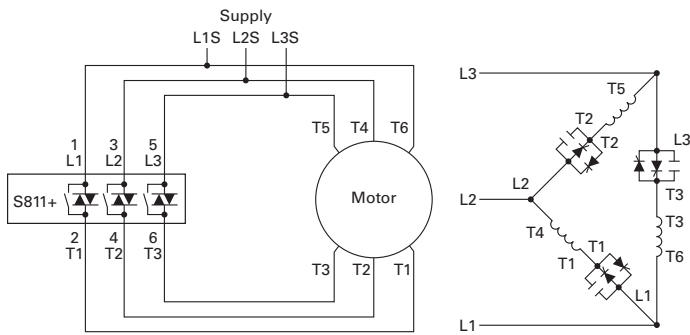
#### 1

#### Wiring Diagrams

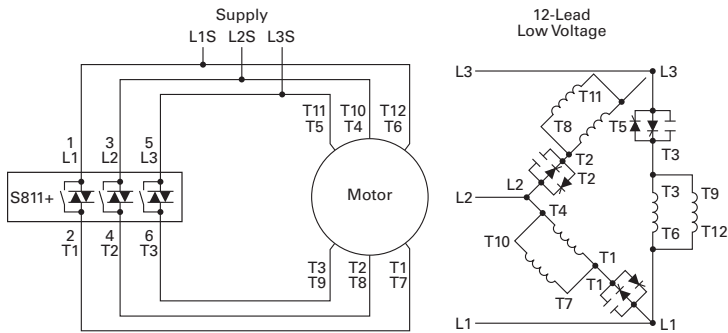
##### Line Connected Soft Starter



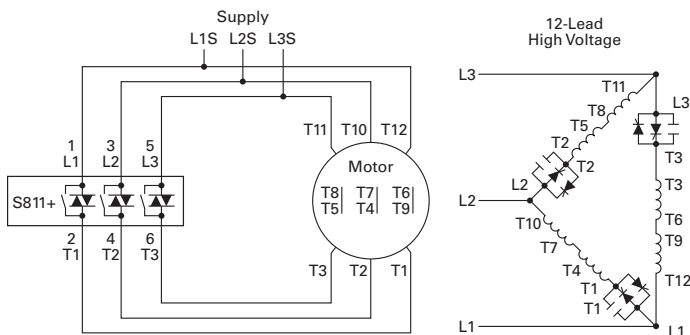
##### Inside-the-Delta Connected Soft Starter for a 6-Lead Motor



##### Inside-the-Delta Connected Soft Starter for a 12-Lead Low Voltage Motor



##### Inside-the-Delta Connected Soft Starter for a 12-Lead High Voltage Motor



**Dimensions**

Approximate Dimensions in Inches (mm)

**Soft Starters—S811+**

Catalog Number <sup>①</sup>	W	H	D	Weight in Lbs (kg)
<b>S811+N37N3S</b>	2.66 (67.6)	7.37 (187.2)	6.45 (163.9)	5.8 (2.6)
<b>S811+N66N3S</b>	2.66 (67.6)	7.37 (187.2)	6.45 (163.9)	5.8 (2.6)
<b>S811+R10N3S</b>	4.38 (111.3)	7.92 (201.1)	6.64 (168.6)	10.5 (4.8)
<b>S811+R13N3S</b>	4.38 (111.3)	7.92 (201.1)	6.64 (168.6)	10.5 (4.8)
<b>S811+T18N3S</b>	7.65 (194.4)	12.71 (322.9)	6.47 (164.4)	48 (21.8) with lugs 41 (18.6) without lugs
<b>S811+T24N3S</b>	7.65 (194.4)	12.71 (322.9)	6.47 (164.4)	48 (21.8) with lugs 41 (18.6) without lugs
<b>S811+T30N3S</b>	7.65 (194.4)	12.71 (322.9)	6.47 (164.4)	48 (21.8) with lugs 41 (18.6) without lugs
<b>S811+U36N3S</b>	7.73 (196.3)	12.72 (323.1)	7.16 (181.8)	48 (21.8) with lugs 41 (18.6) without lugs
<b>S811+U42N3S</b>	7.73 (196.3)	12.72 (323.1)	7.16 (181.8)	48 (21.8) with lugs 41 (18.6) without lugs
<b>S811+U50N3S</b>	7.73 (196.3)	12.72 (323.1)	7.16 (181.8)	48 (21.8) with lugs 41 (18.6) without lugs
<b>S811+V36N3S</b>	11.05 (280.6)	16.57 (420.8)	7.39 (187.8)	103 (46.8) with lugs 91 (41.4) without lugs
<b>S811+V42N3S</b>	11.05 (280.6)	16.57 (420.8)	7.39 (187.8)	103 (46.8) with lugs 91 (41.4) without lugs
<b>S811+V50N3S</b>	11.05 (280.6)	16.57 (420.8)	7.39 (187.8)	103 (46.8) with lugs 91 (41.4) without lugs
<b>S811+V65N3S</b>	11.05 (280.6)	16.57 (420.8)	7.39 (187.8)	103 (46.8) with lugs 91 (41.4) without lugs
<b>S811+V72N3S</b>	11.05 (280.6)	16.57 (420.8)	7.39 (187.8)	103 (46.8) with lugs 91 (41.4) without lugs
<b>S811+V85N3S</b>	11.05 (280.6)	16.57 (420.8)	7.39 (187.8)	103 (46.8) with lugs 91 (41.4) without lugs
<b>S811+V10N3S</b>	11.05 (280.6)	16.57 (420.8)	7.39 (187.8)	103 (46.8) with lugs 91 (41.4) without lugs

Also refer to dimension drawings on **Pages V6-T1-96** through **V6-T1-98**.**Note**

① Dimensions of the frames stay consistent between the N3S, P3S, and V3S options.

# 1.2

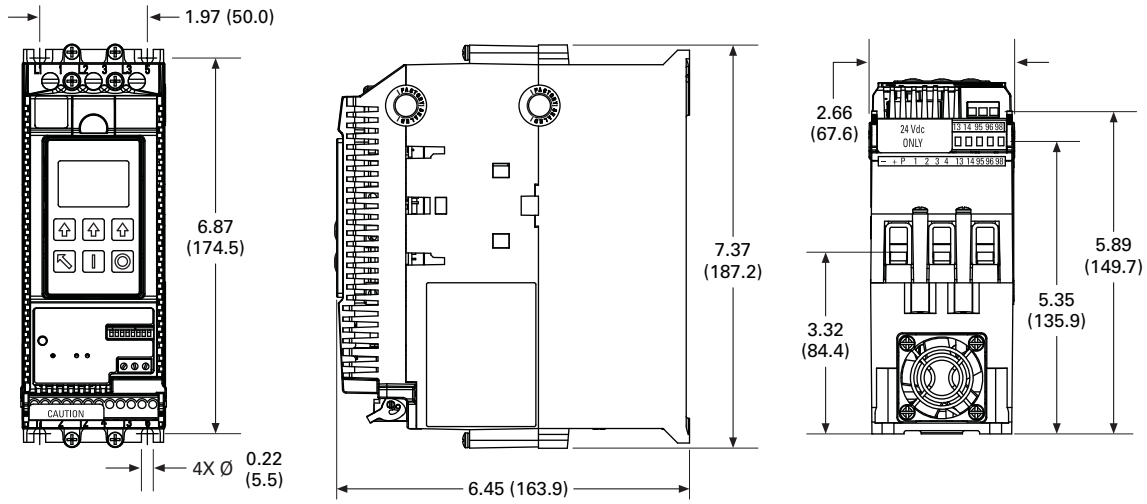
## Reduced Voltage Motor Starters

### Solid-State Starters

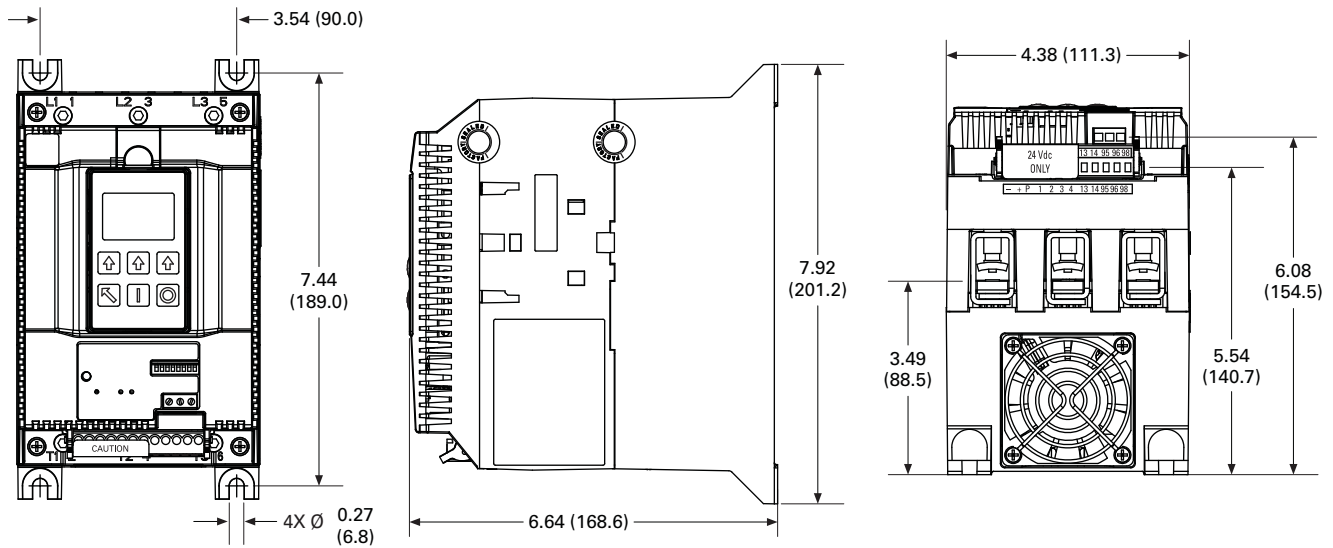
1

Approximate Dimensions in Inches (mm)

#### S811+N...

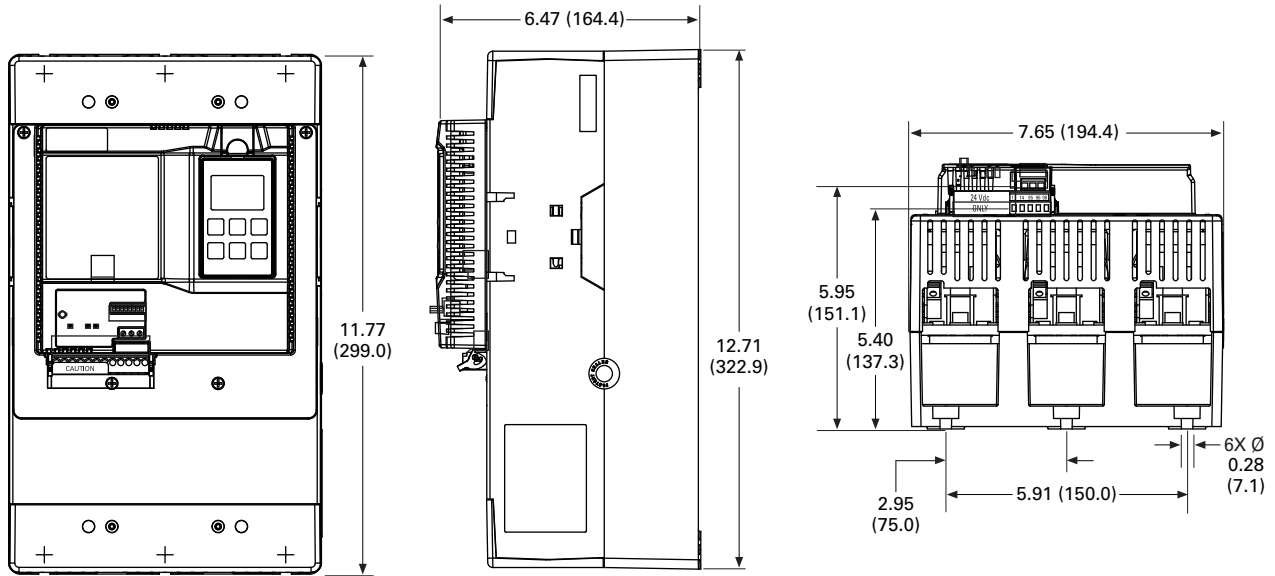


#### S811+R...

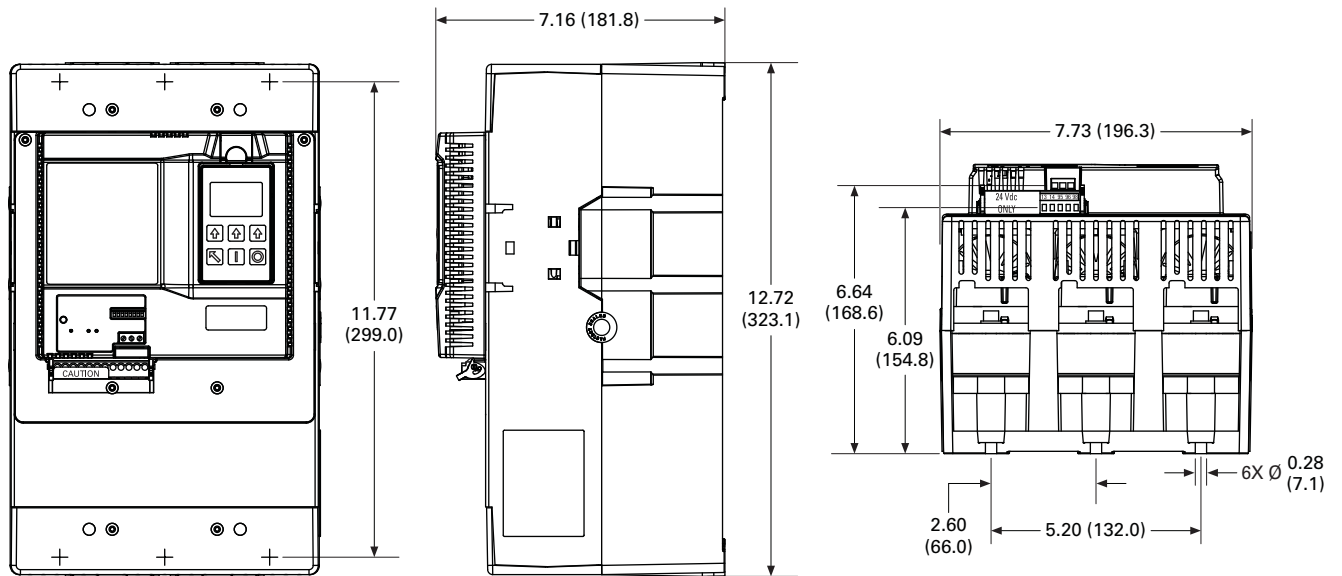


Approximate Dimensions in Inches (mm)

### S811+T...



### S811+U...



# 1.2

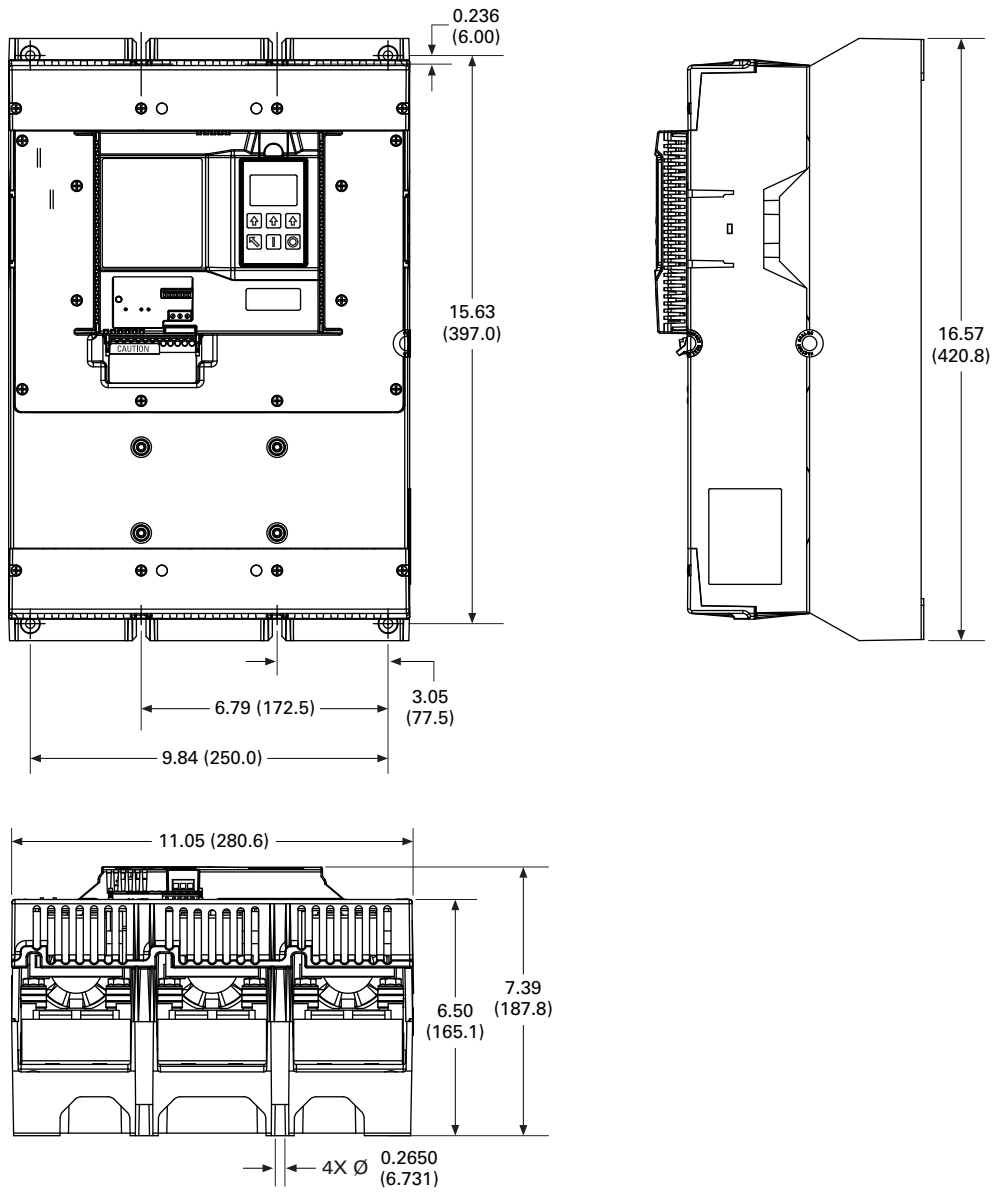
## Reduced Voltage Motor Starters

### Solid-State Starters

1

Approximate Dimensions in Inches (mm)

S811+V...



PowerXL DC1



PowerXL DG1



Enclosed 18-Pulse Drive



<b>2.1</b>	<b>Product Overview</b> .....	<b>V6-T2-2</b>
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**OEM Drives**

<b>2.2</b>	<b>PowerXL DE1 Series</b> .....	<b>V6-T2-9</b>
<b>2.3</b>	<b>PowerXL DC1 Series Drives</b> .....	<b>V6-T2-15</b>
<b>2.4</b>	<b>PowerXL DA1 Series Drives</b> .....	<b>V6-T2-25</b>
<b>2.5</b>	<b>M-Max Series Drives</b> .....	<b>V6-T2-36</b>

**General Purpose Industrial Drives**

<b>2.6</b>	<b>PowerXL DG1 Series Drives</b>	
	DG1 Drives .....	<b>V6-T2-48</b>
	DG1 Enclosed Drives .....	<b>V6-T2-74</b>
<b>2.7</b>	<b>SVX Drives</b>	
	SVX Drives .....	<b>V6-T2-102</b>
	SVX Enclosed Drives .....	<b>V6-T2-140</b>

**General Purpose HVAC Drives**

<b>2.8</b>	<b>PowerXL DH1 Series Drives</b>	
	PowerXL DH1 Series Drives .....	<b>V6-T2-175</b>
	PowerXL DH1 Series Enclosed Drives .....	<b>V6-T2-195</b>
<b>2.9</b>	<b>H-Max Series Drives</b>	
	H-Max Drives .....	<b>V6-T2-223</b>
	H-Max IntelliPass and IntelliDisconnect Drives .....	<b>V6-T2-235</b>

**Performance Drives**

<b>2.10</b>	<b>SPX Drives</b> .....	<b>V6-T2-257</b>
<b>2.11</b>	<b>Clean Power Drives</b>	
	Product Overview .....	<b>V6-T2-298</b>
	Enclosed Passive Filtered Drives	
	EGF Drives .....	<b>V6-T2-305</b>
	CFX Drives .....	<b>V6-T2-325</b>
	HGX Enclosed 12-Pulse Drives .....	<b>V6-T2-351</b>
	CPX Enclosed 18-Pulse Drives .....	<b>V6-T2-355</b>
	RGX Enclosed Regenerative Drives .....	<b>V6-T2-379</b>
<b>2.12</b>	<b>LCX Liquid Cooled Drives</b> .....	<b>V6-T2-392</b>
<b>2.13</b>	<b>SPA/SPN/SPI Common DC Bus Drives</b> .....	<b>V6-T2-408</b>

# 2.1

## Adjustable Frequency Drives

### Product Overview

#### A Drive For Any Application

2

Your application might call for an ultra-compact solution, clean power or future configurability.

Whether it is a standard product from the catalog or a custom-enclosed variable frequency drive (VFD) solution, Eaton delivers.

Eaton drives are designed for industrial, HVAC, water/wastewater treatment, machinery OEM and other application demands.

Whether designing a new industrial complex, renovating an existing structure or developing a new machine, Eaton has the right product for your application.

#### PowerXL® Family



Application	DE1	DC1	DA1	DH1	DG1	EGF (Filtered)
Single-phase input	Yes	Yes	Yes	Yes	Yes	—
Maximum 230 V hp	3	15	7.5	125	125	125
Maximum 480 V hp	10	30	15	250	1000	250
Maximum 575 V hp	—	—	20	250	800	250
OEM drives	●	●	●	●■	●	
General purpose HVAC drives				●■		
General purpose industrial					●■	
Performance			●			
Low harmonic						■

#### 9000X Family























Application	M-Max	H-Max	SVX	SPX	LCX	SPI	CFX (Filtered)	HCX (12-Pulse)	CPX (18-Pulse)	RGX (AFE)
Single-phase input	Yes	—	Yes	Yes	—	—	—	—	—	—
Maximum 230 V hp	15	125	125	125	—	—	100	60	200	—
Maximum 480 V hp	25	250	250	2200	3200	2400	400	125	800	900
Maximum 575 V hp	7.5	200	200	2300	2800	2200	400	—	800	750
OEM drives	●									
General purpose HVAC drives		●■						■		
General purpose industrial			●■	●■						
Performance				●■	●▲	●▲		■	■	■
Low harmonic							■	■	■	■



- = Open drive standard
- = Enclosed drive standard
- ▲ = Enclosed—consult Enclosed Drives Plant (Watertown, WI)

## A History of Drives

Throughout the years, Eaton's drive offering has evolved as technology has changed. Some drives are no longer available, but are listed below for reference and aid in finding the drive in our current offering that fits your application. If needed, please contact the Drives Technical Resource Center (1-877-ETN-CARE, option 2, option 6) for assistance in finding the current drive to suit your needs.

### Legacy Product Offering

								
Application	HVX	SLX	NFX	GVX	MVX	SV	HV	CP (18-Pulse)
Single-phase input	Yes	—	Yes	Yes	Yes	Yes	Yes	—
Maximum 230 V hp	75	40	2	50	7.5	100	150	—
Maximum 480 V hp	150	100	—	125	10	1100	1000	800
Maximum 575 V hp	—	100	—	125	10	800	700	—
OEM drives								
General purpose HVAC drives								
General purpose industrial								
Performance								
Low harmonic								
Current product offering	H-Max	DG1	DE1	DC1 / DG1	DC1 / DA1	DG1	H-Max	CPX

 = Open drive standard  
 = Legacy product; no longer available



# 2.1

## Adjustable Frequency Drives

### Product Overview

#### Product Selection Guide

2

#### OEM Drives

##### PowerXL DE1 Series



Page V6-T2-9

#### Applications

Machinery OEM variable speed starter

#### Description

The DE1 VSS is a variable speed starter that brings the simplicity of a electromechanical starter with the additional functionality of a variable frequency drive. The DE1 offers simple installation in a compact, keypad-less design. With the use of the intuitive plug-in configuration module or the integration of SmartWire-DT®, the DE1 is the simplest solution for variable speed. The VSS is great for HVAC, material handling and general MOEM applications.

#### Offering/Range

Single-phase to three-phase  
230 V to 3 hp  
Three-phase to three-phase  
230 V to 3 hp  
Three-phase to three-phase  
480 V to 10 hp

#### Enclosure

Open IP20

##### PowerXL DC1 Series



Page V6-T2-15

#### Applications

General-purpose microdrive  
Machinery OEM drive

#### Description

The DC1 VFD is a compact VFD with only 14 basic parameters, SmartWire-DT® and EtherNet/IP connectivity and outstanding ease of mounting and installation. The DC1 is perfect for quick commissioning and is ideal for panel builders. The newest version adds support for sensorless vector control and permanent magnet motor compatibility. This drive supports single-phase motor applications, and an IP66 offering provides unique mounting with integrated disconnect and cover controls.

#### Offering/Range

Single-phase to single-phase  
115 V to 0.75 hp  
230 V to 1.5 hp  
Single-phase to three-phase  
115 V to 1.5 hp  
230 V to 5 hp  
Three-phase to three-phase  
230 V to 15 hp  
480 V to 30 hp

#### Enclosure

Open IP20, IP66

##### PowerXL DA1 Series



Page V6-T2-25

#### Applications

High-performance microdrive  
Machinery OEM drive

#### Description

The DA1 VFD is the perfect match for demanding OEM applications. High-performance processor, safe torque off, multiple fieldbus protocols including SmartWire-DT, sensorless vector control and the possibility to operate permanent magnet motors are sure to leave a lasting impression. The DA1 includes an IP66 offering as well.

#### Offering/Range

Single-phase to three-phase  
230 V to 3 hp  
Three-phase to three-phase  
230 V to 7.5 hp  
480 V to 15 hp  
600 V to 20 hp

#### Enclosure

Open IP20, IP66

##### M-Max Series



Page V6-T2-36

#### Applications

General-purpose microdrive

#### Description

The M-Max™ VFD is a compact microdrive with a broad power range, perfectly suited for machinery applications in many industries: food and beverage, HVAC, packaging, pumping, general machine and more.

#### Offering/Range

Single-phase to three-phase  
115 V to 1.5 hp  
230 V to 3 hp  
Three-phase to three-phase  
230 V to 15 hp  
480 V to 25 hp  
575 V to 7.5 hp

#### Enclosure

Open IP20, IP21  
Open NEMA 1

## Product Selection Guide

### General Purpose Industrial Drives

#### PowerXL DG1 Series



##### Page V6-T2-48

##### Applications

General-purpose drive

##### Description

The DG1 general-purpose drives are part of the Eaton next-generation PowerXL series of adjustable frequency drives specifically engineered for today's more demanding commercial and industrial applications. With an industry-leading energy-efficiency algorithm, high short-circuit current rating and robust design, the DG1 offers customers increased efficiency, safety and reliability.

##### Offering/Range

Single-phase to three-phase  
230 V to 40 hp  
480 V to 60 hp  
  
Three-phase to three-phase  
230 V to 125 hp  
480 V to 1000 hp  
575 V to 800 hp

##### Enclosure

Open IP00, IP20, IP21, IP54  
Open NEMA 1, 12  
Enclosed NEMA 1, 12, 3R  
Consult Eaton for NEMA 4X

#### SVX



##### Page V6-T2-102

##### Applications

General-purpose drive

##### Description

The SVX VFD is a general-purpose, compact, modular solution for variable speed applications and offers a variety of features and application capabilities. With a reliable design, quick startup and flexibility with options, the SVX provides a great solution for customer's commercial and industrial applications.

##### Offering/Range

Single-phase to three-phase  
230 V to 40 hp  
480 V to 60 hp  
  
Three-phase to three-phase  
230 V to 125 hp  
480 V to 2200 hp  
575 V to 2300 hp

##### Enclosure

Open IP20, IP21, IP54  
Open NEMA 1, 12  
Enclosed NEMA 1, 12, 3R  
AGSVX (agriculture config)  
Consult Eaton for NEMA 4X

### General Purpose HVAC Drives

#### PowerXL DH1 Series



##### Page V6-T2-175

##### Applications

General-purpose HVAC drive

##### Description

The DH1 HVAC/R drives are part of the Eaton next generation PowerXL series of variable frequency drives specifically engineered to exceed the demands of the HVAC/R market. With an industry-leading energy efficiency algorithm, high short-circuit current rating and robust design, the DH1 offers customers increased efficiency, safety and reliability.

##### Offering/Range

Single-phase to three-phase  
230 V to 40 hp  
480 V to 60 hp  
  
Three-phase to three-phase  
230 V to 125 hp  
480 V to 250 hp  
575 V to 250 hp

##### Enclosure

Open IP21, IP54  
Open NEMA 1, 12

#### Enclosed PowerXL DH1 Series



##### Page V6-T2-195

##### Applications

General-purpose HVAC drive

##### Description

The enclosed DH1 HVAC/R drives are part of the Eaton next generation PowerXL series of variable frequency drives specifically engineered to exceed the demands of the HVAC/R market. The enclosed DH1 construction features allow for easy installation, reliable operation and serviceability with additional onboard wire space and removable conduit plates with knockouts.

##### Offering/Range

Three-phase to three-phase  
208 V to 100 hp  
230 V to 125 hp  
480 V to 250 hp  
575 V to 250 hp

##### Enclosure

Enclosed NEMA 1, 12, 3R  
EHC—Compact Disconnect  
EHD—Disconnect  
EHB—Bypass

### Product Selection Guide

## 2

### Performance Drives

#### SPX



#### Page V6-T2-257

#### Applications

High-performance drive

#### Description

The SPX VFD is a compact, modular solution for high-performance variable speed applications. When high performance is critical to a customer's application, the SPX VFD is the ideal choice. They are equipped with high processing power, capable of closed loop feedback, safe torque off, permanent magnet motor operation and very precise motor control.

#### Offering/Range

Single-phase to three-phase  
230 V to 40 hp  
480 V to 60 hp  
Three-phase to three-phase  
230 V to 125 hp  
480 V to 2200 hp  
575 V to 2300 hp

#### Enclosure

Open IP20, IP21, IP54  
Open NEMA 1, 12  
Enclosed NEMA 1, 12, 3R  
AGSVX (agriculture config)  
Consult Eaton for NEMA 4X

#### Low Harmonic Drives Passive Filtered—EGF



#### Page V6-T2-305

#### Applications

Filtered drive

#### Description

Eaton's enclosed passive filtered drives use tuned passive filters to significantly reduce line harmonics at the drive input terminals.

#### Offering/Range

208 V: 0.75–100 hp  
230 V: 0.75–125 hp  
480 V: 1–250 hp

#### Enclosure

Enclosed NEMA 1, 12, 3R  
Consult Eaton for NEMA 4X

#### Passive Filtered—CFX



#### Page V6-T2-325

#### Applications

Filtered drive

#### Description

The CFX VFD uses a tuned passive filter to significantly reduce the line harmonics generated by a standard 6-pulse drive. Designed for small to mid-sized drive applications, the CFX, in conjunction with the CPX, offers the user a tiered approach to harmonic mitigation.

#### Offering/Range

Three-phase to three-phase  
230 V to 100 hp  
480 V to 400 hp  
575 V to 400 hp

#### Enclosure

Enclosed NEMA 1, 12, 3R  
Consult Eaton for NEMA 4X

## Product Selection Guide

### Performance Drives

#### Low Harmonic Drives

##### 12-Pulse—HCX



#### Page V6-T2-351

#### Applications

12-pulse drive

#### Description

The enclosed HCX drive is specifically tailored for HVAC applications where clean power is necessary. The enclosed HCX drive uses Eaton's SVX drive with a 12-pulse phase shifting transformer to deliver a substantial reduction in voltage and current harmonics.

#### Offering/Range

208 V: 7.5 to 60 hp  
230 V: 7.5 to 60 hp  
480 V: 25 to 125 hp

#### Enclosure

Enclosed NEMA 1, 12

##### 18-Pulse—CPX



#### Page V6-T2-355

#### Applications

18-pulse drive

#### Description

The CPX VFD uses advanced 18-pulse clean power technology that significantly reduces line harmonics at the drive input terminals and is designed to exceed IEEE 519-1992 requirements. Delivering true power factor and reducing harmonic distortion prevents upstream transformer overheating and overloading of breakers and feeders, enabling the application of variable frequency drives on generators and other high-impedance power systems.

#### Offering/Range

Three-phase to three-phase  
230 V to 200 hp  
480 V to 800 hp  
575 V to 800 hp  
(Consult Eaton for larger hp)

#### Enclosure

Enclosed NEMA 1, 12, 3R  
Consult Eaton for NEMA 4X

##### Regenerative—RGX



#### Page V6-T2-379

#### Applications

Regenerative drive

#### Description

The RGX is an enclosed solution to meet the needs of customer's regenerative load applications. It combines Eaton's comprehensive family of DC common DC bus drive products together with the necessary circuit protection and filtering to give the customer an all-in-one package. The RGX is available in 480 V and 575 V configurations in sizes up through 900 hp.

#### Offering/Range

Three-phase to three-phase  
480 V: 900 hp  
575 V: 750 hp

#### Enclosure

Enclosed NEMA 1

### Product Selection Guide

## 2

### Performance Drives

#### Low Harmonic Drives

#### LCX



#### Page V6-T2-392

##### Applications

Liquid cooled drive

##### Description

The LCX VFD is well suited for locations when air-cooling would be difficult or expensive or when space is at a premium. These extremely compact drives are suitable for ships, mines and heavy industry.

##### Offering/Range

Three-phase to three-phase  
480 V to 3200 hp  
575 V to 2800 hp

##### Enclosure

Open IP00

#### SPA/SPN/SPI



#### Page V6-T2-408

##### Applications

Common DC bus drive  
Active front end drive  
Regenerative drive

##### Description

Eaton offers a comprehensive range of common DC bus VFD products. This includes a number of front-end units and inverter units in the entire power range. Common DC bus drives are used in a multitude of applications and combinations. Drives that are braking can transfer the energy directly to the drives in a motoring mode.

##### Offering/Range

Three-phase to three-phase  
480 V to 2400 hp  
575 V to 2200 hp

##### Enclosure

Open IP00, IP21  
Open NEMA 1

## PowerXL DE1 Series



## Product Description

Eaton's PowerXL® DE1 variable speed starter offers the advantages of both a motor starter and a variable frequency drive in a single device. The DE1 is a compact and easy-to-use device with the ability to change the speed of the motor with the simplicity of a contactor starter. With 14 basic parameters, SmartWire-DT® connectivity and an intuitive configuration module, the DE1 setup and commissioning is easy for any panel builder and MOEM. The DE1 was designed for customers who have concerns of the complexity of a VFD but still require variable frequency and advanced motor protection.

Models rated at 480 volts, three-phase, 50/60 Hz are available in sizes ranging from 0.5 to 10 hp. Models rated at 230 volts, single-phase in/three-phase out, 50/60 Hz are available in sizes ranging from 0.33 to 3 hp.

The DE1 VSS is designed without a keypad to provide a simplistic, cost effective solution. Units are shipped without a keypad. In order to change parameters, there are accessories such as the configuration module that can change up to 5 parameters or connectivity products to connect to the drivesConnect PC Tool.

## Features

- Compact, space-saving design
- Rugged design rated up to 60 °C without derating
- DIN rail and screw mountable
- Narrow footprint for true side-by-side installation
- Rated for group motor applications
- Low capacitor design for low harmonics
- Control terminal blocks
  - Three digital inputs
  - One digital/analog (programmable) input
  - One relay output
- Contactor style power wiring
- RS-485/Modbus as standard
- Efficient, simple design without a keypad
  - Three indicating LEDs for fault and condition status
- Reliable design—
  - 150% for 60 s
  - 175% for 2 s
- SmartWire-DT and EtherNet/IP ready for expanding communication gateways

## Contents

### Description

PowerXL DE1 Series

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## Standards and Certifications

### Product

- Complies with EN 61800-3

### Safety

- IEC 61800-5-1
- CE
- UL
- CSA/cUL
- cTick
- UKRsekpro
- GOST R
- RoHS compliant



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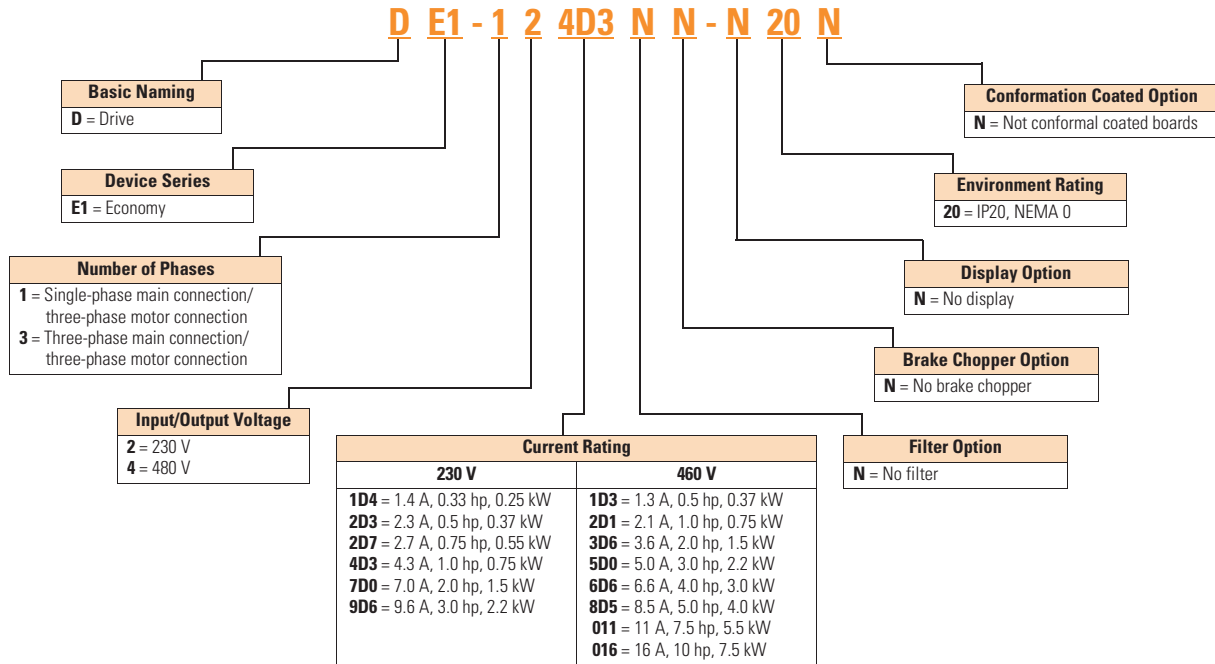
## Adjustable Frequency Drives

PowerXL DE1 Series

### Catalog Number Selection

2

#### DE1 Series Variable Speed Starter



### Product Selection

IP20

#### DE1 Series IP20 Enclosure Drives



hp <sup>①</sup>	kW	Volts	100% Continuous Current In (A)	Frame Size	Catalog Number <sup>②</sup>
0.33	0.25	200–240 V single-phase in <sup>③</sup> / 230 V three-phase out	1.4	1	DE1-121D4NN-N20N
0.5	0.37		2.3	1	DE1-122D3NN-N20N
0.75	0.55		2.7	1	DE1-122D7NN-N20N
1	0.75		4.3	1	DE1-124D3NN-N20N
2	1.5		7	1	DE1-127D0NN-N20N
3	2.2		9.6	2	DE1-129D6NN-N20N
0.5	0.37	380–480 V three-phase in/ 480 V three-phase out	1.3	1	DE1-341D3NN-N20N
1	0.75		2.1	1	DE1-342D1NN-N20N
2	1.5		3.6	1	DE1-343D6NN-N20N
3	2.2		5	2	DE1-345D0NN-N20N
4	3		6.6	2	DE1-346D6NN-N20N
5	4		8.5	2	DE1-348D5NN-N20N
7.5	5.5		11.3	2	DE1-34011NN-N20N
10	7.5		16	2	DE1-34016NN-N20N

#### Notes

- ① For all applications, select the unit such that the motor current is less than or equal to the rated continuous output current.
- ② These are constant torque/high overload rated drives.
- ③ For 230 V three-phase applications, refer to the three-phase to single-phase application note (AP040108EN) to properly set up the system.

## Accessories

### DE1 Series

#### PC Communication Kit and Copy/Paste Module

Description	Catalog Number
Bluetooth copy/paste communication stick	<b>DX-COM-STICK2</b>
USB to RJ45 panel mount kit	<b>DX-COM-PCKIT</b>
USB to RJ45 PC Tool cable	<b>DX-CBL-PC-3M0</b>

#### Keypad Options

Description	Catalog Number
LED remote keypad—7-segment display, IP54 rated	<b>DX-KEY-LED2</b> ①
Configuration module—plug-in unit, DIP switch and dial control	<b>DXE-EXT-SET</b>

#### Extension Cables and Data Cable Splitter

Description	Catalog Number
RJ45 communication cable w/terminating resistor	<b>EASY-NT-R</b>
RS-485 data cable, RJ45, 0.5 m	<b>DX-CBL-RJ45-0M5</b>
RS-485 data cable, RJ45, 1.0 m	<b>DX-CBL-RJ45-1M0</b>
RS-485 data cable, RJ45, 3.0 m	<b>DX-CBL-RJ45-3M0</b>
RS-485 three-way data cable splitter, RJ45	<b>DX-SPL-RJ45-3SL</b>
RS-485 data cable splitter, RJ45, (1 connector to 2 socket)	<b>DX-SPL-RJ45-2SL1PL</b>

#### Communication Modules

Description	Catalog Number
SmartWire-DT interface for DE1 and DC1 IP20	<b>DX-NET-SWD3</b>
Dual EtherNet/IP interface for DE1 and DC1 IP20	<b>DX-NET-ETHERNET2-2</b>

#### Commoning Links ②

Description	Max. Devices Used	Catalog Number
460 V, three-phase link	3xFS1	<b>XTCEXCLK3B</b>
	2xFS1 + 1xFS2	
	2xFS2	
	4xFS1	<b>XTCEXCLK4B</b>
	3xFS1 + 1xFS2	
	1xFS1 + 2xFS2 ③	
	5xFS1	<b>XTCEXCLK5B</b>
	4xFS1 + 1xFS2	
	2xFS1 + 2xFS2 ③	
3xFS2 ③		
460 V, incoming terminal	—	<b>XTCEXITB</b> ④

#### Notes

- ① Includes 1 m RS-485 data cable.
- ② Commoning links can be used to connect multiple line side 460 V DE1 units for use in group motor applications.
- ③ These combinations may result in the total of the individual input currents exceeding the three-phase commoning link's and incoming connection block's ampacity (35 A).
- ④ Required for group motor applications when using the 460 V commoning links.



## Technical Data and Specifications

### DE1 Series

2

#### Ratings

##### PowerXL DE1 Basic Controller Standard Ratings

Description	Specification
<b>Protections</b>	
Overload protection	150% for 60s for every 600 seconds
Overvoltage protection	Yes
Undervoltage protection	Yes
Ground fault protection	Yes
Overtemperature protection	Yes
Motor overload protection	Yes
Motor stall protection	Yes
Short-circuit protection	100 kAIC with Type J fuses, 65 kAIC with PKZM, 10 kAIC with FAZ

##### Programmable Parameters

Description
14 Standard operation parameters
Programmable start function
DC-brake at start and stop
Adjustable switching frequency
Autorestart function after fault
Protections and supervisions
Power section fault indication
External fault
Fieldbus communication
Analog input range selection, signal scaling and filtering
Four preset speed reference

#### Specifications

##### PowerXL DE1 Series

Description	Specification
<b>Input Ratings</b>	
Input voltage ( $V_{in}$ )	$\pm 10\%$
Input frequency ( $f_{in}$ )	50/60 Hz (variation up to 48–62 Hz)
Connection to power	Maximum of one time every 30 seconds
<b>Output Ratings</b>	
Output voltage	0 to $V_{in}$
Continuous output current	Continuous rated current $I_N$ at ambient temperature max. 140 °F (60 °C), 150% for 60 seconds, 175% for 2 seconds
Output frequency	0 to 500 Hz
Frequency resolution	0.1 Hz
Initial output current ( $I_H$ )	175% for 2s for every 20 seconds Torque depends on motor
<b>Control Characteristics</b>	
Operation mode	U/f control, slip compensation
Switching frequency	4 to 32 kHz
Voltage reference	10 Vdc (max. 10 mA)
Field weakening point	0 to 500 Hz
Acceleration time	0.1 to 600 seconds
Deceleration time	0.1 to 600 seconds
<b>Ambient Conditions</b>	
Ambient operating temperature	$-10\text{ °C}$ to $+50\text{ °C}$ , for 60 °C there is no derating required <sup>①</sup>
Storage temperature	$-40\text{ °C}$ to $+70\text{ °C}$
Relative humidity	0 to 95% RH, noncondensing, non-corrosive, no dripping water
Enclosure class	IP20 (FS1–FS3)

#### Note

<sup>①</sup> All units do not require derating except for the 10 hp 460 V unit which may require derating depending on the switching frequency used.

**Standards—DE1 Series Variable Speed Starter****I/O Specifications**

- Digital inputs DI1–DI4 are programmable
- Relay output is programmable
- DI3 and DI4 can be programmed to be digital, thermistor or analog

Includes:

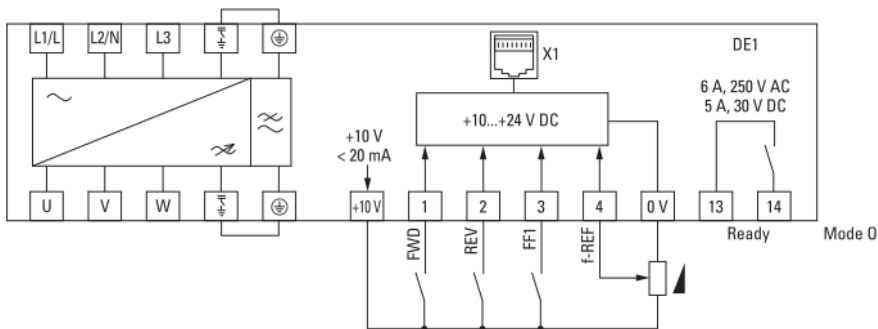
- Four inputs (three digital and one digital/analog)
- Analog input
  - 4–20 mA
  - 0–10 V
- One relay output
- RS-485 interface

**Reliability**

- Pretested components
- Computerized testing
- Robust design rated to 60 °C

**DE1 Series I/O Interface**

Terminal	Signal	Factory Preset	Description
0 V	0 V	—	0 V connection
+0 V	+24 Vdc	—	Maximum load 100 mA Reference potential V
1	DI1	FWD	+10 to 24 V
2	DI2	REV	+10 to 24 V
3	DI3	Fixed frequency FF1	+10 to 24 V
	Ther.	Thermistor	Fixed frequency FF1 External fault: Trip at 3600 Ω Reset at 1600 Ω
4	DI4	Digital Input 4	Frequency reference value +10 to 24 V
	AI1	Analog Input	Frequency reference value 0 to 10 V 0/4–20 mA Can be switched with parameter P16
13	K13	Relay 1, normally open contact	Active = RUN Maximum switching load: 250 Vac/6 A or 30 Vdc/5 A
14	K14	Relay 1, normally open contact	Active = RUN Maximum switching load: 250 Vac/6 A or 30 Vdc/5 A



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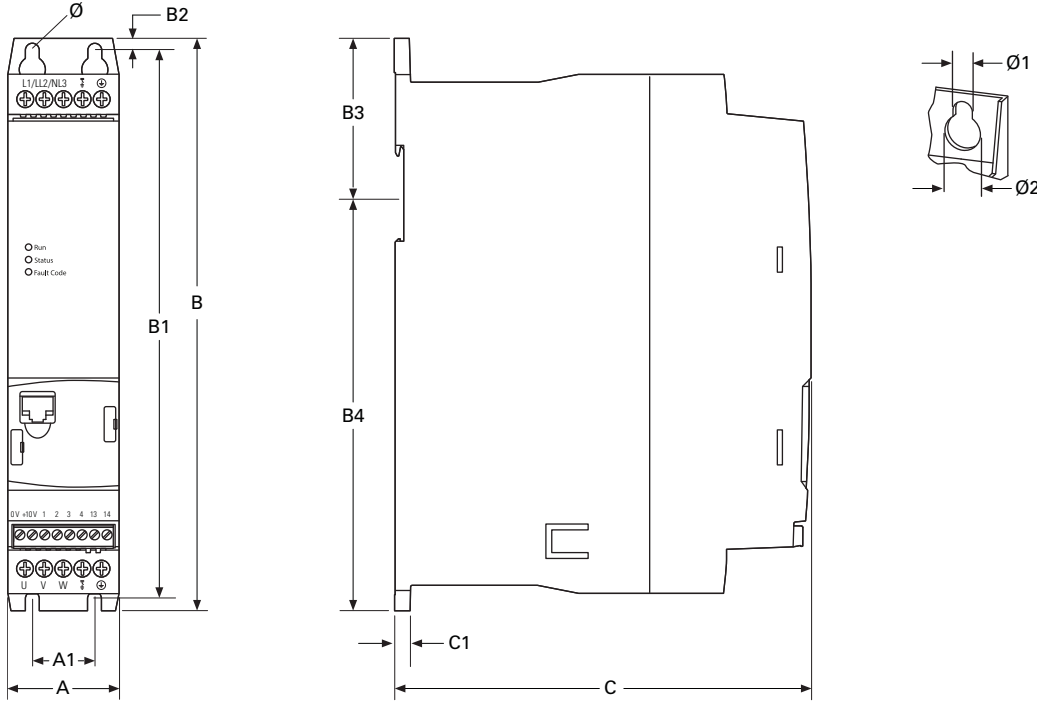
## Adjustable Frequency Drives

PowerXL DE1 Series

### Dimensions

Approximate Dimensions in Inches (mm)

#### 2 DE1, Sizes FS1 and FS2, Degree of Protection IP20/NEMA 0



Frame Size	A	A1	B	B1	B2	B3	B4
FS1	1.77 (45.0)	0.98 (25.0)	9.09 (231.0)	8.66 (220.0)	0.20 (5.1)	2.52 (64.0)	6.54 (166.1)
FS2	3.54 (90.0)	1.97 (50.0)	9.09 (231.0)	8.66 (220.0)	0.20 (5.1)	2.52 (64.0)	6.54 (166.1)

Frame Size	C	C1	Ø1	Ø2	Weight lbs (kg)
FS1	6.65 (169.0)	0.26 (6.6)	0.20 (5.1)	0.39 (10.0)	2.29 (1.04)
FS2	6.65 (169.0)	0.26 (6.6)	0.20 (5.1)	0.39 (10.0)	3.70 (1.68)

## PowerXL DC1 Series Drives



## Product Description

Eaton's PowerXL® DC1 variable frequency drives are the next generation of drives specifically engineered for today's machinery applications.

The DC1 is compact with only 14 basic parameters, SmartWire-DT® and EtherNet/IP connectivity, and outstanding ease of mounting and installation. The newest version adds support for sensorless vector control and permanent magnet motor compatibility. The DC1 is perfect for quick commissioning and is ideal for panel builders. This drive supports single-phase motor applications, and detachable terminal blocks make control wiring much easier.

Models rated at 480 volts, three-phase, 50/60 Hz are available in sizes ranging from 1 to 30 hp. Models rated at 240 volts, single- or three-phase, 50/60 Hz are available in sizes ranging from 0.5 to 15 hp. Models rated at 115 volts, single-phase, 50/60 Hz are available in the 0.5 to 3 hp size range.

## Features

- Compact, space-saving design
- Rugged and reliable—175% for 2 s, 50 °C rated
- DIN rail and screw mountable (FS1 and FS2)
- Side-by-side installation
- Industry-leading efficiency delivers energy savings to the customer
- Optional integrated EMC filters make the unit suitable for commercial and industrial networks
- Brake chopper as standard in frames 2 and higher
- Temperature-controlled fan
- RS-485/Modbus® and CANopen™ as standard
- PI controller as standard
- SmartWire capability
- Dual EtherNet/IP communication module
- Removable I/O terminal blocks
- Contactor style power wiring
- Designed for shaded-pole, single-phase motors and permanent split capacitor single-phase motors
- Sensorless vector control
- Permanent magnet motor compatibility

## Standards and Certifications

### Product

- Complies with EN61800-3 (2004)

### EMC (At Default Settings)

- EMC Category C1, C2 and C3 at default settings (1 m, 5 m, 25 m)

### Safety<sup>①</sup>

- 61800-5-1
- EN 60529
- CE
- UL
- cUL
- UkrSepro
- c-Tick
- RoHS compliant



### Note

- ① See unit nameplate for more detailed approvals.

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Technical Data and Specifications	<b>V6-T2-21</b>
Dimensions	<b>V6-T2-23</b>

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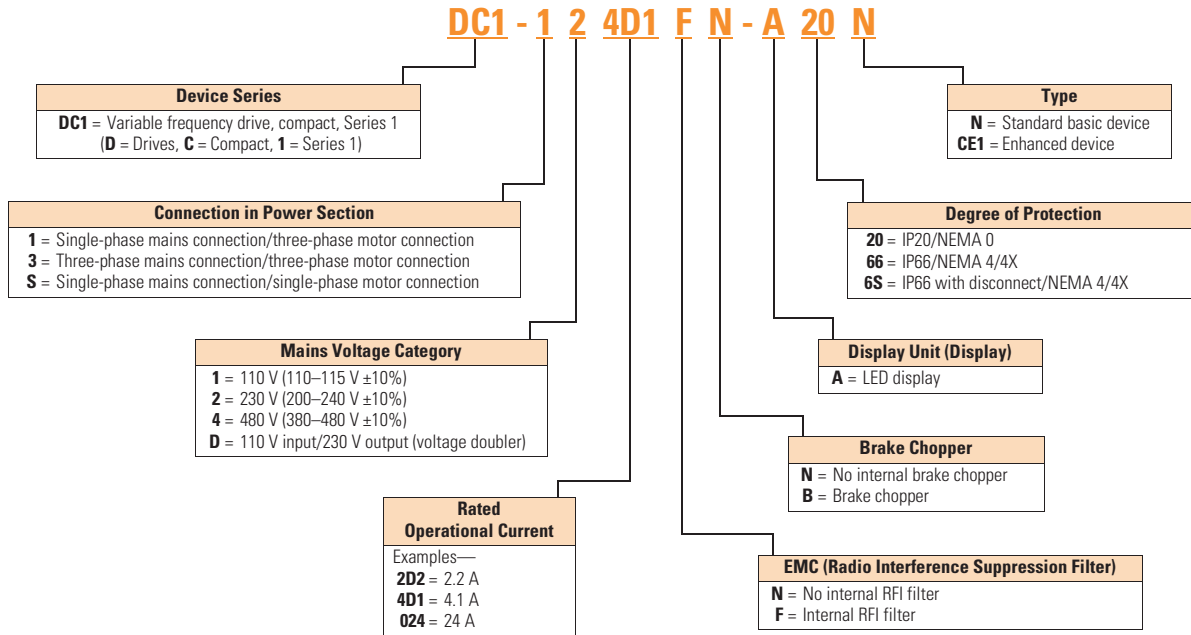
## Adjustable Frequency Drives

PowerXL DC1 Series Drives

### Catalog Number Selection

2

#### DC1 Series Adjustable Frequency AC Drives



## Product Selection

IP20

DC1 Series IP20 Enclosure Drives <sup>①</sup>

hp <sup>②</sup>	kW	Volts	100% Continuous Current In (A)	Frame Size <sup>③</sup>	Catalog Number
0.5	0.37	115 V single-phase in/ <sup>④</sup>	7	1	DC1-S17D0NN-A20N
0.75	0.55	115 V single-phase out	10.5	2	DC1-S1011NB-A20N
0.5	0.37	200–240 V single-phase in/ <sup>④</sup>	4.3	1	DC1-S24D3NN-A20N <sup>⑤</sup>
1	0.75	200–240 V single-phase out	7	1	DC1-S27D0NN-A20N <sup>⑤</sup>
1.5	1.1		10	2	DC1-S2011NB-A20N <sup>⑤</sup>
0.5	0.37	115 V single-phase in/ 230 V three-phase out	2.3	1	DC1-1D2D3NN-A20CE1
1	0.75		4.3	1	DC1-1D4D3NN-A20CE1
1.5	1.1		5.8	2	DC1-1D5D8NB-A20CE1
0.5	0.37	200–240 V single-phase in/ 230 V three-phase out	2.3	1	DC1-122D3NN-A20CE1 <sup>⑤</sup>
1	0.75		4.3	1	DC1-124D3NN-A20CE1 <sup>⑤</sup>
2	1.5		7	1	DC1-127D0NN-A20CE1 <sup>⑤</sup>
2	1.5		7	2	DC1-127D0NB-A20CE1 <sup>⑤</sup>
3	2.2		10.5	2	DC1-12011NB-A20CE1 <sup>⑤</sup>
5	4		15	3	DC1-12015NB-A20CE1
0.5	0.37	200–240 V three-phase in/ 230 V three-phase out	2.3	1	DC1-322D3NN-A20CE1
1	0.75		4.3	1	DC1-324D3NN-A20CE1
2	1.5		7	1	DC1-327D0NN-A20CE1
2	1.5		7	2	DC1-327D0NB-A20CE1 <sup>⑤</sup>
3	2.2		10.5	2	DC1-32011NB-A20CE1 <sup>⑤</sup>
5	4		18	3	DC1-32018NB-A20CE1 <sup>⑤</sup>
7.5	5.6		24	4	DC1-32024NB-A20CE1 <sup>⑤</sup>
10	7.5		30	4	DC1-32030NB-A20CE1 <sup>⑤</sup>
15	11		46	4	DC1-32046NB-A20CE1 <sup>⑤</sup>
1	0.75	380–480 V three-phase in/ 480 V three-phase out	2.2	1	DC1-342D2NN-A20CE1 <sup>⑤</sup>
2	1.5		4.1	1	DC1-344D1NN-A20CE1 <sup>⑤</sup>
2	1.5		4.1	2	DC1-344D1NB-A20CE1 <sup>⑤</sup>
3	2.2		5.8	2	DC1-345D8NB-A20CE1 <sup>⑤</sup>
5	4		9.5	2	DC1-349D5NB-A20CE1 <sup>⑤</sup>
7.5	5.5		14	3	DC1-34014NB-A20CE1 <sup>⑤</sup>
10	7.5		18	3	DC1-34018NB-A20CE1 <sup>⑤</sup>
15	11		24	3	DC1-34024NB-A20CE1 <sup>⑤</sup>
20	15		30	4	DC1-34030NB-A20CE1 <sup>⑤</sup>
25	18.5		39	4	DC1-34039FB-A20N <sup>⑤</sup>
30	22		46	4	DC1-34046FB-A20N <sup>⑤</sup>

**Notes**

- ① These are constant torque/high overload rated drives.
- ② For all applications, select the unit such that the motor current is less than or equal to the rated continuous output current.
- ③ Brake chopper circuit available as standard in frames 2, 3 and 4.
- ④ Only for use with shaded pole or split capacitor single-phase motors.
- ⑤ RFI version available. Substitute with DC1-\*\*\*\*\*F\*.\*\*\*\* for this option.

# 2.3

## Adjustable Frequency Drives

### PowerXL DC1 Series Drives

2

#### IP66 NEMA 4/4X Interior DC1 Drive

The IP66 version of the DC1 is a unique solution to allow for mounting the drive outside of a control panel or next to a motor for distributed control.

#### “-A66...” Option

This version comes with the keypad that is similar to that of IP20 version. There are no additional cover controls to address security concerns.

#### “-A6S...” Option

This version has an integrated potentiometer, a forward/off/reverse switch and a disconnect switch with lock-off capability with the standard keypad. This allows for reduced labor and materials when compared to a IP20 solution in separate enclosure.

IP66



IP66S



#### DC1 Series IP66 Enclosure Drives <sup>①</sup>

hp <sup>②</sup>	kW	Volts	100% Continuous Current In (A)	Frame Size <sup>③</sup>	Catalog Number
0.5	0.37	115 V single-phase in/ 115 V single-phase out	7	1	DC1-S17D0NN-A6SN <sup>④</sup>
0.75	0.55		10.5	2	DC1-S1011NB-A6SN <sup>④</sup>
0.5	0.37	200–240 V single-phase in/ 200–240 V single-phase out	4.3	1	DC1-S24D3NN-A6SN <sup>④⑤</sup>
1	0.75		7	1	DC1-S27D0NN-A6SN <sup>④⑤</sup>
1.5	1.1		10	2	DC1-S2011NB-A6SN <sup>④⑤</sup>
0.5	0.37	115 V single-phase in/ 230 V three-phase out	2.3	1	DC1-1D2D3NN-A6SCE1 <sup>④</sup>
1	0.75		4.3	1	DC1-1D4D3NN-A6SCE1 <sup>④</sup>
1.5	1.1		5.8	2	DC1-1D5D8NB-A6SCE1 <sup>④</sup>
0.5	0.37	200–240 V single-phase in/ 230 V three-phase out	2.3	1	DC1-122D3NN-A6SCE1 <sup>④⑤</sup>
1	0.75		4.3	1	DC1-124D3NN-A6SCE1 <sup>④⑤</sup>
2	1.5		7	1	DC1-127D0NN-A6SCE1 <sup>④⑤</sup>
2	1.5		7	2	DC1-127D0NB-A6SCE1 <sup>④⑤</sup>
3	2.2		10.5	2	DC1-12011NB-A6SCE1 <sup>④⑤</sup>
5	4		15	3	DC1-12015NB-A6SCE1 <sup>④</sup>
0.5	0.37	200–240 V three-phase in/ 230 V three-phase out	2.3	1	DC1-322D3NN-A6SCE1 <sup>④</sup>
1	0.75		4.3	1	DC1-324D3NN-A6SCE1 <sup>④</sup>
2	1.5		7	1	DC1-327D0NN-A6SCE1 <sup>④</sup>
2	1.5		7	2	DC1-327D0NB-A6SCE1 <sup>④⑤</sup>
3	2.2		10.5	2	DC1-32011NB-A6SCE1 <sup>④⑤</sup>
5	4		18	3	DC1-32018NB-A6SCE1 <sup>④⑤</sup>
1	0.75	380–480 V three-phase in/ 460 V three-phase out	2.2	1	DC1-342D2NN-A6SCE1 <sup>④⑤</sup>
2	1.5		4.1	1	DC1-344D1NN-A6SCE1 <sup>④⑤</sup>
2	1.5		4.1	2	DC1-344D1NB-A6SCE1 <sup>④⑤</sup>
3	2.2		5.8	2	DC1-345D8NB-A6SCE1 <sup>④⑤</sup>
5	4		9.5	2	DC1-349D5NB-A6SCE1 <sup>④⑤</sup>
7.5	5.5		14	3	DC1-34014NB-A6SCE1 <sup>④⑤</sup>
10	7.5		18	3	DC1-34018NB-A6SCE1 <sup>④⑤</sup>

#### Notes

- ① These are constant torque/high overload rated drives.
- ② For all applications, select the unit such that the motor current is less than or equal to the rated continuous output current.
- ③ Brake chopper circuit available as standard in frames 2, 3 and 4.
- ④ Non-disconnect version available. Substitute with -A66....
- ⑤ RFI version available. Substitute with DC1-\*\*\*\*\*F\*..... for this option.

## Accessories

### DC1 Series

#### PC Communication Kit and Copy/Paste Module

Description	Catalog Number
Bluetooth copy/paste communication stick	<b>DX-COM-STICK2</b>
USB to RJ45 panel mount kit	<b>DX-COM-PCKIT</b>
USB to RJ45 PC Tool cable	<b>DX-CBL-PC-3M0</b>

#### Encoder Feedback Plug-In Option Module and Miscellaneous Cards

Description	Catalog Number
Local control/test option card	<b>DXC-EXT-LOCSIM</b>
HVACO drive running and tripped relay output card	<b>DXC-EXT-2R01A0</b>
Dual relay output card	<b>DXC-EXT-2R0</b>
110 V logic input card	<b>DXC-EXT-IO110</b>
230 V logic input card	<b>DXC-EXT-IO230</b>

#### Remote Keypad

Description	Catalog Number
LED remote keypad—7-segment display, IP54 rated	<b>DX-KEY-LED2</b> <sup>①</sup>
OLED remote keypad—full text display, multi-line text, multi-language, IP54 hand/auto buttons	<b>DX-KEY-OLED</b> <sup>①</sup>

#### Brake Resistor (FR2 and FR3)

Description	Catalog Number
DC1, DA1 internal mount 200 W, 100 R	<b>DX-BR3-100</b>

#### Extension Cables and Data Cable Splitter

Description	Catalog Number
RJ45 communication cable w/terminating resistor	<b>EASY-NT-R</b>
RS-485 data cable, RJ45, 0.5 m	<b>DX-CBL-RJ45-0M5</b>
RS-485 data cable, RJ45, 1.0 m	<b>DX-CBL-RJ45-1M0</b>
RS-485 data cable, RJ45, 3.0 m	<b>DX-CBL-RJ45-3M0</b>
RS-485 three-way data cable splitter, RJ45	<b>DX-SPL-RJ45-3SL</b>
RS-485 data cable splitter, RJ45, (1 connector to 2 socket)	<b>DX-SPL-RJ45-2SL1PL</b>

#### Communication Modules

Description	Catalog Number
SmartWire-DT interface for DE1 and DC1 IP20	<b>DX-NET-SWD3</b>
Dual EtherNet/IP interface for DE1 and DC1 IP20	<b>DX-NET-ETHERNET2-2</b>

#### Optional Communication Modules

Description	Catalog Number
EtherNet/IP plug-in interface module <sup>②</sup>	<b>DX-NET-ETHERNET2-2</b>

#### Notes

- <sup>①</sup> Includes 1 m RS-485 data cable.
- <sup>②</sup> Available June 2016.



# 2.3

## Adjustable Frequency Drives

### PowerXL DC1 Series Drives

2

#### Line and Load Reactors

A line and load reactor is a three-phase inductance filter that can be placed on the line and load side of the AFD to help improve the harmonic performance of the system. Consult the factory for additional filtering options and further technical details.

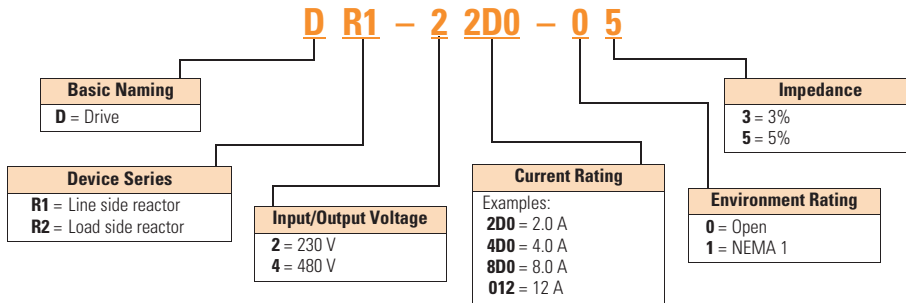
#### DR1 Line Reactor

A line reactor helps to provide a moderate reduction in current harmonics similar to a DC choke. It also provides increased input protection for AFD and its semiconductors from line transients helping to extend the life of the AFD.

#### DR2 Output Reactor

An output filter is used to reduce the transient voltage (dV/dt) at the motor terminals. The output filter is recommended for cable lengths exceeding 100 ft (30 m) with a drive of 3 hp and above and for cable lengths of 33 ft (10 m) with a drive of 2 hp and below.

#### Line and Load Reactors—Catalog Number Selection



#### Line and Load Reactors—230 V

hp (CT)	Open Load Reactor		Line Reactor		NEMA 1 Load Reactor		Line Reactor	
	3%	5%	3%	5%	3%	5%	3%	5%
0.5	DR2-22D0-03	DR2-22D0-05	DR1-22D2-03	DR1-22D2-05	DR2-22D0-13	DR2-22D0-15	DR1-22D2-13	DR1-22D2-15
1	DR2-24D0-03	DR2-28D0-05	DR1-24D2-03	DR1-24D2-05	DR2-24D0-13	DR2-28D0-15	DR1-24D2-13	DR1-24D2-15
1.5	DR2-28D0-03	DR2-28D0-05	DR1-26D0-03	DR1-26D0-05	DR2-28D0-13	DR2-28D0-15	DR1-26D0-13	DR1-26D0-15
2	DR2-28D0-03	DR2-28D0-05	DR1-26D8-03	DR1-26D8-05	DR2-28D0-13	DR2-28D0-15	DR1-26D8-13	DR1-26D8-15
3	DR2-2012-03	DR2-2012-05	DR1-29D6-03	DR1-29D6-05	DR2-2012-13	DR2-2012-15	DR1-29D6-13	DR1-29D6-15
5	DR2-2018-03	DR2-2018-05	DR1-2015-03	DR1-2015-05	DR2-2018-13	DR2-2018-15	DR1-2015-13	DR1-2015-15
7.5	DR2-2025-03	DR2-2025-05	DR1-2022-03	DR1-2022-05	DR2-2025-13	DR2-2025-15	DR1-2022-13	DR1-2022-15
10	DR2-2035-03	DR2-2035-05	DR1-2028-03	DR1-2028-05	DR2-2035-13	DR2-2035-15	DR1-2028-13	DR1-2028-15
15	DR2-2045-03	DR2-2045-05	DR1-2042-03	DR1-2042-05	DR2-2045-13	DR2-2045-15	DR1-2042-13	DR1-2042-15

#### Line and Load Reactors—480 V

hp (CT)	Open Load Reactor		Line Reactor		NEMA 1 Load Reactor		Line Reactor	
	3%	5%	3%	5%	3%	5%	3%	5%
1	DR2-42D0-03	DR2-42D0-05	DR1-42D1-03	DR1-42D1-05	DR2-42D0-13	DR2-42D0-15	DR1-42D1-13	DR1-42D1-15
2	DR2-44D0-03	DR2-44D0-05	DR1-43D4-03	DR1-43D4-05	DR2-44D0-13	DR2-44D0-15	DR1-43D4-13	DR1-43D4-15
3	DR2-48D0-03	DR2-48D0-05	DR1-44D8-03	DR1-44D8-05	DR2-48D0-13	DR2-48D0-15	DR1-44D8-13	DR1-44D8-15
5	DR2-48D0-03	DR2-48D0-05	DR1-47D6-03	DR1-47D6-05	DR2-48D0-13	DR2-48D0-15	DR1-47D6-13	DR1-47D6-15
7.5	DR2-4012-03	DR2-4012-05	DR1-4011-03	DR1-4011-05	DR2-4012-13	DR2-4012-15	DR1-4011-13	DR1-4011-15
10	DR2-4018-03	DR2-4018-05	DR1-4014-03	DR1-4014-05	DR2-4018-13	DR2-4018-15	DR1-4014-13	DR1-4014-15
15	DR2-4025-03	DR2-4025-05	DR1-4021-03	DR1-4021-05	DR2-4025-13	DR2-4025-15	DR1-4021-13	DR1-4021-15
20	DR2-4025-03	DR2-4025-05	DR1-4027-03	DR1-4027-05	DR2-4025-13	DR2-4025-15	DR1-4027-13	DR1-4027-15
25	DR2-4035-03	DR2-4035-05	DR1-4034-03	DR1-4034-05	DR2-4035-13	DR2-4035-15	DR1-4034-13	DR1-4034-15
30	DR2-4045-03	DR2-4045-05	DR1-4040-03	DR1-4040-05	DR2-4045-13	DR2-4045-15	DR1-4040-13	DR1-4040-15

## Technical Data and Specifications

### DC1 Series

#### Ratings

##### PowerXL DC1 Basic Controller IP20 Standard Ratings

Description	Specification
<b>Protections</b>	
Overload protection	150% for 60s for every 600 seconds
Overvoltage protection	Yes
Undervoltage protection	Yes
Ground fault protection	Yes
Overtemperature protection	Yes
Motor overload protection	Yes
Motor stall protection	Yes
Short-circuit withstand rating	100 kAIC with Type J fuses

#### Programmable Parameters

Description
Built-in Help card
14 Standard operation parameters
Reference scaling
Programmable start and stop functions
DC-brake at start and stop
Programmable V/Hz curve
Adjustable switching frequency
Autorestart function after fault
Protections and supervisions
Power section fault indication
External fault
Fieldbus communication
Second deceleration time
Analog input range selection, signal scaling and filtering
PI controller
Skip frequencies

#### Specifications

##### PowerXL DC1 Series Drives

Description	Specification
<b>Input Ratings</b>	
Input voltage ( $V_{in}$ )	$\pm 10\%$
Input frequency ( $f_{in}$ )	50/60 Hz (variation up to 48–62 Hz)
Connection to power	Maximum of one time every 30 seconds
<b>Output Ratings</b>	
Output voltage	0 to $V_{in}$ ①
Continuous output current	Continuous rated current $I_N$ at ambient temperature max. 122 °F (50 °C), 150% for 60 seconds, 175% for 2 seconds
Output frequency	0 to 500 Hz
Frequency resolution	0.1 Hz
Initial output current ( $I_{H}$ )	175% for 2s for every 20 seconds Torque depends on motor
<b>Control Characteristics</b>	
Operation mode	U/f control, slip compensation
Switching frequency	4 to 32 kHz
Voltage reference	10 Vdc (max. 10 mA)
Field weakening point	0 to 500 Hz
Acceleration time	0.1 to 600 seconds
Deceleration time	0.1 to 600 seconds
<b>Brake Resistor (Minimum Values) ②</b>	
230 V Series	FS2 and FS3 47 ohms
400 V Series	FS2 100 ohms, FS3 47 ohms
<b>Ambient Conditions</b>	
Ambient operating temperature	+14 °F (–10 °C), no frost to +122 °F (+50 °C); Rated loadability $I_N$ IP20—NEMA 0
Storage temperature	–40 °F (–40 °C) to +140 °F (+60 °C)
Relative humidity	0 to 95% RH, noncondensing, non-corrosive, no dripping water
Enclosure class	IP20 (FS1–FS4)

#### Notes

- ① Exception: 115 V single-phase in, 230 V three-phase out.  
 ② Only FS2, FS3 and FS4 drives are equipped with brake chopper circuit.

#### Standards—DC1 Series

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#### I/O Specifications

- Digital inputs DI1–DI4 are programmable
- Digital, relay and analog outputs are programmable

Includes:

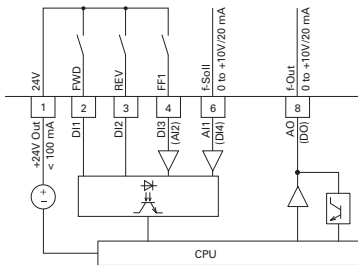
- Four inputs (two digital and two digital/analog)
- Analog inputs
  - 4–20 mA
  - 0–10 V
- One output (analog or digital)
- One relay output
- RS-485 interface

#### Reliability

- Pretested components
- Computerized testing
- Final test with full load
- Conformal-coated boards
- Eaton's Electrical Services & Systems: national network of AF drive specialists

#### DC1 Series I/O Interface

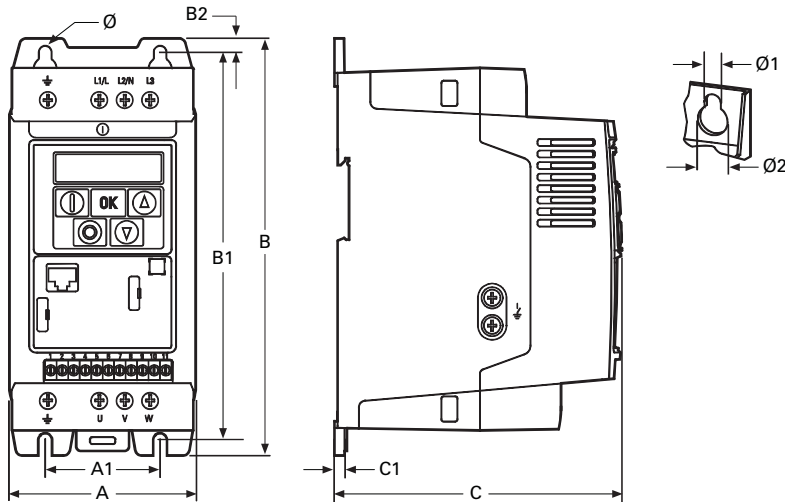
Terminal	Signal	Factory Preset	Description
1	+24 Vdc	Control voltage for DI1–DI4	— Maximum load 100 mA Reference potential V
2	DI1	Digital Input 1	Start Enable FWD
3	DI2	Digital Input 2	Start Enable REV
4	DI3	Digital Input 3	Fixed frequency FF1
	AI2	Analog Input 2	Fixed frequency FF1
			Digital: 8–30 V (high) Analog: 0 to +10 V ( $R_i > 72 \text{ k}\Omega$ ) 0/4–20 mA ( $R_B = 500 \Omega$ ) Can be switched with parameter P-16
5	+10 Vdc	Reference voltage, Output (+10 V)	— Maximum load 10 mA Reference potential 0 V
6	AI1	Analog Input 1	Frequency reference value (fixed frequency)
	DI4	Digital Input 5	Frequency reference value (fixed frequency)
			Analog: 0 to +10 V ( $R_i > 72 \text{ k}\Omega$ ) 0/4–20 mA ( $R_B = 500 \Omega$ ) Can be switched with parameter P-16
7	0 V	Reference potential	— 0 V = connection terminal 9
8	AO1	Analog Output 1	Output frequency
	DO1	Digital Output 1	Output frequency
			Analog: 0 to +10 V, maximum 20 mA Can be switched with parameter P-25 Digital: 8 to +24 V
9	0 V	Reference potential	— 0 V connection terminal 7
10	K13	Relay 1, normally open contact	Active = RUN
11	K14	Relay 1, normally open contact	Active = RUN
			Maximum switching load: 250 Vac/6 A or 30 Vdc/5 A



## Dimensions

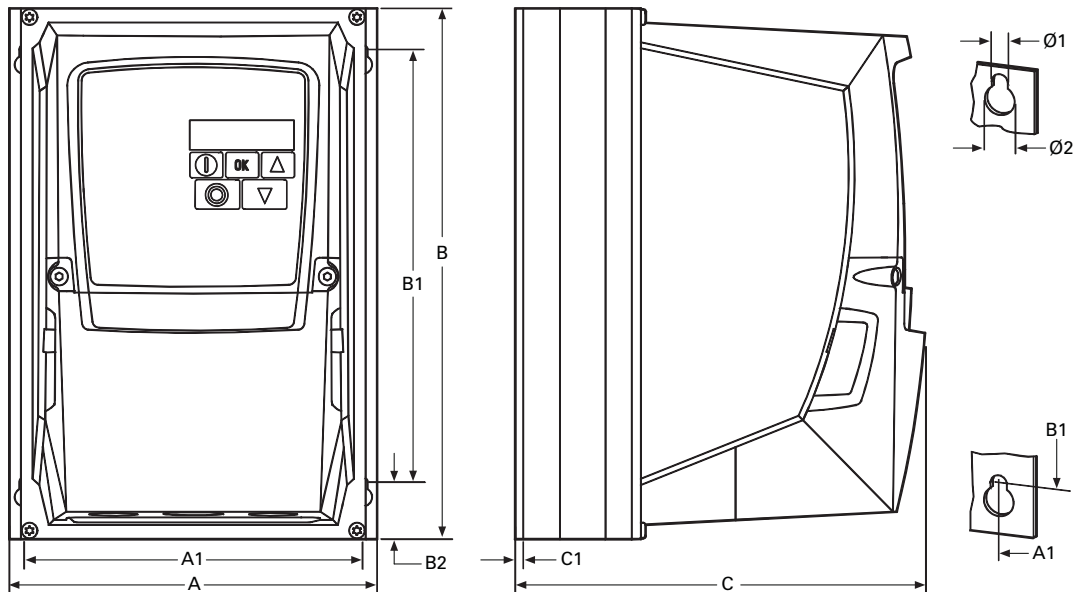
Approximate Dimensions in Inches (mm)

### DC1, Sizes FS1–FS4, Degree of Protection IP20/NEMA 0



Frame Size	A	A1	B	B1	B2	C	C1	Ø1	Ø2	Weight lbs (kg)
FS1	3.19 (81)	1.97 (50)	7.24 (184)	6.69 (170)	0.28 (7)	4.88 (124)	0.16 (4)	0.24 (6)	0.47 (12)	2.43 (1.1)
FS2	4.21 (107)	2.95 (75)	9.09 (231)	8.46 (215)	0.31 (8)	5.98 (152)	0.20 (5)	0.24 (6)	0.47 (12)	5.73 (2.6)
FS3	5.08 (129)	3.94 (100)	10.75 (273)	10.04 (255)	0.33 (8.5)	6.89 (175)	0.20 (5)	0.24 (6)	0.47 (12)	8.82 (4.0)
FS4	6.81 (173)	4.92 (125)	16.48 (418.5)	15.75 (400)	0.41 (10.5)	8.31 (211)	0.16 (4)	0.31 (8)	0.57 (14.5)	18.52 (8.4)

### DC1, Sizes FS1–FS3, Degree of Protection IP66/NEMA 4



Frame Size	A	A1	B	B1	B2	C	C1	Ø1	Ø2	Weight lbs (kg)
FS1	6.34 (161)	5.85 (148.5)	9.13 (232)	7.44 (189)	0.98 (25)	7.24 (184)	0.14 (3.5)	0.16 (4)	0.31 (8)	6.17 (2.8)
FS2	7.40 (188)	6.93 (176)	10.12 (257)	7.87 (200)	1.10 (28)	7.56 (192)	0.14 (3.5)	0.17 (4.2)	0.33 (8.5)	11.02 (5.0)
FS3	8.27 (210)	7.78 (197.5)	12.20 (310)	9.92 (252)	1.30 (33)	9.45 (240)	0.14 (3.5)	0.17 (4.2)	0.33 (8.5)	18.08 (8.2)

# 2.3

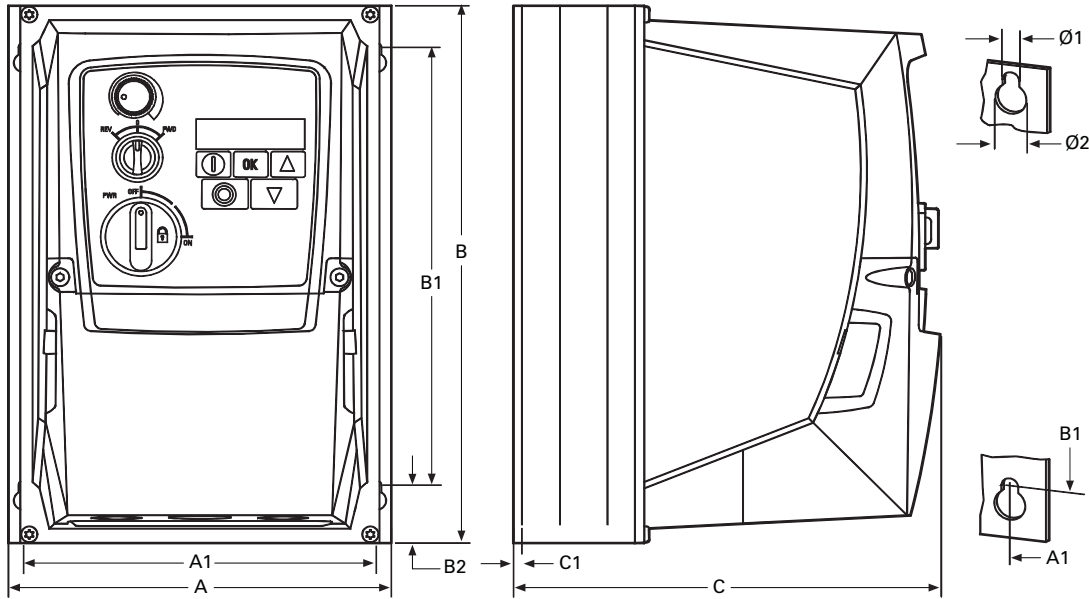
## Adjustable Frequency Drives

### PowerXL DC1 Series Drives

Approximate Dimensions in Inches (mm)

#### DC1, Sizes FS1–FS3, Degree of Protection IP66/NEMA 4, with Local Controls

2



Frame Size	A	A1	B	B1	B2	C	C1	Ø1	Ø2	Weight lbs (kg)
FS1	6.34 (161)	5.85 (148.5)	9.13 (232)	7.44 (189)	0.98 (25)	7.24 (184)	0.14 (3.5)	0.16 (4)	0.31 (8)	6.17 (2.8)
FS2	7.40 (188)	6.93 (176)	10.12 (257)	7.87 (200)	1.10 (28)	7.56 (192)	0.14 (3.5)	0.17 (4.2)	0.33 (8.5)	11.02 (5.0)
FS3	8.27 (210)	7.78 (197.5)	12.20 (310)	9.92 (252)	1.30 (33)	9.45 (240)	0.14 (3.5)	0.17 (4.2)	0.33 (8.5)	18.08 (8.2)

## PowerXL DA1 Series Drives



## Product Description

Eaton's PowerXL® DA1 variable frequency drives are the next generation of drives specifically engineered for today's machinery applications.

DA1 is the perfect match for demanding OEM applications. High-performance processor, safe torque off, multiple fieldbus protocols including SmartWire-DT, sensorless vector control and the possibility to operate permanent magnet motors are sure to leave a lasting impression.

Models rated at 480 volts, three-phase, 50/60 Hz are available in sizes ranging from 1 to 15 hp. Models rated at 240 volts, single- or three-phase, 50/60 Hz are available in sizes ranging from 0.5 to 7.5 hp. Models rated at 575 volts, three-phase, 50/60 Hz are available in sizes ranging from 1 to 20 hp.

## Features

- Compact, space-saving design
- Rugged and reliable—200% for 4s 50 °C rated
- DIN rail and screw mountable (FS1 and FS2)
- Side-by-side installation
- Industry-leading efficiency delivers energy savings to the customer
- Integrated EMC filters make the unit suitable for commercial and industrial networks
- Communication cards that integrate into the drive—
  - EtherNet/IP
  - DeviceNet
  - PROFIBUS-DP
  - EtherCAT
  - PROFINET
  - Modbus TCP
  - BACnet
- Brake chopper as standard
- Temperature-controlled fan
- RS-485/Modbus® and CANopen™ as standard
- PID controller as standard
- SmartWire capability
- Removable I/O terminal blocks
- Contactor style power wiring
- 200% torque at zero speed
- Designed to run surface mounted (SPM) and rotor in-built (IPM) permanent magnet motors
- PLC programming
- Closed loop
- Conformal coated boards

## Standards and Certifications

### Product

- Complies with EN61800-3 (2004)

### EMC (At Default Settings)

- EMC Category C1, C2 and C3 at default settings (1 m, 5 m, 25 m)

### Safety<sup>①</sup>

- 61800-5-1
- EN 60529
- CE
- UL
- cUL
- DNV
- UkrSepro
- c-Tick
- RoHS compliant



### Note

- ① See unit nameplate for more detailed approvals.

## Contents

### Description

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Accessories	V6-T2-29
Technical Data and Specifications	V6-T2-32
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# 2.4

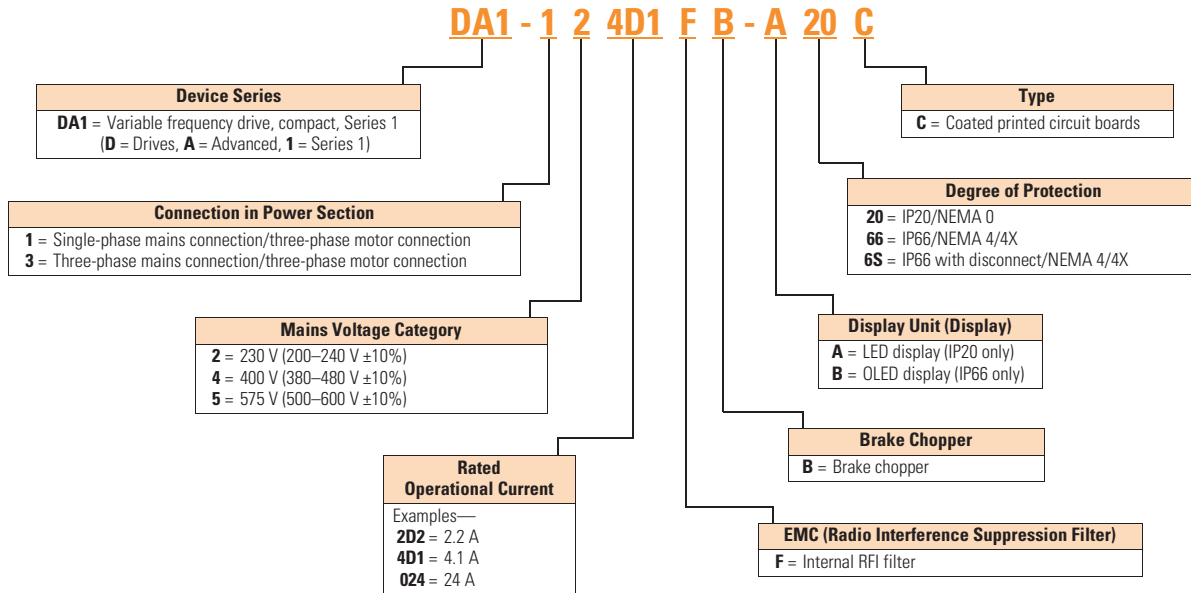
## Adjustable Frequency Drives

PowerXL DA1 Series Drives

### Catalog Number Selection

2

#### DA1 Series Adjustable Frequency AC Drives



## Product Selection

IP20

DA1 Series IP20 Enclosure Drives <sup>①</sup>

hp <sup>②</sup>	kW	Volts	100% Continuous Current In (A)	Frame Size <sup>③</sup>	Catalog Number
1	0.75	200–240 V single-phase in/ 230 V three-phase out	4.3	2	DA1-124D3FB-A20C
2	1.5		7	2	DA1-127D0FB-A20C
3	2.2		10.5	2	DA1-12011FB-A20C
1	0.75	200–240 V three-phase in/ 230 V three-phase out	4.3	2	DA1-324D3FB-A20C
2	1.5		7	2	DA1-327D0FB-A20C
3	2.2		10.5	2	DA1-32011FB-A20C
5	4		18	3	DA1-32018FB-A20C
7.5	5.5		24	3	DA1-32024FB-A20C
1	0.75	380–480 V three-phase in/ 460 V three-phase out	2.2	2	DA1-342D2FB-A20C
2	1.5		4.1	2	DA1-344D1FB-A20C
3	2.2		5.8	2	DA1-345D8FB-A20C
5	4		9.5	2	DA1-349D5FB-A20C
7.5	5.5		14	3	DA1-34014FB-A20C
10	7.5		18	3	DA1-34018FB-A20C
15	11		24	3	DA1-34024FB-A20C
1	0.75	500–600 V three-phase in/ 575 V three-phase out	2.1	2	DA1-352D1NB-A20C
2	4.5		3.1	2	DA1-353D1NB-A20C
3	2.2		4.1	2	DA1-354D1NB-A20C
5	4		6.5	2	DA1-356D5NB-A20C
7.5	5.5		9	2	DA1-359D0NB-A20C
10	7.5		12	3	DA1-35012NB-A20C
15	11		17	3	DA1-35017NB-A20C
20	15		22	3	DA1-35022NB-A20C

**Notes**

- ① These are constant torque/high overload rated drives.
- ② For all applications, select the unit such that the motor current is less than or equal to the rated continuous output current.
- ③ Brake chopper circuit available as standard in frames 2 and 3.



# 2.4

## Adjustable Frequency Drives

### PowerXL DA1 Series Drives

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#### IP66 NEMA 4/4X Interior DA1 Drive

The IP66 version of the DA1 is a unique solution to allow for mounting the drive outside of a control panel or next to a motor for distributed control.

#### “-B66C” Option

This version comes with the OLED keypad. There are no additional cover controls to address security concerns.

#### “-B6SC” Option

This version has an integrated potentiometer, a forward/off/reverse switch and a disconnect switch with lock-off capability with the OLED keypad. This allows for reduced labor and materials when compared to a IP20 solution in separate enclosure.

IP66



IP66S



#### DA1 Series IP66 Enclosure Drives <sup>①</sup>

IP66 NEMA 4/4X Interior DA1 Drive

hp <sup>②</sup>	kW	Volts	100% Continuous Current In (A)	Frame Size <sup>③</sup>	Catalog Number
1	0.75	200–240 V single-phase in/ 230 V three-phase out	4.3	2	DA1-124D3FB-B6SC <sup>④</sup>
2	1.5		7	2	DA1-127D0FB-B6SC <sup>④</sup>
3	2.2		10.5	2	DA1-12011FB-B6SC <sup>④</sup>
1	0.75	200–240 V three-phase in/ 230 V three-phase out	4.3	2	DA1-324D3FB-B6SC <sup>④</sup>
2	1.5		7	2	DA1-327D0FB-B6SC <sup>④</sup>
3	2.2		10.5	2	DA1-32011FB-B6SC <sup>④</sup>
5	4		18	3	DA1-32018FB-B6SC <sup>④</sup>
1	0.75	380–480 V three-phase in/ 460 V three-phase out	2.2	2	DA1-342D2FB-B6SC <sup>④</sup>
2	1.5		4.1	2	DA1-344D1FB-B6SC <sup>④</sup>
3	2.2		5.8	2	DA1-345D8FB-B6SC <sup>④</sup>
5	4		9.5	2	DA1-349D5FB-B6SC <sup>④</sup>
7.5	5.5		14	3	DA1-34014FB-B6SC <sup>④</sup>
10	7.5		18	3	DA1-34018FB-B6SC <sup>④</sup>
1	0.75	500–600 V three-phase in/ 575 V three-phase out	2.1	2	DA1-352D1NB-B6SC
2	4.5		3.1	2	DA1-353D1NB-B6SC
3	2.2		4.1	2	DA1-354D1NB-B6SC
5	4		6.5	2	DA1-356D5NB-B6SC
7.5	5.5		9	2	DA1-359D0NB-B6SC
10	7.5		12	3	DA1-35012NB-B6SC
15	11		17	3	DA1-35017NB-B6SC

#### Notes

- ① These are constant torque/high overload rated drives.
- ② For all applications, select the unit such that the motor current is less than or equal to the rated continuous output current.
- ③ Brake chopper circuit available as standard in frames 2 and 3.
- ④ Non-disconnect version available. Substitute with **-B66C**.

## Accessories

### DA1 Series

#### PC Communication Kit and Copy/Paste Module

Description	Catalog Number
Bluetooth copy/paste communication stick	<b>DX-COM-STICK2</b>
USB to RJ45 panel mount kit	<b>DX-COM-PCKIT</b>
USB to RJ45 PC Tool cable	<b>DX-CBL-PC-3M0</b>

#### Optional Communication Modules

Description	Catalog Number
DeviceNet plug-in interface module	<b>DX-NET-DEVICENET</b>
PROFIBUS-DP plug-in interface module	<b>DX-NET-PROFIBUS</b>
EtherNet/IP plug-in interface module	<b>DX-NET-ETHERNET-2</b>
EtherCAT plug-in interface module	<b>DX-NET-ETHERCAT-2</b>
PROFINET plug-in interface module	<b>DX-NET-PROFINET-2</b>
Modbus TCP plug-in interface module	<b>DX-NET-MOVBUSTCP-2</b>
BACnet/IP plug-in interface module	<b>DX-NET-BACNETIP-2</b>

#### Encoder Feedback Plug-In Option Module and Miscellaneous Cards

Description	Catalog Number
Expansion card: 3 relay outputs	<b>DXA-EXT-3RO</b>
Encoder feedback plug-in option module	<b>DXA-EXT-ENCOD</b>
Expansion card: 3 digital inputs and 1 relay output	<b>DXA-EXT-3DI1RO</b>

#### Remote Keypad

Description	Catalog Number
LED remote keypad—7-segment display, IP54 rated	<b>DX-KEY-LED2</b> <sup>①</sup>
OLED remote keypad—full text display, multi-line text, multi-language, IP54, hand/auto	<b>DX-KEY-OLED</b> <sup>①</sup>

#### Extension Cables and Data Cable Splitter

Description	Catalog Number
RJ45 communication cable w/terminating resistor	<b>EASY-NT-R</b>
RS-485 data cable, RJ45, 0.5 m	<b>DX-CBL-RJ45-0M5</b>
RS-485 data cable, RJ45, 1.0 m	<b>DX-CBL-RJ45-1M0</b>
RS-485 data cable, RJ45, 3.0 m	<b>DX-CBL-RJ45-3M0</b>
RS-485 three-way data cable splitter, RJ45	<b>DX-SPL-RJ45-3SL</b>
RS-485 data cable splitter, RJ45, (1 connector to 2 socket)	<b>DX-SPL-RJ45-2SL1PL</b>

#### SmartWire Modules

Description	Catalog Number
SmartWire-DT interface for DA1 IP20	<b>DX-NET-SWD1</b>

#### Note

<sup>①</sup> Includes 1 m RS-485 data cable.

# 2.4

## Adjustable Frequency Drives

### PowerXL DA1 Series Drives

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#### Line and Load Reactors

A line and load reactor is a three-phase inductance filter that can be placed on the line and load side of the AFD to help improve the harmonic performance of the system. Consult the factory for additional filtering options and further technical details.

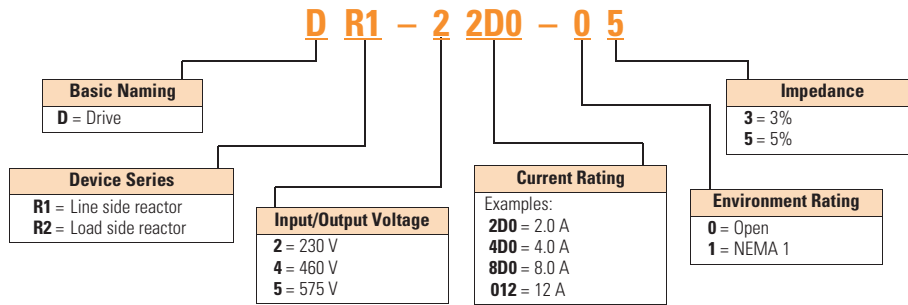
#### DR1 Line Reactor

A line reactor helps to provide a moderate reduction in current harmonics similar to a DC choke. It also provides increased input protection for AFD and its semiconductors from line transients helping to extend the life of the AFD.

#### DR2 Output Reactor

An output filter is used to reduce the transient voltage (dV/dt) at the motor terminals. The output filter is recommended for cable lengths exceeding 100 ft (30 m) with a drive of 3 hp and above and for cable lengths of 33 ft (10 m) with a drive of 2 hp and below.

#### Line and Load Reactors—Catalog Number Selection



#### Line and Load Reactors—230 V

hp (CT)	Open Load Reactor		Line Reactor		NEMA 1 Load Reactor		Line Reactor	
	3%	5%	3%	5%	3%	5%	3%	5%
1	DR2-24D0-03	DR2-28D0-05	DR1-24D2-03	DR1-24D2-05	DR2-24D0-13	DR2-28D0-15	DR1-24D2-13	DR1-24D2-15
2	DR2-28D0-03	DR2-28D0-05	DR1-26D8-03	DR1-26D8-05	DR2-28D0-13	DR2-28D0-15	DR1-26D8-13	DR1-26D8-15
3	DR2-2012-03	DR2-2012-05	DR1-29D6-03	DR1-29D6-05	DR2-2012-13	DR2-2012-15	DR1-29D6-13	DR1-29D6-15
5	DR2-2018-03	DR2-2018-05	DR1-2015-03	DR1-2015-05	DR2-2018-13	DR2-2018-15	DR1-2015-13	DR1-2015-15
7.5	DR2-2025-03	DR2-2025-05	DR1-2022-03	DR1-2022-05	DR2-2025-13	DR2-2025-15	DR1-2022-13	DR1-2022-15

## Line and Load Reactors—480 V

hp (CT)	Open Load Reactor	
	3%	5%
	1	DR2-42D0-03
2	DR2-44D0-03	DR2-44D0-05
3	DR2-48D0-03	DR2-48D0-05
5	DR2-48D0-03	DR2-48D0-05
7.5	DR2-4012-03	DR2-4012-05
10	DR2-4018-03	DR2-4018-05
15	DR2-4025-03	DR2-4025-05

Line Reactor	
3%	5%
DR1-42D1-03	DR1-42D1-05
DR1-43D4-03	DR1-43D4-05
DR1-44D8-03	DR1-44D8-05
DR1-47D6-03	DR1-47D6-05
DR1-4011-03	DR1-4011-05
DR1-4014-03	DR1-4014-05
DR1-4021-03	DR1-4021-05

NEMA 1 Load Reactor	
3%	5%
DR2-42D0-13	DR2-42D0-15
DR2-44D0-13	DR2-44D0-15
DR2-48D0-13	DR2-48D0-15
DR2-48D0-13	DR2-48D0-15
DR2-4012-13	DR2-4012-15
DR2-4018-13	DR2-4018-15
DR2-4025-13	DR2-4025-15

Line Reactor	
3%	5%
DR1-42D1-13	DR1-42D1-15
DR1-43D4-13	DR1-43D4-15
DR1-44D8-13	DR1-44D8-15
DR1-47D6-13	DR1-47D6-15
DR1-4011-13	DR1-4011-15
DR1-4014-13	DR1-4014-15
DR1-4021-13	DR1-4021-15

## Line and Load Reactors—575 V

hp (CT)	Open Load Reactor	
	3%	5%
	1	DR2-52D0-03
2	DR2-54D0-03	DR2-54D0-05
3	DR2-54D0-03	DR2-54D0-05
5	DR2-58D0-03	DR2-58D0-05
7.5	DR2-58D0-03	DR2-58D0-05
10	DR2-5012-03	DR2-5012-05
15	DR2-5018-03	DR2-5018-05
20	DR2-5025-03	DR2-5025-05

Line Reactor	
3%	5%
DR1-51D7-03	DR1-51D7-05
DR1-52D7-03	DR1-52D7-05
DR1-53D9-03	DR1-53D9-05
DR1-56D1-03	DR1-56D1-05
DR1-59D0-03	DR1-59D0-05
DR1-5011-03	DR1-5011-05
DR1-5017-03	DR1-5017-05
DR1-5022-03	DR1-5022-05

NEMA 1 Load Reactor	
3%	5%
DR2-52D0-13	DR2-52D0-15
DR2-54D0-13	DR2-54D0-15
DR2-54D0-13	DR2-54D0-15
DR2-58D0-13	DR2-58D0-15
DR2-58D0-13	DR2-58D0-15
DR2-5012-13	DR2-5012-15
DR2-5018-13	DR2-5018-15
DR2-5025-13	DR2-5025-15

Line Reactor	
3%	5%
DR1-51D7-13	DR1-51D7-15
DR1-52D7-13	DR1-52D7-15
DR1-53D9-13	DR1-53D9-15
DR1-56D1-13	DR1-56D1-15
DR1-59D0-13	DR1-59D0-15
DR1-5011-13	DR1-5011-15
DR1-5017-13	DR1-5017-15
DR1-5022-13	DR1-5022-15

## Technical Data and Specifications

### DA1 Series

2

#### Ratings

##### PowerXL DA1 Basic Controller IP20 Standard Ratings

Description	Specification
<b>Protections</b>	
Overload protection	150% for 60s for every 600 seconds
Overvoltage protection	Yes
Undervoltage protection	Yes
Ground fault protection	Yes
Overtemperature protection	Yes
Motor overload protection	Yes
Motor stall protection	Yes
Short-circuit withstand rating	100 kAIC with Type J fuses

#### Programmable Parameters

Description
Built-in Help card
14 Standard operation parameters
Reference scaling
Programmable start and stop functions
DC-brake at start and stop
Programmable V/Hz curve
Adjustable switching frequency
Autorestart function after fault
Protections and supervisions
Power section fault indication
External fault
Fieldbus communication
Safe torque off (STO) function
Analog input range selection, signal scaling and filtering
PI controller
Skip frequencies

#### Specifications

##### PowerXL DA1 Series Drives

Description	Specification
<b>Input Ratings</b>	
Input voltage ( $V_{in}$ )	$\pm 10\%$
Input frequency ( $f_{in}$ )	50/60 Hz (variation up to 48–62 Hz)
Connection to power	Maximum of one time every 30 seconds
<b>Output Ratings</b>	
Output voltage	0 to $V_{in}$ ①
Continuous output current	Continuous rated current $I_N$ at ambient temperature max. 122 °F (50 °C), 150% for 60 seconds, 200% for 4 seconds
Output frequency	0 to 500 Hz
Frequency resolution	0.1 Hz
Initial output current ( $I_{hi}$ )	200% for 4s for every 40 seconds Torque depends on motor
<b>Control Characteristics</b>	
Operation mode	U/f control, slip compensation, sensorless vector control (SLV), vector control with feedback (CLV)
Switching frequency	4 to 32 kHz
Voltage reference	10 Vdc (max. 10 mA)
Field weakening point	0 to 500 Hz
Acceleration time	0.1 to 600 seconds
Deceleration time	0.1 to 600 seconds
<b>Brake Resistor (Minimum Values) ②</b>	
230 V Series	FS2 and FS3 15 ohms
400 V Series	FS2 33 ohms, FS3 22 ohms
<b>Ambient Conditions</b>	
Ambient operating temperature	+14 °F (–10 °C), no frost to +122 °F (+50 °C): Rated loadability $I_N$ IP20—NEMA 0
Storage temperature	–40 °F (–40 °C) to +140 °F (+60 °C)
Relative humidity	0 to 95% RH, noncondensing, non-corrosive, no dripping water
Enclosure class	IP20 (FS2 and FS3)

#### Notes

- ① Exception: 115 V single-phase in, 230 V three-phase out.  
 ② Only FS2 and FS3 drives are equipped with brake chopper circuit.

## Standards—DA1 Series

## I/O Specifications

- Digital inputs D11–D15 are programmable
- Digital, relay and analog outputs are programmable

Includes:

- Five inputs (three digital and two digital/analog)
- Analog inputs
  - 4–20 mA
  - 0–10 V
- Two outputs (analog or digital)
- Two relay outputs
- RS-485 interface

## Reliability

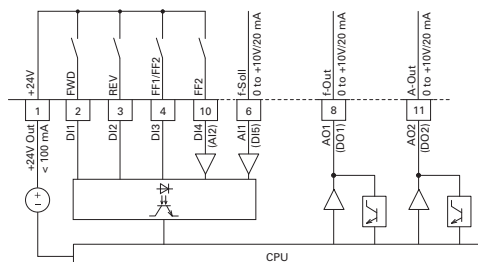
- Pretested components
- Computerized testing
- Final test with full load
- Conformal-coated boards
- Eaton's Electrical Services & Systems: national network of AF drive specialists

## DA1 Series I/O Interface

Terminal	Signal	Factory Preset	Description
1	+24 Vdc	Control voltage for D11–D15	Maximum load 100 mA Reference potential V
2	D11	Digital Input 1	Start Enable FWD ①
3	D12	Digital Input 2	Start Enable REV ①
4	D13	Digital Input 3	Fixed frequency FF1/FF2 ①
5	+10 Vdc	Reference voltage, Output (+10 V)	Maximum load 10 mA Reference potential 0 V
6	A11	Analog Input 1	Frequency reference value ①
	D14	Digital Input 5	Frequency reference value ①
7	0 V	Reference potential	0 V = connection terminal 9
8	A01	Analog Output 1	Output frequency
	D01	Digital Output 1	Output frequency
9	0 V	Reference potential	0 V connection terminal 7
10	D14	Digital Input 4	Fixed frequency FF2 ①
	A12	Analog Input 2	Fixed frequency FF2 ①
11	A02	Analog output 2	Output current ①
	D02	Digital output 2	Output current ①
12	STO+	Safe Torque Off +	Enable = +24 V
13	STO-	Safe Torque Off –	Enable = 0 V
14	K11	Relay 1, changeover contact	Active = FAULT ①
15	K14	Relay 1, changeover contact (N/O)	Active = FAULT ①
16	K12	Relay 1, changeover contact (N/C)	Active = FAULT ①
17	K23	Relay 2, N/O contact	Active = FAULT ①
18	K24	Relay 2, N/C contact	Active = FAULT ①

## Note

① Programmable function.



# 2.4

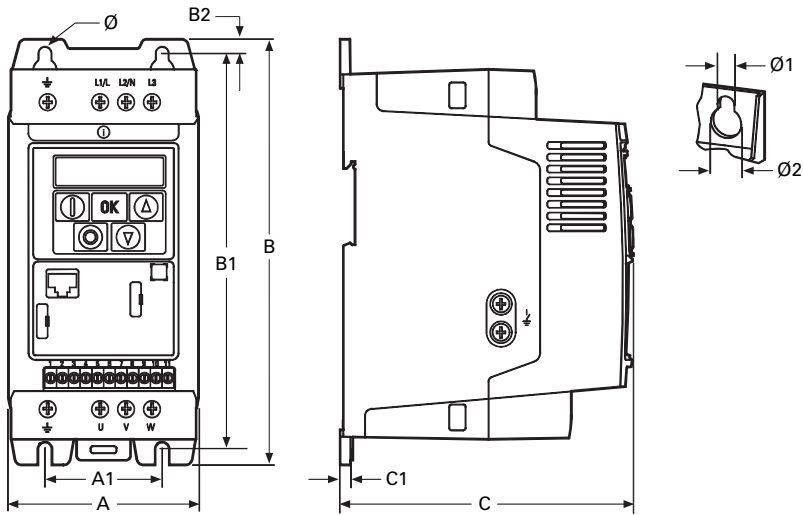
## Adjustable Frequency Drives

### PowerXL DA1 Series Drives

#### Dimensions

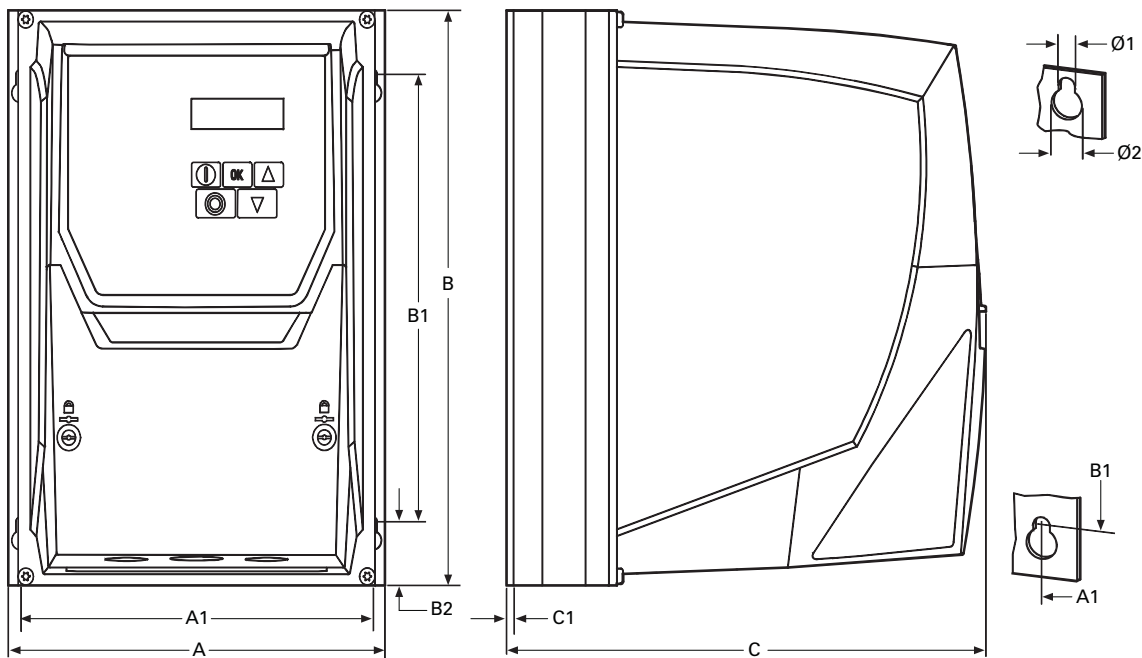
Approximate Dimensions in Inches (mm)

#### 2 DA1, Sizes FS2 and FS3, Degree of Protection IP20/NEMA 0



Frame Size	A	A1	B	B1	B2	C	C1	Ø1	Ø2	Weight lbs (kg)
FS2	4.21 (107.0)	2.95 (75.0)	9.09 (231.0)	8.46 (215.0)	0.31 (8.0)	7.32 (186.0)	0.20 (5.0)	0.24 (6.0)	0.47 (12.0)	3.97 (1.8)
FS3	5.16 (131.0)	3.94 (100.0)	10.75 (273.0)	10.04 (255.0)	0.33 (8.5)	8.03 (204.0)	0.20 (5.0)	0.24 (6.0)	0.47 (12.0)	7.72 (3.5)

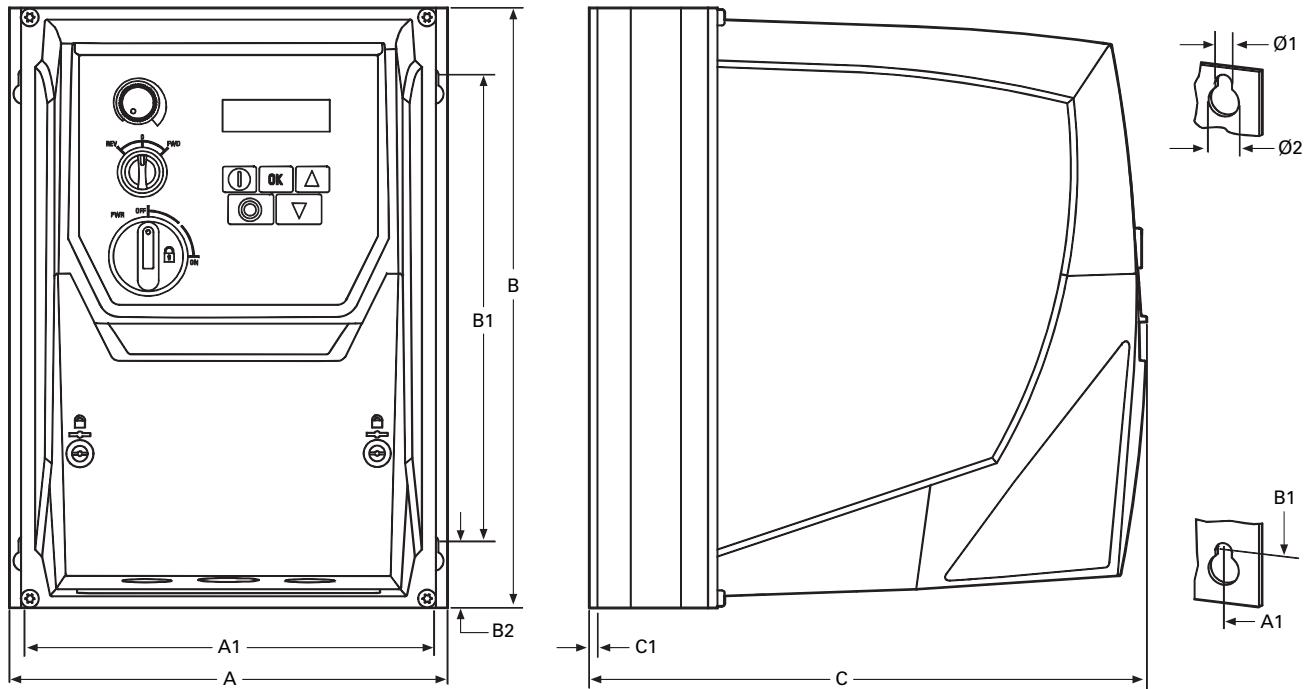
#### DA1, Sizes FS2 and FS3, Degree of Protection IP66/NEMA 4



Frame Size	A	A1	B	B1	B2	C	C1	Ø1	Ø2	Weight lbs (kg)
FS2	7.40 (188.0)	6.93 (176.0)	10.12 (257.0)	7.87 (200.0)	0.79 (20.0)	9.42 (239.3)	0.14 (3.5)	0.16 (4.2)	0.33 (8.5)	10.4 (4.5)
FS3	8.29 (211.0)	7.78 (198.0)	12.20 (310.0)	9.90 (252.0)	0.98 (25.0)	10.48 (266.3)	0.14 (3.5)	0.16 (4.2)	0.33 (8.5)	15.9 (7.0)

Approximate Dimensions in Inches (mm)

## DA1, Sizes FS2 and FS3, Degree of Protection IP66/NEMA 4, with Local Controls



Frame Size	A	A1	B	B1	B2	C	C1	Ø1	Ø2	Weight lbs (kg)
FS2	7.40 (188.0)	6.93 (176.0)	10.12 (257.0)	7.87 (200.0)	0.79 (20.0)	9.42 (239.3)	0.14 (3.5)	0.16 (4.2)	0.33 (8.5)	10.6 (4.8)
FS3	8.29 (211.0)	7.78 (198.0)	12.20 (310.0)	9.90 (252.0)	0.98 (25.0)	10.48 (266.3)	0.14 (3.5)	0.16 (4.2)	0.33 (8.5)	16.1 (7.3)



## M-Max Series Drives for Machinery Applications

2



### Product Description

Eaton's M-Max™ Series Sensorless Vector Adjustable Frequency AC Drives are the next generation of drives specifically engineered for today's machinery applications. These micro-processor-based drives have standard features that can be programmed to tailor the drive's performance to suit a wide variety of application requirements. The M-Max product line uses a 32-bit microprocessor and insulated gate bipolar transistors (IGBTs) that provide quiet motor operation, high motor efficiency, and smooth low-speed performance. The size and simplicity of the M-Max make it ideal for hassle-free installation. Models rated at 575 volts, three-phase, 50/60 Hz are available in sizes ranging from 1 to 7-1/2 hp. Models rated at 480 volts, three-phase, 50/60 Hz are available in sizes ranging from 1/2 to 25 hp. Models rated at 240 volts, single- or three-phase, 50/60 Hz are available in sizes ranging from 1/4 to 15 hp. Models rated at 115 volts, single-phase, 50/60 Hz are available in the 1/4 to 1-1/2 hp size range.

The standard drive includes a digital display, and operating and programming keys on a visually appealing, efficient application programming interface. The display provides drive monitoring, as well as adjustment and diagnostic information. The keys are used for digital adjustment and programming of the drive, as well as for operator control. Separate terminal blocks for control and power wiring are provided for customer connections.

### Contents

#### Description

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M-Max Series Drives	
Standards and Certifications . . . . .	<b>V6-T2-37</b>
Catalog Number Selection . . . . .	<b>V6-T2-37</b>
Product Selection . . . . .	<b>V6-T2-38</b>
Accessories . . . . .	<b>V6-T2-39</b>
Technical Data and Specifications . . . . .	<b>V6-T2-42</b>
Dimensions . . . . .	<b>V6-T2-44</b>

### Features

- Ease of use—preset application macros, startup wizard, diagnostic capabilities
- Compact, space-saving design
- Rugged and reliable—150% torque for one minute, 50C rated, conformal coated boards
- DIN rail and screw mountable
- Side-by-side installation
- Industry leading efficiency delivers energy savings to the customer
- Integrated 5% DC choke (FS4 and FS5)
- Integrated EMC filters make the unit suitable for commercial and industrial networks
- IP21 as standard, option for NEMA® 1 (FS4 and FS5)
- IP20 as standard, option for IP21 and NEMA 1 (FS1–FS3)
- Brake chopper as standard in three-phase, applications of frames 2 (FS2) and larger
- Temperature-controlled fan
- RS-485/Modbus® as standard
- PID controller as standard
- Several fieldbus options
  - PROFIBUS
  - DeviceNet
  - CANopen

## Standards and Certifications

### Product

- Complies with EN61800-3 (2004)

### EMC (At Default Settings)

- EMC Category C2, C3, and C4 (Level H): With an internal RFI filter option

### Safety<sup>①</sup>

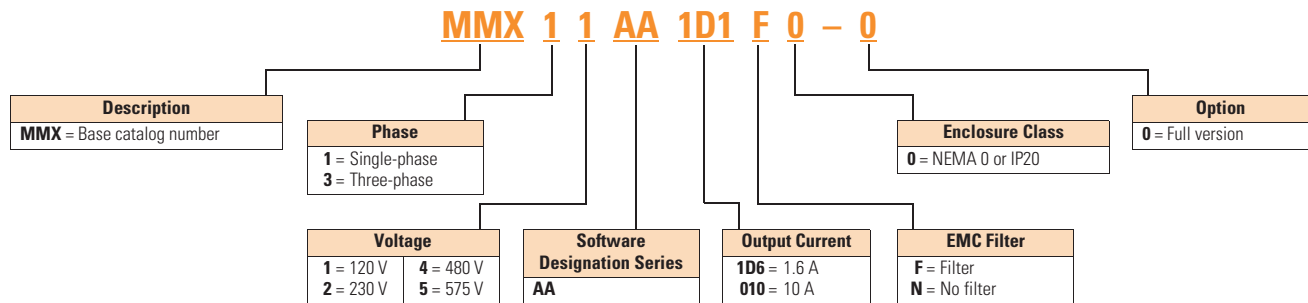
- 61800-5-1
- EN60204-1
- CE
- UL
- cUL
- IEC
- RoHS compliant



### Note

- <sup>①</sup> See unit nameplate for more detailed approvals.

## Catalog Number Selection



## Product Selection

2

## M-Max

## M-Max Basic Controller



hp <sup>①</sup>	Volts <sup>②</sup>	100% Continuous Current I <sub>N</sub> (A)	Nominal Input Current (A)	Frame Size	Catalog Number <sup>③</sup>	
1/4	100–120 V single-phase in 230 V three-phase out	1.7	9.2	FS2	MMX11AA1D7N0-0 <sup>④</sup>	
1/2		2.4	11.6		MMX11AA2D4N0-0 <sup>④</sup>	
3/4		2.8	12.4		MMX11AA2D8N0-0 <sup>④</sup>	
1		3.7	15		MMX11AA3D7N0-0 <sup>④</sup>	
1-1/2		4.8	16.5		FS3	MMX11AA4D8N0-0 <sup>④</sup>
1/4	200–240 V single-phase in 230 V three-phase out	1.7	4.2	FS1	MMX12AA1D7N0-0	
1/2		2.4	5.7		MMX12AA2D4N0-0	
3/4		2.8	6.6		MMX12AA2D8N0-0	
1		3.7	8.3		FS2	MMX12AA3D7N0-0
1-1/2		4.8	11.2		MMX12AA4D8N0-0	
2		7	14.1		MMX12AA7D0N0-0	
3		9.6	15.8	FS3	MMX12AA9D6N0-0	
1/4	200–240 V three-phase in 230 V three-phase out	1.7	2.7	FS1	MMX32AA1D7N0-0	
1/2		2.4	3.5		MMX32AA2D4N0-0	
3/4		2.8	3.8		MMX32AA2D8N0-0	
1		3.7	4.3		FS2	MMX32AA3D7N0-0
1-1/2		4.8	6.8		MMX32AA4D8N0-0	
2		7	8.4		MMX32AA7D0N0-0	
3		11	13.4	FS3	MMX32AA011N0-0	
5		17	17	FS4	MMX32AA017N0-0	
7-1/2		25	25		MMX32AA025N0-0	
10		31	31	FS5	MMX32AA031N0-0	
15		38	38		MMX32AA038N0-0	
1/2	380–480 V three-phase in 460 V three-phase out	1.3	2.2	FS1	MMX34AA1D3N0-0	
3/4		1.9	2.8		MMX34AA1D9N0-0	
1		2.4	3.2		MMX34AA2D4N0-0	
1-1/2		3.3	4		FS2	MMX34AA3D3N0-0
2		4.3	5.6		MMX34AA4D3N0-0	
3		5.6	7.3		MMX34AA5D6N0-0	
4		7.6	9.6	FS3	MMX34AA7D6N0-0	
5		9	11.5		MMX34AA9D0N0-0	
7-1/2		12	14.9		MMX34AA012N0-0	
10		14	18.7		MMX34AA014N0-0	
10		16	16	FS4	MMX34AA016N0-0	
15		23	23		MMX34AA023N0-0	
20		31	31	FS5	MMX34AA031N0-0	
25		38	38		MMX34AA038N0-0	
1	575 V three-phase in 575 V three-phase out	1.7	2.0	FS3	MMX35AA1D7N0-0 <sup>⑤</sup>	
2		2.7	3.6		MMX35AA2D7N0-0 <sup>⑤</sup>	
3		3.9	5.0		MMX35AA3D9N0-0 <sup>⑤</sup>	
5		6.1	7.6		MMX35AA6D1N0-0 <sup>⑤</sup>	
7-1/2		9.0	10.4		MMX35AA9D0N0-0 <sup>⑤</sup>	

## Notes

- <sup>①</sup> Horsepower ratings are based on the use of a 240 V, 460 V, and 575 V NEMA B, four- or six-pole squirrel cage induction motor and are for reference only. Units are to be selected such that the motor current is less than or equal to the MMX rated continuous output current.
- <sup>②</sup> For 208 V, 380 V, or 415 V applications, select the unit such that the motor current is less than or equal to the MMX rated continuous output current.
- <sup>③</sup> For EMC filtered unit, replace “NO-0” with “FO-0”.
- <sup>④</sup> EMC filters are not available on MMX11 units.
- <sup>⑤</sup> All 575 V units come with EMC filter standard.

## Accessories

### M-Max Copy/Paste Module

Description	Catalog Number
Module is plugged onto the front of the drive to provide: upload/download of all parameters, direct link to a PC via USB interface for parameter assignment via MaxConnect software, and copying of parameters for a series of devices or when exchanging devices. No PC required	<b>MMX-COM-PC</b>

### PC Cable

Description	Catalog Number
Remote download USB to RJ-45 cable with software driver disk	<b>REM-USB-DOWN</b>

### NEMA Type 1 Kits <sup>①</sup>

Description	Catalog Number
NEMA Type 1 and IP21 kit for frame 1	<b>MMX-IP21-FS1</b>
NEMA Type 1 and IP21 kit for frame 2	<b>MMX-IP21-FS2</b>
NEMA Type 1 and IP21 kit for frame 3	<b>MMX-IP21-FS3</b>
NEMA Type 1 for frame 4	<b>MMX-CKIT-FS4</b>
NEMA Type 1 for frame 5	<b>MMX-CKIT-FS5</b>

### Optional Communication Modules

Network cards require communication adapter.

Description	Catalog Number
Communication adapter kit (FS1–FS3)	<b>MMX-NET-XA</b>
PROFIBUS DP network card with serial connection <sup>②</sup>	<b>XXM-NET-PS-A</b>
PROFIBUS DP network card with Sub-D connection <sup>②</sup>	<b>XXM-NET-PD-A</b>
DeviceNet network card <sup>②</sup>	<b>XXM-NET-DN-A</b>
CANopen network card <sup>②</sup>	<b>XXM-NET-CO-A</b>

### Remote Keypad <sup>③</sup>

There are three components needed for a full remote keypad.

Description	Catalog Number
Bezel and cable	<b>OPTRMT-BP-HMAX <sup>③</sup></b>
Remote copy/paste keypad	<b>MMX-REMKEY-TEXT <sup>③</sup></b>
VFD adapter	<b>MMX-ADAPTER-RJ45 <sup>③</sup></b>

#### Notes

- <sup>①</sup> NEMA Type 1 kit provides conduit entry plate.
- <sup>②</sup> Requires communication adapter kit.
- <sup>③</sup> All three components are required for remote keypad operation.

# 2.5

## Adjustable Frequency Drives

### M-Max Series Drives

2

#### Line and Load Reactors

A line and load reactor is a three-phase inductance filter that can be placed on the line and load side of the AFD to help improve the harmonic performance of the system. Consult the factory for additional filtering options and further technical details.

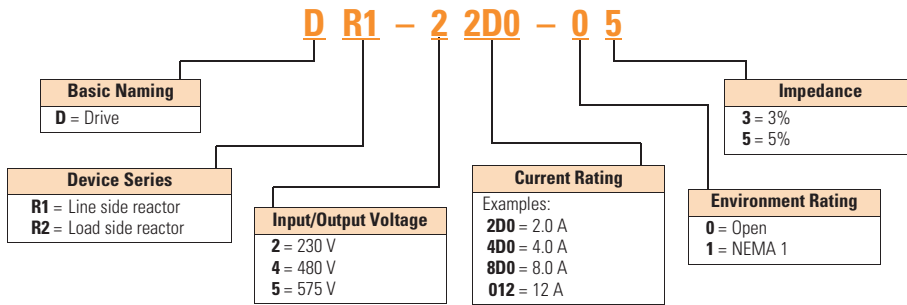
#### DR1 Line Reactor

A line reactor helps to provide a moderate reduction in current harmonics similar to a DC choke. It also provides increased input protection for AFD and its semiconductors from line transients helping to extend the life of the AFD.

#### DR2 Output Reactor

An output filter is used to reduce the transient voltage (dV/dt) at the motor terminals. The output filter is recommended for cable lengths exceeding 100 ft (30 m) with a drive of 3 hp and above and for cable lengths of 33 ft (10 m) with a drive of 2 hp and below.

#### Line and Load Reactors—Catalog Number Selection



#### Line and Load Reactors—230 V

hp (CT)	Open Load Reactor		Line Reactor		NEMA 1 Load Reactor		Line Reactor	
	3%	5%	3%	5%	3%	5%	3%	5%
0.33	DR2-22D0-03	DR2-22D0-05	DR1-21D7-03	DR1-21D7-05	DR2-22D0-13	DR2-22D0-15	DR1-21D7-13	DR1-21D7-15
0.5	DR2-22D0-03	DR2-22D0-05	DR1-22D2-03	DR1-22D2-05	DR2-22D0-13	DR2-22D0-15	DR1-22D2-13	DR1-22D2-15
0.75	DR2-24D0-03	DR2-24D0-05	DR1-23D2-03	DR1-23D2-05	DR2-24D0-13	DR2-24D0-15	DR1-23D2-13	DR1-23D2-15
1	DR2-24D0-03	DR2-28D0-05	DR1-24D2-03	DR1-24D2-05	DR2-24D0-13	DR2-28D0-15	DR1-24D2-13	DR1-24D2-15
1.5	DR2-28D0-03	DR2-28D0-05	DR1-26D0-03	DR1-26D0-05	DR2-28D0-13	DR2-28D0-15	DR1-26D0-13	DR1-26D0-15
2	DR2-28D0-03	DR2-28D0-05	DR1-26D8-03	DR1-26D8-05	DR2-28D0-13	DR2-28D0-15	DR1-26D8-13	DR1-26D8-15
3	DR2-2012-03	DR2-2012-05	DR1-29D6-03	DR1-29D6-05	DR2-2012-13	DR2-2012-15	DR1-29D6-13	DR1-29D6-15
5	DR2-2018-03	DR2-2018-05	DR1-2015-03	DR1-2015-05	DR2-2018-13	DR2-2018-15	DR1-2015-13	DR1-2015-15
7.5	DR2-2025-03	DR2-2025-05	DR1-2022-03	DR1-2022-05	DR2-2025-13	DR2-2025-15	DR1-2022-13	DR1-2022-15
10	DR2-2035-03	DR2-2035-05	DR1-2028-03	DR1-2028-05	DR2-2035-13	DR2-2035-15	DR1-2028-13	DR1-2028-15
15	DR2-2045-03	DR2-2045-05	DR1-2042-03	DR1-2042-05	DR2-2045-13	DR2-2045-15	DR1-2042-13	DR1-2042-15

## Line and Load Reactors—480 V

hp (CT)	Open Load Reactor	
	3%	5%
	0.5	DR2-41D0-03
0.75	DR2-42D0-03	DR2-42D0-05
1	DR2-42D0-03	DR2-42D0-05
1.5	DR2-44D0-03	DR2-44D0-05
2	DR2-44D0-03	DR2-44D0-05
3	DR2-48D0-03	DR2-48D0-05
5	DR2-48D0-03	DR2-48D0-05
7.5	DR2-4012-03	DR2-4012-05
10	DR2-4018-03	DR2-4018-05
15	DR2-4025-03	DR2-4025-05
20	DR2-4025-03	DR2-4025-05
25	DR2-4035-03	DR2-4035-05

Line Reactor	
3%	5%
DR1-41D1-03	DR1-41D1-05
DR1-41D6-03	DR1-41D6-05
DR1-42D1-03	DR1-42D1-05
DR1-43D0-03	DR1-43D0-05
DR1-43D4-03	DR1-43D4-05
DR1-44D8-03	DR1-44D8-05
DR1-47D6-03	DR1-47D6-05
DR1-4011-03	DR1-4011-05
DR1-4014-03	DR1-4014-05
DR1-4021-03	DR1-4021-05
DR1-4027-03	DR1-4027-05
DR1-4034-03	DR1-4034-05

NEMA 1 Load Reactor		Line Reactor	
3%	5%	3%	5%
DR2-41D0-13	DR2-41D0-15	DR1-41D1-13	DR1-41D1-15
DR2-42D0-13	DR2-42D0-15	DR1-41D6-13	DR1-41D6-15
DR2-42D0-13	DR2-42D0-15	DR1-42D1-13	DR1-42D1-15
DR2-44D0-13	DR2-44D0-15	DR1-43D0-13	DR1-43D0-15
DR2-44D0-13	DR2-44D0-15	DR1-43D4-13	DR1-43D4-15
DR2-48D0-13	DR2-48D0-15	DR1-44D8-13	DR1-44D8-15
DR2-48D0-13	DR2-48D0-15	DR1-47D6-13	DR1-47D6-15
DR2-4012-13	DR2-4012-15	DR1-4011-13	DR1-4011-15
DR2-4018-13	DR2-4018-15	DR1-4014-13	DR1-4014-15
DR2-4025-13	DR2-4025-15	DR1-4021-13	DR1-4021-15
DR2-4025-13	DR2-4025-15	DR1-4027-13	DR1-4027-15
DR2-4035-13	DR2-4035-15	DR1-4034-13	DR1-4034-15

## Line and Load Reactors—575 V

hp (CT)	Open Load Reactor	
	3%	5%
	1	DR2-52D0-03
2	DR2-54D0-03	DR2-54D0-05
3	DR2-54D0-03	DR2-54D0-05
5	DR2-58D0-03	DR2-58D0-05
7.5	DR2-58D0-03	DR2-58D0-05

Line Reactor	
3%	5%
DR1-51D7-03	DR1-51D7-05
DR1-43D4-03	DR1-52D7-05
DR1-53D9-03	DR1-53D9-05
DR1-56D1-03	DR1-56D1-05
DR1-59D0-03	DR1-59D0-05

NEMA 1 Load Reactor		Line Reactor	
3%	5%	3%	5%
DR2-52D0-13	DR2-52D0-15	DR1-51D7-13	DR1-51D7-15
DR2-54D0-13	DR2-54D0-15	DR1-52D7-13	DR1-52D7-15
DR2-54D0-13	DR2-54D0-15	DR1-53D9-13	DR1-53D9-15
DR2-58D0-13	DR2-58D0-15	DR1-56D1-13	DR1-56D1-15
DR2-58D0-13	DR2-58D0-15	DR1-59D0-13	DR1-59D0-15

## Technical Data and Specifications

### Ratings

#### M-Max Basic Controller IP20 Standard Ratings

Description	Specification
<b>Protections</b>	
Overcurrent protection	Trip limit $4.0 \times I_{fl}$ instantaneously
Overvoltage protection	115/230 V series: 437 Vdc; 400 V series: 874 Vdc; 575 V series: 1048 Vdc trip level
Undervoltage protection	115/230 V series: 183 Vdc; 400 V series: 333 Vdc; 575 V series: 460 Vdc trip level
Ground fault protection	Ground fault is tested before every start. In case of ground fault in motor or motor cable, only the frequency converter is protected
Overtemperature protection	Yes
Motor overload protection	Yes
Motor stall protection	Yes
Motor underload protection	Yes
Short-circuit protection	100 kAIC with Type J fuses

#### Programmable Parameters

Description
Application macros: basic, pump, fan and high load (hoist)
Programmable start/stop and reverse signal logic (sinking or sourcing)
Reference scaling
Programmable start and stop functions
DC-brake at start and stop
Programmable V/Hz curve
Adjustable switching frequency
Autorestart function after fault
Protections and supervisions (all fully programmable; off, warning, fault)
Current signal input fault
External fault
Fieldbus communication
Eight preset speeds
Analog input range selection, signal scaling and filtering
PID controller
Skip frequencies

### Specifications

#### M-Max Series Drives

Description	Specification
<b>Input Ratings</b>	
Input voltage ( $V_{in}$ )	+10%/–15%
Input frequency ( $f_{in}$ )	50/60 Hz (variation up to 45–66 Hz)
Connection to power	Once per minute or less (typical operation)
<b>Output Ratings</b>	
Output voltage	0 to $V_{in}$ ①
Continuous output current	Continuous rated current $I_N$ at ambient temperature max. 122 °F (50 °C), overload $1.5 \times I_N$ max. 1 min/10 min
Output frequency	0 to 320 Hz
Frequency resolution	0.01 Hz
Initial output current ( $I_{fl}$ )	Current $2 \times I_N$ for 2 seconds in every 20-second period Torque depends on motor
<b>Control Characteristics</b>	
Control method	Frequency control (V/Hz) open loop or sensorless vector control
Switching frequency	1.5 to 16 kHz; default 4 kHz
Frequency reference	Analog input: resolution 0.1% (10-bit), accuracy $\pm 1\%$ V/Hz Panel reference: resolution 0.01 Hz
Field weakening point	30 to 320 Hz
Acceleration time	0 to 3000 sec
Deceleration time	0 to 3000 sec
Braking torque	DC brake: $30\% \times T_n$ (without brake option)
<b>Brake Resistor (Minimum Values) ②</b>	
230 V Series	FS2 35 ohms and FS3 26 ohms, FS4 14 ohms, FS5 9 ohms
400 V Series	FS2 75 ohms and FS3 54 ohms, FS4 28 ohms, FS5 17 ohms
575 V Series	FS3 103 ohms
<b>Ambient Conditions</b>	
Ambient operating temperature	14 °F (–10 °C), no frost to 122 °F (+50 °C): Rated loadability $I_N$
Storage temperature	–40 °F (–40 °C) to 158 °F (70 °C)
Relative humidity	0 to 95% RH, noncondensing, non-corrosive, no dripping water
Air quality	Chemical vapors: IEC 721-3-3, unit in operation, Class 3C2; Mechanical particles: IEC 721-3-3, unit in operation, Class 3S2
Altitude	100% load capacity (no derating) up to 3280 ft (1000 m); 1% derating for each 328 ft (100 m) above 3280 ft (1000 m); max. 6560 ft (2000 m)
Vibration	EN 60068-2-6; 3 to 150 Hz, displacement amplitude 1 mm (peak) at 3 to 15.8 Hz, max. acceleration amplitude 1G at 15.8 to 150 Hz
Shock	EN 50178, IEC 68-2-27 UPS Drop test (for applicable UPS weights); storage and shipping: max. 15 g, 11 ms (in package)
Enclosure class	IP20 (FS1–FS3) IP21 (FS4 and FS5)

#### Notes

- ① Exception: 115 V single-phase in, 230 V three-phase out.
- ② Only three-phase FS2 and FS3 drives are equipped with brake chopper circuit.

## Standards

### I/O Specifications

- Digital inputs DI1–DI6 are freely programmable. The user can assign multiple functions to a single input
- Digital, relay, and analog outputs are freely programmable

Includes:

- Six digital inputs
- Two analog inputs
  - 4–20 mA
  - 0–10 V
- One analog output
- One digital output
- Two relay outputs
- RS-485 interface

### Reliability

- Pretested components
- Computerized testing
- Final test with full load
- Conformal-coated boards
- Eaton's Electrical Services & Systems: national network of AF drive specialists

### M-Max I/O Interface

Terminal	Signal	Factory Preset	Description
1	+10 V	—	Ref. output voltage
2	AI1	Freq. reference <sup>P1</sup>	Maximum load 10 mA
3	GND	—	0–+10 V Ri = 200k ohms [min.]
6	24 V	—	I/O signal ground
7	GND	—	24 V output for DIs
8	DI1	Start forward <sup>P1</sup>	±20%, max. load 50 mA
9	DI2	Start reverse <sup>P1</sup>	I/O signal ground
10	DI3	Preset speed <sup>P1</sup>	—
A	A	FB communication	—
B	B	FB communication	—
4	AI2	PI actual value <sup>P1</sup>	RS-485 signal A
5	GND	—	RS-485 signal B
13	GND	—	0[4]–20 mA, Ri = 200k ohms
14	DI4	Preset speed B1 <sup>P1</sup>	I/O signal ground
15	DI5	Fault reset <sup>P1</sup>	—
16	DI6	Disable PI contr. <sup>P1</sup>	0–+30 V Ri = 12k ohms min.
18	A0	Output frequency <sup>P1</sup>	0–+30 V Ri = 12k ohms min.
20	D0	Active = READY <sup>P1</sup>	0(2)–10 V, RL = 500 ohms
22	R011	Relay out 1	Open collector, max. load 48V/50 mA
23	R012	—	Active = RUN <sup>P1</sup>
24	R021	Relay out 2	Max. switching load: 250 Vac/2 A or 250 Vdc/0.4 A
25	R022	—	Active = FAULT <sup>P1</sup>
26	R023	—	—

### Note

<sup>P1</sup> Parameter-selectable function.



# 2.5

## Adjustable Frequency Drives

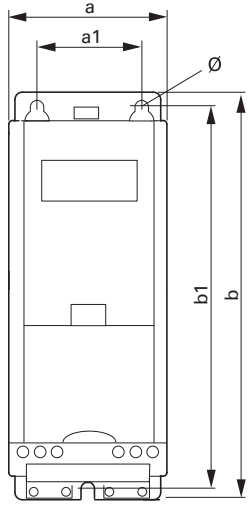
### M-Max Series Drives

#### Dimensions

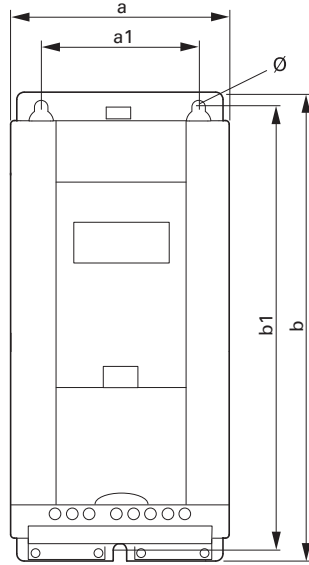
Approximate Dimensions in Inches (mm)

2

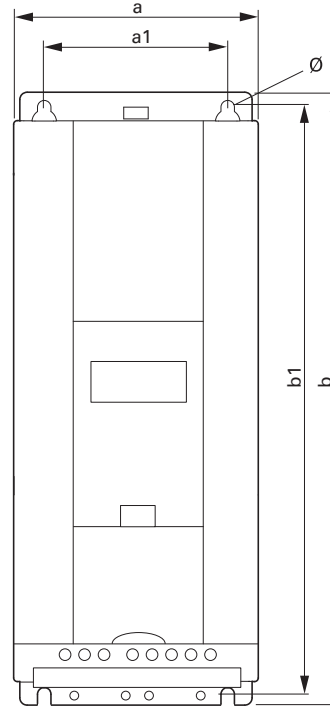
#### Dimensions and Frame Sizes, FS1–FS3 (FS = Frame Size)



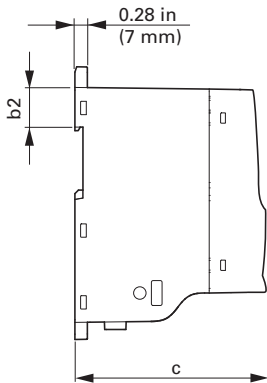
FS1



FS2

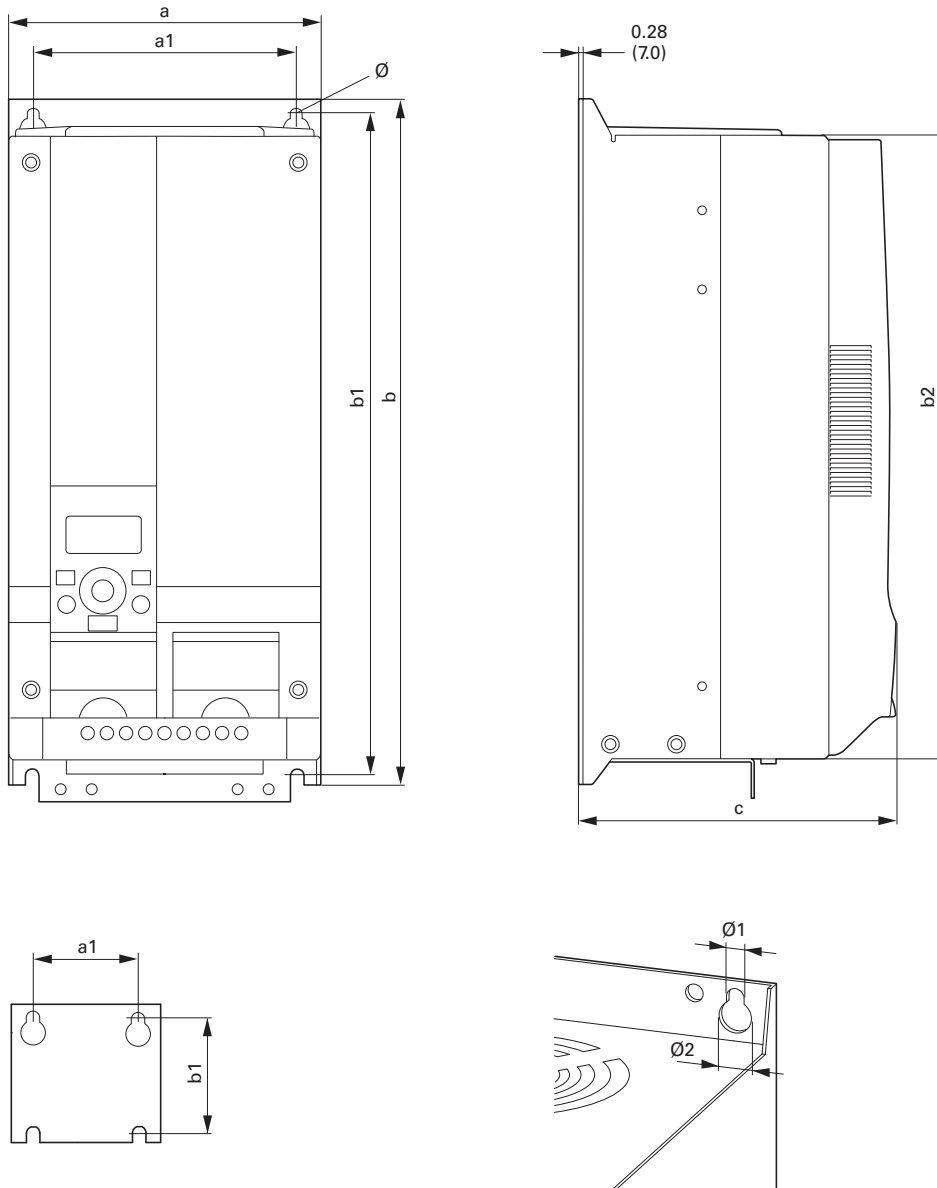


FS3



Approximate Dimensions in Inches (mm)

**Dimensions and Frame Sizes, FS4 and FS5 (FS = Frame Size)**



#### Dimensions and Frame Sizes

Approximate Dimensions in inches (mm)

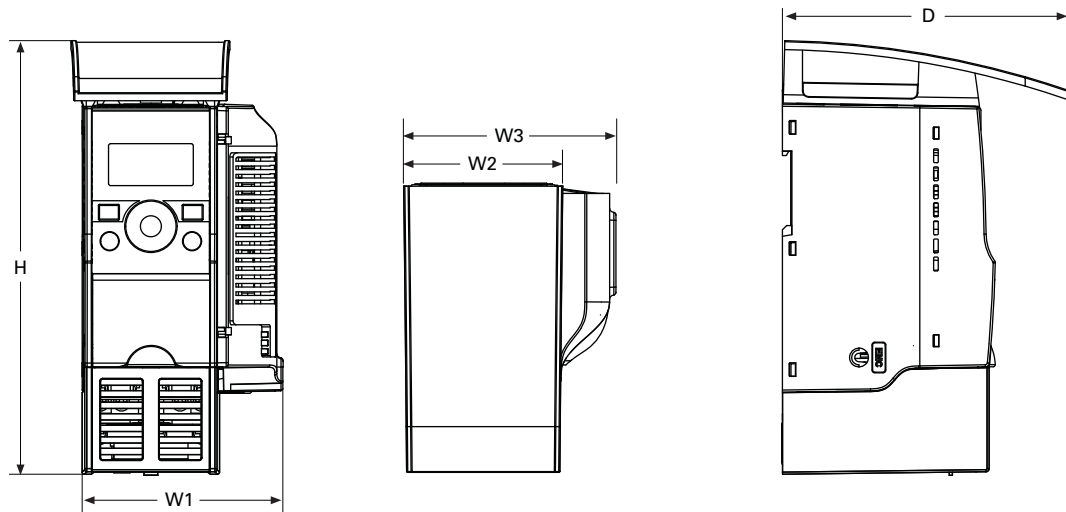
Part Number	a	a1	b	b1	b2	c	Ø, Ø1	Ø2	Installation Size
MMX12AA1D7_	2.60	1.50	6.30	5.79	1.26	4.02	0.18	—	FS1
MMX12AA2D4_	(66)	(38)	(160)	(147)	(32)	(102)	(4.5)		
MMX12AA2D8_									
MMX32AA1D7_									
MMX32AA2D4_									
MMX32AA2D8_									
MMX34AA1D3_									
MMX34AA1D9_									
MMX34AA2D4_									
MMX11AA1D7_	3.54	2.46	7.68	7.17	1.26	4.14	2.17	—	FS2
MMX11AA2D4_	(90)	(62.5)	(195)	(182)	(32)	(105)	(5.5)		
MMX11AA2D8_									
MMX11AA3D7_									
MMX12AA3D7_									
MMX12AA4D8_									
MMX12AA7D0_									
MMX32AA3D7_									
MMX32AA4D8_									
MMX32AA7D0_									
MMX34AA3D3_									
MMX34AA4D3_									
MMX34AA5D6_									
MMX11AA4D8_	3.94	2.95	9.96	9.53	1.34	4.41	2.17	—	
MMX12AA9D6_	(100)	(75)	(253)	(242)	(34)	(112)	(5.5)		
MMX32AA011_									
MMX34AA7D6_									
MMX34AA9D0_									
MMX34AA012_									
MMX34AA014_									
MMX35AA1D7_									
MMX35AA2D7_									
MMX35AA3D9_									
MMX35AA6D1_									
MMX35AA9D0_									
MMX32AA012_	6.50	5.51	14.57	13.82	13.27	6.61	0.28	0.55	
MMX32AA017_	(165.0)	(140.0)	(370.0)	(351.0)	(337.0)	(168.0)	(7.0)	(14.0)	
MMX32AA025_									
MMX34AA016_									
MMX34AA023_									
MMX32AA031_	6.50	5.51	16.30	15.67	15.08	8.07	0.28	0.55	FS5
MMX32AA038_	(165.0)	(140.0)	(414.0)	(398.0)	(383.0)	(205.0)	(7.0)	(14.0)	
MMX34AA031_									
MMX34AA038_									

**Note**

1 in = 25.4 mm, 1 mm = 0.0394 in

Approximate Dimensions in Inches (mm)

### NEMA 1/IP21 M-Max Drives and Communication Adapter Kit



Frame Type	H	W1	W2	W3	D
FS1	8.14 (206.7)	3.77 (95.7)	2.99 (75.9)	3.98 (101.2)	5.41 (137.5)
FS2	9.90 (251.5)	4.72 (120.0)	3.97 (100.8)	4.94 (125.5)	5.68 (144.2)
FS3	12.26 (311.5)	5.12 (130.1)	4.36 (110.8)	5.33 (135.3)	6.32 (160.5)
FS4	16.40 (416.6)	—	6.50 (165.0)	—	6.61 (166.0)
FS5	18.10 (460.1)	—	6.50 (165.0)	—	8.07 (205.0)

#### DG1 General Purpose Drive

2



### Contents

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PowerXL DG1 Series Enclosed Drives	V6-T2-74

## PowerXL DG1 Series Drives

### Product Description

The DG1 general purpose drives are part of Eaton's next generation PowerXL Series of adjustable frequency drives specifically engineered for today's more demanding commercial and industrial applications. The power unit makes use of the most sophisticated semiconductor technology and a highly modular construction that can be flexibly adapted to meet the customer's needs.

The control module was designed to include today's standard communication protocols and I/O while still having the modularity to add additional option cards.

Eaton's patented Active Energy Control is also a standard feature on DG1 drives, offering customers increased efficiency, safety and reliability.

These drives continue the tradition of robust performance and raise the bar on features and functionality, ensuring the best solution at the right price.

### Product Range

230 V to 125 hp, 312 A, 90 kW

480 V to 1000 hp, 1180 A, 630 kW

575 V to 800 hp, 820 A, 597 kW

### Features and Benefits

#### Hardware

- Brake chopper standard on Frames 0, 1, 2, 3
- Dual overload ratings
  - 110% variable torque ( $I_L$ )
  - 150% constant torque ( $I_H$ )
- Open Type/IP00 or IP20 or Type 1/IP21 or Type 12/IP54 enclosures available
- Integrated common mode reduction 5% DC link choke with input surge protection
- EMI/RFI filters standard on all drives—meets EMC Category C2
- Real-time clock—supports calendaring and PLC functionality
- Graphic LCD display and keypad—supports simple menu navigation as well as on-screen diagnostics and troubleshooting
- LOCAL/REMOTE operation from keypad and two configurable soft keys
- Conformal coated control and power boards standard

- Control logic can be powered from an external auxiliary control panel—internal drive functions and fieldbus if necessary
- Standard I/O:
  - 8DI, 1DO
  - 2AI, 2AO
  - 2FC, 1FA relays
- Standard communications:
  - EtherNet/IP, Modbus TCP
  - RS-485: Modbus RTU, BACnet MS/TP
- Seamless integration into EtherNet/IP networks via EIP-Assist I/O tag-generation tool
- Two expansion slots—intended to support additional I/O or communication protocols as necessary
- Quick disconnect terminals for I/O connections—supports fast easy installation
- Safe Torque Off (STO) built-in with functional safety SIL1 certification

#### Software

- Active energy control—minimizes energy losses in your motor, resulting in industry-leading energy efficiency for your application
- Quick Start Wizard upon initial power-up supports fast, easy installation
- Standard applications:
  - Standard
  - Multi-pump and fan Control
  - Multi-PID
  - Multi-purpose
- Copy/paste functionality on drive keypad—allows for fast setup of multiple drives
- Pre-programmed I/O—supports fast, easy installation for most applications
- Dynamic motor regenerative energy management
- Advanced PC Tool with diagnostic capabilities
- Two keypad software keys for easy menu navigation and shortcuts

### Standards and Certifications

#### Product

- IEC/EN 61800-5-1
- IEC/EN 61800-5-2
- UL 508C
- IEC 61508
- EN 62061
- EN ISO 13849-1

#### EMC

- Immunity: IEC/EN 61800-3
- Category C2

#### Certification

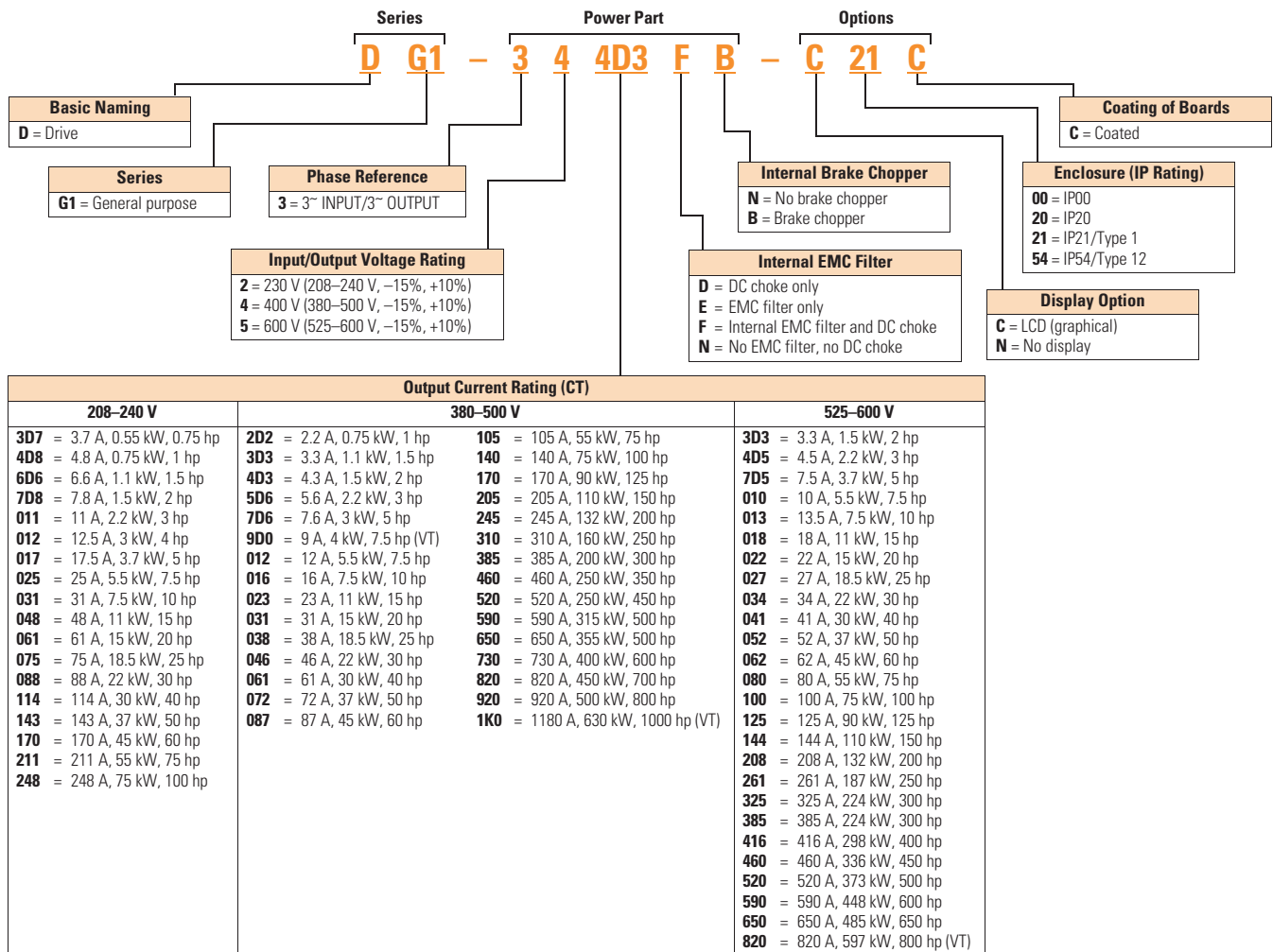
- UL
- cUL
- CE
- C-Tick
- RoHS
- EAC
- Plenum rated



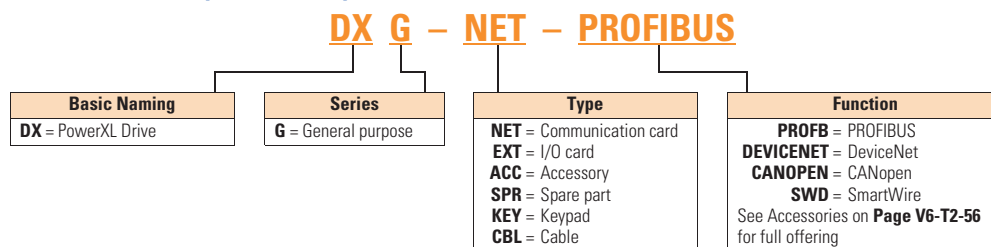
### Catalog Number Selection

Catalog Number Selection is for illustrative purposes only and not to be used to create new catalog numbers.

#### PowerXL Series—DG1 General Purpose Drive



#### PowerXL Series—DG1 General Purpose Drive Option Boards



# 2.6

## Adjustable Frequency Drives

### PowerXL DG1 Series Drives

#### Product Selection

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#### DG1 Series Drives—208–240 Volt

##### PowerXL Series—DG1

##### IP20



Frame Size	Constant Torque (CT) / High Overload (I <sub>H</sub> )			Variable Torque (VT) / Low Overload (I <sub>L</sub> )			Catalog Number
	230 V, 50 Hz kW Rating	230 V, 60 Hz hp	Current A	230 V, 50 Hz kW Rating	230 V, 60 Hz hp	Current A	
FR0	0.55	0.75	3.7	0.75	1	4.8	DG1-323D7EB-C20C
	0.75	1	4.8	1.1	1.5	6.6	DG1-324D8EB-C20C
	1.1	1.5	6.6	1.5	2	7.8	DG1-326D6EB-C20C

##### PowerXL Series—DG1

##### Type 1/IP21



Frame Size	Constant Torque (CT) / High Overload (I <sub>H</sub> )			Variable Torque (VT) / Low Overload (I <sub>L</sub> )			Catalog Number
	230 V, 50 Hz kW Rating	230 V, 60 Hz hp	Current A	230 V, 50 Hz kW Rating	230 V, 60 Hz hp	Current A	
FR1	0.55	0.75	3.7	0.75	1	4.8	DG1-323D7FB-C21C
	0.75	1	4.8	1.1	1.5	6.6	DG1-324D8FB-C21C
	1.1	1.5	6.6	1.5	2	7.8	DG1-326D6FB-C21C
	1.5	2	7.8	2.2	3	11	DG1-327D8FB-C21C
	2.2	3	11	3	—	12.5	DG1-32011FB-C21C
FR2	3	—	12.5	3.7	5	17.5	DG1-32012FB-C21C
	3.7	5	17.5	5.5	7.5	25	DG1-32017FB-C21C
	5.5	7.5	25	7.5	10	31	DG1-32025FB-C21C
FR3	7.5	10	31	11	15	48	DG1-32031FB-C21C
	11	15	48	15	20	61	DG1-32048FB-C21C
FR4	15	20	61	18.5	25	75	DG1-32061FN-C21C
	18.5	25	75	22	30	88	DG1-32075FN-C21C
	22	30	88	30	40	114	DG1-32088FN-C21C
FR5	30	40	114	37	50	143	DG1-32114FN-C21C
	37	50	143	45	60	170	DG1-32143FN-C21C
	45	60	170	55	75	211	DG1-32170FN-C21C
FR6	55	75	211	75	100	261	DG1-32211FN-C21C
	75	100	248	90	125	312	DG1-32248FN-C21C

## PowerXL Series—DG1

## Type 12/IP54



Frame Size	Constant Torque (CT) / High Overload (I <sub>H</sub> )			Variable Torque (VT) / Low Overload (I <sub>L</sub> )			Catalog Number
	230 V, 50 Hz kW Rating	230 V, 60 Hz hp	Current A	230 V, 50 Hz kW Rating	230 V, 60 Hz hp	Current A	
FR1	0.55	0.75	3.7	0.75	1	4.8	DG1-323D7FB-C54C
	0.75	1	4.8	1.1	1.5	6.6	DG1-324D8FB-C54C
	1.1	1.5	6.6	1.5	2	7.8	DG1-326D6FB-C54C
	1.5	2	7.8	2.2	3	11	DG1-327D8FB-C54C
	2.2	3	11	3	—	12.5	DG1-32011FB-C54C
FR2	3	—	12.5	3.7	5	17.5	DG1-32012FB-C54C
	3.7	5	17.5	5.5	7.5	25	DG1-32017FB-C54C
	5.5	7.5	25	7.5	10	31	DG1-32025FB-C54C
FR3	7.5	10	31	11	15	48	DG1-32031FB-C54C
	11	15	48	15	20	61	DG1-32048FB-C54C
FR4	15	20	61	18.5	25	75	DG1-32061FN-C54C
	18.5	25	75	22	30	88	DG1-32075FN-C54C
	22	30	88	30	40	114	DG1-32088FN-C54C
FR5	30	40	114	37	50	143	DG1-32114FN-C54C
	37	50	143	45	60	170	DG1-32143FN-C54C
	45	60	170	55	75	211	DG1-32170FN-C54C
FR6	55	75	211	75	100	261	DG1-32211FN-C54C
	75	100	248	90	125	312	DG1-32248FN-C54C



# 2.6

## Adjustable Frequency Drives

### PowerXL DG1 Series Drives

#### DG1 Series Drives—380–500 Volt

2

##### PowerXL Series—DG1 IP20



Frame Size	Constant Torque (CT) / High Overload (I <sub>H</sub> )			Variable Torque (VT) / Low Overload (I <sub>L</sub> )			Catalog Number
	480 V, 50 Hz kW Rating	480 V, 60 Hz hp	Current A	480 V, 50 Hz kW Rating	480 V, 60 Hz hp	Current A	
FR0	0.75	1	2.2	1.1	1.5	3.3	DG1-342D2EB-C20C
	1.1	1.5	3.3	1.5	2	4.6	DG1-343D3EB-C20C
	1.5	2	4.3	2.2	3	5.6	DG1-344D3EB-C20C
	2.2	3	5.6	3	5	7.6	DG1-345D6EB-C20C

##### PowerXL Series—DG1 Type 1/IP21



Frame Size	Constant Torque (CT) / High Overload (I <sub>H</sub> )			Variable Torque (VT) / Low Overload (I <sub>L</sub> )			Catalog Number
	400 V, 50 Hz kW Rating	460 V, 60 Hz hp	Current A	400 V, 50 Hz kW Rating	460 V, 60 Hz hp	Current A	
FR1	0.75	1	2.2	1.1	1.5	3.3	DG1-342D2FB-C21C
	1.1	1.5	3.3	1.5	2	4.3	DG1-343D3FB-C21C
	1.5	2	4.3	2.2	3	5.6	DG1-344D3FB-C21C
	2.2	3	5.6	3	5	7.6	DG1-345D6FB-C21C
	3	5	7.6	4	—	9	DG1-347D6FB-C21C
	4	—	9	5.5	7.5	12	DG1-349D0FB-C21C
FR2	5.5	7.5	12	7.5	10	16	DG1-34012FB-C21C
	7.5	10	16	11	15	23	DG1-34016FB-C21C
	11	15	23	15	20	31	DG1-34023FB-C21C
FR3	15	20	31	18.5	25	38	DG1-34031FB-C21C
	18.5	25	38	22	30	46	DG1-34038FB-C21C
	22	30	46	30	40	61	DG1-34046FB-C21C
FR4	30	40	61	37	50	72	DG1-34061FN-C21C
	37	50	72	45	60	87	DG1-34072FN-C21C
	45	60	87	55	75	105	DG1-34087FN-C21C
FR5	55	75	105	75	100	140	DG1-34105FN-C21C
	75	100	140	90	125	170	DG1-34140FN-C21C
	90	125	170	110	150	205	DG1-34170FN-C21C
FR6	110	150	205	132	200	261	DG1-34205FN-C21C
	132	200	245	160	250	310	DG1-34245FN-C21C

## PowerXL Series—DG1

## Type 12/IP54



Frame Size	Constant Torque (CT) / High Overload (I <sub>H</sub> )			Variable Torque (VT) / Low Overload (I <sub>L</sub> )			Catalog Number
	400 V, 50 Hz kW Rating	460 V, 60 Hz hp	Current A	400 V, 50 Hz kW Rating	460 V, 60 Hz hp	Current A	
FR1	0.75	1	2.2	1.1	1.5	3.3	DG1-342D2FB-C54C
	1.1	1.5	3.3	1.5	2	4.3	DG1-343D3FB-C54C
	1.5	2	4.3	2.2	3	5.6	DG1-344D3FB-C54C
	2.2	3	5.6	3	5	7.6	DG1-345D6FB-C54C
	3	5	7.6	4	—	9	DG1-347D6FB-C54C
	4	—	9	5.5	7.5	12	DG1-349D0FB-C54C
FR2	5.5	7.5	12	7.5	10	16	DG1-34012FB-C54C
	7.5	10	16	11	15	23	DG1-34016FB-C54C
	11	15	23	15	20	31	DG1-34023FB-C54C
FR3	15	20	31	18.5	25	38	DG1-34031FB-C54C
	18.5	25	38	22	30	46	DG1-34038FB-C54C
	22	30	46	30	40	61	DG1-34046FB-C54C
FR4	30	40	61	37	50	72	DG1-34061FN-C54C
	37	50	72	45	60	87	DG1-34072FN-C54C
	45	60	87	55	75	105	DG1-34087FN-C54C
FR5	55	75	105	75	100	140	DG1-34105FN-C54C
	75	100	140	90	125	170	DG1-34140FN-C54C
	90	125	170	110	150	205	DG1-34170FN-C54C
FR6	110	150	205	132	200	261	DG1-34205FN-C54C
	132	200	245	160	250	310	DG1-34245FN-C54C

## PowerXL Series—DG1

## Open Type/IP00



Frame Size	Constant Torque (CT) / High Overload (I <sub>H</sub> )			Variable Torque (VT) / Low Overload (I <sub>L</sub> )			Catalog Number
	230 V, 50 Hz kW Rating	230 V, 60 Hz hp	Current A	230 V, 50 Hz kW Rating	230 V, 60 Hz hp	Current A	
FR7	160	250	311	200	300	385	DG1-34310FN-C00C
	200	300	385	250	350	460	DG1-34385FN-C00C
	250	350	460	250	450	520	DG1-34460FN-C00C
	250	450	520	315	500	590	DG1-34520FN-C00C
FR8	315	500	590	355	500	650	DG1-34590FN-C00C
	355	500	650	400	600	730	DG1-34650FN-C00C
	400	600	730	450	700	820	DG1-34730FN-C00C
	450	700	820	500	800	920	DG1-34820FN-C00C
	500	800	920	560	900	1040	DG1-34920FN-C00C
	500	800	920	630	1000	1180	DG1-341K0FN-C00C

# 2.6

## Adjustable Frequency Drives

### PowerXL DG1 Series Drives

#### DG1 Series Drives—575 Volt

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##### PowerXL Series—DG1

##### Type 1/IP21



Frame Size	Constant Torque (CT) / High Overload (I <sub>H</sub> )			Variable Torque (VT) / Low Overload (I <sub>L</sub> )			Catalog Number
	575 V, 60 Hz kW Rating	575 V, 60 Hz hp	Current A	575 V, 60 Hz kW Rating	575 V, 60 Hz hp	Current A	
FR1	1.5	2	3.3	2.2	3	4.5	DG1-353D3FB-C21C
	2.2	3	4.5	3.7	5	7.5	DG1-354D5FB-C21C
	3.7	5	7.5	5.5	7.5	10	DG1-357D5FB-C21C
FR2	5.5	7.5	10	7.5	10	13.5	DG1-35010FB-C21C
	7.5	10	13.5	11	15	18	DG1-35013FB-C21C
	11	15	18	15	20	22	DG1-35018FB-C21C
FR3	15	20	22	18.5	25	27	DG1-35022FB-C21C
	18.5	25	27	22	30	34	DG1-35027FB-C21C
	22	30	34	30	40	41	DG1-35034FB-C21C
FR4	30	40	41	37	50	52	DG1-35041FN-C21C
	37	50	52	45	60	62	DG1-35052FN-C21C
	45	60	62	55	75	80	DG1-35062FN-C21C
FR5	55	75	80	75	100	100	DG1-35080FN-C21C
	75	100	100	90	125	125	DG1-35100FN-C21C
	90	125	125	110	150	144	DG1-35125FN-C21C
FR6	110	150	144	150	200	208	DG1-35144FN-C21C
	132	200	208	187	250	250	DG1-35208FN-C21C

##### PowerXL Series—DG1

##### Type 12/IP54



Frame Size	Constant Torque (CT) / High Overload (I <sub>H</sub> )			Variable Torque (VT) / Low Overload (I <sub>L</sub> )			Catalog Number
	575 V, 60 Hz kW Rating	575 V, 60 Hz hp	Current A	575 V, 60 Hz kW Rating	575 V, 60 Hz hp	Current A	
FR1	1.5	2	3.3	2.2	3	4.5	DG1-353D3FB-C54C
	2.2	3	4.5	3.7	5	7.5	DG1-354D5FB-C54C
	3.7	5	7.5	5.5	7.5	10	DG1-357D5FB-C54C
FR2	5.5	7.5	10	7.5	10	13.5	DG1-35010FB-C54C
	7.5	10	13.5	11	15	18	DG1-35013FB-C54C
	11	15	18	15	20	22	DG1-35018FB-C54C
FR3	15	20	22	18.5	25	27	DG1-35022FB-C54C
	18.5	25	27	22	30	34	DG1-35027FB-C54C
	22	30	34	30	40	41	DG1-35034FB-C54C
FR4	30	40	41	37	50	52	DG1-35041FN-C54C
	37	50	52	45	60	62	DG1-35052FN-C54C
	45	60	62	55	75	80	DG1-35062FN-C54C
FR5	55	75	80	75	100	100	DG1-35080FN-C54C
	75	100	100	90	125	125	DG1-35100FN-C54C
	90	125	125	110	150	144	DG1-35125FN-C54C
FR6	110	150	144	150	200	208	DG1-35144FN-C54C
	132	200	208	187	250	250	DG1-35208FN-C54C

## PowerXL Series—DG1

## Open Type/IP00



Frame Size	Constant Torque (CT) / High Overload (I <sub>H</sub> )			Variable Torque (VT) / Low Overload (I <sub>L</sub> )			Catalog Number
	230 V, 50 Hz kW Rating	230 V, 60 Hz hp	Current A	230 V, 50 Hz kW Rating	230 V, 60 Hz hp	Current A	
FR7	186.5	250	261	223.8	300	325	DG1-35261FN-C00C
	223.8	300	325	298.4	400	385	DG1-35325FN-C00C
	223.8	300	385	335.7	450	416	DG1-35385FN-C00C
FR8	298.4	400	416	335.7	450	460	DG1-35416FN-C00C
	335.7	450	460	373	500	520	DG1-35460FN-C00C
	373	500	520	447.6	600	590	DG1-35520FN-C00C
	447.6	600	590	484.9	650	650	DG1-35590FN-C00C
	484.9	650	650	522.2	700	750	DG1-35650FN-C00C
	484.9	650	650	596.8	800	820	DG1-35820FN-C00C

### Accessories

The PowerXL Series—DG1 drives can accommodate a wide selection of expander and adapter option boards to customize the drive for your application needs. The drive's control unit is designed to accept a total of two additional option boards.

The PowerXL Series—DG1 drives come with a factory-installed standard board configuration including the following:

- Standard I/O:
  - 8DI, 1DO
  - 2AI, 2AO
  - 2FC, 1FA relays
- Standard communications:
  - EtherNet/IP, Modbus TCP
  - RS-485: Modbus RTU, BACnet MS/TP

### PowerXL Series—DG1 I/O Card Kits

Description	Catalog Number
3 x DI, 3 x DO, 1 x thermistor, 24 Vdc/EXT option card	<b>DXG-EXT-3DI3DO1T</b>
1 x AI, 2 x AO (isolated to control board) option card	<b>DXG-EXT-1AI2AO</b>
3 x relay dry contact (2NO + 1NO/NC) option card	<b>DXG-EXT-3R0</b>
3 x PT100 RTD thermistor input option card	<b>DXG-EXT-THER1</b>
6 x DI 240 Vac input option card	<b>DXG-EXT-6DI</b>

### PowerXL Series—DG1 Communication Card Kits

Description	Catalog Number
PROFIBUS-DP communication card	<b>DXG-NET-PROFB</b>
CANopen communication card	<b>DXG-NET-CANOPEN</b>
DeviceNet communication card	<b>DXG-NET-DEVICENET</b>
PROFIBUS DB9 to 5-pin adapter card	<b>DXG-NET-PROAD</b>
SmartWire communication card and module IP20	<b>DXG-NET-SWD-IP20</b>
SmartWire communication card and module IP54	<b>DXG-NET-SWD-IP54</b>

### PowerXL Series—DG1 Keypad Kits

Description	Catalog Number
Standard keypad	<b>DXG-KEY-LCD</b>
Remote keypad kit (IP 54 rated keypad holder and 3 m cable)	<b>DXG-KEY-RMTKIT</b>
1 m remote keypad cable	<b>DXG-CBL-1M0</b>
3 m remote keypad cable	<b>DXG-CBL-3M0</b>
Remote keypad mounting holder only	<b>DXG-KEY-HOLDER</b>
Type 12/IP54 keypad hole plug (maintain rating without keypad)	<b>DXG-KEY-N12PLUG</b>

### PowerXL Series—DG1 Conversion and Flange Kits

The Type 12/IP54 option kit is used to convert a Type 1/IP21 to a Type 12/IP54 drive. The kit includes cover, fan and grommets.

#### Type 12/IP54 Conversion Kits <sup>①</sup>

Description	Catalog Number
Frame 1 230 V Type 12/IP54 kit	<b>DXG-ACC-2FR1N12KIT</b>
Frame 1 480 V Type 12/IP54 kit	<b>DXG-ACC-4FR1N12KIT</b>
Frame 2 Type 12/IP54 kit	<b>DXG-ACC-FR2N12KIT</b>

The flange kit is used when the power section heat sink is mounted through the back panel of an enclosure. The kit includes hardware, top flange plate, bottom flange plate and two side flange plates.

#### Flange Kits

Description	Catalog Number
Frame 1 flange kit Type 12/IP54	<b>DXG-ACC-FR1N12FK</b>
Frame 2 flange kit Type 12/IP54	<b>DXG-ACC-FR2N12FK</b>
Frame 3 flange kit Type 12/IP54	<b>DXG-ACC-FR3N12FK</b>
Frame 4 flange kit Type 12/IP54	<b>DXG-ACC-FR4N12FK</b>
Frame 5 flange kit Type 12/IP54	<b>DXG-ACC-FR5N12FK</b>
Frame 6 flange kit Type 12/IP54	<b>DXG-ACC-FR6N12FK</b>

### PowerXL Series—DG1 Demo Units

#### Demo Units

Description	Catalog Number
DG1 control module demo stand	<b>DG1-DEMO1</b>
DG1 full drive demo case	<b>DG1-DEMO2</b>

#### Note

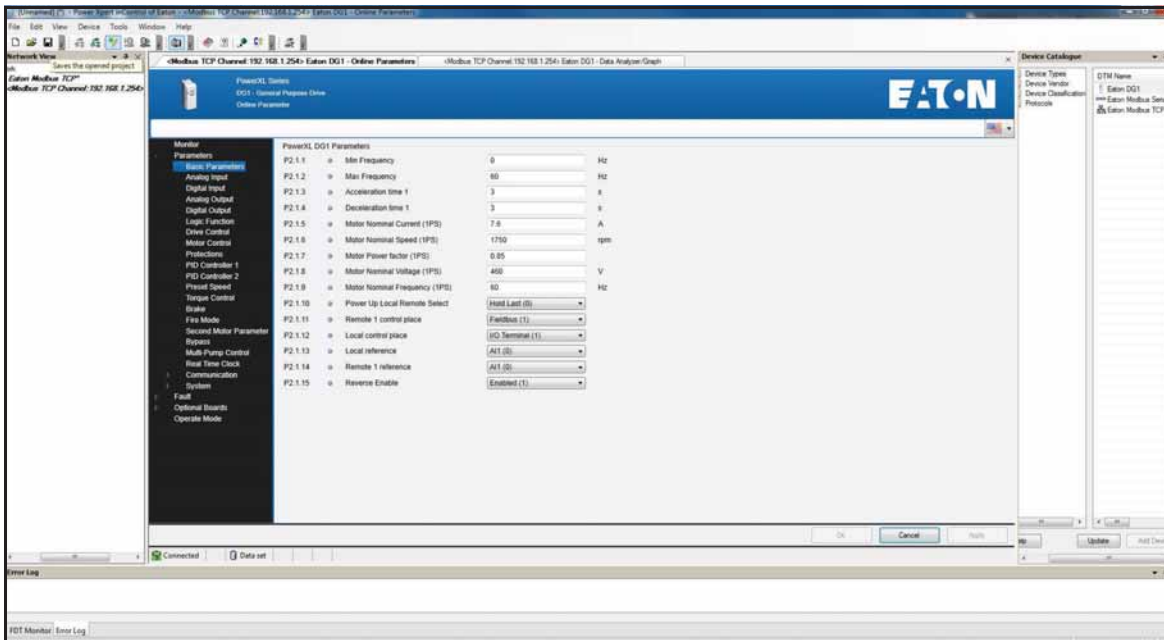
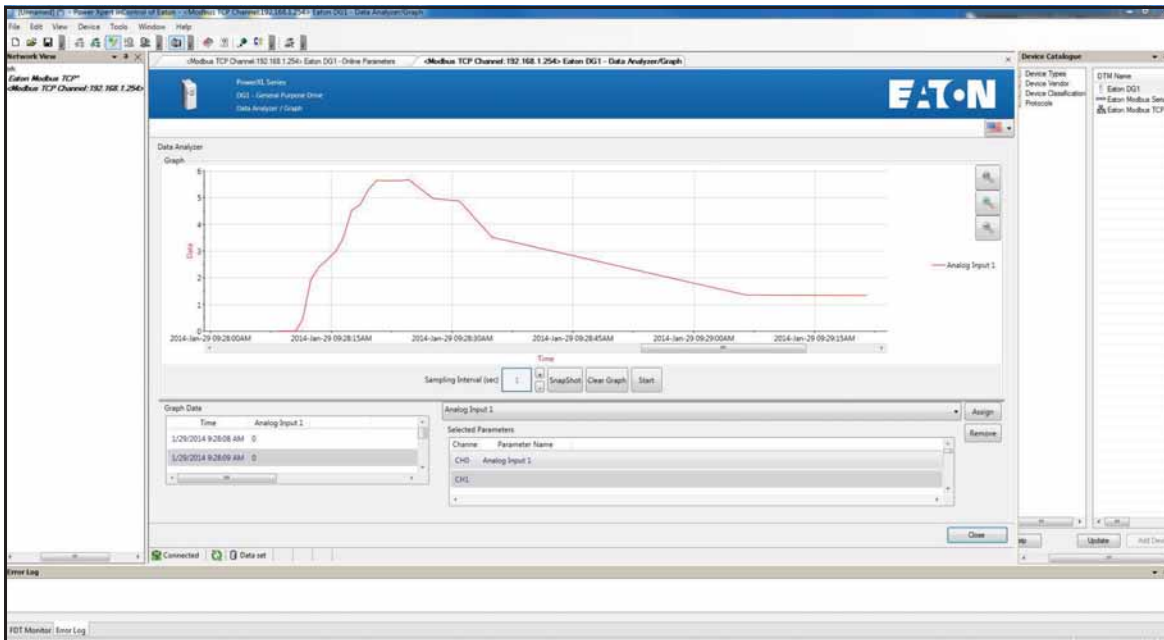
① NEMA 12 DG1 drives from W34 are available within 3 business days.

## Power Xpert inControl Software

The PowerXL Series PC Tool is designed for programming, controlling and monitoring of the DG1 drives. Features include loading parameters that can be saved to a file or printed, setting references, starting and stopping the motor, monitoring signals in graphical or text form, and real-time display.

### PowerXpert inControl Software

Description	Catalog Number
Software kit (software, cable, manual)	<b>DXG-ACC-SOFTWARE</b>
Software cable (USB to keypad [RJ45])	<b>DXG-CBL-PCCABLE</b>
Real-time clock battery (approximately 10,000 hours life)	<b>DXG-ACC-RTBATT</b>



# 2.6

## Adjustable Frequency Drives

### PowerXL DG1 Series Drives

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#### Brake Chopper Options

The brake chopper circuit option is used for applications that require dynamic braking. Dynamic braking resistors are not included with drive purchase. Consult the factory for additional dynamic braking resistor selections that are supplied separately. A list of common resistors are listed below and are complete indoor assemblies, include a pre-wired terminal block and a thermal switch, and are not UL Listed.

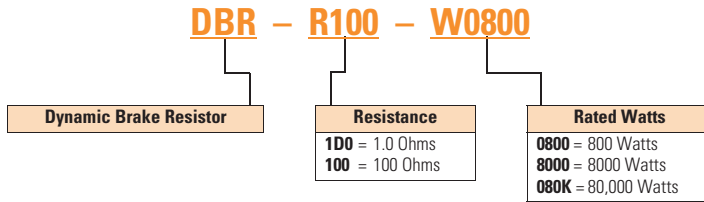
#### Duty Cycle

The duty cycle rating is based on a 60-second period. For example, the 20% duty cycle resistor can carry 100% current for 12 seconds out of every 60 seconds, while the 50% duty cycle resistor can carry 150% current for 30 seconds out of every 60 seconds.

#### Torque

If the braking torque required is less than 15%, dynamic braking is not required because the regenerated energy will be dissipated in the drive and motor losses.

#### Dynamic Brake Resistor—Catalog Number Selection



#### 230 V Brake Resistors

Drive hp (CT/1H)	Minimum Ohms	20% Duty Cycle, 100% Torque		50% Duty Cycle, 150% Torque	
		Catalog Number	Dimensions (Inches)	Catalog Number	Dimensions (Inches)
0.75	30.0	DBR-R100-W0400	12W x 5D x 5H	DBR-R100-W0800	12W x 7D x 5H
1	30.0	DBR-R100-W0400	12W x 5D x 5H	DBR-R100-W0800	12W x 7D x 5H
1.5	30.0	DBR-R100-W0400	12W x 5D x 5H	DBR-R036-W1200	12W x 10D x 5H
2	30.0	DBR-R100-W0400	12W x 5D x 5H	DBR-R036-W1200	12W x 10D x 5H
3	30.0	DBR-R036-W0800	12W x 7D x 5H	DBR-R036-W2000	12W x 16D x 5H
4	30.0	DBR-R036-W0800	12W x 7D x 5H	DBR-R030-W2400	19W x 10D x 5H
5	30.0	DBR-R036-W0800	12W x 7D x 5H	DBR-R030-W2800	19W x 13D x 5H
7.5	20.0	DBR-R020-W1200	12W x 10D x 5H	DBR-R020-W4800	26.5W x 13D x 5H
10	10.0	DBR-R015-W1600	12W x 13D x 5H	DBR-R112-W6000	26.5W x 13D x 5H
15	10.0	DBR-R012-W2400	19W x 10D x 5H	DBR-R010-W9000	28W x 10D x 10H
20	3.3	DBR-R9D3-W3200	19W x 10D x 5H	DBR-R3D4-W012K	28W x 10D x 10H
25	3.3	DBR-R5D5-W4000	26.5W x 10D x 5H	DBR-R5D1-W015K	28W x 16D x 10H
30	3.3	DBR-R4D8-W4800	26.5W x 10D x 5H	DBR-R4D1-W020K	28W x 16D x 10H
40	1.4	DBR-R004-W6000	26.5W x 13D x 5H	DBR-R3D4-W025K	30W x 18D x 16H
50	1.4	DBR-R3D1-W7500	26.5W x 16D x 5H	DBR-R2D1-W030K	30W x 18D x 24H
60	1.4	DBR-R2D8-W9000	26.5W x 16D x 5H	DBR-R002-W036K	30W x 18D x 24H
75	1.4	DBR-R2D6-W012K	28W x 10D x 10H	DBR-R1D5-W045K	30W x 18D x 32H
100	1.4	DBR-R002-W015K	28W x 16D x 10H	DBR-R1D4-W060K	30W x 18D x 40H

## 480 V Brake Resistors

Drive hp (CT/1 $\frac{1}{2}$ )	Minimum Ohms	20% Duty Cycle, 100% Torque		50% Duty Cycle, 150% Torque	
		Catalog Number	Dimensions (Inches)	Catalog Number	Dimensions (Inches)
1	63.0	<b>DBR-R100-W0400</b>	12W x 5D x 5H	<b>DBR-R100-W0800</b>	12W x 7D x 5H
1.5	63.0	<b>DBR-R100-W0400</b>	12W x 5D x 5H	<b>DBR-R100-W1200</b>	12W x 10D x 5H
2	63.0	<b>DBR-R100-W0400</b>	12W x 5D x 5H	<b>DBR-R100-W1200</b>	12W x 10D x 5H
3	63.0	<b>DBR-R100-W0800</b>	12W x 7D x 5H	<b>DBR-R100-W2000</b>	12W x 16D x 5H
5	63.0	<b>DBR-R100-W0800</b>	12W x 7D x 5H	<b>DBR-R100-W2800</b>	19W x 13D x 5H
6	63.0	<b>DBR-R100-W1200</b>	12W x 10D x 5H	<b>DBR-R070-W4000</b>	19W x 16D x 5H
7.5	63.0	<b>DBR-R100-W1200</b>	12W x 10D x 5H	<b>DBR-R063-W4800</b>	26.5W x 13D x 5H
10	63.0	<b>DBR-R063-W1600</b>	12W x 13D x 5H	<b>DBR-R063-W6000</b>	26.5W x 16D x 5H
15	42.0	<b>DBR-R042-W2400</b>	19W x 10D x 5H	<b>DBR-R042-W9000</b>	28W x 10D x 10H
20	21.0	<b>DBR-R030-W3200</b>	19W x 13D x 5H	<b>DBR-R023-W012K</b>	28W x 13D x 10H
25	21.0	<b>DBR-R030-W4000</b>	19W x 16D x 5H	<b>DBR-R021-W015K</b>	28W x 13D x 10H
30	14.0	<b>DBR-R020-W4800</b>	26.5W x 13D x 5H	<b>DBR-R014-W020K</b>	30W x 18D x 24H
40	6.5	<b>DBR-R112-W6000</b>	26.5W x 13D x 5H	<b>DBR-R007-W025K</b>	30W x 18D x 16H
50	6.5	<b>DBR-R013-W7500</b>	26.5W x 16D x 5H	<b>DBR-R8D5-W030K</b>	30W x 18D x 24H
60	6.5	<b>DBR-R010-W9000</b>	28W x 10D x 10H	<b>DBR-R7D3-W036K</b>	30W x 18D x 24H
75	3.3	<b>DBR-R009-W012K</b>	28W x 13D x 10H	<b>DBR-R3D3-W045K</b>	30W x 18D x 32H
100	3.3	<b>DBR-R5D1-W015K</b>	28W x 16D x 10H	<b>DBR-R004-W060K</b>	30W x 18D x 40H
125	3.3	<b>DBR-R4D1-W020K</b>	28W x 16D x 10H	<b>DBR-R004-W070K</b>	30W x 18D x 48H
150	3.3	<b>DBR-R3D4-W025K</b>	30W x 18D x 16H	<b>DBR-R3D5-W085K</b>	30W x 18D x 56H
200	3.3	<b>DBR-R3D3-W030K</b>	30W x 18D x 24H	<b>DBR-R3D3-W110K</b>	30W x 18D x 72H
250	1.4	<b>DBR-R2D5-W036K</b>	30W x 18D x 24H	Ⓢ	—
300	1.4	<b>DBR-R1D5-W045K</b>	30W x 18D x 32H	Ⓢ	—
350	1.4	<b>DBR-R1D4-W060K</b>	30W x 18D x 40H	Ⓢ	—
400	0.9	<b>DBR-R1D4-W060K</b>	30W x 18D x 40H	Ⓢ	—
500	0.9	<b>DBR-R0D9-W080K</b>	30W x 18D x 48H	Ⓢ	—
550	0.9	<b>DBR-R001-W085K</b>	30W x 18D x 56H	Ⓢ	—

**Note**

Ⓢ Consult factory.



# 2.6

## Adjustable Frequency Drives

### PowerXL DG1 Series Drives

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#### 575 V Brake Resistors

Drive hp (CT/l <sub>H</sub> )	Minimum Ohms	20% Duty Cycle, 100% Torque		50% Duty Cycle, 150% Torque	
		Catalog Number	Dimensions (Inches)	Catalog Number	Dimensions (Inches)
2	100.0	<b>DBR-R100-W0400</b>	12W x 5D x 5H	<b>DBR-R100-W1200</b>	12W x 10D x 5H
3	100.0	<b>DBR-R100-W0800</b>	12W x 7D x 5H	<b>DBR-R100-W2000</b>	12W x 16D x 5H
4	100.0	<b>DBR-R100-W0800</b>	12W x 7D x 5H	<b>DBR-R100-W2400</b>	19W x 10D x 5H
5	100.0	<b>DBR-R100-W0800</b>	12W x 7D x 5H	<b>DBR-R100-W2800</b>	19W x 13D x 5H
7.5	100.0	<b>DBR-R100-W1200</b>	12W x 10D x 5H	<b>DBR-R100-W4800</b>	26.5W x 13D x 5H
10	30.0	<b>DBR-R063-W1600</b>	12W x 13D x 5H	<b>DBR-R063-W6000</b>	26.5W x 16D x 5H
15	30.0	<b>DBR-R042-W2400</b>	19W x 10D x 5H	<b>DBR-R042-W9000</b>	28W x 10D x 10H
20	30.0	<b>DBR-R030-W3200</b>	19W x 13D x 5H	<b>DBR-R030-W012K</b>	28W x 13D x 10H
25	30.0	<b>DBR-R030-W4000</b>	19W x 16D x 5H	<b>DBR-R030-W015K</b>	28W x 16D x 10H
30	18.0	<b>DBR-R020-W4800</b>	26.5W x 13D x 5H	<b>DBR-R020-W020K</b>	30W x 18D x 16H
40	18.0	<b>DBR-R030-W6000</b>	26.5W x 16D x 5H	<b>DBR-R184-W025K</b>	30W x 18D x 16H
50	9.0	<b>DBR-R013-W7500</b>	26.5W x 16D x 5H	<b>DBR-R012-W030K</b>	30W x 18D x 24H
60	9.0	<b>DBR-R010-W9000</b>	28W x 10D x 10H	<b>DBR-R010-W036K</b>	30W x 18D x 24H
75	9.0	<b>DBR-R009-W012K</b>	28W x 13D x 10H	<b>DBR-R009-W045K</b>	30W x 18D x 24H
100	7.0	<b>DBR-R013-W015K</b>	28W x 16D x 10H	<b>DBR-R8D4-W060K</b>	30W x 18D x 40H
125	7.0	<b>DBR-R8D2-W020K</b>	30W x 18D x 10H	<b>DBR-R007-W070K</b>	30W x 18D x 40H
150	7.0	<b>DBR-R007-W025K</b>	30W x 18D x 16H	<b>DBR-R006-W085K</b>	30W x 18D x 56H
175	7.0	<b>DBR-R007-W030K</b>	30W x 18D x 24H	<b>DBR-R007-W100K</b>	30W x 18D x 72H
200	2.5	<b>DBR-R3D3-W030K</b>	30W x 18D x 24H	<b>DBR-R2D6-W110K</b>	30W x 18D x 64H
250	2.5	<b>DBR-R2D5-W036K</b>	30W x 18D x 24H	<b>DBR-R003-W140K</b>	30W x 18D x 72H
300	2.5	<b>DBR-R3D3-W045K</b>	30W x 18D x 32H	①	—
400	1.7	<b>DBR-R002-W060K</b>	30W x 18D x 48H	①	—
450	1.7	<b>DBR-R1D8-W070K</b>	30W x 18D x 48H	①	—
500	1.7	<b>DBR-R002-W080K</b>	30W x 18D x 56H	①	—

**Note**

① Consult factory.

### Line and Load Reactors

A line and load reactor is a three-phase inductance filter that can be placed on the line and load side of the AFD to help improve the harmonic performance of the system. Consult the factory for additional filtering options and further technical details.

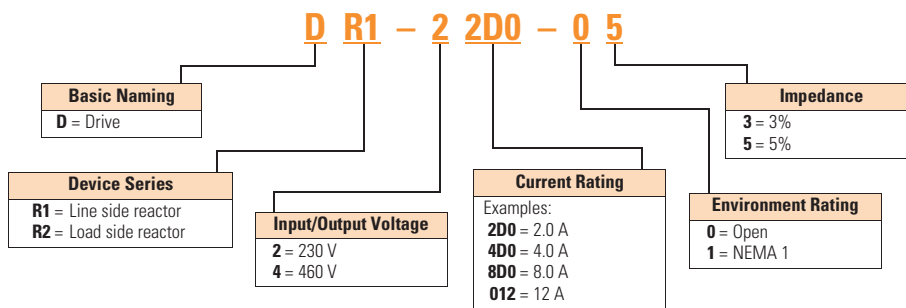
#### DR1 Line Reactor

A line reactor helps to provide a moderate reduction in current harmonics similar to a DC choke. It also provides increased input protection for AFD and its semiconductors from line transients helping to extend the life of the AFD.

#### DR2 Output Reactor

An output filter is used to reduce the transient voltage (dV/dt) at the motor terminals. The output filter is recommended for cable lengths exceeding 100 ft (30 m) with a drive of 3 hp and above and for cable lengths of 33 ft (10 m) with a drive of 2 hp and below.

### Line and Load Reactors—Catalog Number Selection



### Line and Load Reactors—230 V

hp (CT)	Open Line Reactor		Load Reactor		NEMA 1 Line Reactor		Load Reactor	
	3%	5%	3%	5%	3%	5%	3%	5%
0.75	DR1-23D2-03	DR1-23D2-05	DR2-24D0-03	DR2-24D0-05	DR1-23D2-13	DR1-23D2-15	DR2-24D0-13	DR2-24D0-15
1	DR1-24D2-03	DR1-24D2-05	DR2-24D0-03	DR2-28D0-05	DR1-24D2-13	DR1-24D2-15	DR2-24D0-13	DR2-28D0-15
1.5	DR1-26D0-03	DR1-26D0-05	DR2-28D0-03	DR2-28D0-05	DR1-26D0-13	DR1-26D0-15	DR2-28D0-13	DR2-28D0-15
2	DR1-26D8-03	DR1-26D8-05	DR2-28D0-03	DR2-28D0-05	DR1-26D8-13	DR1-26D8-15	DR2-28D0-13	DR2-28D0-15
3	DR1-29D6-03	DR1-29D6-05	DR2-2012-03	DR2-2012-05	DR1-29D6-13	DR1-29D6-15	DR2-2012-13	DR2-2012-15
5	DR1-2015-03	DR1-2015-05	DR2-2018-03	DR2-2018-05	DR1-2015-13	DR1-2015-15	DR2-2018-13	DR2-2018-15
7.5	DR1-2022-03	DR1-2022-05	DR2-2025-03	DR2-2025-05	DR1-2022-13	DR1-2022-15	DR2-2025-13	DR2-2025-15
10	DR1-2028-03	DR1-2028-05	DR2-2035-03	DR2-2035-05	DR1-2028-13	DR1-2028-15	DR2-2035-13	DR2-2035-15
15	DR1-2042-03	DR1-2042-05	DR2-2045-03	DR2-2045-05	DR1-2042-13	DR1-2042-15	DR2-2045-13	DR2-2045-15
20	DR1-2054-03	DR1-2054-05	DR2-2055-03	DR2-2055-05	DR1-2054-13	DR1-2054-15	DR2-2055-13	DR2-2055-15
25	DR1-2068-03	DR1-2068-05	DR2-2080-03	DR2-2080-05	DR1-2068-13	DR1-2068-15	DR2-2080-13	DR2-2080-15
30	DR1-2080-03	DR1-2080-05	DR2-2080-03	DR2-2100-05	DR1-2080-13	DR1-2080-15	DR2-2080-13	DR2-2100-15
40	DR1-2104-03	DR1-2104-05	DR2-2100-03	DR2-2100-05	DR1-2104-13	DR1-2104-15	DR2-2100-13	DR2-2100-15
50	DR1-2130-03	DR1-2130-05	DR2-2130-03	DR2-2130-05	DR1-2130-13	DR1-2130-15	DR2-2130-13	DR2-2130-15
60	DR1-2154-03	DR1-2154-05	DR2-2160-03	DR2-2200-15	DR1-2154-13	DR1-2154-15	DR2-2160-13	DR2-2200-15
75	DR1-2192-03	DR1-2192-05	DR2-2200-13	DR2-2200-15	DR1-2192-13	DR1-2192-15	DR2-2200-13	DR2-2200-15
100	DR1-2248-03	DR1-2248-05	DR2-2225-13	DR2-2225-15	DR1-2248-13	DR1-2248-15	DR2-2225-13	DR2-2225-15

### Line and Load Reactors—480 V

hp (CT)	Open Line Reactor	
	3%	5%
1	DR1-42D1-03	DR1-42D1-05
1.5	DR1-43D0-03	DR1-43D0-05
2	DR1-43D4-03	DR1-43D4-05
3	DR1-44D8-03	DR1-44D8-05
5	DR1-47D6-03	DR1-47D6-05
7.5	DR1-4011-03	DR1-4011-05
10	DR1-4014-03	DR1-4014-05
15	DR1-4021-03	DR1-4021-05
20	DR1-4027-03	DR1-4027-05
25	DR1-4034-03	DR1-4034-05
30	DR1-4040-03	DR1-4040-05
40	DR1-4052-03	DR1-4052-05
50	DR1-4065-03	DR1-4065-05
60	DR1-4077-03	DR1-4077-05
75	DR1-4096-03	DR1-4096-05
100	DR1-4124-03	DR1-4124-05
125	DR1-4156-03	DR1-4156-05
150	DR1-4180-03	DR1-4180-05
200	DR1-4240-03	DR1-4240-05
250	DR1-4302-03	DR1-4302-05
300	DR1-4361-03	DR1-4361-05
350	DR1-4414-03	DR1-4414-05
400	DR1-4477-03	DR1-4477-05
500	DR1-4590-03	DR1-4590-05
600	DR1-4708-03	DR1-4708-05

Load Reactor	
3%	5%
DR2-42D0-05	DR2-42D0-05
DR2-44D0-05	DR2-44D0-05
DR2-44D0-03	DR2-44D0-05
DR2-48D0-03	DR2-48D0-05
DR2-48D0-03	DR2-48D0-05
DR2-4012-03	DR2-4012-05
DR2-4018-03	DR2-4018-05
DR2-4025-03	DR2-4025-05
DR2-4025-03	DR2-4025-05
DR2-4035-03	DR2-4035-05
DR2-4045-03	DR2-4045-05
DR2-4055-03	DR2-4055-05
DR2-4080-03	DR2-4080-05
DR2-4100-03	DR2-4080-05
DR2-4100-03	DR2-4100-05
DR2-4130-03	DR2-4130-05
DR2-4160-03	DR2-4160-05
DR2-4200-13	DR2-4200-15
DR2-4250-13	DR2-4250-15
DR2-4320-13	DR2-4320-15
DR2-4400-13	DR2-4400-15
DR2-4400-13	DR2-4400-15
DR2-4500-13	DR2-4500-05
DR2-4600-03	DR2-4600-05
DR2-4750-03	DR2-4750-05

NEMA 1 Line Reactor	
3%	5%
DR1-42D1-13	DR1-42D1-15
DR1-43D0-13	DR1-43D0-15
DR1-43D4-13	DR1-43D4-15
DR1-44D8-13	DR1-44D8-15
DR1-47D6-13	DR1-47D6-15
DR1-4011-13	DR1-4011-15
DR1-4014-13	DR1-4014-15
DR1-4021-13	DR1-4021-15
DR1-4027-13	DR1-4027-15
DR1-4034-13	DR1-4034-15
DR1-4040-13	DR1-4040-15
DR1-4052-13	DR1-4052-15
DR1-4065-13	DR1-4065-15
DR1-4077-13	DR1-4077-15
DR1-4096-13	DR1-4096-15
DR1-4124-13	DR1-4124-15
DR1-4156-13	DR1-4156-15
DR1-4180-13	DR1-4180-15
DR1-4240-13	DR1-4240-15
DR1-4302-13	DR1-4302-15
DR1-4361-13	DR1-4361-15
DR1-4414-13	DR1-4414-15
DR1-4477-13	DR1-4477-15
DR1-4590-13	DR1-4590-15
DR1-4708-13	DR1-4708-15

Load Reactor	
3%	5%
DR2-42D0-13	DR2-42D0-15
DR2-44D0-13	DR2-44D0-15
DR2-44D0-13	DR2-44D0-15
DR2-48D0-13	DR2-48D0-15
DR2-48D0-13	DR2-48D0-15
DR2-4012-13	DR2-4012-15
DR2-4018-13	DR2-4018-15
DR2-4025-13	DR2-4025-15
DR2-4025-13	DR2-4025-15
DR2-4035-13	DR2-4035-15
DR2-4045-13	DR2-4045-15
DR2-4055-13	DR2-4055-15
DR2-4080-13	DR2-4080-15
DR2-4100-13	DR2-4080-15
DR2-4100-13	DR2-4100-15
DR2-4130-13	DR2-4130-15
DR2-4160-13	DR2-4160-15
DR2-4200-13	DR2-4200-15
DR2-4250-13	DR2-4250-15
DR2-4320-13	DR2-4320-15
DR2-4400-13	DR2-4400-15
DR2-4400-13	DR2-4400-15
DR2-4500-13	DR2-4500-15
DR2-4600-13	DR2-4600-15
DR2-4750-13	DR2-4750-15

### Line and Load Reactors—575 V

hp (CT)	Open Line Reactor	
	3%	5%
2	DR1-52D7-03	DR1-52D7-05
3	DR1-53D9-03	DR1-53D9-05
5	DR1-56D1-03	DR1-56D1-05
7.5	DR1-59D0-03	DR1-59D0-05
10	DR1-5011-03	DR1-5011-05
15	DR1-5017-03	DR1-5017-05
20	DR1-5022-03	DR1-5022-05
25	DR1-5027-03	DR1-5027-05
30	DR1-5032-03	DR1-5032-05
40	DR1-5041-03	DR1-5041-05
50	DR1-5052-03	DR1-5052-05
60	DR1-5062-03	DR1-5062-05
75	DR1-5077-03	DR1-5077-05
100	DR1-5100-03	DR1-5100-05
125	DR1-5125-03	DR1-5125-05
150	DR1-5144-03	DR1-5144-05
200	DR1-5192-03	DR1-5192-05
250	DR1-5242-03	DR1-5242-05
300	DR1-5289-03	DR1-5289-05
400	DR1-5382-03	DR1-5382-05
450	DR1-5412-03	DR1-5412-05
500	DR1-5472-03	DR1-5472-05
600	DR1-5576-03	DR1-5576-05

Load Reactor	
3%	5%
DR2-54D0-03	DR2-54D0-05
DR2-54D0-03	DR2-54D0-05
DR2-58D0-03	DR2-58D0-05
DR2-58D0-03	DR2-58D0-05
DR2-5012-03	DR2-5012-05
DR2-5018-03	DR2-5018-05
DR2-5025-03	DR2-5025-05
DR2-5025-03	DR2-5025-05
DR2-5035-03	DR2-5035-05
DR2-5045-03	DR2-5045-05
DR2-5055-03	DR2-5055-05
DR2-5080-03	DR2-5080-05
DR2-5080-03	DR2-5080-05
DR2-5100-03	DR2-5100-05
DR2-5130-03	DR2-5130-05
DR2-5160-03	DR2-5160-05
DR2-5200-13	DR2-5200-15
DR2-5250-13	DR2-5250-15
DR2-5320-13	DR2-5320-15
DR2-5400-13	DR2-5400-15
DR2-5400-13	DR2-5400-15
DR2-5500-03	DR2-5500-05
DR2-5600-03	DR2-5600-05

NEMA 1 Line Reactor	
3%	5%
DR1-52D7-13	DR1-52D7-15
DR1-53D9-13	DR1-53D9-15
DR1-56D1-13	DR1-56D1-15
DR1-59D0-13	DR1-59D0-15
DR1-5011-13	DR1-5011-15
DR1-5017-13	DR1-5017-15
DR1-5022-13	DR1-5022-15
DR1-5027-13	DR1-5027-15
DR1-5032-13	DR1-5032-15
DR1-5041-13	DR1-5041-15
DR1-5052-13	DR1-5052-15
DR1-5062-13	DR1-5062-15
DR1-5077-13	DR1-5077-15
DR1-5100-13	DR1-5100-15
DR1-5125-13	DR1-5125-15
DR1-5144-13	DR1-5144-15
DR1-5192-13	DR1-5192-15
DR1-5242-13	DR1-5242-15
DR1-5289-13	DR1-5289-15
DR1-5382-13	DR1-5382-15
DR1-5412-13	DR1-5412-15
DR1-5472-13	DR1-5472-15
DR1-5576-13	DR1-5576-15

Load Reactor	
3%	5%
DR2-54D0-13	DR2-54D0-15
DR2-54D0-13	DR2-54D0-15
DR2-58D0-13	DR2-58D0-15
DR2-58D0-13	DR2-58D0-15
DR2-5012-13	DR2-5012-15
DR2-5018-13	DR2-5018-15
DR2-5025-13	DR2-5025-15
DR2-5025-13	DR2-5025-15
DR2-5035-13	DR2-5035-15
DR2-5045-13	DR2-5045-15
DR2-5055-13	DR2-5055-15
DR2-5080-13	DR2-5080-15
DR2-5080-13	DR2-5080-15
DR2-5100-13	DR2-5100-15
DR2-5130-13	DR2-5130-15
DR2-5160-13	DR2-5160-15
DR2-5200-13	DR2-5200-15
DR2-5250-13	DR2-5250-15
DR2-5320-13	DR2-5320-15
DR2-5400-13	DR2-5400-15
DR2-5400-13	DR2-5400-15
DR2-5500-13	DR2-5500-15
DR2-5600-13	DR2-5600-15

## Replacement Parts

### Frame 0

Description	230 V	480 V	575 V
	Catalog Number	Catalog Number	Catalog Number
Standard keypad	DXG-KEY-LCD	DXG-KEY-LCD	—
Main control board	DXG-SPR-CTRLBOARD	DXG-SPR-CTRLBOARD	—
Control module kit with keypad <sup>①</sup>	DXG-SPR-CTRLKIT	DXG-SPR-CTRLKIT	—
Main fan kit	DXG-SPR-FR0FAN	DXG-SPR-FR0FAN	—
Main power board	DXG-SPR-2FR0MPB	DXG-SPR-4FR0MPB	—
EMI kit for C2	DXG-SPR-FR0EMCKIT	DXG-SPR-FR0EMCKIT	—

### Frame 1

Description	230 V	480 V	575 V
	Catalog Number	Catalog Number	Catalog Number
Standard keypad	DXG-KEY-LCD	DXG-KEY-LCD	DXG-KEY-LCD
Main control board	DXG-SPR-CTRLBOARD	DXG-SPR-CTRLBOARD	DXG-SPR-CTRLBOARD
Control module kit with keypad <sup>①</sup>	DXG-SPR-CTRLKIT	DXG-SPR-CTRLKIT	DXG-SPR-CTRLKIT
Control board cover	DXG-SPR-BCOVER	DXG-SPR-BCOVER	DXG-SPR-BCOVER
Standard cover	DXG-SPR-FR1CVR	DXG-SPR-FR1CVR	DXG-SPR-FR1CVR
Main fan kit <sup>①</sup>	DXG-SPR-FR1FAN	DXG-SPR-FR1FAN	DXG-SPR-FR1FAN
Control fan	DXG-SPR-2FR1CF	DXG-SPR-4FR1CF	DXG-SPR-4FR1CF
Main power board	DXG-SPR-2FR1MPB	DXG-SPR-4FR1MPB	DXG-SPR-4FR1MPB
EMI board	DXG-SPR-2FR1EB	DXG-SPR-4FR1EB	DXG-SPR-4FR1EB
Middle chassis cover	DXG-SPR-FR1MCC	DXG-SPR-FR1MCC	DXG-SPR-FR1MCC
Outer housing	DXG-SPR-FR10H	DXG-SPR-FR10H	DXG-SPR-FR10H
UL conduit plate	DXG-SPR-FR1CPUL	DXG-SPR-FR1CPUL	DXG-SPR-FR1CPUL
IEC conduit plate	DXG-SPR-FR1CPIEC	DXG-SPR-FR1CPIEC	DXG-SPR-FR1CPIEC

### Frame 2

Description	230 V	480 V	575 V
	Catalog Number	Catalog Number	Catalog Number
Standard keypad	DXG-KEY-LCD	DXG-KEY-LCD	DXG-KEY-LCD
Main control board	DXG-SPR-CTRLBOARD	DXG-SPR-CTRLBOARD	DXG-SPR-CTRLBOARD
Control module kit with keypad <sup>①</sup>	DXG-SPR-CTRLKIT	DXG-SPR-CTRLKIT	DXG-SPR-CTRLKIT
Control board cover	DXG-SPR-BCOVER	DXG-SPR-BCOVER	DXG-SPR-BCOVER
Standard cover	DXG-SPR-FR2CVR	DXG-SPR-FR2CVR	DXG-SPR-FR2CVR
Main fan kit <sup>①</sup>	DXG-SPR-FR2FAN	DXG-SPR-FR2FAN	DXG-SPR-FR2FAN
Control fan	DXG-SPR-FR2CF	DXG-SPR-FR2CF	DXG-SPR-FR2CF
Bus capacitor	DXG-SPR-2FR2BC	DXG-SPR-4FR24BC	DXG-SPR-4FR24BC
Main power board	DXG-SPR-2FR2MPB	DXG-SPR-4FR2MPB	DXG-SPR-4FR2MPB
EMI board	DXG-SPR-2FR2EB	DXG-SPR-4FR2EB	DXG-SPR-4FR2EB
Middle chassis cover	DXG-SPR-FR2MCC	DXG-SPR-FR2MCC	DXG-SPR-FR2MCC
Outer housing	DXG-SPR-FR20H	DXG-SPR-FR20H	DXG-SPR-FR20H
UL conduit plate	DXG-SPR-FR2CPUL	DXG-SPR-FR2CPUL	DXG-SPR-FR2CPUL
IEC conduit plate	DXG-SPR-FR2CPIEC	DXG-SPR-FR2CPIEC	DXG-SPR-FR2CPIEC

#### Note

<sup>①</sup> Factory recommended spare parts.

# 2.6

## Adjustable Frequency Drives

### PowerXL DG1 Series Drives

#### Frame 3

2

Description	230 V Catalog Number	480 V Catalog Number	575 V Catalog Number
Standard keypad	DXG-KEY-LCD	DXG-KEY-LCD	DXG-KEY-LCD
Main control board	DXG-SPR-CTRLBOARD	DXG-SPR-CTRLBOARD	DXG-SPR-CTRLBOARD
Control module kit with keypad <sup>①</sup>	DXG-SPR-CTRLKIT	DXG-SPR-CTRLKIT	DXG-SPR-CTRLKIT
Control board cover	DXG-SPR-BCOVER	DXG-SPR-BCOVER	DXG-SPR-BCOVER
Standard cover	DXG-SPR-FR3CVR	DXG-SPR-FR3CVR	DXG-SPR-FR3CVR
Main fan kit <sup>①</sup>	DXG-SPR-FR3FANKIT	DXG-SPR-FR3FANKIT	DXG-SPR-FR3FANKIT
Main fan	DXG-SPR-FR3FAN	DXG-SPR-FR3FAN	DXG-SPR-FR3FAN
Control fan	DXG-SPR-FR34CF	DXG-SPR-FR34CF	DXG-SPR-FR34CF
Bus capacitor	DXG-SPR-FR3BC	DXG-SPR-FR3BC	DXG-SPR-FR3BC
Main power board	DXG-SPR-2FR3MPB	DXG-SPR-4FR3MPB	DXG-SPR-4FR3MPB
EMI board	DXG-SPR-2FR3EB	DXG-SPR-4FR3EB	DXG-SPR-4FR3EB
Drive board	DXG-SPR-2FR3DB	DXG-SPR-4FR3DB	DXG-SPR-4FR3DB
Output board	DXG-SPR-FR3OB	DXG-SPR-FR3OB	DXG-SPR-FR3OB
Middle chassis cover	DXG-SPR-FR3MCC	DXG-SPR-FR3MCC	DXG-SPR-FR3MCC
Outer housing	DXG-SPR-FR3OH	DXG-SPR-FR3OH	DXG-SPR-FR3OH
UL conduit plate	DXG-SPR-FR3CPUL	DXG-SPR-FR3CPUL	DXG-SPR-FR3CPUL
IEC conduit plate	DXG-SPR-FR3CPIEC	DXG-SPR-FR3CPIEC	DXG-SPR-FR3CPIEC

#### Frame 4

Description	230 V Catalog Number	480 V Catalog Number	575 V Catalog Number
Standard keypad	DXG-KEY-LCD	DXG-KEY-LCD	DXG-KEY-LCD
Main control board	DXG-SPR-CTRLBOARD	DXG-SPR-CTRLBOARD	DXG-SPR-CTRLBOARD
Control module kit with keypad <sup>①</sup>	DXG-SPR-CTRLKIT	DXG-SPR-CTRLKIT	DXG-SPR-CTRLKIT
Control board cover	DXG-SPR-BCOVER	DXG-SPR-BCOVER	DXG-SPR-BCOVER
Standard cover	DXG-SPR-FR4CVR	DXG-SPR-FR4CVR	DXG-SPR-FR4CVR
Main fan kit <sup>①</sup>	DXG-SPR-FR4FANKIT	DXG-SPR-FR4FANKIT	DXG-SPR-FR4FANKIT
Main fan	DXG-SPR-FR4FAN	DXG-SPR-FR4FAN	DXG-SPR-FR4FAN
Control fan	DXG-SPR-FR34CF	DXG-SPR-FR34CF	DXG-SPR-FR34CF
Bus capacitor	DXG-SPR-2FR4BC	DXG-SPR-4FR24BC	DXG-SPR-4FR24BC
Main power board	DXG-SPR-2FR4MPB	DXG-SPR-4FR4MPB	DXG-SPR-4FR4MPB
EMI board	DXG-SPR-2FR4EB	DXG-SPR-4FR4EB	DXG-SPR-4FR4EB
Softstart board	DXG-SPR-2FR4SB	DXG-SPR-4FR4SB	DXG-SPR-4FR4SB
IGBT module	DXG-SPR-2FR4IGBT	DXG-SPR-4FR4IGBT	DXG-SPR-4FR4IGBT
Rectifier module	DXG-SPR-2FR4RM	DXG-SPR-4FR4RM	DXG-SPR-4FR4RM
Brake chopper module	DXG-SPR-2FR4BCM	DXG-SPR-4FR4BCM	DXG-SPR-4FR4BCM
Middle chassis cover	DXG-SPR-FR4MCC	DXG-SPR-FR4MCC	DXG-SPR-FR4MCC
Outer housing	DXG-SPR-FR4OH	DXG-SPR-FR4OH	DXG-SPR-FR4OH
UL conduit plate	DXG-SPR-FR4CPUL	DXG-SPR-FR4CPUL	DXG-SPR-FR4CPUL
IEC conduit plate	DXG-SPR-FR4CPIEC	DXG-SPR-FR4CPIEC	DXG-SPR-FR4CPIEC

#### Note

<sup>①</sup> Factory recommended spare parts.

## Frame 5

Description	230 V	480 V	575 V
	Catalog Number	Catalog Number	Catalog Number
Standard keypad	DXG-KEY-LCD	DXG-KEY-LCD	DXG-KEY-LCD
Main control board	DXG-SPR-CTRLBOARD	DXG-SPR-CTRLBOARD	DXG-SPR-CTRLBOARD
Control module kit with keypad <sup>①</sup>	DXG-SPR-CTRLKIT	DXG-SPR-CTRLKIT	DXG-SPR-CTRLKIT
Control board cover	DXG-SPR-BCOVER	DXG-SPR-BCOVER	DXG-SPR-BCOVER
Standard cover	DXG-SPR-FR5CVR	DXG-SPR-FR5CVR	DXG-SPR-FR5CVR
Main fan kit <sup>①</sup>	DXG-SPR-FR5FANKIT	DXG-SPR-FR5FANKIT	DXG-SPR-FR5FANKIT
Main fan	DXG-SPR-FR5FAN	DXG-SPR-FR5FAN	DXG-SPR-FR5FAN
Control fan	DXG-SPR-FR5CF	DXG-SPR-FR5CF	DXG-SPR-FR5CF
Bus capacitor	DXG-SPR-FR5BC	DXG-SPR-FR5BC	DXG-SPR-FR5BC
Main power board	DXG-SPR-2FR5MPB	DXG-SPR-4FR5MPB	DXG-SPR-4FR5MPB
EMI-1 board	DXG-SPR-2FR5E1B	DXG-SPR-4FR5E1B	DXG-SPR-4FR5E1B
EMI-2 board	DXG-SPR-2FR5E2B	DXG-SPR-4FR5E2B	DXG-SPR-4FR5E2B
EMI-3 board	DXG-SPR-FR5E3B	DXG-SPR-FR5E3B	DXG-SPR-FR5E3B
IGBT module	DXG-SPR-2FR5IGBT	DXG-SPR-4FR5IGBT	DXG-SPR-5FR5IGBT
Rectifier module	DXG-SPR-FR5RM	DXG-SPR-FR5RM	DXG-SPR-5FR5RM
Brake chopper module	DXG-SPR-2FR5BCM	DXG-SPR-4FR5BCM	DXG-SPR-4FR5BCM
Middle chassis cover	DXG-SPR-FR5MCC	DXG-SPR-FR5MCC	DXG-SPR-FR5MCC
Outer housing	DXG-SPR-FR5OH	DXG-SPR-FR5OH	DXG-SPR-FR5OH
UL conduit plate	DXG-SPR-FR5CPUL	DXG-SPR-FR5CPUL	DXG-SPR-FR5CPUL
IEC conduit plate	DXG-SPR-FR5IECCP	DXG-SPR-FR5IECCP	DXG-SPR-FR5IECCP
DC terminal kit	DXG-SPR-FR5DCKIT	DXG-SPR-FR5DCKIT	DXG-SPR-FR5DCKIT

## Frame 6

Description	230 V	480 V	600 V
	Catalog Number	Catalog Number	Catalog Number
Standard keypad	DXG-KEY-LCD	DXG-KEY-LCD	DXG-KEY-LCD
Main control board	DXG-SPR-CTRLBOARD	DXG-SPR-CTRLBOARD	DXG-SPR-CTRLBOARD
Control module kit with keypad	DXG-SPR-CTRLKIT	DXG-SPR-CTRLKIT	DXG-SPR-CTRLKIT
Control board cover	DXG-SPR-BCOVER	DXG-SPR-BCOVER	DXG-SPR-BCOVER
Standard cover	DXG-SPR-FR6CVR	DXG-SPR-FR6CVR	DXG-SPR-FR6CVR
Type 12 grommet kit	DXG-SPR-FR6GRN12	DXG-SPR-FR6GRN12	DXG-SPR-FR6GRN12
Main fan kit	DXG-SPR-FR6FANKIT	DXG-SPR-FR6FANKIT	DXG-SPR-FR6FANKIT
Main fan	DXG-SPR-FR6FAN	DXG-SPR-FR6FAN	DXG-SPR-FR6FAN
Control fan	DXG-SPR-FR6CF	DXG-SPR-FR6CF	DXG-SPR-FR6CF
Bus capacitor	DXG-SPR-FR6BC	DXG-SPR-FR6BC	DXG-SPR-5FR6BC
Main power board	DXG-SPR-2FR6MPB	DXG-SPR-4FR6MPB	DXG-SPR-5FR6MPB
EMI board	DXG-SPR-FR6EB	DXG-SPR-FR6EB	DXG-SPR-FR6EB
IGBT module	DXG-SPR-2FR6IGBT	DXG-SPR-4FR6IGBT	DXG-SPR-5FR6IGBT
Rectifier module	DXG-SPR-FR6RM	DXG-SPR-FR6RM	DXG-SPR-5FR6RM
Middle chassis cover	DXG-SPR-FR6MCC	DXG-SPR-FR6MCC	DXG-SPR-FR6MCC
Outer housing	DXG-SPR-FR6OH	DXG-SPR-FR6OH	DXG-SPR-FR6OH
UL conduit plate	DXG-SPR-FR6CPUL	DXG-SPR-FR6CPUL	DXG-SPR-FR6CPUL
IEC conduit plate	DXG-SPR-FR6CPIEC	DXG-SPR-FR6CPIEC	DXG-SPR-FR6CPIEC
Softstart board	DXG-SPR-2FR6SB	DXG-SPR-4FR6SB	DXG-SPR-5FR6SB
Rectifier snubber board	DXG-SPR-2FR6RSB	DXG-SPR-4FR6RSB	DXG-SPR-5FR6RSB
Terminal block kit (1-pole)	DXG-SPR-FR6TB1P	DXG-SPR-FR6TB1P	DXG-SPR-FR6TB1P
Terminal block kit (3-pole)	DXG-SPR-FR6TB3P	DXG-SPR-FR6TB3P	DXG-SPR-FR6TB3P

**Note**

<sup>①</sup> Factory recommended spare parts.

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## Adjustable Frequency Drives

### PowerXL DG1 Series Drives

#### Frame 7

2

<b>Description</b>	<b>230 V Catalog Number</b>	<b>480 V Catalog Number</b>	<b>575 V Catalog Number</b>
Standard keypad	—	<b>DXG-KEY-LCD</b>	<b>DXG-KEY-LCD</b>
Control module kit with keypad <sup>①</sup>	—	<b>DXG-SPR-HPCTRLKIT</b>	<b>DXG-SPR-HPCTRLKIT</b>
Control board cover	—	<b>DXG-SPR-BCOVER</b>	<b>DXG-SPR-BCOVER</b>
Standard cover	—	<b>DXG-SPR-FR1CVR</b>	<b>DXG-SPR-FR1CVR</b>

#### Frame 8

<b>Description</b>	<b>230 V Catalog Number</b>	<b>480 V Catalog Number</b>	<b>575 V Catalog Number</b>
Standard keypad	—	<b>DXG-KEY-LCD</b>	<b>DXG-KEY-LCD</b>
Control module kit with keypad <sup>①</sup>	—	<b>DXG-SPR-HPCTRLKIT</b>	<b>DXG-SPR-HPCTRLKIT</b>
Control board cover	—	<b>DXG-SPR-BCOVER</b>	<b>DXG-SPR-BCOVER</b>
Standard cover	—	<b>DXG-SPR-FR1CVR</b>	<b>DXG-SPR-FR1CVR</b>

**Note**

<sup>①</sup> Factory recommended spare parts.

## Technical Data and Specifications

### PowerXL Series—DG1 Technical Data and Specifications

Attribute	Description	Specification	
Input ratings	Input voltage $U_{in}$	208 V to 240 V, 380 V to 500 V, 525 V to 600 V, -15 to 10%	
	Input frequency	50 Hz to 60 Hz (variation up to 45 Hz to 66 Hz)	
	Connection to power	Once per minute or less	
	Starting delay	3 s (FR1 to FR2), 4 s (FR3), 5 s (FR4), 6 s (FR5 and FR6)	
	Short-circuit withstand rating	100 kAIC (fuses and circuit breakers); 5 kAIC (without fuses or breakers)	
Output ratings	Output voltage	0 to $U_{in}$	
	Continuous output current	$I_L$ : ambient temperature maximum 40 °C, up to 60 °C with derating, overload 1.1 x $I_L$ (1 min./10 min.) $I_H$ : ambient temperature maximum 50 °C, up to 60 °C with derating, overload 1.5 x $I_H$ (1 min./10 min.)	
	Overload current	150% of drive rating for constant torque, 110% for variable torque	
	Initial output current	200% (2 s / 20 s)	
	Output frequency	0–400 Hz (standard)	
	Frequency resolution	0.01 Hz	
Control characteristics	Control methods	Frequency control Speed control Open-loop speed control Open-loop torque control	
	Switching frequency	230 V / 480 V range: FR1–3: 1 kHz to 12 kHz FR4–6: 1 kHz to 10 kHz 230 V / 480 V defaults: FR1–3: 4 kHz FR4–5: 3.6 kHz FR6: 2 kHz 575 V range: FR1–6: 1 kHz to 6 kHz 575 V defaults: FR1–4: 3 kHz FR5–6: 2 kHz Automatic switching frequency derating in case of overload.	
	Frequency reference	Analog input: resolution 0.1% (10-bit), accuracy +1% Analog output: resolution 0.1% (10-bit), accuracy +1% Panel reference: resolution 0.01 Hz	
	Field weakening point	20 Hz to 400 Hz	
	Acceleration time	0.1 s to 3000 s	
	Deceleration time	0.1 s to 3000 s	
	Braking torque	DC brake: 30% x Motor Rated Torque ( $T_n$ ) (without brake chopper) Dynamic braking (with optional brake chopper using an external brake resistor): 100% continuous maximum rating	
	Ambient conditions	Ambient operating temperature	-10 °C (no frost) to +50 °C, up to +60 °C with derating (CT) -10 °C (no frost) to +40 °C, up to +60 °C with derating (VT)
		Storage temperature	-40 °C to +70 °C
		Relative humidity	0–95% RH, noncondensing, non-corrosive
Air quality: • Chemical vapors • Mechanical particles		Tested according to IEC 60068-2-60 Test Key: Flowing mixed gas corrosion test, Method 1 (H <sub>2</sub> S [hydrogen sulfide] and SO <sub>2</sub> [sulfur dioxide]) Designed according to: IEC 60721-3-3, unit in operation, class 3C2 IEC 60721-3-3, unit in operation, class 3S2	
Altitude		100% load capacity (no derating) up to 3280 ft (1000 m); 1% derating for each 328 ft (100 m) above 3280 ft (1000 m); max. 9842 ft (3000 m) (2000 m for corner grounded earth main systems) For 575 V product, maximum altitude is 6561 ft (2000 m) regardless of main system	



# 2.6

## Adjustable Frequency Drives

### PowerXL DG1 Series Drives

#### PowerXL Series—DG1 Technical Data and Specifications, continued

2

Attribute	Description	Specification
Ambient conditions, continued	Vibration:	5–150 Hz
	• EN 61800-5-1	Displacement amplitude: 1 mm (peak) at 5 Hz to 15.8 Hz (FR1–FR6)
	• EN 60668-2-6	Maximum acceleration amplitude: 1g at 15.8 Hz to 150 Hz (FR1–FR6)
	Shock:	Storage and shipping: maximum 15 g, 11 ms (in package)
	• ISTA 1 A	
	• EN 60068-2-27	
	Overvoltage	Overvoltage Category III
	Pollution degree	Pollution Degree 2
	Enclosure class	IP21/Type 1 standard in entire kW/hp range IP54/Type 12 option Note: Keypad or keypad hole plug required to be mounted in drive for IP54/Type 12 rating
	Immunity	Fulfills EN 61800-3 (2004), first and second environment
MTBF		FR1: 165,457 hours
		FR2: 134,833 hours
		FR3: 102,515 hours
		FR4: 121,567 hours
		FR5: 108,189 hours
		FR6: 100,000 hours
Noise		FR1: 51.2 dB
		FR2: 58.6 dB
		FR3: 61.0 dB
		FR4: 68.0 dB
		FR5: 69.1 dB
		FR6: 73.2 dB
Standards	Safety	UL 508C, CSA C22.2 No. 274-13 and EN 61800-5-1
	EMC	+EMC2: EN 61800-3 (2004), Category C2 The drive can be modified for IT networks and corner grounding TN system
	Electrostatic discharge	Second environment, IEC 61000-4-2, 4 kV CD or 8 kV AD, Criterion B
	Fast transient burst	Second environment, IEC 61000-4-4, 2 kV/5 kHz, Criterion B
	Dielectrical strength	Primary to secondary: 3600 Vac/5100 Vdc Primary to earth: 2000 Vac/2828 Vdc
	Approvals	EAC, RCM (C-Tick), RoHS, CE, UL and cUL (see nameplate for more detailed approvals)
Fieldbus connections		Onboard: EtherNet/IP, Modbus® TCP, Modbus RTU, BACnet

**PowerXL Series—DG1 Technical Data and Specifications, continued**

<b>Attribute</b>	<b>Description</b>	<b>Specification</b>
Safety/protections	Overtoltage protection	Yes
	Overtoltage trip limit	230 V drives: 456 V 480 V drives: 911 V 575 V drives: 1100 V
	Undervoltage protection	Yes
	Undervoltage trip limit	230 V drives: 211 V 480 V drives: 370 V 575 V drives: 550 V
	Earth fault protection	Yes Default: 15% motor FLA Minimum: 0% motor FLA Maximum: 30% motor FLA
	Input phase supervision	Yes
	Motor phase supervision	Yes
	Overcurrent protection	Yes
	Unit overtemperature protection	Yes
	Motor overload protection	Yes
	Motor stall protection	Yes
	Motor underload protection	Yes
	DC bus overvoltage control	Yes
	Short-circuit protection of 24 V reference voltages	Yes
	Surge protection	Yes (differential mode 2 kV; common mode 4 kV 230 V drives: 275 Vac, 10,000 A 480 V drives: 320 Vac, 8000 A 575 V drives: 385 Vac, 10,000 A
Common coated boards	Yes (prevents corrosion)	

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## Adjustable Frequency Drives

### PowerXL DG1 Series Drives

#### PowerXL Series—DG1 Technical Data and Specifications—Efficiency

2

#### 230 V

Frame Size	Load Torque	Efficiency		Input THDi
		VT	CT	
FR1	25%	92.10%	90.90%	42.8%
	50%	95.20%	95.20%	35.2%
	100%	96.70%	96.20%	29.9%
FR2	25%	90.80%	94.20%	70.0%
	50%	96.64%	97.09%	46.6%
	100%	97.30%	97.30%	33.3%
FR3	25%	97.23%	97.06%	53.1%
	50%	97.37%	97.17%	43.6%
	100%	97.00%	97.20%	30.8%
FR4	25%	94.60%	94.30%	39.4%
	50%	97.20%	97.10%	32.4%
	100%	97.60%	97.60%	25.6%
FR5	25%	94.5	94.30%	30.50%
	50%	97.80%	97.60%	30.8%
	100%	97.70%	97.80%	25.0%

#### 575 V












Frame Size	Load Torque	Efficiency		Input THDi
		VT	CT	
FR1	25%	97.48%	97.25%	62.6%
	50%	97.79%	97.66%	45.6%
	100%	98.10%	97.60%	36.8%
FR2	25%	98.06%	97.98%	60.6%
	50%	98.19%	98.11%	47.2%
	100%	98.20%	98.10%	36.7%
FR3	25%	97.98%	97.77%	78.9%
	50%	98.32%	98.18%	55.5%
	100%	98.10%	98.10%	36.3%
FR4	25%	98.27%	97.96%	66.1%
	50%	98.57%	98.44%	41.6%
	100%	98.30%	98.30%	31.2%
FR5	25%	98.60%	98.50%	52.80%
	50%	98.81%	98.78%	35.9%
	100%	98.60%	98.70%	28.4%

#### 480 V

Frame Size	Load Torque	Efficiency		Input THDi
		VT	CT	
FR1	25%	93.30%	90.70%	54.0%
	50%	97.10%	96.98%	46.8%
	100%	97.61%	97.67%	35.3%
FR2	25%	95.90%	94.20%	59.8%
	50%	97.81%	98.34%	42.7%
	100%	98.11%	98.20%	33.8%
FR3	25%	96.40%	95.20%	69.2%
	50%	97.87%	97.99%	45.2%
	100%	97.79%	98.15%	32.6%
FR4	25%	98.00%	97.80%	56.5%
	50%	97.97%	97.89%	39.8%
	100%	97.96%	98.17%	31.5%
FR5	25%	97.8	97.60%	50.3%
	50%	98.39%	98.10%	37.0%
	100%	98.14%	98.19%	29.5%

## Wiring Diagram

## PowerXL Series—DG1 Control Wiring Diagram

External Wiring	Pin	Signal Name	Signal	Default Setting	Description
	1	+10 V	Ref. Output Voltage	—	10 Vdc Supply Source
	2	AI1+	Analog Input 1	0–10 V	Voltage Speed Reference (Programmable to 4 mA to 20 mA)
	3	AI1–	Analog Input 1 Ground	—	Analog Input 1 Common (Ground)
	4	AI2+	Analog Input 2	4 mA to 20 mA	Current Speed Reference (Programmable to 0–10 V)
	5	AI2–	Analog Input 2 Ground	—	Analog Input 2 Common (Ground)
	6	GND	I/O Signal Ground	—	I/O Ground for Reference and Control
	7	DIN5	Digital Input 5	Preset Speed B0	Sets frequency output to Preset Speed 1
	8	DIN6	Digital Input 6	Preset Speed B1	Sets frequency output to Preset Speed 2
	9	DIN7	Digital Input 7	—	—
	10	DIN8	Digital Input 8	Force Remote (TI+)	Input takes VFD from Local to Remote
	11	CMB	DI5 to DI8 Common	Grounded	Allows source input
	12	GND	I/O Signal Ground	—	I/O Ground for Reference and Control
	13	24 V	+24 Vdc Output	—	Control voltage output (100 mA max.)
	14	DO1	Digital Output 1	Ready	Shows the drive is ready to run
	15	24 Vo	+24 Vdc Output	—	Control voltage output (100 mA max.)
	16	GND	I/O Signal Ground	—	I/O Ground for Reference and Control
	17	AO1+	Analog Output 1	Output Frequency	Shows Output frequency to motor 0–60 Hz (4 mA to 20 mA)
	18	AO2+	Analog Output 2	Motor Current	Shows Motor current of motor 0–FLA (4 mA to 20 mA)
	19	24 Vi	+24 Vdc Input	—	External control voltage input
	20	DIN1	Digital Input 1	Run Forward	Input starts drive in forward direction (start enable)
	21	DIN2	Digital Input 2	Run Reverse	Input starts drive in reverse direction (start enable)
	22	DIN3	Digital Input 3	External Fault	Input causes drive to fault
	23	DIN4	Digital Input 4	Fault Reset	Input resets active faults
	24	CMA	DI1 to DI4 Common	Grounded	Allows source input
	25	A	RS-485 Signal A	—	Fieldbus Communication (Modbus, BACnet)
	26	B	RS-485 Signal B	—	Fieldbus Communication (Modbus, BACnet)
	27	R3NO	Relay 3 Normally Open	At Speed	Relay output 3 shows VFD is at Ref. Frequency
	28	R1NC	Relay 1 Normally Closed	Run	Relay output 1 shows VFD is in a run state
	29	R1CM	Relay 1 Common		
	30	R1NO	Relay 1 Normally Open		
	31	R3CM	Relay 3 Common	At Speed	Relay output 3 shows VFD is at Ref. Frequency
	32	R2NC	Relay 2 Normally Closed	Fault	Relay output 2 shows VFD is in a fault state
	33	R2CM	Relay 2 Common		
	34	R2NO	Relay 2 Normally Open		

**Notes**

The above wiring demonstrates a SINK configuration. It is important that CMA and CMB are wired to ground (as shown by dashed line).

If a SOURCE configuration is desired, wire 24 V to CMA and CMB and close the inputs to ground.

When using the +10 V for AI1, it is important to wire AI1– to ground (as shown by dashed line).

If using +10 V for AI1 or AI2, terminals 3, 5 and 6 need to be jumpered together.

# 2.6

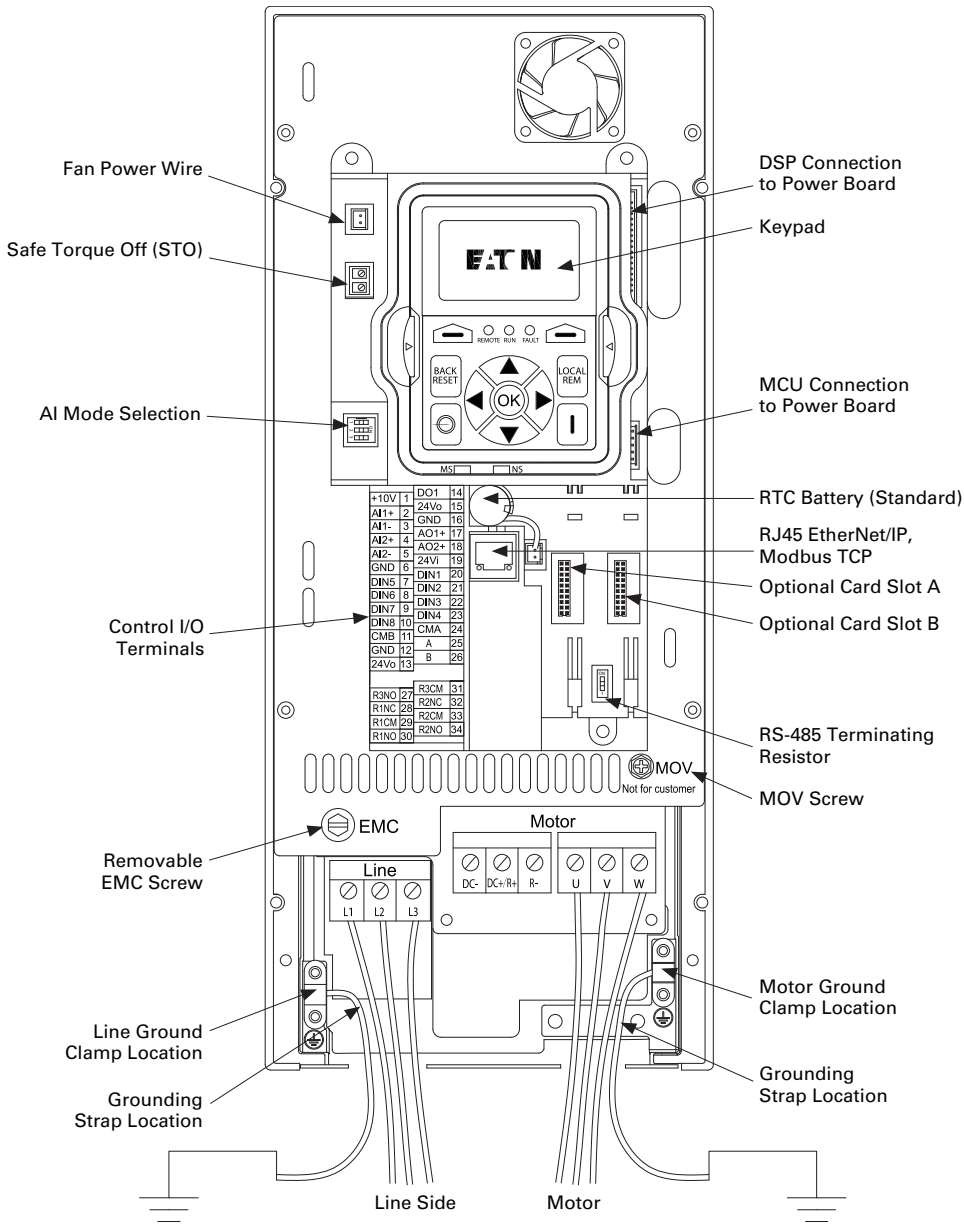
## Adjustable Frequency Drives

### PowerXL DG1 Series Drives

#### Control Board Layout

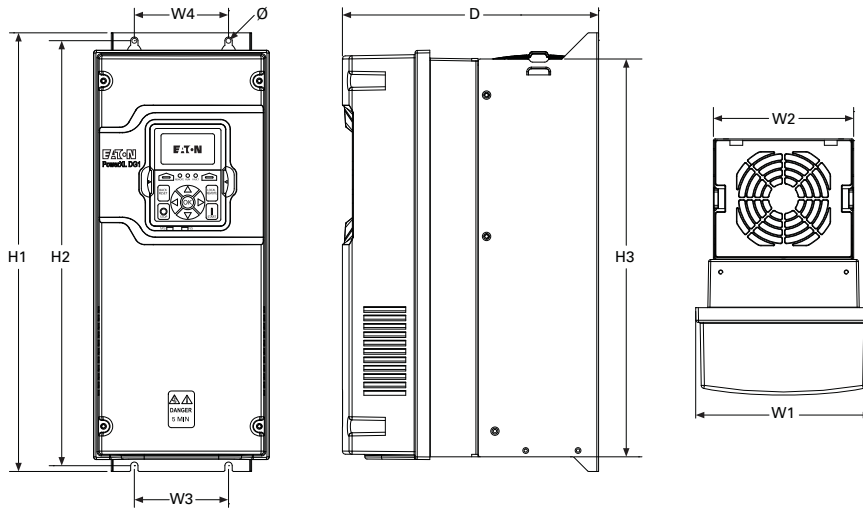
#### PowerXL Series—DG1 Control Board Layout

2



**Dimensions**

Approximate Dimensions in Inches (mm)

**PowerXL Series—DG1 Dimensions**

Frame Size	Voltage	hp (CT/I <sub>H</sub> )	kW	Amperes (CT/I <sub>H</sub> )	Approximate Dimensions in Inches (mm)									Weight Lb (kg)
					D	H1	H2	H3	W1	W2	W3	W4	Ø	
FR0	230 Vac	0.75–1.5	0.55–1.1	3.7–6.6	6.83	10.58	10.16	9.54	5.00	4.97	4.26	4.26	0.28	4.41
	480 Vac	1–3	0.75–2.2	2.2–5.6	(173.5)	(268.7)	(258)	(242.3)	(127)	(126.3)	(108.3)	(108.3)	(7.0)	(2.0)
FR1	230 Vac	0.75–3	0.55–2.2	3.5–11	7.91	12.87	12.28	11.50	6.02	4.80	3.94	3.94	0.28	14.33
	480 Vac	1–5	0.75–3.7	2.3–7.6	(200.9)	(326.9)	(311.9)	(292.1)	(153.0)	(121.9)	(100.1)	(100.1)	(7.0)	(6.5)
	575 Vac	2–5	1.5–3.7	3.3–7.5										
FR2	230 Vac	5–7.5	3–5.5	12.5–25	9.63	16.50	15.98	14.96	6.61	5.28	3.54	3.54	0.28	23.37
	480 Vac	7.5–15	5.5–11	12–23	(244.7)	(419.1)	(405.9)	(380.0)	(167.8)	(134.1)	(90.0)	(90.0)	(7.0)	(10.6)
	575 Vac	7.5–15	5.5–11	10–18										
FR3	230 Vac	10–15	7.5–11	31–48	10.44	21.97	21.46	20.41	8.06	7.24	4.92	4.92	0.35	49.82
	480 Vac	20–30	15–22	31–46	(265.1)	(558.0)	(545.0)	(518.5)	(204.6)	(183.9)	(125.0)	(125.0)	(9.0)	(22.6)
	575 Vac	20–30	15–22	22–34										
FR4	230 Vac	20–30	15–22	61–88	11.57	24.80	24.31	23.27	9.36	9.13	8.07	8.07	0.35	77.60
	480 Vac	40–60	30–45	61–87	(294.0)	(629.9)	(617.5)	(591.1)	(237.7)	(231.9)	(205.0)	(205.0)	(9.0)	(35.2)
	575 Vac	40–60	30–45	41–62										
FR5	230 Vac	40–60	30–45	114–170	13.41	34.98	29.65	27.83	11.34	11.10	8.66	8.66	0.35	154.32
	480 Vac	75–125	55–90	105–170	(340.7)	(888.5)	(753.1)	(706.9)	(288.0)	(281.9)	(220.0)	(220.0)	(9.0)	(70.0)
	575 Vac	75–125	55–90	80–125										
FR6	230 Vac	75–100	55–75	211–248	14.61	34.04	33.27	40.75	19.13	18.90	15.75	15.75	0.35	281.3
	480 Vac	150–200	110–150	205–261	(371.0)	(864.5)	(845.0)	(1035.0)	(486.0)	(480.0)	(400.0)	(400.0)	(9.0)	(127.6)
	575 Vac	150–200	110–160	144–208										
FR7	480 Vac	250–450	160–250	311–520	20.51	38.58	34.25	34.49	19.92	19.92	17.99	18.74	0.98	452
	575 Vac	250–400	187–298	261–416	(507.0)	(980.0)	(870.0)	(876.0)	(506.0)	(506.0)	(457.0)	(476.0)	(25.0)	(205.0)
	690 Vac	335–536	250–400	261–416										
FR7 with brake chopper	480 Vac	250–450	160–250	311–520	20.67	60.55	56.81	59.13	19.92	19.92	15.91	18.74	0.98	904
	575 Vac	250–400	187–298	261–416	(525.0)	(1538.0)	(1442.0)	(1501.9.0)	(506.0)	(506.0)	(404.0)	(476.0)	(25.0)	(410.0)
	690 Vac	335–536	250–400	261–416										
FR8	480 Vac	500–800	315–500	590–920	20.51	38.58	34.25	34.49	39.84	39.84	17.99	18.74	0.98	904
	575 Vac	450–650	336–485	460–650	(507.0)	(980.0)	(870.0)	(876.0)	(1012.0)	(1012.0)	(457.0)	(476.0)	(25.0)	(410.0)
	690 Vac	603–845	450–630	460–650										
FR8 with brake chopper	480 Vac	500–800	315–500	590–920	20.67	60.55	56.81	59.13	39.84	39.84	15.91	18.74	0.98	1808
	575 Vac	450–650	336–485	460–650	(525.0)	(1538.0)	(1442.0)	(1501.9.0)	(1012.0)	(1012.0)	(404.0)	(476.0)	(25.0)	(820.0)
	690 Vac	603–845	450–630	460–650										

**Note:** The FR8 drive includes 2 FR7 power units coupled together.

#### DG1 General Purpose Enclosed Drive



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### PowerXL DG1 Series Enclosed Drives

#### Product Description

The DG1 Enclosed Drive family incorporates the latest Eaton drive technology into pre-engineered enclosed solutions covering the industry's most common applications. Using the benefits of the PowerXL DG1, the enclosed family provides enhanced user safety with the Safe Torque feature as well as industry-leading energy efficiency from the patented Active Energy Control algorithm. Eaton further raises the bar by providing customers with industry best lead times with the Rapid Response System. This system allows customers to select from 9 million standard configurations that have been pre-engineered with each configuration having a set lead time. The Rapid Response System delivers an improved quotation process and a faster delivery.

#### Features and Benefits

- Dual rated for both constant torque (CT) / high overload (I<sub>H</sub>) and variable torque (VT) / low overload applications
- Optional Brake Chopper for external braking applications
- Available circuit breaker, motor circuit protector, fused disconnect, isolation fusing and surge protection device options to provide input power protection
- Optional 3% input and output reactors provide a reduction in voltage and current harmonics on both line and load side
- Bypass options include a standard three-contactor design and a reduced voltage soft starter design
- Output contactor option provides a means for positive disconnection of the drive output from the motor terminals
- MotoRX and dV/dt filter options are used to reduce transients voltages at the motor terminals
- Customizable cover control options
- Padlockable disconnect

#### Standards and Certifications

- UL 508C



- The PowerXL DG1 comes standard with the following communication protocols:
  - EtherNet/IP
  - Modbus/TCP
  - Modbus RTU
  - BACnet MS/TP

#### Communication Options

- PROFIBUS-DP
- LonWorks
- CANopen
- DeviceNet

#### Enclosure Ratings

- NEMA Type 1
- NEMA Type 12
- NEMA Type 3R

#### Mounting

- Wall mount
- Floor mount: 12-inch legs
- Floor mount: 22-inch legs

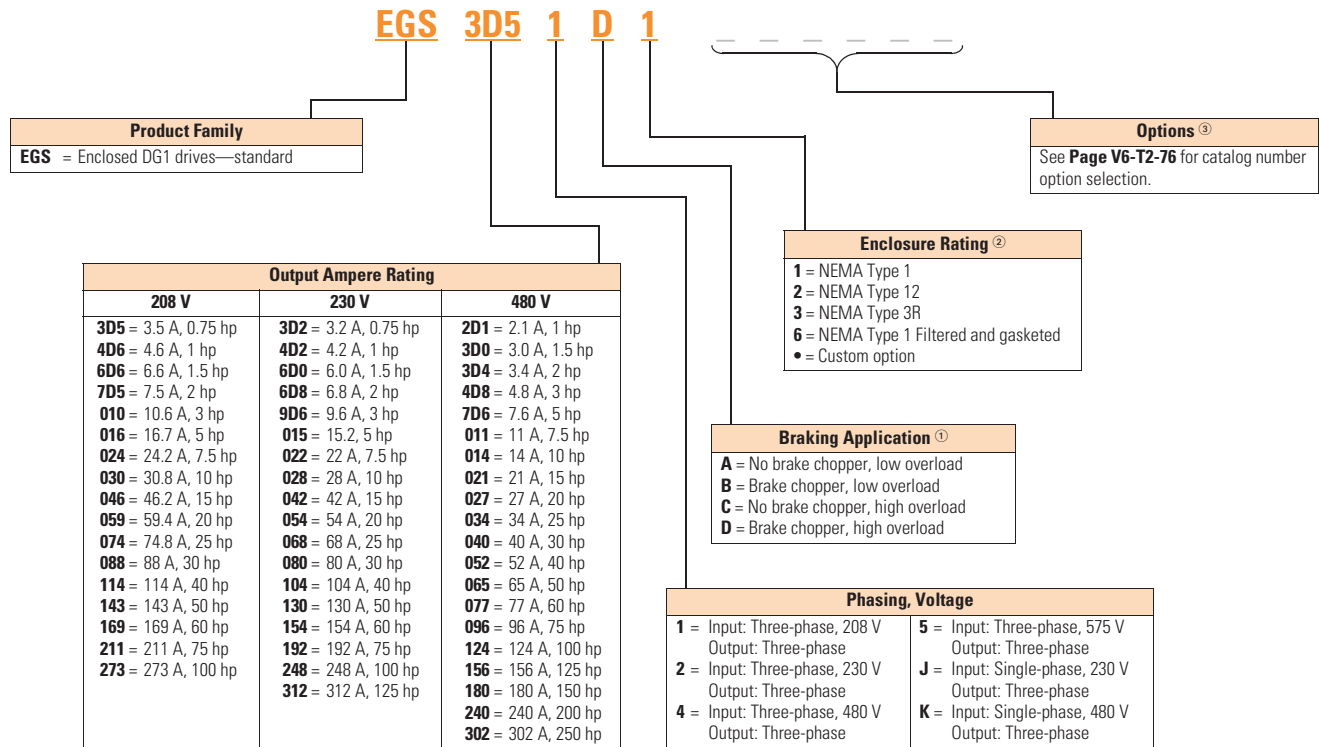
#### Product Range

- 208 V: 0.75–100 hp
- 230 V: 0.75–125 hp
- 480 V: 1–250 hp
- 230 V single-phase: 1–30 hp
- 480 V single-phase: 1.5–60 hp

## Catalog Number Selection

Catalog Number Selection is for reference only. Not all option combinations may be available.

### DG1 Enclosed—Base Catalog Number



### Notes

- <sup>(1)</sup> Brake chopper is a factory-installed option only. Braking resistors sold separately. See DG1 drives starting on Page V6-T2-59 for selection.
- <sup>(2)</sup> Additional enclosure options including NEMA 4, 4X, 7 and 9 are available. Please contact the factory for configuration and pricing.
- <sup>(3)</sup> Part number configuration continued on the following page.



# 2.6

## Adjustable Frequency Drives

### PowerXL DG1 Series Drives

Catalog Number Selection is for reference only. Not all option combinations may be available.

#### DG1 Enclosed—Catalog Number Options

2

**EGS 3D5 1 D 1**

**2 0 0 B 1 0 0 0 0**

**Base Catalog Number Example**  
See **Page V6-T2-75** for base catalog number selection.

**Power Disconnect Options**

- 0 = None
- 1 = MCP disconnect ①
- 2 = Circuit breaker
- 3 = Circuit breaker/isolation fusing
- 4 = Circuit breaker/isolation fusing/3% input reactor
- 5 = Circuit breaker/isolation fusing/SPD
- 6 = Circuit breaker/isolation fusing/SPD/3% input reactor
- 7 = Circuit breaker/3% input reactor
- 8 = Circuit breaker/SPD
- 9 = Circuit breaker/SPD/3% input reactor
- A = Fused disconnect
- B = Fused disconnect/SPD
- C = Fused disconnect/SPD/3% input reactor
- D = Fused disconnect/3% input reactor
- E = Isolation fuses
- F = Isolation fuses/3% input reactor
- G = Isolation fuses/SPD
- H = Isolation fuses/SPD/3% input reactor
- = Custom option ②

**Bypass Options ③**

- 0 = None
- 1 = Manual HOA bypass
- 2 = Manual HOA bypass/isolation fusing
- 3 = Manual HOA bypass/isolation fusing/3% input reactor
- 4 = Manual HOA bypass/isolation fusing/SPD
- 5 = Manual HOA bypass/isolation fusing/SPD/3% input reactor
- 6 = Manual HOA bypass/3% input reactor
- 7 = Manual HOA bypass/SPD
- 8 = Manual HOA bypass/SPD/3% input reactor
- H = Manual HOA RVSS bypass
- J = Manual HOA RVSS bypass/isolation fusing
- K = Manual HOA RVSS bypass/isolation fusing/3% input reactor
- L = Manual HOA RVSS bypass/isolation fusing/SPD
- M = Manual HOA RVSS bypass/isolation fusing/SPD/3% input reactor
- N = Manual HOA RVSS bypass/3% input reactor
- P = Manual HOA RVSS bypass/SPD
- R = Manual HOA RVSS bypass/SPD/3% input reactor
- = Custom option ②

**Output Power Options ④**

- 0 = None
- A = Output contactor
- B = 3% Output reactor
- D = dV/dt filter
- E = 3% Output Reactor/output contactor
- G = dV/dt/output contactor
- = Custom option ②

**Control Options ⑤**

- 0 = None
- 1 = Speed pot
- 2 = Start-stop pushbutton
- 3 = Start-stop pushbutton with speed pot
- A = HOA switch
- B = Start-stop pushbutton with speed pot & HOA switch
- C = Start-stop pushbutton with HOA switch
- D = HOA switch with speed pot
- = Custom option ②

**Option Boards 2**  
Same options and codes as Option Boards 1

**Option Boards 1**

- 0 = No option
- 1 = 3 x DI, 3 x DO, 1 Thermistor, 24 Vdc/EXT
- 2 = 1 x AI, 2 x AO (isolated to control board)
- 3 = 3 x relay dry contact (2NO + 1NO/NC)
- 4 = 3 x PT100 RTD thermistor input
- 5 = 6 DI 240 Vac input
- = Custom option ②

**Communication Options**

- 0 = No option
- 1 = PROFIBUS-DP
- 3 = CANopen (slave)
- 4 = DeviceNet
- 5 = PROFIBUS-DP (D9 connector)
- D = SmartWire-DT
- = Custom option ②

**Enclosure Options**

- 0 = None
- 1 = Floor stand—12 inches
- 2 = Floor stand—22 inches
- A = Space heater
- B = Space heater & 12-inch floor stands
- C = Space heater & 22-inch floor stands
- = Custom option ②

**Light Options ⑤**

- 0 = None
- 1 = Non-bypass light kit—Power On, Run, Fault
- 2 = Bypass light kit—On, VFD Run, Fault, Bypass Run
- = Custom option ②

**Notes**

- ① HMCP disconnect option required and only available when bypass is selected.
- ② More options are available as Engineered to Order through the Bid Manager tool.
- ③ All bypass options include third contactor for drive isolation when in bypass mode.
- ④ Output contactor not available with bypass. Bypass comes standard with output contactor.
- ⑤ Pilot devices are 22 mm standard. 30 mm options are available as engineered to order through the Bid Manager tool.

## Production Selection

## DG1 Enclosed Drive



## 208 V Drives—Constant Torque (CT)/High Overload (H) Enclosed Drives

hp	Current (A)	Drive Frame Size	NEMA Type 1	NEMA Type 12	NEMA Type 3R
			Base Catalog Number <sup>①</sup>	Base Catalog Number <sup>①</sup>	Base Catalog Number <sup>①</sup>
0.75	3.5	1	EGS3D51D1	EGS3D51D2	EGS3D51D3
1	4.6	1	EGS4D61D1	EGS4D61D2	EGS4D61D3
1.5	6.6	1	EGS6D61D1	EGS6D61D2	EGS6D61D3
2	7.5	1	EGS7D51D1	EGS7D51D2	EGS7D51D3
3	10.6	1	EGS0101D1	EGS0101D2	EGS0101D3
5	16.7	2	EGS0161D1	EGS0161D2	EGS0161D3
7.5	24.2	2	EGS0241D1	EGS0241D2	EGS0241D3
10	30.8	3	EGS0301D1	EGS0301D2	EGS0301D3
15	46.2	3	EGS0461D1	EGS0461D2	EGS0461D3
20	59.4	4	EGS0591C1	EGS0591C2	EGS0591C3
25	74.8	4	EGS0741C1	EGS0741C2	EGS0741C3
30	88	4	EGS0881C1	EGS0881C2	EGS0881C3
40	114	5	EGS1141C1	EGS1141C2	EGS1141C3
50	143	5	EGS1431C1	EGS1431C2	EGS1431C3
60	169	5	EGS1691C1	EGS1691C2	EGS1691C3
75 <sup>②</sup>	211	6	EGS2111C1 <sup>②</sup>	EGS2111C2 <sup>②</sup>	EGS2111C3 <sup>②</sup>
100 <sup>②③</sup>	261 <sup>③</sup>	6	EGS2611C1 <sup>②</sup>	EGS2611C2 <sup>②</sup>	EGS2611C3 <sup>②</sup>

## DG1 Enclosed Drive



## 208 V Drives—Variable Torque (VT)/Low Overload (L) Enclosed Drives

hp	Current (A)	Drive Frame Size	NEMA Type 1	NEMA Type 12	NEMA Type 3R
			Base Catalog Number <sup>①</sup>	Base Catalog Number <sup>①</sup>	Base Catalog Number <sup>①</sup>
1	4.6	1	EGS4D61B1	EGS4D61B2	EGS4D61B3
1.5	6.6	1	EGS6D61B1	EGS6D61B2	EGS6D61B3
2	7.5	1	EGS7D51B1	EGS7D51B2	EGS7D51B3
3	10.6	1	EGS0101B1	EGS0101B2	EGS0101B3
5	16.7	2	EGS0161B1	EGS0161B2	EGS0161B3
7.5	24.2	2	EGS0241B1	EGS0241B2	EGS0241B3
10	30.8	2	EGS0301B1	EGS0301B2	EGS0301B3
15	46.2	3	EGS0461B1	EGS0461B2	EGS0461B3
20	59.4	3	EGS0591B1	EGS0591B2	EGS0591B3
25	74.8	4	EGS0741A1	EGS0741A2	EGS0741A3
30	88	4	EGS0881A1	EGS0881A2	EGS0881A3
40	114	4	EGS1141A1	EGS1141A2	EGS1141A3
50	143	5	EGS1431A1	EGS1431A2	EGS1431A3
60	169	5	EGS1691A1	EGS1691A2	EGS1691A3
75	211	5	EGS2111A1	EGS2111A2	EGS2111A3
100 <sup>②</sup>	273	6	EGS2731A1 <sup>②</sup>	EGS2731A2 <sup>②</sup>	EGS2731A3 <sup>②</sup>

**Notes**

<sup>①</sup> Table is for base catalog number reference only. For complete catalog number selection, see **Page V6-T2-76**.

<sup>②</sup> Available in 2017.

<sup>③</sup> These units are current rated. They do not meet NEC ampere rating at this horsepower.

# 2.6

## Adjustable Frequency Drives

### PowerXL DG1 Series Drives

2

#### DG1 Enclosed Drive



#### 230 V Drives—Constant Torque (CT)/High Overload (H) Enclosed Drives

hp	Current (A)	Drive Frame Size	NEMA Type		
			1 Base Catalog Number ①	12 Base Catalog Number ①	3R Base Catalog Number ①
0.75	3.2	1	EGS3D22D1	EGS3D22D2	EGS3D22D3
1	4.2	1	EGS4D22D1	EGS4D22D2	EGS4D22D3
1.5	6	1	EGS6D02D1	EGS6D02D2	EGS6D02D3
2	6.8	1	EGS6D82D1	EGS6D82D2	EGS6D82D3
3	9.6	1	EGS9D62D1	EGS9D62D2	EGS9D62D3
5	15.2	2	EGS0152D1	EGS0152D2	EGS0152D3
7.5	22	2	EGS0222D1	EGS0222D2	EGS0222D3
10	28	3	EGS0282D1	EGS0282D2	EGS0282D3
15	42	3	EGS0422D1	EGS0422D2	EGS0422D3
20	54	4	EGS0542C1	EGS0542C2	EGS0542C3
25	68	4	EGS0682C1	EGS0682C2	EGS0682C3
30	80	4	EGS0802C1	EGS0802C2	EGS0802C3
40	104	5	EGS1042C1	EGS1042C2	EGS1042C3
50	130	5	EGS1302C1	EGS1302C2	EGS1302C3
60	154	5	EGS1542C1	EGS1542C2	EGS1542C3
75 ②	192	6	EGS1922C1 ②	EGS1922C2 ②	EGS1922C3 ②
100 ②	248	6	EGS2482C1 ②	EGS2482C2 ②	EGS2482C3 ②

#### DG1 Enclosed Drive



#### 230 V Drives—Variable Torque (VT)/Low Overload (L) Enclosed Drives

hp	Current (A)	Drive Frame Size	NEMA Type		
			1 Base Catalog Number ①	12 Base Catalog Number ①	3R Base Catalog Number ①
1	4.2	1	EGS4D22B1	EGS4D22B2	EGS4D22B3
1.5	6	1	EGS6D02B1	EGS6D02B2	EGS6D02B3
2	6.8	1	EGS6D82B1	EGS6D82B2	EGS6D82B3
3	9.6	1	EGS9D62B1	EGS9D62B2	EGS9D62B3
5	15.2	2	EGS0152B1	EGS0152B2	EGS0152B3
7.5	22	2	EGS0222B1	EGS0222B2	EGS0222B3
10	28	2	EGS0282B1	EGS0282B2	EGS0282B3
15	42	3	EGS0422B1	EGS0422B2	EGS0422B3
20	54	3	EGS0542B1	EGS0542B2	EGS0542B3
25	68	4	EGS0682A1	EGS0682A2	EGS0682A3
30	80	4	EGS0802A1	EGS0802A2	EGS0802A3
40	104	4	EGS1042A1	EGS1042A2	EGS1042A3
50	130	5	EGS1302A1	EGS1302A2	EGS1302A3
60	154	5	EGS1542A1	EGS1542A2	EGS1542A3
75	192	5	EGS1922A1	EGS1922A2	EGS1922A3
100 ②	248	6	EGS2482A1 ②	EGS2482A2 ②	EGS2482A3 ②
125 ②	312	6	EGS3122A1 ②	EGS3122A2 ②	EGS3122A3 ②

**Notes**

- ① Table is for base catalog number reference only. For complete catalog number selection, see **Page V6-T2-76**.
- ② Available in 2017.

## DG1 Enclosed Drive



## 480 V Drives—Constant Torque (CT)/High Overload (IH) Enclosed Drives

hp	Current (A)	Drive Frame Size	NEMA Type 1 Base Catalog Number ①	NEMA Type 12 Base Catalog Number ①	NEMA Type 3R Base Catalog Number ①
1	2.1	1	EGS2D14D1	EGS2D14D2	EGS2D14D3
1.5	3	1	EGS3D04D1	EGS3D04D2	EGS3D04D3
2	3.4	1	EGS3D44D1	EGS3D44D2	EGS3D44D3
3	4.8	1	EGS4D84D1	EGS4D84D2	EGS4D84D3
5	7.6	1	EGS7D64D1	EGS7D64D2	EGS7D64D3
7.5	11	2	EGS0114D1	EGS0114D2	EGS0114D3
10	14	2	EGS0144D1	EGS0144D2	EGS0144D3
15	21	2	EGS0214D1	EGS0214D2	EGS0214D3
20	27	3	EGS0274D1	EGS0274D2	EGS0274D3
25	34	3	EGS0344D1	EGS0344D2	EGS0344D3
30	40	3	EGS0404D1	EGS0404D2	EGS0404D3
40	52	4	EGS0524C1	EGS0524C2	EGS0524C3
50	65	4	EGS0654C1	EGS0654C2	EGS0654C3
60	77	4	EGS0774C1	EGS0774C2	EGS0774C3
75	96	5	EGS0964C1	EGS0964C2	EGS0964C3
100	124	5	EGS1244C1	EGS1244C2	EGS1244C3
125	156	5	EGS1564C1	EGS1564C2	EGS1564C3
150 ②	180	6	EGS1804C1 ②	EGS1804C2 ②	EGS1804C3 ②
200 ②	240	6	EGS2404C1 ②	EGS2404C2 ②	EGS2404C3 ②

## DG1 Enclosed Drive



## 480 V Drives—Variable Torque (VT)/Low Overload (L) Enclosed Drives

hp	Current (A)	Drive Frame Size	NEMA Type 1 Base Catalog Number ①	NEMA Type 12 Base Catalog Number ①	NEMA Type 3R Base Catalog Number ①
1.5	3	1	EGS3D04B1	EGS3D04B2	EGS3D04B3
2	3.4	1	EGS3D44B1	EGS3D44B2	EGS3D44B3
3	4.8	1	EGS4D84B1	EGS4D84B2	EGS4D84B3
5	7.6	1	EGS7D64B1	EGS7D64B2	EGS7D64B3
7.5	11	1	EGS0114B1	EGS0114B2	EGS0114B3
10	14	2	EGS0144B1	EGS0144B2	EGS0144B3
15	21	2	EGS0214B1	EGS0214B2	EGS0214B3
20	27	2	EGS0274B1	EGS0274B2	EGS0274B3
25	34	3	EGS0344B1	EGS0344B2	EGS0344B3
30	40	3	EGS0404B1	EGS0404B2	EGS0404B3
40	52	3	EGS0524B1	EGS0524B2	EGS0524B3
50	65	4	EGS0654A1	EGS0654A2	EGS0654A3
60	77	4	EGS0774A1	EGS0774A2	EGS0774A3
75	96	4	EGS0964A1	EGS0964A2	EGS0964A3
100	124	5	EGS1244A1	EGS1244A2	EGS1244A3
125	156	5	EGS1564A1	EGS1564A2	EGS1564A3
150	180	5	EGS1804A1	EGS1804A2	EGS1804A3
200 ②	240	6	EGS2404A1 ②	EGS2404A2 ②	EGS2404A3 ②
250 ②	302	6	EGS3024A1 ②	EGS3024A2 ②	EGS3024A3 ②

**Notes**

① Table is for base catalog number reference only. For complete catalog number selection, see **Page V6-T2-76**.

② Available in 2017.

DG1 Enclosed Drive



#### 230 V Single-Phase Drives—Variable Torque (VT)/Low Overload (L) Enclosed Drives

hp	Current (A)	Drive Frame Size	NEMA Type 1 Base Catalog Number <sup>①</sup>	NEMA Type 12 Base Catalog Number <sup>①</sup>	NEMA Type 3R Base Catalog Number <sup>①</sup>
<b>Low Overload (VT) Enclosed Drives</b>					
0.75	3.2	1	EGS3D2JB1	EGS3D2JB2	EGS3D2JB3
1	4.2	1	EGS4D2JB1	EGS4D2JB2	EGS4D2JB3
1.5	6	2	EGS6D0JB1	EGS6D0JB2	EGS6D0JB3
2	6.8	2	EGS6D8JB1	EGS6D8JB2	EGS6D8JB3
3	9.6	2	EGS9D6JB1	EGS9D6JB2	EGS9D6JB3
5	15.2	2	EGS015JB1	EGS015JB2	EGS015JB3
7.5	22	3	EGS022JB1	EGS022JB2	EGS022JB3
10	28	3	EGS028JB1	EGS028JB2	EGS028JB3
15	42	4	EGS042JB1	EGS042JB2	EGS042JB3
20	54	4	EGS054JB1	EGS054JB2	EGS054JB3
25	68	5	EGS068JA1	EGS068JA2	EGS068JA3
30	80	5	EGS080JA1	EGS080JA2	EGS080JA3
40	104	5	EGS104JA1	EGS104JA2	EGS104JA3

DG1 Enclosed Drive



#### 480 V Single-Phase Drives—Variable Torque (VT)/Low Overload (L) Enclosed Drives

hp	Current (A)	Drive Frame Size	NEMA Type 1 Base Catalog Number <sup>①</sup>	NEMA Type 12 Base Catalog Number <sup>①</sup>	NEMA Type 3R Base Catalog Number <sup>①</sup>
<b>Low Overload (VT) Enclosed Drives</b>					
1	2.1	1	EGS2D1KB1	EGS2D1KB2	EGS2D1KB3
1.5	3	1	EGS3D0KB1	EGS3D0KB2	EGS3D0KB3
2	3.4	1	EGS3D4KB1	EGS3D4KB2	EGS3D4KB3
3	4.8	1	EGS4D8KB1	EGS4D8KB2	EGS4D8KB3
5	7.6	2	EGS7D6KB1	EGS7D6KB2	EGS7D6KB3
7.5	11	2	EGS011KB1	EGS011KB2	EGS011KB3
10	14	2	EGS014KB1	EGS014KB2	EGS014KB3
15	21	3	EGS021KB1	EGS021KB2	EGS021KB3
20	27	4	EGS027KB1	EGS027KB2	EGS027KB3
25	34	4	EGS034KB1	EGS034KB2	EGS034KB3
30	40	4	EGS040KB1	EGS040KB2	EGS040KB3
40	52	5	EGS052KB1	EGS052KB2	EGS052KB3
50	65	5	EGS065KA1	EGS065KA2	EGS065KA3
60	77	5	EGS077KA1	EGS077KA2	EGS077KA3

**Note**

<sup>①</sup> Table is for base catalog number reference only. For complete catalog number selection, see **Page V6-T2-76**.

## Enclosure Selection

### EGS

Enclosure selection charts are based on physical space limitations only and only to be used as a reference. For actual enclosure sizing, refer to Bid Manager.

**Note:** Standard enclosure sizing includes dedicated space for a circuit breaker or fusible disconnect, CPT, SPD, heater/thermostat, control relay and terminal blocks.

### Standard Enclosure X-Space

Enclosure Size	Frame 1	Frame 2	Frame 3	Frame 4	Frame 5
AX	2	2	2	—	—
BX	4	4	4	4	—
CX	7	7	7	7	7
DX	18	18	18	18	18

### Standard Power Options X-Space

Power Options	Frame 1	Frame 2	Frame 3	Frame 4	Frame 5
Isolation fuses	1	1	1	1	1
3% Input reactor	2	2	3	5	6
3% Output reactor	1	1	3	5	6
dV/dt filter	3	3	3	5	6
Output contactor	1	1	1	1	1

**Note:** Bypass enclosure sizing includes dedicated space for a MCP, CPT, input contactor, output bypass contactors, overload relay, SPD, heater/thermostat, control relay and terminal blocks.

### Bypass Enclosure X-Space

Enclosure Size	Frame 1	Frame 2	Frame 3	Frame 4	Frame 5
AX	0	0	0	—	—
BX	2	2	2	0	—
CX	5	5	5	3	2
DX	16	16	16	14	13

### Bypass Power Options X-Space

Power Options	Frame 1	Frame 2	Frame 3	Frame 4	Frame 5
Isolation fuses	1	1	1	1	1
3% Input reactor	2	2	3	5	6
RVSS bypass	2	2	2	3	4
3% output reactor	1	1	3	5	6
dV/dt filter	3	3	3	5	6

**Note:** Single-phase enclosure sizing includes dedicated space for a capacitor kit, circuit breaker or fusible disconnect, CPT, SPD, heater/thermostat, control relay and terminal blocks.

### Single-Phase Enclosure X-Space

Enclosure Size	Frame 1	Frame 2	Frame 3	Frame 4	Frame 5
AX	0	0	—	—	—
BX	2	2	1	1	—
CX	5	5	4	4	4
DX	16	16	15	15	15

### Single-Phase Power Options X-Space

Power Options	Frame 1	Frame 2	Frame 3	Frame 4	Frame 5
Isolation fuses	1	1	1	1	1
3% Input reactor	2	2	3	5	6
3% Output reactor	1	1	3	5	6
dV/dt filter	3	3	3	5	6
Output contactor	1	1	1	1	1

### Accessories

The PowerXL Series—DG1 drives can accommodate a wide selection of expander and adapter option boards to customize the drive for your application needs. The drive's control unit is designed to accept a total of two additional option boards.

The PowerXL Series—DG1 drives come with a factory-installed standard board configuration including the following:

- Standard I/O:
  - 8DI, 1DO
  - 2AI, 2AO
  - 2FC, 1FA relays
- Standard communications:
  - EtherNet/IP, Modbus TCP
  - RS-485: Modbus RTU, BACnet MS/TP

### PowerXL Series—DG1 I/O Card Kits

Description	Catalog Number
3 x DI, 3 x DO, 1 x thermistor, 24 Vdc/EXT option card	<b>DXG-EXT-3DI3DO1T</b>
1 x AI, 2 x AO (isolated to control board) option card	<b>DXG-EXT-1AI2AO</b>
3 x relay dry contact (2NO + 1NO/NC) option card	<b>DXG-EXT-3R0</b>
3 x PT100 RTD thermistor input option card	<b>DXG-EXT-THER1</b>
6 x DI 240 Vac input option card	<b>DXG-EXT-6DI</b>

### PowerXL Series—DG1 Communication Card Kits

Description	Catalog Number
PROFIBUS-DP communication card	<b>DXG-NET-PROFB</b>
CANopen communication card	<b>DXG-NET-CANOPEN</b>
DeviceNet communication card	<b>DXG-NET-DEVICENET</b>
PROFIBUS DB9 to 5-pin adapter card	<b>DXG-NET-PROAD</b>
SmartWire communication card and module	<b>DXG-NET-SWD</b> <sup>①</sup>

#### Note

<sup>①</sup> Available in January 2017.

## Options

### Input Power Options

Option	Description
HMCP Disconnect	The HMCP motor protection circuit breaker uses an electronic trip unit to provide typical motor overload relay functionality and short-circuit protection against potential phase-to-phase or phase-to-ground faults.
Circuit Breaker	Utilizes a circuit breaker to provide a means of short-circuit protection for the power cables between it and the drive, and protection from high-level ground faults on the power cable. Allows a convenient means of disconnecting the drive from the line, and the operating mechanism can be padlocked in the OFF position. This is factory mounted in the enclosure.
Isolation Fusing	Provides high-level fault protection of the drive input power circuit from the load side of the fuses to the input side of the power transistors. This option consists of three 200 kA fuses that are factory mounted in the enclosure.
3% Input Reactor	The input reactor is a three-phase series inductance on the line side of an AFD. It is used to provide a reduction in voltage and current harmonics. It also provides increased input protection for AFD and its semiconductors from line transients.
SPD	Provides a UL 1449 surge protection device (SPD) rated for 40 kA/ph that is connected to the line side terminals.
Fused Disconnect	Utilizes fusing to provide a means of short-circuit protection for the power cables between it and the drive, and protection from high-level ground faults on the power cable. Allows a convenient means of disconnecting the drive from the line, and the operating mechanism can be padlocked in the OFF position. This is factory mounted in the enclosure.

### Bypass Options

Option	Description
Manual HOA Bypass	Provides a three-position selector switch that allows the user to select either a HAND or AUTO mode of operation. HAND mode is defaulted keypad operation, and AUTO mode is defaulted to control from an external terminal source. These modes of operation can be configured via programming to allow for alternate combinations of start and speed sources. Start and speed sources include keypad, I/O and fieldbus.
Manual HOA RVSS Bypass	This option adds a reduced voltage soft starter to bypass assembly for soft starting in bypass mode.

### Output Power Options

Option	Description
Output Contactor	Provides a means for positive disconnection of the drive output from the motor terminals. The contactor coil is controlled by the drive's run or permissive logic. NC and NO auxiliary contacts rated at 10 A, 600 Vac are provided for customer use. This option includes a low VA 115 Vac fused control power transformer and is factory mounted in the enclosure.
3% Output Reactor	The output reactor is a three-phase series inductance on the load side of a VFD. It is used to reduce transient voltage (dv/dt) and peak voltages at the motor terminals. A 3% output filter is recommended for motor cable lengths up to 300 ft (10 m).
dV/dt Filter	Used to reduce the transient voltage (dV/dt) at the motor terminals. Recommended for motor cable lengths over 300 ft (10 m) and up to 1000 ft (304.8 m). This option is mounted in the enclosure.

### Control Options

Option	Description
Speed Pot	Provides the ability to adjust the frequency reference using a door-mounted potentiometer. This option uses the 10 Vdc reference to generate a 0–10 V signal at the analog voltage input signal terminal. When the HOA bypass option is added, the speed is controlled when the HOA switch is in the HAND position. Without the HOA bypass option, a two-position switch (labeled local/remote) is provided on the keypad to select speed reference from the speed potentiometer or a remote speed signal.
HOA Switch	Provides a three-position selector switch that allows the user to select either a HAND or AUTO mode of operation. HAND mode is defaulted to keypad operation, and AUTO mode is defaulted to control from an external terminal source. These modes of operation can be configured via drive programming to allow for alternate combinations of start and speed sources. Start and speed sources include Keypad, I/O and fieldbus.
Start-Stop Pushbutton	Provides door-mounted START and STOP pushbuttons for either bypass or non-bypass configurations.

### Light Options

Option	Description
Non-Bypass Light Kit—Power On, Run, Fault	Provides a white POWER ON light that indicates power to the enclosed cabinet, a green RUN light that indicates the drive is running and a red FAULT light that indicates a drive fault has occurred.
Bypass Light Kit—On, VFD Run, Fault, Bypass Run	Provides a white POWER ON light that indicates power to the enclosed cabinet, a green RUN light that indicates the drive is running, a red FAULT light that indicates a drive fault has occurred and an amber light that indicates when the motor is running in Bypass mode.

### Enclosure Options

Option	Description
Floor Stand 12 in	Converts a normally wall-mounted enclosure to a floor-standing enclosure with a height of 12 in (304.8 mm).
Floor Stand 22 in	Converts a normally wall-mounted enclosure to a floor-standing enclosure with a height of 22 in (558.8 mm).



## Technical Data and Specifications

### PowerXL Series—DG1 Technical Data and Specifications

2

Attribute	Description	Specification	
Input ratings	Input voltage $U_{in}$	208 V, 230 V, 480 V, 575 V, –15 to 10%	
	Input frequency	50 Hz to 60 Hz (variation up to 45 Hz to 66 Hz)	
	Connection to power	Once per minute or less	
	Starting delay	3 s (FR1 to FR2), 4 s (FR3), 5 s (FR4), 6 s (FR5 and FR6)	
	Short-circuit withstand rating	100 kAIC (fuses and circuit breakers)	
Output ratings	Output voltage	0 to $U_{in}$	
	Output current	$I_L$ : ambient temperature maximum 40 °C, up to 60 °C with derating, overload 1.1 x $I_L$ (1 min./10 min.) $I_H$ : ambient temperature maximum 50 °C, up to 60 °C with derating, overload 1.5 x $I_H$ (1 min./10 min.)	
	Initial output current	200% (2 s / 20 s)	
	Output frequency	0–400 Hz (standard)	
	Frequency resolution	0.01 Hz	
Control characteristics	Control methods	Frequency control Speed control Open-loop speed control Open-loop torque control	
	Switching frequency	230 V / 480 V range: FR1–3: 1 kHz to 12 kHz FR4–6: 1 kHz to 10 kHz  230 V / 480 V defaults: FR1–3: 4 kHz FR4–5: 3.6 kHz FR6: 2 kHz  575 V range: FR1–6: 1 kHz to 6 kHz  575 V defaults: FR1–4: 3 kHz FR5–6: 2 kHz  Automatic switching frequency derating in case of overload.	
	Frequency reference	Analog input: resolution 0.1% (10-bit), accuracy +1% Analog output: resolution 0.1% (10-bit), accuracy +1% Panel reference: resolution 0.01 Hz	
	Field weakening point	20 Hz to 400 Hz	
	Acceleration time	0.1 s to 3000 s	
	Deceleration time	0.1 s to 3000 s	
	Braking torque	DC brake: 30% x Motor Rated Torque ( $T_n$ ) (without brake chopper) Dynamic braking (with optional brake chopper using an external brake resistor): 100% continuous maximum rating	
	Ambient conditions	Ambient operating temperature	–10 °C (no frost) to +40 °C
		Storage temperature	–40 °C to +70 °C
		Relative humidity	0–95% RH, noncondensing, non-corrosive
Air quality: • Chemical vapors • Mechanical particles		Tested according to IEC 60068-2-60 Test Key: Flowing mixed gas corrosion test, Method 1 (H2S [hydrogen sulfide] and SO2 [sulfur dioxide]) Designed according to: IEC 60721-3-3, unit in operation, class 3C2 IEC 60721-3-3, unit in operation, class 3S2	
Altitude		100% load capacity (no derating) up to 3280 ft (1000 m); 1% derating for each 328 ft (100 m) above 3280 ft (1000 m); max. 9842 ft (3000 m) (2000 m for corner grounded earth main systems) For 575 V product, maximum altitude is 6561 ft (2000 m) regardless of main system	

## PowerXL Series—DG1 Technical Data and Specifications, continued

Attribute	Description	Specification
Ambient conditions, continued	Overvoltage	Overvoltage Category III
	Pollution degree	Pollution Degree 2
	Enclosure class	NEMA Type 1, 12, 3R
	Immunity	Fulfills EN 61800-3 (2004), first and second environment
Standards	Safety	UL 508C, EN 61800-5-1
	Approvals	UL and cUL
Fieldbus connections		Onboard: EtherNet/IP, Modbus <sup>®</sup> TCP, Modbus RTU, BACnet
Safety/protections	Overvoltage protection	Yes
	Overvoltage trip limit	230 V drives: 456 V 480 V drives: 911 V 575 V drives: 1100 V
	Undervoltage protection	Yes
	Undervoltage trip limit	230 V drives: 211 V 480 V drives: 370 V 575 V drives: 550 V
	Earth fault protection	Yes Default: 15% motor FLA Minimum: 0% motor FLA Maximum: 30% motor FLA
	Input phase supervision	Yes
	Motor phase supervision	Yes
	Overcurrent protection	Yes
	Unit overtemperature protection	Yes
	Motor overload protection	Yes
	Motor stall protection	Yes
	Motor underload protection	Yes
	DC bus overvoltage control	Yes
	Short-circuit protection of 24 V reference voltages	Yes
	Surge protection	Yes (differential mode 2 kV; common mode 4 kV 230 V drives: 275 Vac, 10,000 A 480 V drives: 320 Vac, 8000 A 575 V drives: 385 Vac, 10,000 A)
Common coated boards	Yes (prevents corrosion)	
Efficiency	Drive efficiency ratings <sup>Ⓢ</sup>	480 V: FR1 = 97.7% FR2 = 97.9% FR3 = 97.7% FR4 = 98.0% FR5 = 98.2%
		230 V: FR1 = 96.7% FR2 = 97.4% FR3 = 97.2% FR4 = 97.4% FR5 = 97.7%

**Note**

<sup>Ⓢ</sup> Based on DG1 efficiency ratings in an enclosure with no options.

# 2.6

## Adjustable Frequency Drives

### PowerXL DG1 Series Drives

#### Wiring Diagram

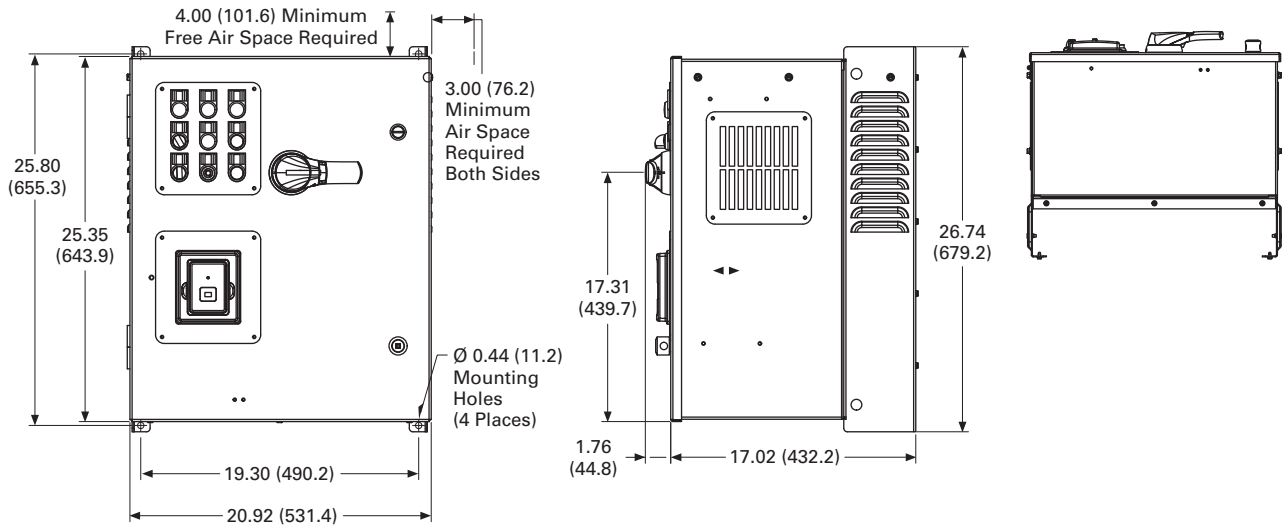
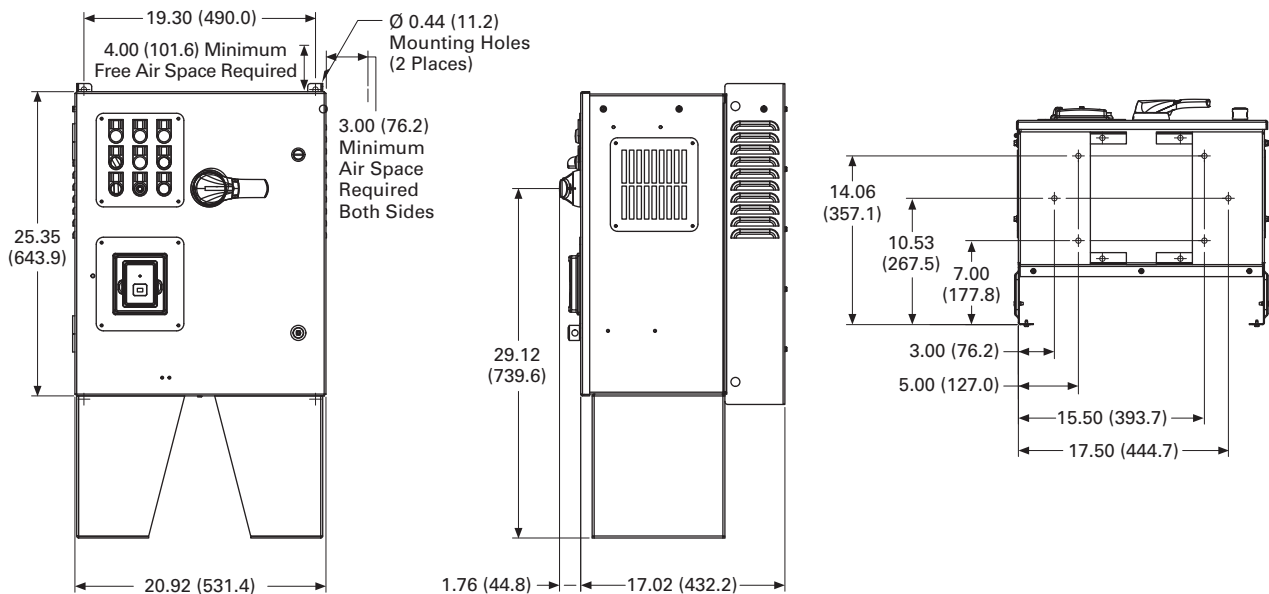
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PowerXL Series—DG1 Control Wiring Diagram

Pin	Signal Name	Signal	Default Setting	Description
1	+10 V	Ref. Output Voltage	—	10 Vdc Supply Source
2	AI1+	Analog Input 1	0–10 V	Voltage Speed Reference (Programmable to 4 mA to 20 mA)
3	AI1–	Analog Input 1 Ground	—	Analog Input 1 Common (Ground)
4	AI2+	Analog Input 2	4 mA to 20 mA	Current Speed Reference (Programmable to 0–10 V)
5	AI2–	Analog Input 2 Ground	—	Analog Input 2 Common (Ground)
6	GND	I/O Signal Ground	—	I/O Ground for Reference and Control
7	DIN5	Digital Input 5	Preset Speed B0	Sets frequency output to Preset Speed 1
8	DIN6	Digital Input 6	Preset Speed B1	Sets frequency output to Preset Speed 2
9	DIN7	Digital Input 7	Emergency Stop (TI–)	Input forces VFD output to shut off
10	DIN8	Digital Input 8	Force Remote (TI+)	Input takes VFD from Local to Remote
11	CMB	DI5 to DI8 Common	Grounded	Allows source input
12	GND	I/O Signal Ground	—	I/O Ground for Reference and Control
13	24 V	+24 Vdc Output	—	Control voltage output (100 mA max.)
14	DO1	Digital Output 1	Ready	Shows the drive is ready to run
15	24 Vo	+24 Vdc Output	—	Control voltage output (100 mA max.)
16	GND	I/O Signal Ground	—	I/O Ground for Reference and Control
17	AO1+	Analog Output 1	Output Frequency	Shows Output frequency to motor 0–60 Hz (4 mA to 20 mA)
18	AO2+	Analog Output 2	Motor Current	Shows Motor current of motor 0–FLA (4 mA to 20 mA)
19	24 Vi	+24 Vdc Input	—	External control voltage input
20	DIN1	Digital Input 1	Run Forward	Input starts drive in forward direction (start enable)
21	DIN2	Digital Input 2	Run Reverse	Input starts drive in reverse direction (start enable)
22	DIN3	Digital Input 3	External Fault	Input causes drive to fault
23	DIN4	Digital Input 4	Fault Reset	Input resets active faults
24	CMA	DI1 to DI4 Common	Grounded	Allows source input
25	A	RS-485 Signal A	—	Fieldbus Communication (Modbus, BACnet)
26	B	RS-485 Signal B	—	Fieldbus Communication (Modbus, BACnet)
27	R3NO	Relay 3 Normally Open	At Speed	Relay output 3 shows VFD is at Ref. Frequency
28	R1NC	Relay 1 Normally Closed	Run	Relay output 1 shows VFD is in a run state
29	R1CM	Relay 1 Common		
30	R1NO	Relay 1 Normally Open		
31	R3CM	Relay 3 Common	At Speed	Relay output 3 shows VFD is at Ref. Frequency
32	R2NC	Relay 2 Normally Closed	Fault	Relay output 2 shows VFD is in a fault state
33	R2CM	Relay 2 Common		
34	R2NO	Relay 2 Normally Open		

**Dimensions**

Approximate Dimensions in Inches (mm)

**AX Box Type 1****AX Box Type 1—12 Inch Floor Stands**

# 2.6

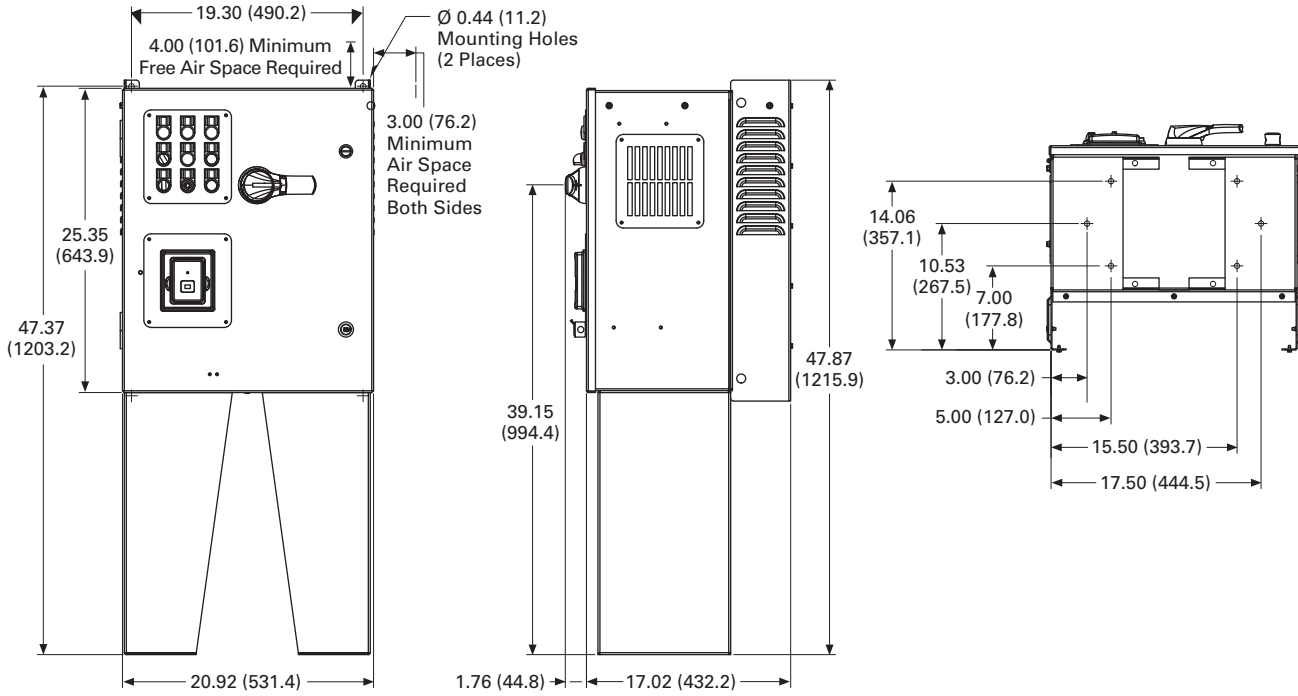
## Adjustable Frequency Drives

### PowerXL DG1 Series Drives

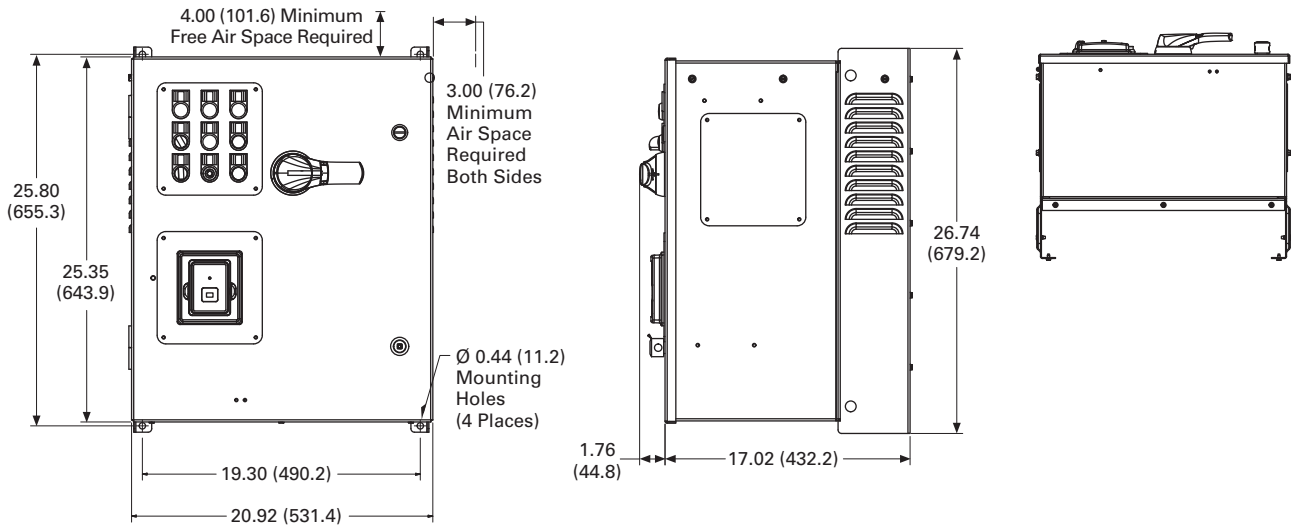
Approximate Dimensions in Inches (mm)

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#### AX Box Type 1—22 Inch Floor Stands

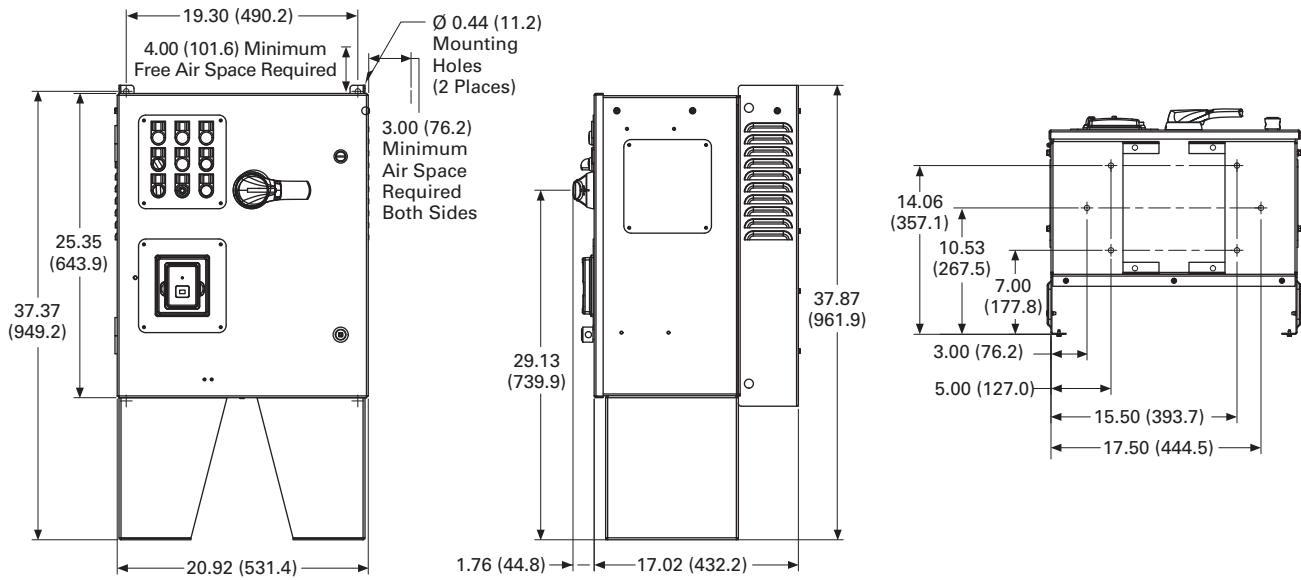


#### AX Box Type 12

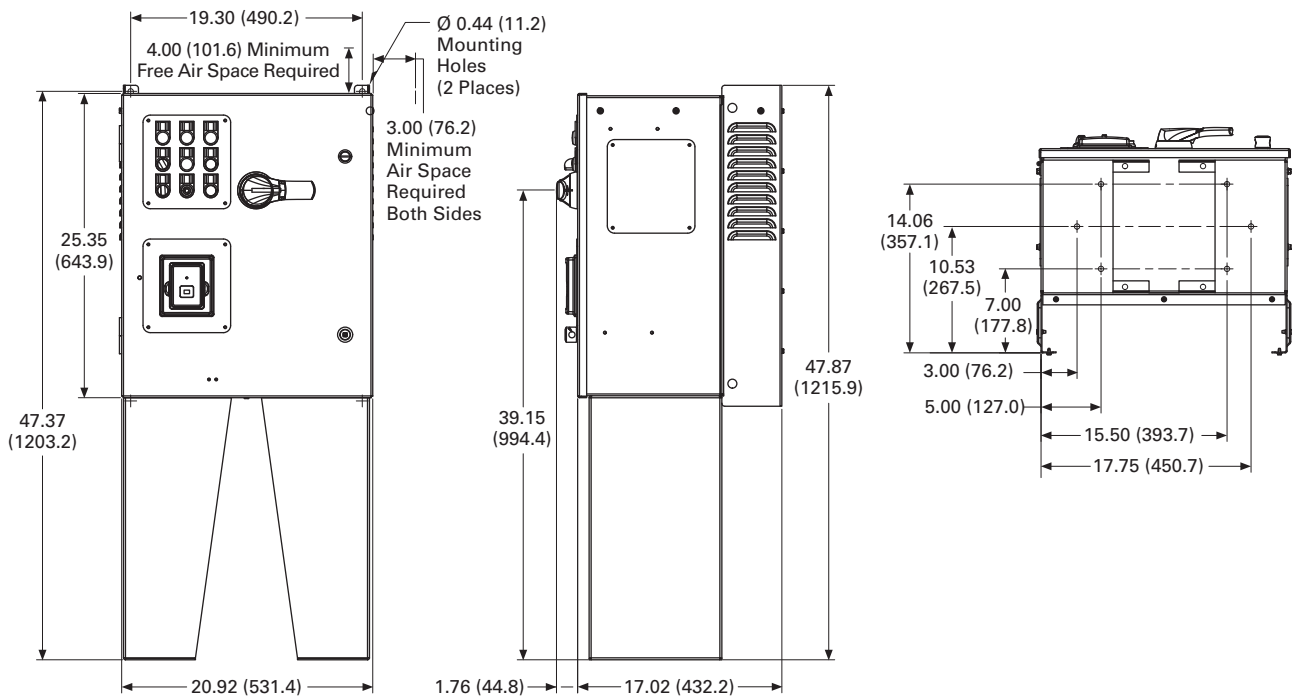


Approximate Dimensions in Inches (mm)

### AX Box Type 12—12 Inch Floor Stands



### AX Box Type 12—22 Inch Floor Stands



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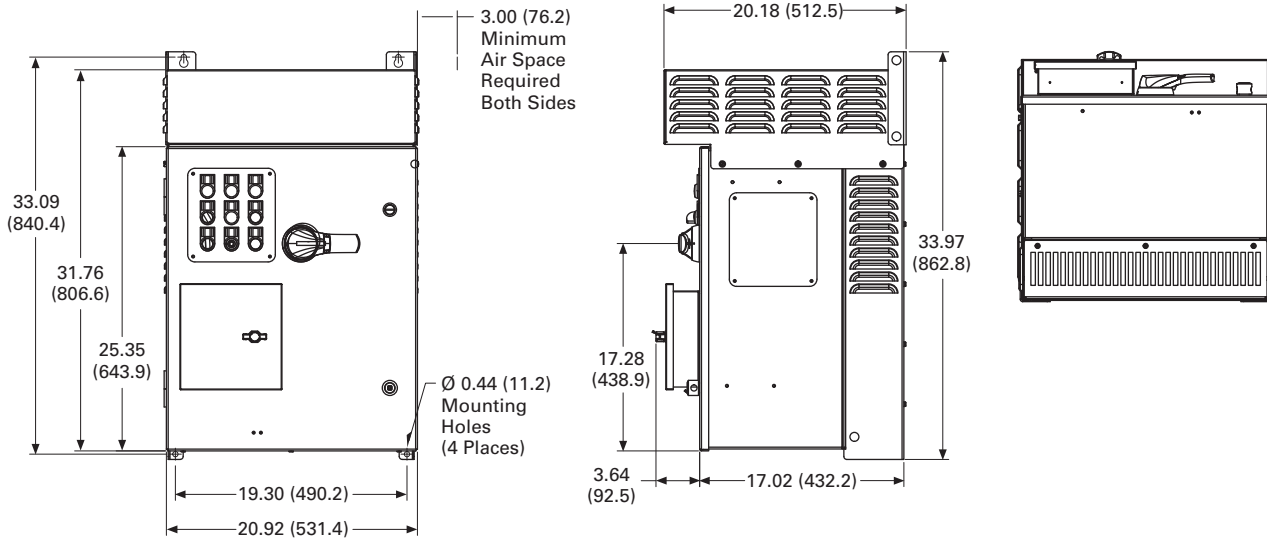
## Adjustable Frequency Drives

### PowerXL DG1 Series Drives

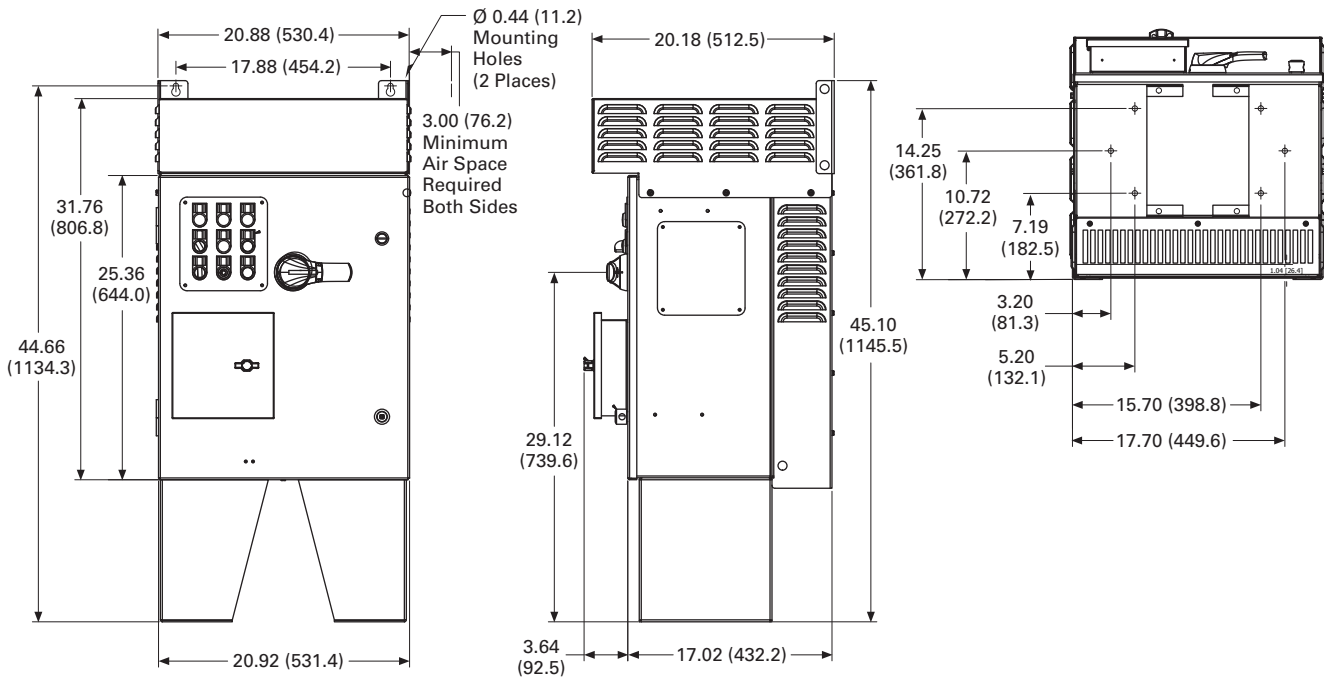
Approximate Dimensions in Inches (mm)

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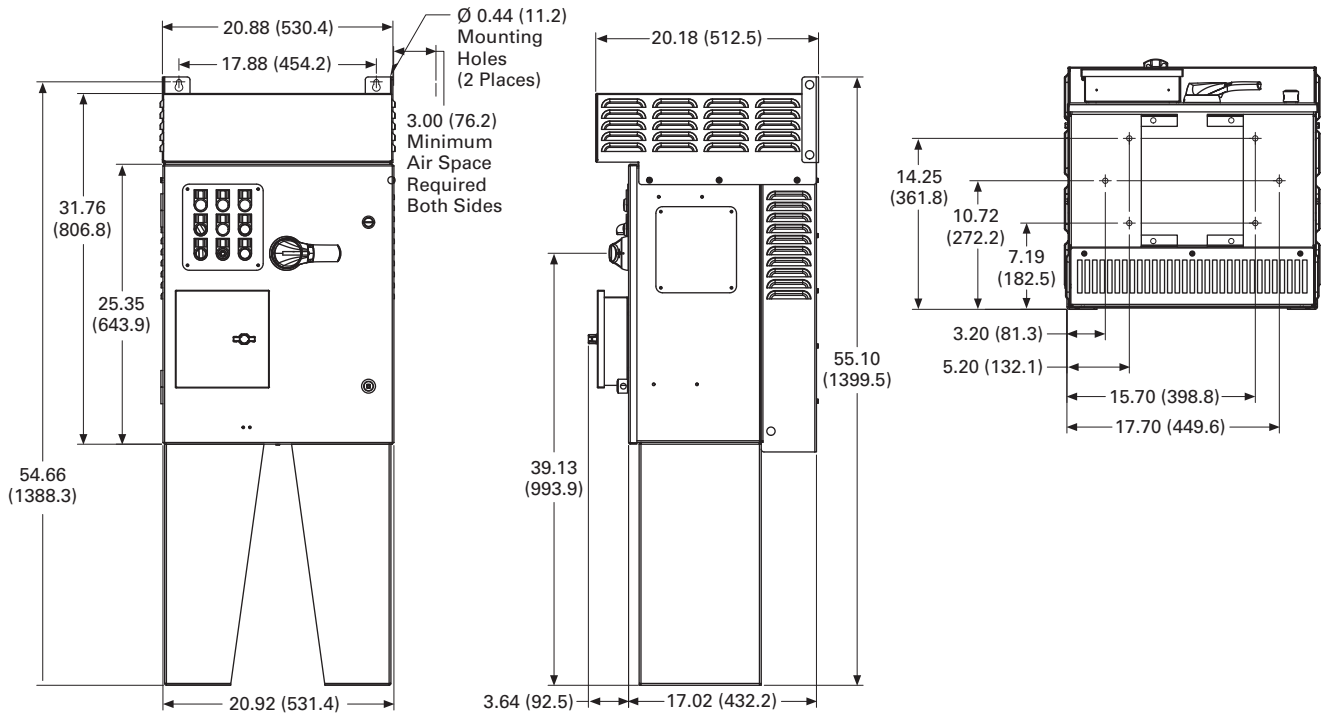


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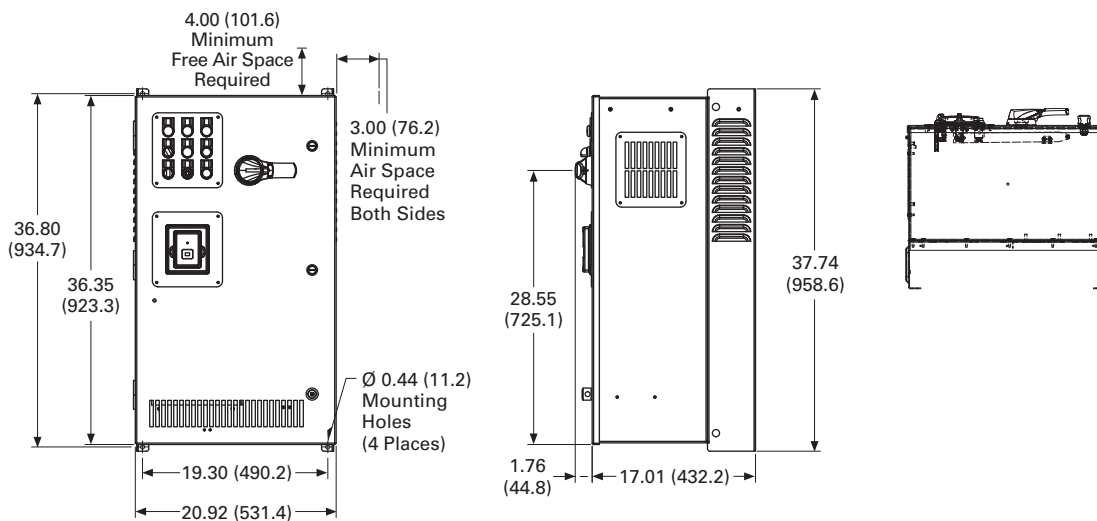


Approximate Dimensions in Inches (mm)

### AX Box Type 3R—22 Inch Floor Stands



### BX Box Type 1





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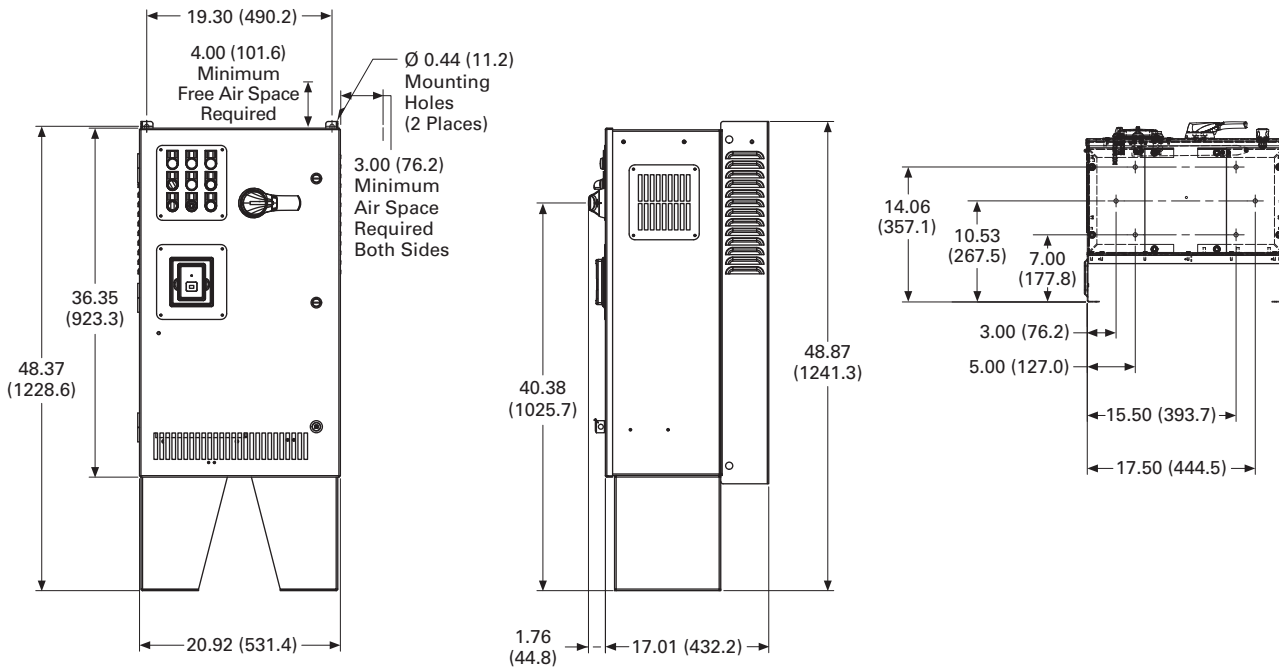
## Adjustable Frequency Drives

### PowerXL DG1 Series Drives

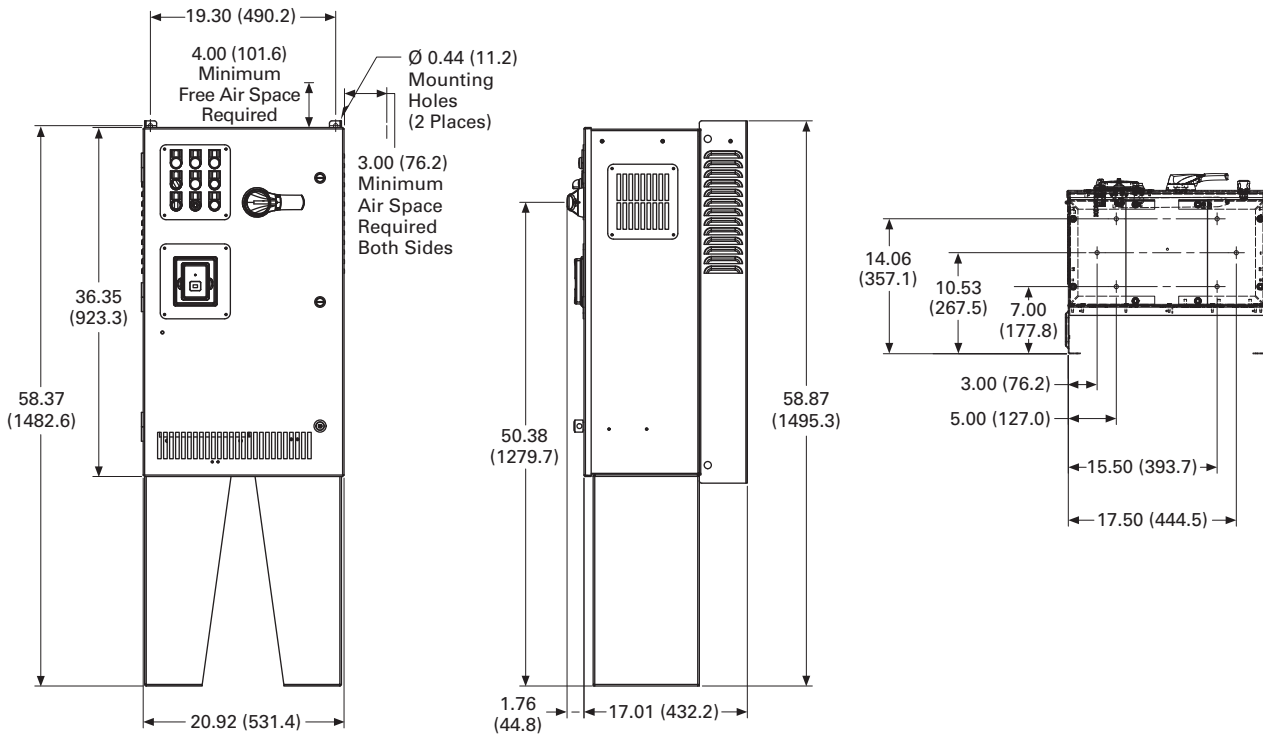
Approximate Dimensions in Inches (mm)

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#### BX Box Type 1—12 Inch Floor Stands

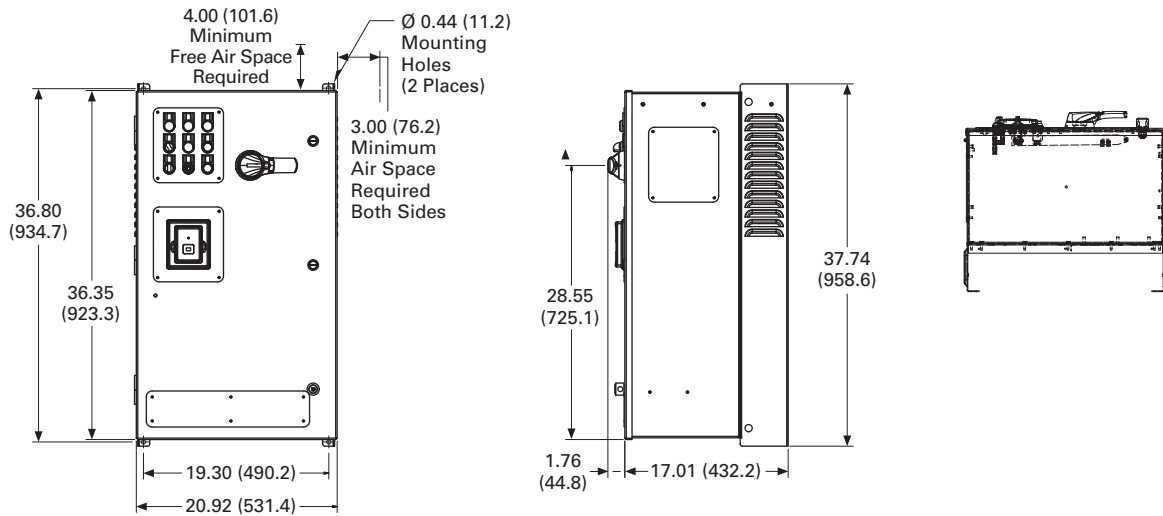


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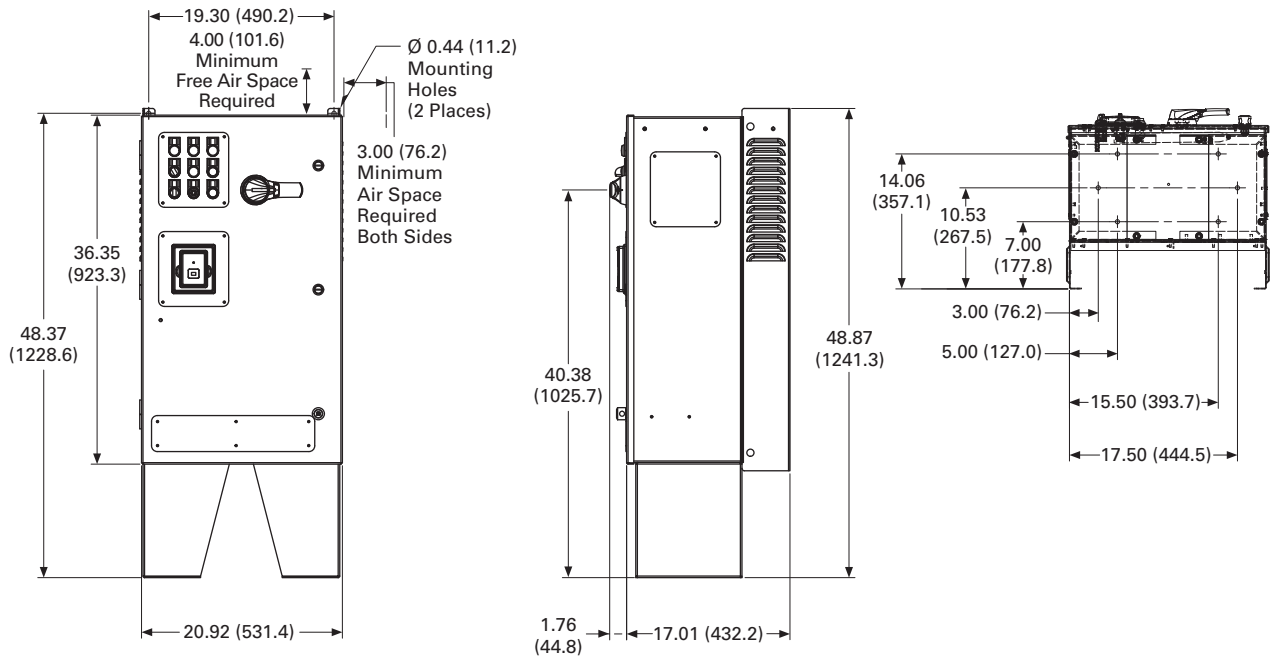


Approximate Dimensions in Inches (mm)

### BX Box Type 12



### BX Box Type 12—12 Inch Floor Stands



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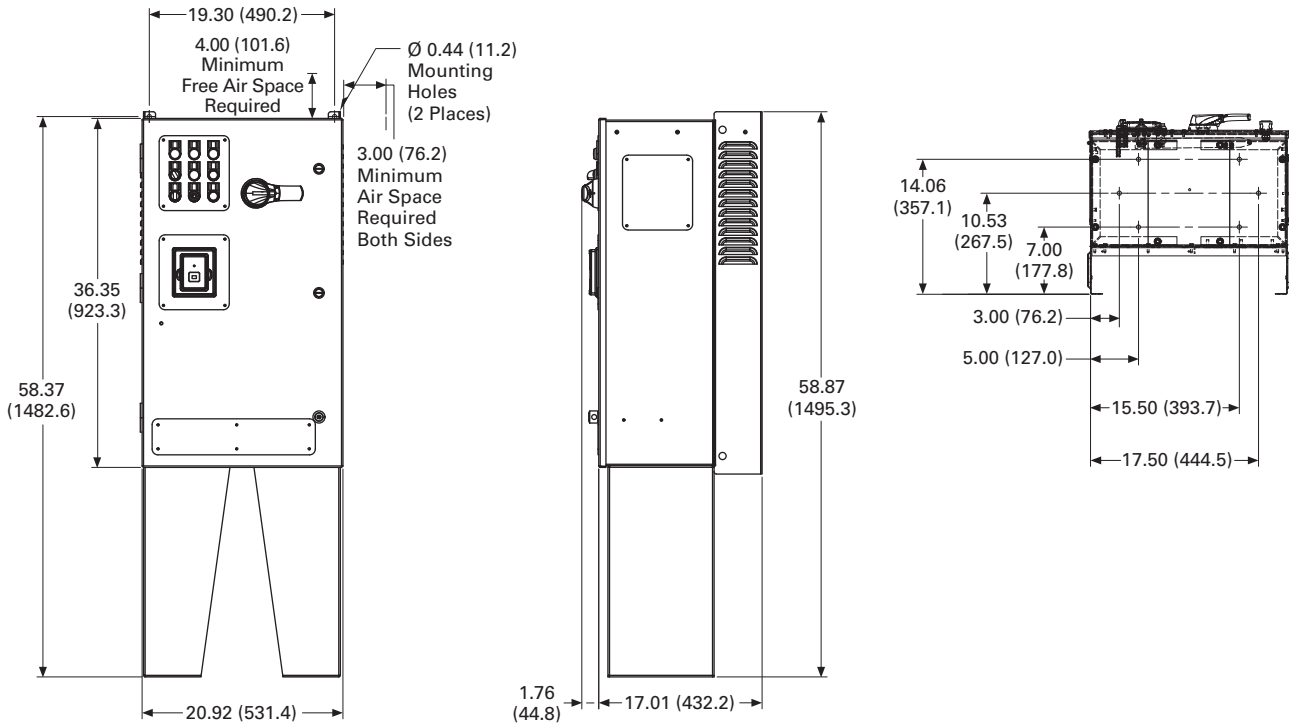
## Adjustable Frequency Drives

### PowerXL DG1 Series Drives

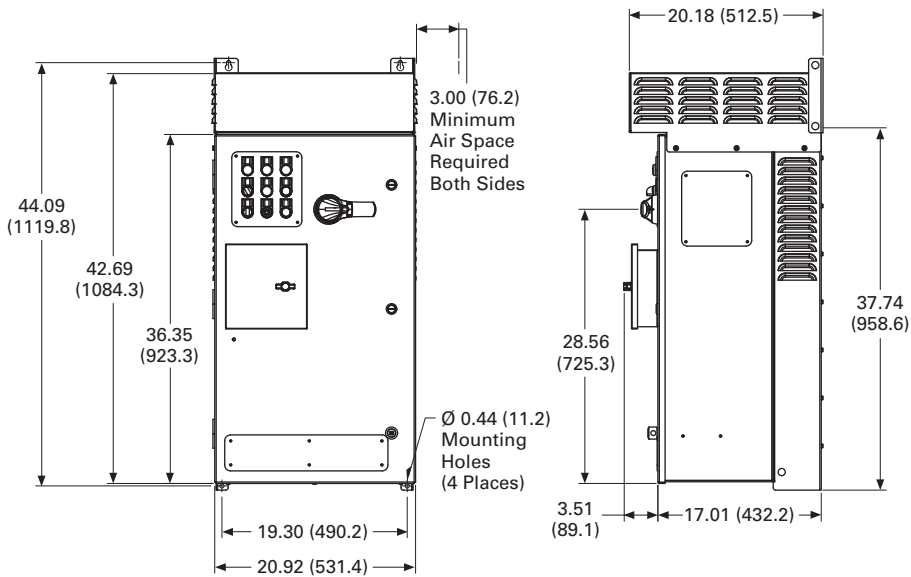
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#### BX Box Type 12–22 Inch Floor Stands

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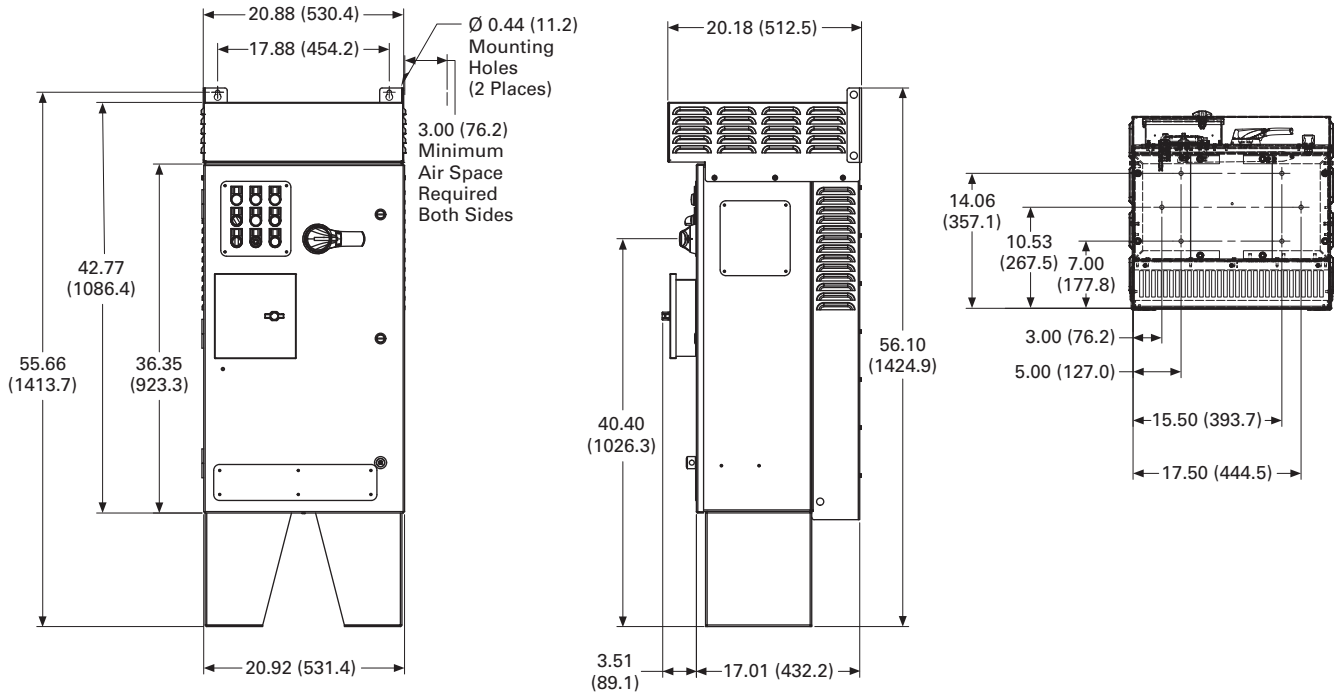


#### BX Box Type 3R

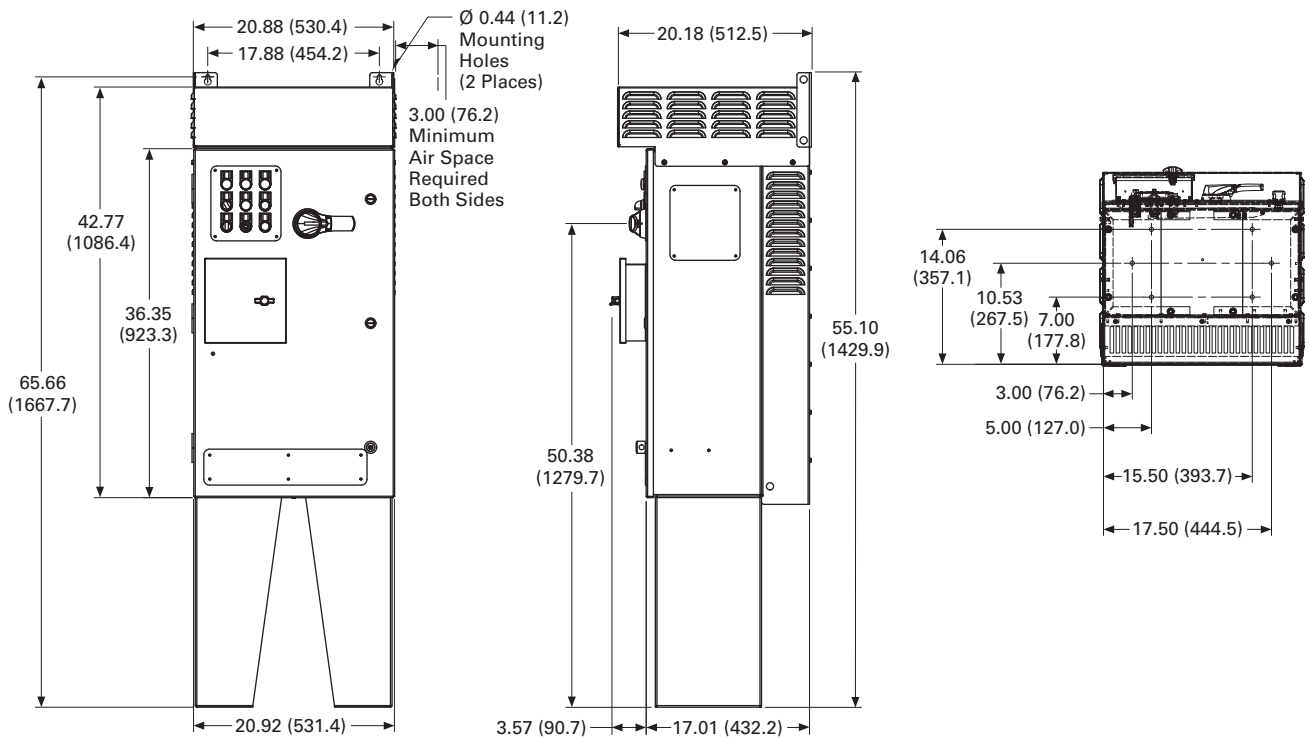


Approximate Dimensions in Inches (mm)

### BX Box Type 3R—12 Inch Floor Stands



### BX Box Type 3R—22 Inch Floor Stands



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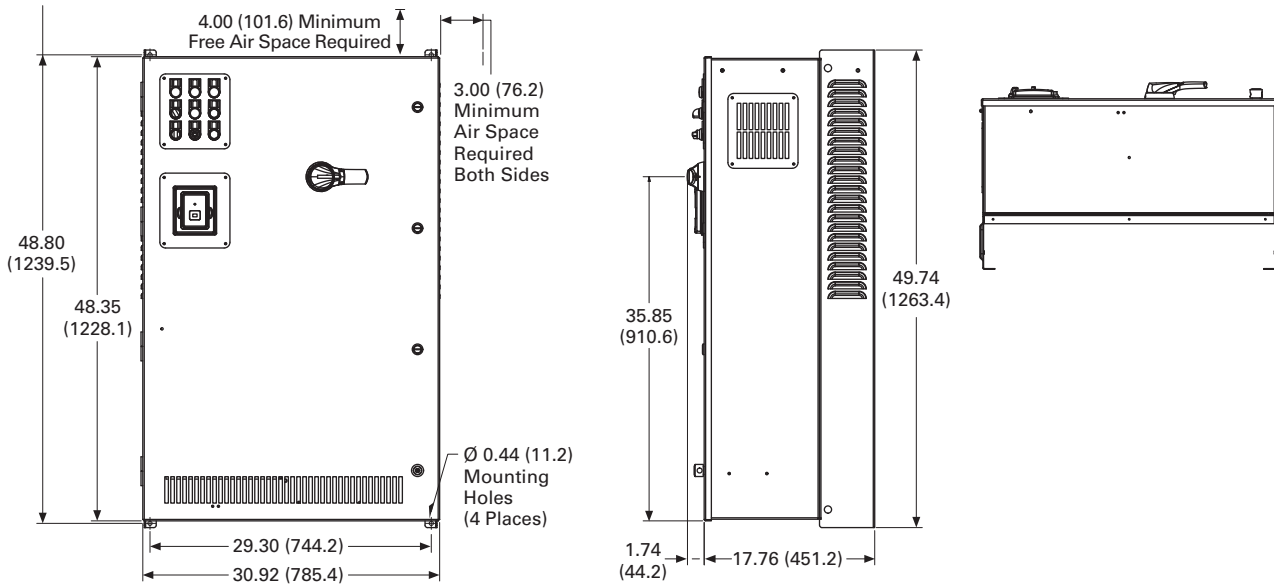
## Adjustable Frequency Drives

### PowerXL DG1 Series Drives

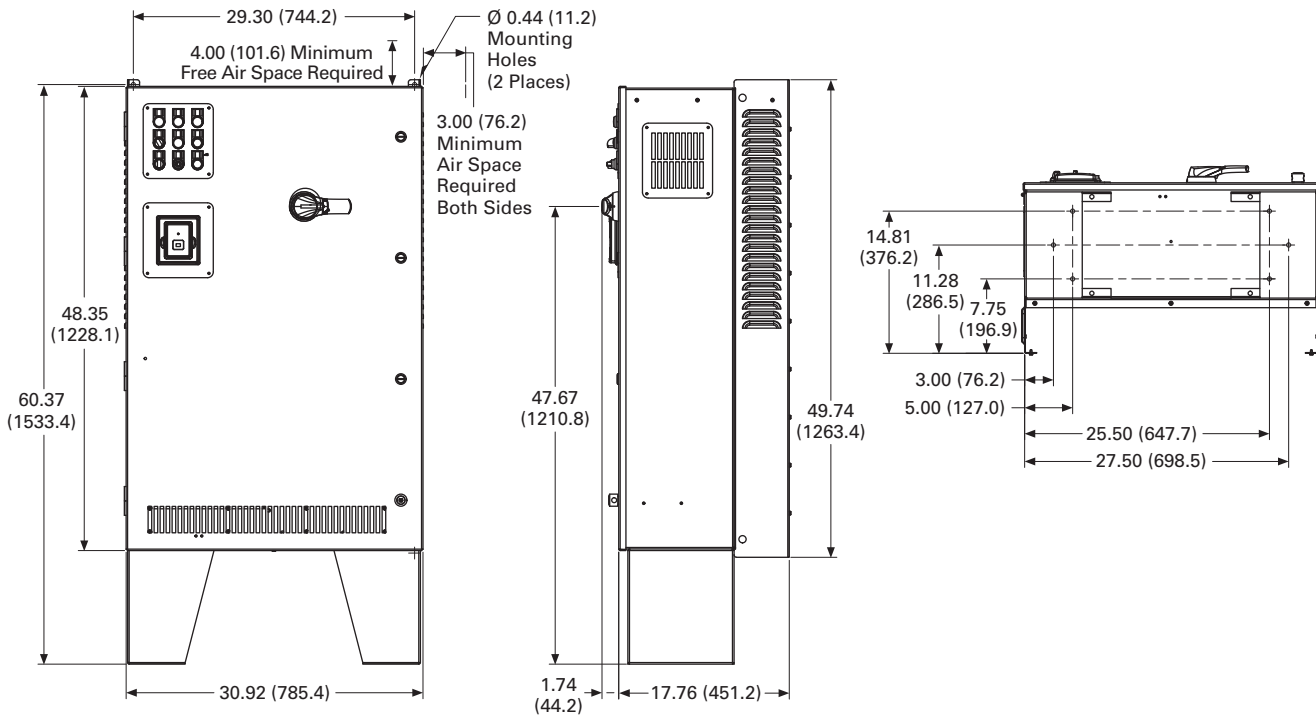
Approximate Dimensions in Inches (mm)

#### CX Box Type 1

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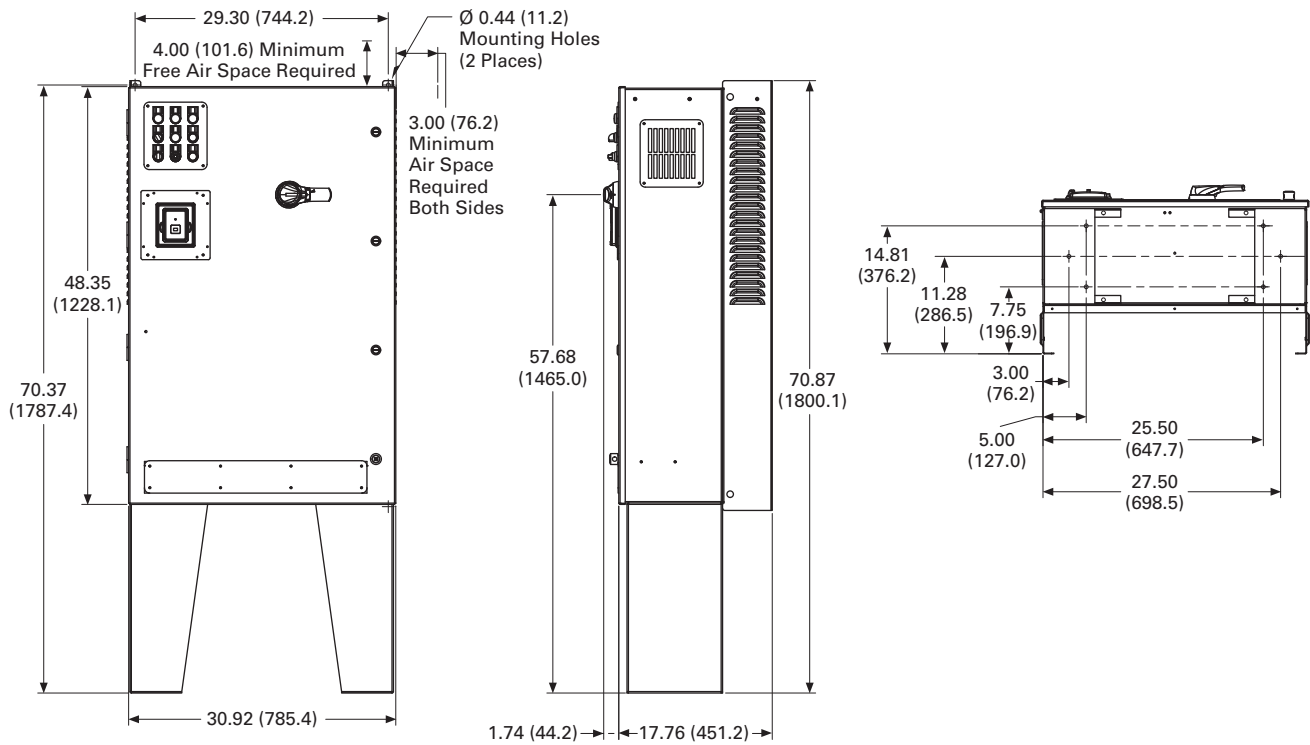


#### CX Box Type 1—12 Inch Floor Stands

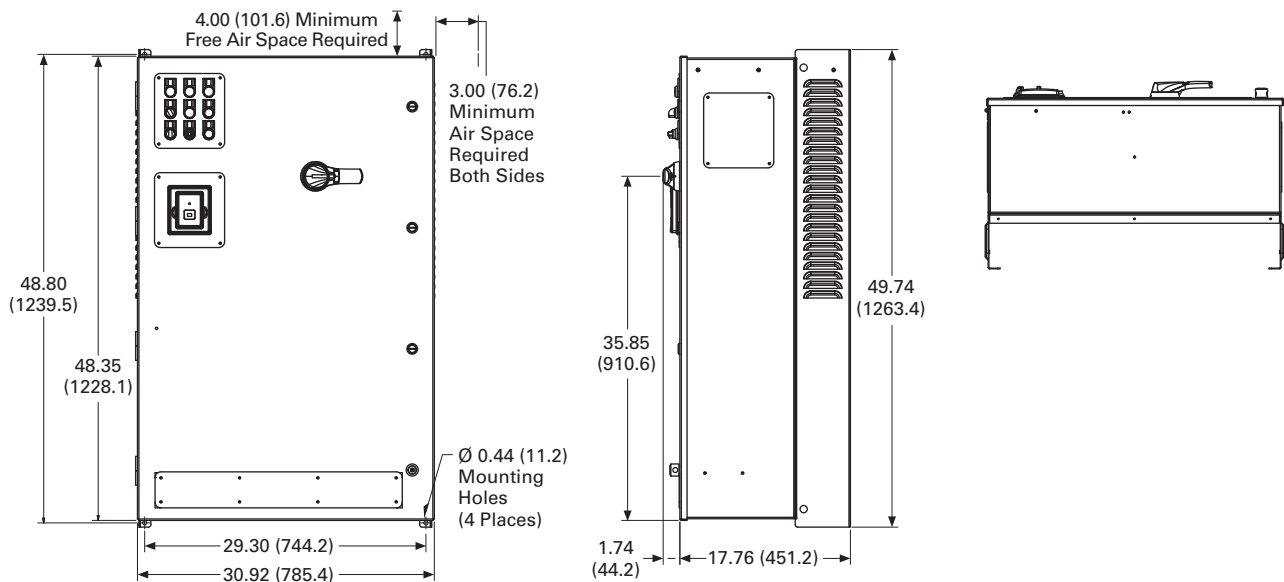


Approximate Dimensions in Inches (mm)

### CX Box Type 1—22 Inch Floor Stands



### CX Box Type 12



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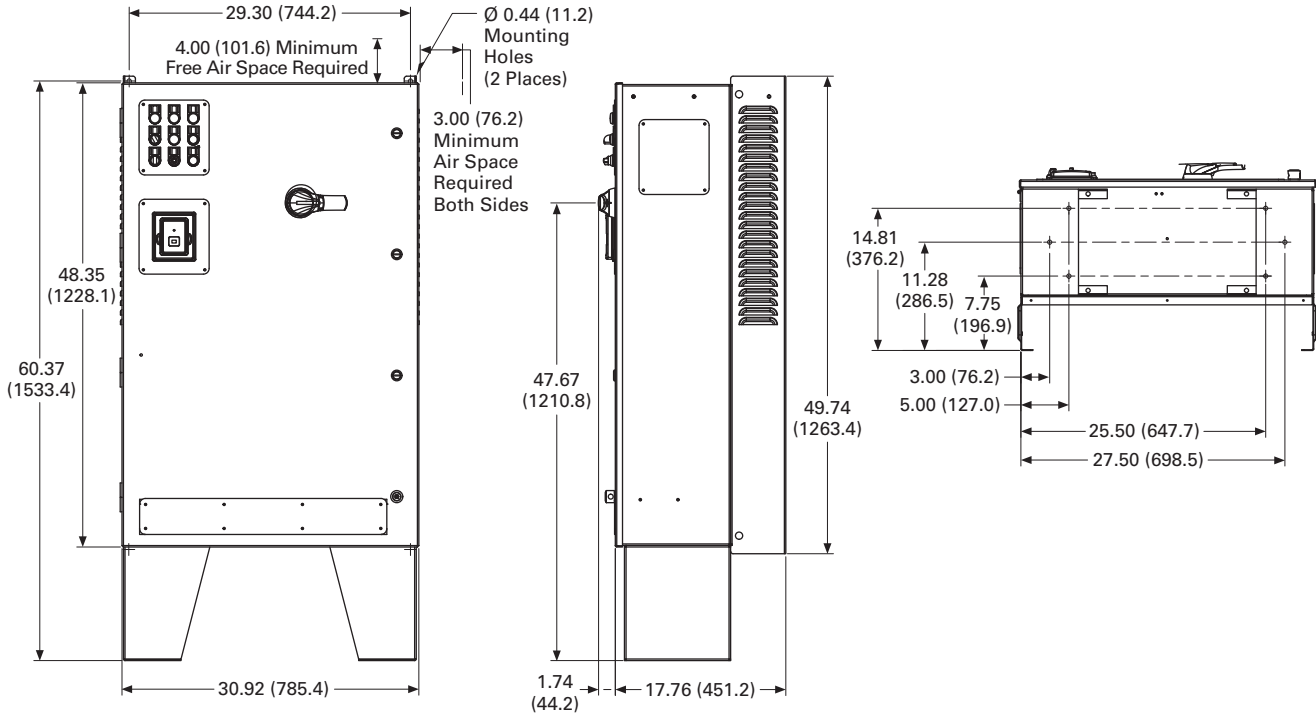
## Adjustable Frequency Drives

### PowerXL DG1 Series Drives

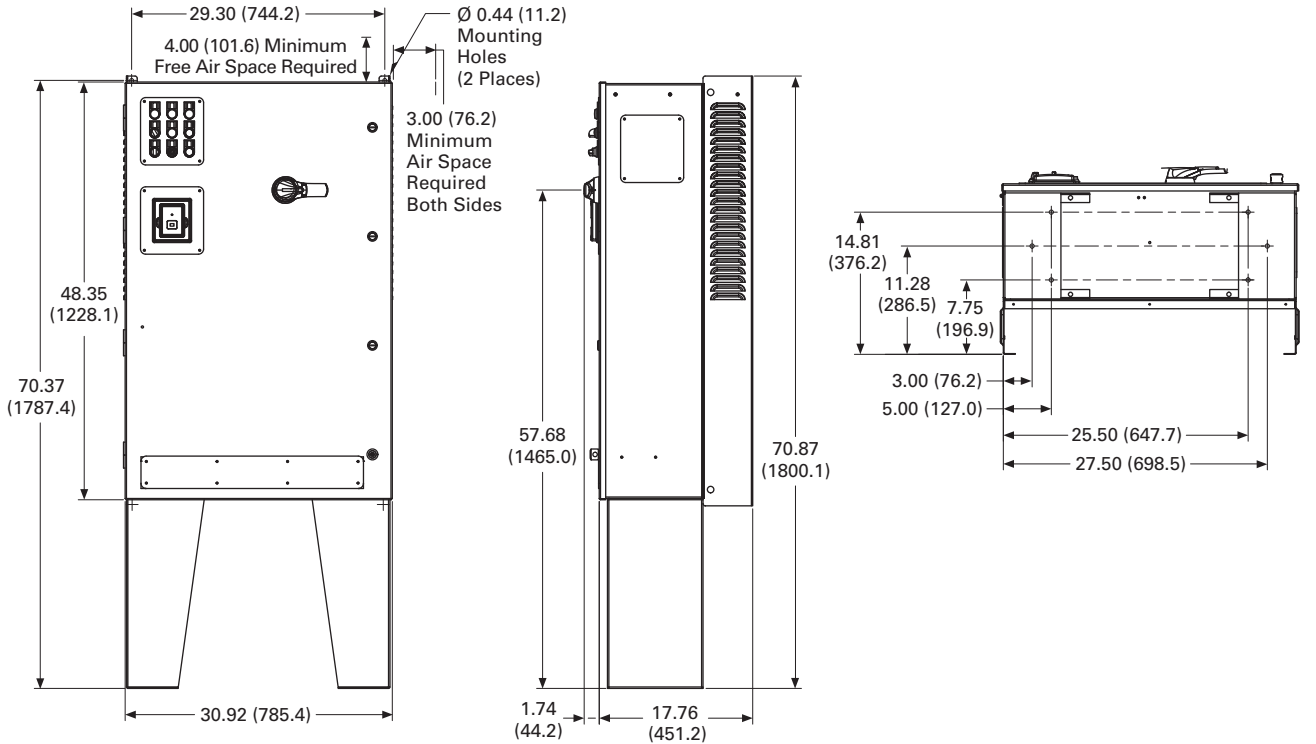
Approximate Dimensions in Inches (mm)

2

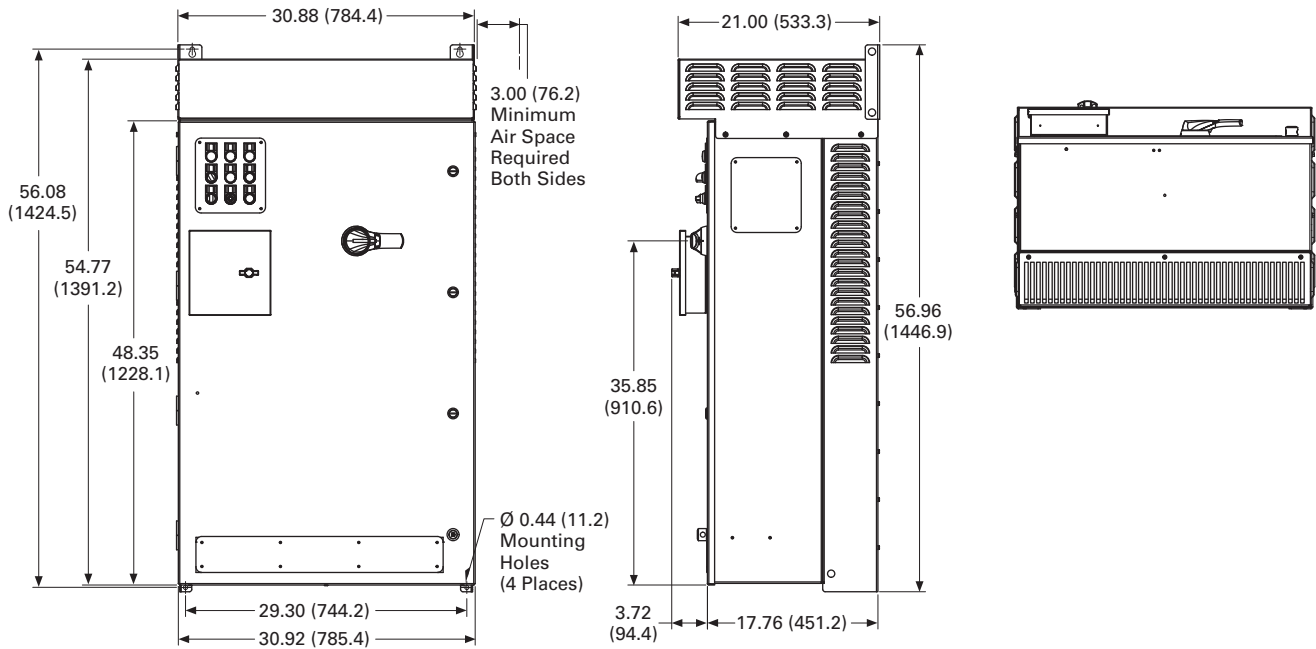
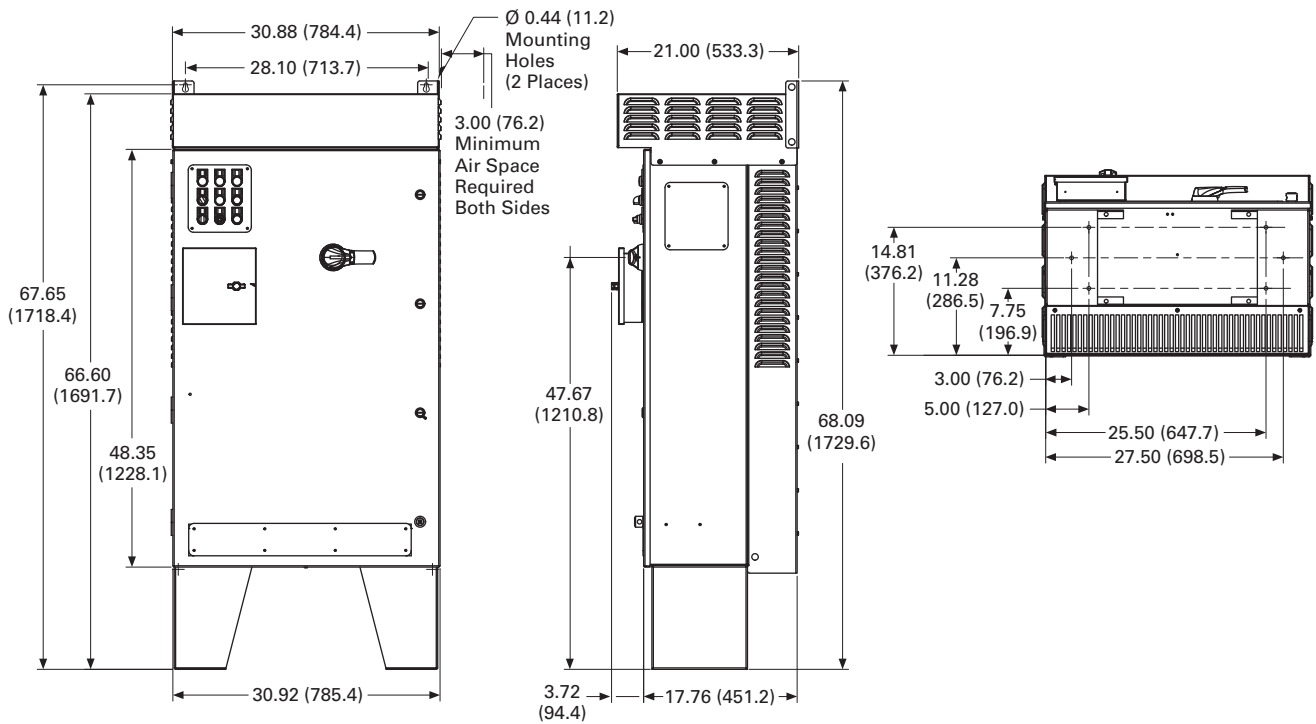
#### CX Box Type 12—12 Inch Floor Stands



#### CX Box Type 12—22 Inch Floor Stands



Approximate Dimensions in Inches (mm)

**CX Box Type 3R****CX Box Type 3R—12 Inch Floor Stands**



# 2.6

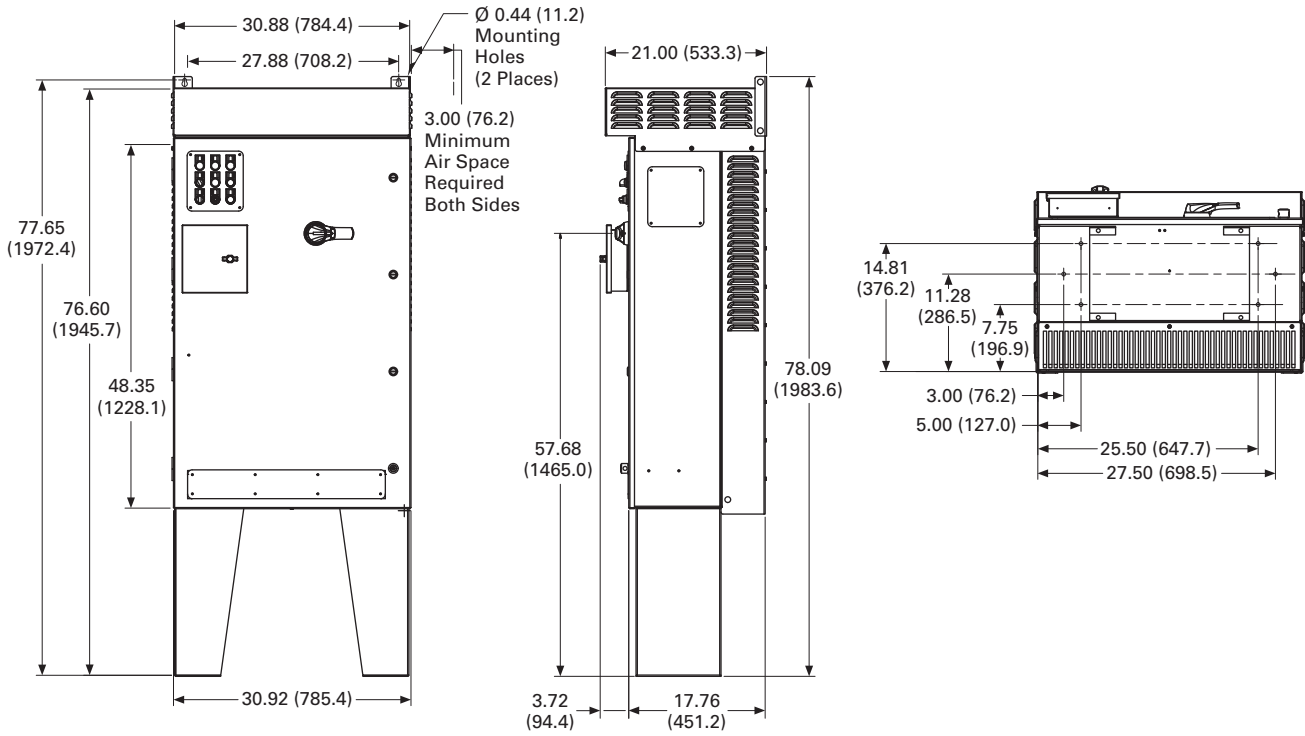
## Adjustable Frequency Drives

### PowerXL DG1 Series Drives

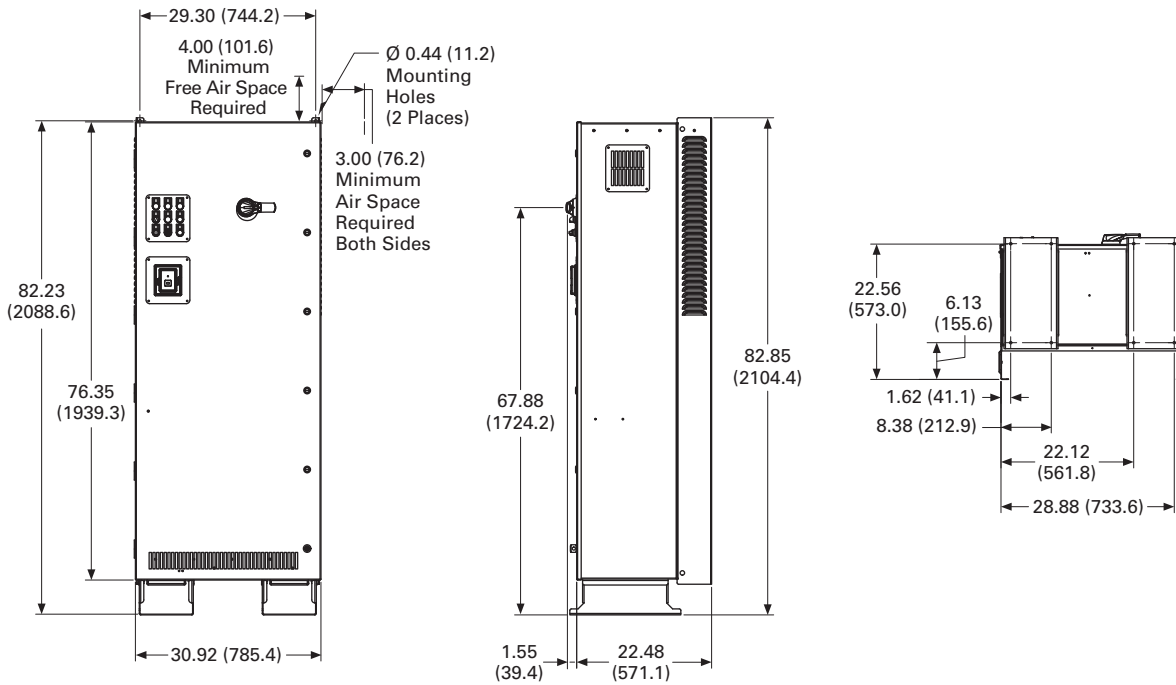
Approximate Dimensions in Inches (mm)

2

#### CX Box Type 3R—22 Inch Floor Stands

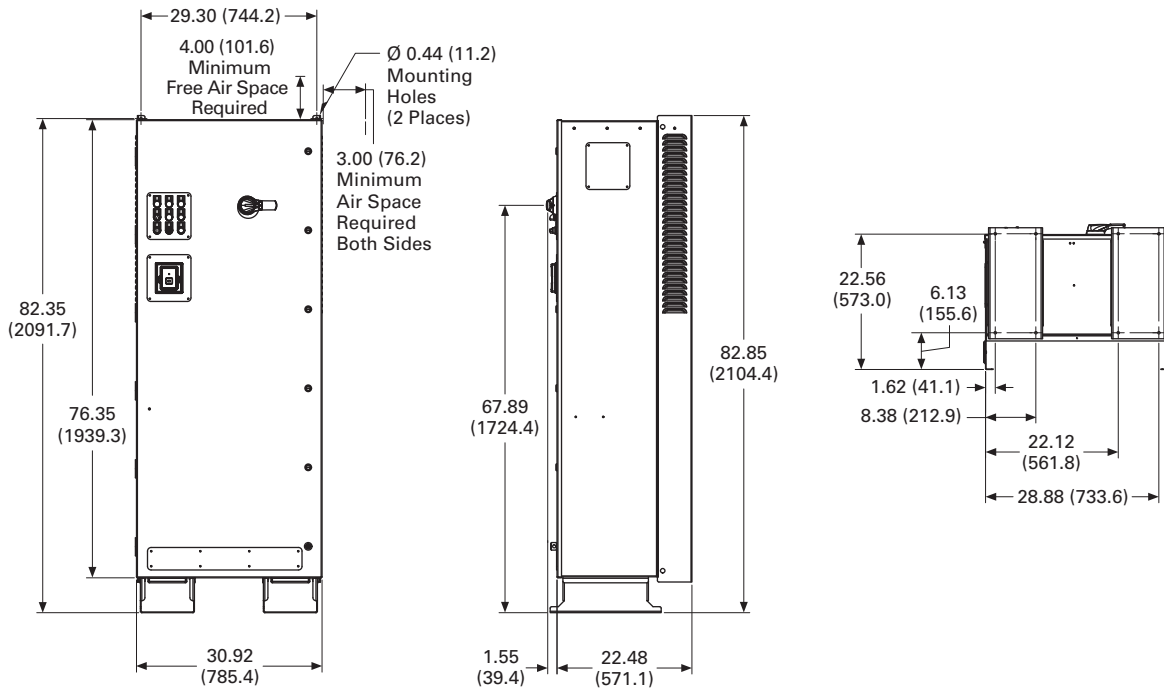


#### DX Box Type 1

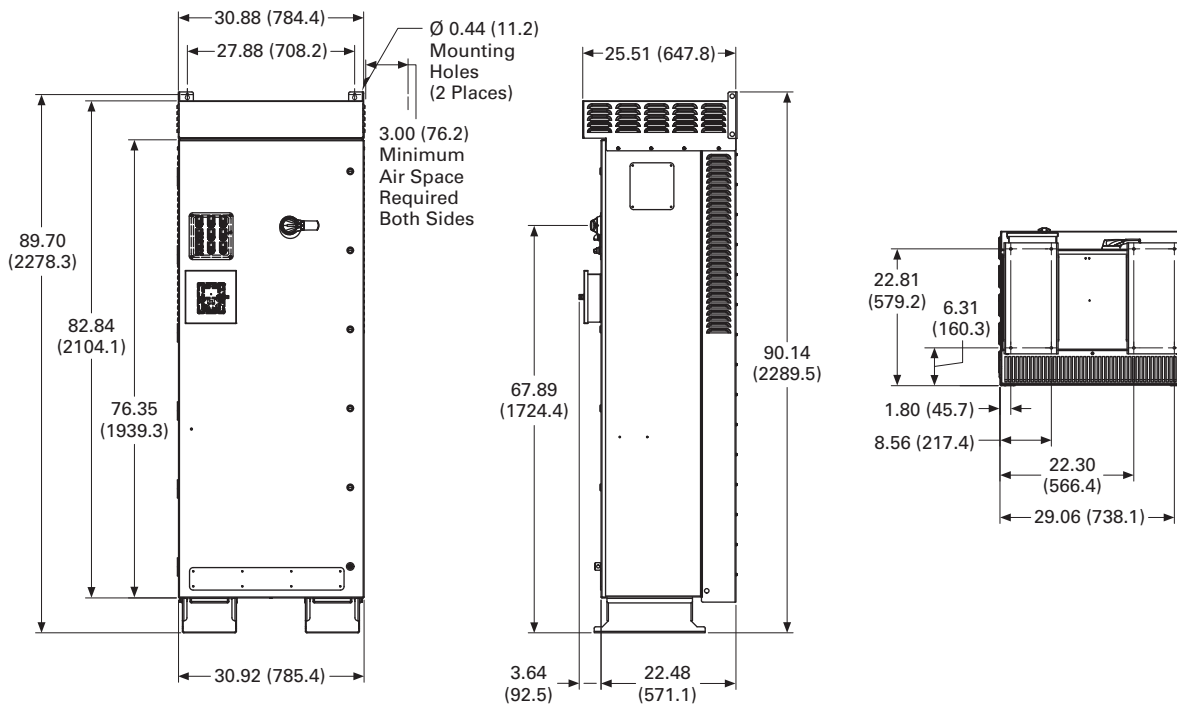


Approximate Dimensions in Inches (mm)

### DX Box Type 12



### DX Box Type 3R





### SVX Drives

#### Product Description

SVX Series Adjustable Frequency Drives from Eaton's Electrical Sector are the next generation of drives specifically engineered for today's commercial and industrial applications. The power unit makes use of the most sophisticated semiconductor technology and a highly modular construction that can be flexibly adapted to the customer's needs.

The input and output configuration (I/O) is designed with modularity in mind. The I/O is comprised of option cards, each with its own input and output configuration. The control module is designed to accept a total of five of these cards. The cards contain not only normal analog and digital inputs but also fieldbus cards.

These drives continue the tradition of robust performance, and raise the bar on features and functionality, ensuring the best solution at the right price.

#### Features

- Robust design—proven 500,000 hours MTBF
- Integrated 3% line reactors standard on drives from FR4 through FR9
- EMI/RFI Filters H standard up to 200 hp I<sub>H</sub> 480 V, 100 hp I<sub>H</sub> 230 V
- Simplified operating menu allows for typical programming changes, while programming mode provides control of everything
- Quick Start Wizard built into the programming of the drive ensures a smooth start-up
- Keypad can display up to three monitored parameters simultaneously
- LOCAL/REMOTE operation from keypad
- Copy/paste function allows transfer of parameter settings from one drive to the next
- Standard NEMA Type 12/IP54 keypad on all drives
- The SVX can be flexibly adapted to a variety of needs using our pre-installed "Seven in One" precision application programs consisting of:
  - Basic
  - Standard
  - Local/remote
  - Multi step speed control
  - PID control
  - Multi-purpose control
  - Pump and fan control with auto change
- Additional I/O and communication cards provide plug and play functionality
- I/O connections with simple quick connection terminals
- Hand-held auxiliary 24 V power supply allows programming/monitoring of control module without applying full power to the drive
- Control logic can be powered from an external auxiliary control panel, internal drive functions and fieldbus if necessary
- Brake chopper standard from: 1–30 hp/380–500 V 3/4–15 hp/208–230 V
- NEMA Type 1/IP21 and NEMA Type 12/IP54 enclosures available, Frame Sizes FR4–FR9
- Open chassis FR10 and greater
- Standard option board configuration includes an A9 I/O board and an A2 relay output board installed in slots A and B

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## Standards and Certifications

## Product

- IEC 61800-2

## EMC (At Default Settings)

- Immunity: Fulfills all EMC immunity requirements; Emissions: EN 61800-3, LEVEL H

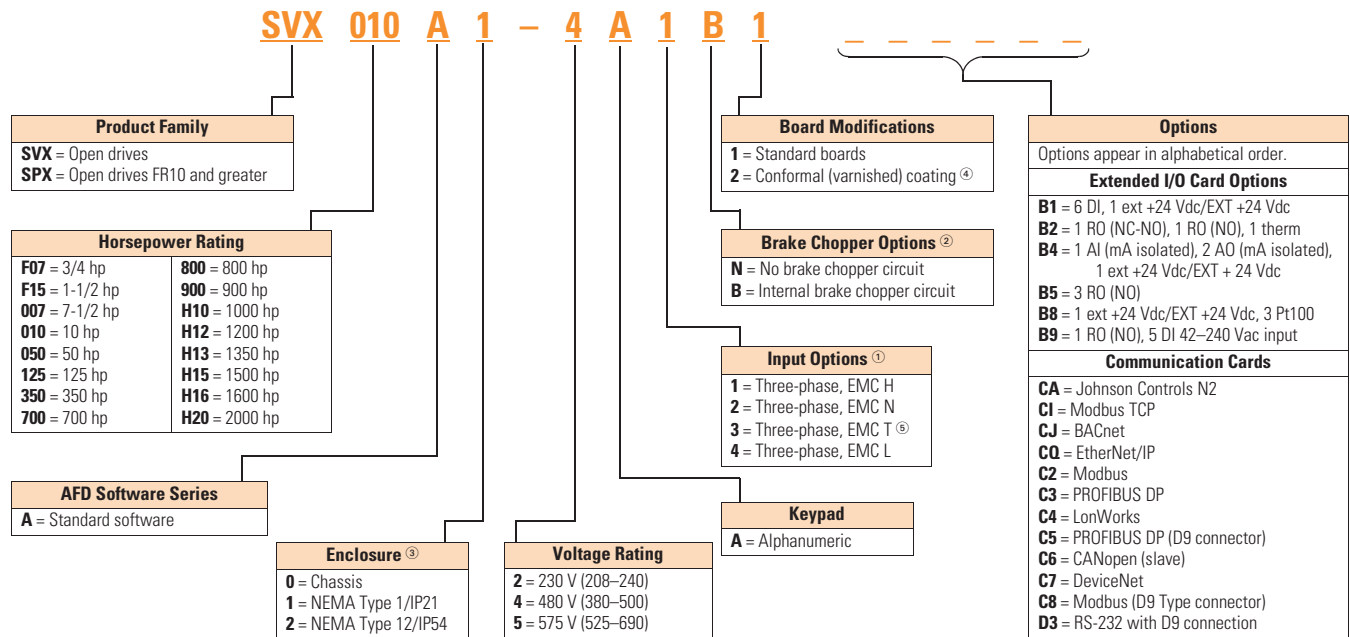
## Safety

- UL 508C
- CE



## Catalog Number Selection

## SVX Adjustable Frequency Drives



## Notes

- <sup>①</sup> All 230 V drives and 480 V drives up to 200 hp (IH) are only available with input option **1** (EMC Level H). 480 V drives 250 hp (IH) or larger are available with input option **2** (EMC Level N). 480 V drives are available with input option **4** (EMC Level L). 575 V drives 200 hp (IH) or larger are only available with input option **2**. 575 V drives up to 150 hp (IH) are only available with input option **4** (EMC Level L).
- <sup>②</sup> 480 V drives up to 30 hp (IH) are only available with brake chopper option **B**. 480 V drives 40 hp (IH) or larger come standard with brake chopper option **N**. 230 V drives up to 15 hp (IH) are only available with brake chopper option **B**. 230 V drives 20 hp or larger come standard with brake chopper option **N**. All 575 V drives come standard without brake chopper option (N). **N = No** brake chopper.
- <sup>③</sup> 480 V drives 250 hp (IH) and larger are available with enclosure style **0** (chassis); 690 V drives 200 hp (IH) and larger are available with enclosure style **0** (chassis).
- <sup>④</sup> Factory promise delivery. Consult sales office for availability.
- <sup>⑤</sup> For high-resistance ground systems, any SVX/SPX drive can be used if the HRG system has ground supervision. If no ground supervision feature is available, use EMC class N or T.

## Product Selection

## 230 V SVX Drives

2

## SVX Open Drives



## 208–240 V, NEMA Type 1/IP21 Drives

Frame Size	hp (I <sub>H</sub> )	Current (I <sub>H</sub> )	hp (I <sub>L</sub> )	Current (I <sub>L</sub> )	Catalog Number
FR4	3/4	3.7	1	4.8	SVXF07A1-2A1B1
	1	4.8	1-1/2	6.6	SVX001A1-2A1B1
	1-1/2	6.6	2	7.8	SVXF15A1-2A1B1
	2	7.8	3	11	SVX002A1-2A1B1
	3	11	—	12.5	SVX003A1-2A1B1
FR5	—	12.5	5	17.5	SVX004A1-2A1B1
	5	17.5	7-1/2	25	SVX005A1-2A1B1
	7-1/2	25	10	31	SVX007A1-2A1B1
FR6	10	31	15	48	SVX010A1-2A1B1
	15	48	20	61	SVX015A1-2A1B1
FR7	20	61	25	75	SVX020A1-2A1N1
	25	75	30	88	SVX025A1-2A1N1
	30	88	40	114	SVX030A1-2A1N1
FR8	40	114	50	140	SVX040A1-2A1N1
	50	140	60	170	SVX050A1-2A1N1
	60	170	75	205	SVX060A1-2A1N1
FR9	75	205	100	261	SVX075A1-2A1N1
	100	261	125	300	SVX100A1-2A1N1

## 208–240 V, NEMA Type 12/IP54 Drives

Frame Size	hp (I <sub>H</sub> )	Current (I <sub>H</sub> )	hp (I <sub>L</sub> )	Current (I <sub>L</sub> )	Catalog Number
FR4	3/4	3.7	1	4.8	SVXF07A2-2A1B1
	1	4.8	1-1/2	6.6	SVX001A2-2A1B1
	1-1/2	6.6	2	7.8	SVXF15A2-2A1B1
	2	7.8	3	11	SVX002A2-2A1B1
	3	11	—	12.5	SVX003A2-2A1B1
FR5	—	12.5	5	17.5	SVX004A2-2A1B1
	5	17.5	7-1/2	25	SVX005A2-2A1B1
	7-1/2	25	10	31	SVX007A2-2A1B1
FR6	10	31	15	48	SVX010A2-2A1B1
	15	48	20	61	SVX015A2-2A1B1
FR7	20	61	25	75	SVX020A2-2A1N1
	25	75	30	88	SVX025A2-2A1N1
	30	88	40	114	SVX030A2-2A1N1
FR8	40	114	50	140	SVX040A2-2A1N1
	50	140	60	170	SVX050A2-2A1N1
	60	170	75	205	SVX060A2-2A1N1
FR9	75	205	100	261	SVX075A2-2A1N1
	100	261	125	300	SVX100A2-2A1N1

## 480 V SVX Drives

## SVX Open Drives



## 380–500 V, NEMA Type 1/IP21 Drives

Frame Size	hp (I <sub>H</sub> )	Current (I <sub>H</sub> )	hp (I <sub>L</sub> )	Current (I <sub>L</sub> )	Catalog Number
FR4	1	2.2	1-1/2	3.3	SVX001A1-4A1B1
	1-1/2	3.3	2	4.3	SVXF15A1-4A1B1
	2	4.3	3	5.6	SVX002A1-4A1B1
	3	5.6	5	7.6	SVX003A1-4A1B1
	5	7.6	—	9	SVX005A1-4A1B1
	—	9	7-1/2	12	SVX006A1-4A1B1
FR5	7-1/2	12	10	16	SVX007A1-4A1B1
	10	16	15	23	SVX010A1-4A1B1
	15	23	20	31	SVX015A1-4A1B1
FR6	20	31	25	38	SVX020A1-4A1B1
	25	38	30	46	SVX025A1-4A1B1
	30	46	40	61	SVX030A1-4A1B1
FR7	40	61	50	72	SVX040A1-4A1N1
	50	72	60	87	SVX050A1-4A1N1
	60	87	75	105	SVX060A1-4A1N1
FR8	75	105	100	140	SVX075A1-4A1N1
	100	140	125	170	SVX100A1-4A1N1
	125	170	150	205	SVX125A1-4A1N1
FR9	150	205	200	261	SVX150A1-4A1N1
	200	245	250	300	SVX200A1-4A1N1

## 380–500 V, NEMA Type 12/IP54 Drives

Frame Size	hp (I <sub>H</sub> )	Current (I <sub>H</sub> )	hp (I <sub>L</sub> )	Current (I <sub>L</sub> )	Catalog Number
FR4	1	2.2	1-1/2	3.3	SVX001A2-4A1B1
	1-1/2	3.3	2	4.3	SVXF15A2-4A1B1
	2	4.3	3	5.6	SVX002A2-4A1B1
	3	5.6	5	7.6	SVX003A2-4A1B1
	5	7.6	—	9	SVX005A2-4A1B1
	—	9	7-1/2	12	SVX006A2-4A1B1
FR5	7-1/2	12	10	16	SVX007A2-4A1B1
	10	16	15	23	SVX010A2-4A1B1
	15	23	20	31	SVX015A2-4A1B1
FR6	20	31	25	38	SVX020A2-4A1B1
	25	38	30	46	SVX025A2-4A1B1
	30	46	40	61	SVX030A2-4A1B1
FR7	40	61	50	72	SVX040A2-4A1N1
	50	72	60	87	SVX050A2-4A1N1
	60	87	75	105	SVX060A2-4A1N1
FR8	75	105	100	140	SVX075A2-4A1N1
	100	140	125	170	SVX100A2-4A1N1
	125	170	150	205	SVX125A2-4A1N1
FR9	150	205	200	261	SVX150A2-4A1N1
	200	245	250	300	SVX200A2-4A1N1

## SVX Open Drives

2



## 380–500 V, Open Chassis Drives

Frame Size	hp (I <sub>H</sub> )	Current (I <sub>H</sub> )	hp (I <sub>L</sub> )	Current (I <sub>L</sub> )	Catalog Number
FR10 ①	250	330	300	385	SPX250A0-4A2N1
	300	385	350	460	SPX300A0-4A2N1
	350	460	400	520	SPX350A0-4A2N1
FR11	400	520	500	590	SPX400A0-4A2N1
	500	590	—	650	SPX500A0-4A2N1
	—	650	600	730	SPX550A0-4A2N1
FR12	600	730	—	820	SPX600A0-4A2N1
	—	820	700	920	SPX650A0-4A2N1
	700	920	800	1030	SPX700A0-4A2N1
FR13	800	1030	900	1150	SPX800A0-4A2N1
	900	1150	1000	1300	SPX900A0-4A2N1
	1000	1300	1200	1450	SPXH10A0-4A2N1
FR14	1200	1600	1500	1770	SPXH12A0-4A2N1
	1600	1940	1800	2150	SPXH16A0-4A2N1
	1900	2300	2200	2700	SPXH19A0-4A2N1

## 575 V SVX Drives

## 525–690 V, NEMA Type 1/IP21 Drives

Frame Size	hp (I <sub>H</sub> )	Current (I <sub>H</sub> )	hp (I <sub>L</sub> )	Current (I <sub>L</sub> )	Catalog Number
FR6	2	3.3	3	4.5	SVX002A1-5A4N1
	3	4.5	—	5.5	SVX003A1-5A4N1
	—	5.5	5	7.5	SVX004A1-5A4N1
	5	7.5	7-1/2	10	SVX005A1-5A4N1
	7-1/2	10	10	13.5	SVX007A1-5A4N1
	10	13.5	15	18	SVX010A1-5A4N1
	15	18	20	22	SVX015A1-5A4N1
	20	22	25	27	SVX020A1-5A4N1
FR7	25	27	30	34	SVX025A1-5A4N1
	30	34	40	41	SVX030A1-5A4N1
FR8	40	41	50	52	SVX040A1-5A4N1
	50	52	60	62	SVX050A1-5A4N1
FR9	60	62	75	80	SVX060A1-5A4N1
	75	80	100	100	SVX075A1-5A4N1
	100	100	125	125	SVX100A1-5A4N1
	125	125	150	144	SVX125A1-5A4N1
FR10	150	144	—	170	SVX150A1-5A4N1
	—	170	200	208	SVX175A1-5A4N1

**Note**

① FR10–FR14 includes 3% line reactor, but it is not integral to chassis.

## SVX Open Drives



## 525–690 V, NEMA Type 12/IP54 Drives

Frame Size	hp (I <sub>H</sub> )	Current (I <sub>H</sub> )	hp (I <sub>L</sub> )	Current (I <sub>L</sub> )	Catalog Number
FR6	2	3.3	3	4.5	SVX002A2-5A4N1
	3	4.5	—	5.5	SVX003A2-5A4N1
	—	5.5	5	7.5	SVX004A2-5A4N1
	5	7.5	7-1/2	10	SVX005A2-5A4N1
	7-1/2	10	10	13.5	SVX007A2-5A4N1
	10	13.5	15	18	SVX010A2-5A4N1
	15	18	20	22	SVX015A2-5A4N1
	20	22	25	27	SVX020A2-5A4N1
FR7	25	27	30	34	SVX025A2-5A4N1
	30	34	40	41	SVX030A2-5A4N1
FR8	40	41	50	52	SVX040A2-5A4N1
	50	52	60	62	SVX050A2-5A4N1
FR9	60	62	75	80	SVX060A2-5A4N1
	75	80	100	100	SVX075A2-5A4N1
	100	100	125	125	SVX100A2-5A4N1
FR9	125	125	150	144	SVX125A2-5A4N1
	150	144	—	170	SVX150A2-5A4N1
	—	170	200	208	SVX175A2-5A4N1

## 525–690 V, Open Chassis Drives

Frame Size	hp (I <sub>H</sub> )	Current (I <sub>H</sub> )	hp (I <sub>L</sub> )	Current (I <sub>L</sub> )	Catalog Number
FR10	200	208	250	261	SPX200A0-5A2N1
	250	261	300	325	SPX250A0-5A2N1
	300	325	400	385	SPX300A0-5A2N1
FR11	400	385	450	460	SPX400A0-5A2N1
	450	460	500	502	SPX450A0-5A2N1
	500	502	—	590	SPX500A0-5A2N1
FR12	—	590	600	650	SPX550A0-5A2N1
	600	650	700	750	SPX600A0-5A2N1
	700	750	800	820	SPX700A0-5A2N1
FR13	800	820	900	920	SPX800A0-5A2N1
	900	920	1000	1030	SPX900A0-5A2N1
	1000	1030	1250	1180	SPXH10A0-5A2N1
FR14	1350	1300	1500	1500	SPXH13A0-5A2N1
	1500	1500	2000	1900	SPXH15A0-5A2N1
	2000	1900	2300	2250	SPXH20A0-5A2N1



**Accessories****2****Demo Drive and Power Supply****Demo Drive and Power Supply**

Description	Catalog Number
9000X demo drive	9000XDEMO

**9000X Series—SVX/SPX Conversion and Flange Kits**

The Type 12/IP54 option kit is used to convert a Type 1/IP21 to a Type 12/IP54 drive. The kit includes:

**NEMA Type 12 / IP54 Conversion Kits**

Frame Size	Catalog Number
Frame 4 Type 12/IP54 kit	OPTN12FR4
Frame 5 Type 12/IP54 kit	OPTN12FR5
Frame 6 Type 12/IP54 kit	OPTN12FR6

**Flange Kits**

The flange kit is used when the power section heat sink is mounted through the back panel of an enclosure. The kit includes hardware and supporting steel plates.

**NEMA Type 12 / IP54 Conversion Kits****Kit**

Frame Size	Catalog Number
Frame 4 flange kit Type 12/IP54	OPTTHR4
Frame 5 flange kit Type 12/IP54	OPTTHR5
Frame 6 flange kit Type 12/IP54	OPTTHR6
Frame 7 flange kit Type 12/IP54	OPTTHR7
Frame 8 flange kit Type 12/IP54	OPTTHR8
Frame 9 flange kit Type 12/IP54	OPTTHR9

## Options

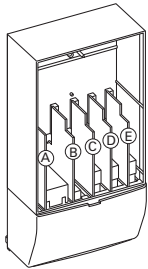
## SVX Series Option Board Kits

The SVX Series drives can accommodate a wide selection of expander and adapter option boards to customize the drive for your application needs. The drive's control unit is designed to accept a total of five option boards.

The SVX Series factory installed standard board configuration includes an A9 I/O board and an A2 relay output board, which are installed in slots A and B.

## Option Boards

## Option Board Kits



Option Kit Description <sup>①</sup>	Allowed Slot Locations <sup>②</sup>	Field Installed Catalog Number	Factory Installed Option Designator	SVX Ready Programs						
				Basic	Local/Remote	Standard	MSS	PID	Multi-P.	PFC
<b>Standard I/O Cards</b>										
6 DI, 1 DO, 2 AI, 1 AO, 1 +10 Vdc ref, 2 ext +24 Vdc/EXT +24 Vdc	A	<b>OPTA9</b>	—	■	■	■	■	■	■	■
2 RO (NC-NO)	B	<b>OPTA2</b>	—	■	■	■	■	■	■	■
<b>Extended I/O Cards</b>										
2 RO, therm	B	<b>OPTA3</b>	<b>A3</b>	—	■	■	■	■	■	■
Encoder low volt +5 V/15 V/24 V—SPX only	C	<b>OPTA4</b>	<b>A4</b>	—	■	■	■	■	■	■
Encoder high volt +15 V/24 V—SPX only	C	<b>OPTA5</b>	<b>A5</b>	—	■	■	■	■	■	■
Double encoder—SPX only	C	<b>OPTA7</b>	<b>A7</b>	■	■	■	■	■	■	■
6 DI, 1 DO, 2 AI, 1 AO	A	<b>OPTA8</b>	<b>A8</b>	—	■	■	■	■	■	■
3 DI (encoder 10–24 V), out +15 V/+24 V, 2 DO (pulse+direction)—SPX only	C	<b>OPTAE</b>	<b>AE</b>	■	■	■	■	■	■	■
6 DI, 1 ext +24 Vdc/EXT +24 Vdc	B, C, <b>D</b> , E	<b>OPTB1</b>	<b>B1</b>	—	—	—	—	—	■	■
1 RO (NC-NO), 1 RO (NO), 1 therm	B, C, <b>D</b> , E	<b>OPTB2</b>	<b>B2</b>	—	—	—	—	—	■	■
1 AI (mA isolated), 2 AO (mA isolated), 1 ext +24 Vdc/EXT +24 Vdc	B, C, <b>D</b> , E	<b>OPTB4</b>	<b>B4</b>	■	■	■	■	■	■	■
3 RO (NO)	B, C, <b>D</b> , E	<b>OPTB5</b>	<b>B5</b>	—	—	—	—	—	■	■
1 ext +24 Vdc/EXT +24 Vdc, 3 Pt100	B, C, <b>D</b> , E	<b>OPTB8</b>	<b>B8</b>	—	—	—	—	—	—	—
1 RO (NO), 5 DI 42–240 Vac input	B, C, <b>D</b> , E	<b>OPTB9</b>	<b>B9</b>	—	—	—	—	—	■	■
<b>Communication Cards</b>										
Modbus RTU	D, E	OPTC2	C2	■	■	■	■	■	■	■
Modbus RTU (D9 connector)	D, E	OPTC8	C8	■	■	■	■	■	■	■
PROFIBUS DP	D, E	OPTC3	C3	■	■	■	■	■	■	■
PROFIBUS DP (D9 connector)	D, E	OPTC5	C5	■	■	■	■	■	■	■
Johnson Controls N2	D, E	OPTC2	CA	—	—	—	—	—	—	—
BACnet MSTP	D, E	OPTCJ	CJ	■	■	■	■	■	■	■
LonWorks	D, E	OPTC4	C4	■	■	■	■	■	■	■
CANopen (slave)	D, E	OPTC6	C6	■	■	■	■	■	■	■
DeviceNet	D, E	OPTC7	C7	■	■	■	■	■	■	■
Modbus TCP	D, E	OPTCI	CI	■	■	■	■	■	■	■
EtherNet/IP	D, E	OPTCQ	CQ	■	■	■	■	■	■	■
PROFINET, Modbus TCP, EtherNet/IP (dual-port) <sup>④</sup>	D, E	OPTC9	E9	■	■	■	■	■	■	■
EtherCAT (dual-port) <sup>④</sup>	D, E	OPTCQ	EQ	■	■	■	■	■	■	■
SPX adapter	D, E	OPTD1	D1	■	■	■	■	■	■	■
SPX adapter	D, E	OPTD2	D2	■	■	■	■	■	■	■
RS-232 adapter	D, E	OPTD3	D3	■	■	■	■	■	■	■

## Notes

<sup>①</sup> AI = Analog Input; AO = Analog Output, DI = Digital Input, DO = Digital Output, RO = Relay Output

<sup>②</sup> Option card must be installed in one of the slots listed for that card. Slot indicated in bold is the preferred location.

<sup>③</sup> OPTC2 is a multi-protocol option card.

<sup>④</sup> Available October 2016.

### Modbus RTU Network Communications

The Modbus Network Card OPTC2 is used for connecting the SVX Drive as a slave on a Modbus network. The interface is connected by a 9-pin DSUB connector (female) and the baud rate ranges from 300 to 19,200 baud. Other communication parameters include an address range from 1 to 247; a parity of None, Odd or Even; and the stop bit is 1.

### PROFIBUS Network Communications

The PROFIBUS Network Card OPTC3 is used for connecting the SVX Drive as a slave on a PROFIBUS-DP network. The interface is connected by a 9-pin DSUB connector (female). The baud rates range from 9.6 Kbaud to 12 Mbaud, and the addresses range from 1 to 127.

### LonWorks Network Communications

The LonWorks Network Card OPTC4 is used for connecting the SVX Drive on a LonWorks network. This interface uses Standard Network Variable Types (SNVT) as data types.

The channel connection is achieved using a FTT-10 A Free Topology transceiver via a single twisted transfer cable. The communication speed with LonWorks is 78 kBits/s.

### CANopen (Slave) Communications

The CANopen (Slave) Network Card OPTC6 is used for connecting the SVX Drive to a host system. According to ISO11898 standard cables to be chosen for CANbus should have a nominal impedance of 120 ohms, and specific line delay of nominal 5 nS/m. 120 ohms line termination resistors required for installation.

### DeviceNet Network Communications

The DeviceNet Network Card OPTC7 is used for connecting the SVX Drive on a DeviceNet Network. It includes a 5.08 mm pluggable connector. Transfer method is via CAN using a two-wire twisted shielded cable with two-wire bus power cable and drain. The baud rates used for communication include 125 Kbaud, 250 Kbaud and 500 Kbaud.

### Johnson Controls Metasys N2 Network Communications

The OPTC2 fieldbus board provides communication between the SVX Drive and a Johnson Controls Metasys™ N2 network. With this connection, the drive can be controlled, monitored and programmed from the Metasys system. The N2 fieldbus is available as a factory installed option and as a field installable kit.

### Modbus/TCP Network Communications

The Modbus/TCP Network Card OPTC1 is used for connecting the SVX Drive to Ethernet networks utilizing Modbus protocol. It includes an RJ-45 pluggable connector. This interface provides a selection of standard and custom register values to communicate drive parameters. The board supports 10 Mbps and 100 Mbps communication speeds. The IP address of the board is configurable over Ethernet using a supplied software tool.

### BACnet Network Communications

The BACnet Network Card OPTCJ is used for connecting the SVX Drive to BACnet networks. It includes a 5.08 mm pluggable connector. Data transfer is Master-Slave/Token Passing (MS/TP) RS-485. This interface uses a collection of 30 Binary Value Objects (BVOs) and 35 Analog Value Objects (AVOs) to communicate drive parameters. The card supports 9.6, 19.2 and 38.4 Kbaud communication speeds and supports network addresses 1–127.

### EtherNet/IP Network Communications

The EtherNet/IP Network Card OPTCK is used for connecting the SVX Drive to Ethernet/Industrial Protocol networks. It includes an RJ-45 pluggable connector. The interface uses CIP objects to communicate drive parameters (CIP is “Common Industrial Protocol”, the same protocol used by DeviceNet). The board supports 10 Mbps and 100 Mbps communication speeds. The IP address of the board is configurable by Static, BOOTP and DHCP methods.

## Control Panel Options

### Factory Options

Description	Factory Installed Option Code	Field Installed NEMA Type 1/IP21 Catalog Number
<b>Local/Remote Keypad SVX Control Panel</b> —This option is standard on all drives and consists of an RS-232 connection, backlit alphanumeric LCD display with nine indicators for the RUN status and two indicators for the control source. The nine pushbuttons on the panel are used for panel programming and monitoring of all SVX parameters. The panel is detachable and isolated from the input line potential. Include LOC/REM key to choose control location.	<b>A</b>	<b>KEYPAD-LOC/REM</b>
<b>Keypad Remote Mounting Kit</b> —This option is used to remote mount the SVX keypad. The footprint is compatible to the SV remote mount kit. Includes 10 ft cable, keypad holder and mounting hardware.	—	<b>OPTRMT-KIT-9000X</b>

## Miscellaneous Options

Description	Catalog Number
<b>9000XDrive</b> —A PC-based tool for controlling and monitoring of the SVX. Features include: loading parameters that can be saved to a file or printed, setting references, starting and stopping the motor, monitoring signals in graphical or text form, and real-time display. To avoid damage to the drive or computer, SVDrivecable must be used.	<b>9000XDRIVE</b>
<b>SVDrivecable</b> —6 ft (1.8 m) RS-232 cable (22 gauge) with a 7-pin connector on each end. Should be used in conjunction with the 9000XDrive option to avoid damage to the SVX or computer. The same cable can be used for downloading specialized applications to the drive.	<b>SVDRIVECABLE</b>
<b>External Dynamic Braking Resistors</b> —Used with the dynamic braking chopper circuit to absorb motor regenerative energy for stopping the load and to dissipate the energy flowing back into the drive. Resistors are separated into standard duty and heavy-duty. Standard duty is defined as 20% duty or less with 100% braking torque, while heavy-duty is defined as 50% duty or less with 150% braking torque.	See <b>Page V6-T2-111</b>

## Open Drive Options

### Brake Chopper Options

The brake chopper circuit option is used for applications that require dynamic braking. Dynamic braking resistors are not included with drive purchase. Consult the factory for additional dynamic braking resistor selections that are supplied separately. A list of common resistors are listed below and are complete indoor assemblies, include a pre-wired terminal block and a thermal switch, and are not UL Listed.

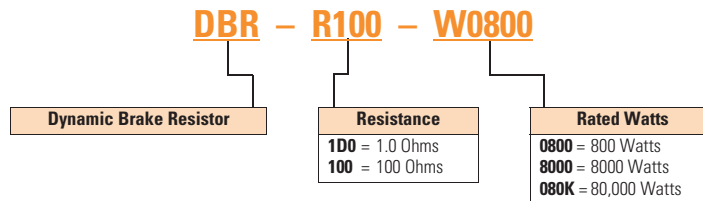
### Duty Cycle

The duty cycle rating is based on a 60-second period. For example, the 20% duty cycle resistor can carry 100% current for 12 seconds out of every 60 seconds, while the 50% duty cycle resistor can carry 150% current for 30 seconds out of every 60 seconds.

### Torque

If the braking torque required is less than 15%, dynamic braking is not required because the regenerated energy will be dissipated in the drive and motor losses.

### Dynamic Brake Resistor—Catalog Number Selection



### 230 V Brake Resistors

Drive hp (CT/lH)	Minimum Ohms	20% Duty Cycle, 100% Torque		50% Duty Cycle, 150% Torque	
		Catalog Number	Dimensions (Inches)	Catalog Number	Dimensions (Inches)
0.75	30.0	<b>DBR-R100-W0400</b>	12W x 5D x 5H	<b>DBR-R100-W0800</b>	12W x 7D x 5H
1	30.0	<b>DBR-R100-W0400</b>	12W x 5D x 5H	<b>DBR-R100-W0800</b>	12W x 7D x 5H
1.5	30.0	<b>DBR-R100-W0400</b>	12W x 5D x 5H	<b>DBR-R036-W1200</b>	12W x 10D x 5H
2	30.0	<b>DBR-R100-W0400</b>	12W x 5D x 5H	<b>DBR-R036-W1200</b>	12W x 10D x 5H
3	30.0	<b>DBR-R036-W0800</b>	12W x 7D x 5H	<b>DBR-R036-W2000</b>	12W x 16D x 5H
4	30.0	<b>DBR-R036-W0800</b>	12W x 7D x 5H	<b>DBR-R030-W2400</b>	19W x 10D x 5H
5	30.0	<b>DBR-R036-W0800</b>	12W x 7D x 5H	<b>DBR-R030-W2800</b>	19W x 13D x 5H
7.5	20.0	<b>DBR-R020-W1200</b>	12W x 10D x 5H	<b>DBR-R020-W4800</b>	26.5W x 13D x 5H
10	10.0	<b>DBR-R015-W1600</b>	12W x 13D x 5H	<b>DBR-R112-W6000</b>	26.5W x 13D x 5H
15	10.0	<b>DBR-R012-W2400</b>	19W x 10D x 5H	<b>DBR-R010-W9000</b>	28W x 10D x 10H
20	3.3	<b>DBR-R9D3-W3200</b>	19W x 10D x 5H	<b>DBR-R3D4-W012K</b>	28W x 10D x 10H
25	3.3	<b>DBR-R5D5-W4000</b>	26.5W x 10D x 5H	<b>DBR-R5D1-W015K</b>	28W x 16D x 10H
30	3.3	<b>DBR-R4D8-W4800</b>	26.5W x 10D x 5H	<b>DBR-R4D1-W020K</b>	28W x 16D x 10H
40	1.4	<b>DBR-R004-W6000</b>	26.5W x 13D x 5H	<b>DBR-R3D4-W025K</b>	30W x 18D x 16H
50	1.4	<b>DBR-R3D1-W7500</b>	26.5W x 16D x 5H	<b>DBR-R2D1-W030K</b>	30W x 18D x 24H
60	1.4	<b>DBR-R2D8-W9000</b>	26.5W x 16D x 5H	<b>DBR-R002-W036K</b>	30W x 18D x 24H
75	1.4	<b>DBR-R2D6-W012K</b>	28W x 10D x 10H	<b>DBR-R1D5-W045K</b>	30W x 18D x 32H
100	1.4	<b>DBR-R002-W015K</b>	28W x 16D x 10H	<b>DBR-R1D4-W060K</b>	30W x 18D x 40H

## 480 V Brake Resistors

2

Drive hp (CT/l <sub>H</sub> )	Minimum Ohms	20% Duty Cycle, 100% Torque		50% Duty Cycle, 150% Torque	
		Catalog Number	Dimensions (Inches)	Catalog Number	Dimensions (Inches)
1	63.0	<b>DBR-R100-W0400</b>	12W x 5D x 5H	<b>DBR-R100-W0800</b>	12W x 7D x 5H
1.5	63.0	<b>DBR-R100-W0400</b>	12W x 5D x 5H	<b>DBR-R100-W1200</b>	12W x 10D x 5H
2	63.0	<b>DBR-R100-W0400</b>	12W x 5D x 5H	<b>DBR-R100-W1200</b>	12W x 10D x 5H
3	63.0	<b>DBR-R100-W0800</b>	12W x 7D x 5H	<b>DBR-R100-W2000</b>	12W x 16D x 5H
5	63.0	<b>DBR-R100-W0800</b>	12W x 7D x 5H	<b>DBR-R100-W2800</b>	19W x 13D x 5H
6	63.0	<b>DBR-R100-W1200</b>	12W x 10D x 5H	<b>DBR-R070-W4000</b>	19W x 16D x 5H
7.5	63.0	<b>DBR-R100-W1200</b>	12W x 10D x 5H	<b>DBR-R063-W4800</b>	26.5W x 13D x 5H
10	63.0	<b>DBR-R063-W1600</b>	12W x 13D x 5H	<b>DBR-R063-W6000</b>	26.5W x 16D x 5H
15	42.0	<b>DBR-R042-W2400</b>	19W x 10D x 5H	<b>DBR-R042-W9000</b>	28W x 10D x 10H
20	21.0	<b>DBR-R030-W3200</b>	19W x 13D x 5H	<b>DBR-R023-W012K</b>	28W x 13D x 10H
25	21.0	<b>DBR-R030-W4000</b>	19W x 16D x 5H	<b>DBR-R021-W015K</b>	28W x 13D x 10H
30	14.0	<b>DBR-R020-W4800</b>	26.5W x 13D x 5H	<b>DBR-R014-W020K</b>	30W x 18D x 24H
40	6.5	<b>DBR-R112-W6000</b>	26.5W x 13D x 5H	<b>DBR-R007-W025K</b>	30W x 18D x 16H
50	6.5	<b>DBR-R013-W7500</b>	26.5W x 16D x 5H	<b>DBR-R8D5-W030K</b>	30W x 18D x 24H
60	6.5	<b>DBR-R010-W9000</b>	28W x 10D x 10H	<b>DBR-R7D3-W036K</b>	30W x 18D x 24H
75	3.3	<b>DBR-R009-W012K</b>	28W x 13D x 10H	<b>DBR-R3D3-W045K</b>	30W x 18D x 32H
100	3.3	<b>DBR-R5D1-W015K</b>	28W x 16D x 10H	<b>DBR-R004-W060K</b>	30W x 18D x 40H
125	3.3	<b>DBR-R4D1-W020K</b>	28W x 16D x 10H	<b>DBR-R004-W070K</b>	30W x 18D x 48H
150	3.3	<b>DBR-R3D4-W025K</b>	30W x 18D x 16H	<b>DBR-R3D5-W085K</b>	30W x 18D x 56H
200	3.3	<b>DBR-R3D3-W030K</b>	30W x 18D x 24H	<b>DBR-R3D3-W110K</b>	30W x 18D x 72H
250	1.4	<b>DBR-R2D5-W036K</b>	30W x 18D x 24H	Ⓢ	—
300	1.4	<b>DBR-R1D5-W045K</b>	30W x 18D x 32H	Ⓢ	—
350	1.4	<b>DBR-R1D4-W060K</b>	30W x 18D x 40H	Ⓢ	—
400	0.9	<b>DBR-R1D4-W060K</b>	30W x 18D x 40H	Ⓢ	—
500	0.9	<b>DBR-R0D9-W080K</b>	30W x 18D x 48H	Ⓢ	—
550	0.9	<b>DBR-R001-W085K</b>	30W x 18D x 56H	Ⓢ	—

**Note**

Ⓢ Consult factory.

## 575 V Brake Resistors

Drive hp (CT/1H)	Minimum Ohms	20% Duty Cycle, 100% Torque		50% Duty Cycle, 150% Torque	
		Catalog Number	Dimensions (Inches)	Catalog Number	Dimensions (Inches)
2	100.0	<b>DBR-R100-W0400</b>	12W x 5D x 5H	<b>DBR-R100-W1200</b>	12W x 10D x 5H
3	100.0	<b>DBR-R100-W0800</b>	12W x 7D x 5H	<b>DBR-R100-W2000</b>	12W x 16D x 5H
4	100.0	<b>DBR-R100-W0800</b>	12W x 7D x 5H	<b>DBR-R100-W2400</b>	19W x 10D x 5H
5	100.0	<b>DBR-R100-W0800</b>	12W x 7D x 5H	<b>DBR-R100-W2800</b>	19W x 13D x 5H
7.5	100.0	<b>DBR-R100-W1200</b>	12W x 10D x 5H	<b>DBR-R100-W4800</b>	26.5W x 13D x 5H
10	30.0	<b>DBR-R063-W1600</b>	12W x 13D x 5H	<b>DBR-R063-W6000</b>	26.5W x 16D x 5H
15	30.0	<b>DBR-R042-W2400</b>	19W x 10D x 5H	<b>DBR-R042-W9000</b>	28W x 10D x 10H
20	30.0	<b>DBR-R030-W3200</b>	19W x 13D x 5H	<b>DBR-R030-W012K</b>	28W x 13D x 10H
25	30.0	<b>DBR-R030-W4000</b>	19W x 16D x 5H	<b>DBR-R030-W015K</b>	28W x 16D x 10H
30	18.0	<b>DBR-R020-W4800</b>	26.5W x 13D x 5H	<b>DBR-R020-W020K</b>	30W x 18D x 16H
40	18.0	<b>DBR-R030-W6000</b>	26.5W x 16D x 5H	<b>DBR-R184-W025K</b>	30W x 18D x 16H
50	9.0	<b>DBR-R013-W7500</b>	26.5W x 16D x 5H	<b>DBR-R012-W030K</b>	30W x 18D x 24H
60	9.0	<b>DBR-R010-W9000</b>	28W x 10D x 10H	<b>DBR-R010-W036K</b>	30W x 18D x 24H
75	9.0	<b>DBR-R009-W012K</b>	28W x 13D x 10H	<b>DBR-R009-W045K</b>	30W x 18D x 24H
100	7.0	<b>DBR-R013-W015K</b>	28W x 16D x 10H	<b>DBR-R8D4-W060K</b>	30W x 18D x 40H
125	7.0	<b>DBR-R8D2-W020K</b>	30W x 18D x 10H	<b>DBR-R007-W070K</b>	30W x 18D x 40H
150	7.0	<b>DBR-R007-W025K</b>	30W x 18D x 16H	<b>DBR-R006-W085K</b>	30W x 18D x 56H
175	7.0	<b>DBR-R007-W030K</b>	30W x 18D x 24H	<b>DBR-R007-W100K</b>	30W x 18D x 72H
200	2.5	<b>DBR-R3D3-W030K</b>	30W x 18D x 24H	<b>DBR-R2D6-W110K</b>	30W x 18D x 64H
250	2.5	<b>DBR-R2D5-W036K</b>	30W x 18D x 24H	<b>DBR-R003-W140K</b>	30W x 18D x 72H
300	2.5	<b>DBR-R3D3-W045K</b>	30W x 18D x 32H	①	—
400	1.7	<b>DBR-R002-W060K</b>	30W x 18D x 48H	①	—
450	1.7	<b>DBR-R1D8-W070K</b>	30W x 18D x 48H	①	—
500	1.7	<b>DBR-R002-W080K</b>	30W x 18D x 56H	①	—

**Note**

① Consult factory.

# 2.7

## Adjustable Frequency Drives

### SVX Drives

2

#### Line and Load Reactors

A line and load reactor is a three-phase inductance filter that can be placed on the line and load side of the AFD to help improve the harmonic performance of the system. Consult the factory for additional filtering options and further technical details.

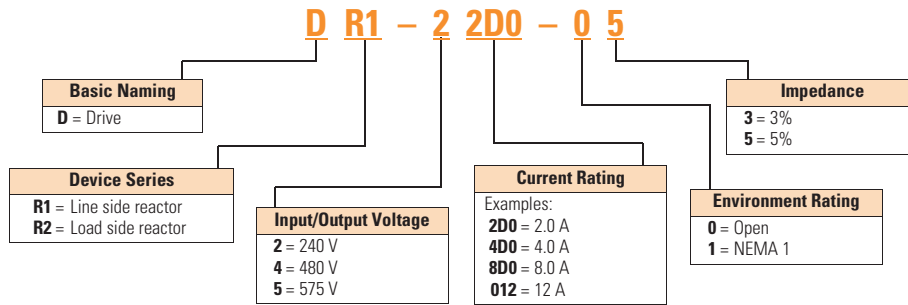
#### DR1 Line Reactor

A line reactor helps to provide a moderate reduction in current harmonics similar to a DC choke. It also provides increased input protection for AFD and its semiconductors from line transients helping to extend the life of the AFD.

#### DR2 Output Reactor

An output filter is used to reduce the transient voltage (dV/dt) at the motor terminals. The output filter is recommended for cable lengths exceeding 100 ft (30 m) with a drive of 3 hp and above and for cable lengths of 33 ft (10 m) with a drive of 2 hp and below.

#### Line and Load Reactors—Catalog Number Selection



#### Line and Load Reactors—230 V

hp (CT)	Open Line Reactor		Load Reactor		NEMA 1 Line Reactor		Load Reactor	
	3%	5%	3%	5%	3%	5%	3%	5%
0.75	DR1-23D2-03	DR1-23D2-05	DR2-24D0-03	DR2-24D0-05	DR1-23D2-13	DR1-23D2-15	DR2-24D0-13	DR2-24D0-15
1	DR1-24D2-03	DR1-24D2-05	DR2-24D0-03	DR2-28D0-05	DR1-24D2-13	DR1-24D2-15	DR2-24D0-13	DR2-28D0-15
1.5	DR1-26D0-03	DR1-26D0-05	DR2-28D0-03	DR2-28D0-05	DR1-26D0-13	DR1-26D0-15	DR2-28D0-13	DR2-28D0-15
2	DR1-26D8-03	DR1-26D8-05	DR2-28D0-03	DR2-28D0-05	DR1-26D8-13	DR1-26D8-15	DR2-28D0-13	DR2-28D0-15
3	DR1-29D6-03	DR1-29D6-05	DR2-2012-03	DR2-2012-05	DR1-29D6-13	DR1-29D6-15	DR2-2012-13	DR2-2012-15
5	DR1-2015-03	DR1-2015-05	DR2-2018-03	DR2-2018-05	DR1-2015-13	DR1-2015-15	DR2-2018-13	DR2-2018-15
7.5	DR1-2022-03	DR1-2022-05	DR2-2025-03	DR2-2025-05	DR1-2022-13	DR1-2022-15	DR2-2025-13	DR2-2025-15
10	DR1-2028-03	DR1-2028-05	DR2-2035-03	DR2-2035-05	DR1-2028-13	DR1-2028-15	DR2-2035-13	DR2-2035-15
15	DR1-2042-03	DR1-2042-05	DR2-2045-03	DR2-2045-05	DR1-2042-13	DR1-2042-15	DR2-2045-13	DR2-2045-15
20	DR1-2054-03	DR1-2054-05	DR2-2055-03	DR2-2055-05	DR1-2054-13	DR1-2054-15	DR2-2055-13	DR2-2055-15
25	DR1-2068-03	DR1-2068-05	DR2-2080-03	DR2-2080-05	DR1-2068-13	DR1-2068-15	DR2-2080-13	DR2-2080-15
30	DR1-2080-03	DR1-2080-05	DR2-2080-03	DR2-2100-05	DR1-2080-13	DR1-2080-15	DR2-2080-13	DR2-2100-15
40	DR1-2104-03	DR1-2104-05	DR2-2100-03	DR2-2100-05	DR1-2104-13	DR1-2104-15	DR2-2100-13	DR2-2100-15
50	DR1-2130-03	DR1-2130-05	DR2-2130-03	DR2-2130-05	DR1-2130-13	DR1-2130-15	DR2-2130-13	DR2-2130-15
60	DR1-2154-03	DR1-2154-05	DR2-2160-03	DR2-2200-15	DR1-2154-13	DR1-2154-15	DR2-2160-13	DR2-2200-15
75	DR1-2192-03	DR1-2192-05	DR2-2200-13	DR2-2200-15	DR1-2192-13	DR1-2192-15	DR2-2200-13	DR2-2200-15
100	DR1-2248-03	DR1-2248-05	DR2-2225-13	DR2-2225-15	DR1-2248-13	DR1-2248-15	DR2-2225-13	DR2-2225-15

## Line and Load Reactors—480 V

hp (CT)	Open Line Reactor	
	3%	5%
1	DR1-42D1-03	DR1-42D1-05
1.5	DR1-43D0-03	DR1-43D0-05
2	DR1-43D4-03	DR1-43D4-05
3	DR1-44D8-03	DR1-44D8-05
5	DR1-47D6-03	DR1-47D6-05
7.5	DR1-4011-03	DR1-4011-05
10	DR1-4014-03	DR1-4014-05
15	DR1-4021-03	DR1-4021-05
20	DR1-4027-03	DR1-4027-05
25	DR1-4034-03	DR1-4034-05
30	DR1-4040-03	DR1-4040-05
40	DR1-4052-03	DR1-4052-05
50	DR1-4065-03	DR1-4065-05
60	DR1-4077-03	DR1-4077-05
75	DR1-4096-03	DR1-4096-05
100	DR1-4124-03	DR1-4124-05
125	DR1-4156-03	DR1-4156-05
150	DR1-4180-03	DR1-4180-05
200	DR1-4240-03	DR1-4240-05
250	DR1-4302-03	DR1-4302-05
300	DR1-4361-03	DR1-4361-05
350	DR1-4414-03	DR1-4414-05
400	DR1-4477-03	DR1-4477-05
500	DR1-4590-03	DR1-4590-05
600	DR1-4708-03	DR1-4708-05

Load Reactor	
3%	5%
DR2-42D0-05	DR2-42D0-05
DR2-44D0-05	DR2-44D0-05
DR2-44D0-03	DR2-44D0-05
DR2-48D0-03	DR2-48D0-05
DR2-48D0-03	DR2-48D0-05
DR2-4012-03	DR2-4012-05
DR2-4018-03	DR2-4018-05
DR2-4025-03	DR2-4025-05
DR2-4025-03	DR2-4025-05
DR2-4035-03	DR2-4035-05
DR2-4045-03	DR2-4045-05
DR2-4055-03	DR2-4055-05
DR2-4080-03	DR2-4080-05
DR2-4100-03	DR2-4080-05
DR2-4100-03	DR2-4100-05
DR2-4130-03	DR2-4130-05
DR2-4160-03	DR2-4160-05
DR2-4200-13	DR2-4200-15
DR2-4250-13	DR2-4250-15
DR2-4320-13	DR2-4320-15
DR2-4400-13	DR2-4400-15
DR2-4400-13	DR2-4400-15
DR2-4500-03	DR2-4500-05
DR2-4600-03	DR2-4600-05
DR2-4750-03	DR2-4750-05

NEMA 1 Line Reactor	
3%	5%
DR1-42D1-13	DR1-42D1-15
DR1-43D0-13	DR1-43D0-15
DR1-43D4-13	DR1-43D4-15
DR1-44D8-13	DR1-44D8-15
DR1-47D6-13	DR1-47D6-15
DR1-4011-13	DR1-4011-15
DR1-4014-13	DR1-4014-15
DR1-4021-13	DR1-4021-15
DR1-4027-13	DR1-4027-15
DR1-4034-13	DR1-4034-15
DR1-4040-13	DR1-4040-15
DR1-4052-13	DR1-4052-15
DR1-4065-13	DR1-4065-15
DR1-4077-13	DR1-4077-15
DR1-4096-13	DR1-4096-15
DR1-4124-13	DR1-4124-15
DR1-4156-13	DR1-4156-15
DR1-4180-13	DR1-4180-15
DR1-4240-13	DR1-4240-15
DR1-4302-13	DR1-4302-15
DR1-4361-13	DR1-4361-15
DR1-4414-13	DR1-4414-15
DR1-4477-13	DR1-4477-15
DR1-4590-13	DR1-4590-15
DR1-4708-13	DR1-4708-15

Load Reactor	
3%	5%
DR2-42D0-13	DR2-42D0-15
DR2-44D0-13	DR2-44D0-15
DR2-44D0-13	DR2-44D0-15
DR2-48D0-13	DR2-48D0-15
DR2-48D0-13	DR2-48D0-15
DR2-4012-13	DR2-4012-15
DR2-4018-13	DR2-4018-15
DR2-4025-13	DR2-4025-15
DR2-4025-13	DR2-4025-15
DR2-4035-13	DR2-4035-15
DR2-4045-13	DR2-4045-15
DR2-4055-13	DR2-4055-15
DR2-4080-13	DR2-4080-15
DR2-4100-13	DR2-4080-15
DR2-4100-13	DR2-4100-15
DR2-4130-13	DR2-4130-15
DR2-4160-13	DR2-4160-15
DR2-4200-13	DR2-4200-15
DR2-4250-13	DR2-4250-15
DR2-4320-13	DR2-4320-15
DR2-4400-13	DR2-4400-15
DR2-4400-13	DR2-4400-15
DR2-4500-13	DR2-4500-15
DR2-4600-13	DR2-4600-15
DR2-4750-13	DR2-4750-15

## Line and Load Reactors—575 V

hp (CT)	Open Line Reactor	
	3%	5%
2	DR1-52D7-03	DR1-52D7-05
3	DR1-53D9-03	DR1-53D9-05
5	DR1-56D1-03	DR1-56D1-05
7.5	DR1-59D0-03	DR1-59D0-05
10	DR1-5011-03	DR1-5011-05
15	DR1-5017-03	DR1-5017-05
20	DR1-5022-03	DR1-5022-05
25	DR1-5027-03	DR1-5027-05
30	DR1-5032-03	DR1-5032-05
40	DR1-5041-03	DR1-5041-05
50	DR1-5052-03	DR1-5052-05
60	DR1-5062-03	DR1-5062-05
75	DR1-5077-03	DR1-5077-05
100	DR1-5100-03	DR1-5100-05
125	DR1-5125-03	DR1-5125-05
150	DR1-5144-03	DR1-5144-05
200	DR1-5192-03	DR1-5192-05
250	DR1-5242-03	DR1-5242-05
300	DR1-5289-03	DR1-5289-05
400	DR1-5382-03	DR1-5382-05
450	DR1-5412-03	DR1-5412-05
500	DR1-5472-03	DR1-5472-05
600	DR1-5576-03	DR1-5576-05

Load Reactor	
3%	5%
DR2-54D0-03	DR2-54D0-05
DR2-54D0-03	DR2-54D0-05
DR2-58D0-03	DR2-58D0-05
DR2-58D0-03	DR2-58D0-05
DR2-5012-03	DR2-5012-05
DR2-5018-03	DR2-5018-05
DR2-5025-03	DR2-5025-05
DR2-5025-03	DR2-5025-05
DR2-5035-03	DR2-5035-05
DR2-5045-03	DR2-5045-05
DR2-5055-03	DR2-5055-05
DR2-5080-03	DR2-5080-05
DR2-5080-03	DR2-5080-05
DR2-5100-03	DR2-5100-05
DR2-5130-03	DR2-5130-05
DR2-5160-03	DR2-5160-05
DR2-5200-13	DR2-5200-15
DR2-5250-13	DR2-5250-15
DR2-5320-13	DR2-5320-15
DR2-5400-13	DR2-5400-15
DR2-5400-13	DR2-5400-15
DR2-5500-03	DR2-5500-05
DR2-5600-03	DR2-5600-05

NEMA 1 Line Reactor	
3%	5%
DR1-52D7-13	DR1-52D7-15
DR1-53D9-13	DR1-53D9-15
DR1-56D1-13	DR1-56D1-15
DR1-59D0-13	DR1-59D0-15
DR1-5011-13	DR1-5011-15
DR1-5017-13	DR1-5017-15
DR1-5022-13	DR1-5022-15
DR1-5027-13	DR1-5027-15
DR1-5032-13	DR1-5032-15
DR1-5041-13	DR1-5041-15
DR1-5052-13	DR1-5052-15
DR1-5062-13	DR1-5062-15
DR1-5077-13	DR1-5077-15
DR1-5100-13	DR1-5100-15
DR1-5125-13	DR1-5125-15
DR1-5144-13	DR1-5144-15
DR1-5192-13	DR1-5192-15
DR1-5242-13	DR1-5242-15
DR1-5289-13	DR1-5289-15
DR1-5382-13	DR1-5382-15
DR1-5412-13	DR1-5412-15
DR1-5472-13	DR1-5472-15
DR1-5576-13	DR1-5576-15

Load Reactor	
3%	5%
DR2-54D0-13	DR2-54D0-15
DR2-54D0-13	DR2-54D0-15
DR2-58D0-13	DR2-58D0-15
DR2-58D0-13	DR2-58D0-15
DR2-5012-13	DR2-5012-15
DR2-5018-13	DR2-5018-15
DR2-5025-13	DR2-5025-15
DR2-5025-13	DR2-5025-15
DR2-5035-13	DR2-5035-15
DR2-5045-13	DR2-5045-15
DR2-5055-13	DR2-5055-15
DR2-5080-13	DR2-5080-15
DR2-5080-13	DR2-5080-15
DR2-5100-13	DR2-5100-15
DR2-5130-13	DR2-5130-15
DR2-5160-13	DR2-5160-15
DR2-5200-13	DR2-5200-15
DR2-5250-13	DR2-5250-15
DR2-5320-13	DR2-5320-15
DR2-5400-13	DR2-5400-15
DR2-5400-13	DR2-5400-15
DR2-5500-13	DR2-5500-15
DR2-5600-13	DR2-5600-15



## Replacement Parts

## FR4 Spare Parts

2

Category	Description	Quantity/ Drive	230 V Catalog Number	480 V Catalog Number	575 V Catalog Number
Control fan	NEMA Type 12 control fan <sup>①</sup>	1	PP01086	PP01086	—
Control module <sup>②</sup>	SVX control module	1	CSBS0000000000	CSBS0000000000	—
	Standard slot A I/O card	1	OPTA9	OPTA9	—
	Standard slot B I/O card	1	OPTA2	OPTA2	—
Keypad <sup>②</sup>	SVX/SPX keypad	1	KEYPAD-LOC/REM	KEYPAD-LOC/REM	—
Main fan <sup>②</sup>	DC fan (main)	1	PP01060	PP01060	—
Other	Mounting kit, fixing kit	1	FR00040	FR00040	—
	Mounting kit, fixing kit, N12 <sup>①</sup>	1	FR00079	FR00079	—
	Control cover, plastic, N1	1	FR00006	FR00006	—

## FR5 Spare Parts

Category	Description	Quantity/ Drive	230 V Catalog Number	480 V Catalog Number	575 V Catalog Number
Control fan	NEMA Type 12 control fan <sup>①</sup>	1	PP01088	PP01088	—
Control module <sup>②</sup>	SVX control module	1	CSBS0000000000	CSBS0000000000	—
	Standard slot A I/O card	1	OPTA9	OPTA9	—
	Standard slot B I/O card	1	OPTA2	OPTA2	—
Keypad <sup>②</sup>	SVX/SPX keypad	1	KEYPAD-LOC/REM	KEYPAD-LOC/REM	—
Main fan <sup>②</sup>	DC fan (main)	1	PP01061	PP01061	—
Other	Mounting kit, fixing kit	1	FR00050	FR00050	—
	Mounting kit, fixing kit, N12 <sup>①</sup>	1	FR00081	FR00081	—

## FR6 Spare Parts

Category	Description	Quantity/ Drive	230 V Catalog Number	480 V Catalog Number	575 V Catalog Number
Control fan	NEMA Type 12 control fan <sup>①</sup>	1	PP01049	PP01049	—
Control module <sup>②</sup>	SVX control module	1	CSBS0000000000	CSBS0000000000	CSBS0000000000
	Standard slot A I/O card	1	OPTA9	OPTA9	OPTA9
	Standard slot B I/O card	1	OPTA2	OPTA2	OPTA2
Keypad <sup>②</sup>	SVX/SPX keypad	1	KEYPAD-LOC/REM	KEYPAD-LOC/REM	KEYPAD-LOC/REM
Main fan <sup>②</sup>	DC fan (main)	1	PP01062	PP01062	—
Other	Mounting kit, fixing kit	1	FR00060	FR00060	FR00060
	Mounting kit, fixing kit, N12 <sup>①</sup>	1	FR00082	FR00082	FR00082
	Control cover, plastic, N1	1	FR06011	FR06011	FR06011

## FR7 Spare Parts

Category	Description	Quantity/ Drive	230 V Catalog Number	480 V Catalog Number	575 V Catalog Number
Control fan	NEMA Type 12 control fan <sup>①</sup>	1	PP01049	PP01049	PP01049
Control module <sup>②</sup>	SVX control module	1	CSBS0000000000	CSBS0000000000	CSBS0000000000
	Standard slot A I/O card	1	OPTA9	OPTA9	OPTA9
	Standard slot B I/O card	1	OPTA2	OPTA2	OPTA2
Keypad <sup>②</sup>	SVX/SPX keypad	1	KEYPAD-LOC/REM	KEYPAD-LOC/REM	KEYPAD-LOC/REM
Main fan <sup>②</sup>	DC fan (main)	1	PP01063	PP01063	PP01063
Other	Mounting kit, fixing kit	1	FR07071	FR07071	FR07071
	Mounting kit, fixing kit, N12 <sup>①</sup>	1	FR07072	FR07072	FR07072
	Control cover, plastic, N1	1	FR07011	FR07011	FR07011

## Notes

<sup>①</sup> Only for NEMA Type 12/IP54 Type drives.

<sup>②</sup> Factory recommended spare parts.

## FR8 Spare Parts

Category	Description	Quantity/ Drive	230 V Catalog Number	480 V Catalog Number	575 V Catalog Number
Control fan	NEMA Type 12 control fan <sup>①</sup>	1	CP01180	CP01180	CP01180
Control module <sup>②</sup>	SVX control module	1	CSBS0000000000	CSBS0000000000	CSBS0000000000
	Standard slot A I/O card	1	OPTA9	OPTA9	OPTA9
	Standard slot B I/O card	1	OPTA2	OPTA2	OPTA2
Keypad <sup>②</sup>	SVX/SPX keypad	1	KEYPAD-LOC/REM	KEYPAD-LOC/REM	KEYPAD-LOC/REM
Main AC fan	Fan AC	1	PP01123	PP01123	PP01123
	Fan fuse	2	PP20202	PP20202	PP20202
	Starting cap	1	S00734	S00734	S00734
	Fan driver board AC	1	VB00599	VB00799	VB00799
	Isolation transformer (fan)	1	S0000113	S0000113	S0000113
Main DC fan <sup>②</sup>	DC fan	1	PP00071	PP00071	PP00071
	DC power supply	1	S01016	S01016	S01016
Other	Front cover, N12 <sup>①</sup>	1	FR08079	FR08079	FR08079
	Conduit plate, N12	1	FR08082	FR08082	FR08082

## FR9 Spare Parts

Category	Description	Quantity/ Drive	230 V Catalog Number	480 V Catalog Number	575 V Catalog Number
Control fan	50 mm fan	1	PP09041	PP09041	PP09041
	80 mm fan	1	PP01068	PP01068	PP01068
Control module <sup>①</sup>	SVX control module	1	CSBS0000000000	CSBS0000000000	CSBS0000000000
	Standard slot A I/O card	1	OPTA9	OPTA9	OPTA9
	Standard slot B I/O card	1	OPTA2	OPTA2	OPTA2
Inverter	Power module <sup>②</sup>	1	FR09-0261-2-ANV	FR09-0261-4-ANV	FR09-0125-5-ANV
		1	FR09-0300-2-ANV	FR09-0300-4-ANV	FR09-0144-5-ANV
		1	—	—	FR09-0170-5-ANV
	Driver board	1	S00583	S00583	S00583
	Shunt board <sup>②</sup>	6	—	VB00535	VB00537
		6	—	VB00536	VB00542
6		—	—	VB00543	
DC section	Balancing resistor	3	PP00052	PP00052	PP00052
	Bus capacitor	8	S00335	S00335	PP01041
	DC busbars DC-	1	FR09043	FR09043	FR09043
	DC busbars DC+	1	FR09044	FR09044	FR09044
	DC busbars connection	1	FR09045	FR09045	FR09045
	DC busbars +/- insulator	1	FR09046	FR09046	FR09046
	DC busbars -/con insulator	1	FR09047	FR09047	FR09047
Converter	Rectifier module	1	FR09826	FR09822	FR09823
	Diode	3	CP01268	CP01268	CP01268
	Rectifier board	1	—	VB00459	VB00460
Keypad <sup>①</sup>	SVX/SPX keypad	1	KEYPAD-LOC/REM	KEYPAD-LOC/REM	KEYPAD-LOC/REM
Main DC fan <sup>①</sup>	DC fan	1	PP00072	PP00072	PP00072
	DC power supply	1	S01017	S01017	S01017
Other	Front cover power	1	FR09012	FR09012	FR09012
	Front cover connection	1	FR09013	FR09013	FR09013
	Front power conduit	1	FR09014	FR09014	FR09014

## Notes

<sup>①</sup> Factory recommended spare parts.

<sup>②</sup> Select one part number based on the amperage rating of the drive. Please contact EatonCare at 877-ETN-CARE for assistance.

## FR10 Spare Parts

2

Category	Description	Quantity/ Drive	230 V Catalog Number	480 V Catalog Number	575 V Catalog Number
Control	Fiber board	1	—	S00451	S00451
	ASIC board	1	—	S00457	S00457
Control fan	ASIC fan	1	—	PP01096	PP01096
Control module <sup>①</sup>	SVX control module	1	—	CPBS0000000000	CPBS0000000000
	Standard slot A I/O card	1	—	OPTA9	OPTA9
	Standard slot B I/O card	1	—	OPTA2	OPTA2
Inverter	Power module <sup>②</sup>	1	—	FR10-0385-4-ANV	FR10-0261-5-ANV
		1	—	FR10-0460-4-ANV	FR10-0325-5-ANV
		1	—	FR10-0520-4-ANV	FR10-0385-5-ANV
		1	—	—	FR10-0416-5-ANV
	Driver board	1	—	S00450	S00450
	Driver adapter board	1	—	VB00330	VB00330
	Shunt board <sup>②</sup>	6	—	VB00497	VB00510
		6	—	VB00498	VB00511
		6	—	VB00537	VB00545
	Covers	Top cover	1	—	FR10340
Side cover		2	—	FR10341	FR10341
DC section	Balancing resistor	2	—	PP13027	PP13028
	DC busbars kit (right)	1	—	S0000005	S0000005
	Bus capacitor	12	—	S00335	S00336
Converter	Rectifier module	1	—	FR10823	FR10823
	Charging resistor	1	—	PP00066	PP00066
	Diode	3	—	PP01177	PP01177
	Rectifier board	1	—	S00591	S00592
Keypad <sup>①</sup>	SVX/SPX keypad	1	—	KEYPAD-LOC/REM	KEYPAD-LOC/REM
Main DC fan <sup>①</sup>	DC fan	2	—	PP00072	PP00072
	DC power supply	2	—	S01017	S01017

**Notes**

<sup>①</sup> Factory recommended spare parts.

<sup>②</sup> Select one part number based on the amperage rating of the drive. Please contact EatonCare at 877-ETN-CARE for assistance.

## FR11 Spare Parts

Category	Description	Quantity/ Drive	230 V Catalog Number	480 V Catalog Number	575 V Catalog Number
Control	Fiber board	1	—	S00451	S00451
	ASIC board	1	—	S00457	S00457
Control fan	ASIC fan	1	—	PP01096	PP01096
Control module ①	SVX control module	1	—	CPBS0000000000	CPBS0000000000
	Standard slot A I/O card	1	—	OPTA9	OPTA9
	Standard slot B I/O card	1	—	OPTA2	OPTA2
Inverter	Power module ②	1	—	FR11-0590-4-ANV	FR11-0460-5-ANV
		1	—	FR11-0650-4-ANV	FR11-0502-5-ANV
		1	—	FR11-0730-4-ANV	FR11-0590-5-ANV
	Driver board	1	—	S00452	S00452
	Driver adapter board	1	—	VB00330	VB00330
	Shunt board ②	9	—	VB00513	VB00512
		9	—	VB00514	VB00546
		9	—	VB00538	VB00547
	Covers	Top cover	1	—	FR11345
DC section	Balancing resistor	3	—	PP13027	PP13027
	DC busbars kit (right)	3	—	S0000005	S0000005
	Bus capacitor	18	—	S00335	S00335
Converter	Rectifier module	1	—	FR10823	FR10823
	Diode	3	—	PP01177	PP01177
	Rectifier board	1	—	S00591	S00591
Keypad ①	SVX/SPX keypad	1	—	KEYPAD-LOC/REM	KEYPAD-LOC/REM
Main DC fan ①	DC fan	2	—	PP00072	PP00072
	DC power supply	2	—	S01017	S01017

**Notes**

① Factory recommended spare parts.

② Select one part number based on the amperage rating of the drive. Please contact EatonCare at 877-ETN-CARE for assistance.

## FR12 Spare Parts

2

Category	Description	Quantity/ Drive	230 V Catalog Number	480 V Catalog Number	575 V Catalog Number
Control	Fiber board	2	—	S00451	S00451
	ASIC board	2	—	S00457	S00457
	Star coupler	1	—	S00593	S00593
Control fan	ASIC fan	2	—	PP01096	PP01096
Control module <sup>①</sup>	SVX control module	1	—	CPBS0000000000	CPBS0000000000
	Standard slot A I/O card	1	—	OPTA9	OPTA9
	Standard slot B I/O card	1	—	OPTA2	OPTA2
Inverter	Power module <sup>②</sup>	1	—	FR12-0820-4-ANV	FR12-0650-5-ANV
		1	—	FR12-0920-4-ANV	FR12-0750-5-ANV
		1	—	FR12-1030-4-ANV	FR12-0820-5-ANV
	Driver board	2	—	S00450	S00450
	Driver adapter board	2	—	VB00330	VB00330
	Shunt board	12	—	VB00498	VB00511
	Covers	Top cover	2	—	FR10340
Side cover		4	—	FR10341	FR10341
DC section	Balancing resistor	4	—	PP13027	PP13027
	DC busbars kit (right)	2	—	S0000005	S0000005
	Bus capacitor	24	—	S00335	S00336
Converter	Rectifier module	2	—	FR10823	FR10823
	Diode	3	—	PP01177	PP01177
	Rectifier board	2	—	S00591	S00591
Keypad <sup>①</sup>	SVX/SPX keypad	1	—	KEYPAD-LOC/REM	KEYPAD-LOC/REM
Main DC fan <sup>①</sup>	DC fan	4	—	PP00072	PP00072
	DC power supply	4	—	S01017	S01017

**Notes**

<sup>①</sup> Factory recommended spare parts.

<sup>②</sup> Select one part number based on the amperage rating of the drive. Please contact EatonCare at 877-ETN-CARE for assistance.

## FR13 Spare Parts

Category	Description	Quantity/ Drive	230 V Catalog Number	480 V Catalog Number	575 V Catalog Number
Control	ASIC board	1	—	S00457	S00457
	ASIC assembly	1	—	60S01030	60S01030
Control fan	ASIC fan	1	—	PP01096	PP01096
Control module ①	SVX control module	1	—	CPBS0000000000	CPBS0000000000
	Standard slot A I/O card	1	—	OPTA9	OPTA9
	Standard slot B I/O card	1	—	OPTA2	OPTA2
Inverter	Power module ②	3	—	FI13-1150-4-ANV	FR13-1030-5-ANV
		3	—	FI13-1300-4-ANV	FR13-1180-5-ANV
		3	—	FI13-1450-4-ANV	FR13-920-5-ANV
	Driver board	3	—	S00454	S00454
	Driver adapter board	2	—	VB00330	VB00330
	Shunt board ②	18	—	VB00505	VB00516
		18	—	VB00514	VB00517
		18	—	VB00541	VB00547
Covers	Top cover	3	—	FI10001	FI10001
	Side cover	3	—	FI10003	FI10003
DC section	Balancing resistor	6	—	PP13034	PP13034
	Bus capacitor	36	—	S00335	S00336
	DC busbars kit	3	—	FI13329	FI13329
Converter	Rectifier module	2	—	FR10823	FR10823
	Diode	3	—	PP01177	PP01177
	Rectifier board	2	—	S00591	S00591
Keypad ①	SVX/SPX keypad	1	—	KEYPAD-LOC/REM	KEYPAD-LOC/REM
Main DC fan ①	DC fan	4	—	PP00072	PP00072
	DC power supply	4	—	S01017	S01017

**Notes**

① Factory recommended spare parts.

② Select one part number based on the amperage rating of the drive. Please contact EatonCare at 877-ETN-CARE for assistance.

## FR14 Spare Parts

2

Category	Description	Quantity/ Drive	230 V Catalog Number	480 V Catalog Number	575 V Catalog Number
Control	ASIC board	2	—	S00457	S00457
	Star coupler	1	—	S00593	S00593
	ASIC assembly	2	—	60S01030	60S01030
	Star coupler kit	1	—	FR10860	FR10860
Control fan	ASIC fan	2	—	PP01096	PP01096
Control module ①	SVX control module	1	—	CPBS0000000000	CPBS0000000000
	Standard slot A I/O card	1	—	OPTA9	OPTA9
	Standard slot B I/O card	1	—	OPTA2	OPTA2
Inverter	Power module ②	1	—	FR14-1770-4-ANV	FR14-1500-5-ANV
		1	—	FR14-2150-4-ANV	FR14-1900-5-ANV
		1	—	FR14-2700-4-ANV	FR14-2250-5-ANV
	Driver board	6	—	S00454	S00454
	Driver adapter board	2	—	VB00330	VB00330
	Shunt board ②	36	—	VB00541	VB00516
		36	—	—	VB00517
Covers	Top cover	6	—	FI10001	FI10001
	Side cover	6	—	FI10003	FI10003
DC section	Balancing resistor	6	—	PP13034	PP13034
	Bus capacitor	72	—	S00335	S00336
	DC busbars kit	6	—	FI13329	FI13329
Converter	Rectifier module	2	—	FR10823	FR10823
	Diode	3	—	PP01177	PP01177
	Rectifier board	2	—	S00591	S00591
Keypad ①	SVX/SPX keypad	1	—	KEYPAD-LOC/REM	KEYPAD-LOC/REM
Main DC fan ①	DC fan	6	—	PP00072	PP00072
	DC power supply	6	—	S01017	S01017

**Notes**

① Factory recommended spare parts.

② Select one part number based on the amperage rating of the drive. Please contact EatonCare at 877-ETN-CARE for assistance.

## Technical Data and Specifications

### SVX Drives

Description	Specification
<b>Input Ratings</b>	
Input voltage ( $V_{in}$ )	+10%/–15%
Input frequency ( $f_{in}$ )	50/60 Hz (variation up to 45–66 Hz)
Connection to power	Once per minute or less (typical operation)
High withstand rating	100 kAIC
<b>Output Ratings</b>	
Output voltage	0 to $V_{in}$
Continuous output current	$I_H$ rated 100% at 122 °F (50 °C), FR9 and below $I_L$ rated 100% at 104 °F (40 °C), FR9 and below $I_H/I_L$ 100% at 104 °F (40 °C), FR10 and above
Overload current ( $I_H/I_L$ )	150% $I_H$ , 110% $I_L$ for 1 min.
Output frequency	0 to 320 Hz
Frequency resolution	0.01 Hz
Initial output current ( $I_H$ )	250% for 2 seconds
Efficiency	>96%
<b>Control Characteristics</b>	
Control method	Frequency control (V/f) Open loop: Sensorless vector control Closed loop: SPX drives only
Switching frequency	Adjustable with parameter 2.6.9
Frame 4–6	1–16 kHz; default 10 kHz
Frame 7–12	1–10 kHz; default 3.6 kHz
Frequency reference	Analog input: Resolution 0.1% (10-bit), accuracy $\pm 1\%$ V/Hz Panel reference: Resolution 0.01 Hz
Field weakening point	30–320 Hz
Acceleration time	0–3000 sec.
Deceleration time	0–3000 sec.
Braking torque	DC brake: 30% $\times T_n$ (without brake option)
<b>Ambient Conditions</b>	
Ambient operating temperature	14 °F (–10 °C), no frost to 122 °F (50 °C) $I_H$ (FR4–FR9) 14 °F (–10 °C), no frost to 104 °F (40 °C) $I_H$ (FR10 and up) 14 °F (–10 °C), no frost to 104 °F (40 °C) $I_L$ (all frames)
Storage temperature	–40° to 158 °F (–40° to 70 °C)
Relative humidity	0 to 95% RH, noncondensing, non-corrosive, no dripping water
Air quality	Chemical vapors: IEC 721-3-3, unit in operation, class 3C2; Mechanical particles: IEC 721-3-3, unit in operation, class 3S2
Altitude	100% load capacity (no derating) up to 3280 ft (1000 m); 1% derating for each 328 ft (100 m) above 3280 ft (1000 m); max. 9842 ft (3000 m)
Vibration	EN 50178, EN 60068-2-6; 5 to 50 Hz, displacement amplitude 1 mm (peak) at 3 to 15.8 Hz, max. acceleration amplitude 1G at 15.8 to 150 Hz
Shock	EN 50178, EN 60068-2-27 UPS Drop test (for applicable UPS weights) Storage and shipping: max. 15 g, 11 ms (in package)
Enclosure class	NEMA 1/IP21 or NEMA 12/IP54, open chassis/IP20

Description	Specification
<b>Control Connections</b>	
Analog input voltage	0 to 10 V, $R = 200$ kohms (–10 to 10 V joystick control) resolution 0.1%; accuracy $\pm 1\%$
Analog input current	0(4) to 20 mA; $R_i = 250$ ohms differential
Digital inputs (6)	Positive or negative logic; 18 to 30 Vdc
Auxiliary voltage	+24 V $\pm 15\%$ , max. 250 mA
Output reference voltage	+10 V +3%, max. load 10 mA
Analog output	0(4) to 20 mA; $R_i$ max. 500 ohms; resolution 10 bit; accuracy $\pm 2\%$
Digital outputs	Open collector output, 50 mA/48V
Relay outputs	Two programmable Form C relay outputs switching capacity: 24 Vdc/8 A, 250 Vac/8 A, 125 Vdc/0.4 A
<b>Protections</b>	
Overcurrent protection	Trip limit 4.0 $\times I_H$ instantaneously
Overvoltage protection	Yes
Undervoltage protection	Yes
Earth fault protection	In case of earth fault in motor or motor cable, only the frequency converter is protected
Input phase supervision	Trips if any of the input phases are missing
Motor phase supervision	Trips if any of the output phases are missing
Overtemperature protection	Yes
Motor overload protection	Yes
Motor stall protection	Yes
Motor underload protection	Yes
Short-circuit protection	Yes (+24 V and +10 V reference voltages)

### Standard I/O Specifications

Description	Specification
Six–digital input programmable	24 V: "0" $\leq 10$ V, "1" $\geq 18$ V, $R_i > 5$ kohms
Two–analog input configurable w/jumpers	Voltage: 0– $\pm 10$ V, $R_i > 200$ kohms Current: 0 (4)–20 mA, $R_i = 250$ ohms
Two–digital output programmable	Form C relays 250 Vac 30 Vdc 2 amp resistive
One–analog output programmable configurable w/jumper	0–20 mA, $R_i$ max. 500 ohms 10 bits $\pm 2\%$
One digital output programmable	Open collector 48 Vdc 50 mA



# 2.7

## Adjustable Frequency Drives

### SVX Drives

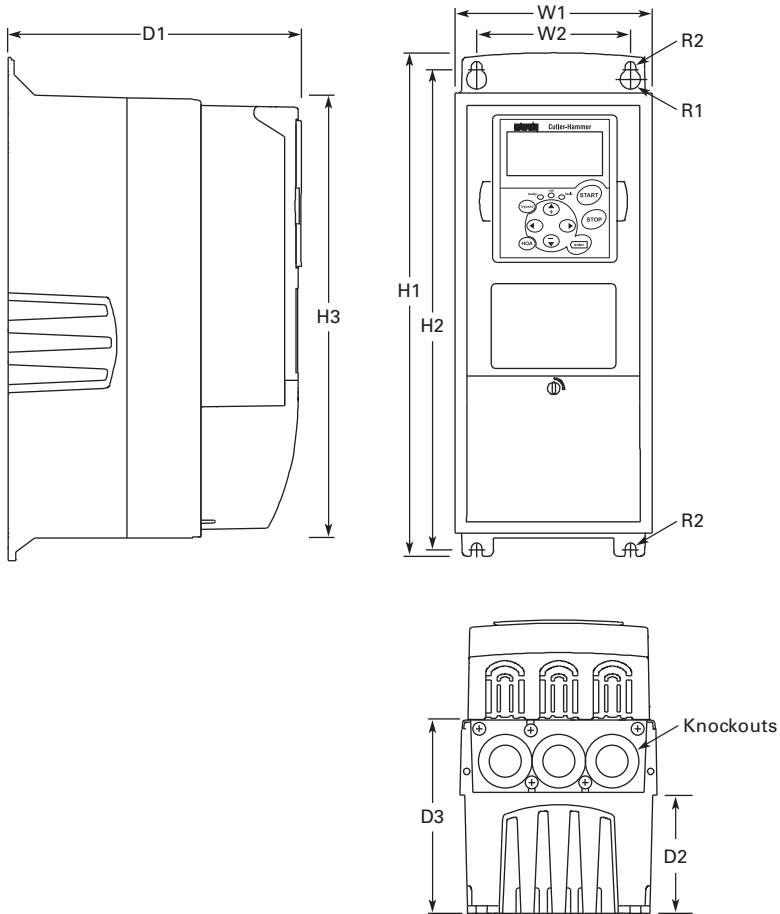
#### Dimensions

Approximate Dimensions in Inches (mm)

2

#### 9000X Open Drives

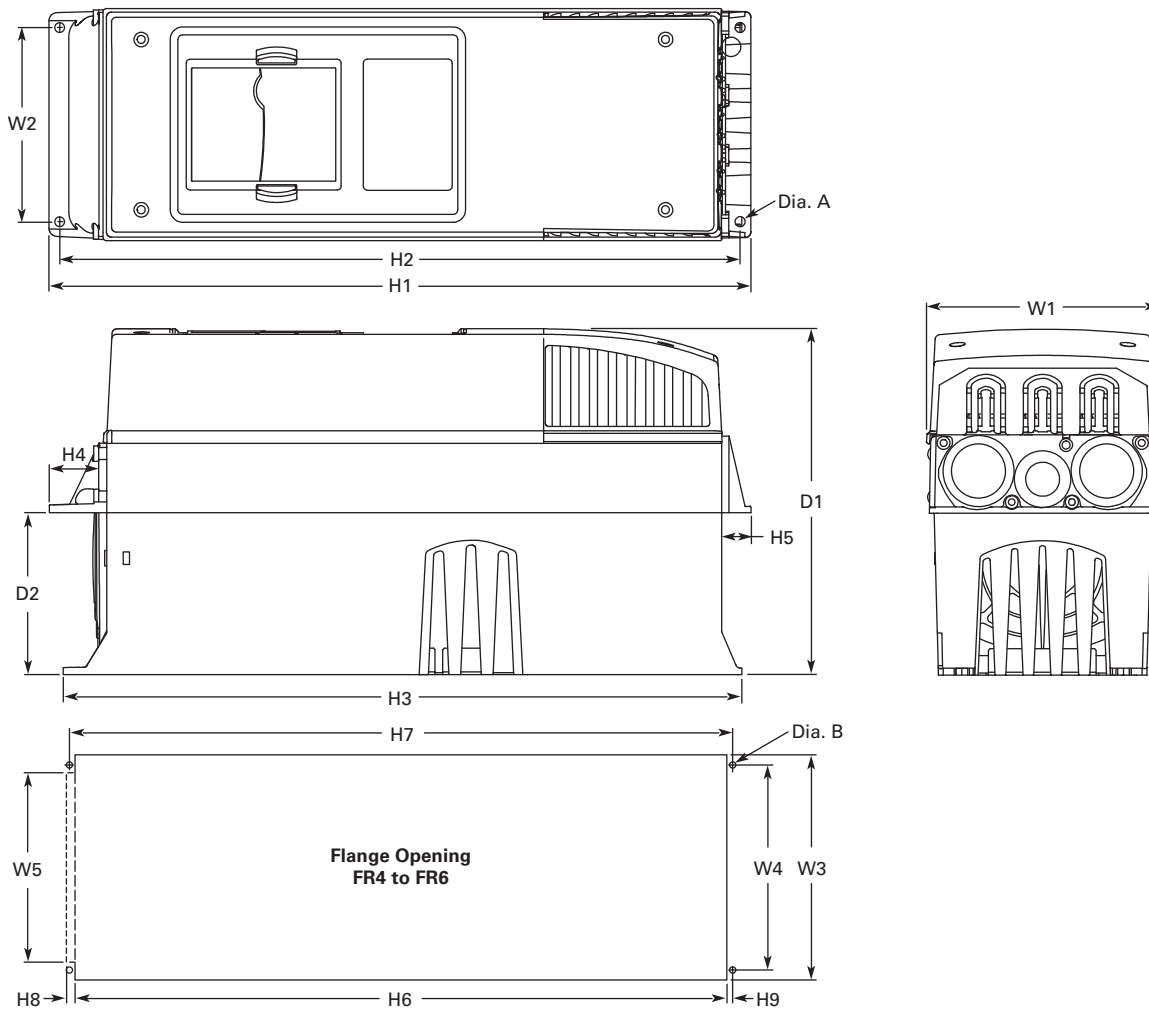
#### NEMA Type 1/IP21 and NEMA Type 12/IP54, FR4, FR5 and FR6



Voltage	hp (I <sub>H</sub> )	H1	H2	H3	D1	D2	D3	W1	W2	R1 Dia.	R2 Dia.	Weight Lbs (kg)	Knockouts at Inches (mm) N1 (O.D.)
<b>FR4</b>													
230 V	3/4–3	12.9	12.3	11.5	7.5	3.0	4.9	5.0	3.9	0.5 (13)	0.3 (7)	11.0 (5)	3 @ 1.1 (28)
480 V	1–5	(327)	(313)	(292)	(190)	(77)	(126)	(128)	(100)				
<b>FR5</b>													
230 V	5–7-1/2	16.5	16.0	15.3	8.4	3.9	5.8	5.6	3.9	0.5 (13)	0.3 (7)	17.9 (8)	2 @ 1.5 (37)
480 V	7-1/2–15	(419)	(406)	(389)	(214)	(100)	(148)	(143)	(100)				1 @ 1.1 (28)
<b>FR6</b>													
230 V	10–15	22.0	21.3	20.4	9.3	4.2	6.5	7.6	5.8	0.6 (15.5)	0.4 (9)	40.8 (19)	3 @ 1.5 (37)
480 V	20–30	(558)	(541)	(519)	(237)	(105)	(165)	(195)	(148)				
575 V	2–25												

Approximate Dimensions in Inches (mm)

**NEMA Type 1/IP21 and NEMA Type 12/IP54 with Flange Kit, FR4, FR5 and FR6**



**FR4, FR5 and FR6 with Flange Kit**

W1	W2	H1	H2	H3	H4	H5	D1	D2	Dia. A
<b>FR4</b>									
5.0 (128)	4.5 (113)	13.3 (337)	12.8 (325)	12.9 (327)	1.2 (30)	0.9 (22)	7.5 (190)	3.0 (77)	0.3 (7)
<b>FR5</b>									
5.6 (143)	4.7 (120)	17.0 (434)	16.5 (420)	16.5 (419)	1.4 (36)	0.7 (18)	8.4 (214)	3.9 (100)	0.3 (7)
<b>FR6</b>									
7.7 (195)	6.7 (170)	22.0 (560)	21.6 (549)	22.0 (558)	1.2 (30)	0.8 (20)	9.3 (237)	4.2 (106)	0.3 (7)

**Flange Opening, FR4 to FR6**

W3	W4	W5	H6	H7	H8	H9	Dia. B
<b>FR4</b>							
4.8 (123)	4.5 (113)	—	12.4 (315)	12.8 (325)	—	0.2 (5)	0.3 (7)
<b>FR5</b>							
5.3 (135)	4.7 (120)	—	16.2 (410)	16.5 (420)	—	0.2 (5)	0.3 (7)
<b>FR6</b>							
7.3 (185)	6.7 (170)	6.2 (157)	21.2 (539)	21.6 (549)	0.3 (7)	0.2 (5)	0.3 (7)

# 2.7

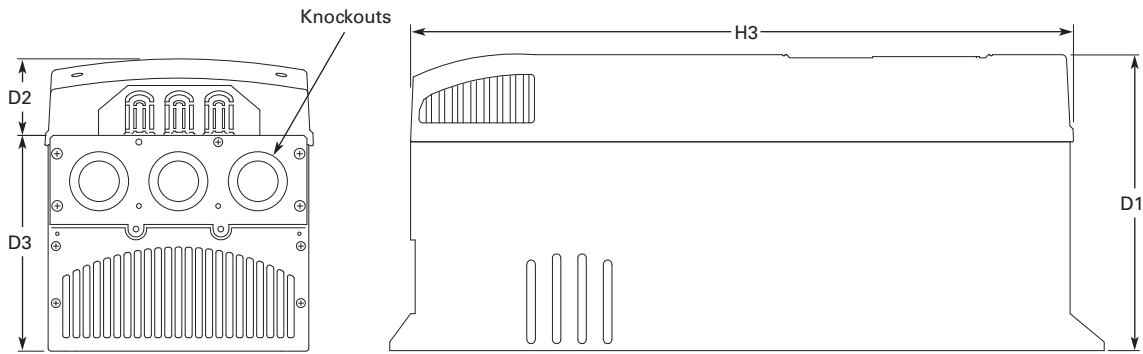
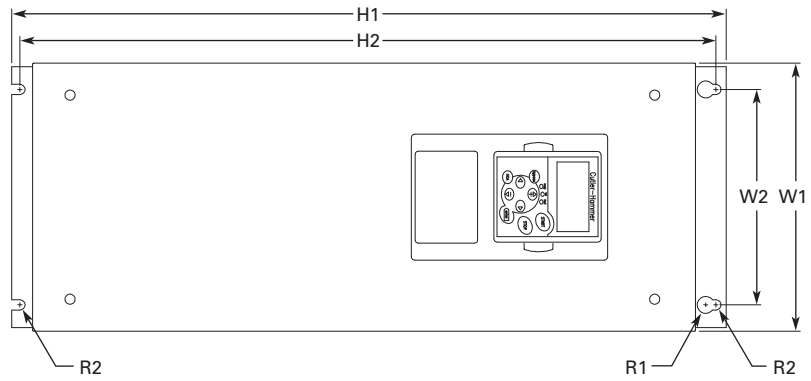
## Adjustable Frequency Drives

### SVX Drives

Approximate Dimensions in Inches (mm)

**NEMA Type 1/IP21 and NEMA Type 12/IP54, FR7**

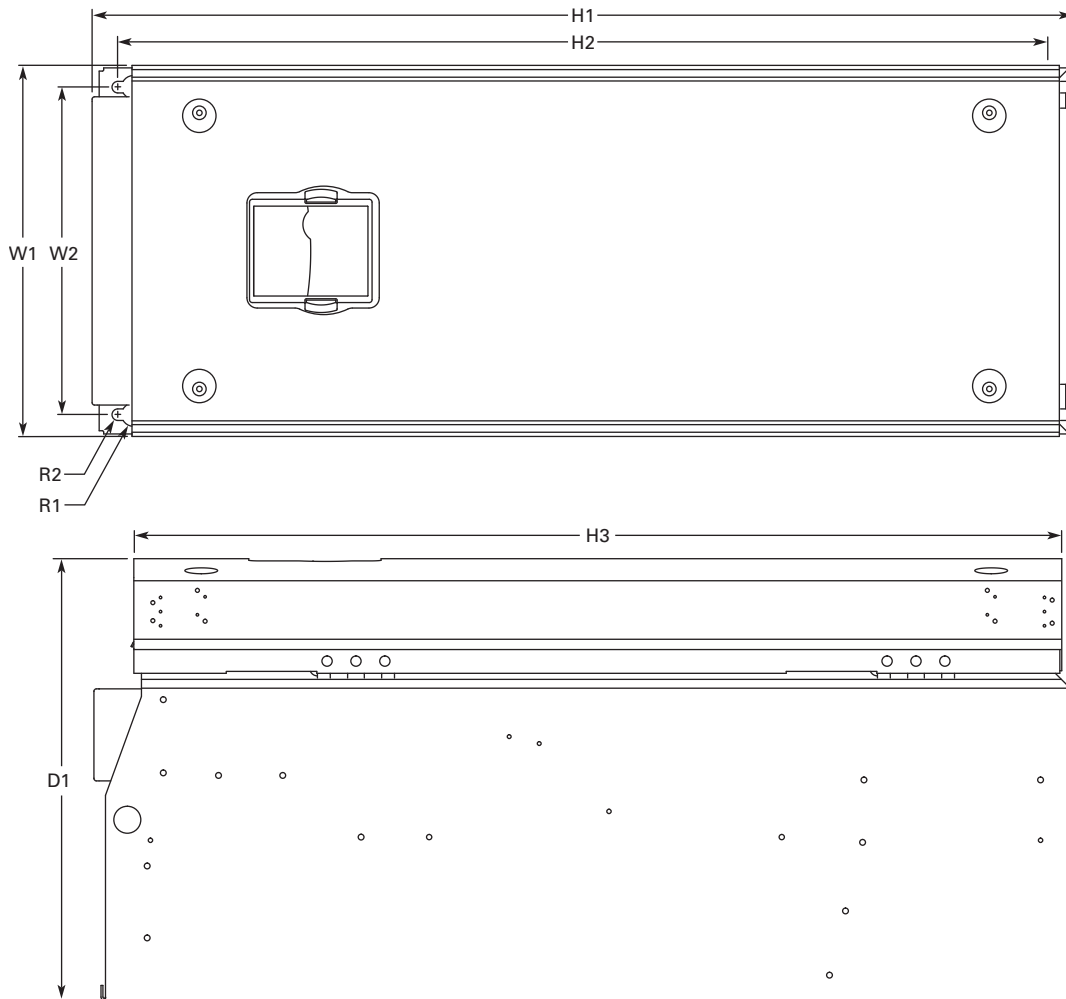
2



Voltage	hp (I <sub>H</sub> )	H1	H2	H3	D1	D2	D3	W1	W2	R1 Dia.	R2 Dia.	Weight Lbs (kg)	Knockouts at Inches (mm) N1 (O.D.)
230 V	20–30	24.8 (630)	24.2 (614)	23.2 (590)	10.1 (257)	3.0 (77)	7.3 (184)	9.3 (237)	7.5 (190)	0.7 (18)	0.4 (9)	77.2 (35)	3 at 1.5 (37)
480 V	40–60												
575 V	30–40												

Approximate Dimensions in Inches (mm)

**NEMA Type 1/IP21 and NEMA Type 12/IP54, FR8**



Voltage	hp (I <sub>H</sub> )	D1	H1	H2	H3	W1	W2	R1 Dia.	R2 Dia.	Weight Lbs (kg)
230 V	40–60	13.5 (344)	30.1 (764)	28.8 (732)	28.4 (721)	11.5 (291)	10 (255)	0.7 (18)	0.4 (9)	127 (58)
480 V	75–125									
575 V	50–75									

# 2.7

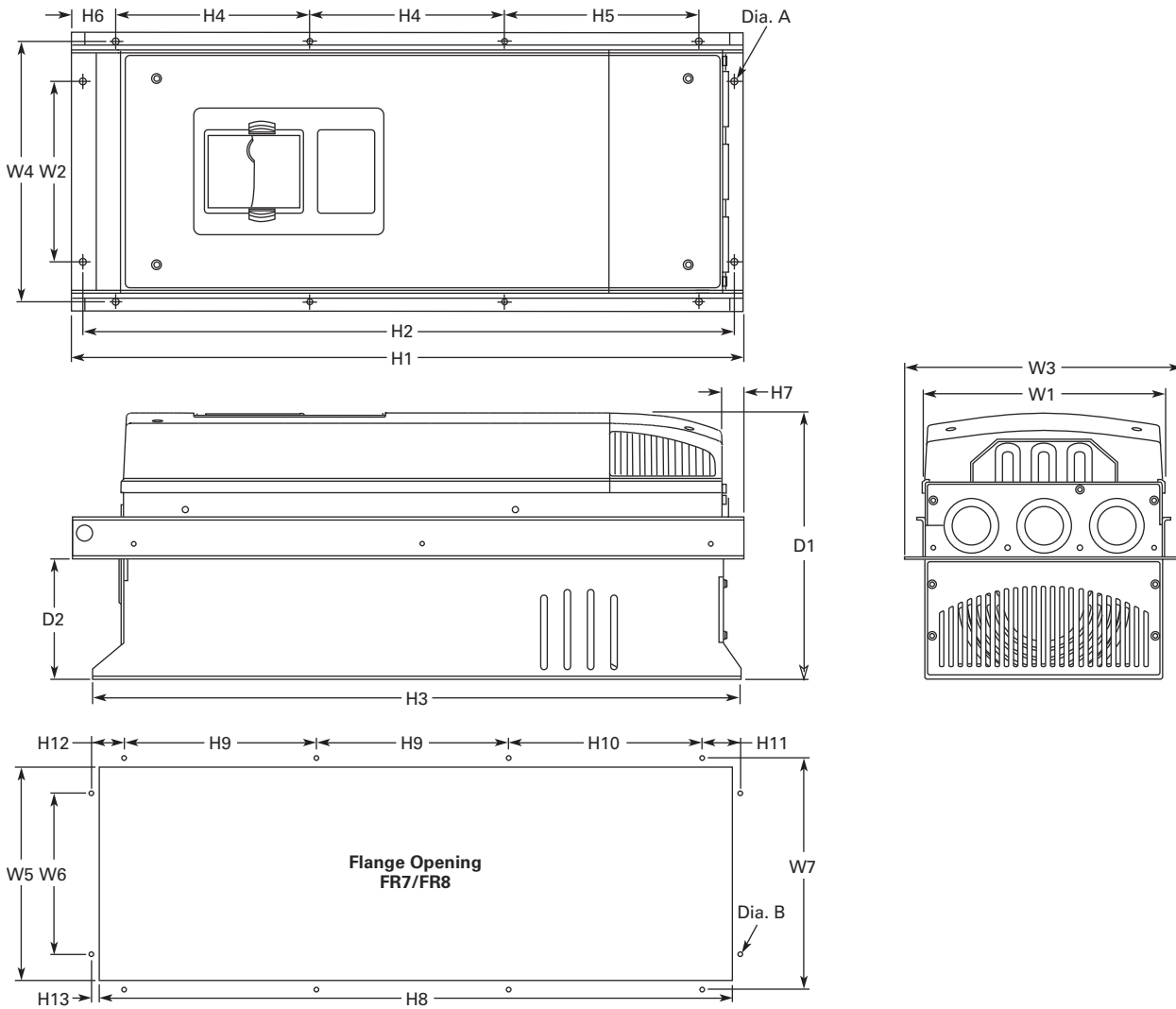
## Adjustable Frequency Drives

### SVX Drives

Approximate Dimensions in Inches (mm)

#### NEMA Type 1/IP21 and NEMA Type 12/IP54, with Flange Kit, FR7 and FR8

2



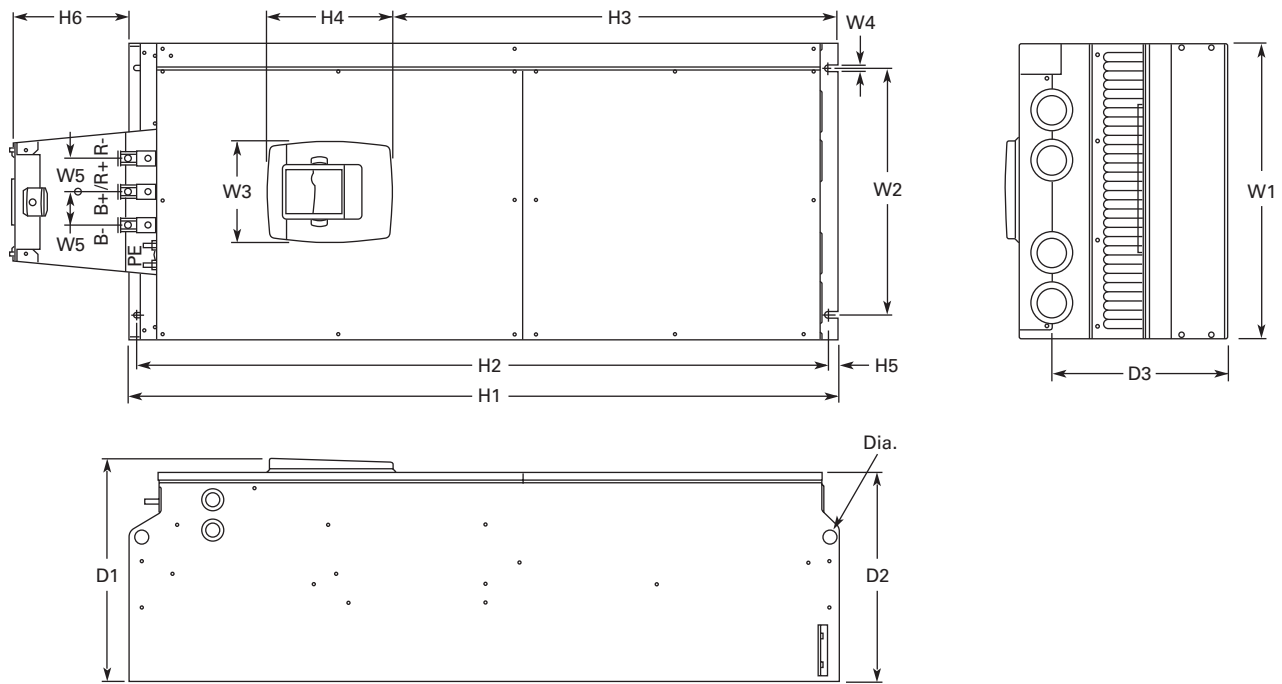
W1	W2	W3	W4	H1	H2	H3	H4	H5	H6	H7	D1	D2	Dia. A
<b>FR7</b>													
9.3 (237)	6.8 (175)	10.6 (270)	10.0 (253)	24.9 (652)	24.8 (632)	24.8 (630)	7.4 (189)	7.4 (189)	0.9 (23)	0.8 (20)	10.1 (257)	4.6 (117)	0.3 (6)
<b>FR8</b>													
11.2 (285)	—	14.0 (355)	13.0 (330)	32.8 (832)	—	29.3 (745)	10.2 (258)	10.4 (265)	1.7 (43)	2.2 (57)	13.5 (344)	4.3 (110)	0.4 (9)

#### Flange Opening, FR7 and FR8

W5	W6	W7	H8	H9	H10	H11	H12	H13	Dia. B
<b>FR7</b>									
9.2 (233)	6.9 (175)	10.0 (253)	24.4 (619)	7.4 (189)	7.4 (189)	1.4 (35)	1.3 (32)	1.0 (25)	0.3 (6)
<b>FR8</b>									
11.9 (301)	—	13.0 (330)	31.9 (810)	10.2 (258)	10.4 (265)	—	—	1.3 (33)	0.4 (9)

Approximate Dimensions in Inches (mm)

**NEMA Type 1/IP21 and NEMA Type 12/IP54 FR9**



Voltage	hp (I <sub>H</sub> )	W1	W2	W3	W4	H1	H2	H3	H4 <sup>①</sup>	D1	D2	D3	Dia.	Weight Lbs (kg)
230 V	75–100	18.9	15.7	0.4	2.1	45.3	44.1	0.6	7.4	14.2	13.4	11.2	0.8	321.9 (146)
480 V	150–200	(480)	(400)	(9)	(54)	(1150)	(1120)	(16)	(188)	(361.5)	(340)	(285)	(21)	
575 V	100–175													

**Note**

① Brake resistor terminal box (H6) included when brake chopper ordered.

# 2.7

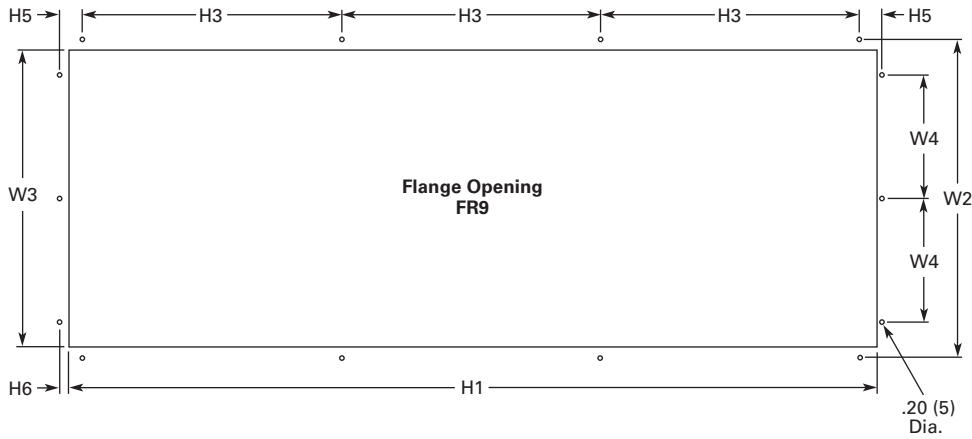
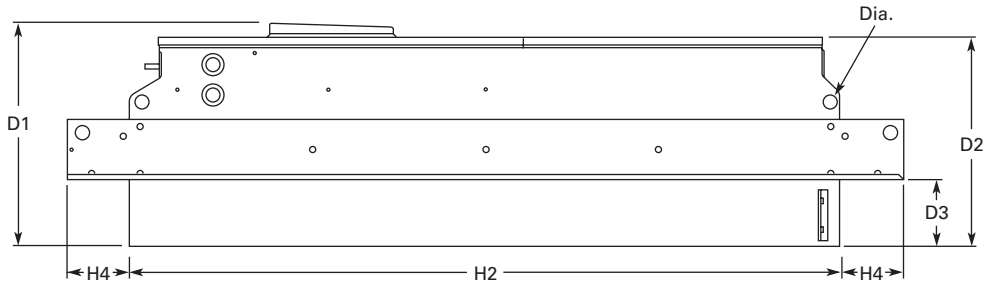
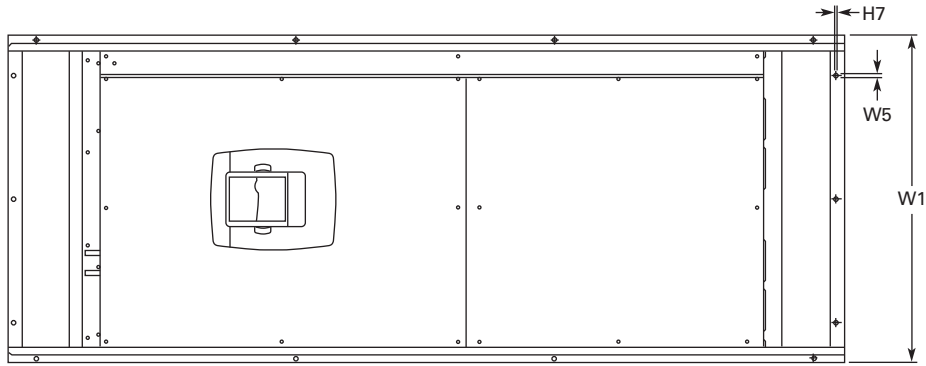
## Adjustable Frequency Drives

### SVX Drives

Approximate Dimensions in Inches (mm)

#### NEMA Type 1/IP21 and NEMA Type 12/IP54, FR9 with Flange Kit

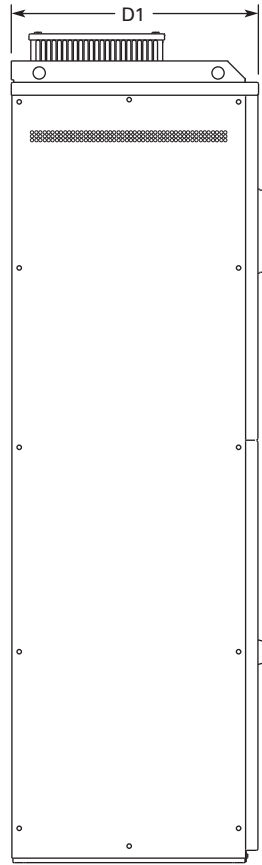
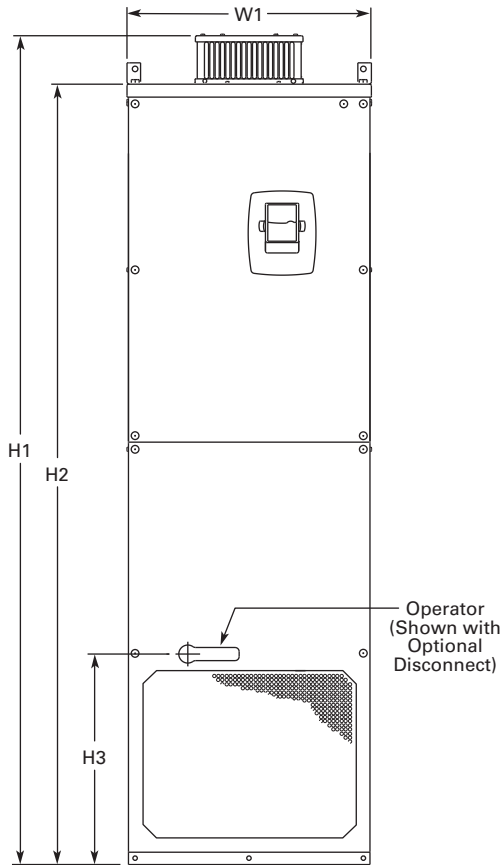
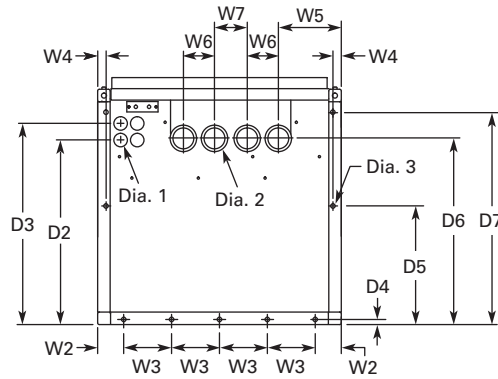
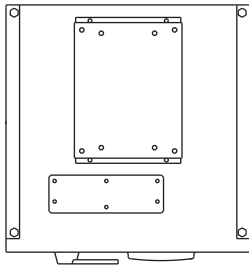
2



W1	W2	W3	W4	W5	H1	H2	H3	H4	H5	H6	H7	D1	D2	D3	Dia.
20.9 (530)	20.0 (510)	19.1 (485)	7.9 (200)	0.2 (5.5)	51.7 (1312)	45.3 (1150)	16.5 (420)	3.9 (100)	1.4 (35)	0.4 (9)	0.1 (2)	24.9 (362)	13.4 (340)	4.3 (109)	0.8 (21)

Approximate Dimensions in Inches (mm)

**NEMA Type 1/IP21 and NEMA Type 12/IP54, FR10 Freestanding**



W1	W2	W3	W4	W5	W6	W7	H1	H2	H3	D1	D2	D3	D4	D5	D6	D7	Dia. 1	Dia. 2	Dia. 3	Weight Lbs (kg)
23.43 (595)	2.46 (62.5)	4.53 (115)	0.79 (20)	5.95 (151)	2.95 (75)	30.11 (79)	79.45 (2018)	74.80 (1900)	20.18 (512.5)	23.70 (602)	17.44 (443)	19.02 (483)	0.47 (12)	11.22 (285)	17.60 (447)	20.08 (510)	0.83 (21)	1.89 (48)	0.43 (11)	857 (389)



# 2.7

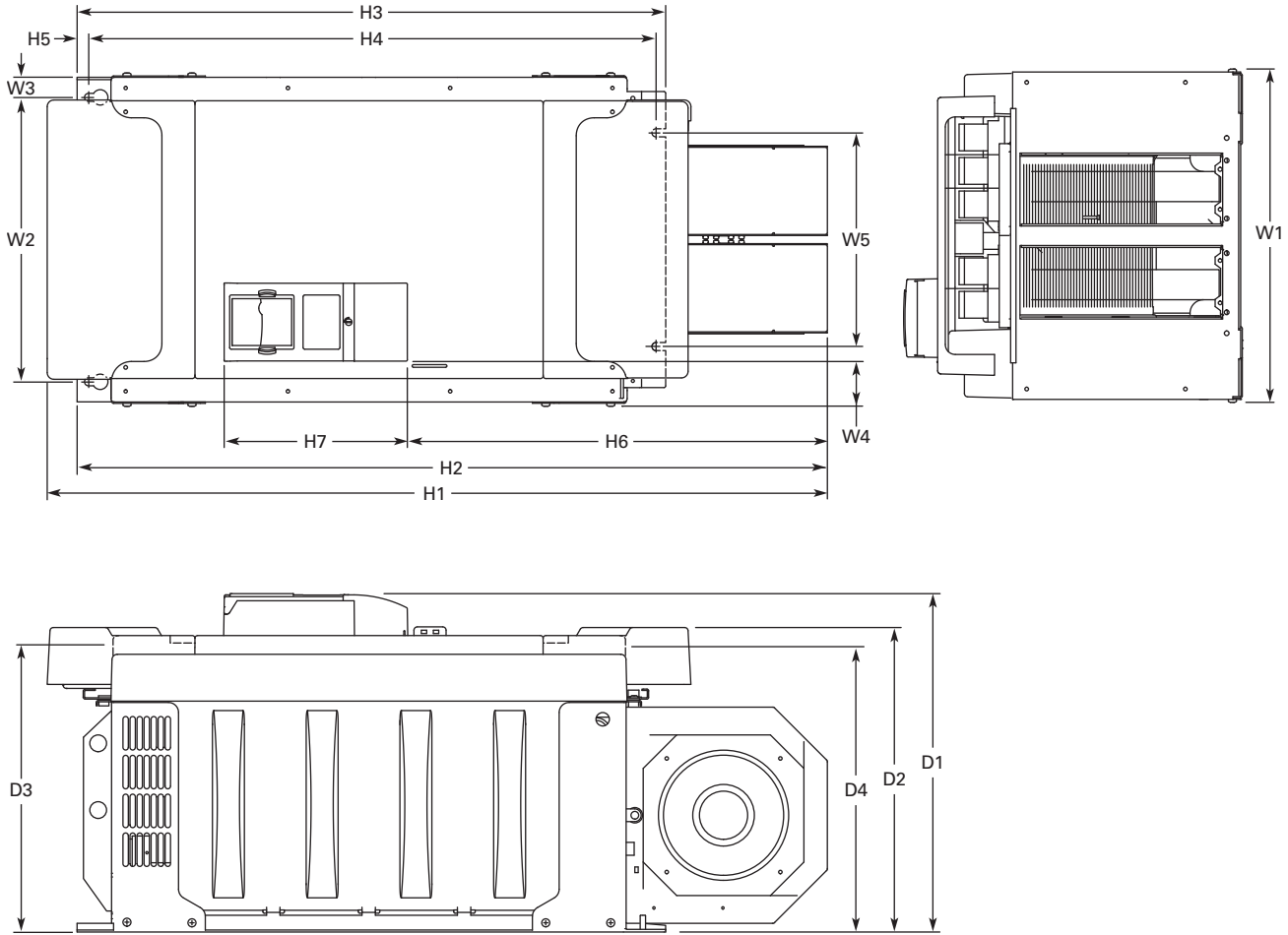
## Adjustable Frequency Drives

### SVX Drives

Approximate Dimensions in Inches (mm)

#### FR10 Open Chassis ①

2



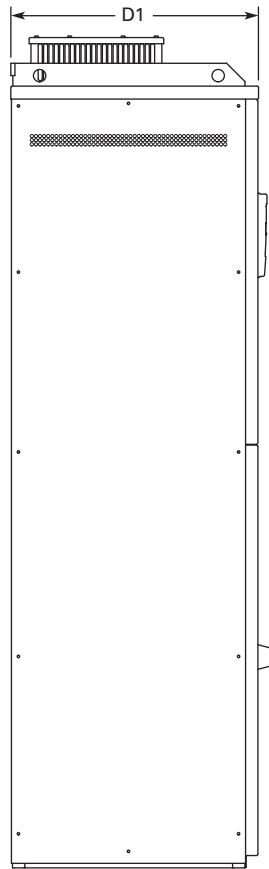
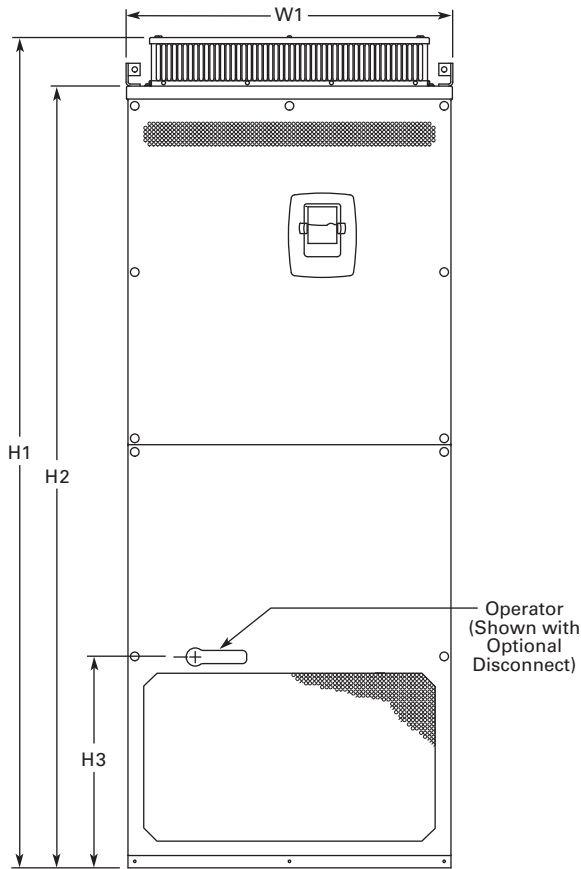
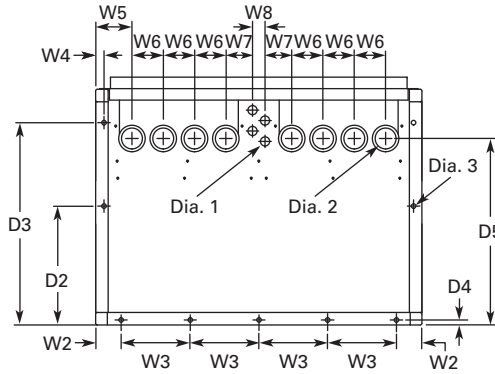
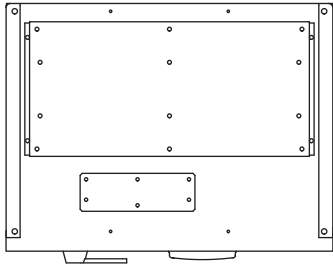
Voltage	hp (I <sub>H</sub> )	W1	W2	W3	W4	W5	H1	H2	H3	H4	H5	H6	H7	D1	D2	D3	D4	Weight Lbs (kg)
480 V	250–350	19.7 (500)	16.7 (425)	1.2 (30)	2.6 (67)	12.8 (325)	45.9 (1165)	44.1 (1121)	34.6 (879)	33.5 (850)	0.7 (17)	24.7 (627)	10.8 (275)	19.9 (506)	17.9 (455)	16.7 (423)	16.6 (421)	518 (235)
575 V	200–300																	

**Note**

① 9000X FR12 is built of two FR10 modules. Please refer to SPX installation manual for mounting instructions.

Approximate Dimensions in Inches (mm)

**NEMA Type 1/IP21, FR11 Freestanding Drive**



Voltage	hp (I <sub>H</sub> )	W1	W2	W3	W4	W5	W6	W7	W8	H1	H2	H3	D1	D2	D3	D4	D5	Dia. 1	Dia. 2	Dia. 3	Weight Lbs (kg)
480	400-550	31.26 (794)	2.40 (61)	6.50 (165)	0.79 (20)	3.43 (87)	2.95 (75)	2.52 (64)	1.18 (30)	79.45 (2018)	74.80 (1900)	20.18 (512.5)	23.70 (602)	11.22 (285)	19.09 (485)	0.47 (12)	17.60 (447)	0.83 (21)	1.89 (48)	0.35 x 0.43 (9 x 11)	526 (239)

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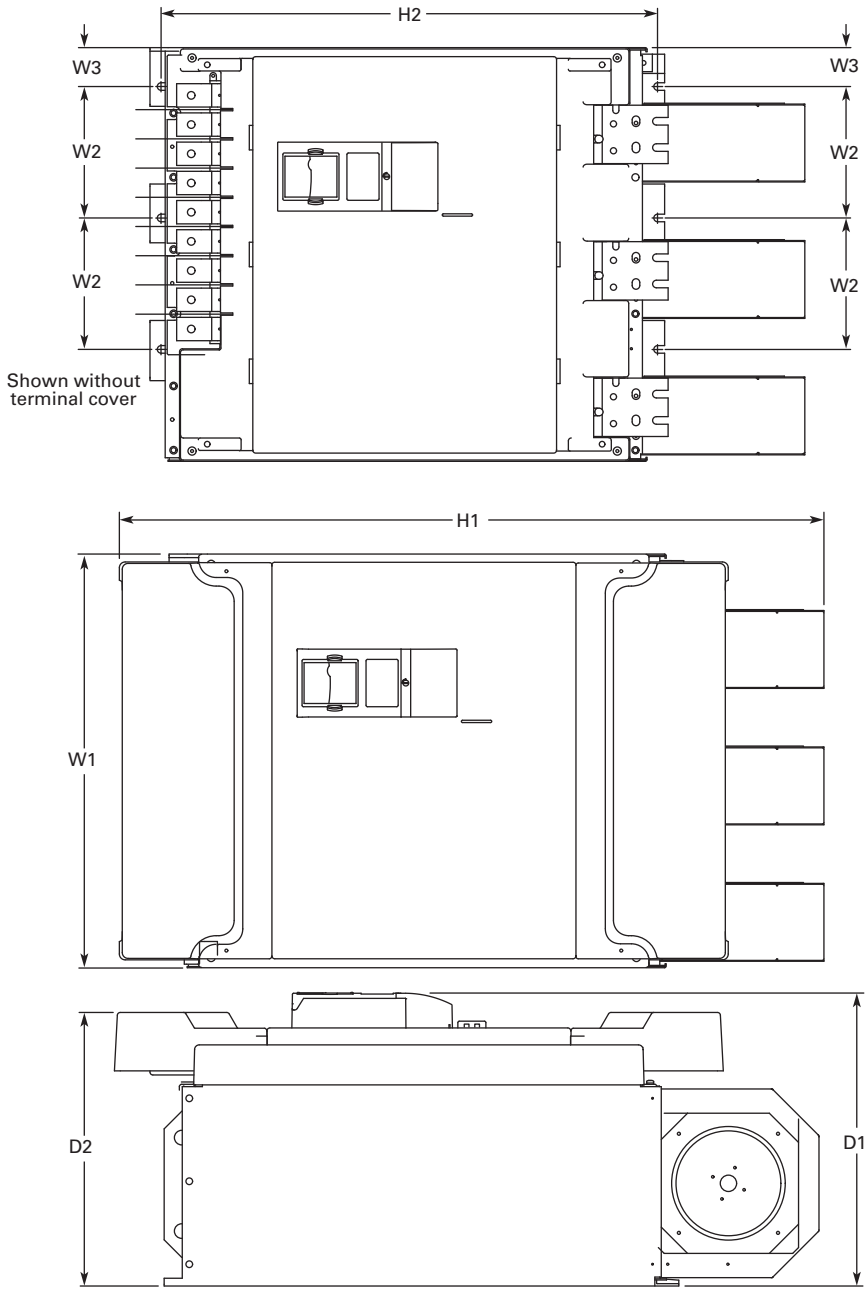
## Adjustable Frequency Drives

### SVX Drives

Approximate Dimensions in Inches (mm)

#### FR11 Open Chassis

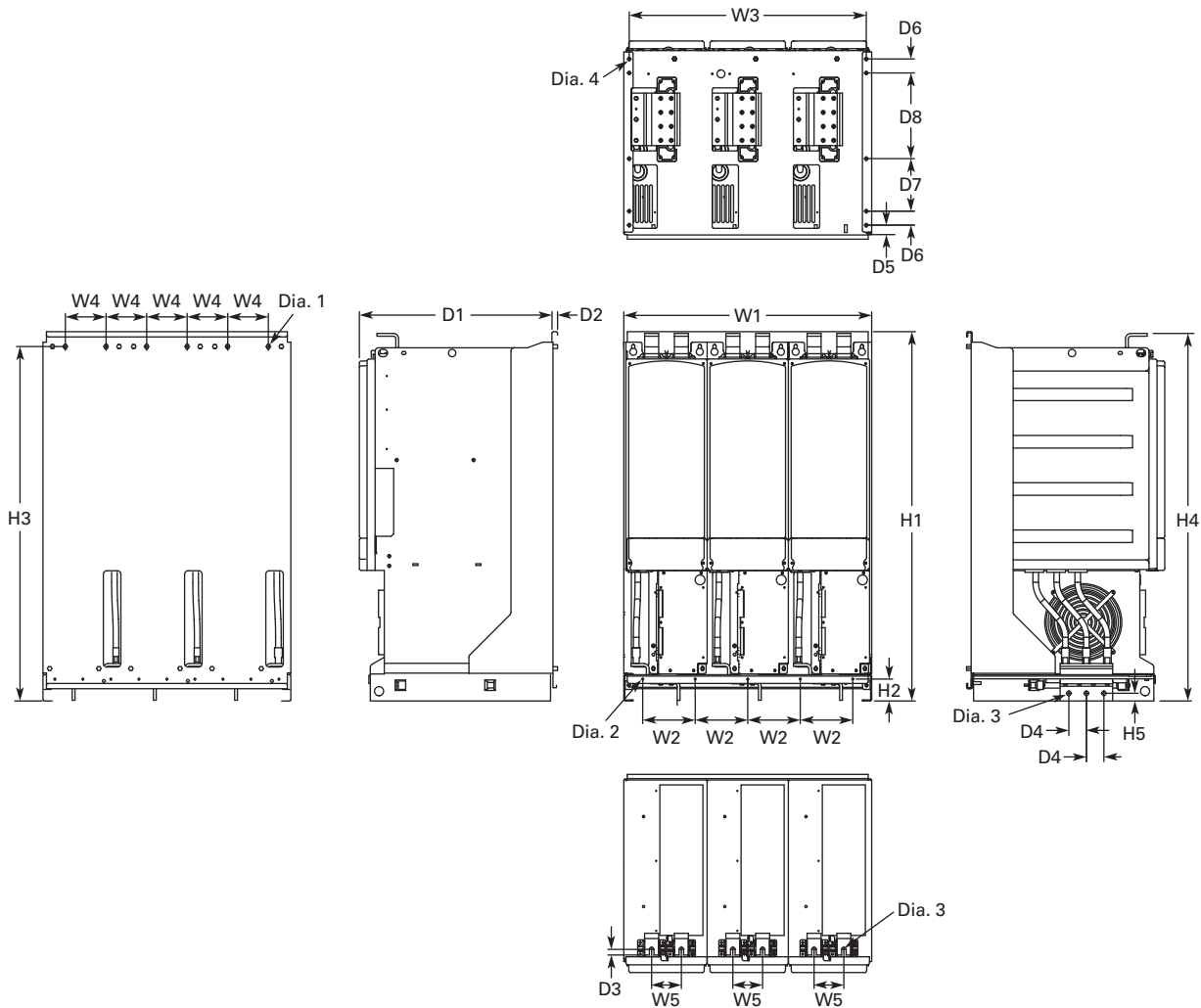
2



Voltage	hp (I <sub>H</sub> )	W1	W2	W3	H1	H2	D1	D2	Weight Lbs (kg)
480 V	400–550	27.9 (709)	8.86 (225)	2.6 (67)	45.5 (1155)	33.5 (850)	19.8 (503)	18.4 (468)	833 (378)
575 V	400–500								

Approximate Dimensions in Inches (mm)

### FR13, Open Chassis Inverter



W1	W2	W3	W4	W5	H1	H2	H3	H4	H5	D1	D2	D3	D4	D5	D6	D7	D8	Dia. 1	Dia. 2	Dia. 3	Dia. 4	Weight Lbs (kg)
27.87	5.91	26.65	4.57	3.35	41.54	2.46	39.86	41.34	0.79	21.77	0.51	0.63	1.97	1.06	1.57	5.91	9.64	0.35x0.59	0.18	0.51	0.37	683
(708)	(150)	(677)	(116)	(85)	(1055)	(62.5)	(1012.5)	(1050)	(20)	(553)	(13)	(16)	(50)	(27)	(40)	(150)	(244.8)	(9x15)	(4.6)	(13)	(9.5)	(310)

**Notes**

9000X FR14 is built of two FR13 modules. Please refer to SPX installation manual for mounting instructions.  
 FR13 is built from an inverter module and a converter module. Please refer to SPX installation manual for mounting instructions.

# 2.7

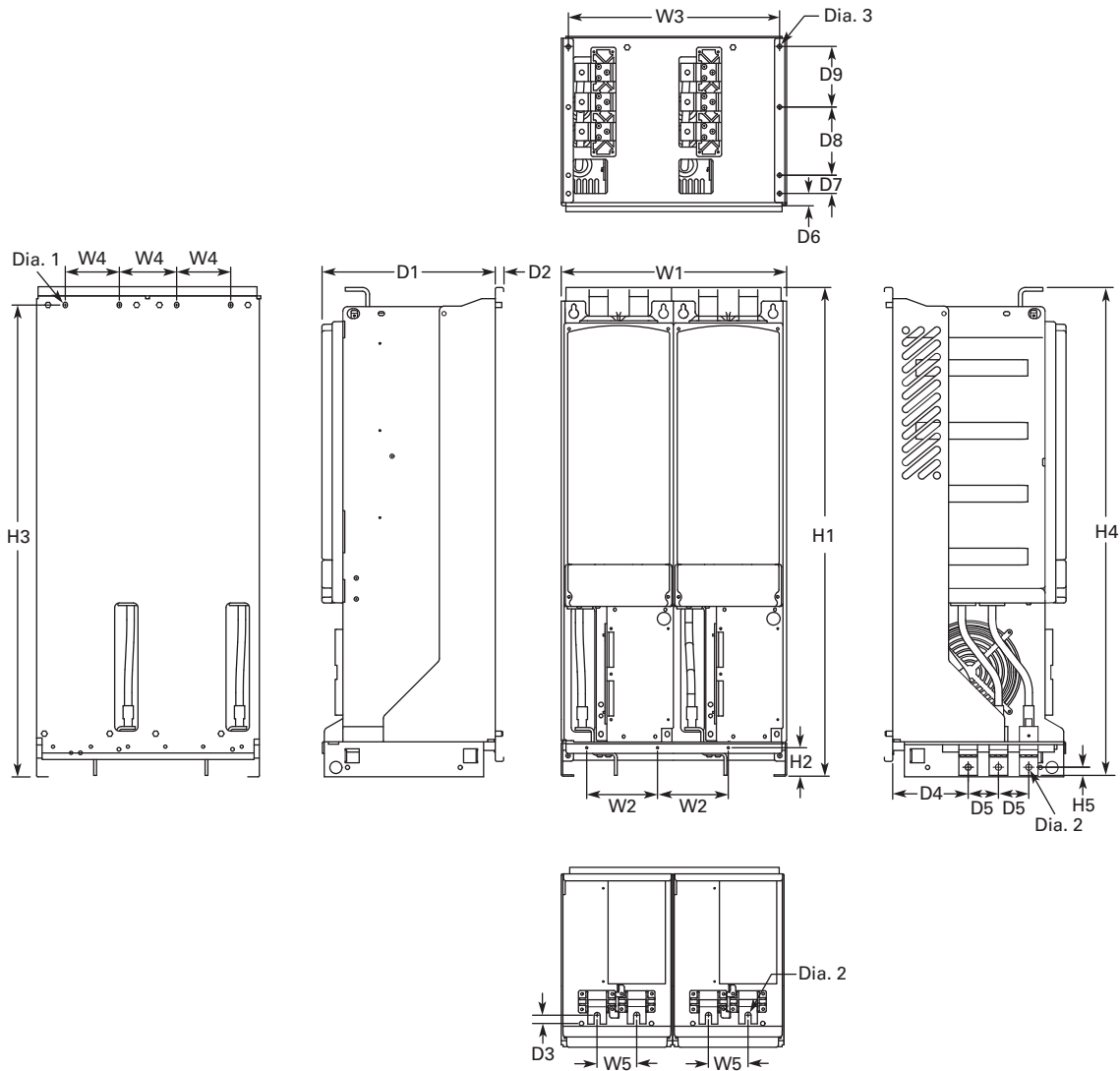
## Adjustable Frequency Drives

### SVX Drives

Approximate Dimensions in Inches (mm)

#### FR13, Open Chassis Converter

2



W1	W2	W3	W4	W5	H1	H2	H3	H4	H5	D1	D2	D3	D4	D5	D6	D7	D8	D9	Dia. 1	Dia. 2	Dia. 3	Weight Lbs (kg)
18.74 (476)	5.91 (150)	17.52 (445)	4.57 (116)	3.35 (85)	41.54 (1055)	2.46 (62.5)	39.86 (1012.5)	41.34 (1050)	0.69 (17.5)	14.69 (373)	0.51 (13)	0.73 (18.5)	6.42 (163)	2.56 (65)	1.06 (27)	1.57 (40)	5.91 (150)	5.24 (133)	0.35x0.59 (9x15)	0.51 (13)	0.37 (9.5)	295 (134)

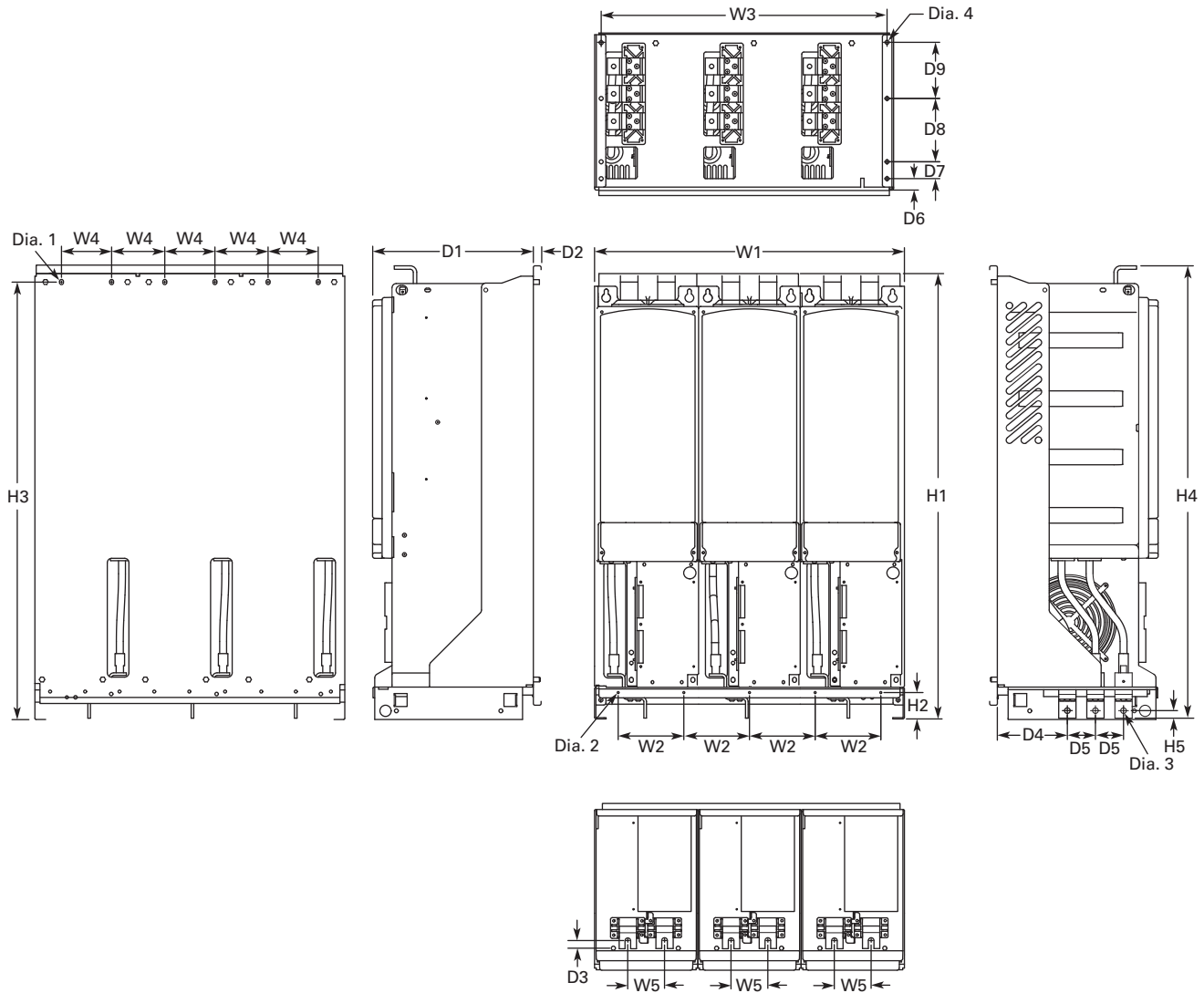
#### Number of Input Units

480 V Catalog Number	hp	Input Modules
SPX800A0-4A2N1	800	2

690 V Catalog Number	hp	Input Modules
SPX800A0-5A2N1	800	2
SPX900A0-5A2N1	900	2
SPXH10A0-5A2N1	1000	2

Approximate Dimensions in Inches (mm)

### FR13, Open Chassis Converter—900/1000 hp 480 V



W1	W2	W3	W4	W5	H1	H2	H3	H4	H5	D1	D2	D3	D4	D5	D6	D7	D8	D9	Dia. 1	Dia. 2	Dia. 3	Dia. 4	Weight Lbs (kg)
27.87 (708)	5.91 (150)	26.65 (677)	4.57 (116)	3.35 (85)	41.54 (1055)	2.46 (62.5)	39.86 (1012.5)	41.34 (1050)	0.69 (17.5)	14.69 (373)	0.51 (13)	0.73 (18.5)	6.42 (163)	2.56 (65)	1.06 (27)	1.57 (40)	5.91 (150)	5.24 (133)	0.35x0.59 (9x15)	0.18 (4.6)	0.51 (13)	0.37 (9.5)	443 (201)

### Number of Input Units

480 V Catalog Number	hp	Input Modules
SPX900A0-4A2N1	900	3
SPXH10A0-4A2N1	1000	3

# 2.7

## Adjustable Frequency Drives

### SVX Drives

Approximate Dimensions in Inches (mm)

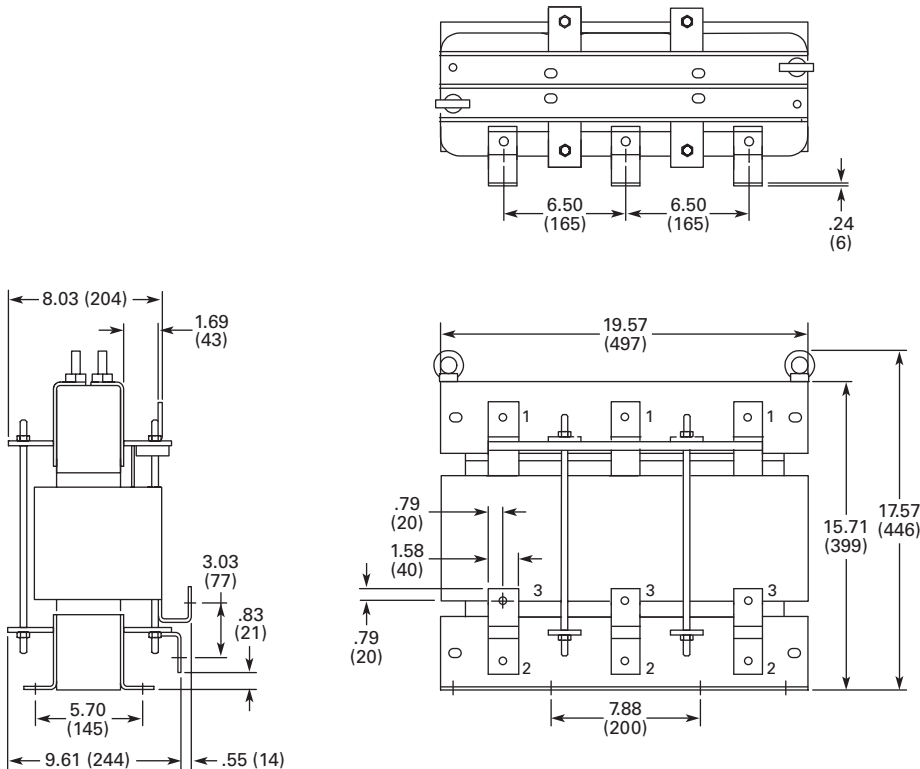
2

#### AC Choke Dimensions

##### Choke Types

Catalog Number	Frame Size	Choke Type ①	Catalog Number	Frame Size	Choke Type ①
<b>Voltage Range 380–500 V</b>			<b>Voltage Range 525–690 V</b>		
SPX 250 4	FR10	CHK0400	SPX 200 5	FR10	CHK0261
SPX 300 4		CHK0520	SPX 250 5		CHK0400
SPX 350 4		CHK0520	SPX 300 5		CHK0400
SPX 400 4	FR11	2 x CHK0400	SPX 400 5	FR11	CHK0520
SPX 500 4		2 x CHK0400	SPX 450 5		CHK0520
SPX 550 4		2 x CHK0400	SPX 500 5		2 x CHK0400
SPX 600 4	FR12	2 x CHK0520	SPX 550 5	FR12	2 x CHK0400
SPX 650 4		2 x CHK0520	SPX 600 5		2 x CHK0400
SPX 700 4		2 x CHK0520	SPX 700 5		2 x CHK0400
SPX 800 4	FR13	2 x CHK0400	SPX 800 5	FR13	2 x CHK0400
SPX 900 4		3 x CHK0520	SPX 900 5		2 x CHK0400
SPX H10 4		3 x CHK0520	SPX H10 5		2 x CHK0400
SPX H12 4	FR14	4 x CHK0520	SPX H13 5	FR14	4 x CHK0400
SPX H16 4		6 x CHK0400	SPX H15 5		6 x CHK0400

#### CHK0520

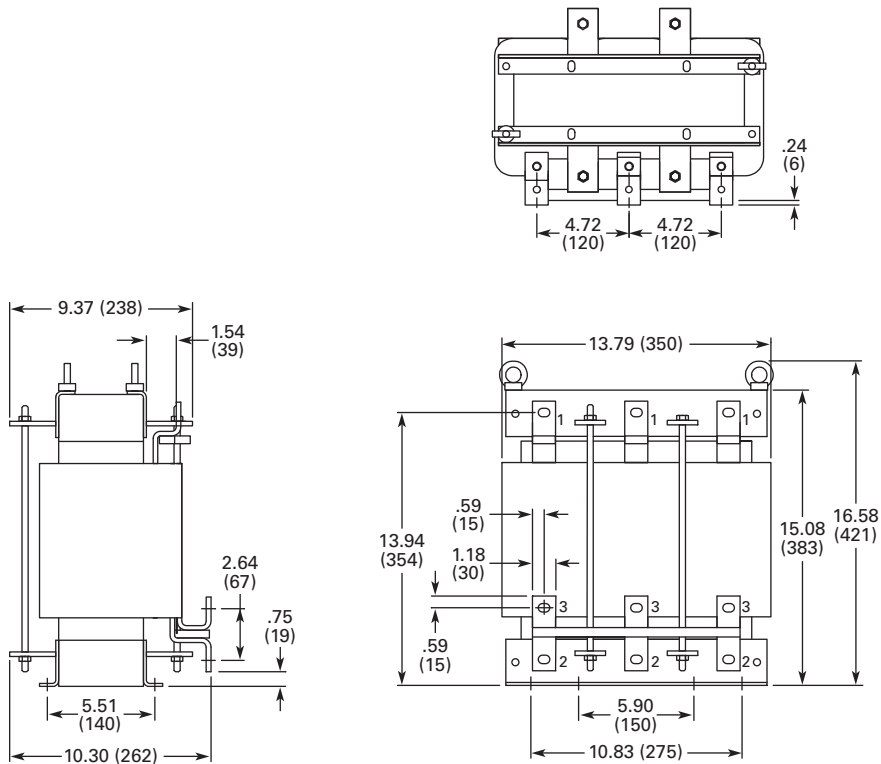


#### Note

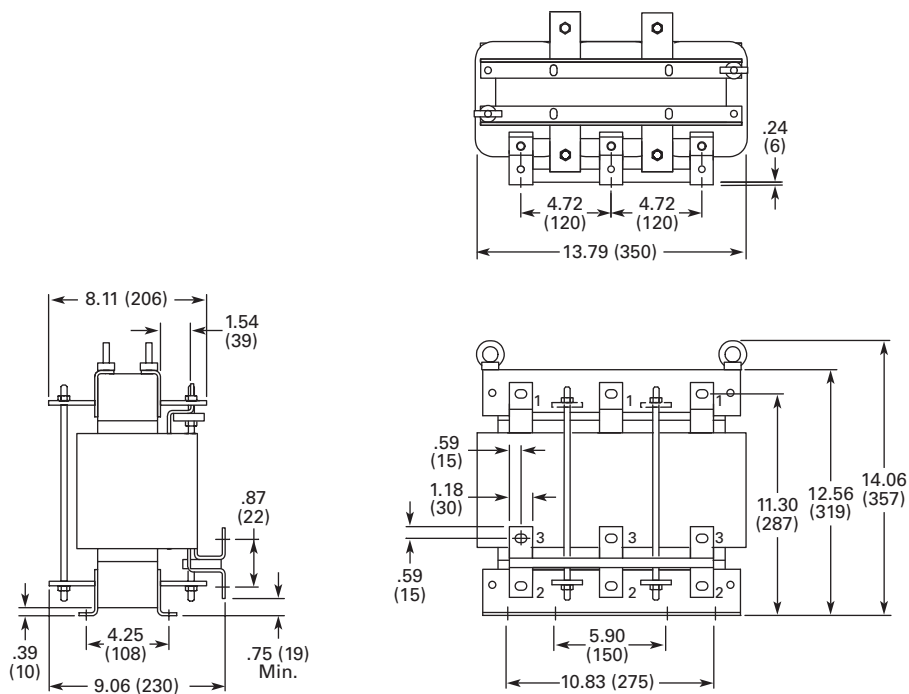
① Chokes are provided with all FR10–FR14 drives.

Approximate Dimensions in Inches (mm)

## CHK0400



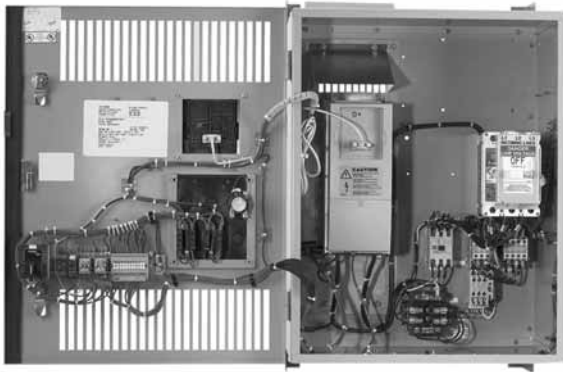
## CHK0261





## SVX Enclosed Drives

2



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## SVX Enclosed Drives

## Product Description

Eaton's line of enclosed SVX drives combine the proven performance from Eaton's SVX drives with the enhanced capabilities of enclosed control. With a comprehensive list of pre-engineered options, Eaton's SVX enclosed drives eliminate the lead time normally associated with customer specific options. For those applications with more unique or complex requirements, Eaton offers individually engineered solutions to meet the customer's needs.

## Features and Benefits

- Dual rated for both constant torque (CT) / high overload (IH) and variable torque (VT) / low overload applications
- Optional Brake Chopper for external braking applications
- High-performance drive option uses an Eaton SPX (IH) drive that allows for increased functionality and performance
- Available circuit breaker, motor circuit protector, isolation fusing and surge protection device options to provide input power protection
- Optional 3% input and output reactors provide a reduction in voltage and current harmonics on both line and load side
- Bypass options include a standard three-contactor design and a reduced voltage soft starter design
- Output contactor option provides a means for positive disconnection of the drive output from the motor terminals
- MotoRX and dV/dt filter options are used to reduce transients voltages at the motor terminals
- Customizable cover control options
- Padlockable disconnect

## Communication Options

- Modbus
- Modbus/TCP
- Johnson Controls N2
- BACnet
- EtherNet/IP
- PROFIBUS-DP
- LonWorks
- CANopen
- DeviceNet

## Enclosure Ratings

- NEMA Type 1
- NEMA Type 12
- NEMA Type 3R

## Mounting

- Wall mount
- Floor mount: 12-inch legs
- Floor mount: 22-inch legs

## Product Range

- 208 V: 0.75–100 hp
- 230 V: 0.75–125 hp
- 480 V: 1–800 hp
- 575 V: 2–800 hp
- 230 V single-phase: 1–30 hp
- 480 V single-phase: 1.5–60 hp

## Standards and Certifications

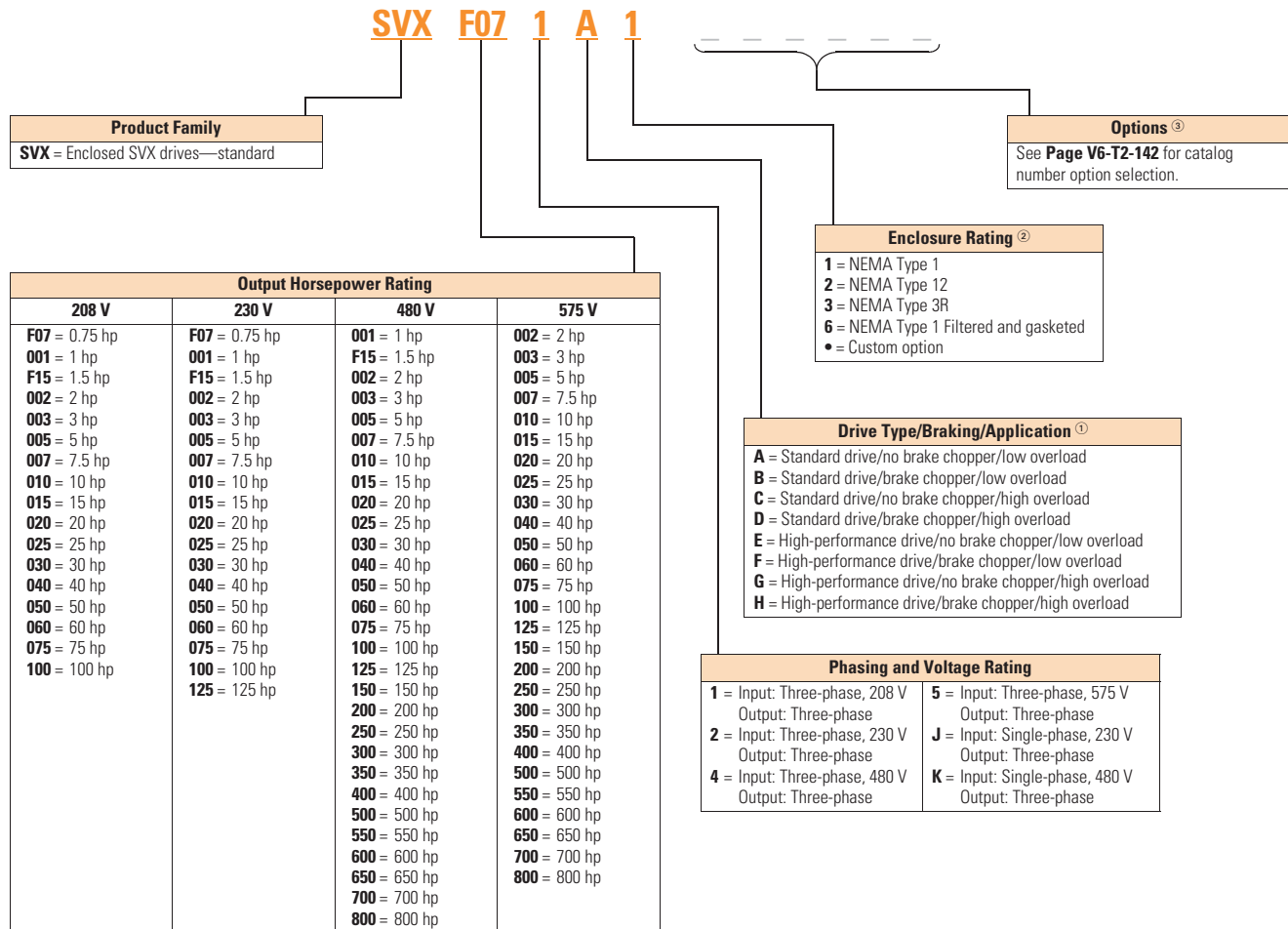
- UL 508C



## Catalog Number Selection

Catalog Number Selection is for reference only. Not all option combinations may be available.

### SVX Enclosed—Base Catalog Number



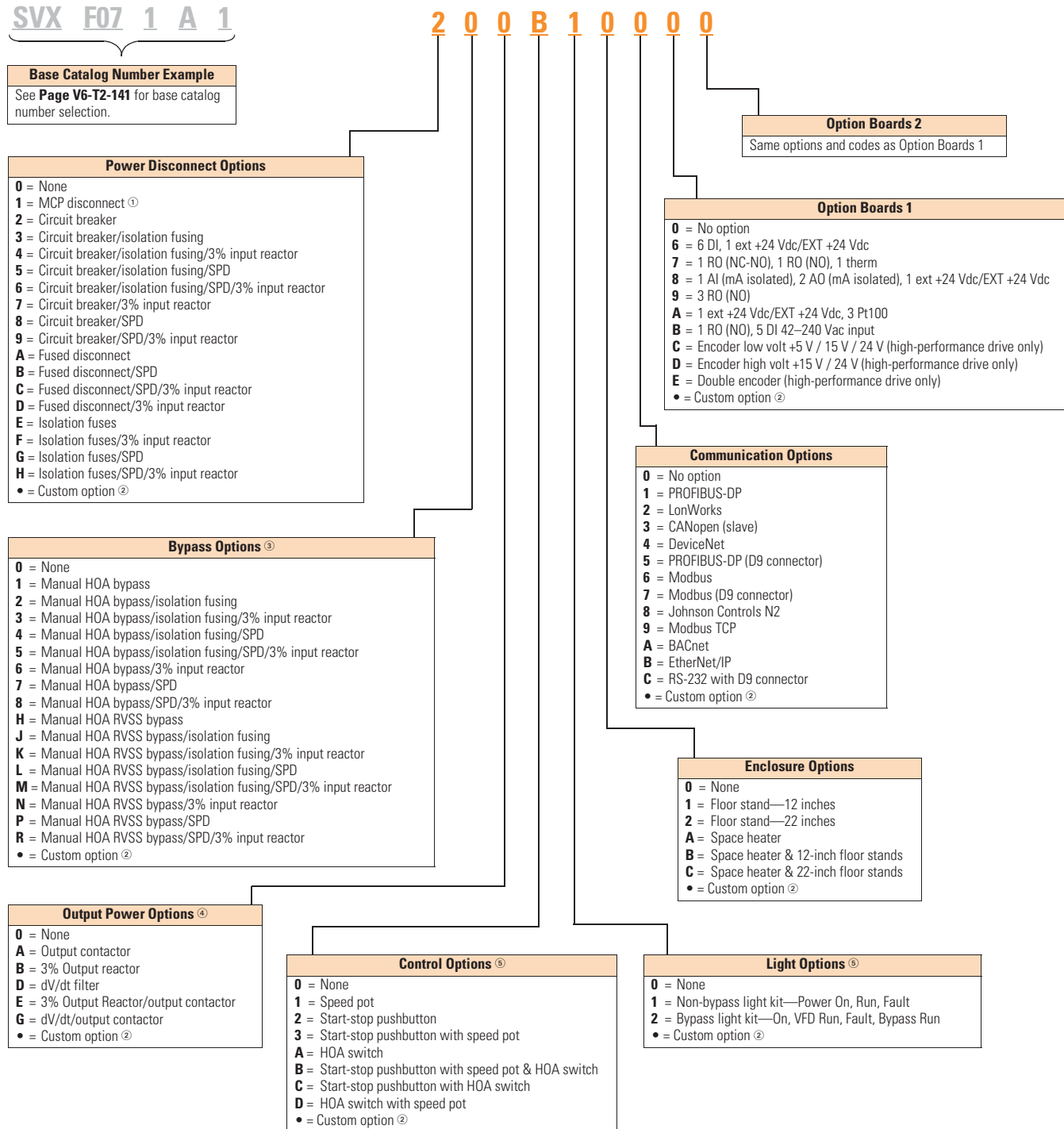
### Notes

- ① Brake chopper is a factory-installed option only. Braking resistors sold separately. See SVX catalog section for selection.
- ② Additional enclosure options including NEMA 4 and 4X are available. Please contact the factory for configuration and pricing.
- ③ Part number configuration continued on the following page.

Catalog Number Selection is for reference only. Not all option combinations may be available.

### SVX Enclosed—Catalog Number Options

2



**Notes**

- ① HMCP disconnect option required and only available when bypass is selected.
- ② More options are available as Engineered to Order through the Bid Manager tool.
- ③ All bypass options include third contactor for drive isolation when in bypass mode.
- ④ Output contactor not available with bypass. Bypass comes standard with output contactor.
- ⑤ Pilot devices are 22 mm standard. 30 mm options are available as engineered to order through the Bid Manager tool.

## Product Selection

## 208 V Drives

## SVX Enclosed Drives



## 208 V Drives—Constant Torque (CT)/High Overload (H) Enclosed Drives

hp	Current (A)	Drive Frame Size	NEMA Type 1 Base Catalog Number <sup>①</sup>	NEMA Type 12 Base Catalog Number <sup>①</sup>	NEMA Type 3R Base Catalog Number <sup>①</sup>
0.75	3.5	4	SVXF071D1	SVXF071D2	SVXF071D3
1	4.6	4	SVX0011D1	SVX0011D2	SVX0011D3
1.5	6.6	4	SVXF151D1	SVXF151D2	SVXF151D3
2	7.5	4	SVX0021D1	SVX0021D2	SVX0021D3
3	10.6	4	SVX0031D1	SVX0031D2	SVX0031D3
5	16.7	5	SVX0051D1	SVX0051D2	SVX0051D3
7.5	24.2	5	SVX0071D1	SVX0071D2	SVX0071D3
10	30.8	6	SVX0101D1	SVX0101D2	SVX0101D3
15	46.2	6	SVX0151D1	SVX0151D2	SVX0151D3
20	59.4	7	SVX0201C1	SVX0201C2	SVX0201C3
25	74.8	7	SVX0251C1	SVX0251C2	SVX0251C3
30	88	7	SVX0301C1	SVX0301C2	SVX0301C3
40	114	8	SVX0401C1	SVX0401C2	SVX0401C3
50	143	8	SVX0501C1	SVX0501C2	SVX0501C3
60	169	8	SVX0601C1	SVX0601C2	SVX0601C3
75	211	9	SVX0751C1	SVX0751C2	SVX0751C3
<sup>②</sup>	261	9	SVX1001C1	SVX1001C2	SVX1001C3

## SVX Enclosed Drives



## 208 V Drives—Variable Torque (VT)/Low Overload (L) Enclosed Drives

hp	Current (A)	Drive Frame Size	NEMA Type 1 Base Catalog Number <sup>①</sup>	NEMA Type 12 Base Catalog Number <sup>①</sup>	NEMA Type 3R Base Catalog Number <sup>①</sup>
1	4.6	4	SVX0011B1	SVX0011B2	SVX0011B3
1.5	6.6	4	SVXF151B1	SVXF151B2	SVXF151B3
2	7.5	4	SVX0021B1	SVX0021B2	SVX0021B3
3	10.6	4	SVX0031B1	SVX0031B2	SVX0031B3
5	16.7	5	SVX0051B1	SVX0051B2	SVX0051B3
7.5	24.2	5	SVX0071B1	SVX0071B2	SVX0071B3
10	30.8	5	SVX0101B1	SVX0101B2	SVX0101B3
15	46.2	6	SVX0151B1	SVX0151B2	SVX0151B3
20	59.4	6	SVX0201B1	SVX0201B2	SVX0201B3
25	74.8	7	SVX0251A1	SVX0251A2	SVX0251A3
30	88	7	SVX0301A1	SVX0301A2	SVX0301A3
40	114	7	SVX0401A1	SVX0401A2	SVX0401A3
50	143	8	SVX0501A1	SVX0501A2	SVX0501A3
60	169	8	SVX0601A1	SVX0601A2	SVX0601A3
75	211	9	SVX0751A1	SVX0751A2	SVX0751A3
100	273	9	SVX1001A1	SVX1001A2	SVX1001A3

## Notes

<sup>①</sup> Table is for base catalog number reference only. For complete catalog number selection, see Page V6-T2-141.

<sup>②</sup> These units are current rated. They do not meet NEC ampere rating at this horsepower.

#### 230 V Drives

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#### SVX Enclosed Drives



#### 230 V Drives—Constant Torque (CT)/High Overload (IH) Enclosed Drives

hp	Current (A)	Drive Frame Size	NEMA Type 1 Base Catalog Number ①	NEMA Type 12 Base Catalog Number ①	NEMA Type 3R Base Catalog Number ①
0.75	3.2	4	SVXF072D1	SVXF072D2	SVXF072D3
1	4.2	4	SVX0012D1	SVX0012D2	SVX0012D3
1.5	6	4	SVXF152D1	SVXF152D2	SVXF152D3
2	6.8	4	SVX0022D1	SVX0022D2	SVX0022D3
3	9.6	4	SVX0032D1	SVX0032D2	SVX0032D3
5	15.2	5	SVX0052D1	SVX0052D2	SVX0052D3
7.5	22	5	SVX0072D1	SVX0072D2	SVX0072D3
10	28	6	SVX0102D1	SVX0102D2	SVX0102D3
15	42	6	SVX0152D1	SVX0152D2	SVX0152D3
20	54	7	SVX0202C1	SVX0202C2	SVX0202C3
25	68	7	SVX0252C1	SVX0252C2	SVX0252C3
30	80	7	SVX0302C1	SVX0302C2	SVX0302C3
40	104	8	SVX0402C1	SVX0402C2	SVX0402C3
50	130	8	SVX0502C1	SVX0502C2	SVX0502C3
60	154	8	SVX0602C1	SVX0602C2	SVX0602C3
75	192	9	SVX0752C1	SVX0752C2	SVX0752C3
100	248	9	SVX1002C1	SVX1002C2	SVX1002C3

#### SVX Enclosed Drives



#### 230 V Drives—Variable Torque (VT)/Low Overload (IL) Enclosed Drives

hp	Current (A)	Drive Frame Size	NEMA Type 1 Base Catalog Number ①	NEMA Type 12 Base Catalog Number ①	NEMA Type 3R Base Catalog Number ①
1	4.2	4	SVX0012B1	SVX0012B2	SVX0012B3
1.5	6	4	SVXF152B1	SVXF152B2	SVXF152B3
2	6.8	4	SVX0022B1	SVX0022B2	SVX0022B3
3	9.6	4	SVX0032B1	SVX0032B2	SVX0032B3
5	15.2	5	SVX0052B1	SVX0052B2	SVX0052B3
7.5	22	5	SVX0072B1	SVX0072B2	SVX0072B3
10	28	5	SVX0102B1	SVX0102B2	SVX0102B3
15	42	6	SVX0152B1	SVX0152B2	SVX0152B3
20	54	6	SVX0202B1	SVX0202B2	SVX0202B3
25	68	7	SVX0252A1	SVX0252A2	SVX0252A3
30	80	7	SVX0302A1	SVX0302A2	SVX0302A3
40	104	7	SVX0402A1	SVX0402A2	SVX0402A3
50	130	8	SVX0502A1	SVX0502A2	SVX0502A3
60	154	8	SVX0602A1	SVX0602A2	SVX0602A3
75	192	8	SVX0752A1	SVX0752A2	SVX0752A3
100	248	9	SVX1002A1	SVX1002A2	SVX1002A3
②	300	9	SVX1252A1	SVX1252A2	SVX1252A3

#### Notes

- ① Table is for base catalog number reference only. For complete catalog number selection, see **Page V6-T2-141**.
- ② These units are current rated. They do not meet NEC ampere rating at this horsepower.

## 480 V Drives

## SVX Enclosed Drives



## 480 V Drives—Constant Torque (CT)/High Overload (IH) Enclosed Drives

hp	Current (A)	Drive Frame Size	NEMA Type 1 Base Catalog Number <sup>①</sup>	NEMA Type 12 Base Catalog Number <sup>①</sup>	NEMA Type 3R Base Catalog Number <sup>①</sup>
1	2.1	4	SVX0014D1	SVX0014D2	SVX0014D3
1.5	3	4	SVXF154D1	SVXF154D2	SVXF154D3
2	3.4	4	SVX0024D1	SVX0024D2	SVX0024D3
3	4.8	4	SVX0034D1	SVX0034D2	SVX0034D3
5	7.6	4	SVX0054D1	SVX0054D2	SVX0054D3
7.5	11	5	SVX0074D1	SVX0074D2	SVX0074D3
10	14	5	SVX0104D1	SVX0104D2	SVX0104D3
15	21	5	SVX0154D1	SVX0154D2	SVX0154D3
20	27	6	SVX0204D1	SVX0204D2	SVX0204D3
25	34	6	SVX0254D1	SVX0254D2	SVX0254D3
30	40	6	SVX0304D1	SVX0304D2	SVX0304D3
40	52	7	SVX0404C1	SVX0404C2	SVX0404C3
50	65	7	SVX0504C1	SVX0504C2	SVX0504C3
60	77	7	SVX0604C1	SVX0604C2	SVX0604C3
75	96	8	SVX0754C1	SVX0754C2	SVX0754C3
100	124	8	SVX1004C1	SVX1004C2	SVX1004C3
125	156	8	SVX1254C1	SVX1254C2	SVX1254C3
150	180	9	SVX1504C1	SVX1504C2	SVX1504C3
200	240	9	SVX2004C1	SVX2004C2	SVX2004C3
250	302	10	SVX2504G1	SVX2504G6 <sup>②</sup>	SVX2504G3
300	361	10	SVX3004G1	SVX3004G6 <sup>②</sup>	SVX3004G3
350	414	10	SVX3504G1	SVX3504G6 <sup>②</sup>	SVX3504G3
400	477	11	SVX4004G1	SVX4004G6 <sup>②</sup>	SVX4004G3
500	590	11	SVX5004G1	SVX5004G6 <sup>②</sup>	SVX5004G3
550	650	11	SVX5504G1	SVX5504G6 <sup>②</sup>	SVX5504G3
600	730	12	SVX6004G1	SVX6004G6 <sup>②</sup>	SVX6004G3
650	820	12	SVX6504G1	SVX6504G6 <sup>②</sup>	SVX6504G3
700	920	12	SVX7004G1	SVX7004G6 <sup>②</sup>	SVX7004G3

**Notes**

<sup>①</sup> Table is for base catalog number reference only. For complete catalog number selection, see **Page V6-T2-141**.

<sup>②</sup> Enclosure rating is NEMA Type 1 filtered and gasketed.

## 480 V Drives, continued

2

## SVX Enclosed Drives



## 480 V Drives—Variable Torque (VT)/Low Overload (L) Enclosed Drives

hp	Current (A)	Drive Frame Size	NEMA Type 1 Base Catalog Number <sup>①</sup>	NEMA Type 12 Base Catalog Number <sup>①</sup>	NEMA Type 3R Base Catalog Number <sup>①</sup>
1.5	3	4	SVXF154B1	SVXF154B2	SVXF154B3
2	3.4	4	SVX0024B1	SVX0024B2	SVX0024B3
3	4.8	4	SVX0034B1	SVX0034B2	SVX0034B3
5	7.6	4	SVX0054B1	SVX0054B2	SVX0054B3
7.5	11	4	SVX0074B1	SVX0074B2	SVX0074B3
10	14	5	SVX0104B1	SVX0104B2	SVX0104B3
15	21	5	SVX0154B1	SVX0154B2	SVX0154B3
20	27	5	SVX0204B1	SVX0204B2	SVX0204B3
25	34	6	SVX0254B1	SVX0254B2	SVX0254B3
30	40	6	SVX0304B1	SVX0304B2	SVX0304B3
40	52	6	SVX0404B1	SVX0404B2	SVX0404B3
50	65	7	SVX0504A1	SVX0504A2	SVX0504A3
60	77	7	SVX0604A1	SVX0604A2	SVX0604A3
75	96	7	SVX0754A1	SVX0754A2	SVX0754A3
100	124	8	SVX1004A1	SVX1004A2	SVX1004A3
125	156	8	SVX1254A1	SVX1254A2	SVX1254A3
150	180	8	SVX1504A1	SVX1504A2	SVX1504A3
200	240	9	SVX2004A1	SVX2004A2	SVX2004A3
②	300	9	SVX2504A1	SVX2504A2	SVX2504A3
300	361	10	SVX3004E1	SVX3004E6 <sup>③</sup>	SVX3004E3
350	414	10	SVX3504E1	SVX3504E6 <sup>③</sup>	SVX3504E3
400	477	10	SVX4004E1	SVX4004E6 <sup>③</sup>	SVX4004E3
500	590	11	SVX5004E1	SVX5004E6 <sup>③</sup>	SVX5004E3
550	650	11	SVX5504E1	SVX5504E6 <sup>③</sup>	SVX5504E3
600	730	11	SVX6004E1	SVX6004E6 <sup>③</sup>	SVX6004E3
650	820	12	SVX6504E1	SVX6504E6 <sup>③</sup>	SVX6504E3
700	920	12	SVX7004E1	SVX7004E6 <sup>③</sup>	SVX7004E3
800	1030	12	SVX8004E1	SVX8004E6 <sup>③</sup>	SVX8004E3

**Notes**

<sup>①</sup> Table is for base catalog number reference only. For complete catalog number selection, see **Page V6-T2-141**.

<sup>②</sup> These units are current rated. They do not meet NEC ampere rating at this horsepower.

<sup>③</sup> Enclosure rating is NEMA Type 1 filtered and gasketed.

## 575 V Drives

## SVX Enclosed Drives



## 575 V Drives—Variable Torque (VT)/Low Overload (LO) Enclosed Drives

hp	Current (A)	Drive Frame Size	NEMA Type 1 Base Catalog Number <sup>①</sup>	NEMA Type 12 Base Catalog Number <sup>①</sup>	NEMA Type 3R Base Catalog Number <sup>①</sup>
3	3.9	6	SVX0035B1	SVX0035B2	SVX0035B3
5	6.1	6	SVX0055B1	SVX0055B2	SVX0055B3
7.5	9	6	SVX0075B1	SVX0075B2	SVX0075B3
10	11	6	SVX0105B1	SVX0105B2	SVX0105B3
15	17	6	SVX0155B1	SVX0155B2	SVX0155B3
20	22	6	SVX0205B1	SVX0205B2	SVX0205B3
25	27	6	SVX0255B1	SVX0255B2	SVX0255B3
30	32	6	SVX0305B1	SVX0305B2	SVX0305B3
40	41	7	SVX0405A1	SVX0405A2	SVX0405A3
50	52	7	SVX0505A1	SVX0505A2	SVX0505A3
60	62	8	SVX0605A1	SVX0605A2	SVX0605A3
75	77	8	SVX0755A1	SVX0755A2	SVX0755A3
100	99	8	SVX1005A1	SVX1005A2	SVX1005A3
125	125	9	SVX1255A1	SVX1255A2	SVX1255A3
150	144	9	SVX1505A1	SVX1505A2	SVX1505A3
200	192	9	SVX2005A1	SVX2005A2	SVX2005A3
250	242	10	SVX2505E1	SVX2505E6 <sup>②</sup>	SVX2505E3
300	289	10	SVX3005E1	SVX3005E6 <sup>②</sup>	SVX3005E3
400	382	10	SVX4005E1	SVX4005E6 <sup>②</sup>	SVX4005E3
450	412	11	SVX4505E1	SVX4505E6 <sup>②</sup>	SVX4505E3
500	472	11	SVX5005E1	SVX5005E6 <sup>②</sup>	SVX5005E3
550	590	11	SVX5505E1	SVX5505E6 <sup>②</sup>	SVX5505E3
600	650	12	SVX6005E1	SVX6005E6 <sup>②</sup>	SVX6005E3
700	750	12	SVX7005E1	SVX7005E6 <sup>②</sup>	SVX7005E3
800	820	12	SVX8005E1	SVX8005E6 <sup>②</sup>	SVX8005E3

**Notes**

<sup>①</sup> Table is for base catalog number reference only. For complete catalog number selection, see **Page V6-T2-141**.

<sup>②</sup> Enclosure rating is NEMA Type 1 filtered and gasketed.



## 230 V, Single-Phase Drives

## SVX Enclosed Drives



## 230 V Single-Phase Drives—Variable Torque (VT)/Low Overload (L) Enclosed Drives

hp	Current (A)	Drive Frame Size	NEMA Type 1 Base Catalog Number <sup>①</sup>	NEMA Type 12 Base Catalog Number <sup>①</sup>	NEMA Type 3R Base Catalog Number <sup>①</sup>
<b>Low Overload (VT) Enclosed Drives</b>					
3	9.6	5	SVX003JB1	SVX003JB2	SVX003JB3
5	15.2	5	SVX005JB1	SVX005JB2	SVX005JB3
7.5	22	6	SVX007JB1	SVX007JB2	SVX007JB3
10	28	6	SVX010JB1	SVX010JB2	SVX010JB3
15	42	7	SVX015JB1	SVX015JB2	SVX015JB3
20	54	7	SVX020JB1	SVX020JB2	SVX020JB3
25	68	8	SVX025JA1	SVX025JA2	SVX025JA3
30	80	8	SVX030JA1	SVX030JA2	SVX030JA3
40	104	8	SVX040JA1	SVX040JA2	SVX040JA3

## 480 V, Single-Phase Drives

## SVX Enclosed Drives



## 480 V Single-Phase Drives—Variable Torque (VT)/Low Overload (L) Enclosed Drives

hp	Current (A)	Drive Frame Size	NEMA Type 1 Base Catalog Number <sup>①</sup>	NEMA Type 12 Base Catalog Number <sup>①</sup>	NEMA Type 3R Base Catalog Number <sup>①</sup>
<b>Low Overload (VT) Enclosed Drives</b>					
1	2.1	4	SVX001KB1	SVX001KB2	SVX001KB3
3	4.8	4	SVX003KB1	SVX003KB2	SVX003KB3
5	7.6	5	SVX005KB1	SVX005KB2	SVX005KB3
7.5	11	5	SVX007KB1	SVX007KB2	SVX007KB3
10	14	5	SVX010KB1	SVX010KB2	SVX010KB3
15	21	6	SVX015KB1	SVX015KB2	SVX015KB3
20	27	6	SVX020KB1	SVX020KB2	SVX020KB3
25	34	7	SVX025KB1	SVX025KB2	SVX025KB3
30	40	7	SVX030KB1	SVX030KB2	SVX030KB3
40	52	8	SVX040KB1	SVX040KB2	SVX040KB3
50	65	8	SVX050KA1	SVX050KA2	SVX050KA3
60	77	8	SVX060KA1	SVX060KA2	SVX060KA3

**Note**

<sup>①</sup> Table is for base catalog number reference only. For complete catalog number selection, see **Page V6-T2-141**.

## Enclosure Selection

### SVX Drives

Enclosure selection charts are based on physical space limitations only and only to be used as a reference. For actual enclosure sizing, refer to Bid Manager.

**Note:** Standard enclosure sizing includes dedicated space for a circuit breaker or fusible disconnect, CPT, SPD, heater/thermostat, control relay and terminal blocks.

### Standard Enclosure X-Space

Enclosure Size	Frame 4	Frame 5	Frame 6	Frame 7	Frame 8
AX	2	2	2	—	—
BX	4	4	4	4	—
CX	7	7	7	7	7
DX	18	18	18	18	18

### Standard Power Options X-Space

Power Options	Frame 4	Frame 5	Frame 6	Frame 7	Frame 8
Isolation fuses	1	1	1	1	1
3% Input reactor	2	2	3	5	6
3% Output reactor	1	1	3	5	6
dV/dt filter	3	3	3	5	6
Output contactor	1	1	1	1	1

### Larger Frame Enclosure Sizes

Frame Size	Type 1	Type 12	Type 1 Filtered and Gasketed	Type 3R
Frame 9	Size 5	Size 5	—	Size F
Frame 10 (without power options)	Size 6	—	Size 6	Size F
Frame 10 (with power options)	Size 8	—	Size 8	Size F
Frame 11 (without power options)	Size 8	—	Size 8	Size F
Frame 11 (with power options)	Size 9	—	Size 9	Size F
Frame 12	①	—	①	①

**Note:** Bypass enclosure sizing includes dedicated space for a MCP, CPT, input contactor, output bypass contactors, overload relay, SPD, heater/thermostat, control relay and terminal blocks.

### Bypass Enclosure X-Space

Enclosure Size	Frame 4	Frame 5	Frame 6	Frame 7	Frame 8
AX	0	0	0	—	—
BX	2	2	2	0	—
CX	5	5	5	3	2
DX	16	16	16	14	13

### Bypass Power Options X-Space

Power Options	Frame 4	Frame 5	Frame 6	Frame 7	Frame 8
Isolation fuses	1	1	1	1	1
3% Input reactor	2	2	3	5	6
RVSS bypass	2	2	2	3	4
3% Output reactor	1	1	3	5	6
dV/dt filter	3	3	3	5	6

### Larger Frame Enclosure Sizes

Frame Size	Type 1	Type 12	Type 1 Filtered and Gasketed	Type 3R
Frame 9	Size 5	Size 5	—	Size F
Frame 10	Size 8	—	Size 8	Size F
Frame 11	Size 9	—	Size 9	Size F
Frame 12	①	—	①	①

**Note:** Single-phase enclosure sizing includes dedicated space for a capacitor kit, circuit breaker or fusible disconnect, CPT, SPD, heater/thermostat, control relay and terminal blocks.

### Single-Phase Enclosure X-Space

Enclosure Size	Frame 4	Frame 5	Frame 6	Frame 7	Frame 8
AX	0	0	—	—	—
BX	2	2	1	1	—
CX	5	5	4	4	4
DX	16	16	15	15	15

### Single-Phase Power Options X-Space

Power Options	Frame 4	Frame 5	Frame 6	Frame 7	Frame 8
Isolation fuses	1	1	1	1	1
3% Input reactor	2	2	3	5	6
3% Output reactor	1	1	3	5	6
dV/dt filter	3	3	3	5	6
Output contactor	1	1	1	1	1

### Larger Frame Enclosure Sizes

Frame Size	Type 1	Type 12	Type 1A Filtered and Gasketed	Type 3R
Frame 9	Size 5	Size 5	—	Size F
Frame 10	Size 8	—	Size 8	Size F
Frame 11	Size 9	—	Size 9	Size F
Frame 12	①	—	①	①

#### Note

① Consult factory.

#### Options

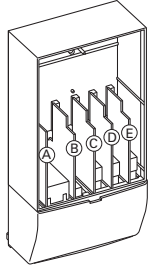
##### SVX Series Option Board Kits

2

The SVX Series drives can accommodate a wide selection of expander and adapter option boards to customize the drive for your application needs. The drive's control unit is designed to accept a total of five option boards.

The SVX Series factory installed standard board configuration includes an A9 I/O board and an A2 relay output board, which are installed in slots A and B.

#### Option Boards



#### Option Board Kits

Option Kit Description <sup>①</sup>	Allowed Slot Locations <sup>②</sup>	Field Installed Catalog Number	Factory Installed Option Designator	SVX Ready Programs						
				Basic	Local/Remote	Standard	MSS	PID	Multi-P.	PFC
<b>Standard I/O Cards</b>										
6 DI, 1 DO, 2 AI, 1 AO, 1 +10 Vdc ref, 2 ext +24 Vdc/EXT +24 Vdc	A	<b>OPTA9</b>	—	■	■	■	■	■	■	■
2 RO (NC-NO)	B	<b>OPTA2</b>	—	■	■	■	■	■	■	■
<b>Extended I/O Cards</b>										
2 RO, therm	B	<b>OPTA3</b>	<b>A3</b>	—	■	■	■	■	■	■
Encoder low volt +5 V/15 V/24 V—SPX only	C	<b>OPTA4</b>	<b>A4</b>	—	■	■	■	■	■	■
Encoder high volt +15 V/24 V—SPX only	C	<b>OPTA5</b>	<b>A5</b>	—	■	■	■	■	■	■
Double encoder—SPX only	C	<b>OPTA7</b>	<b>A7</b>	■	■	■	■	■	■	■
6 DI, 1 DO, 2 AI, 1 AO	A	<b>OPTA8</b>	<b>A8</b>	—	■	■	■	■	■	■
3 DI (encoder 10–24 V), out +15 V/+24 V, 2 DO (pulse+direction)—SPX only	C	<b>OPTAE</b>	<b>AE</b>	■	■	■	■	■	■	■
6 DI, 1 ext +24 Vdc/EXT +24 Vdc	B, C, <b>D</b> , E	<b>OPTB1</b>	<b>B1</b>	—	—	—	—	—	■	■
1 RO (NC-NO), 1 RO (NO), 1 therm	B, C, <b>D</b> , E	<b>OPTB2</b>	<b>B2</b>	—	—	—	—	—	■	■
1 AI (mA isolated), 2 AO (mA isolated), 1 ext +24 Vdc/EXT +24 Vdc	B, C, <b>D</b> , E	<b>OPTB4</b>	<b>B4</b>	■	■	■	■	■	■	■
3 RO (NO)	B, C, <b>D</b> , E	<b>OPTB5</b>	<b>B5</b>	—	—	—	—	—	■	■
1 ext +24 Vdc/EXT +24 Vdc, 3 Pt100	B, C, <b>D</b> , E	<b>OPTB8</b>	<b>B8</b>	—	—	—	—	—	—	—
1 RO (NO), 5 DI 42–240 Vac input	B, C, <b>D</b> , E	<b>OPTB9</b>	<b>B9</b>	—	—	—	—	—	■	■
<b>Communication Cards</b>										
Modbus <sup>③</sup>	D, <b>E</b>	<b>OPTC2</b>	<b>C2</b>	■	■	■	■	■	■	■
Modbus TCP	D, <b>E</b>	<b>OPTCI</b>	<b>CI</b>	■	■	■	■	■	■	■
BACnet	D, <b>E</b>	<b>OPTCJ</b>	<b>CJ</b>	■	■	■	■	■	■	■
EtherNet/IP	D, <b>E</b>	<b>OPTCQ</b>	<b>CQ</b>	■	■	■	■	■	■	■
Johnson Controls N2 <sup>③</sup>	D, <b>E</b>	<b>OPTC2</b>	<b>CA</b>	—	—	—	—	—	—	—
PROFIBUS DP	D, <b>E</b>	<b>OPTC3</b>	<b>C3</b>	■	■	■	■	■	■	■
LonWorks	D, <b>E</b>	<b>OPTC4</b>	<b>C4</b>	■	■	■	■	■	■	■
PROFIBUS DP (D9 connector)	D, <b>E</b>	<b>OPTC5</b>	<b>C5</b>	■	■	■	■	■	■	■
CANopen (slave)	D, <b>E</b>	<b>OPTC6</b>	<b>C6</b>	■	■	■	■	■	■	■
DeviceNet	D, <b>E</b>	<b>OPTC7</b>	<b>C7</b>	■	■	■	■	■	■	■
Modbus (D9 type connector)	D, <b>E</b>	<b>OPTC8</b>	<b>C8</b>	■	■	■	■	■	■	■
Adapter—SPX only	D, <b>E</b>	<b>OPTD1</b>	<b>D1</b>	■	■	■	■	■	■	■
Adapter—SPX only	D, <b>E</b>	<b>OPTD2V</b>	<b>D2</b>	■	■	■	■	■	■	■
RS-232 with D9 connection	D, <b>E</b>	<b>OPTD3</b>	<b>D3</b>	■	■	■	■	■	■	■

#### Notes

- ① AI = Analog Input; AO = Analog Output, DI = Digital Input, DO = Digital Output, RO = Relay Output
- ② Option card must be installed in one of the slots listed for that card. Slot indicated in bold is the preferred location.
- ③ OPTC2 is a multi-protocol option card.

### Modbus RTU Network Communications

The Modbus Network Card OPTC2 is used for connecting the SVX Drive as a slave on a Modbus network. The interface is connected by a 9-pin DSUB connector (female) and the baud rate ranges from 300 to 19,200 baud. Other communication parameters include an address range from 1 to 247; a parity of None, Odd or Even; and the stop bit is 1.

### PROFIBUS Network Communications

The PROFIBUS Network Card OPTC3 is used for connecting the SVX Drive as a slave on a PROFIBUS-DP network. The interface is connected by a 9-pin DSUB connector (female). The baud rates range from 9.6 Kbaud to 12 Mbaud, and the addresses range from 1 to 127.

### LonWorks Network Communications

The LonWorks Network Card OPTC4 is used for connecting the SVX Drive on a LonWorks network. This interface uses Standard Network Variable Types (SNVT) as data types. The channel connection is achieved using a FTT-10 A Free Topology transceiver via a single twisted transfer cable. The communication speed with LonWorks is 78 kBits/s.

### CANopen (Slave) Communications

The CANopen (Slave) Network Card OPTC6 is used for connecting the SVX Drive to a host system. According to ISO11898 standard cables to be chosen for CANbus should have a nominal impedance of 120 ohms, and specific line delay of nominal 5 nS/m. 120 ohms line termination resistors required for installation.

### DeviceNet Network Communications

The DeviceNet Network Card OPTC7 is used for connecting the SVX Drive on a DeviceNet Network. It includes a 5.08 mm pluggable connector. Transfer method is via CAN using a two-wire twisted shielded cable with two-wire bus power cable and drain. The baud rates used for communication include 125 Kbaud, 250 Kbaud and 500 Kbaud.

### Johnson Controls Metasys N2 Network Communications

The OPTC2 fieldbus board provides communication between the SVX Drive and a Johnson Controls Metasys™ N2 network. With this connection, the drive can be controlled, monitored and programmed from the Metasys system. The N2 fieldbus is available as a factory installed option and as a field installable kit.

### Modbus/TCP Network Communications

The Modbus/TCP Network Card OPTC1 is used for connecting the SVX Drive to Ethernet networks utilizing Modbus protocol. It includes an RJ-45 pluggable connector. This interface provides a selection of standard and custom register values to communicate drive parameters. The board supports 10 Mbps and 100 Mbps communication speeds. The IP address of the board is configurable over Ethernet using a supplied software tool.

### BACnet Network Communications

The BACnet Network Card OPTCJ is used for connecting the SVX Drive to BACnet networks. It includes a 5.08 mm pluggable connector. Data transfer is Master-Slave/Token Passing (MS/TP) RS-485. This interface uses a collection of 30 Binary Value Objects (BVOs) and 35 Analog Value Objects (AVOs) to communicate drive parameters. The card supports 9.6, 19.2 and 38.4 Kbaud communication speeds and supports network addresses 1–127.

### EtherNet/IP Network Communications

The EtherNet/IP Network Card OPTCK is used for connecting the SVX Drive to Ethernet/Industrial Protocol networks. It includes an RJ-45 pluggable connector. The interface uses CIP objects to communicate drive parameters (CIP is “Common Industrial Protocol”, the same protocol used by DeviceNet). The board supports 10 Mbps and 100 Mbps communication speeds. The IP address of the board is configurable by Static, BOOTP and DHCP methods.

### Input Power Options

Option	Description
HMCP Disconnect	The HMCP motor protection circuit breaker uses an electronic trip unit to provide typical motor overload relay functionality and short-circuit protection against potential phase-to-phase or phase-to-ground faults.
Circuit Breaker	Utilizes a circuit breaker to provide a means of short-circuit protection for the power cables between it and the drive, and protection from high-level ground faults on the power cable. Allows a convenient means of disconnecting the drive from the line, and the operating mechanism can be padlocked in the OFF position. This is factory mounted in the enclosure.
Isolation Fusing	Provides high-level fault protection of the drive input power circuit from the load side of the fuses to the input side of the power transistors. This option consists of three 200 kA fuses that are factory mounted in the enclosure.
3% Input Reactor	The input reactor is a three-phase series inductance on the line side of an AFD. It is used to provide a reduction in voltage and current harmonics. It also provides increased input protection for AFD and its semiconductors from line transients.
SPD	Provides a UL 1449 surge protection device (SPD) rated for 40 kA/ph that is connected to the line side terminals.
Fused Disconnect	Utilizes fusing to provide a means of short-circuit protection for the power cables between it and the drive, and protection from high-level ground faults on the power cable. Allows a convenient means of disconnecting the drive from the line, and the operating mechanism can be padlocked in the OFF position. This is factory mounted in the enclosure.

### Bypass Options

Option	Description
Manual HOA Bypass	Provides a three-position selector switch that allows the user to select either a HAND or AUTO mode of operation. HAND mode is defaulted keypad operation, and AUTO mode is defaulted to control from an external terminal source. These modes of operation can be configured via programming to allow for alternate combinations of start and speed sources. Start and speed sources include keypad, I/O and fieldbus.
Manual HOA RVSS Bypass	This option adds a reduced voltage soft starter to bypass assembly for soft starting in bypass mode.

### Output Power Options

Option	Description
Output Contactor	Provides a means for positive disconnection of the drive output from the motor terminals. The contactor coil is controlled by the drive's run or permissive logic. NC and NO auxiliary contacts rated at 10 A, 600 Vac are provided for customer use. This option includes a low VA 115 Vac fused control power transformer and is factory mounted in the enclosure.
3% Output Reactor	The output reactor is a three-phase series inductance on the load side of a VFD. It is used to reduce transient voltage (dv/dt) and peak voltages at the motor terminals. A 3% output filter is recommended for motor cable lengths up to 300 ft (10 m).
dV/dt Filter	Used to reduce the transient voltage (dV/dt) at the motor terminals. Recommended for motor cable lengths over 300 ft (10 m) and up to 1000 ft (304.8 m). This option is mounted in the enclosure.

### Control Options

Option	Description
Speed Pot	Provides the ability to adjust the frequency reference using a door-mounted potentiometer. This option uses the 10 Vdc reference to generate a 0–10 V signal at the analog voltage input signal terminal. When the HOA bypass option is added, the speed is controlled when the HOA switch is in the HAND position. Without the HOA bypass option, a two-position switch (labeled local/remote) is provided on the keypad to select speed reference from the speed potentiometer or a remote speed signal.
HOA Switch	Provides a three-position selector switch that allows the user to select either a HAND or AUTO mode of operation. HAND mode is defaulted to keypad operation, and AUTO mode is defaulted to control from an external terminal source. These modes of operation can be configured via drive programming to allow for alternate combinations of start and speed sources. Start and speed sources include Keypad, I/O and fieldbus.
Start-Stop Pushbutton	Provides door-mounted START and STOP pushbuttons for either bypass or non-bypass configurations.

### Light Options

Option	Description
Non-Bypass Light Kit—Power On, Run, Fault	Provides a white POWER ON light that indicates power to the enclosed cabinet, a green RUN light that indicates the drive is running and a red FAULT light that indicates a drive fault has occurred.
Bypass Light Kit—On, VFD Run, Fault, Bypass Run	Provides a white POWER ON light that indicates power to the enclosed cabinet, a green RUN light that indicates the drive is running, a red FAULT light that indicates a drive fault has occurred and an amber light that indicates when the motor is running in Bypass mode.

### Enclosure Options

Option	Description
Floor Stand 12 in	Converts a normally wall-mounted enclosure to a floor-standing enclosure with a height of 12 in (304.8 mm).
Floor Stand 22 in	Converts a normally wall-mounted enclosure to a floor-standing enclosure with a height of 22 in (558.8 mm).

**Enclosed Drive Options****Brake Chopper Options**

The brake chopper circuit option is used for applications that require dynamic braking. Dynamic braking resistors are not included with drive purchase. Consult **Page V6-T2-111** for dynamic braking resistors which are supplied separately. Resistors are not UL Listed.

For brake chopper circuit selection and adder—NEMA Type 1/IP21, NEMA Type 12/IP54, consult the factory

**Technical Data and Specifications****SVX Enclosed Drives**

Description	Specification
<b>Primary Design Features</b>	
45–66 Hz input frequency	Standard
Output: AC volts maximum	Input voltage base
Output frequency range	0–320 Hz
Initial output current ( $I_H$ )	250% for 2 seconds
Overload (1 minute [ $I_H/I_L$ ])	150%/110%
Enclosure space heater	Optional
Oversize enclosure	Standard
Output contactor	Optional
Bypass motor starter	Optional
Listings	UL, cUL
<b>Protection Features</b>	
Incoming line fuses	Optional
AC input circuit disconnect	Optional
Line reactors (3%)	Standard
Phase rotation insensitive	Standard
EMI filter	Standard
Input phase loss protection	Standard
Input overvoltage protection	Standard
Line surge protection	Optional
Output short-circuit protection	Standard
Output ground fault protection	Standard
Output phase protection	Standard
Overtemperature protection	Standard
DC overvoltage protection	Standard
Drive overload protection	Standard
Motor overload protection	Standard
Programmer software	Optional
Local/remote keypad	Standard
Keypad lockout	Standard
Fault alarm output	Standard
Built-in diagnostics	Standard

Description	Specification
<b>Input/Output Interface Features</b>	
Setup adjustment provisions	
Remote keypad/display	Standard
Personal computer	Standard
Operator control provisions	
Drive mounted keypad/display	Standard
Remote keypad/display	Standard
Conventional control elements	Standard
Serial communications	Optional
115 Vac control circuit	Optional
Speed setting inputs	
Keypad	Standard
0–10 Vdc potentiometer/voltage signal	Standard
4–20 mA Isolated	Configurable
4–20 mA Differential	Configurable
Analog outputs	
Speed/frequency	Standard
Torque/load/current	Programmable
Motor voltage	Programmable
Kilowatts	Programmable
0–10 Vdc signals	Configurable w/jumpers
4–20 mA DC signals	Standard
Isolated signals	Optional
Discrete outputs	
Fault alarm	Standard
Drive running	Standard
Drive at set speed	Programmable
Optional parameters	14
Dry contacts	1 (2 relays Form C)
Open collector outputs	1
Additional discrete outputs	Optional
<b>Communications</b>	
RS-232	Standard
RS-422/485	Optional
DeviceNet™	Optional
Modbus RTU	Optional
CANopen (slave)	Optional
PROFIBUS-DP	Optional
Lonworks®	Optional
Johnson Controls Metasys™ N2	Optional
EtherNet/IP	Optional
Modbus TCP	Optional
BACnet	Optional

## SVX Enclosed Drives, continued

Description	Specification
<b>Performance Features</b>	
Sensorless vector control	Standard
Volts/hertz control	Standard
IR and slip compensation	Standard
Electronic reversing	Standard
Dynamic braking	Optional ①
DC braking	Standard
PID setpoint controller	Programmable
Critical speed lockout	Standard
Current (torque) limit	Standard
Adjustable acceleration/deceleration	Standard
Linear or S curve accel/decel	Standard
Jog at preset speed	Standard
Thread/preset speeds	7 Standard, 15 Optional
Automatic restart	Selectable
Coasting motor start	Standard
Coast or ramp stop selection	Standard
Elapsed time meter	Optional
Carrier frequency adjustment	1–16 kHz

**Standard Conditions for Application and Service**

Operating ambient temperature	0 to 40 °C
Storage temperature	–40 to 60 °C
Humidity (maximum), non-condensing	95%
Altitude (maximum without derate)	3300 ft (1000 m)
Line voltage variation	+10/–15%
Line frequency variation	45–66 Hz
Efficiency	>96%
Power factor (displacement)	>0.94

## Standard I/O Specifications

Description	Specification
Six–digital input programmable	24 V: "0" ≤10 V, "1" ≥18V, R <sub>i</sub> >5 kohms
Two–analog input configurable w/jumpers	Voltage: 0–±10 V, R <sub>i</sub> >200 kohms Current: 0 (4)–20 mA, R <sub>i</sub> = 250 ohms
Two–digital output programmable	Form C relays 250 Vac 30 Vdc 2 amp resistive
One–analog output programmable configurable w/jumper	0–20 mA, R <sub>L</sub> max. 500 ohms 10 bits ±2%
One digital output programmable	Open collector 48 Vdc 50 mA

## I/O Specifications for Control/Communication Options

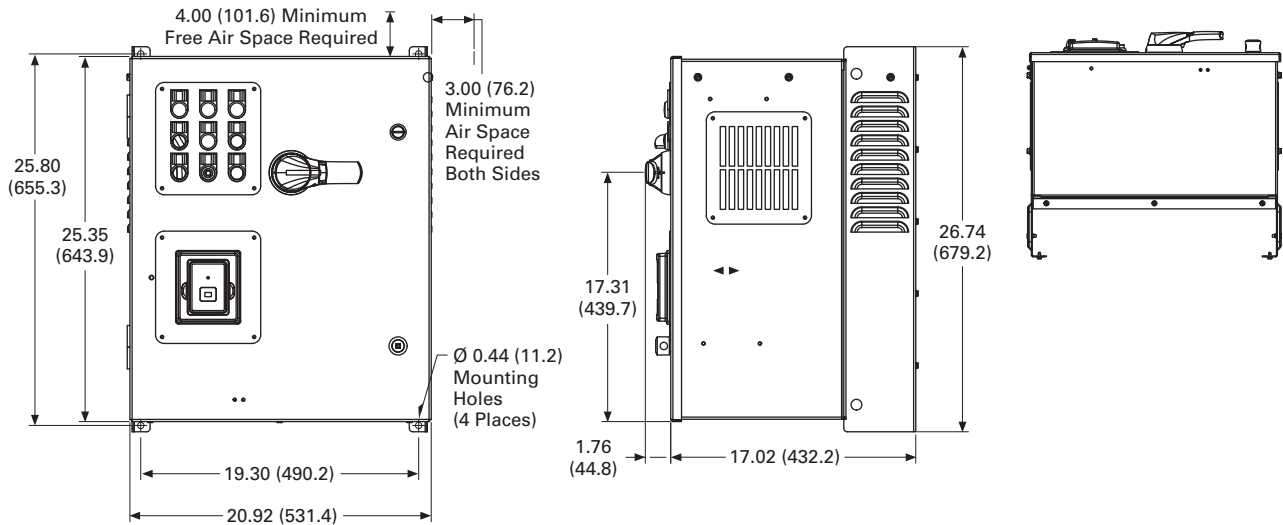
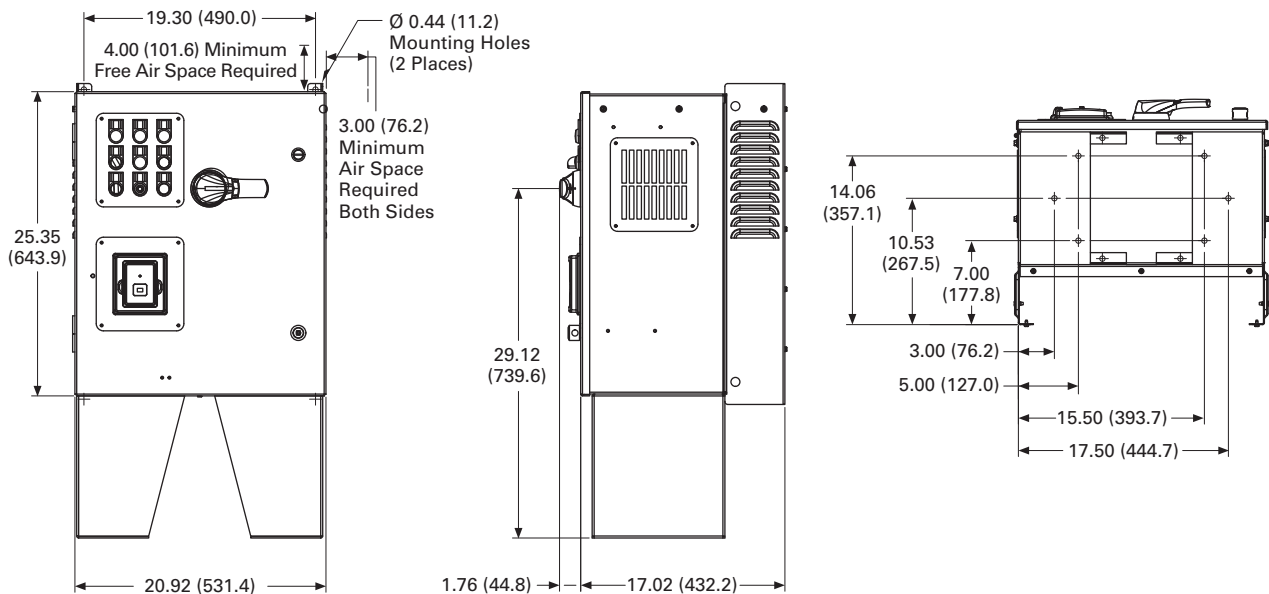
Description	Specification
Analog voltage, input	0–±10 V, R <sub>i</sub> ≥200 kohms
Analog current, input	0 (4)–20 mA, R <sub>i</sub> = 250 ohms
Digital input	24 V: "0" ≤10 V, "1" ≥18V, R <sub>i</sub> >5 kohms
Auxiliary voltage	24 V (±20%), max. 50 mA
Reference voltage	10 V ±3%, max. 10 mA
Analog current, output	0 (4)–20 mA, R <sub>L</sub> = 500 kohms resolution 10 bit, accuracy ≤±2%
Analog voltage, output	0 (2)–10 V, R <sub>L</sub> ≥1 kohms, resolution 10 bit, accuracy ≤±2%
Relay output	
Maximum switching voltage	300 Vdc, 250 Vac
Maximum switching load	8 A/24 Vdc, 0.4 A/300 Vdc, 2 kVA/250 Vac
Maximum continuous load	2 A rms
Thermistor input	R <sub>trip</sub> = 4.7 kohms
Encoder input	24 V: "0" ≤10 V, "1" ≥18V, R <sub>i</sub> = 2.2 kohms 5 V: "0" ≤2V, "1" ≥3V, R <sub>i</sub> = 330 ohms

**Note**

- ① Some horsepower units include dynamic braking chopper as standard—refer to individual drive sections.

**Dimensions**

Approximate Dimensions in Inches (mm)

**AX Box Type 1****AX Box Type 1—12 Inch Floor Stands**



# 2.7

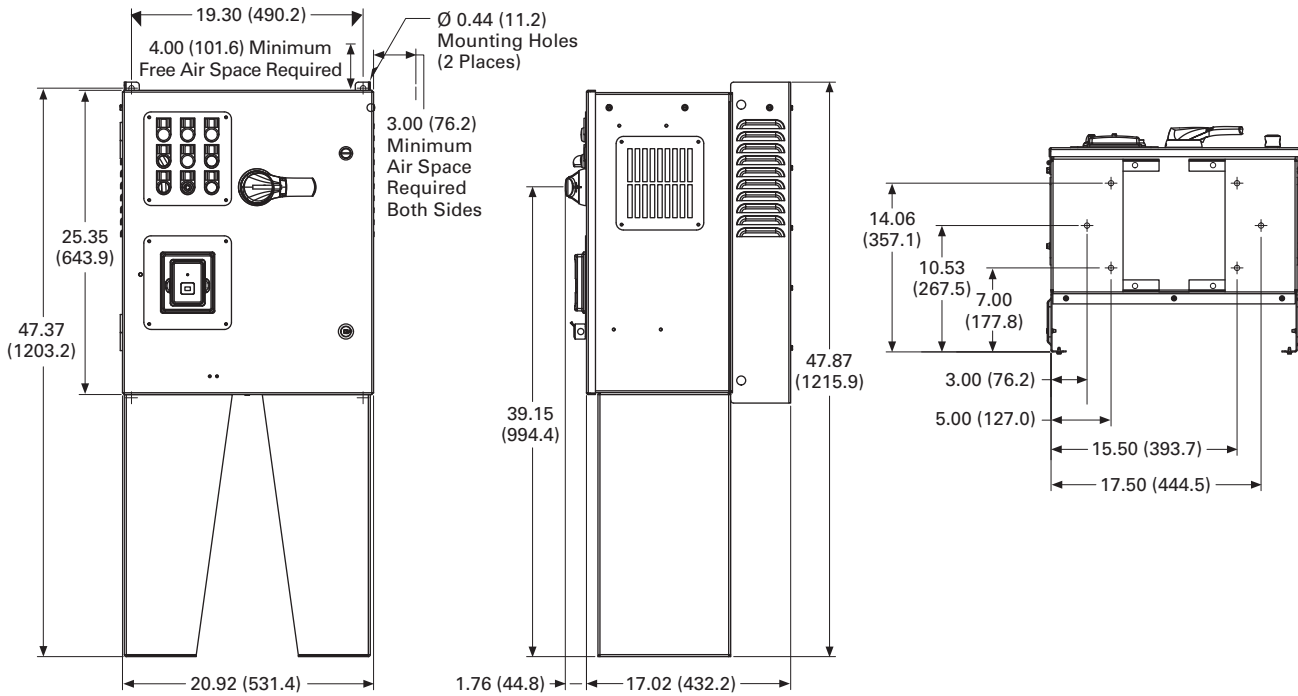
## Adjustable Frequency Drives

### SVX Drives

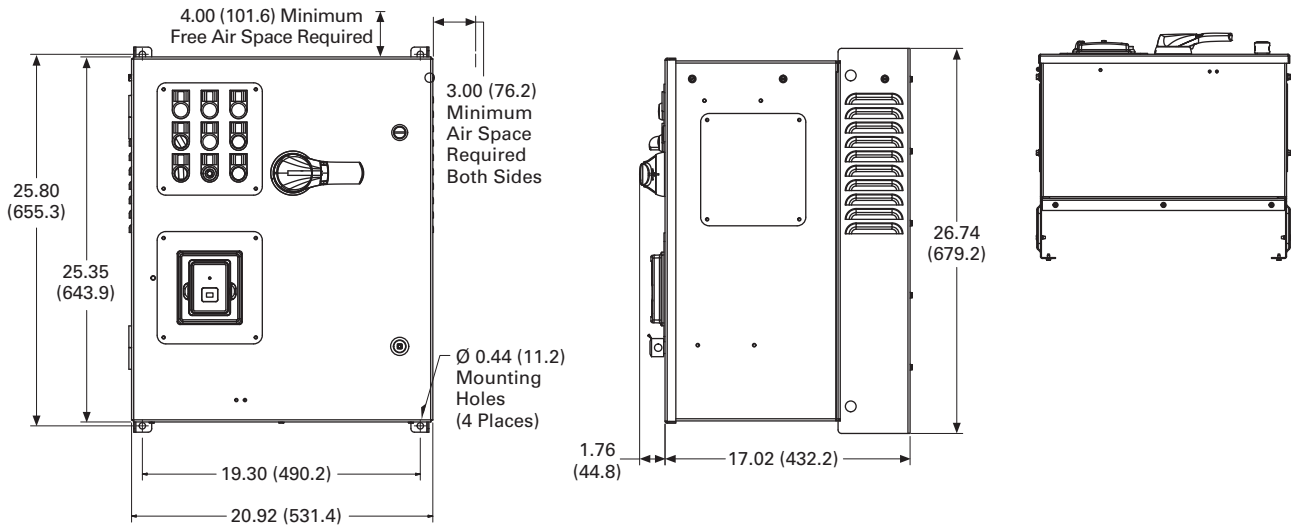
Approximate Dimensions in Inches (mm)

#### AX Box Type 1—22 Inch Floor Stands

2

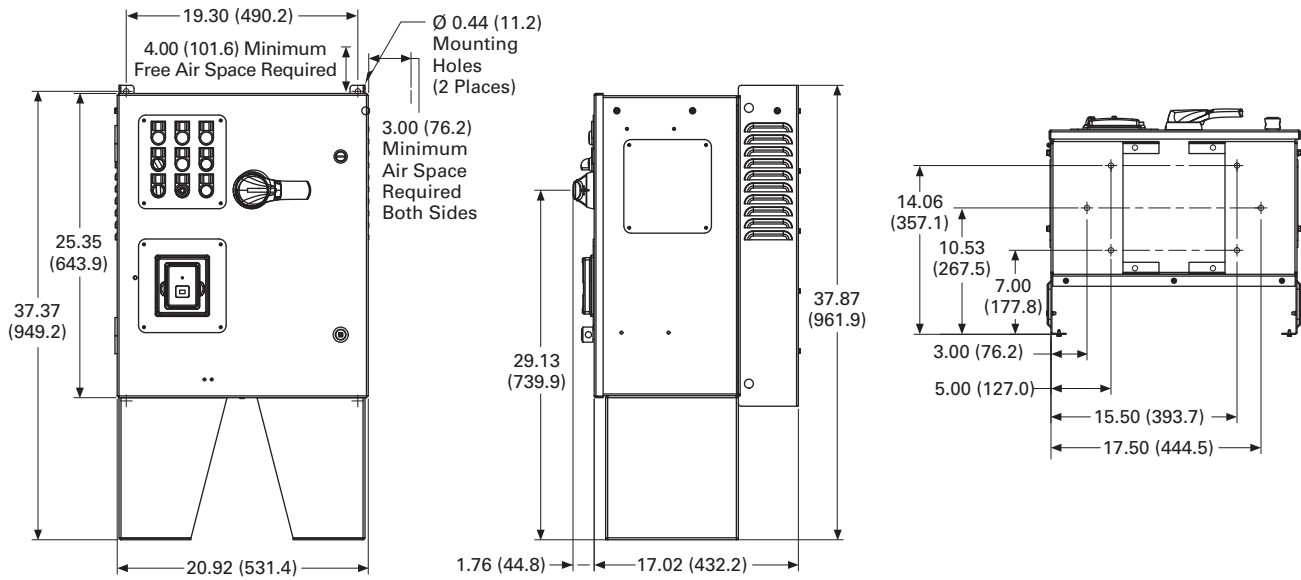


#### AX Box Type 12

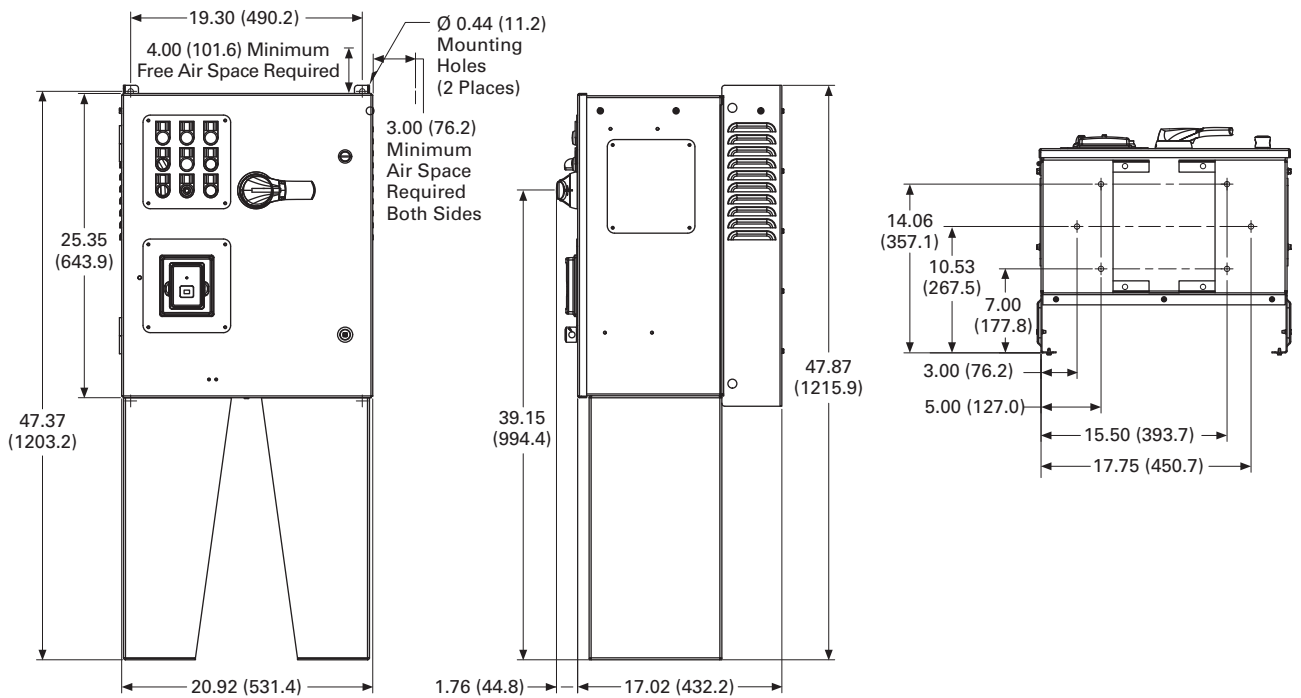


Approximate Dimensions in Inches (mm)

### AX Box Type 12—12 Inch Floor Stands



### AX Box Type 12—22 Inch Floor Stands



# 2.7

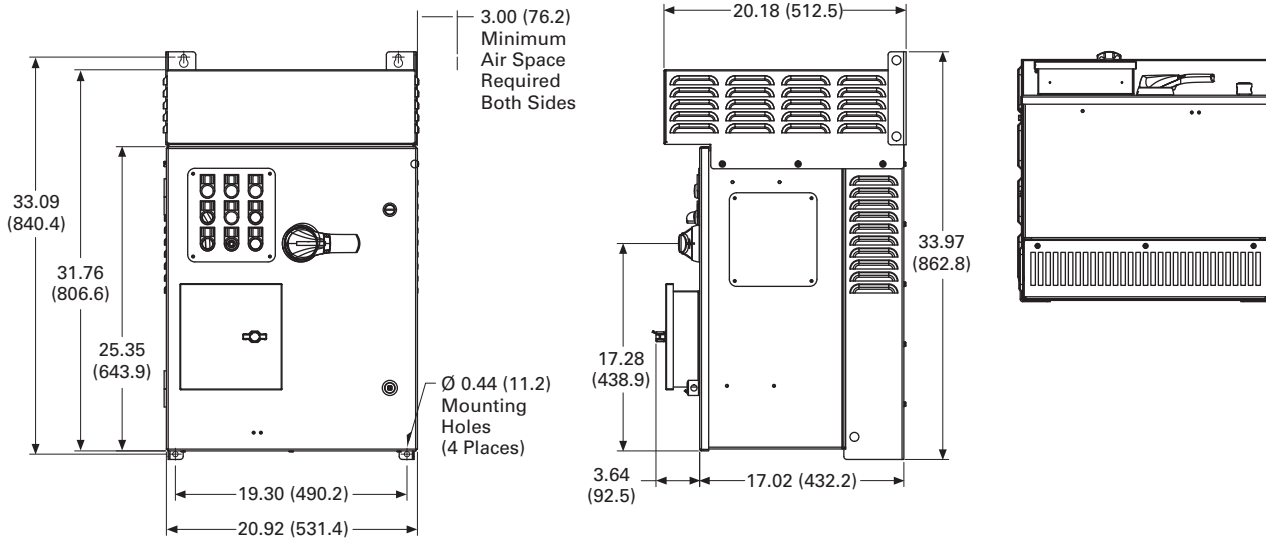
## Adjustable Frequency Drives

### SVX Drives

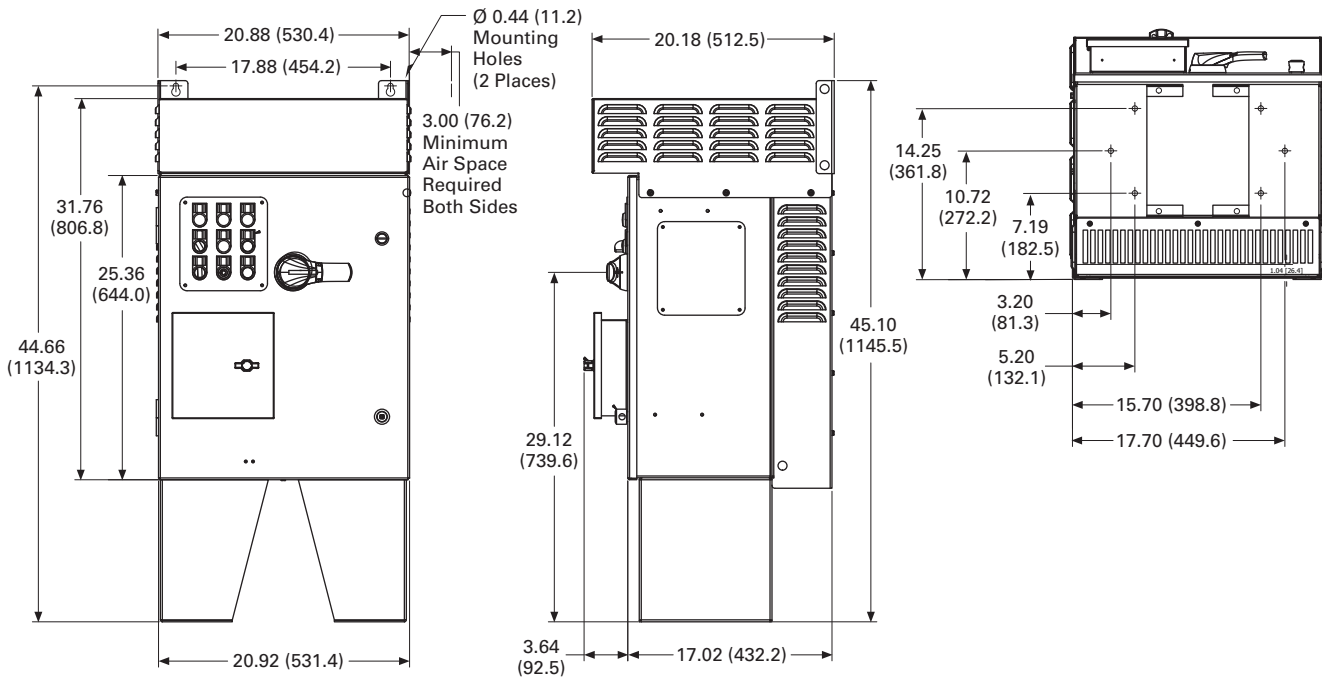
Approximate Dimensions in Inches (mm)

2

#### AX Box Type 3R

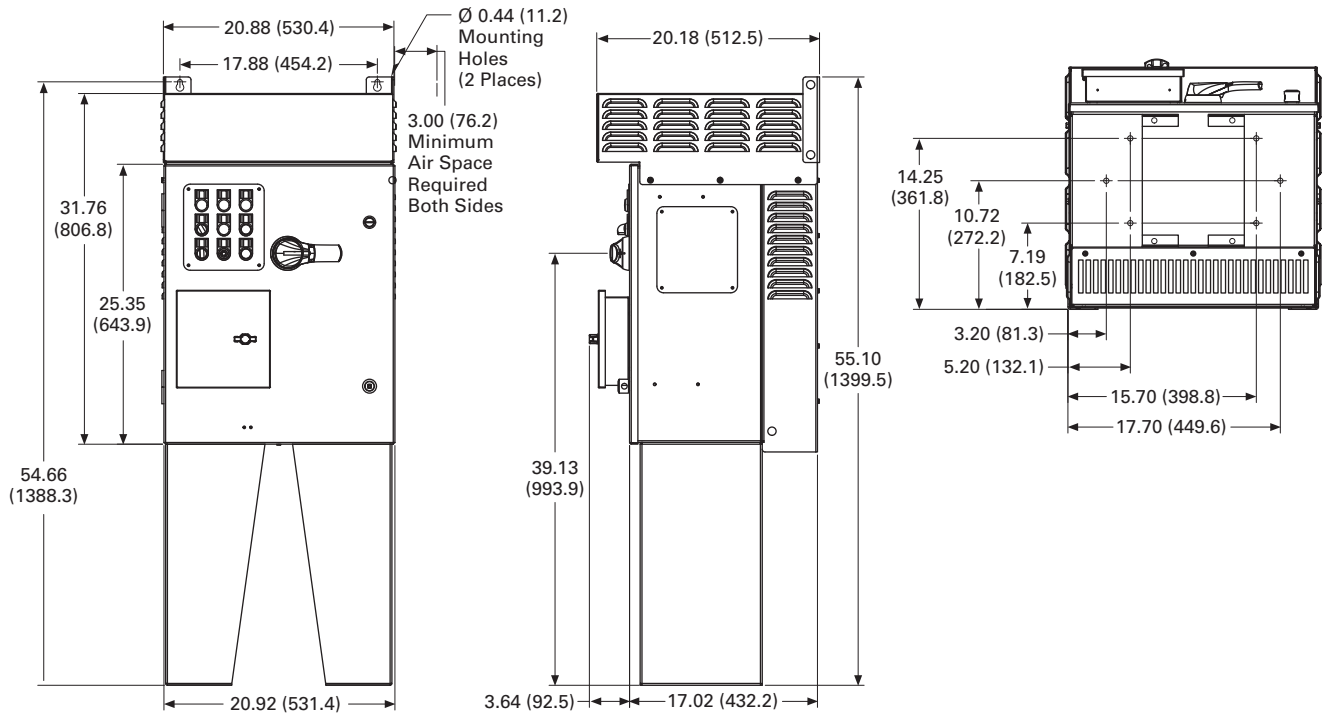


#### AX Box Type 3R—12 Inch Floor Stands

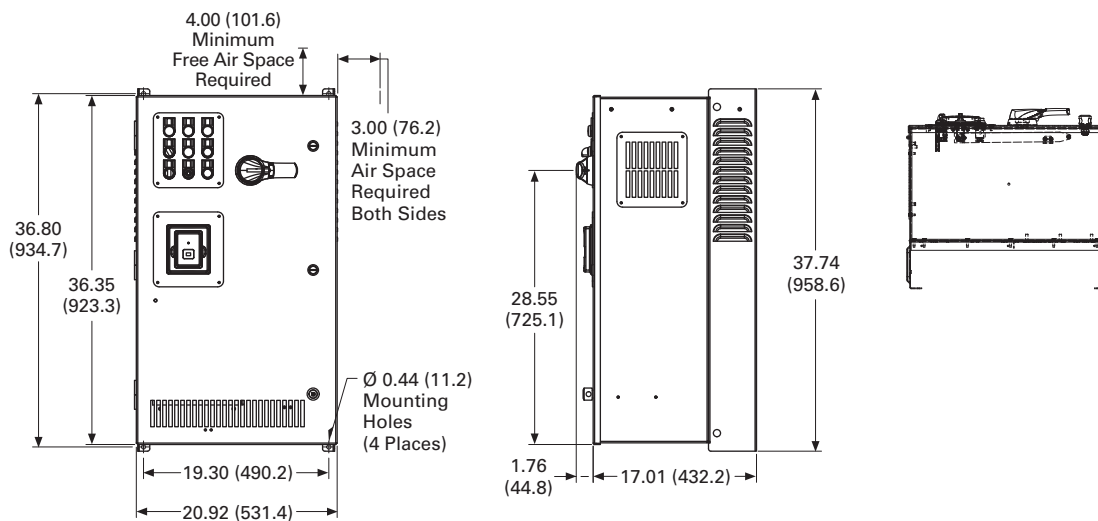


Approximate Dimensions in Inches (mm)

### AX Box Type 3R—22 Inch Floor Stands



### BX Box Type 1



# 2.7

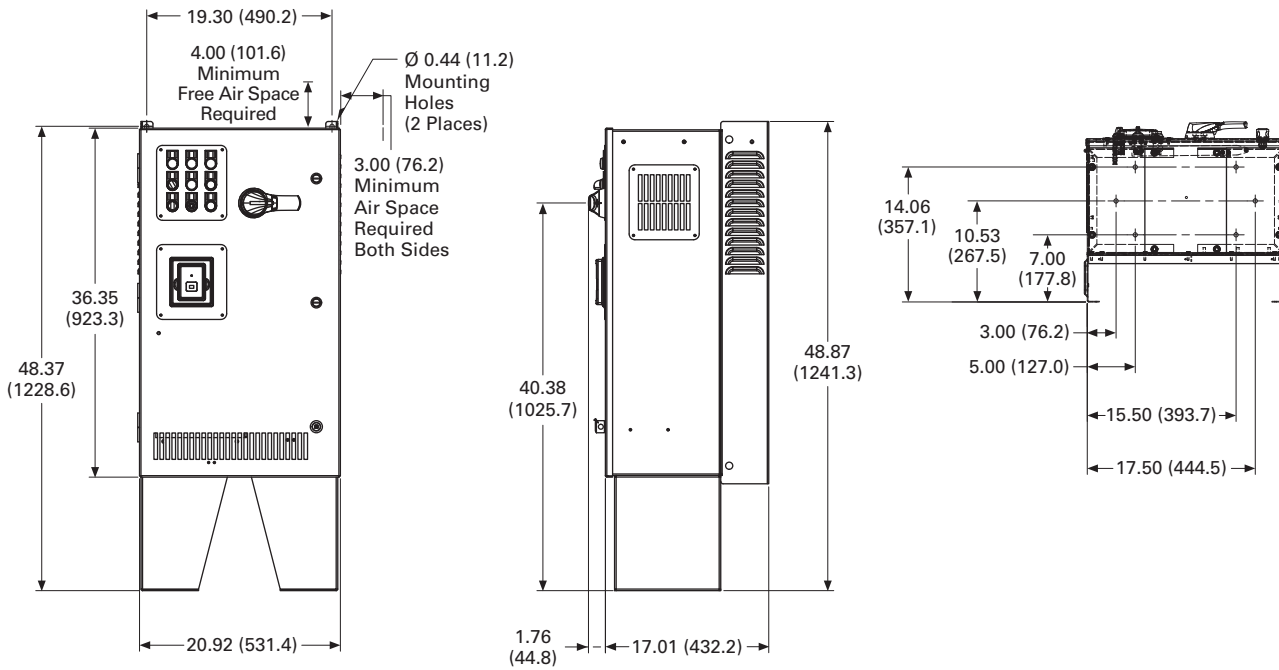
## Adjustable Frequency Drives

### SVX Drives

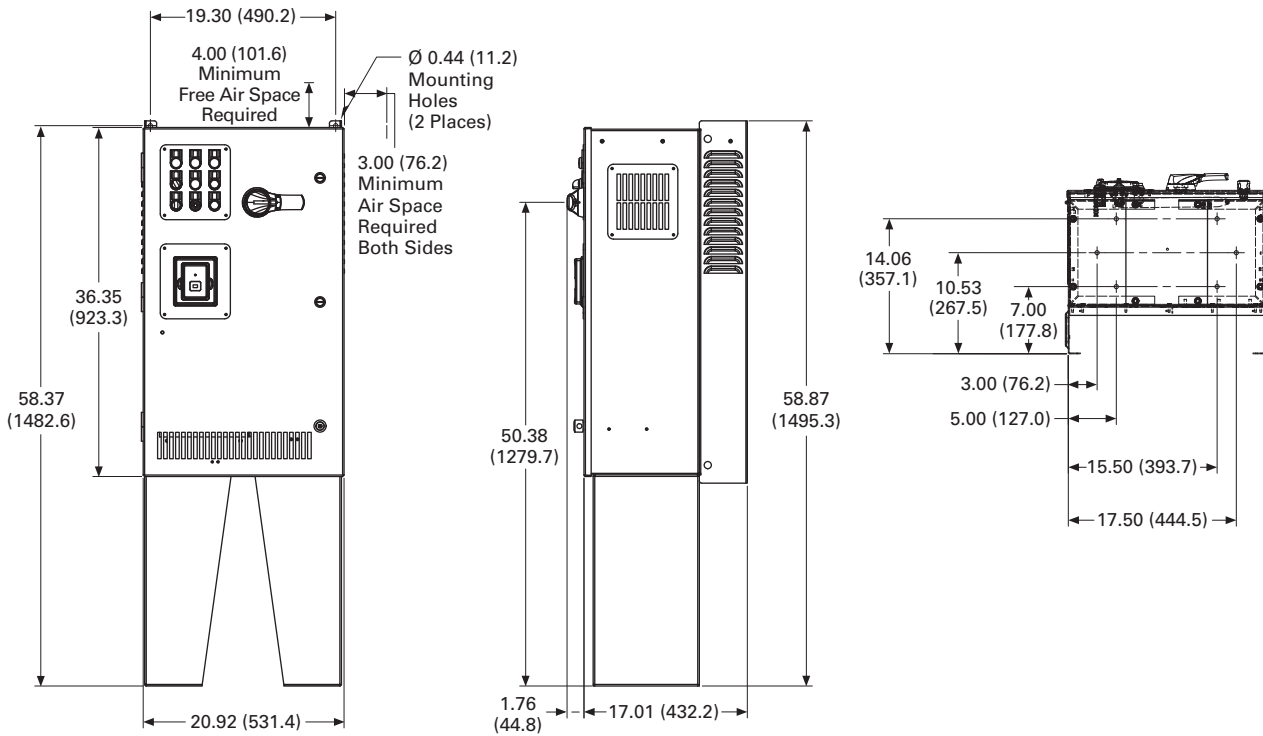
Approximate Dimensions in Inches (mm)

2

#### BX Box Type 1—12 Inch Floor Stands

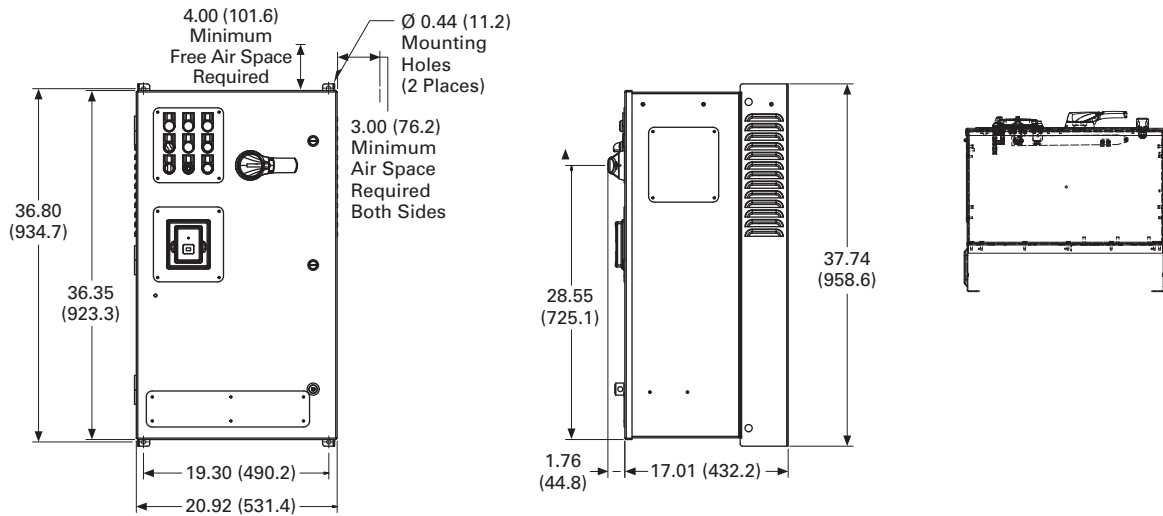


#### BX Box Type 1—22 Inch Floor Stands

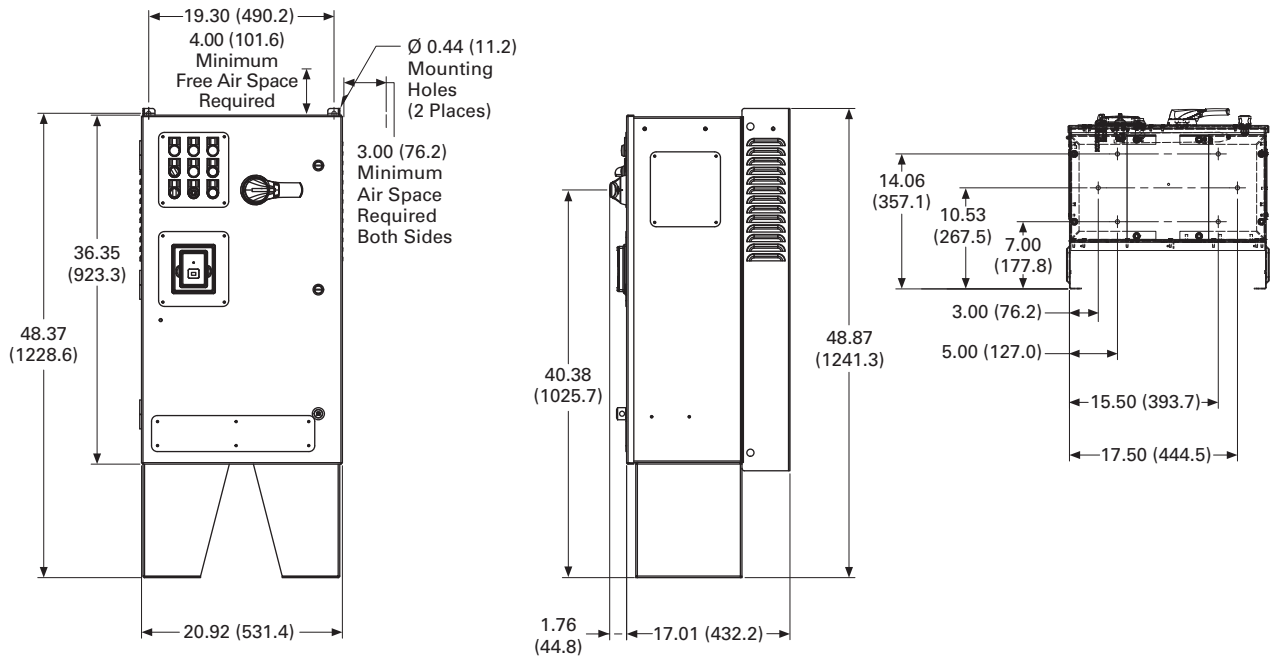


Approximate Dimensions in Inches (mm)

### BX Box Type 12



### BX Box Type 12—12 Inch Floor Stands



# 2.7

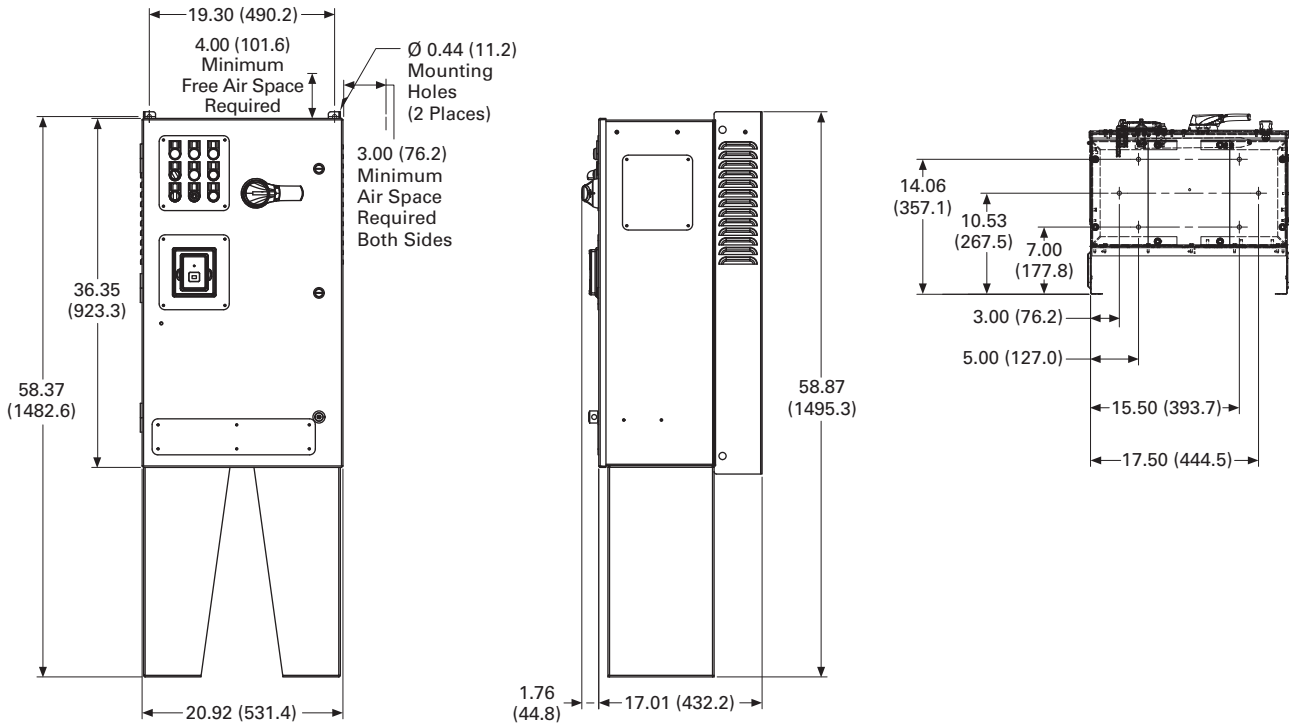
## Adjustable Frequency Drives

### SVX Drives

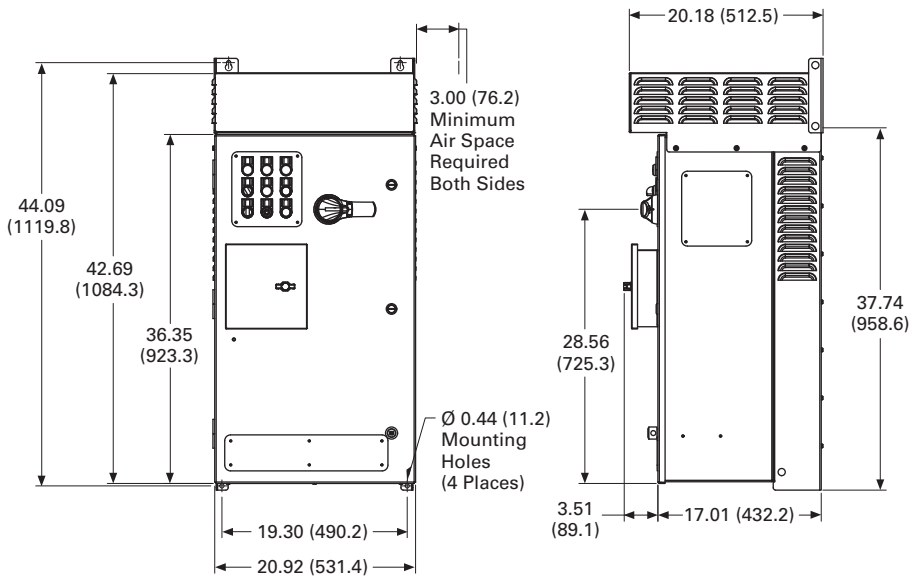
Approximate Dimensions in Inches (mm)

#### BX Box Type 12–22 Inch Floor Stands

2

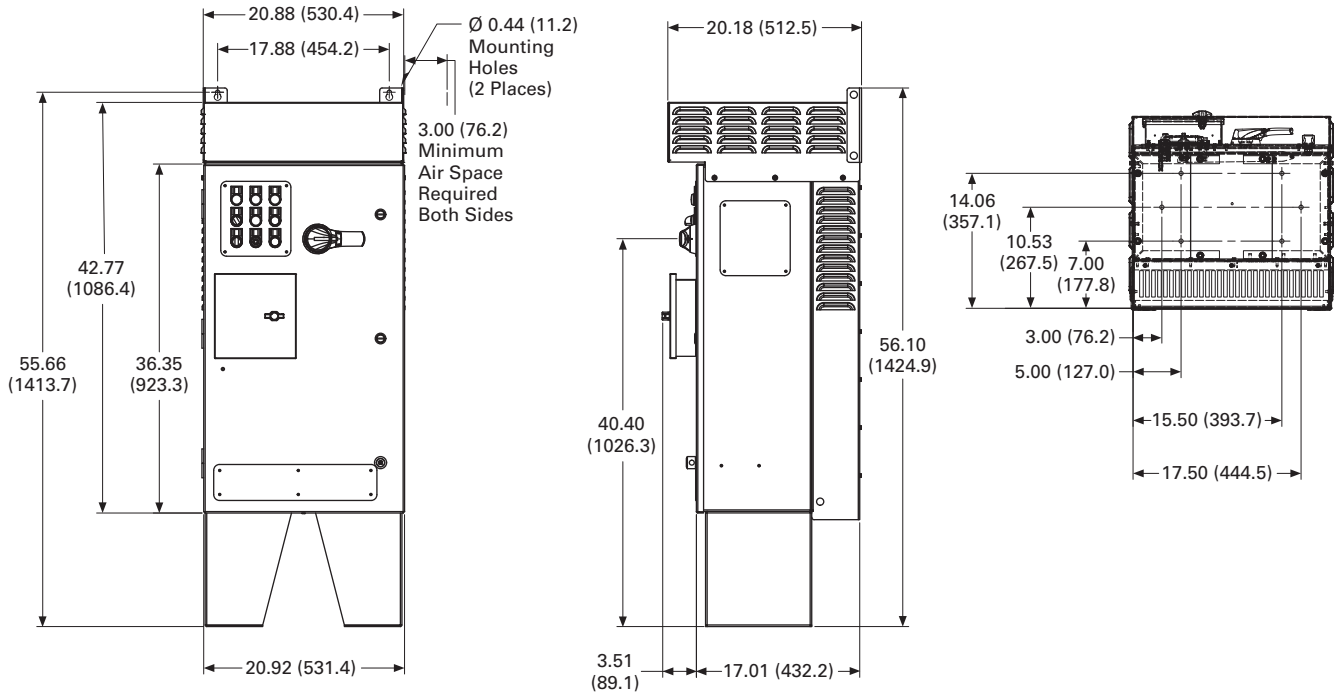


#### BX Box Type 3R

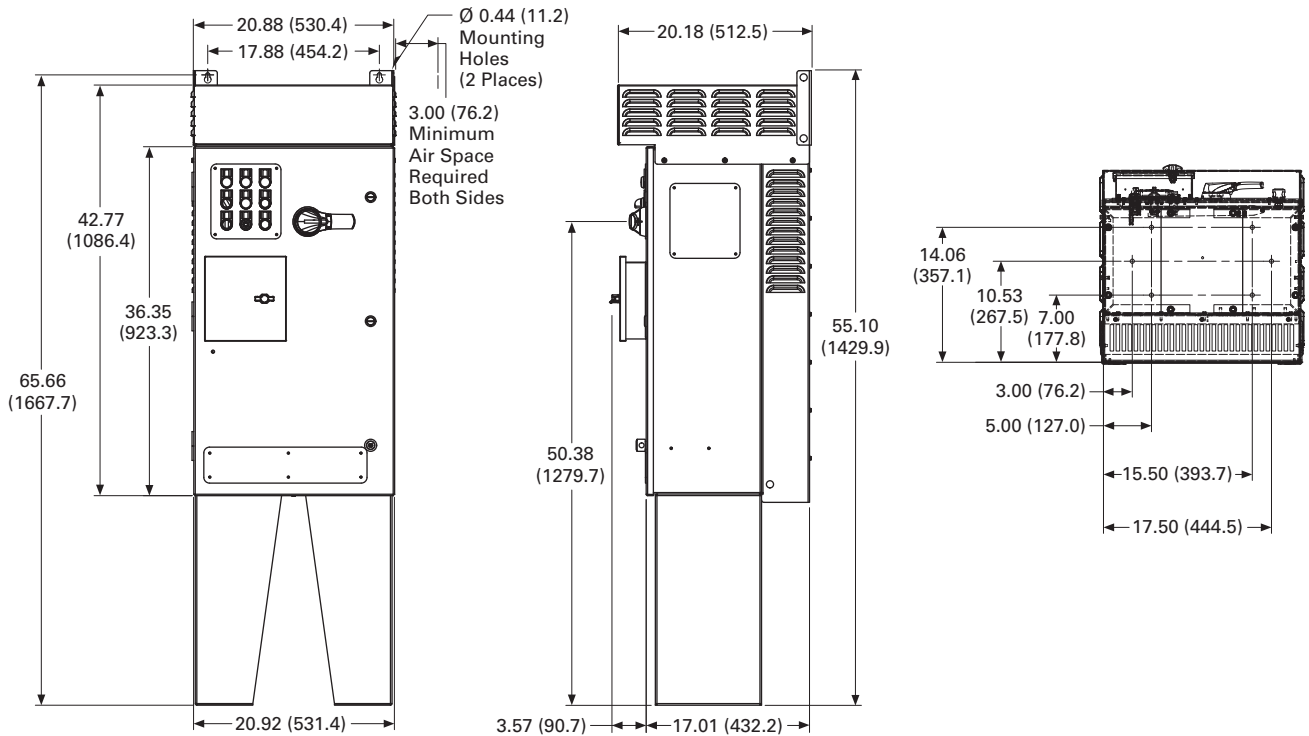


Approximate Dimensions in Inches (mm)

### BX Box Type 3R—12 Inch Floor Stands



### BX Box Type 3R—22 Inch Floor Stands





# 2.7

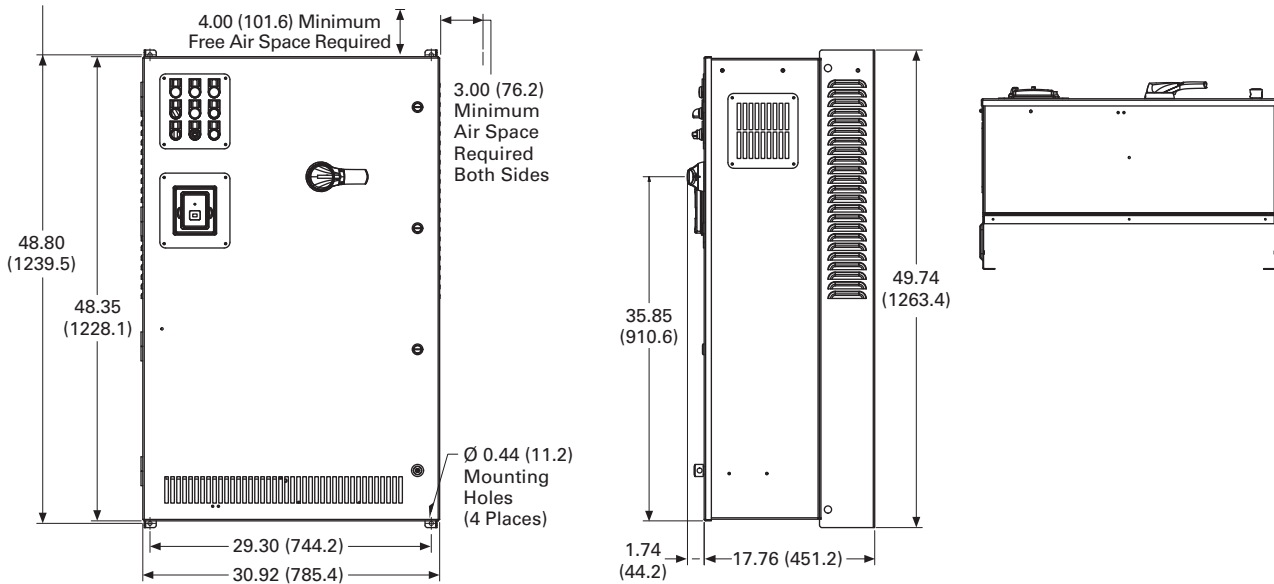
## Adjustable Frequency Drives

### SVX Drives

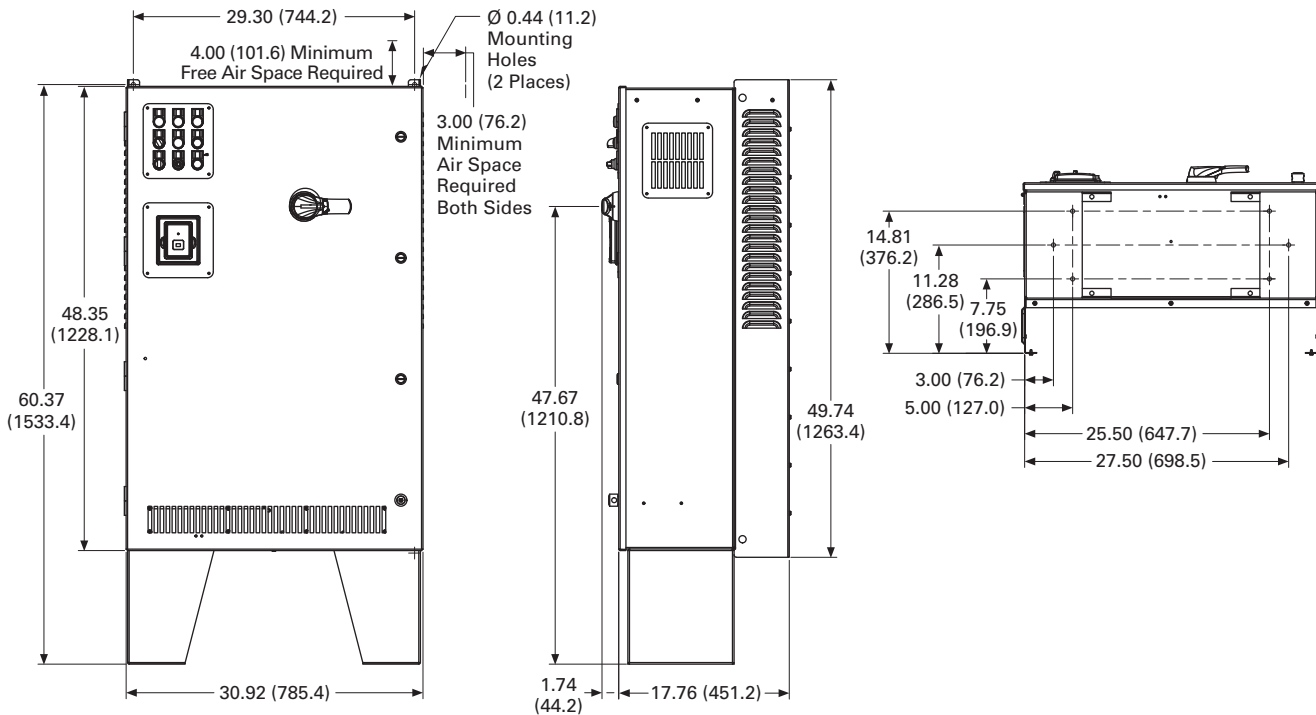
Approximate Dimensions in Inches (mm)

#### CX Box Type 1

2

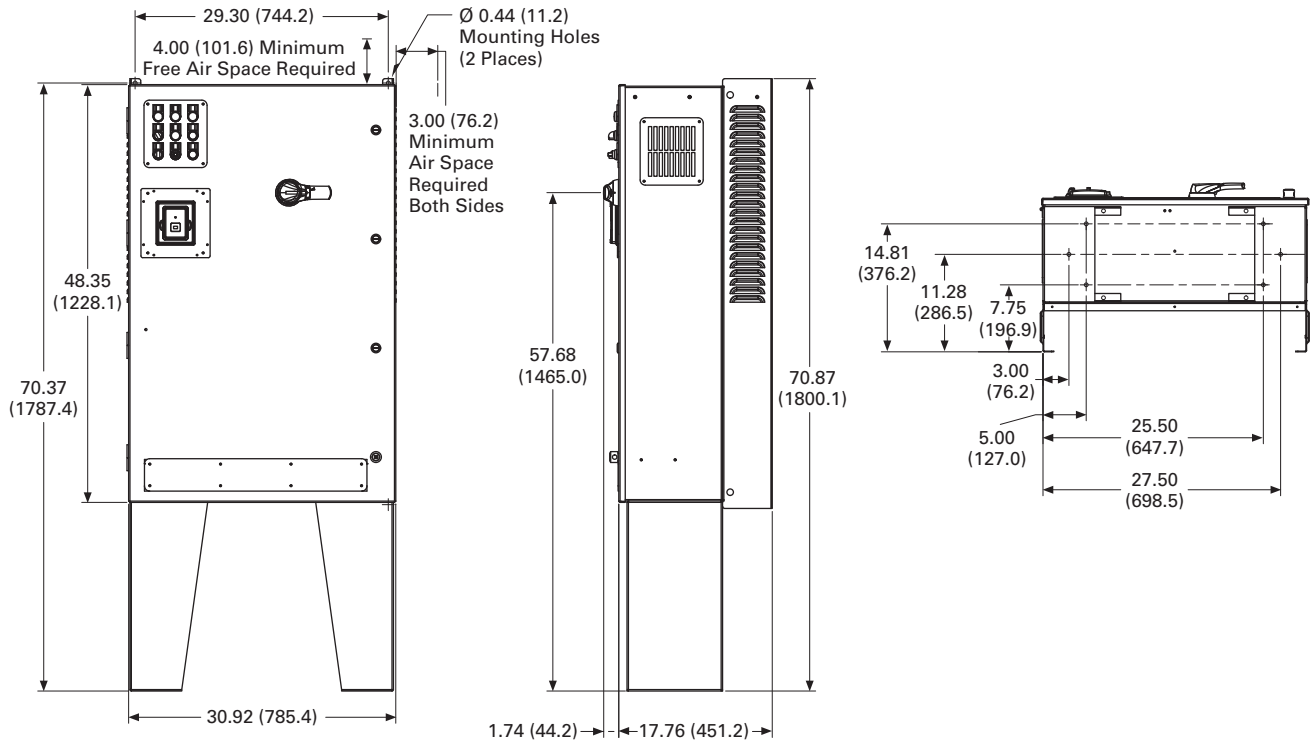


#### CX Box Type 1—12 Inch Floor Stands

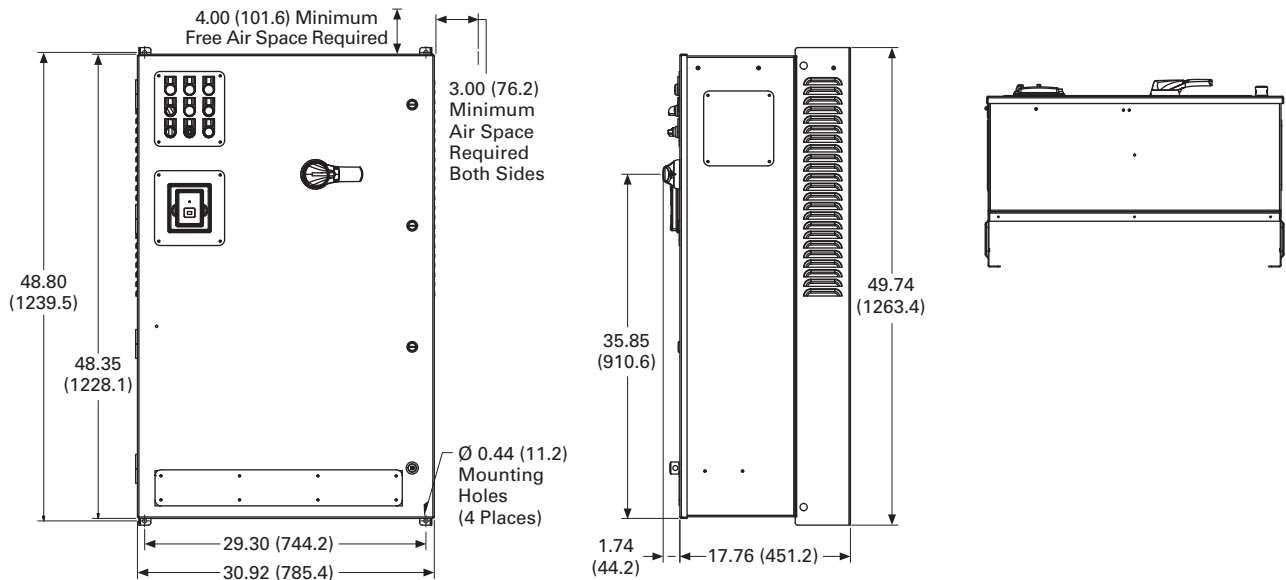


Approximate Dimensions in Inches (mm)

### CX Box Type 1—22 Inch Floor Stands



### CX Box Type 12



# 2.7

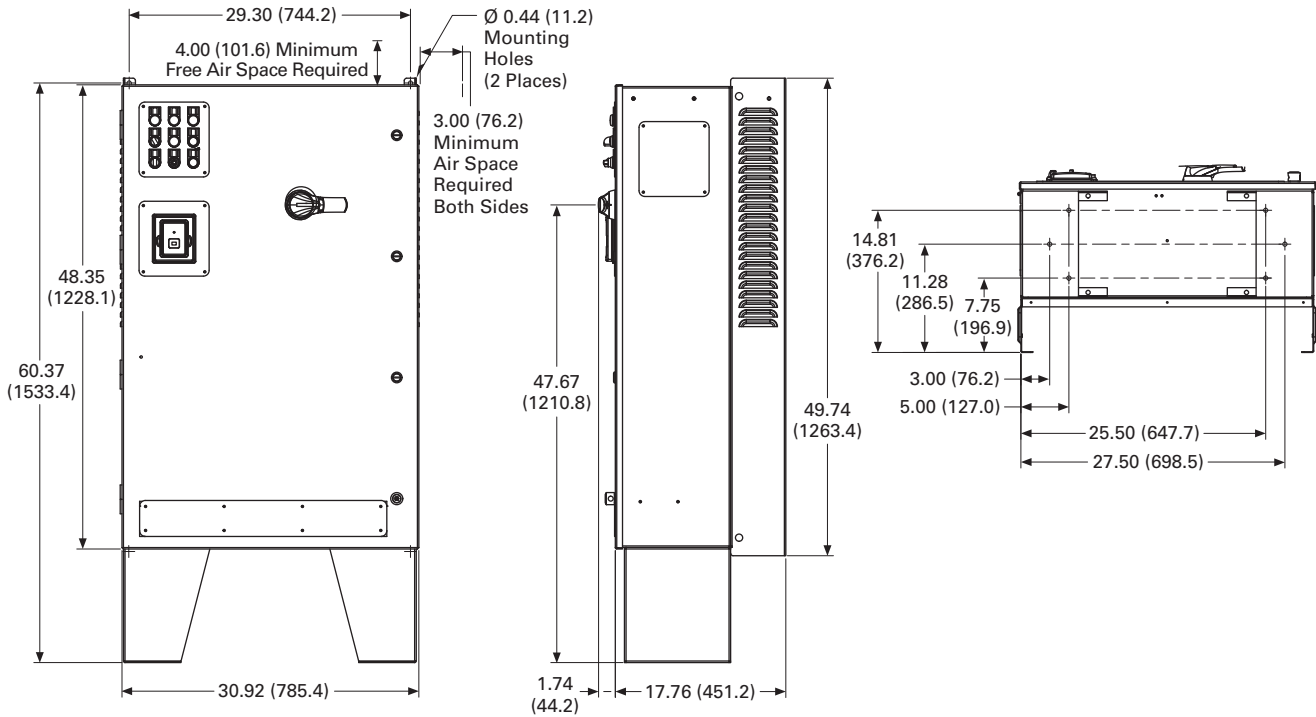
## Adjustable Frequency Drives

### SVX Drives

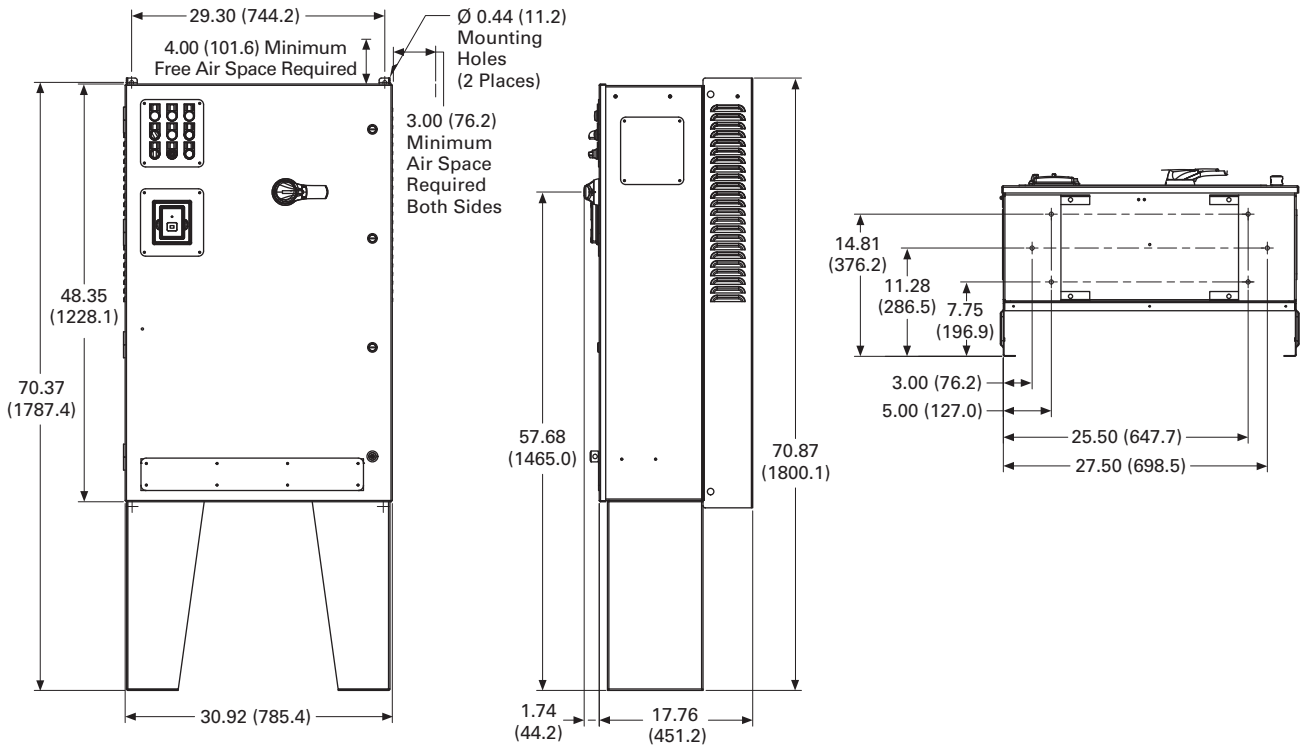
Approximate Dimensions in Inches (mm)

2

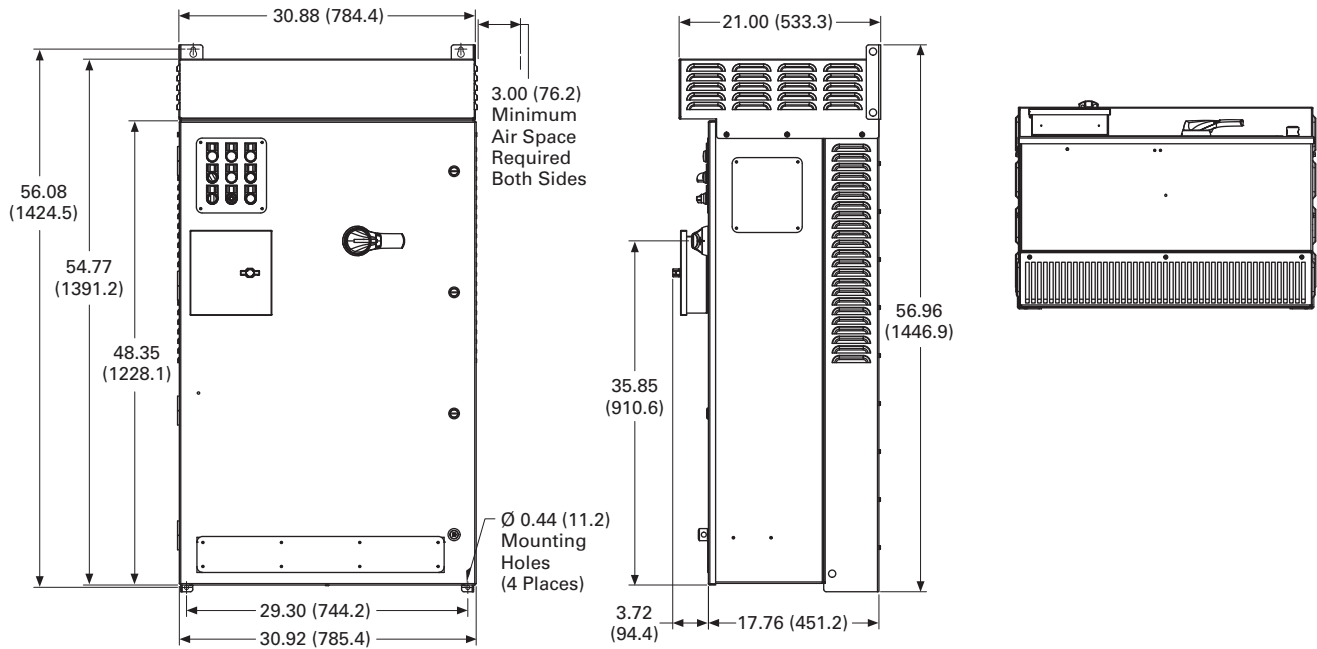
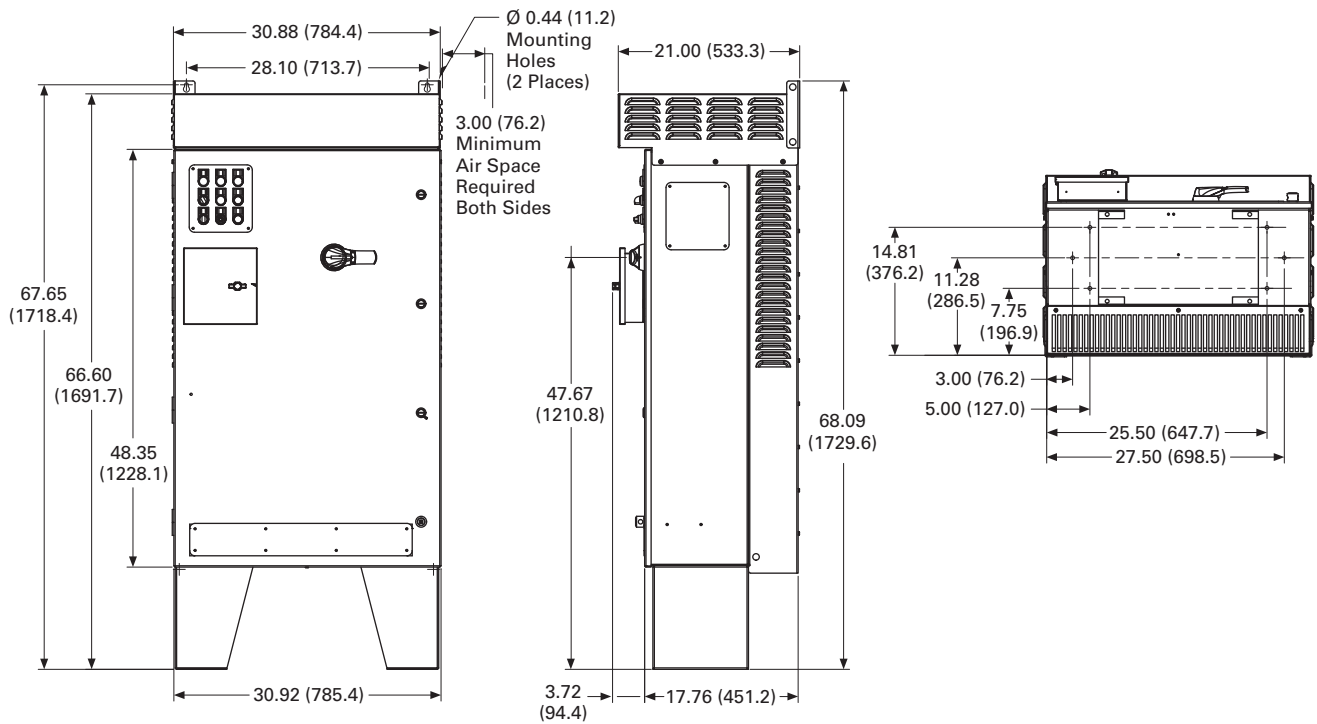
#### CX Box Type 12—12 Inch Floor Stands



#### CX Box Type 12—22 Inch Floor Stands



Approximate Dimensions in Inches (mm)

**CX Box Type 3R****CX Box Type 3R—12 Inch Floor Stands**

# 2.7

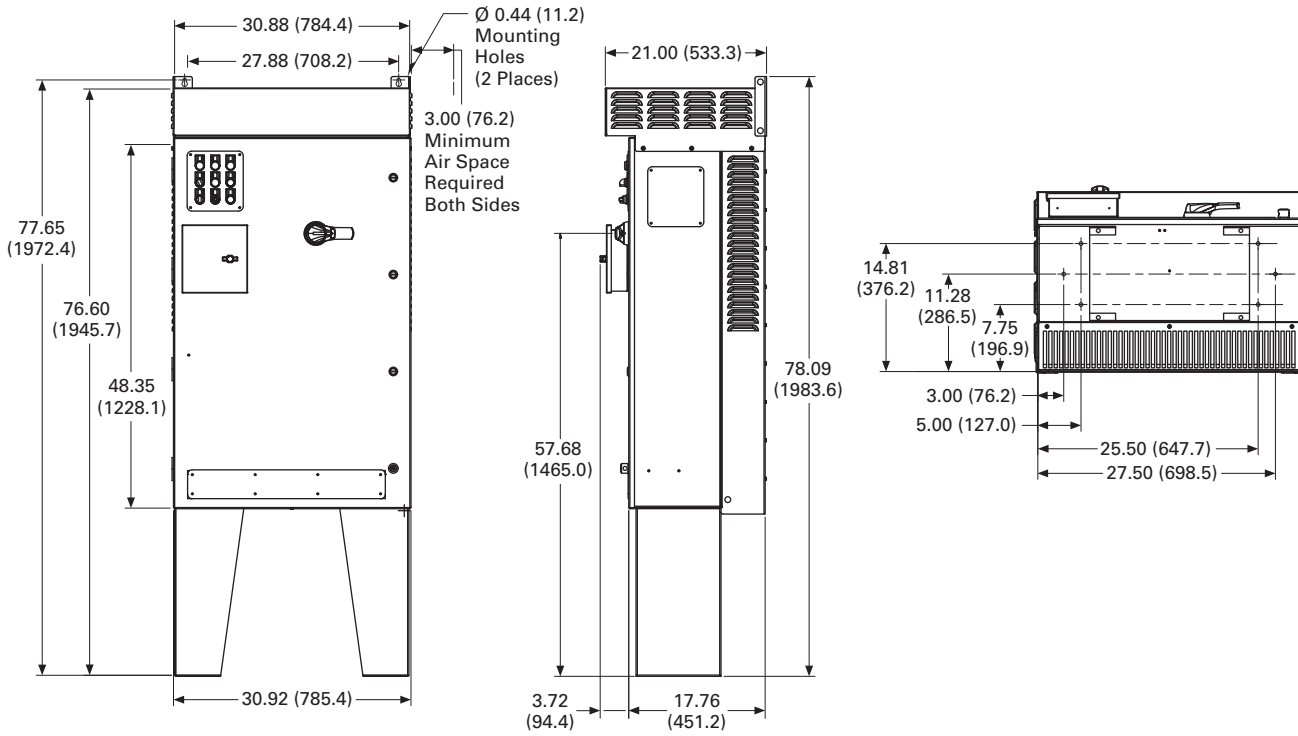
## Adjustable Frequency Drives

### SVX Drives

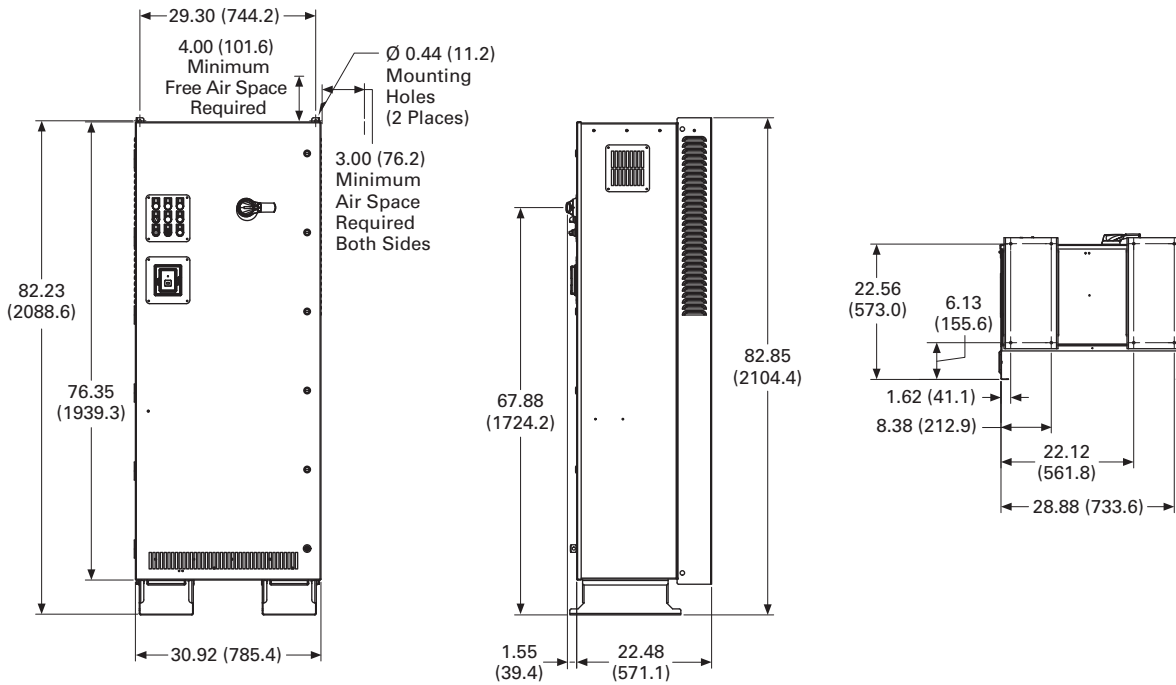
Approximate Dimensions in Inches (mm)

#### CX Box Type 3R—22 Inch Floor Stands

2

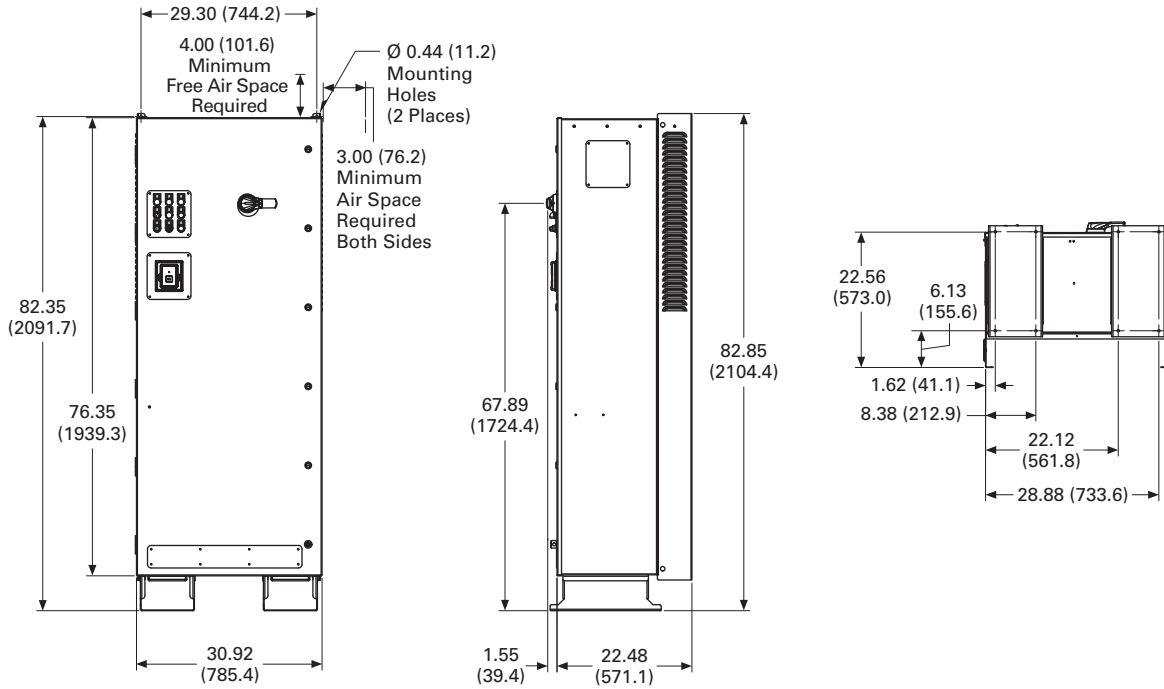


#### DX Box Type 1

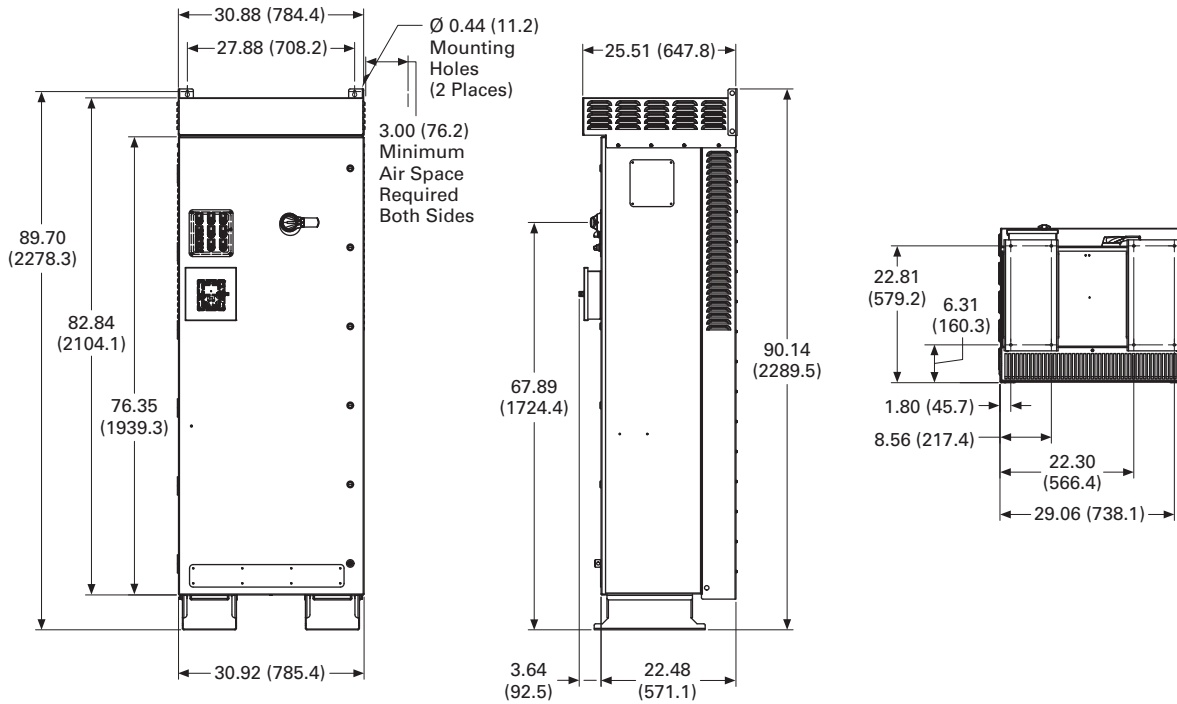


Approximate Dimensions in Inches (mm)

### DX Box Type 12



### DX Box Type 3R



# 2.7

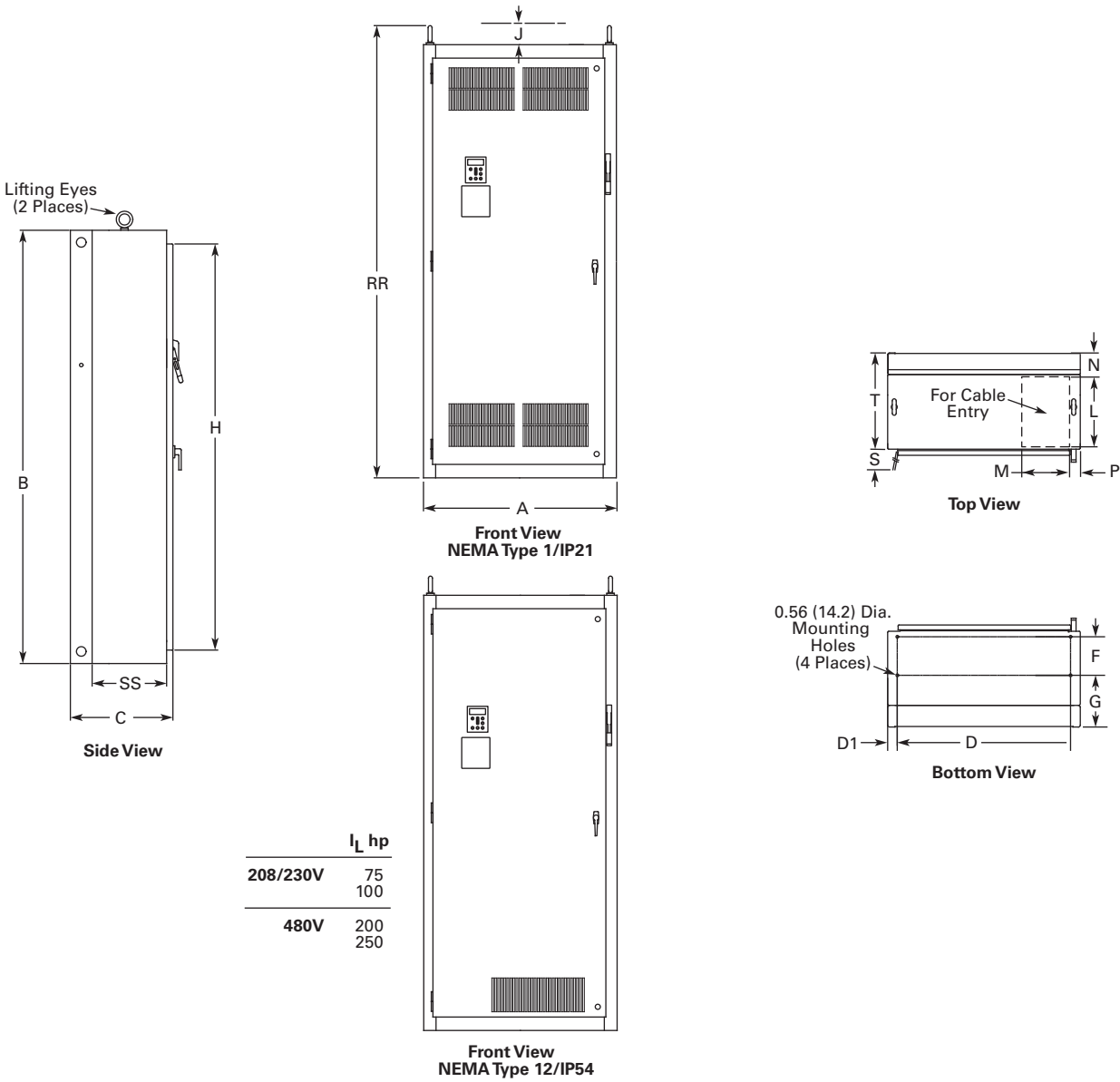
## Adjustable Frequency Drives

### SVX Drives

Approximate Dimensions in Inches (mm)

#### Size 5

2



For reference only, dimensions are subject to change.

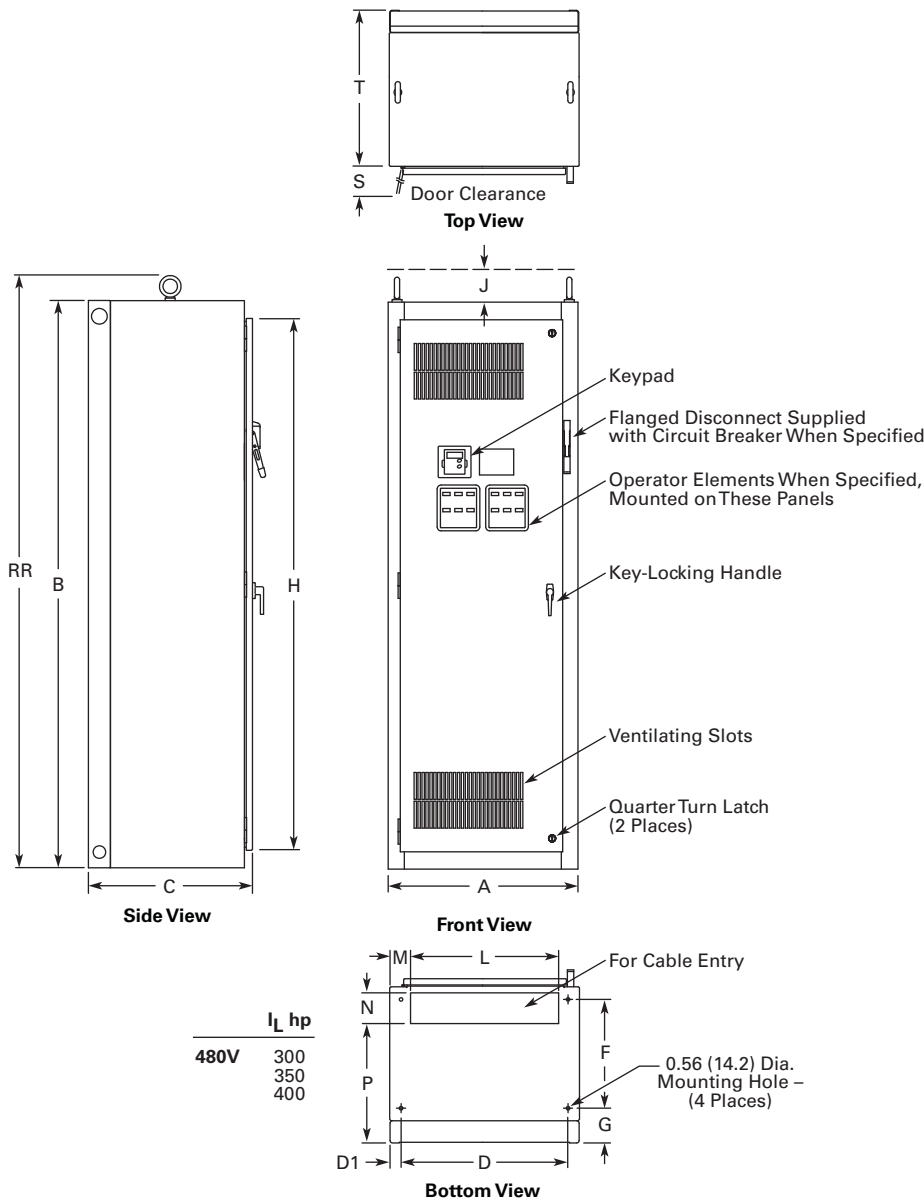
Wide	High	Deep	Mounting							Door Height	Min. Air Space	
A	B	C	D	D1	E	E1	F	G	G1	H	J	K
40.0 (1016)	90.0 (2286)	21.3 (541)	36.0 (914)	2.0 (51)	—	—	8.0 (203)	10.8 (273)	—	84.4 (2143)	4.0 (102)	—

Cable Entry		Door Clearance											Max. Approx. Shipping Weight		
L	M	N	P	R	S	T	U	V	W	RR	SS	TT	UU	VV	Lbs (kg)
15.0 (381)	10.0 (254)	4.8 (122)	2.0 (51)	—	36.3 (921)	20.0 (508)	—	—	—	94.0 (2387)	15.5 (394)	—	—	—	1275 (579)

Approximate Dimensions in Inches (mm)

**Size 6**



For reference only, dimensions are subject to change. See **Page V6-T2-145**, notes 3 and 5 for enclosure and option selection.

Wide	High	Deep	Mounting							Door Height	Min. Air Space	
A	B	C	D	D1	E	E1	F	G	G1	H	J	K
30.0 (762)	90.0 (2286)	26.0 (660)	26.5 (673)	1.8 (46)	—	—	17.3 (438)	5.5 (140)	—	84.4 (2143)	4.0 (102)	—

Cable Entry			Door Clearance										Max. Approx. Shipping Weight		
L	M	N	P	R	S	T	U	V	W	RR	SS	TT	UU	VV	Lbs (kg)
23.5 (597)	3.3 (84)	4.5 (114)	19.3 (490)	—	26.2 (667)	24.8 (629)	—	—	—	93.9 (2386)	—	—	—	—	1500 (681)



# 2.7

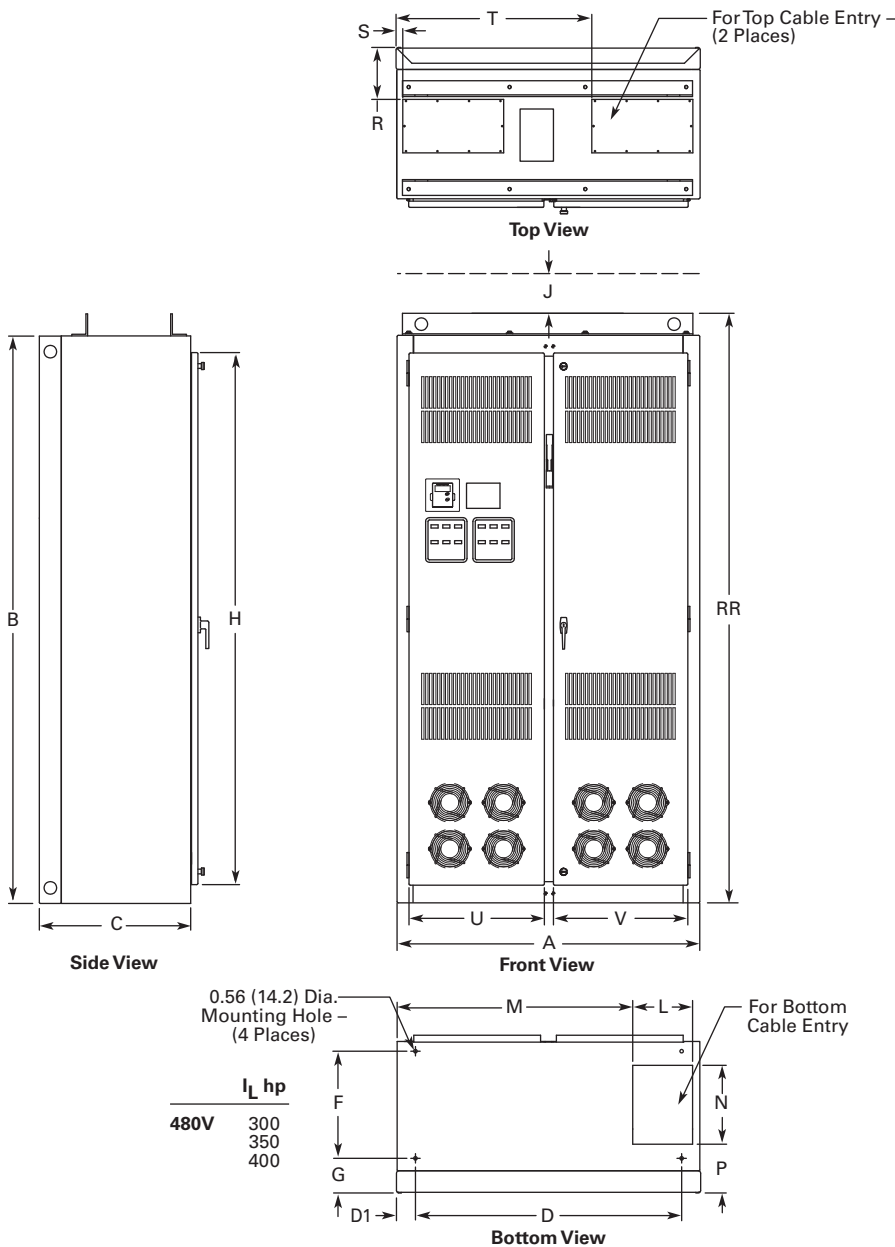
## Adjustable Frequency Drives

### SVX Drives

Approximate Dimensions in Inches (mm)

#### Size 8

2



For reference only, dimensions are subject to change. See **Page V6-T2-145**, notes 3 and 5 for enclosure and option selection.

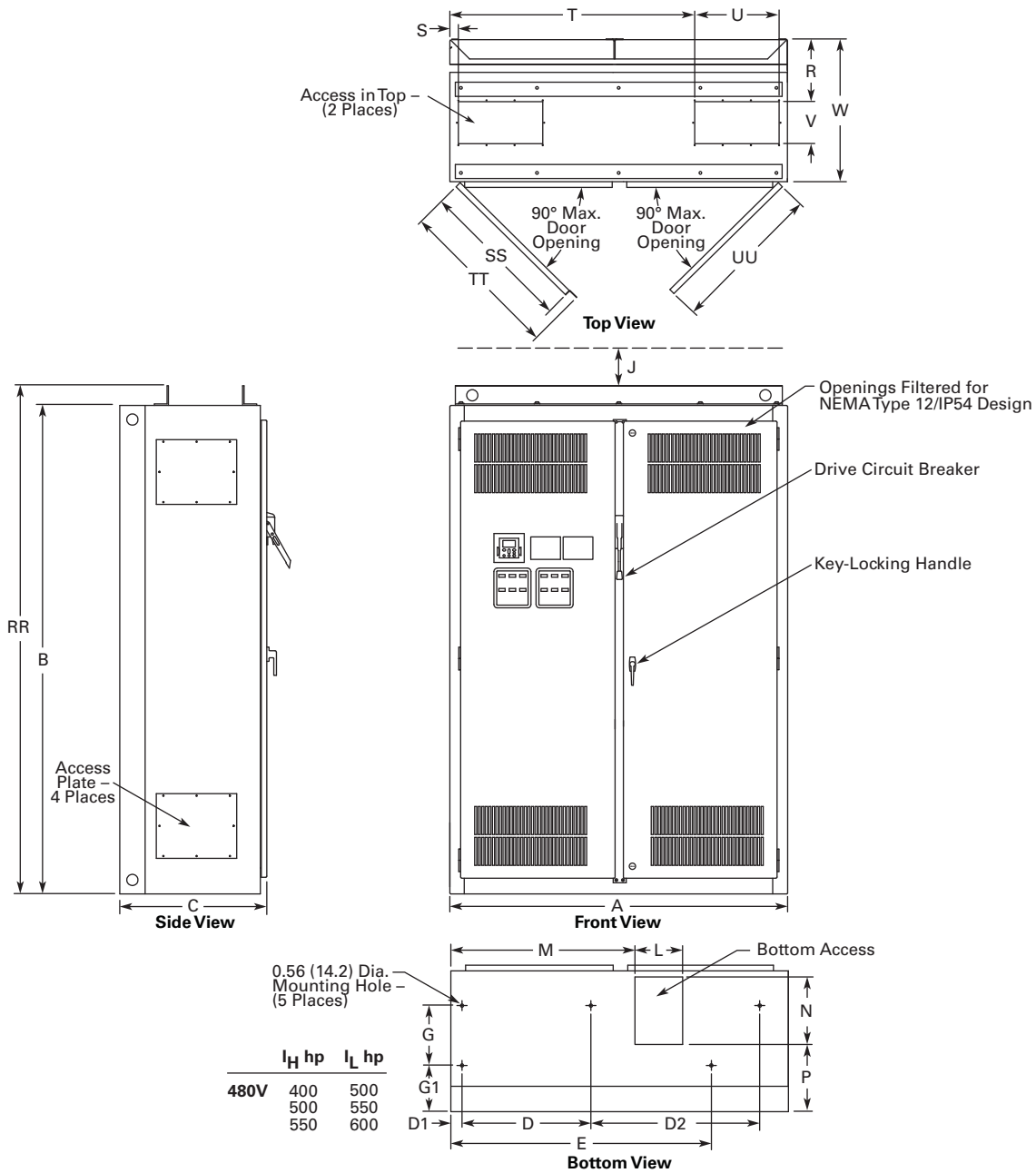
Wide A	High B	Deep C	Mounting D		D1	E	E1	F	G	G1	Door Height H	Min. Air Space J	K
48.0 (1219)	90.0 (2286)	24.0 (610)	42.2 (1072)	3.0 (77)	—	—	—	—	5.5 (139)	—	84.4 (2143)	4.0 (102)	—

Cable Entry														Max. Approx. Shipping Weight Lbs (kg)	
L	M	N	P	R	S	T	U	V	W	RR	SS	TT	UU	VV	
9.5 (241)	37.5 (952)	12.5 (318)	7.7 (196)	8.3 (210)	1.3 (32)	31.0 (787)	21.5 (545)	21.3 (541)	—	93.5 (2375)	—	—	—	—	2000 (908)

Approximate Dimensions in Inches (mm)

### Size 9



For reference only, dimensions are subject to change. See **Page V6-T2-145**, notes 3 and 5 for enclosure and option selection.

Wide A	High B	Deep C	Mounting D		D1	E	E1	F	G	G1	Door Height H	Min. Air Space J	K
60.0 (1524)	90.0 (2286)	26.1 (664)	22.9 (582)	2.0 (51)	30.0 (762)	44.3 (1125)	10.6 (270)	10.6 (270)	8.2 (208)	—	4.0 (102)	—	

Cable Entry															Max. Approx. Shipping Weight Lbs (kg)
L	M	N	P	R	S	T	U	V	W	RR	SS	TT	UU	VV	
8.5 (216)	32.7 (831)	12.0 (305)	11.9 (303)	9.8 (249)	1.5 (38)	43.5 (1105)	15.0 (381)	7.5 (191)	25.0 (635)	93.5 (2375)	27.4 (696)	290.1 (738)	270.1 (687)	—	2500 (1135)

# 2.7

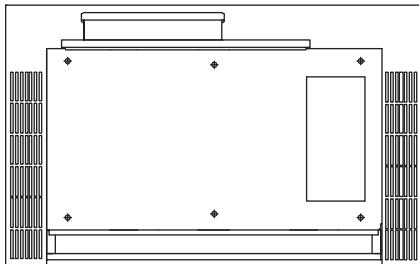
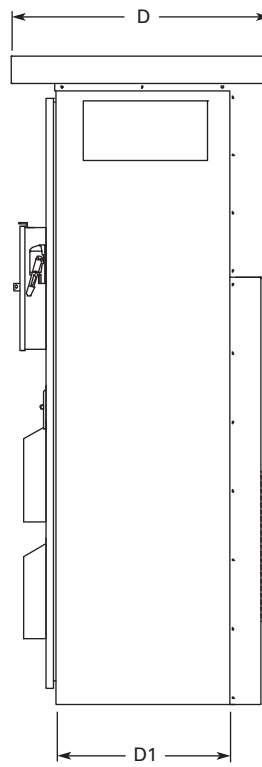
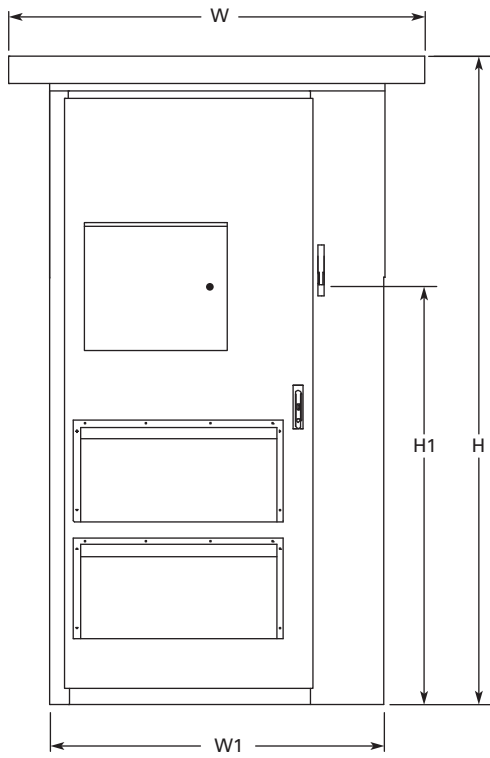
## Adjustable Frequency Drives

### SVX Drives

Approximate Dimensions in Inches (mm)

#### Enclosure Size F

2



H	H1	W	W1	D	D1	Approximate Weight Lbs (kg)	Approximate Shipping Weight Lbs (kg)
93.58 (2376.9)	69.51 (1765.60)	60.00 (1524.0)	48.00 (1219.2)	37.50 (952.5)	26.00 (660.4)	1700 (771)	1850 (839)

## DH1 HVAC/R Drive



## Contents

Description	Page
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Catalog Number Selection	V6-T2-176
Product Selection	V6-T2-177
Accessories	V6-T2-180
Replacement Parts	V6-T2-186
Technical Data and Specifications	V6-T2-188
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PowerXL DH1 Series Enclosed Drives	V6-T2-195

## PowerXL DH1 Series Drives

## Product Description

The DH1 HVAC/R drives are part of Eaton's next generation PowerXL Series of adjustable frequency drives specifically engineered for today's demanding HVAC/R market. The power unit makes use of the most sophisticated semiconductor technology and a highly modular construction that can be flexibly adapted to meet the customer's needs.

The control module was designed to include today's standard HVAC/R communication protocols and I/O while still having the modularity to add additional option cards.

Eaton's patented Active Energy Control is also a standard feature on DH1 drives, offering customers increased efficiency, safety and reliability.

These drives continue the tradition of robust performance and raise the bar on features and functionality, ensuring the best solution at the right price.

## Product Range

230 V to 125 hp, 312 A, 90 kW

480 V to 250 hp, 310 A, 160 kW

575 V to 250 hp, 250 A, 187 kW

## Features and Benefits

## Hardware

- Integrated common mode reduction 5% DC link choke with input surge protection
- Variable torque rated for HVAC/R demands
- 110% variable torque (IL)
- Type 1/IP21 and Type 12/IP54 enclosures available
- Real-time clock—supports calendaring and PLC functionality
- Graphic LCD display and keypad—supports simple menu navigation as well as on-screen diagnostics and troubleshooting
- AUTO operation from keypad and two configurable soft keys
- Conformal coated control and power boards standard

- Control logic can be powered from an external auxiliary control panel—internal drive functions and fieldbus if necessary
- Standard I/O:
  - 8DI, 1DO
  - 2AI, 2AO
  - 2FC, 1FA relays
- Standard communications:
  - BACnet/IP, Modbus TCP, Modbus RTU, BACnet MS/TP
- Two expansion slots—intended to support additional I/O or communication protocols as necessary
- Quick disconnect terminals for I/O connections—supports fast, easy installation

## Software

- Active Energy Control—minimizes energy losses in the motor, resulting in industry-leading energy efficiency for your application
- Energy savings calculator
- Quick Start Wizard upon initial power-up supports fast, easy installation
- Standard applications:
  - Standard
  - Multi-PID
  - Advanced
- Copy/paste functionality on drive keypad—allows for fast setup of multiple drives
- Pre-programmed I/O—supports fast, easy installation for most applications
- Dynamic motor regenerative energy management
- Advanced PC Tool with diagnostic capabilities
- Two keypad software keys for easy menu navigation and shortcuts

# 2.8

## Adjustable Frequency Drives

### PowerXL DH1 Series Drives

#### Standards and Certifications

##### Product

- IEC/EN 61800-5-1
- IEC/EN 61800-5-2
- UL 508C
- IEC 61508
- EN 62061
- EN ISO 13849-1

##### EMC

- Immunity: IEC/EN 61800-3
- Category C2

##### Certification

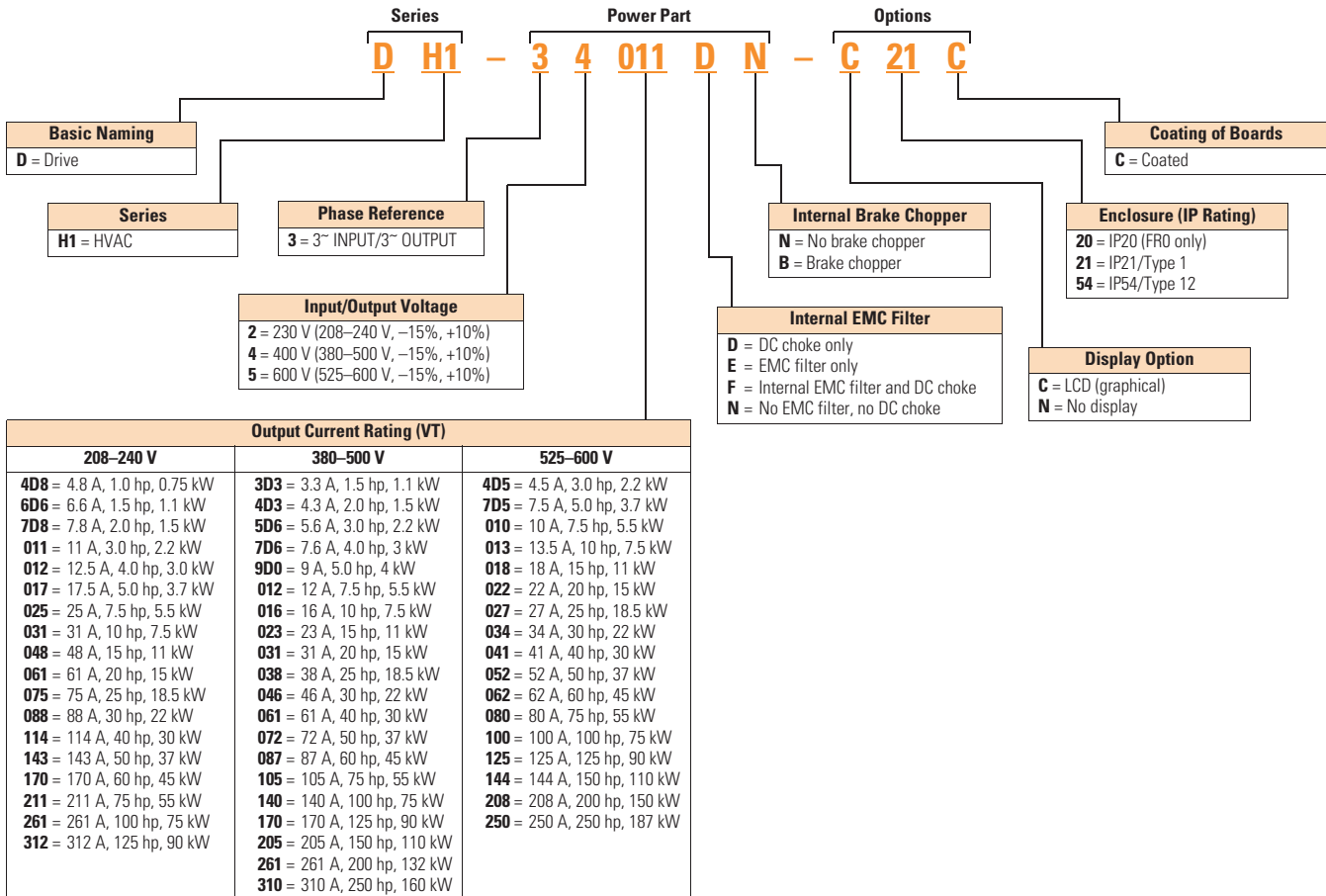
- UL
- cUL
- CE
- C-Tick
- RoHS
- Plenum rated



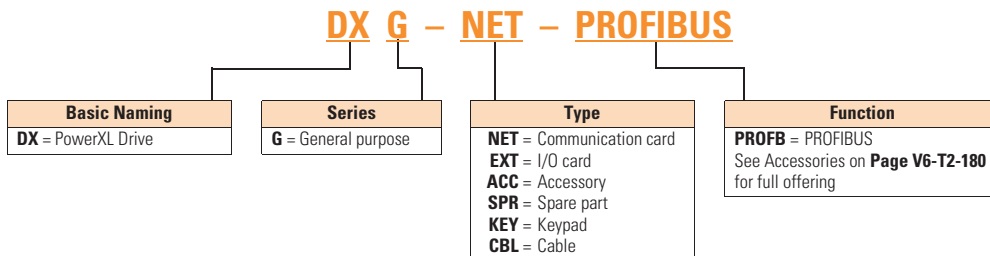
#### Catalog Number Selection

Catalog Number Selection is for illustrative purposes only and not to be used to create new catalog numbers.

#### PowerXL Series—DH1 HVAC/R Drive



#### PowerXL Series—DH1 HVAC/R Drive Option Boards



## Product Selection

## DH1 Series Drives—208–240 Volt

## PowerXL Series—DH1 Type 1/IP21



Frame Size	Variable Torque (VT) / Low Overload (I <sub>L</sub> )			Catalog Number
	230 V, 50 Hz kW Rating	230 V, 60 Hz hp	Current A	
FR0	0.75	1	4.8	DH1-324D8EB-C20C ①
	1.1	1.5	6.6	DH1-326D6EB-C20C ①
	1.5	2	7.8	DH1-327D8EB-C20C ①
FR1	0.75	1	4.8	DH1-324D8DN-C21C
	1.1	1.5	6.6	DH1-326D6DN-C21C
	1.5	2	7.8	DH1-327D8DN-C21C
	2.2	3	11	DH1-32011DN-C21C
	3	—	12.5	DH1-32012DN-C21C
FR2	3.7	5	17.5	DH1-32017DN-C21C
	5.5	7.5	25	DH1-32025DN-C21C
	7.5	10	31	DH1-32031DN-C21C
FR3	11	15	48	DH1-32048DN-C21C
	15	20	61	DH1-32061DN-C21C
FR4	18.5	25	75	DH1-32075DN-C21C
	22	30	88	DH1-32088DN-C21C
	30	40	114	DH1-32114DN-C21C
FR5	37	50	143	DH1-32143DN-C21C
	45	60	170	DH1-32170DN-C21C
	55	75	211	DH1-32211DN-C21C
FR6	75	100	261	DH1-32261FN-C21C
	90	125	312	DH1-32312FN-C21C

## PowerXL Series—DH1 Type 12/IP54



Frame Size	Variable Torque (VT) / Low Overload (I <sub>L</sub> )			Catalog Number
	230 V, 50 Hz kW Rating	230 V, 60 Hz hp	Current A	
FR1	0.75	1	4.8	DH1-324D8DN-C54C
	1.1	1.5	6.6	DH1-326D6DN-C54C
	1.5	2	7.8	DH1-327D8DN-C54C
	2.2	3	11	DH1-32011DN-C54C
	3	—	12.5	DH1-32012DN-C54C
FR2	3.7	5	17.5	DH1-32017DN-C54C
	5.5	7.5	25	DH1-32025DN-C54C
	7.5	10	31	DH1-32031DN-C54C
FR3	11	15	48	DH1-32048DN-C54C
	15	20	61	DH1-32061DN-C54C
FR4	18.5	25	75	DH1-32075DN-C54C
	22	30	88	DH1-32088DN-C54C
	30	40	114	DH1-32114DN-C54C
FR5	37	50	143	DH1-32143DN-C54C
	45	60	170	DH1-32170DN-C54C
	55	75	211	DH1-32211DN-C54C
FR6	75	100	261	DH1-32261FN-C54C
	90	125	312	DH1-32312FN-C54C

**Note**

① IP20 FR0 will be available in June 2018.

## DH1 Series Drives—380–500 Volt

2

## PowerXL Series—DH1 Type 1/IP21



Frame Size	Variable Torque (VT) / Low Overload (I <sub>L</sub> )			Catalog Number
	400 V, 50 Hz kW Rating	460 V, 60 Hz hp	Current A	
FR0	1.1	1.5	3.3	DH1-343D3EB-C20C ①
	1.5	2	4.6	DH1-344D3EB-C20C ①
	2.2	3	5.6	DH1-345D6EB-C20C ①
	3	5	7.6	DH1-347D6EB-C20C ①
FR1	1.1	1.5	3.3	DH1-343D3DN-C21C
	1.5	2	4.3	DH1-344D3DN-C21C
	2.2	3	5.6	DH1-345D6DN-C21C
	3	5	7.6	DH1-347D6DN-C21C
	4	—	9	DH1-349D0DN-C21C
FR2	5.5	7.5	12	DH1-34012DN-C21C
	7.5	10	16	DH1-34016DN-C21C
	11	15	23	DH1-34023DN-C21C
FR3	15	20	31	DH1-34031DN-C21C
	18.5	25	38	DH1-34038DN-C21C
	22	30	46	DH1-34046DN-C21C
FR4	30	40	61	DH1-34061DN-C21C
	37	50	72	DH1-34072DN-C21C
	45	60	87	DH1-34087DN-C21C
FR5	55	75	105	DH1-34105DN-C21C
	75	100	140	DH1-34140DN-C21C
	90	125	170	DH1-34170DN-C21C
FR6	110	150	205	DH1-34205DN-C21C
	132	200	261	DH1-34261FN-C21C
	160	250	310	DH1-34310FN-C21C

## PowerXL Series—DH1 Type 12/IP54



Frame Size	Variable Torque (VT) / Low Overload (I <sub>L</sub> )			Catalog Number
	400 V, 50 Hz kW Rating	460 V, 60 Hz hp	Current A	
FR1	1.1	1.5	3.3	DH1-343D3DN-C54C
	1.5	2	4.3	DH1-344D3DN-C54C
	2.2	3	5.6	DH1-345D6DN-C54C
	3	5	7.6	DH1-347D6DN-C54C
	4	—	9	DH1-349D0DN-C54C
FR2	5.5	7.5	12	DH1-34012DN-C54C
	7.5	10	16	DH1-34016DN-C54C
	11	15	23	DH1-34023DN-C54C
FR3	15	20	31	DH1-34031DN-C54C
	18.5	25	38	DH1-34038DN-C54C
	22	30	46	DH1-34046DN-C54C
FR4	30	40	61	DH1-34061DN-C54C
	37	50	72	DH1-34072DN-C54C
	45	60	87	DH1-34087DN-C54C
FR5	55	75	105	DH1-34105DN-C54C
	75	100	140	DH1-34140DN-C54C
	90	125	170	DH1-34170DN-C54C
FR6	110	150	205	DH1-34205DN-C54C
	132	200	261	DH1-34261FN-C54C
	160	250	310	DH1-34310FN-C54C

**Note**

① IP20 FR0 will be available in June 2018.

## DH1 Series Drives—575 Volt

## PowerXL Series—DH1 Type 1/IP21



Frame Size	Variable Torque (VT) / Low Overload (I <sub>L</sub> )			Catalog Number
	575 V, 60 Hz kW Rating	575 V, 60 Hz hp	Current A	
FR1	2.2	3	4.5	DH1-354D5FB-C21C
	3.7	5	7.5	DH1-357D5FB-C21C
	5.5	7.5	10	DH1-35010FB-C21C
FR2	7.5	10	13.5	DH1-35013FB-C21C
	11	15	18	DH1-35018FB-C21C
	15	20	22	DH1-35022FB-C21C
FR3	18.5	25	27	DH1-35027FB-C21C
	22	30	34	DH1-35034FB-C21C
	30	40	41	DH1-35041FB-C21C
FR4	37	50	52	DH1-35052FN-C21C
	45	60	62	DH1-35062FN-C21C
	55	75	80	DH1-35080FN-C21C
FR5	75	100	100	DH1-35100FN-C21C
	90	125	125	DH1-35125FN-C21C
	110	150	144	DH1-35144FN-C21C
FR6	150	200	208	DH1-35208FN-C21C
	187	250	250	DH1-35250FN-C21C

## PowerXL Series—DH1 Type 12/IP54



Frame Size	Variable Torque (VT) / Low Overload (I <sub>L</sub> )			Catalog Number
	575 V, 60 Hz kW Rating	575 V, 60 Hz hp	Current A	
FR1	2.2	3	4.5	DH1-354D5FB-C54C
	3.7	5	7.5	DH1-357D5FB-C54C
	5.5	7.5	10	DH1-35010FB-C54C
FR2	7.5	10	13.5	DH1-35013FB-C54C
	11	15	18	DH1-35018FB-C54C
	15	20	22	DH1-35022FB-C54C
FR3	18.5	25	27	DH1-35027FB-C54C
	22	30	34	DH1-35034FB-C54C
	30	40	41	DH1-35041FB-C54C
FR4	37	50	52	DH1-35052FN-C54C
	45	60	62	DH1-35062FN-C54C
	55	75	80	DH1-35080FN-C54C
FR5	75	100	100	DH1-35100FN-C54C
	90	125	125	DH1-35125FN-C54C
	110	150	144	DH1-35144FN-C54C
FR6	150	200	208	DH1-35208FN-C54C
	187	250	250	DH1-35250FN-C54C



### Accessories

The PowerXL Series—DH1 drives can accommodate a wide selection of expander and adapter option boards to customize the drive for your application needs. The drive's control unit is designed to accept a total of two additional option boards.

The PowerXL Series—DH1 drives come with a factory-installed standard board configuration including the following:

- Standard I/O:
  - 8DI, 1DO
  - 2AI, 2AO
  - 2FC, 1FA relays
- Standard communications:
  - BACnet MS/TP, BACnet/IP
  - Modbus TCP, Modbus RTU

### PowerXL Series—DH1 I/O Card Kits

Description	Catalog Number
3 x DI, 3 x DO, 1 x thermistor, 24 Vdc/EXT option card	<b>DXG-EXT-3DI3DO1T</b>
1 x AI, 2 x AO (isolated to control board) option card	<b>DXG-EXT-1AI2AO</b>
3 x relay dry contact (2NO + 1NO/NC) option card	<b>DXG-EXT-3RO</b>
3 x PT100 RTD thermistor input option card	<b>DXG-EXT-THER1</b>
6 x DI 240 Vac input option card	<b>DXG-EXT-6DI</b>

### PowerXL Series—DH1 Communication Card Kits

Description	Catalog Number
PROFIBUS-DP communication card	<b>DXG-NET-PROFB</b>
PROFIBUS DB9 to 5-pin adapter card	<b>DXG-NET-PROAD</b>

### PowerXL Series—DH1 Keypad Kits

Description	Catalog Number
Standard keypad	<b>DXH-KEY-LCD</b>
Remote keypad kit (IP 54 rated keypad holder and 3 m cable)	<b>DXG-KEY-RMTKIT</b>
1 m remote keypad cable	<b>DXG-CBL-1M0</b>
3 m remote keypad cable	<b>DXG-CBL-3M0</b>
Remote keypad mounting holder only	<b>DXG-KEY-HOLDER</b>
Type 12/IP54 keypad hole plug (maintain rating without keypad)	<b>DXG-KEY-N12PLUG</b>

### PowerXL Series—DH1 Conversion and Flange Kits

The Type 12/IP54 option kit is used to convert a Type 1/IP21 to a Type 12/IP54 drive. The kit includes cover, fan and grommets.

#### Type 12/IP54 Conversion Kits <sup>①</sup>

Description	Catalog Number
Frame 1 230 V Type 12/IP54 kit	<b>DXH-ACC-2FR1N12KIT</b>
Frame 1 480 V Type 12/IP54 kit	<b>DXH-ACC-4FR1N12KIT</b>
Frame 2 Type 12/IP54 kit	<b>DXH-ACC-FR2N12KIT</b>

The flange kit is used when the power section heat sink is mounted through the back panel of an enclosure. The kit includes hardware, top flange plate, bottom flange plate and two side flange plates.

#### Flange Kits

Description	Catalog Number
Frame 1 flange kit Type 12/IP54	<b>DXG-ACC-FR1N12FK</b>
Frame 2 flange kit Type 12/IP54	<b>DXG-ACC-FR2N12FK</b>
Frame 3 flange kit Type 12/IP54	<b>DXG-ACC-FR3N12FK</b>
Frame 4 flange kit Type 12/IP54	<b>DXG-ACC-FR4N12FK</b>
Frame 5 flange kit Type 12/IP54	<b>DXG-ACC-FR5N12FK</b>
Frame 6 flange kit Type 12/IP54	<b>DXG-ACC-FR6N12FK</b>

### PowerXL Series—DH1 Demo Unit

#### Demo Unit

Description	Catalog Number
DH1 control module demo stand	<b>DH1-DEMO1</b>

#### Note

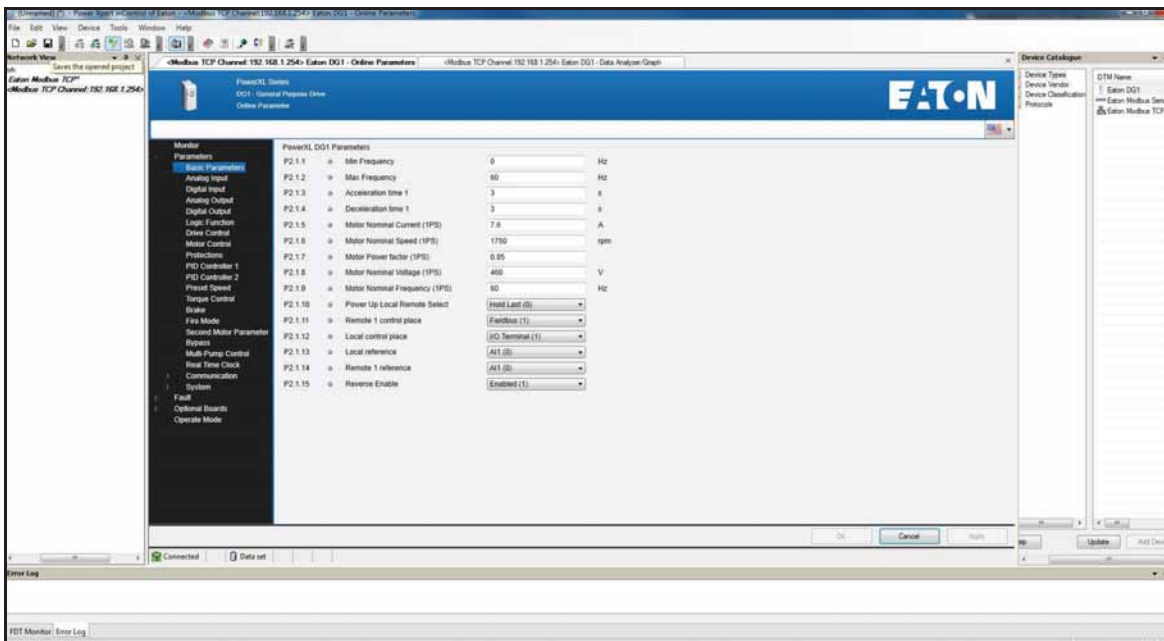
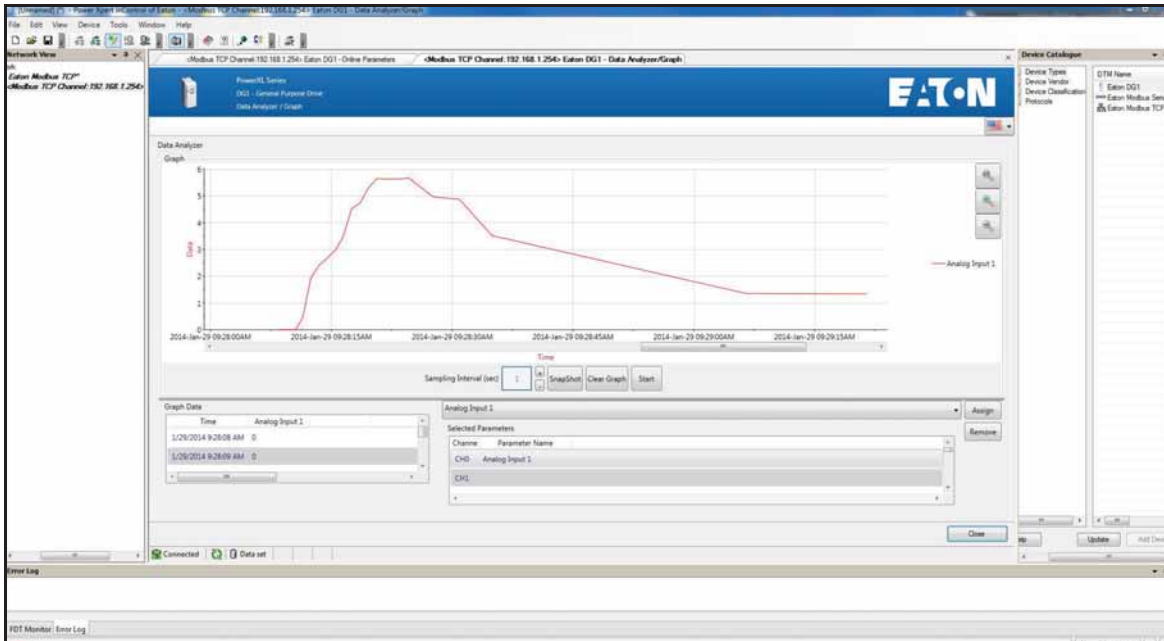
<sup>①</sup> NEMA 12 DH1 drives from W34 are available within 3 business days.

## Power Xpert *inControl* Software

The PowerXL Series PC Tool is designed for programming, controlling and monitoring of the DH1 drives. Features include loading parameters that can be saved to a file or printed, setting references, starting and stopping the motor, monitoring signals in graphical or text form, and real-time display.

### PowerXpert *inControl* Software

Description	Catalog Number
Software cable (USB to keypad [RJ45])	<b>DXG-CBL-PCCABLE</b>
Real-time clock battery (approximately 10,000 hours life)	<b>DXG-ACC-RTBATT</b>



# 2.8

## Adjustable Frequency Drives

### PowerXL DH1 Series Drives

2

#### Brake Chopper Options

The brake chopper circuit option is used for applications that require dynamic braking. Dynamic braking resistors are not included with drive purchase. Consult the factory for additional dynamic braking resistor selections that are supplied separately. A list of common resistors are listed below and are complete indoor assemblies, include a pre-wired terminal block and a thermal switch, and are not UL Listed.

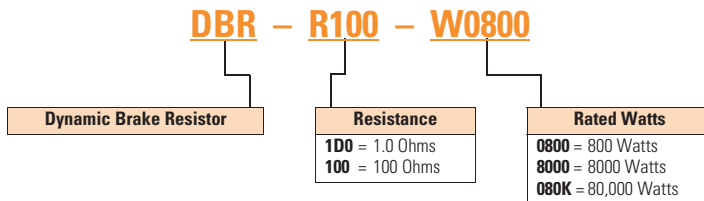
#### Duty Cycle

The duty cycle rating is based on a 60-second period. For example, the 20% duty cycle resistor can carry 100% current for 12 seconds out of every 60 seconds, while the 50% duty cycle resistor can carry 150% current for 30 seconds out of every 60 seconds.

#### Torque

If the braking torque required is less than 15%, dynamic braking is not required because the regenerated energy will be dissipated in the drive and motor losses.

#### Dynamic Brake Resistor—Catalog Number Selection



#### 230 V Brake Resistors

Drive hp (CT/Hz)	Minimum Ohms	20% Duty Cycle, 100% Torque		50% Duty Cycle, 150% Torque	
		Catalog Number	Dimensions	Catalog Number	Dimensions
0.75	15.0	<b>DBR-R100-W0400</b>	12W x 5D x 5H	<b>DBR-R100-W0800</b>	12W x 7D x 5H
1	15.0	<b>DBR-R100-W0400</b>	12W x 5D x 5H	<b>DBR-R100-W0800</b>	12W x 7D x 5H
1.5	15.0	<b>DBR-R100-W0400</b>	12W x 5D x 5H	<b>DBR-R036-W1200</b>	12W x 10D x 5H
2	15.0	<b>DBR-R100-W0400</b>	12W x 5D x 5H	<b>DBR-R036-W1200</b>	12W x 10D x 5H
3	15.0	<b>DBR-R036-W0800</b>	12W x 7D x 5H	<b>DBR-R036-W2000</b>	12W x 16D x 5H
4	9.0	<b>DBR-R036-W0800</b>	12W x 7D x 5H	<b>DBR-R012-W2400</b>	19W x 10D x 5H
5	9.0	<b>DBR-R036-W0800</b>	12W x 7D x 5H	<b>DBR-R020-W2800</b>	19W x 13D x 5H
7.5	9.0	<b>DBR-R020-W1200</b>	12W x 10D x 5H	<b>DBR-R012-W4800</b>	26.5W x 10D x 5H
10	7.0	<b>DBR-R015-W1600</b>	12W x 13D x 5H	<b>DBR-R112-W6000</b>	26.5W x 13D x 5H
15	7.0	<b>DBR-R012-W2400</b>	19W x 10D x 5H	<b>DBR-R7D8-W9000</b>	28W x 10D x 10H
20	2.0	<b>DBR-R9D3-W3200</b>	19W x 10D x 5H	<b>DBR-R3D4-W012K</b>	28W x 10D x 10H
25	2.0	<b>DBR-R5D5-W4000</b>	26.5W x 10D x 5H	<b>DBR-R5D1-W015K</b>	28W x 16D x 10H
30	2.0	<b>DBR-R4D8-W4800</b>	26.5W x 10D x 5H	<b>DBR-R4D1-W020K</b>	28W x 16D x 10H
40	2.0	<b>DBR-R004-W6000</b>	26.5W x 13D x 5H	<b>DBR-R3D4-W025K</b>	30W x 18D x 16H
50	2.0	<b>DBR-R3D1-W7500</b>	26.5W x 16D x 5H	<b>DBR-R2D1-W030K</b>	30W x 18D x 24H
60	2.0	<b>DBR-R2D8-W9000</b>	26.5W x 16D x 5H	<b>DBR-R002-W036K</b>	30W x 18D x 24H
75	2.0	<b>DBR-R2D6-W012K</b>	28W x 10D x 10H	<b>DBR-R002-W045K</b>	30W x 18D x 32H
100	2.0	<b>DBR-R002-W015K</b>	28W x 16D x 10H	<b>DBR-R002-W060K</b>	30W x 18D x 48H

## 480 V Brake Resistors

Drive hp (CT/1 <sub>H</sub> )	Minimum Ohms	20% Duty Cycle, 100% Torque	
		Catalog Number	Dimensions
1	36.0	<b>DBR-R100-W0400</b>	12W x 5D x 5H
1.5	36.0	<b>DBR-R100-W0400</b>	12W x 5D x 5H
2	36.0	<b>DBR-R100-W0400</b>	12W x 5D x 5H
3	36.0	<b>DBR-R100-W0800</b>	12W x 7D x 5H
5	36.0	<b>DBR-R100-W0800</b>	12W x 7D x 5H
6	36.0	<b>DBR-R100-W1200</b>	12W x 10D x 5H
7.5	18.0	<b>DBR-R100-W1200</b>	12W x 10D x 5H
10	18.0	<b>DBR-R063-W1600</b>	12W x 13D x 5H
15	18.0	<b>DBR-R030-W2400</b>	19W x 10D x 5H
20	13.0	<b>DBR-R030-W3200</b>	19W x 13D x 5H
25	13.0	<b>DBR-R030-W4000</b>	19W x 16D x 5H
30	13.0	<b>DBR-R020-W4800</b>	26.5W x 13D x 5H
40	2.0	<b>DBR-R112-W6000</b>	26.5W x 13D x 5H
50	2.0	<b>DBR-R013-W7500</b>	26.5W x 16D x 5H
60	2.0	<b>DBR-R010-W9000</b>	28W x 10D x 10H
75	2.0	<b>DBR-R009-W012K</b>	28W x 13D x 10H
100	2.0	<b>DBR-R5D1-W015K</b>	28W x 16D x 10H
125	2.0	<b>DBR-R4D1-W020K</b>	28W x 16D x 10H
150	2.0	<b>DBR-R3D4-W025K</b>	30W x 18D x 16H
200	2.0	<b>DBR-R3D3-W030K</b>	30W x 18D x 24H

50% Duty Cycle, 150% Torque	
Catalog Number	Dimensions
<b>DBR-R100-W0800</b>	12W x 7D x 5H
<b>DBR-R100-W1200</b>	12W x 10D x 5H
<b>DBR-R100-W1200</b>	12W x 10D x 5H
<b>DBR-R100-W2000</b>	12W x 16D x 5H
<b>DBR-R100-W2800</b>	19W x 13D x 5H
<b>DBR-R070-W4000</b>	19W x 16D x 5H
<b>DBR-R020-W4800</b>	26.5W x 13D x 5H
<b>DBR-R030-W6000</b>	26.5W x 16D x 5H
<b>DBR-R030-W9000</b>	28W x 10D x 10H
<b>DBR-R023-W012K</b>	28W x 13D x 10H
<b>DBR-R013-W015K</b>	28W x 16D x 10H
<b>DBR-R014-W020K</b>	30W x 18D x 24H
<b>DBR-R007-W025K</b>	30W x 18D x 16H
<b>DBR-R8D5-W030K</b>	30W x 18D x 24H
<b>DBR-R7D3-W036K</b>	30W x 18D x 24H
<b>DBR-R002-W045K</b>	30W x 18D x 32H
<b>DBR-R004-W060K</b>	30W x 18D x 40H
<b>DBR-R004-W070K</b>	30W x 18D x 48H
<b>DBR-R3D5-W085K</b>	30W x 18D x 56H
<b>DBR-R2D6-W110K</b>	30W x 18D x 64H

## 575 V Brake Resistors

Drive hp (CT/1 <sub>H</sub> )	Minimum Ohms	20% Duty Cycle, 100% Torque	
		Catalog Number	Dimensions
2	100.0	<b>DBR-R100-W0400</b>	12W x 5D x 5H
3	100.0	<b>DBR-R100-W0800</b>	12W x 7D x 5H
4	100.0	<b>DBR-R100-W0800</b>	12W x 7D x 5H
5	100.0	<b>DBR-R100-W0800</b>	12W x 7D x 5H
7.5	100.0	<b>DBR-R100-W1200</b>	12W x 10D x 5H
10	30.0	<b>DBR-R063-W1600</b>	12W x 13D x 5H
15	30.0	<b>DBR-R042-W2400</b>	19W x 10D x 5H
20	30.0	<b>DBR-R030-W3200</b>	19W x 13D x 5H
25	30.0	<b>DBR-R030-W4000</b>	19W x 16D x 5H
30	18.0	<b>DBR-R020-W4800</b>	26.5W x 13D x 5H
40	18.0	<b>DBR-R030-W6000</b>	26.5W x 16D x 5H
50	9.0	<b>DBR-R013-W7500</b>	26.5W x 16D x 5H
60	9.0	<b>DBR-R010-W9000</b>	28W x 10D x 10H
75	9.0	<b>DBR-R009-W012K</b>	28W x 13D x 10H
100	7.0	<b>DBR-R013-W015K</b>	28W x 16D x 10H
125	7.0	<b>DBR-R8D2-W020K</b>	30W x 18D x 10H
150	7.0	<b>DBR-R007-W025K</b>	30W x 18D x 16H
200	2.5	<b>DBR-R3D3-W030K</b>	30W x 18D x 24H

50% Duty Cycle, 150% Torque	
Catalog Number	Dimensions
<b>DBR-R100-W1200</b>	12W x 10D x 5H
<b>DBR-R100-W2000</b>	12W x 16D x 5H
<b>DBR-R100-W2400</b>	19W x 10D x 5H
<b>DBR-R100-W2800</b>	19W x 13D x 5H
<b>DBR-R100-W4800</b>	26.5W x 13D x 5H
<b>DBR-R063-W6000</b>	26.5W x 16D x 5H
<b>DBR-R042-W9000</b>	28W x 10D x 10H
<b>DBR-R030-W012K</b>	28W x 13D x 10H
<b>DBR-R030-W015K</b>	28W x 16D x 10H
<b>DBR-R020-W020K</b>	30W x 18D x 16H
<b>DBR-R184-W025K</b>	30W x 18D x 16H
<b>DBR-R012-W030K</b>	30W x 18D x 24H
<b>DBR-R010-W036K</b>	30W x 18D x 24H
<b>DBR-R009-W045K</b>	30W x 18D x 24H
<b>DBR-R8D4-W060K</b>	30W x 18D x 40H
<b>DBR-R007-W070K</b>	30W x 18D x 40H
<b>DBR-R006-W085K</b>	30W x 18D x 56H
<b>DBR-R2D6-W110K</b>	30W x 18D x 64H

# 2.8

## Adjustable Frequency Drives

### PowerXL DH1 Series Drives

2

#### Line and Load Reactors

A line and load reactor is a three-phase inductance filter that can be placed on the line and load side of the AFD to help improve the harmonic performance of the system. Consult the factory for additional filtering options and further technical details.

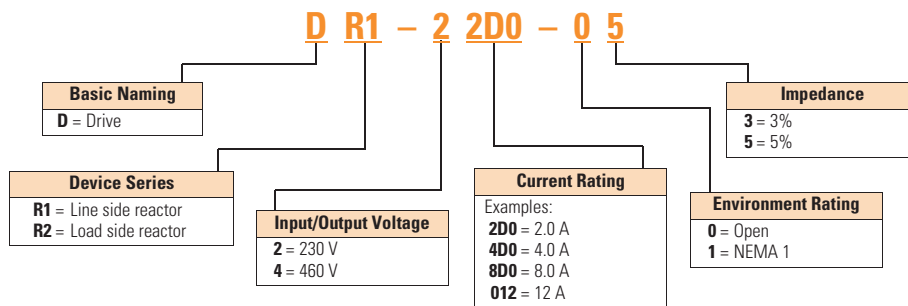
#### DR1 Line Reactor

A line reactor helps to provide a moderate reduction in current harmonics similar to a DC choke. It also provides increased input protection for AFD and its semiconductors from line transients helping to extend the life of the AFD.

#### DR2 Output Reactor

An output filter is used to reduce the transient voltage (dV/dt) at the motor terminals. The output filter is recommended for cable lengths exceeding 100 ft (30 m) with a drive of 3 hp and above and for cable lengths of 33 ft (10 m) with a drive of 2 hp and below.

#### Line and Load Reactors—Catalog Number Selection



#### Line and Load Reactors—230 V

hp (CT)	Open Line Reactor		Load Reactor		NEMA 1 Line Reactor		Load Reactor	
	3%	5%	3%	5%	3%	5%	3%	5%
0.75	DR1-23D2-03	DR1-23D2-05	DR2-24D0-03	DR2-24D0-05	DR1-23D2-13	DR1-23D2-15	DR2-24D0-13	DR2-24D0-15
1	DR1-24D2-03	DR1-24D2-05	DR2-24D0-03	DR2-28D0-05	DR1-24D2-13	DR1-24D2-15	DR2-24D0-13	DR2-28D0-15
1.5	DR1-26D0-03	DR1-26D0-05	DR2-28D0-03	DR2-28D0-05	DR1-26D0-13	DR1-26D0-15	DR2-28D0-13	DR2-28D0-15
2	DR1-26D8-03	DR1-26D8-05	DR2-28D0-03	DR2-28D0-05	DR1-26D8-13	DR1-26D8-15	DR2-28D0-13	DR2-28D0-15
3	DR1-29D6-03	DR1-29D6-05	DR2-2012-03	DR2-2012-05	DR1-29D6-13	DR1-29D6-15	DR2-2012-13	DR2-2012-15
5	DR1-2015-03	DR1-2015-05	DR2-2018-03	DR2-2018-05	DR1-2015-13	DR1-2015-15	DR2-2018-13	DR2-2018-15
7.5	DR1-2022-03	DR1-2022-05	DR2-2025-03	DR2-2025-05	DR1-2022-13	DR1-2022-15	DR2-2025-13	DR2-2025-15
10	DR1-2028-03	DR1-2028-05	DR2-2035-03	DR2-2035-05	DR1-2028-13	DR1-2028-15	DR2-2035-13	DR2-2035-15
15	DR1-2042-03	DR1-2042-05	DR2-2045-03	DR2-2045-05	DR1-2042-13	DR1-2042-15	DR2-2045-13	DR2-2045-15
20	DR1-2054-03	DR1-2054-05	DR2-2055-03	DR2-2055-05	DR1-2054-13	DR1-2054-15	DR2-2055-13	DR2-2055-15
25	DR1-2068-03	DR1-2068-05	DR2-2080-03	DR2-2080-05	DR1-2068-13	DR1-2068-15	DR2-2080-13	DR2-2080-15
30	DR1-2080-03	DR1-2080-05	DR2-2080-03	DR2-2100-05	DR1-2080-13	DR1-2080-15	DR2-2080-13	DR2-2100-15
40	DR1-2104-03	DR1-2104-05	DR2-2100-03	DR2-2100-05	DR1-2104-13	DR1-2104-15	DR2-2100-13	DR2-2100-15
50	DR1-2130-03	DR1-2130-05	DR2-2130-03	DR2-2130-05	DR1-2130-13	DR1-2130-15	DR2-2130-13	DR2-2130-15
60	DR1-2154-03	DR1-2154-05	DR2-2160-03	DR2-2200-15	DR1-2154-13	DR1-2154-15	DR2-2160-13	DR2-2200-15
75	DR1-2192-03	DR1-2192-05	DR2-2200-13	DR2-2200-15	DR1-2192-13	DR1-2192-15	DR2-2200-13	DR2-2200-15
100	DR1-2248-03	DR1-2248-05	DR2-2225-13	DR2-2225-15	DR1-2248-13	DR1-2248-15	DR2-2225-13	DR2-2225-15

## Line and Load Reactors—480 V

hp (CT)	Open				NEMA 1			
	Line Reactor		Load Reactor		Line Reactor		Load Reactor	
	3%	5%	3%	5%	3%	5%	3%	5%
1	DR1-42D1-03	DR1-42D1-05	DR2-42D0-05	DR2-42D0-05	DR1-42D1-13	DR1-42D1-15	DR2-42D0-13	DR2-42D0-15
1.5	DR1-43D0-03	DR1-43D0-05	DR2-44D0-05	DR2-44D0-05	DR1-43D0-13	DR1-43D0-15	DR2-44D0-13	DR2-44D0-15
2	DR1-43D4-03	DR1-43D4-05	DR2-44D0-03	DR2-44D0-05	DR1-43D4-13	DR1-43D4-15	DR2-44D0-13	DR2-44D0-15
3	DR1-44D8-03	DR1-44D8-05	DR2-48D0-03	DR2-48D0-05	DR1-44D8-13	DR1-44D8-15	DR2-48D0-13	DR2-48D0-15
5	DR1-47D6-03	DR1-47D6-05	DR2-48D0-03	DR2-48D0-05	DR1-47D6-13	DR1-47D6-15	DR2-48D0-13	DR2-48D0-15
7.5	DR1-4011-03	DR1-4011-05	DR2-4012-03	DR2-4012-05	DR1-4011-13	DR1-4011-15	DR2-4012-13	DR2-4012-15
10	DR1-4014-03	DR1-4014-05	DR2-4018-03	DR2-4018-05	DR1-4014-13	DR1-4014-15	DR2-4018-13	DR2-4018-15
15	DR1-4021-03	DR1-4021-05	DR2-4025-03	DR2-4025-05	DR1-4021-13	DR1-4021-15	DR2-4025-13	DR2-4025-15
20	DR1-4027-03	DR1-4027-05	DR2-4025-03	DR2-4025-05	DR1-4027-13	DR1-4027-15	DR2-4025-13	DR2-4025-15
25	DR1-4034-03	DR1-4034-05	DR2-4035-03	DR2-4035-05	DR1-4034-13	DR1-4034-15	DR2-4035-13	DR2-4035-15
30	DR1-4040-03	DR1-4040-05	DR2-4045-03	DR2-4045-05	DR1-4040-13	DR1-4040-15	DR2-4045-13	DR2-4045-15
40	DR1-4052-03	DR1-4052-05	DR2-4055-03	DR2-4055-05	DR1-4052-13	DR1-4052-15	DR2-4055-13	DR2-4055-15
50	DR1-4065-03	DR1-4065-05	DR2-4080-03	DR2-4080-05	DR1-4065-13	DR1-4065-15	DR2-4080-13	DR2-4080-15
60	DR1-4077-03	DR1-4077-05	DR2-4100-03	DR2-4080-05	DR1-4077-13	DR1-4077-15	DR2-4100-13	DR2-4080-15
75	DR1-4096-03	DR1-4096-05	DR2-4100-03	DR2-4100-05	DR1-4096-13	DR1-4096-15	DR2-4100-13	DR2-4100-15
100	DR1-4124-03	DR1-4124-05	DR2-4130-03	DR2-4130-05	DR1-4124-13	DR1-4124-15	DR2-4130-13	DR2-4130-15
125	DR1-4156-03	DR1-4156-05	DR2-4160-03	DR2-4160-05	DR1-4156-13	DR1-4156-15	DR2-4160-13	DR2-4160-15
150	DR1-4180-03	DR1-4180-05	DR2-4200-13	DR2-4200-15	DR1-4180-13	DR1-4180-15	DR2-4200-13	DR2-4200-15
200	DR1-4240-03	DR1-4240-05	DR2-4250-13	DR2-4250-15	DR1-4240-13	DR1-4240-15	DR2-4250-13	DR2-4250-15

## Line and Load Reactors—575 V

hp (CT)	Open				NEMA 1			
	Line Reactor		Load Reactor		Line Reactor		Load Reactor	
	3%	5%	3%	5%	3%	5%	3%	5%
2	DR1-52D7-03	DR1-52D7-05	DR2-54D0-03	DR2-54D0-05	DR1-52D7-13	DR1-52D7-15	DR2-54D0-13	DR2-54D0-15
3	DR1-53D9-03	DR1-53D9-05	DR2-54D0-03	DR2-54D0-05	DR1-53D9-13	DR1-53D9-15	DR2-54D0-13	DR2-54D0-15
5	DR1-56D1-03	DR1-56D1-05	DR2-58D0-03	DR2-58D0-05	DR1-56D1-13	DR1-56D1-15	DR2-58D0-13	DR2-58D0-15
7.5	DR1-59D0-03	DR1-59D0-05	DR2-58D0-03	DR2-58D0-05	DR1-59D0-13	DR1-59D0-15	DR2-58D0-13	DR2-58D0-15
10	DR1-5011-03	DR1-5011-05	DR2-5012-03	DR2-5012-05	DR1-5011-13	DR1-5011-15	DR2-5012-13	DR2-5012-15
15	DR1-5017-03	DR1-5017-05	DR2-5018-03	DR2-5018-05	DR1-5017-13	DR1-5017-15	DR2-5018-13	DR2-5018-15
20	DR1-5022-03	DR1-5022-05	DR2-5025-03	DR2-5025-05	DR1-5022-13	DR1-5022-15	DR2-5025-13	DR2-5025-15
25	DR1-5027-03	DR1-5027-05	DR2-5025-03	DR2-5025-05	DR1-5027-13	DR1-5027-15	DR2-5025-13	DR2-5025-15
30	DR1-5032-03	DR1-5032-05	DR2-5035-03	DR2-5035-05	DR1-5032-13	DR1-5032-15	DR2-5035-13	DR2-5035-15
40	DR1-5041-03	DR1-5041-05	DR2-5045-03	DR2-5045-05	DR1-5041-13	DR1-5041-15	DR2-5045-13	DR2-5045-15
50	DR1-5052-03	DR1-5052-05	DR2-5055-03	DR2-5055-05	DR1-5052-13	DR1-5052-15	DR2-5055-13	DR2-5055-15
60	DR1-5062-03	DR1-5062-05	DR2-5080-03	DR2-5080-05	DR1-5062-13	DR1-5062-15	DR2-5080-13	DR2-5080-15
75	DR1-5077-03	DR1-5077-05	DR2-5080-03	DR2-5080-05	DR1-5077-13	DR1-5077-15	DR2-5080-13	DR2-5080-15
100	DR1-5100-03	DR1-5100-05	DR2-5100-03	DR2-5100-05	DR1-5100-13	DR1-5100-15	DR2-5100-13	DR2-5100-15
125	DR1-5125-03	DR1-5125-05	DR2-5130-03	DR2-5130-05	DR1-5125-13	DR1-5125-15	DR2-5130-13	DR2-5130-15
150	DR1-5144-03	DR1-5144-05	DR2-5160-03	DR2-5160-05	DR1-5144-13	DR1-5144-15	DR2-5160-13	DR2-5160-15
200	DR1-5192-03	DR1-5192-05	DR2-5200-13	DR2-5200-15	DR1-5192-13	DR1-5192-15	DR2-5200-13	DR2-5200-15

## Replacement Parts

## 2

## Frame 1

Description	230 V	480 V	600 V
	Catalog Number	Catalog Number	Catalog Number
Standard keypad	DXH-KEY-LCD	DXH-KEY-LCD	DXH-KEY-LCD
Control module kit with keypad	DXH-SPR-CTRLKIT	DXH-SPR-CTRLKIT	DXH-SPR-CTRLKIT
Control module kit without keypad	DXH-SPR-CTRLBOARD	DXH-SPR-CTRLBOARD	DXH-SPR-CTRLBOARD
Software kit (software, cable, manual)	DXH-ACC-SOFTWARE	DXH-ACC-SOFTWARE	DXH-ACC-SOFTWARE
Type 1/IP21 standard cover	DXH-SPR-FR1CVR	DXH-SPR-FR1CVR	DXH-SPR-FR1CVR
EMI board	DXH-SPR-2FR1EB	DXH-SPR-4FR1EB	DXG-SPR-5FR1EB
Type 12/IP54 kit	DXH-ACC-2FR1N12KIT	DXH-ACC-4FR1N12KIT	DXH-ACC-4FR1N12KIT
Main power board	DXH-SPR-2FR1MPB	DXH-SPR-4FR1MPB	DXG-SPR-5FR1MPB

## Frame 2

Description	230 V	480 V	600 V
	Catalog Number	Catalog Number	Catalog Number
Standard keypad	DXH-KEY-LCD	DXH-KEY-LCD	DXH-KEY-LCD
Control module kit with keypad	DXH-SPR-CTRLKIT	DXH-SPR-CTRLKIT	DXH-SPR-CTRLKIT
Control module kit without keypad	DXH-SPR-CTRLBOARD	DXH-SPR-CTRLBOARD	DXH-SPR-CTRLBOARD
Software kit (software, cable, manual)	DXH-ACC-SOFTWARE	DXH-ACC-SOFTWARE	DXH-ACC-SOFTWARE
Type 1/IP21 standard cover	DXH-SPR-FR2CVR	DXH-SPR-FR2CVR	DXH-SPR-FR2CVR
EMI board	DXH-SPR-2FR2EB	DXH-SPR-4FR2EB	DXG-SPR-5FR2EB
Type 12/IP54 kit	DXH-ACC-FR2N12KIT	DXH-ACC-FR2N12KIT	DXH-ACC-FR2N12KIT
Main power board	DXH-SPR-2FR2MPB	DXH-SPR-4FR2MPB	DXG-SPR-5FR2MPB

## Frame 3

Description	230 V	480 V	600 V
	Catalog Number	Catalog Number	Catalog Number
Standard keypad	DXH-KEY-LCD	DXH-KEY-LCD	DXH-KEY-LCD
Control module kit with keypad	DXH-SPR-CTRLKIT	DXH-SPR-CTRLKIT	DXH-SPR-CTRLKIT
Control module kit without keypad	DXH-SPR-CTRLBOARD	DXH-SPR-CTRLBOARD	DXH-SPR-CTRLBOARD
Software kit (software, cable, manual)	DXH-ACC-SOFTWARE	DXH-ACC-SOFTWARE	DXH-ACC-SOFTWARE
Type 1/IP21 standard cover	DXH-SPR-FR3CVR	DXH-SPR-FR3CVR	DXH-SPR-FR3CVR
EMI board	DXH-SPR-2FR3EB	DXH-SPR-4FR3EB	DXG-SPR-5FR3EB
Drive board	DXH-SPR-2FR3DB	DXH-SPR-4FR3DB	DXG-SPR-5FR3DB
Main power board	DXG-SPR-2FR3MPB	DXG-SPR-4FR3MPB	DXG-SPR-5FR3MPB

**Note**

① Factory recommended spare parts.

**Frame 4**

Description	230 V	480 V	600 V
	Catalog Number	Catalog Number	Catalog Number
Standard keypad	<b>DXH-KEY-LCD</b>	<b>DXH-KEY-LCD</b>	<b>DXH-KEY-LCD</b>
Control module kit with keypad	<b>DXH-SPR-CTRLKIT</b>	<b>DXH-SPR-CTRLKIT</b>	<b>DXH-SPR-CTRLKIT</b>
Control module kit without keypad	<b>DXH-SPR-CTRLBOARD</b>	<b>DXH-SPR-CTRLBOARD</b>	<b>DXH-SPR-CTRLBOARD</b>
Software kit (software, cable, manual)	<b>DXH-ACC-SOFTWARE</b>	<b>DXH-ACC-SOFTWARE</b>	<b>DXH-ACC-SOFTWARE</b>
Type 1/IP21 standard cover	<b>DXH-SPR-FR4CVR</b>	<b>DXH-SPR-FR4CVR</b>	<b>DXH-SPR-FR4CVR</b>
EMI board	<b>DXG-SPR-2FR4EB</b>	<b>DXG-SPR-4FR4EB</b>	<b>DXG-SPR-5FR4EB</b>
Softstart board	<b>DXH-SPR-2FR4SB</b>	<b>DXH-SPR-4FR4SB</b>	<b>DXG-SPR-5FR4SB</b>
Main power board	<b>DXH-SPR-2FR4MPB</b>	<b>DXH-SPR-4FR4MPB</b>	<b>DXG-SPR-5FR4MPB</b>

**Frame 5**

Description	230 V	480 V	600 V
	Catalog Number	Catalog Number	Catalog Number
Standard keypad	<b>DXH-KEY-LCD</b>	<b>DXH-KEY-LCD</b>	<b>DXH-KEY-LCD</b>
Control module kit with keypad	<b>DXH-SPR-CTRLKIT</b>	<b>DXH-SPR-CTRLKIT</b>	<b>DXH-SPR-CTRLKIT</b>
Control module kit without keypad	<b>DXH-SPR-CTRLBOARD</b>	<b>DXH-SPR-CTRLBOARD</b>	<b>DXH-SPR-CTRLBOARD</b>
Software kit (software, cable, manual)	<b>DXH-ACC-SOFTWARE</b>	<b>DXH-ACC-SOFTWARE</b>	<b>DXH-ACC-SOFTWARE</b>
Type 1/IP21 standard cover	<b>DXH-SPR-FR5CVR</b>	<b>DXH-SPR-FR5CVR</b>	<b>DXH-SPR-FR5CVR</b>
EMI-1 board	<b>DXH-SPR-2FR5E1B</b>	<b>DXG-SPR-4FR5E1B</b>	<b>DXG-SPR-5FR5E1B</b>
EMI-2 board	—	—	<b>DXG-SPR-5FR5E2B</b>
Main power board	<b>DXH-SPR-2FR5MPB</b>	<b>DXH-SPR-4FR5MPB</b>	<b>DXG-SPR-5FR5MPB</b>

**Frame 6**

Description	230 V	480 V	600 V
	Catalog Number	Catalog Number	Catalog Number
Standard keypad	<b>DXH-KEY-LCD</b>	<b>DXH-KEY-LCD</b>	<b>DXH-KEY-LCD</b>
Control module kit with keypad	<b>DXH-SPR-CTRLKIT</b>	<b>DXH-SPR-CTRLKIT</b>	<b>DXH-SPR-CTRLKIT</b>
Control module kit without keypad	<b>DXH-SPR-CTRLBOARD</b>	<b>DXH-SPR-CTRLBOARD</b>	<b>DXH-SPR-CTRLBOARD</b>
Software kit (software, cable, manual)	<b>DXH-ACC-SOFTWARE</b>	<b>DXH-ACC-SOFTWARE</b>	<b>DXH-ACC-SOFTWARE</b>
Type 1/IP21 standard cover	<b>DXH-SPR-FR6CVR</b>	<b>DXH-SPR-FR6CVR</b>	<b>DXH-SPR-FR6CVR</b>
EMI board	<b>DXG-SPR-FR6EB</b>	<b>DXG-SPR-FR6EB</b>	<b>DXG-SPR-FR6EB</b>
Main power board	<b>DXG-SPR-2FR6MPB</b>	<b>DXG-SPR-4FR6MPB</b>	<b>DXG-SPR-5FR6MPB</b>
Softstart board	<b>DXG-SPR-2FR6SB</b>	<b>DXG-SPR-4FR6SB</b>	<b>DXG-SPR-5FR6SB</b>

**Note**

① Factory recommended spare parts.



## Technical Data and Specifications

## 2

### PowerXL Series—DH1 Technical Data and Specifications

Attribute	Description	Specification	
Input ratings	Input voltage $U_{in}$	208 V to 240 V, 380 V to 500 V, 525 V to 600 V, –15 to 10%	
	Input frequency	50 Hz to 60 Hz (variation up to 45 Hz to 66 Hz)	
	Connection to power	Once per minute or less	
	Starting delay	3 s (FR1 to FR2), 4 s (FR3), 5 s (FR4), 6 s (FR5 and FR6)	
	Short-circuit withstand rating	100 kAIC (fuses and circuit breakers); 5 kAIC (without fuses or breakers)	
Output ratings	Output voltage	0 to $U_{in}$	
	Continuous output current	$I_L$ : ambient temperature maximum 40 °C, up to 60 °C with derating, overload 1.1 x $I_L$ (1 min./10 min.)	
	Overload current	110% for variable torque	
	Initial output current	200% (2 s / 20 s)	
	Output frequency	0–400 Hz (standard)	
	Frequency resolution	0.01 Hz	
Control characteristics	Control methods	Frequency control Speed control Open-loop speed control Open-loop torque control	
	Switching frequency	230 V / 480 V range: FR1–3: 1 kHz to 12 kHz FR4–6: 1 kHz to 10 kHz 230 V / 480 V defaults: FR1–3: 4 kHz FR4–5: 3.6 kHz FR6: 2 kHz 575 V range: FR1–6: 1 kHz to 6 kHz 575 V defaults: FR1–4: 3 kHz FR5–6: 2 kHz Automatic switching frequency derating in case of overload.	
	Frequency reference	Analog input: resolution 0.1% (10-bit), accuracy +1% Analog output: resolution 0.1% (10-bit), accuracy +1% Panel reference: resolution 0.01 Hz	
	Field weakening point	20 Hz to 400 Hz	
	Acceleration time	0.1 s to 3000 s	
	Deceleration time	0.1 s to 3000 s	
	Braking torque	DC brake: 30% x Motor Rated Torque ( $T_n$ ) (without brake chopper) Dynamic braking (with optional brake chopper using an external brake resistor): 100% continuous maximum rating	
	Ambient conditions	Ambient operating temperature	–10 °C (no frost) to +50 °C, up to +60 °C with derating (CT) –10 °C (no frost) to +40 °C, up to +60 °C with derating (VT)
		Storage temperature	–40 °C to +70 °C
		Relative humidity	0–95% RH, noncondensing, non-corrosive
Air quality: • Chemical vapors • Mechanical particles		Tested according to IEC 60068-2-60 Test Key: Flowing mixed gas corrosion test, Method 1 (H2S [hydrogen sulfide] and SO2 [sulfur dioxide]) Designed according to: IEC 60721-3-3, unit in operation, class 3C2 IEC 60721-3-3, unit in operation, class 3S2	
Altitude		100% load capacity (no derating) up to 3280 ft (1000 m); 1% derating for each 328 ft (100 m) above 3280 ft (1000 m); max. 9842 ft (3000 m) (2000 m for corner grounded earth main systems) For 575 V product, maximum altitude is 6561 ft (2000 m) regardless of main system	

## PowerXL Series—DH1 Technical Data and Specifications, continued

Attribute	Description	Specification
Ambient conditions, continued	Vibration:	5–150 Hz
	• EN 61800-5-1	Displacement amplitude: 1 mm (peak) at 5 Hz to 15.8 Hz (FR1–FR6)
	• EN 60668-2-6	Maximum acceleration amplitude: 1g at 15.8 Hz to 150 Hz (FR1–FR6)
	Shock:	Storage and shipping: maximum 15 g, 11 ms (in package)
	• ISTA 1 A	
	• EN 60068-2-27	
	Overvoltage	Overvoltage Category III
	Pollution degree	Pollution Degree 2
	Enclosure class	IP21/Type 1 standard in entire kW/hp range IP54/Type 12 option Note: Keypad or keypad hole plug required to be mounted in drive for IP54/Type 12 rating
	Immunity	Fulfills EN 61800-3 (2004), first and second environment
MTBF		FR1: 165,457 hours
		FR2: 134,833 hours
		FR3: 102,515 hours
		FR4: 121,567 hours
		FR5: 108,189 hours
		FR6: 100,000 hours
Noise		FR1: 51.2 dB
		FR2: 58.6 dB
		FR3: 61.0 dB
		FR4: 68.0 dB
		FR5: 69.1 dB
		FR6: 73.2 dB
Standards	Safety	UL 508C, CSA C22.2 No. 274-13 and EN 61800-5-1
	EMC	+EMC2: EN 61800-3 (2004), Category C2 The drive can be modified for IT networks and corner grounding TN system
	Electrostatic discharge	Second environment, IEC 61000-4-2, 4 kV CD or 8 kV AD, Criterion B
	Fast transient burst	Second environment, IEC 61000-4-4, 2 kV/5 kHz, Criterion B
	Dielectrical strength	Primary to secondary: 3600 Vac/5100 Vdc Primary to earth: 2000 Vac/2828 Vdc
	Approvals	EAC, RCM (C-Tick), RoHS, CE, UL and cUL (see nameplate for more detailed approvals)
Fieldbus connections	Onboard: BACnet/IP, BACnet MS/TP, Modbus TCP, Modbus RTU	

## PowerXL Series—DH1 Technical Data and Specifications, continued

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Attribute	Description	Specification
Safety/protections	Overvoltage protection	Yes
	Overvoltage trip limit	230 V drives: 456 V 480 V drives: 911 V 575 V drives: 1100 V
	Undervoltage protection	Yes
	Undervoltage trip limit	230 V drives: 211 V 480 V drives: 370 V 575 V drives: 550 V
	Earth fault protection	Yes Default: 15% motor FLA Minimum: 0% motor FLA Maximum: 30% motor FLA
	Input phase supervision	Yes
	Motor phase supervision	Yes
	Overcurrent protection	Yes
	Unit overtemperature protection	Yes
	Motor overload protection	Yes
	Motor stall protection	Yes
	Motor underload protection	Yes
	DC bus overvoltage control	Yes
	Short-circuit protection of 24 V reference voltages	Yes
	Surge protection	Yes (differential mode 2 kV; common mode 4 kV 230 V drives: 275 Vac, 10,000 A 480 V drives: 320 Vac, 8000 A 575 V drives: 385 Vac, 10,000 A
Common coated boards	Yes (prevents corrosion)	

**PowerXL Series—DH1 Technical Data and Specifications—Efficiency****230 V**

Frame Size	Load Torque	Efficiency	
		VT	Input THDi
FR1	25%	92.10%	42.8%
	50%	95.20%	35.2%
	100%	96.70%	29.9%
FR2	25%	90.80%	70.0%
	50%	96.64%	46.6%
	100%	97.30%	33.3%
FR3	25%	97.23%	53.1%
	50%	97.37%	43.6%
	100%	97.00%	30.8%
FR4	25%	94.60%	39.4%
	50%	97.20%	32.4%
	100%	97.60%	25.6%
FR5	25%	94.5	30.50%
	50%	97.80%	30.8%
	100%	97.70%	25.0%

**480 V**

Frame Size	Load Torque	Efficiency	
		VT	Input THDi
FR1	25%	93.30%	54.0%
	50%	97.10%	46.8%
	100%	97.61%	35.3%
FR2	25%	95.90%	59.8%
	50%	97.81%	42.7%
	100%	98.11%	33.8%
FR3	25%	96.40%	69.2%
	50%	97.87%	45.2%
	100%	97.79%	32.6%
FR4	25%	98.00%	56.5%
	50%	97.97%	39.8%
	100%	97.96%	31.5%
FR5	25%	97.8	50.3%
	50%	98.39%	37.0%
	100%	98.14%	29.5%

**575 V**

Frame Size	Load Torque	Efficiency	
		VT	Input THDi
FR1	25%	97.48%	62.6%
	50%	97.79%	45.6%
	100%	98.10%	36.8%
FR2	25%	98.06%	60.6%
	50%	98.19%	47.2%
	100%	98.20%	36.7%
FR3	25%	97.98%	78.9%
	50%	98.32%	55.5%
	100%	98.10%	36.3%
FR4	25%	98.27%	66.1%
	50%	98.57%	41.6%
	100%	98.30%	31.2%
FR5	25%	98.60%	52.80%
	50%	98.81%	35.9%
	100%	98.60%	28.4%

#### Wiring Diagram

2

#### PowerXL Series—DH1 Control Wiring Diagram

External Wiring	Pin	Signal Name	Signal	Default Setting	Description
	1	+10 V	Ref. Output Voltage	—	10 Vdc Supply Source
	2	AI1+	Analog Input 1	0–10 V	Voltage Speed Reference (Programmable to 4 mA to 20 mA)
	3	AI1–	Analog Input 1 Ground	—	Analog Input 1 Common (Ground)
	4	AI2+	Analog Input 2	4 mA to 20 mA	Current Speed Reference (Programmable to 0–10 V)
	5	AI2–	Analog Input 2 Ground	—	Analog Input 2 Common (Ground)
	6	GND	I/O Signal Ground	—	I/O Ground for Reference and Control
	7	DIN5	Digital Input 5	Preset Speed B0	Sets frequency output to Preset Speed 1
	8	DIN6	Digital Input 6	Preset Speed B1	Sets frequency output to Preset Speed 2
	9	DIN7	Digital Input 7	—	—
	10	DIN8	Digital Input 8	Force Remote (TI+)	Input takes VFD from Local to Remote
	11	CMB	DI5 to DI8 Common	Grounded	Allows source input
	12	GND	I/O Signal Ground	—	I/O Ground for Reference and Control
	13	24 V	+24 Vdc Output	—	Control voltage output (100 mA max.)
	14	DO1	Digital Output 1	Ready	Shows the drive is ready to run
	15	24 Vo	+24 Vdc Output	—	Control voltage output (100 mA max.)
	16	GND	I/O Signal Ground	—	I/O Ground for Reference and Control
	17	AO1+	Analog Output 1	Output Frequency	Shows Output frequency to motor 0–60 Hz (4 mA to 20 mA)
	18	AO2+	Analog Output 2	Motor Current	Shows Motor current of motor 0–FLA (4 mA to 20 mA)
	19	24 Vi	+24 Vdc Input	—	External control voltage input
	20	DIN1	Digital Input 1	Run Forward	Input starts drive in forward direction (start enable)
	21	DIN2	Digital Input 2	Run Reverse	Input starts drive in reverse direction (start enable)
	22	DIN3	Digital Input 3	External Fault	Input causes drive to fault
	23	DIN4	Digital Input 4	Fault Reset	Input resets active faults
	24	CMA	DI1 to DI4 Common	Grounded	Allows source input
	25	A	RS-485 Signal A	—	Fieldbus Communication (Modbus, BACnet)
	26	B	RS-485 Signal B	—	Fieldbus Communication (Modbus, BACnet)
	27	R3NO	Relay 3 Normally Open	At Speed	Relay output 3 shows VFD is at Ref. Frequency
	28	R1NC	Relay 1 Normally Closed	Run	Relay output 1 shows VFD is in a run state
	29	R1CM	Relay 1 Common	—	—
	30	R1NO	Relay 1 Normally Open	—	—
	31	R3CM	Relay 3 Common	At Speed	Relay output 3 shows VFD is at Ref. Frequency
	32	R2NC	Relay 2 Normally Closed	Fault	Relay output 2 shows VFD is in a fault state
	33	R2CM	Relay 2 Common	—	—
	34	R2NO	Relay 2 Normally Open	—	—

#### Notes

The above wiring demonstrates a SINK configuration. It is important that CMA and CMB are wired to ground (as shown by dashed line).

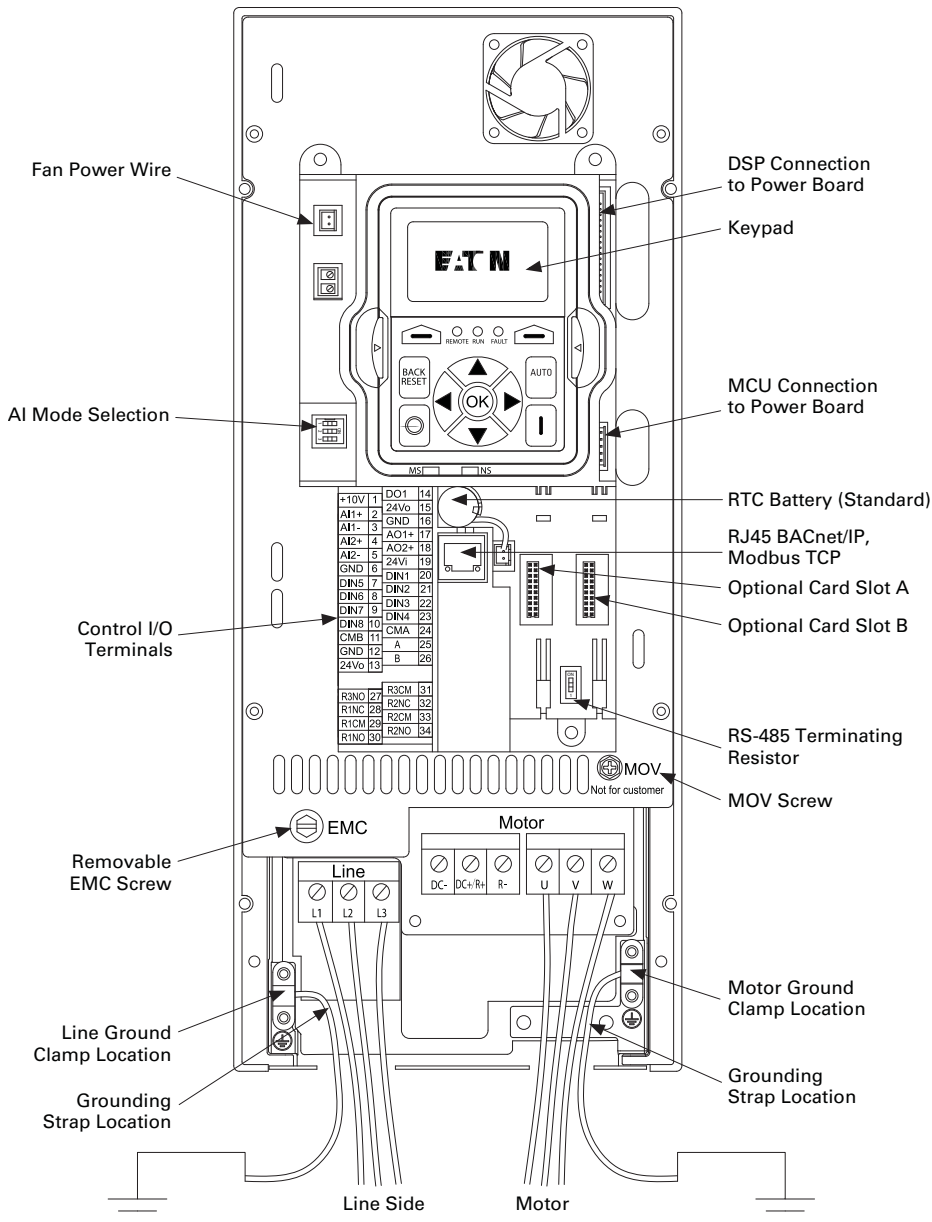
If a SOURCE configuration is desired, wire 24 V to CMA and CMB and close the inputs to ground.

When using the +10 V for AI1, it is important to wire AI1– to ground (as shown by dashed line).

If using +10 V for AI1 or AI2, terminals 3, 5 and 6 need to be jumpered together.

## Control Board Layout

## PowerXL Series—DH1 Control Board Layout



# 2.8

## Adjustable Frequency Drives

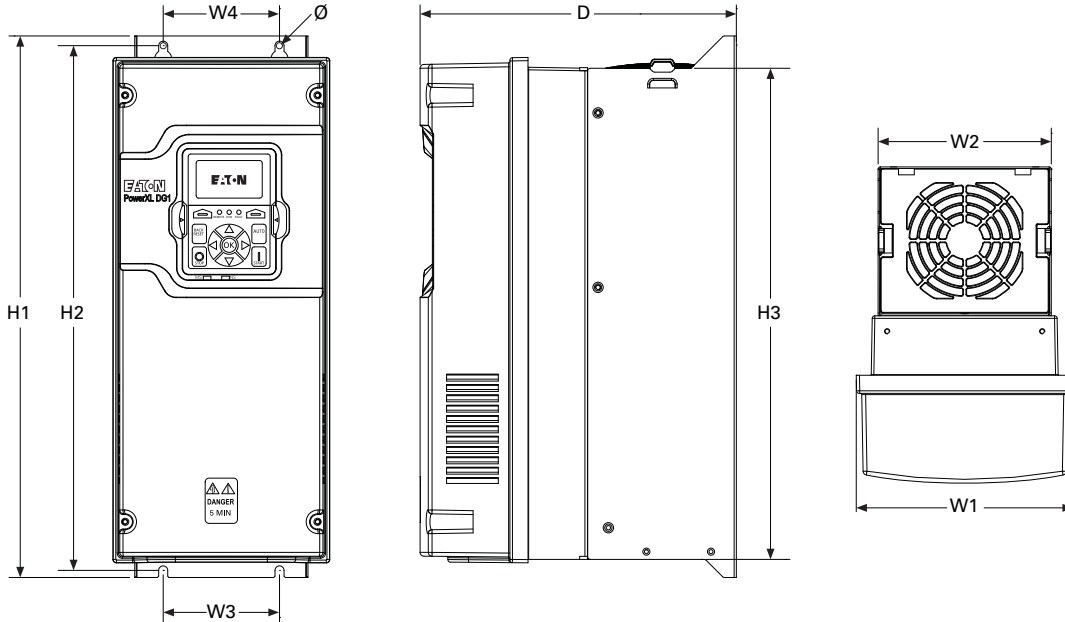
### PowerXL DH1 Series Drives

#### Dimensions

Approximate Dimensions in Inches (mm)

2

#### PowerXL Series—DH1 Dimensions



Frame Size	Voltage	hp (CT/I <sub>H</sub> )	kW	Amperes (CT/I <sub>H</sub> )	Approximate Dimensions in Inches (mm)									Weight Lb (kg)
					D	H1	H2	H3	W1	W2	W3	W4	Ø	
FR0	230 Vac	1–2	0.75–1.5	4.8–7.8	6.83	10.58	10.16	9.54	5.00	4.97	4.26	4.26	0.28	4.41
	480 Vac	1.5–5	1.1–3	3.3–7.6	(173.5)	(268.7)	(258.0)	(242.3)	(127.0)	(126.3)	(108.3)	(108.3)	(7.0)	(2.0)
FR1	230 Vac	1–4	0.75–3	4.8–12.5	7.91	12.87	12.28	11.50	6.02	4.80	3.94	3.94	0.28	14.33
	480 Vac	1.5–7.5	1.1–5.5	3.3–12	(200.9)	(326.9)	(311.9)	(292.1)	(153.0)	(121.9)	(100.1)	(100.1)	(7.0)	(6.5)
	575 Vac	3–7.5	2.2–5.5	4.5–10										
FR2	230 Vac	5–10	3.7–7.5	17.5–31	9.63	16.50	15.98	14.96	6.61	5.28	3.54	3.54	0.28	23.37
	480 Vac	10–20	7.5–15	16–31	(244.7)	(419.1)	(405.9)	(380.0)	(167.8)	(134.1)	(90.0)	(90.0)	(7.0)	(10.6)
	575 Vac	10–20	7.5–15	13.5–22										
FR3	230 Vac	15–20	11–15	48–61	10.44	21.97	21.46	20.41	8.06	7.24	4.92	4.92	0.35	49.82
	480 Vac	25–40	18.5–30	38–61	(265.1)	(558.0)	(545.0)	(518.5)	(204.6)	(183.9)	(125.0)	(125.0)	(9.0)	(22.6)
	575 Vac	25–40	18.5–30	27–41										
FR4	230 Vac	25–40	18.5–30	75–114	11.57	24.80	24.31	23.27	9.36	9.13	8.07	8.07	0.35	77.60
	480 Vac	50–75	37–55	72–105	(294.0)	(629.9)	(617.5)	(591.1)	(237.7)	(231.9)	(205.0)	(205.0)	(9.0)	(35.2)
	575 Vac	50–75	37–55	52–80										
FR5	230 Vac	50–75	37–55	143–211	13.41	34.98	29.65	27.83	11.34	11.10	8.66	8.66	0.35	154.32
	480 Vac	100–150	75–110	140–205	(340.7)	(888.5)	(753.1)	(706.9)	(288.0)	(281.9)	(220.0)	(220.0)	(9.0)	(70.0)
	575 Vac	100–150	75–110	100–144										
FR6	230 Vac	100–125	75–90	261–312	14.61	34.04	33.27	40.75	19.13	18.90	15.75	15.75	0.35	281.3
	480 Vac	200–250	132–160	261–310	(371.0)	(864.5)	(845.0)	(1035.0)	(486.0)	(480.0)	(400.0)	(400.0)	(9.0)	(127.6)
	575 Vac	200–250	150–187	208–250										

PowerXL DH1 Series HVAC/R Enclosed Drive



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## PowerXL DH1 Series Enclosed Drives

### Product Description

The DH1 enclosed drive family incorporates the latest Eaton drive technology into pre-engineered enclosed solutions covering the HVAC/R industry's most common applications. Using the benefits of the PowerXL DH1, the enclosed family provides enhanced user safety with short circuit current ratings up to 100 kAIC as well as industry-leading energy efficiency from the patented Active Energy Control<sup>®</sup> algorithm.

### Features and Benefits

- VT rated to meet HVAC/R industry standards
  - Available circuit breaker, motor circuit protector, fused disconnect and isolation fusing options to provide input power protection up to 100 kAIC
  - Standard 2 and 3 contactor bypass configurations
  - Multi-color LED pilot device allows for one light to represent multiple drive states
  - Compact disconnect enclosure allows for simple 100 kAIC disconnect platform for simple HVAC/R applications
  - Standard NEMA 12 and 3R designs allow for optimized product footprint
  - Onboard HVAC/R communications allow for easy connection to most building management systems
  - Plenum rated
- The PowerXL DH1 comes standard with the following communication protocols:
    - BACnet/IP
    - Modbus/TCP
    - Modbus RTU
    - BACnet MS/TP

### Standards and Certifications

- UL 508C



### Enclosure Ratings

- NEMA Type 1
- NEMA Type 12
- NEMA Type 3R

### Mounting

- Wall mount
- Floor mount: 12-inch legs
- Floor mount: 22-inch legs

### Product Range

- 208 V: 1–100 hp
- 230 V: 1–125 hp
- 480 V: 1.5–250 hp



# 2.8

## Adjustable Frequency Drives

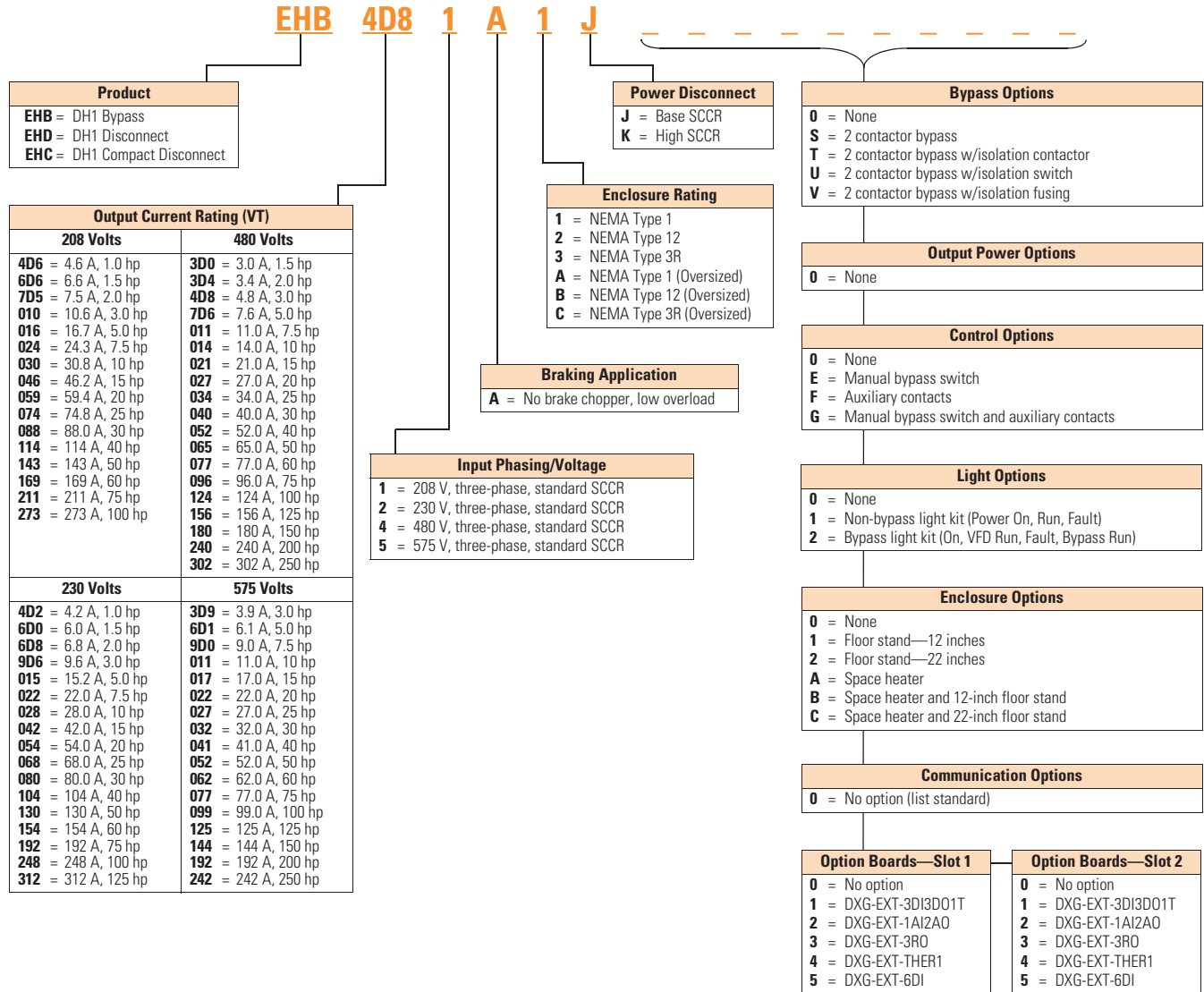
### PowerXL DH1 Series Drives

#### Catalog Number Selection

Catalog Number Selection is for reference only. Not all option combinations may be available.

2

#### PowerXL DH1 Series Enclosed Drives



## Product Selection

## EHC—DH1 Compact Disconnect

EHC



## 208 V

Horsepower	Drive Rated NEC Amps	Catalog Number
<b>Frame Size H1D</b>		
1	4.6	EHC4D61A1K00000000
1.5	6.6	EHC6D61A1K00000000
2	7.5	EHC7D51A1K00000000
3	10.6	EHC0101A1K00000000
<b>Frame Size H2D</b>		
5	16.7	EHC0161A1K00000000
7.5	24.3	EHC0241A1K00000000
10	30.8	EHC0301A1K00000000
<b>Frame Size H3D</b>		
15	46.2	EHC0461A1K00000000
20	59.4	EHC0591A1K00000000
<b>Frame Size H4D</b>		
25	74.8	EHC0741A1K00000000
30	88	EHC0881A1K00000000
40	114	EHC1141A1K00000000

## 230 V

Horsepower	Drive Rated NEC Amps	Catalog Number
<b>Frame Size H1D</b>		
1	4.2	EHC4D22A1K00000000
1.5	6	EHC6D02A1K00000000
2	6.8	EHC6D82A1K00000000
3	9.6	EHC9D62A1K00000000
<b>Frame Size H2D</b>		
5	15.2	EHC0152A1K00000000
7.5	22	EHC0222A1K00000000
10	28	EHC0282A1K00000000
<b>Frame Size H3D</b>		
15	42	EHC0422A1K00000000
20	54	EHC0542A1K00000000
<b>Frame Size H4D</b>		
25	68	EHC0682A1K00000000
30	80	EHC0802A1K00000000
40	104	EHC1042A1K00000000

## 480 V

Horsepower	Drive Rated NEC Amps	Catalog Number
<b>Frame Size H1D</b>		
1.5	3	EHC3D04A1K00000000
2	3.4	EHC3D44A1K00000000
3	4.8	EHC4D84A1K00000000
5	7.6	EHC7D64A1K00000000
7.5	11	EHC0114A1K00000000
<b>Frame Size H2D</b>		
10	14	EHC0144A1K00000000
15	21	EHC0214A1K00000000
20	27	EHC0274A1K00000000
<b>Frame Size H3D</b>		
25	34	EHC0344A1K00000000
30	40	EHC0404A1K00000000
40	52	EHC0524A1K00000000
<b>Frame Size H4D</b>		
50	65	EHC0654A1K00000000
60	77	EHC0774A1K00000000
75	96	EHC0964A1K00000000

## 575 V

Horsepower	Drive Rated NEC Amps	Catalog Number
<b>Frame Size H1D</b>		
3	3.9	EHC3D95A1K00000000
5	6.1	EHC6D15A1K00000000
7.5	9	EHC9D05A1K00000000
<b>Frame Size H2D</b>		
10	11	EHC0115A1K00000000
15	17	EHC0175A1K00000000
20	22	EHC0225A1K00000000
<b>Frame Size H3D</b>		
25	27	EHC0275A1K00000000
30	32	EHC0325A1K00000000
40	41	EHC0415A1K00000000
<b>Frame Size H4D</b>		
50	52	EHC0525A1K00000000
60	62	EHC0625A1K00000000
75	77	EHC0775A1K00000000

#### EHD—DH1 Disconnect

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EHD\_



#### 208 V—NEMA Type 1

Horsepower	Drive Rated NEC Amps	Catalog Number
<b>Frame Size H1S</b>		
1	4.6	EHD4D61A1J00000000
1.5	6.6	EHD6D61A1J00000000
2	7.5	EHD7D51A1J00000000
3	10.6	EHD0101A1J00000000
<b>Frame Size H2S</b>		
5	16.7	EHD0161A1J00000000
7.5	24.3	EHD0241A1J00000000
10	30.8	EHD0301A1J00000000
<b>Frame Size H3</b>		
15	46.2	EHD0461A1J00000000
20	59.4	EHD0591A1J00000000
<b>Frame Size H4</b>		
25	74.8	EHD0741A1K00000000
30	88	EHD0881A1K00000000
40	114	EHD1141A1K00000000
<b>Frame Size CX</b>		
50	143	EHD1431A1K00000000
60	169	EHD1691A1K00000000
75	211	EHD2111A1K00000000
<b>Frame Size DX</b>		
100	273	EHD2731A1K00000000

#### 208 V—NEMA Type 12

Horsepower	Drive Rated NEC Amps	Catalog Number
<b>Frame Size H3X</b>		
1	4.6	EHD4D61A2J00000000
1.5	6.6	EHD6D61A2J00000000
2	7.5	EHD7D51A2J00000000
3	10.6	EHD0101A2J00000000
5	16.7	EHD0161A2J00000000
7.5	24.3	EHD0241A2J00000000
10	30.8	EHD0301A2J00000000
15	46.2	EHD0461A2J00000000
20	59.4	EHD0591A2J00000000
<b>Frame Size BX</b>		
25	74.8	EHD0741A2K00000000
30	88	EHD0881A2K00000000
40	114	EHD1141A2K00000000
<b>Frame Size CX</b>		
50	143	EHD1431A2K00000000
60	169	EHD1691A2K00000000
75	211	EHD2111A2K00000000
<b>Frame Size DX</b>		
100	273	EHD2731A2K00000000

#### 208 V—NEMA Type 3R

Horsepower	Drive Rated NEC Amps	Catalog Number
<b>Frame Size H3X</b>		
1	4.6	EHD4D61A3J00000000
1.5	6.6	EHD6D61A3J00000000
2	7.5	EHD7D51A3J00000000
3	10.6	EHD0101A3J00000000
5	16.7	EHD0161A3J00000000
7.5	24.3	EHD0241A3J00000000
10	30.8	EHD0301A3J00000000
15	46.2	EHD0461A3J00000000
20	59.4	EHD0591A3J00000000
<b>Frame Size BX</b>		
25	74.8	EHD0741A3K00000000
30	88	EHD0881A3K00000000
40	114	EHD1141A3K00000000
<b>Frame Size CX</b>		
50	143	EHD1431A3K00000000
60	169	EHD1691A3K00000000
75	211	EHD2111A3K00000000
<b>Frame Size DX</b>		
100	273	EHD2731A3K00000000

EHD\_

**230 V—NEMA Type 1**

Horsepower	Drive Rated NEC Amps	Catalog Number
<b>Frame Size H1S</b>		
1	4.2	EHD4D22A1J00000000
1.5	6	EHD6D02A1J00000000
2	6.8	EHD6D82A1J00000000
3	9.6	EHD9D62A1J00000000
<b>Frame Size H2S</b>		
5	15.2	EHD0152A1J00000000
7.5	22	EHD0222A1J00000000
10	28	EHD0282A1J00000000
<b>Frame Size H3</b>		
15	42	EHD0422A1J00000000
20	54	EHD0542A1J00000000
<b>Frame Size H4</b>		
25	68	EHD0682A1K00000000
30	80	EHD0802A1K00000000
40	104	EHD1042A1K00000000
<b>Frame Size CX</b>		
50	130	EHD1302A1K00000000
60	154	EHD1542A1K00000000
75	192	EHD1922A1K00000000
<b>Frame Size DX</b>		
100	248	EHD2482A1K00000000
125	312	EHD3122A1K00000000

**230 V—NEMA Type 12**

Horsepower	Drive Rated NEC Amps	Catalog Number
<b>Frame Size H3X</b>		
1	4.2	EHD4D22A2J00000000
1.5	6	EHD6D02A2J00000000
2	6.8	EHD6D82A2J00000000
3	9.6	EHD9D62A2J00000000
5	15.2	EHD0152A2J00000000
7.5	22	EHD0222A2J00000000
10	28	EHD0282A2J00000000
15	42	EHD0422A2J00000000
20	54	EHD0542A2J00000000
<b>Frame Size BX</b>		
25	68	EHD0682A2K00000000
30	80	EHD0802A2K00000000
40	104	EHD1042A2K00000000
<b>Frame Size CX</b>		
50	130	EHD1302A2K00000000
60	154	EHD1542A2K00000000
75	192	EHD1922A2K00000000
<b>Frame Size DX</b>		
100	248	EHD2482A2K00000000
125	312	EHD3122A2K00000000

**230 V—NEMA Type 3R**

Horsepower	Drive Rated NEC Amps	Catalog Number
<b>Frame Size H3X</b>		
1	4.2	EHD4D22A3J00000000
1.5	6	EHD6D02A3J00000000
2	6.8	EHD6D82A3J00000000
3	9.6	EHD9D62A3J00000000
5	15.2	EHD0152A3J00000000
7.5	22	EHD0222A3J00000000
10	28	EHD0282A3J00000000
15	42	EHD0422A3J00000000
20	54	EHD0542A3J00000000
<b>Frame Size BX</b>		
25	68	EHD0682A3K00000000
30	80	EHD0802A3K00000000
40	104	EHD1042A3K00000000
<b>Frame Size CX</b>		
50	130	EHD1302A3K00000000
60	154	EHD1542A3K00000000
75	192	EHD1922A3K00000000
<b>Frame Size DX</b>		
100	248	EHD2482A3K00000000
125	312	EHD3122A3K00000000

EHD\_

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#### 480 V—NEMA Type 1

Horsepower	Drive Rated NEC Amps	Catalog Number
<b>Frame Size H1S</b>		
1.5	3	EHD3D04A1J00000000
2	3.4	EHD3D44A1J00000000
3	4.8	EHD4D84A1J00000000
5	7.6	EHD7D64A1J00000000
7.5	11	EHD0114A1J00000000
<b>Frame Size H2</b>		
10	14	EHD0144A1J00000000
15	21	EHD0214A1J00000000
20	27	EHD0274A1J00000000
<b>Frame Size H3</b>		
25	34	EHD0344A1J00000000
30	40	EHD0404A1J00000000
40	52	EHD0524A1J00000000
<b>Frame Size H4</b>		
50	65	EHD0654A1K00000000
60	77	EHD0774A1K00000000
75	96	EHD0964A1K00000000
<b>Frame Size CX</b>		
100	124	EHD1244A1K00000000
125	156	EHD1564A1K00000000
150	180	EHD1804A1K00000000
<b>Frame Size DX</b>		
200	240	EHD2404A1K00000000
250	302	EHD3024A1K00000000

#### 480 V—NEMA Type 12

Horsepower	Drive Rated NEC Amps	Catalog Number
<b>Frame Size H3X</b>		
1.5	3	EHD3D04A2J00000000
2	3.4	EHD3D44A2J00000000
3	4.8	EHD4D84A2J00000000
5	7.6	EHD7D64A2J00000000
7.5	11	EHD0114A2J00000000
10	14	EHD0144A2J00000000
15	21	EHD0214A2J00000000
20	27	EHD0274A2J00000000
25	34	EHD0344A2J00000000
30	40	EHD0404A2J00000000
40	52	EHD0524A2J00000000
<b>Frame Size BX</b>		
50	65	EHD0654A2K00000000
60	77	EHD0774A2K00000000
75	96	EHD0964A2K00000000
<b>Frame Size CX</b>		
100	124	EHD1244A2K00000000
125	156	EHD1564A2K00000000
150	180	EHD1804A2K00000000
<b>Frame Size DX</b>		
200	240	EHD2404A2K00000000
250	302	EHD3024A2K00000000

#### 480 V—NEMA Type 3R

Horsepower	Drive Rated NEC Amps	Catalog Number
<b>Frame Size H3X</b>		
1.5	3	EHD3D04A3J00000000
2	3.4	EHD3D44A3J00000000
3	4.8	EHD4D84A3J00000000
5	7.6	EHD7D64A3J00000000
7.5	11	EHD0114A3J00000000
10	14	EHD0144A3J00000000
15	21	EHD0214A3J00000000
20	27	EHD0274A3J00000000
25	34	EHD0344A3J00000000
30	40	EHD0404A3J00000000
40	52	EHD0524A3J00000000
<b>Frame Size BX</b>		
50	65	EHD0654A3K00000000
60	77	EHD0774A3K00000000
75	96	EHD0964A3K00000000
<b>Frame Size CX</b>		
100	124	EHD1244A3K00000000
125	156	EHD1564A3K00000000
150	180	EHD1804A3K00000000
<b>Frame Size DX</b>		
200	240	EHD2404A3K00000000
250	302	EHD3024A3K00000000

EHD\_

**575 V—NEMA Type 1**

Horsepower	Drive Rated NEC Amps	Catalog Number
<b>Frame Size H1</b>		
3	3.9	EHD3D95A1K00000000
5	6.1	EHD6D15A1K00000000
7.5	9	EHD9D05A1K00000000
<b>Frame Size H2</b>		
10	11	EHD0115A1K00000000
15	17	EHD0175A1K00000000
20	22	EHD0225A1K00000000
<b>Frame Size H3</b>		
25	27	EHD0275A1K00000000
30	32	EHD0325A1K00000000
40	41	EHD0415A1K00000000
<b>Frame Size H4</b>		
50	52	EHD0525A1K00000000
60	62	EHD0625A1K00000000
75	77	EHD0775A1K00000000
<b>Frame Size CX</b>		
100	99	EHD0995A1K00000000
125	125	EHD1255A1K00000000
150	144	EHD1445A1K00000000
<b>Frame Size DX</b>		
200	192	EHD1925A1K00000000
250	242	EHD2425A1K00000000

**575 V—NEMA Type 12**

Horsepower	Drive Rated NEC Amps	Catalog Number
<b>Frame Size H3X</b>		
3	3.9	EHD3D95A2K00000000
5	6.1	EHD6D15A2K00000000
7.5	9	EHD9D05A2K00000000
10	11	EHD0115A2K00000000
15	17	EHD0175A2K00000000
20	22	EHD0225A2K00000000
25	27	EHD0275A2K00000000
30	32	EHD0325A2K00000000
40	41	EHD0415A2K00000000
<b>Frame Size BX</b>		
50	52	EHD0525A2K00000000
60	62	EHD0625A2K00000000
75	77	EHD0775A2K00000000
<b>Frame Size CX</b>		
100	99	EHD0995A2K00000000
125	125	EHD1255A2K00000000
150	144	EHD1445A2K00000000
<b>Frame Size DX</b>		
200	192	EHD1925A2K00000000
250	242	EHD2425A2K00000000

**575 V—NEMA Type 3R**

Horsepower	Drive Rated NEC Amps	Catalog Number
<b>Frame Size H3X</b>		
3	3.9	EHD3D95A3K00000000
5	6.1	EHD6D15A3K00000000
7.5	9	EHD9D05A3K00000000
10	11	EHD0115A3K00000000
15	17	EHD0175A3K00000000
20	22	EHD0225A3K00000000
25	27	EHD0275A3K00000000
30	32	EHD0325A3K00000000
40	41	EHD0415A3K00000000
<b>Frame Size BX</b>		
50	52	EHD0525A3K00000000
60	62	EHD0625A3K00000000
75	77	EHD0775A3K00000000
<b>Frame Size CX</b>		
100	99	EHD0995A3K00000000
125	125	EHD1255A3K00000000
150	144	EHD1445A3K00000000
<b>Frame Size DX</b>		
200	192	EHD1925A3K00000000
250	242	EHD2425A3K00000000

#### EHB—DH1 Bypass

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EHB\_



#### 208 V—NEMA Type 1

Horsepower	Drive Rated NEC Amps	Catalog Number ①
<b>Frame Size H1S</b>		
1	4.6	EHB4D61A1JS0000000
1.5	6.6	EHB6D61A1JS0000000
2	7.5	EHB7D51A1JS0000000
3	10.6	EHB0101A1JS0000000
<b>Frame Size H2S</b>		
5	16.7	EHB0161A1JS0000000
7.5	24.3	EHB0241A1JS0000000
10	30.8	EHB0301A1JS0000000
<b>Frame Size H3</b>		
15	46.2	EHB0461A1JS0000000
20	59.4	EHB0591A1JS0000000
<b>Frame Size H4</b>		
25	74.8	EHB0741A1KS0000000
30	88	EHB0881A1KS0000000
40	114	EHB1141A1KS0000000
<b>Frame Size DX</b>		
50	143	EHB1431A1KS0000000
60	169	EHB1691A1KS0000000
75	211	EHB2111A1KS0000000
100	273	EHB2731A1KS0000000

#### 208 V—NEMA Type 12

Horsepower	Drive Rated NEC Amps	Catalog Number
<b>Frame Size H3X</b>		
1	4.6	EHB4D61A2JS0000000
1.5	6.6	EHB6D61A2JS0000000
2	7.5	EHB7D51A2JS0000000
3	10.6	EHB0101A2JS0000000
5	16.7	EHB0161A2JS0000000
7.5	24.3	EHB0241A2JS0000000
10	30.8	EHB0301A2JS0000000
15	46.2	EHB0461A2JS0000000
20	59.4	EHB0591A2JS0000000
<b>Frame Size CX</b>		
25	74.8	EHB0741A2KS0000000
30	88	EHB0881A2KS0000000
40	114	EHB1141A2KS0000000
<b>Frame Size DX</b>		
50	143	EHB1431A2KS0000000
60	169	EHB1691A2KS0000000
75	211	EHB2111A2KS0000000
100	273	EHB2731A2KS0000000

#### 208 V—NEMA Type 3R

Horsepower	Drive Rated NEC Amps	Catalog Number
<b>Frame Size H3X</b>		
1	4.6	EHB4D61A3JS0000000
1.5	6.6	EHB6D61A3JS0000000
2	7.5	EHB7D51A3JS0000000
3	10.6	EHB0101A3JS0000000
5	16.7	EHB0161A3JS0000000
7.5	24.3	EHB0241A3JS0000000
10	30.8	EHB0301A3JS0000000
15	46.2	EHB0461A3JS0000000
20	59.4	EHB0591A3JS0000000
<b>Frame Size CX</b>		
25	74.8	EHB0741A3KS0000000
30	88	EHB0881A3KS0000000
40	114	EHB1141A3KS0000000
<b>Frame Size DX</b>		
50	143	EHB1431A3KS0000000
60	169	EHB1691A3KS0000000
75	211	EHB2111A3KS0000000
100	273	EHB2731A3KS0000000

**Note**

① Two contactors.

EHB\_

**230 V—NEMA Type 1**

Horsepower	Drive Rated NEC Amps	Catalog Number <sup>①</sup>
<b>Frame Size H1S</b>		
1	4.2	EHB4D22A1JS0000000
1.5	6	EHB6D02A1JS0000000
2	6.8	EHB6D82A1JS0000000
3	9.6	EHB9D62A1JS0000000
<b>Frame Size H2S</b>		
5	15.2	EHB0152A1JS0000000
7.5	22	EHB0222A1JS0000000
10	28	EHB0282A1JS0000000
<b>Frame Size H3</b>		
15	42	EHB0422A1JS0000000
20	54	EHB0542A1JS0000000
<b>Frame Size H4</b>		
25	68	EHB0682A1KS0000000
30	80	EHB0802A1KS0000000
40	104	EHB1042A1KS0000000
<b>Frame Size DX</b>		
50	130	EHB1302A1KS0000000
60	154	EHB1542A1KS0000000
75	192	EHB1922A1KS0000000
100	248	EHB2482A1KS0000000
125	312	EHB3122A1KS0000000

**230 V—NEMA Type 12**

Horsepower	Drive Rated NEC Amps	Catalog Number
<b>Frame Size H3X</b>		
1	4.2	EHB4D22A2JS0000000
1.5	6	EHB6D02A2JS0000000
2	6.8	EHB6D82A2JS0000000
3	9.6	EHB9D62A2JS0000000
5	15.2	EHB0152A2JS0000000
7.5	22	EHB0222A2JS0000000
10	28	EHB0282A2JS0000000
15	42	EHB0422A2JS0000000
20	54	EHB0542A2JS0000000
<b>Frame Size CX</b>		
25	68	EHB0682A2KS0000000
30	80	EHB0802A2KS0000000
40	104	EHB1042A2KS0000000
<b>Frame Size DX</b>		
50	130	EHB1302A2KS0000000
60	154	EHB1542A2KS0000000
75	192	EHB1922A2KS0000000
100	248	EHB2482A2KS0000000
125	312	EHB3122A2KS0000000

**230 V—NEMA Type 3R**

Horsepower	Drive Rated NEC Amps	Catalog Number
<b>Frame Size H3X</b>		
1	4.2	EHB4D22A3JS0000000
1.5	6	EHB6D02A3JS0000000
2	6.8	EHB6D82A3JS0000000
3	9.6	EHB9D62A3JS0000000
5	15.2	EHB0152A3JS0000000
7.5	22	EHB0222A3JS0000000
10	28	EHB0282A3JS0000000
15	42	EHB0422A3JS0000000
20	54	EHB0542A3JS0000000
<b>Frame Size CX</b>		
25	68	EHB0682A3KS0000000
30	80	EHB0802A3KS0000000
40	104	EHB1042A3KS0000000
<b>Frame Size DX</b>		
50	130	EHB1302A3KS0000000
60	154	EHB1542A3KS0000000
75	192	EHB1922A3KS0000000
100	248	EHB2482A3KS0000000
125	312	EHB3122A3KS0000000

**Note**

① Two contactors.



EHB\_

2



#### 480 V—NEMA Type 1

Horsepower	Drive Rated NEC Amps	Catalog Number ①
<b>Frame Size H1S</b>		
1.5	3	EHB3D04A1JS0000000
2	3.4	EHB3D44A1JS0000000
3	4.8	EHB4D84A1JS0000000
5	7.6	EHB7D64A1JS0000000
7.5	11	EHB0114A1JS0000000
<b>Frame Size H2S</b>		
10	14	EHB0144A1JS0000000
15	21	EHB0214A1JS0000000
20	27	EHB0274A1JS0000000
<b>Frame Size H3</b>		
25	34	EHB0344A1JS0000000
30	40	EHB0404A1JS0000000
40	52	EHB0524A1JS0000000
<b>Frame Size H4</b>		
50	65	EHB0654A1KS0000000
60	77	EHB0774A1KS0000000
75	96	EHB0964A1KS0000000
<b>Frame Size DX</b>		
100	124	EHB1244A1KS0000000
125	156	EHB1564A1KS0000000
150	180	EHB1804A1KS0000000
200	240	EHB2404A1KS0000000
250	302	EHB3024A1KS0000000

#### 480 V—NEMA Type 12

Horsepower	Drive Rated NEC Amps	Catalog Number
<b>Frame Size H3X</b>		
1.5	3	EHB3D04A2JS0000000
2	3.4	EHB3D44A2JS0000000
3	4.8	EHB4D84A2JS0000000
5	7.6	EHB7D64A2JS0000000
7.5	11	EHB0114A2JS0000000
10	14	EHB0144A2JS0000000
15	21	EHB0214A2JS0000000
20	27	EHB0274A2JS0000000
25	34	EHB0344A2JS0000000
30	40	EHB0404A2JS0000000
40	52	EHB0524A2JS0000000
<b>Frame Size CX</b>		
50	65	EHB0654A2KS0000000
60	77	EHB0774A2KS0000000
75	96	EHB0964A2KS0000000
<b>Frame Size DX</b>		
100	124	EHB1244A2KS0000000
125	156	EHB1564A2KS0000000
150	180	EHB1804A2KS0000000
200	240	EHB2404A2KS0000000
250	302	EHB3024A2KS0000000

#### 480 V—NEMA Type 3R

Horsepower	Drive Rated NEC Amps	Catalog Number
<b>Frame Size H3X</b>		
1.5	3	EHB3D04A3JS0000000
2	3.4	EHB3D44A3JS0000000
3	4.8	EHB4D84A3JS0000000
5	7.6	EHB7D64A3JS0000000
7.5	11	EHB0114A3JS0000000
10	14	EHB0144A3JS0000000
15	21	EHB0214A3JS0000000
20	27	EHB0274A3JS0000000
25	34	EHB0344A3JS0000000
30	40	EHB0404A3JS0000000
40	52	EHB0524A3JS0000000
<b>Frame Size CX</b>		
50	65	EHB0654A3KS0000000
60	77	EHB0774A3KS0000000
75	96	EHB0964A3KS0000000
<b>Frame Size DX</b>		
100	124	EHB1244A3KS0000000
125	156	EHB1564A3KS0000000
150	180	EHB1804A3KS0000000
200	240	EHB2404A3KS0000000
250	302	EHB3024A3KS0000000

**Note**

① Two contactors.

EHB\_



## 575 V—NEMA Type 1

Horsepower	Drive Rated NEC Amps	Catalog Number <sup>①</sup>
<b>Frame Size H1</b>		
3	3.9	EHB3D95A1KS0000000
5	6.1	EHB6D15A1KS0000000
7.5	9	EHB9D05A1KS0000000
<b>Frame Size H2</b>		
10	11	EHB0115A1KS0000000
15	17	EHB0175A1KS0000000
20	22	EHB0225A1KS0000000
<b>Frame Size H3</b>		
25	27	EHB0275A1KS0000000
30	32	EHB0325A1KS0000000
40	41	EHB0415A1KS0000000
<b>Frame Size H4</b>		
50	52	EHB0525A1KS0000000
60	62	EHB0625A1KS0000000
75	77	EHB0775A1KS0000000
<b>Frame Size DX</b>		
100	99	EHB0995A1KS0000000
125	125	EHB1255A1KS0000000
150	144	EHB1445A1KS0000000
200	192	EHB1925A1KS0000000
250	242	EHB2425A1KS0000000

## 575 V—NEMA Type 12

Horsepower	Drive Rated NEC Amps	Catalog Number
<b>Frame Size H3X</b>		
3	3.9	EHB3D95A2KS0000000
5	6.1	EHB6D15A2KS0000000
7.5	9	EHB9D05A2KS0000000
10	11	EHB0115A2KS0000000
15	17	EHB0175A2KS0000000
20	22	EHB0225A2KS0000000
25	27	EHB0275A2KS0000000
30	32	EHB0325A2KS0000000
40	41	EHB0415A2KS0000000
<b>Frame Size CX</b>		
50	52	EHB0525A2KS0000000
60	62	EHB0625A2KS0000000
75	77	EHB0775A2KS0000000
<b>Frame Size DX</b>		
100	99	EHB0995A2KS0000000
125	125	EHB1255A2KS0000000
150	144	EHB1445A2KS0000000
200	192	EHB1925A2KS0000000
250	242	EHB2425A2KS0000000

## 575 V—NEMA Type 3R

Horsepower	Drive Rated NEC Amps	Catalog Number
<b>Frame Size H3X</b>		
3	3.9	EHB2425A3KS0000000
5	6.1	EHB3D95A3KS0000000
7.5	9	EHB6D15A3KS0000000
10	11	EHB9D05A3KS0000000
15	17	EHB0115A3KS0000000
20	22	EHB0175A3KS0000000
25	27	EHB0225A3KS0000000
30	32	EHB0275A3KS0000000
40	41	EHB0325A3KS0000000
<b>Frame Size CX</b>		
50	52	EHB0415A3KS0000000
60	62	EHB0525A3KS0000000
75	77	EHB0625A3KS0000000
<b>Frame Size DX</b>		
100	99	EHB0775A3KS0000000
125	125	EHB0995A3KS0000000
150	144	EHB1255A3KS0000000
200	192	EHB1445A3KS0000000
250	242	EHB1925A3KS0000000

**Note**

① Two contactors.

## Options

## DH1 Series Drives Options

## 2

## Option Boards Slots 1 and 2

Description	Suffix Number	Catalog Number
None	0	—
3 x DI, 3 x DO, 1 x thermistor, 24 Vdc/EXT option card	1	<b>DXG-EXT-3DI3DO1T</b>
1 x AI, 2 x AO (isolated to control board) option card	2	<b>DXG-EXT-1AI2AO</b>
3 x relay dry contact (2NO + 1NO/NC) option card	3	<b>DXG-EXT-3R0</b>
3 x PT100 RTD thermistor input option card	4	<b>DXG-EXT-THER1</b>
6 x DI 240 Vac input option card	5	<b>DXG-EXT-6DI</b>

## Light Options

Description	Suffix Number
None	0
Non-bypass light kit (Power On, Run, Fault)	1
Bypass light kit (On, VFD Run, Fault, Bypass Run)	2

## Enclosure Options

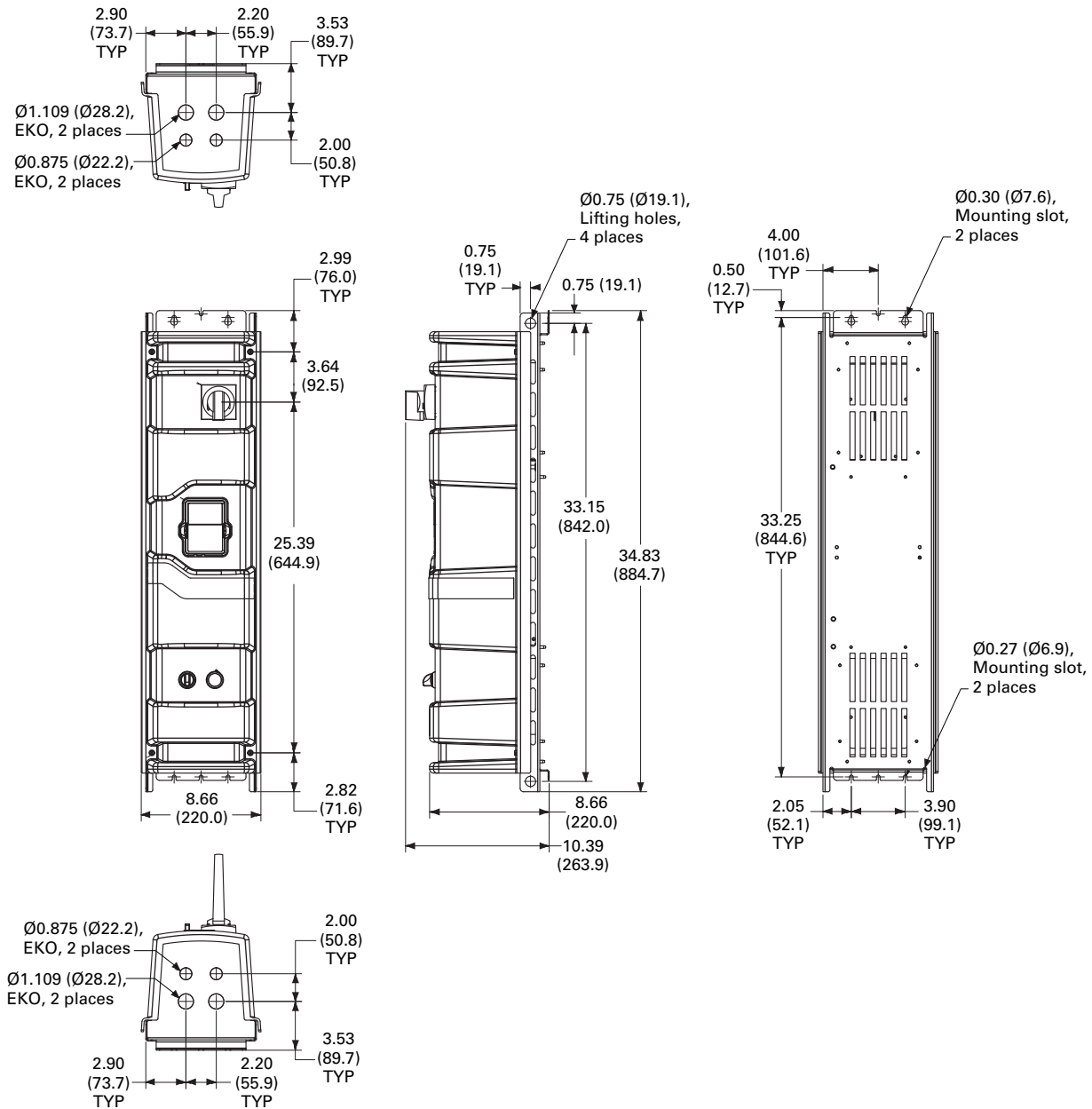
Description	Suffix Number
None	0
Floor stand—12 inches	1
Floor stand—22 inches	2
Space heater	A
Space heater and 12-inch floor stands	B
Space heater and 22-inch floor stands	C

**Note:** Floor stands are only an option for BX and CX enclosures.

**Note:** No communication options.

**Dimensions**

Approximate Dimensions in Inches (mm)

**H1S**

# 2.8

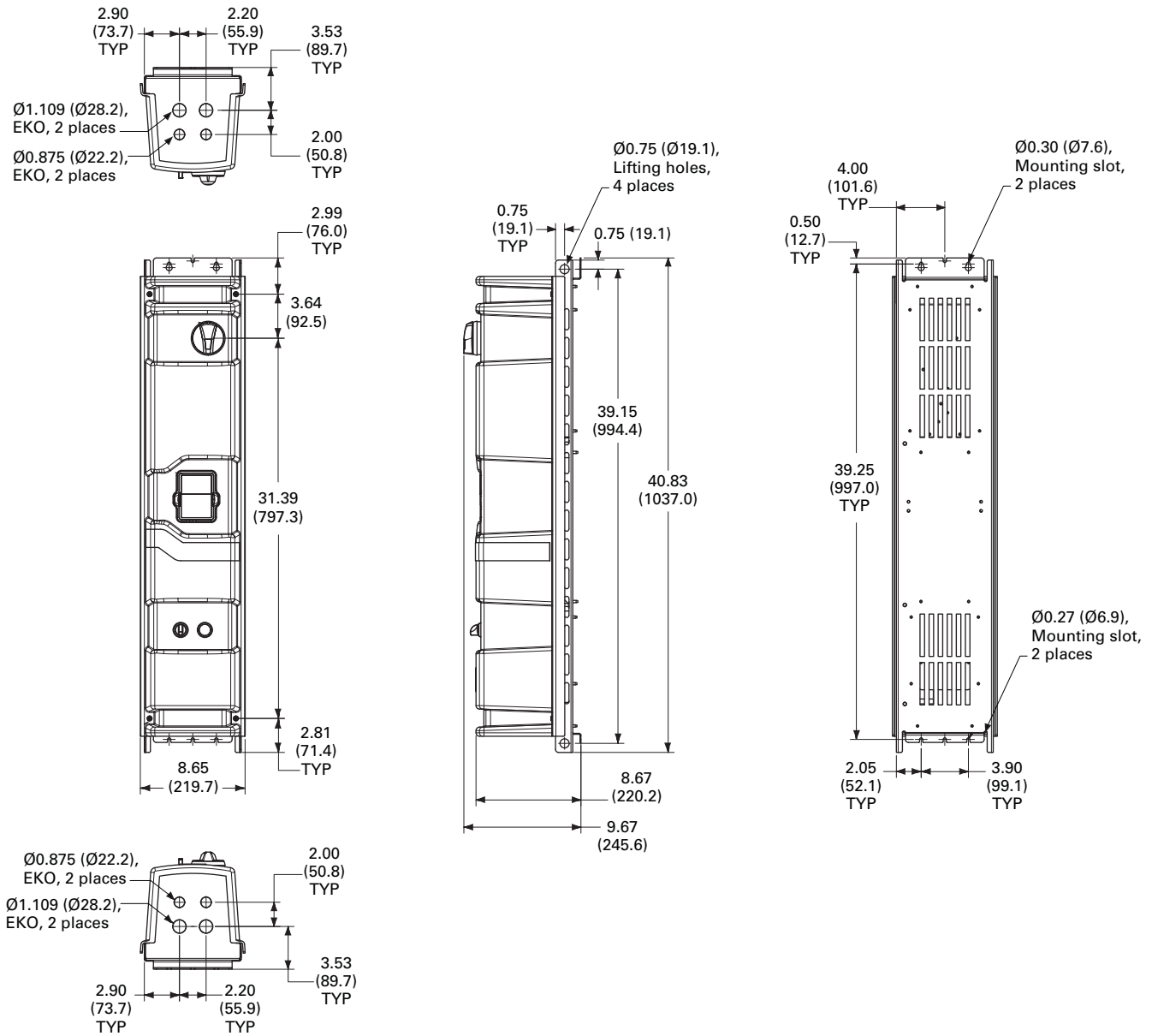
## Adjustable Frequency Drives

### PowerXL DH1 Series Drives

Approximate Dimensions in Inches (mm)

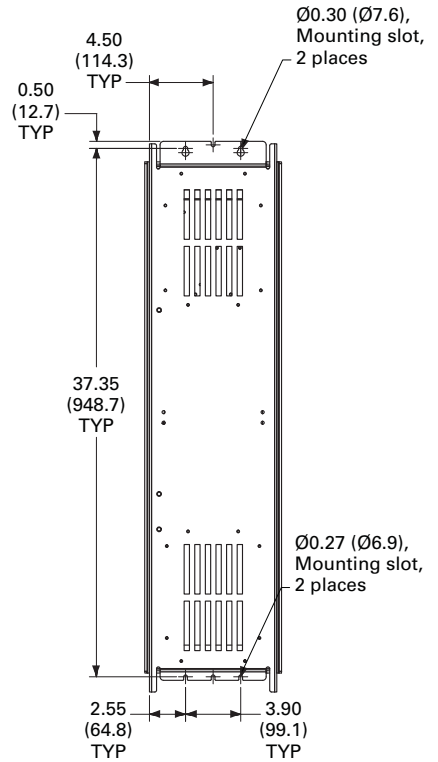
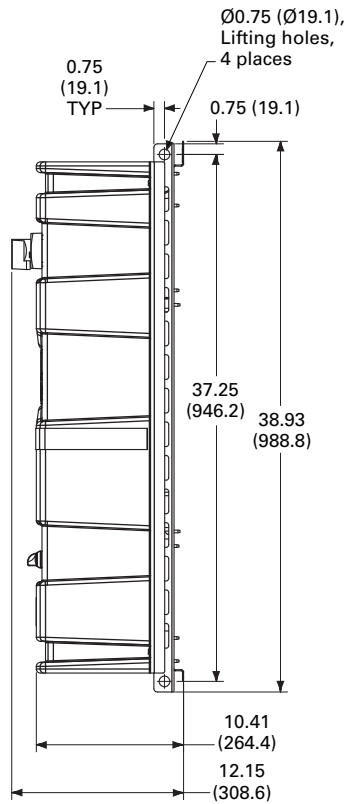
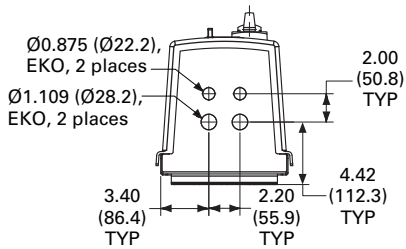
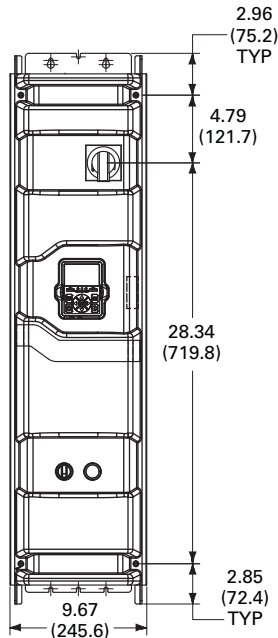
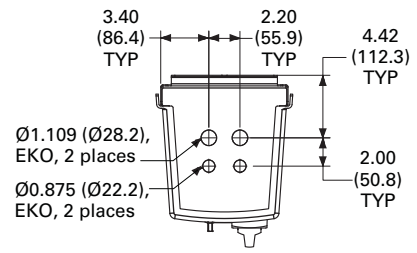
H1

2



Approximate Dimensions in Inches (mm)

### H2S



# 2.8

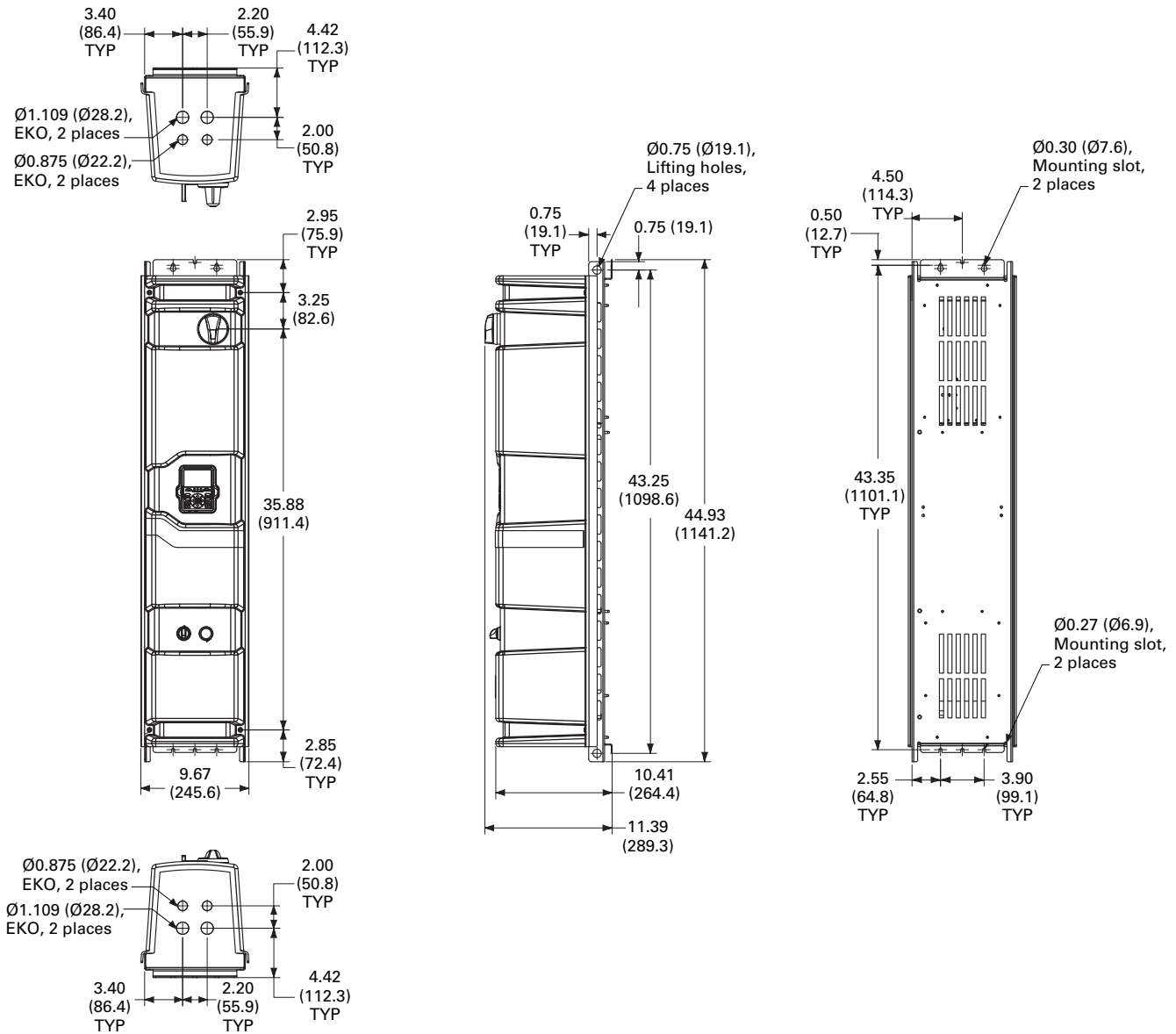
## Adjustable Frequency Drives

### PowerXL DH1 Series Drives

Approximate Dimensions in Inches (mm)

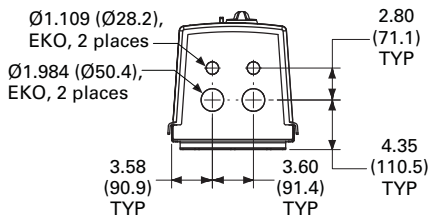
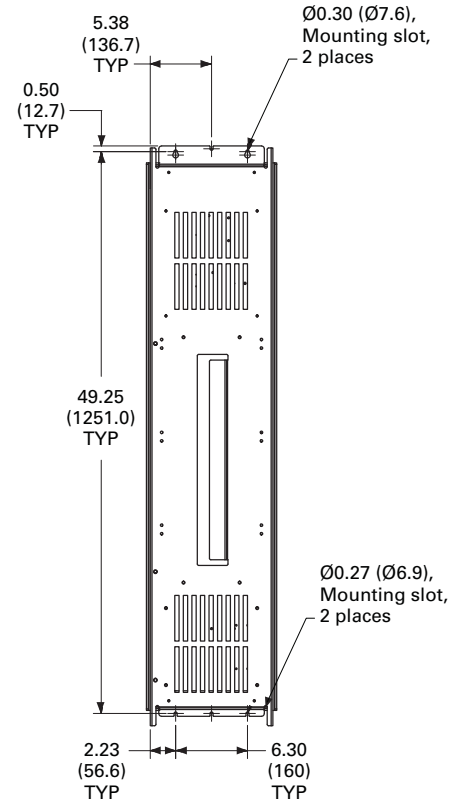
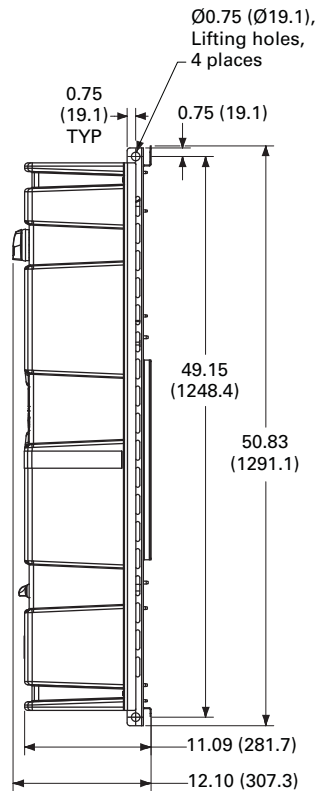
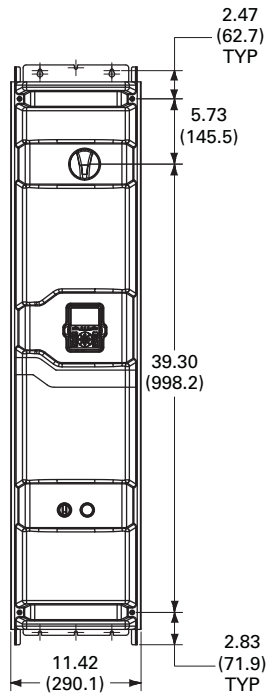
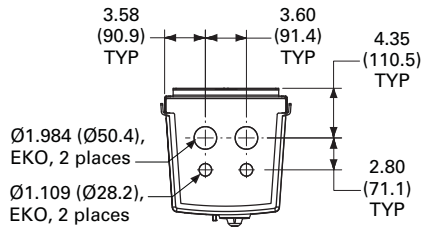
H2

2



Approximate Dimensions in Inches (mm)

**H3**





# 2.8

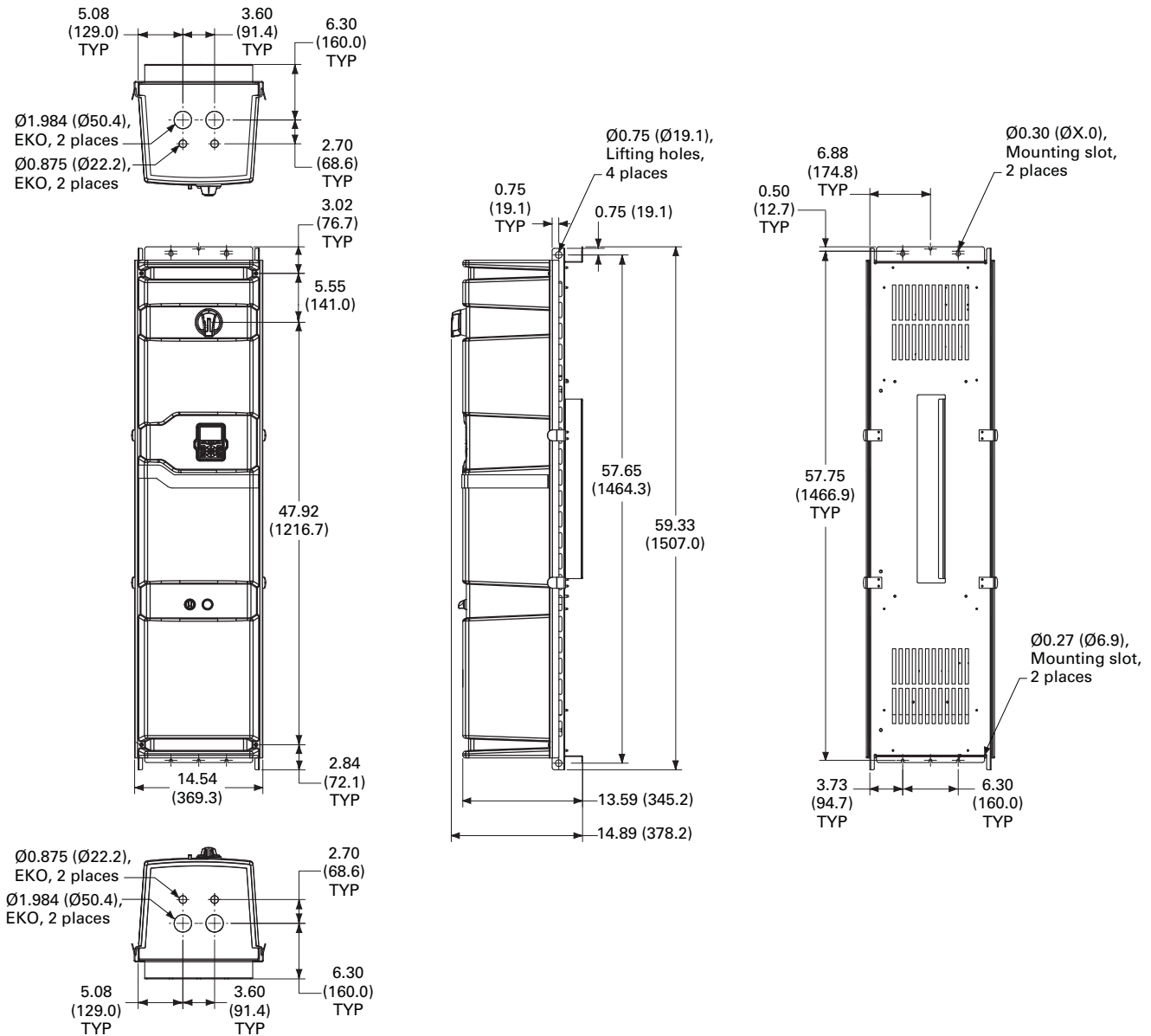
## Adjustable Frequency Drives

### PowerXL DH1 Series Drives

Approximate Dimensions in Inches (mm)

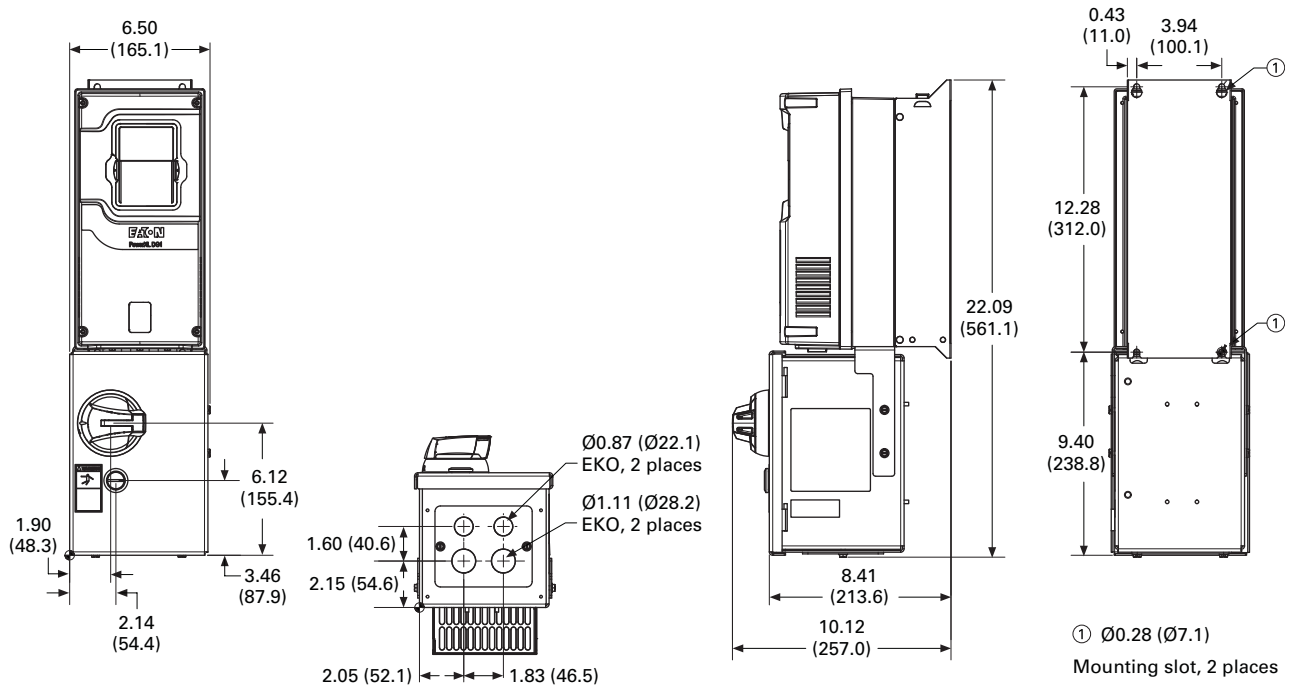
H4

2

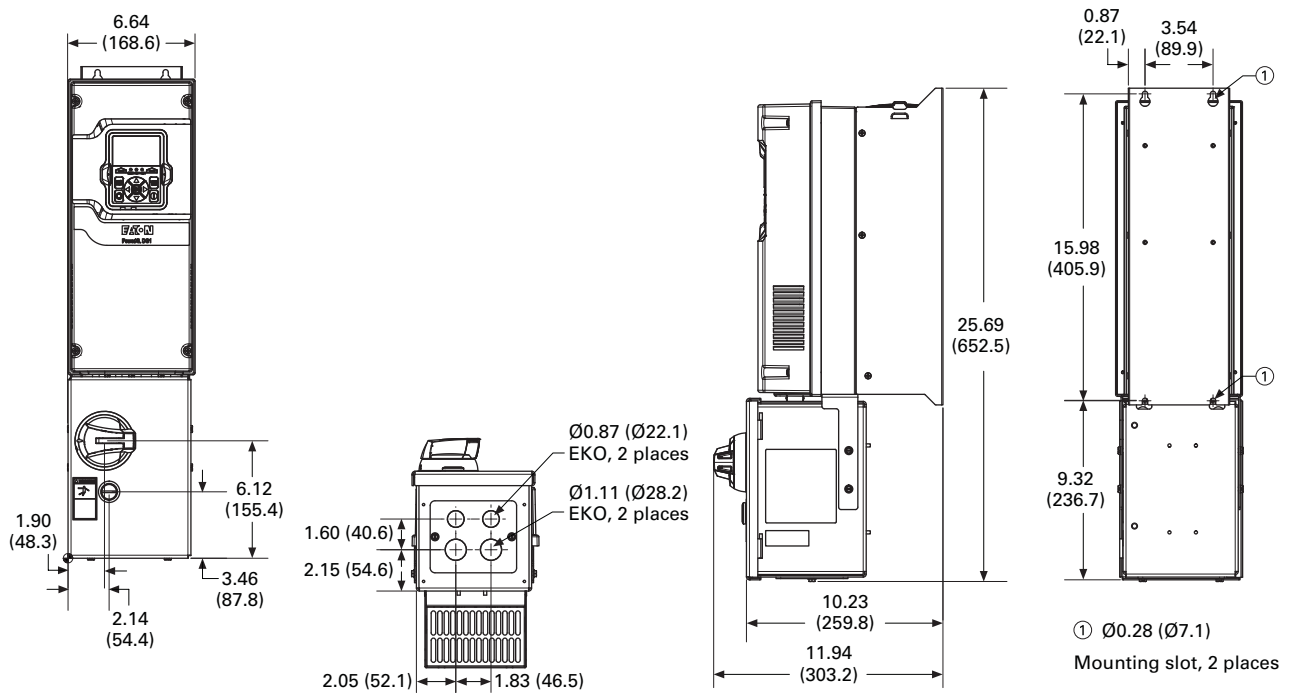


Approximate Dimensions in Inches (mm)

## H1D



## H2D



# 2.8

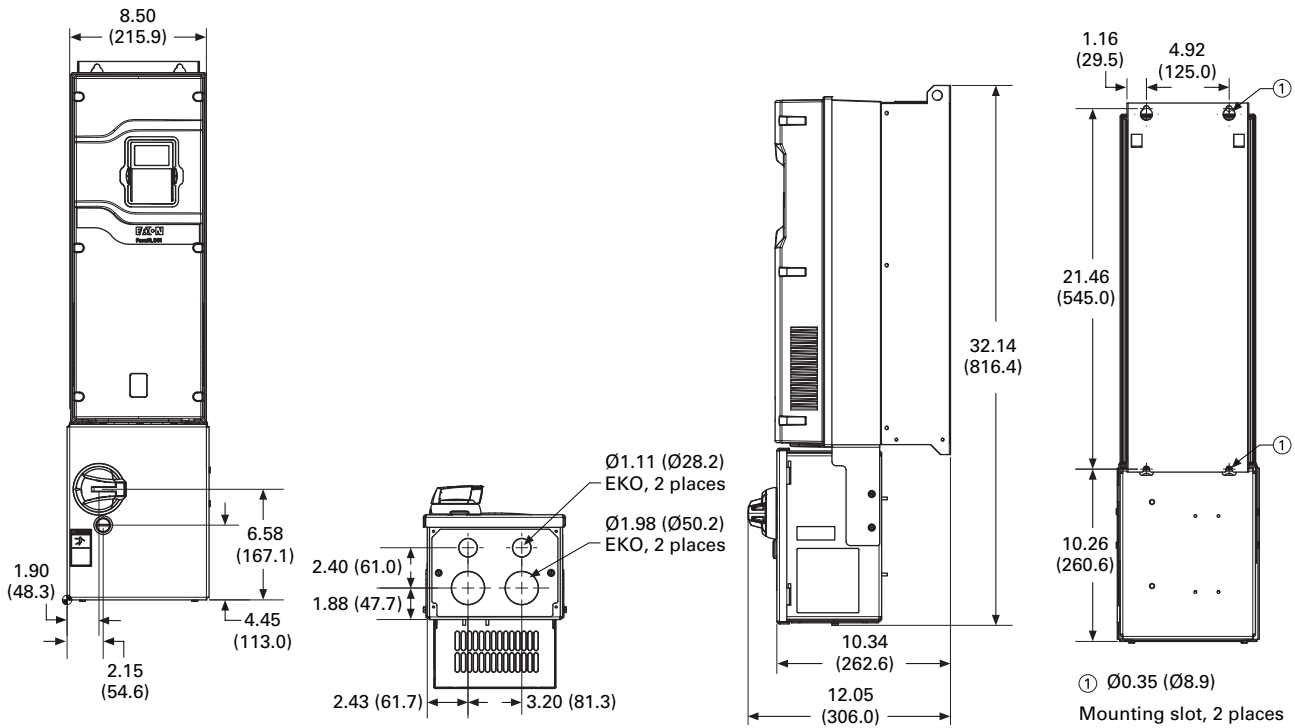
## Adjustable Frequency Drives

### PowerXL DH1 Series Drives

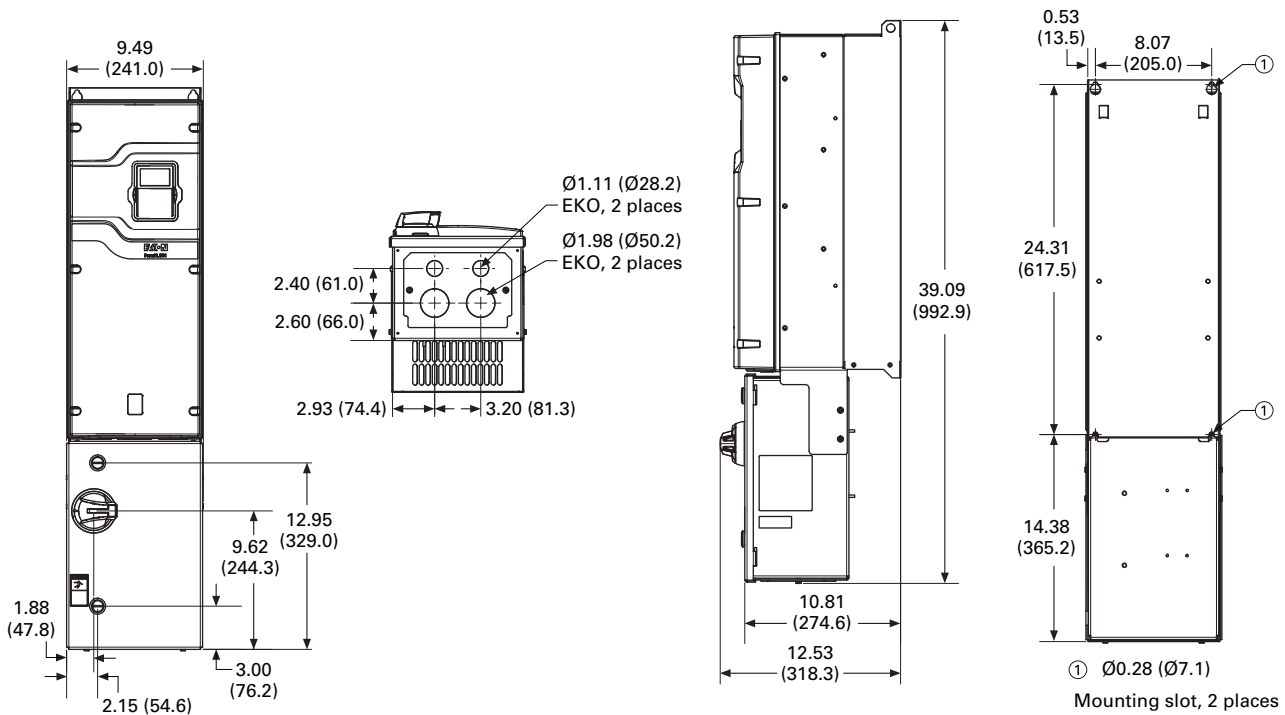
Approximate Dimensions in Inches (mm)

#### H3D

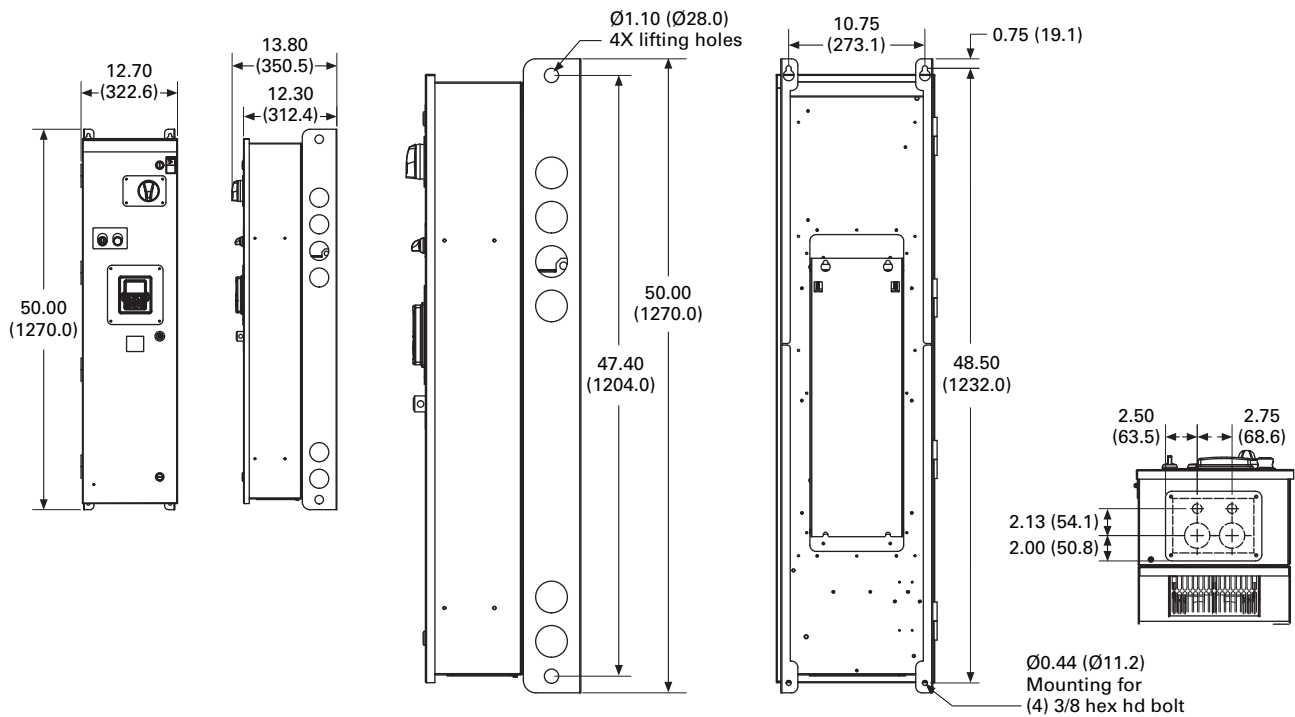
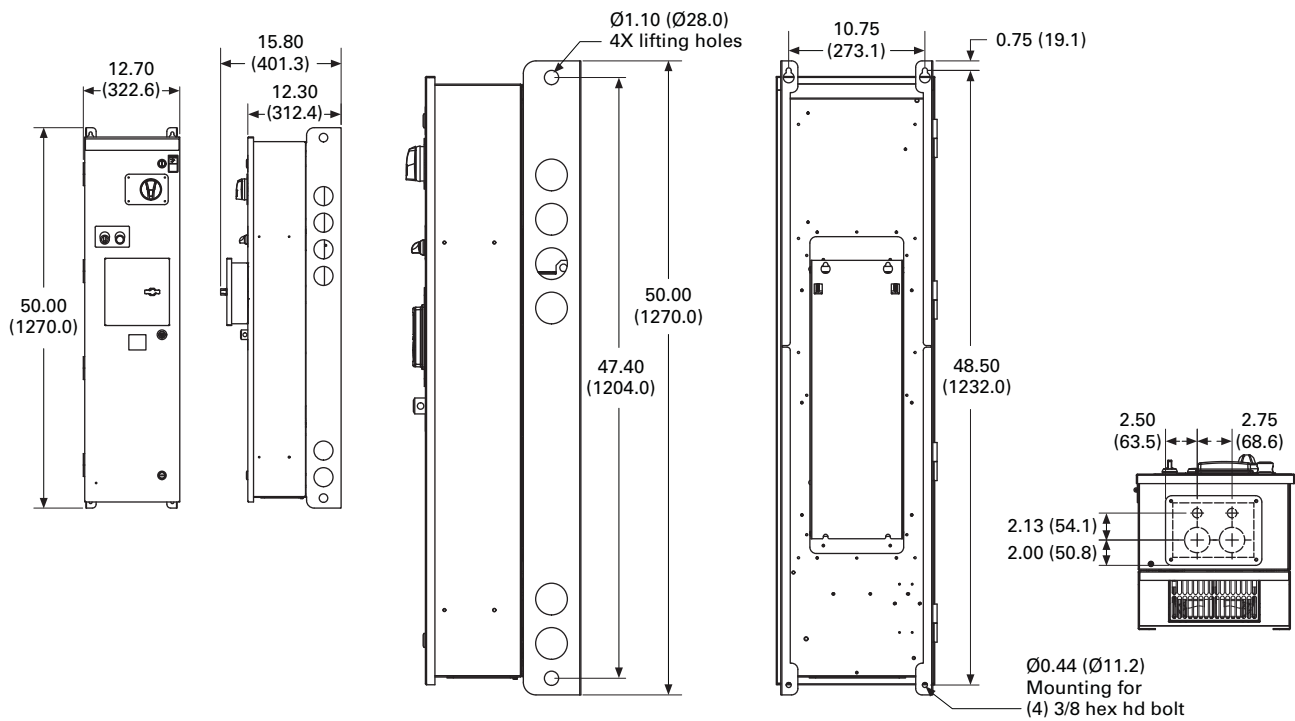
2



#### H4D



Approximate Dimensions in Inches (mm)

**H3X—Type 12****H3X—Type 3R**

# 2.8

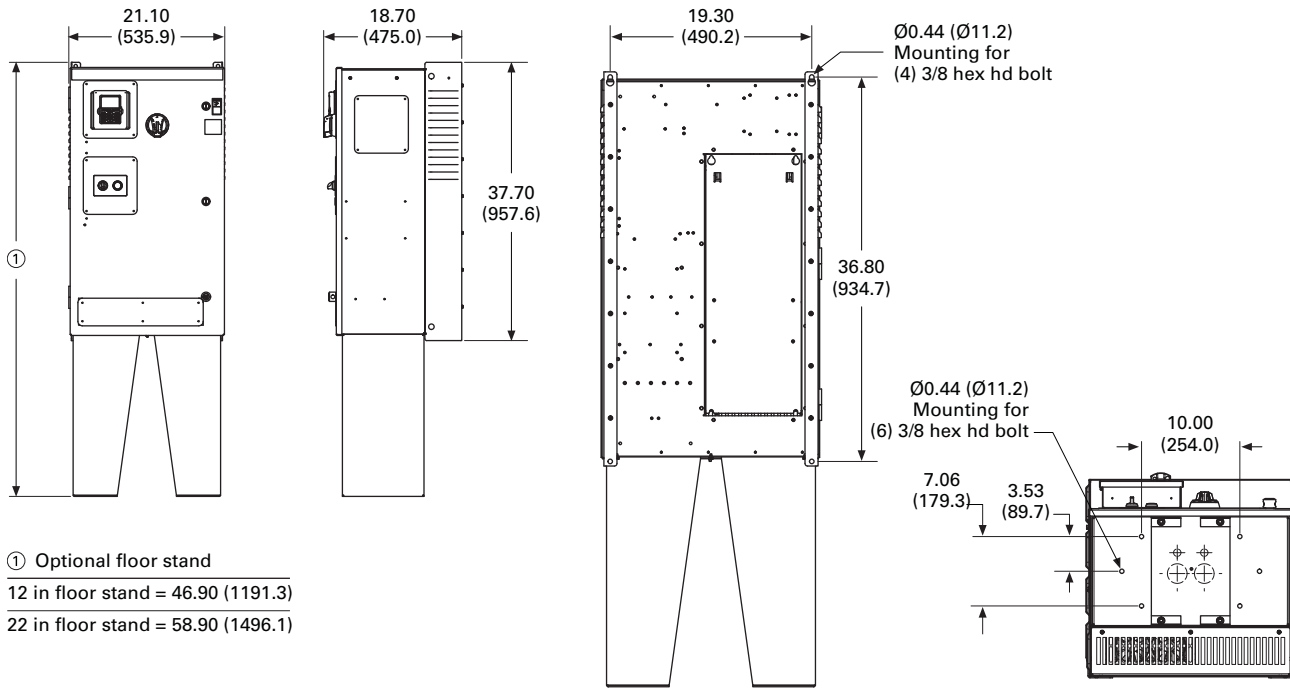
## Adjustable Frequency Drives

### PowerXL DH1 Series Drives

Approximate Dimensions in Inches (mm)

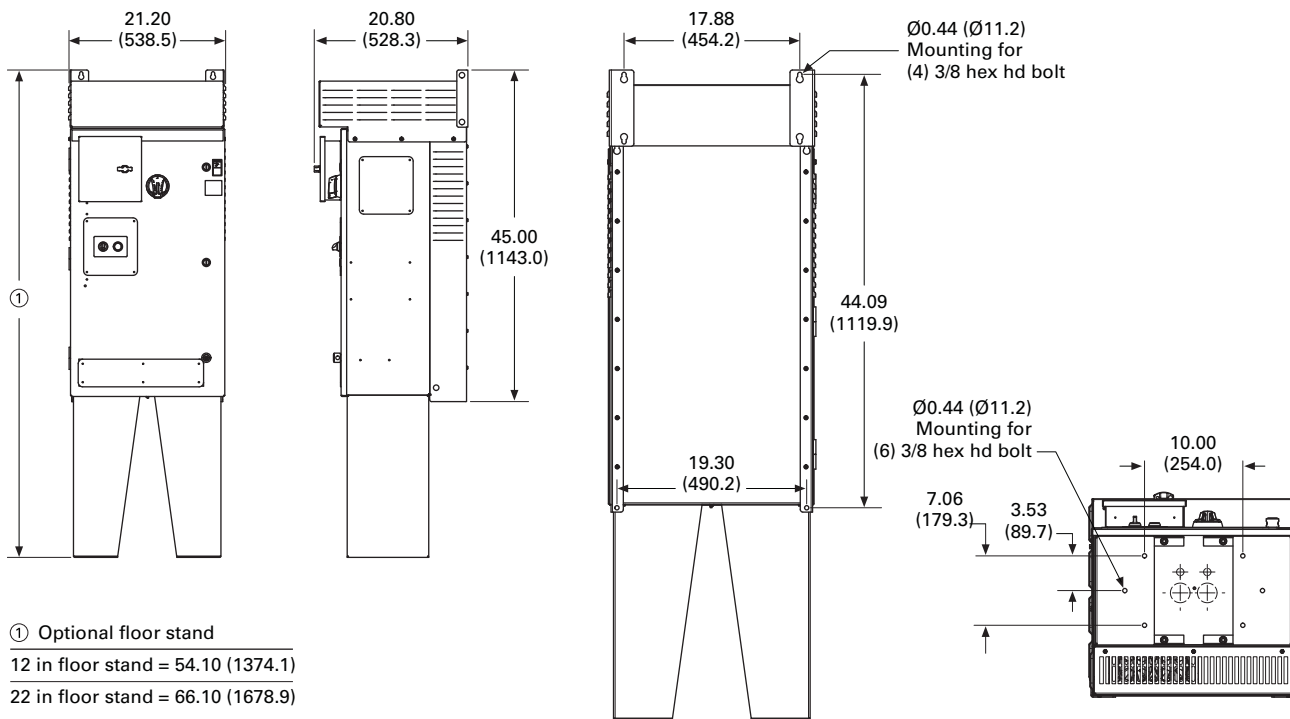
#### BX—Type 12

2



- ① Optional floor stand
- 12 in floor stand = 46.90 (1191.3)
- 22 in floor stand = 58.90 (1496.1)

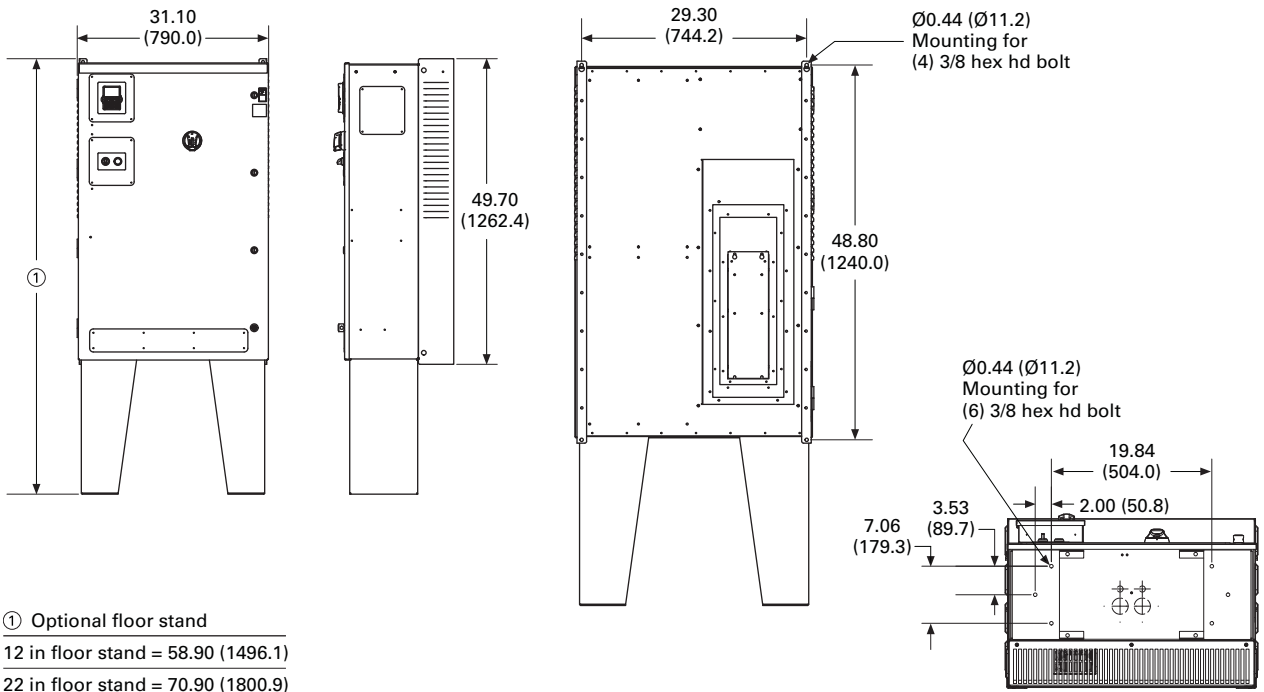
#### BX—Type 3R



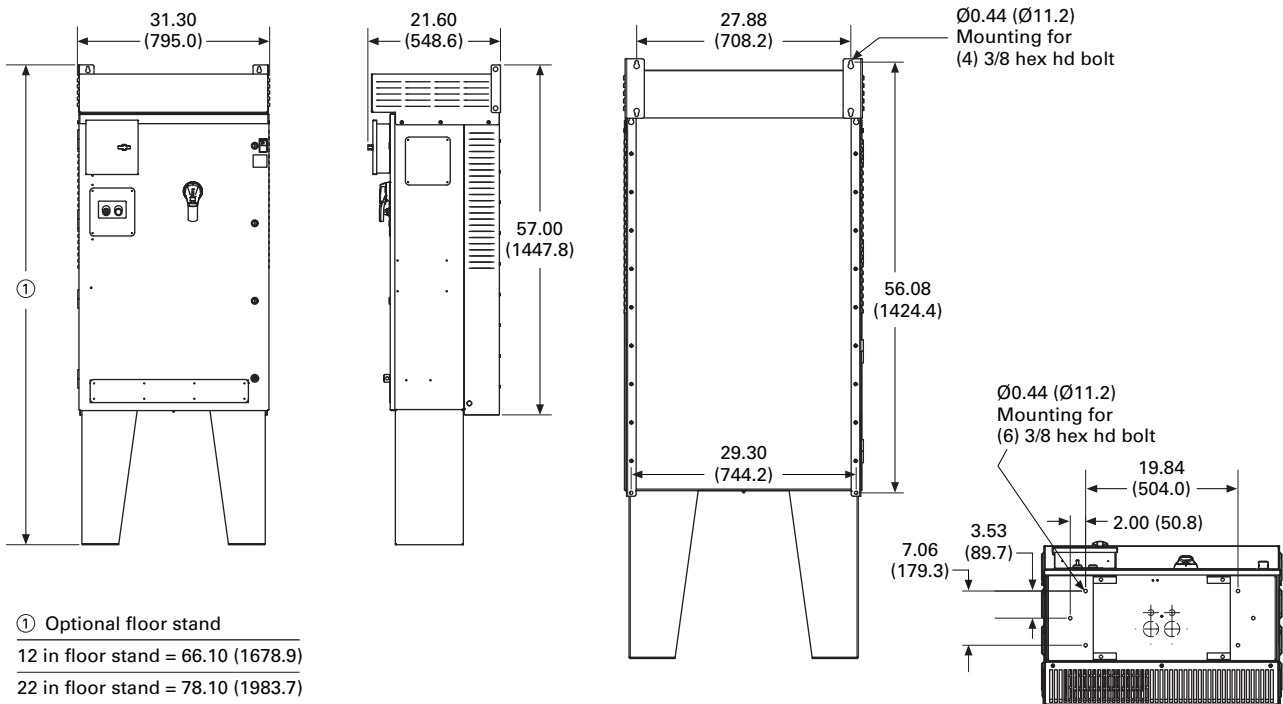
- ① Optional floor stand
- 12 in floor stand = 54.10 (1374.1)
- 22 in floor stand = 66.10 (1678.9)

Approximate Dimensions in Inches (mm)

### CX—Type 1 and Type 12



### CX—Type 3R



# 2.8

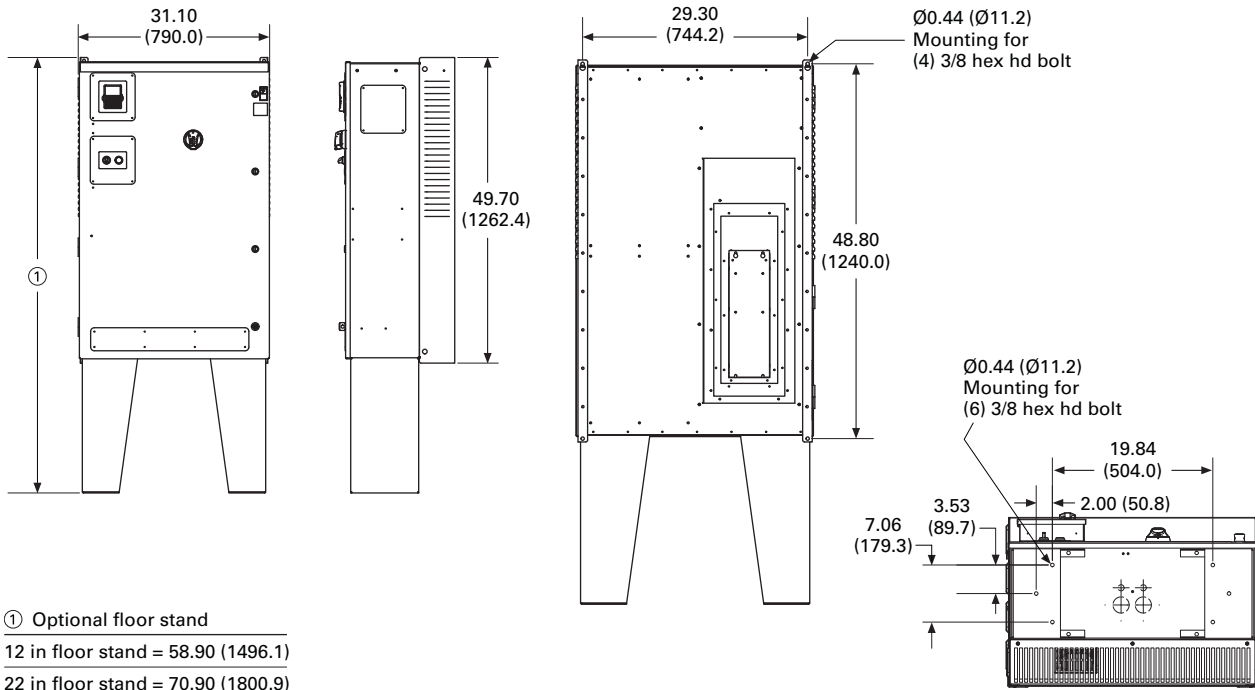
## Adjustable Frequency Drives

### PowerXL DH1 Series Drives

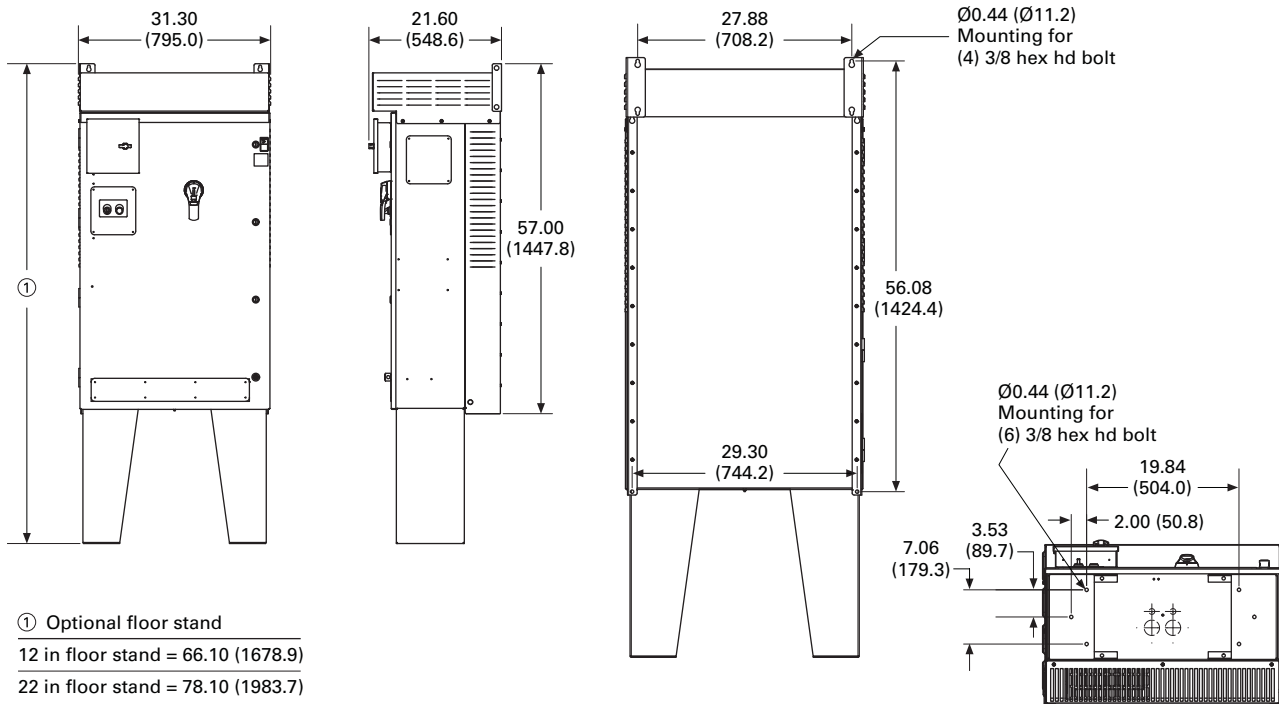
Approximate Dimensions in Inches (mm)

#### CX-XL—Type 1 and Type 12

2

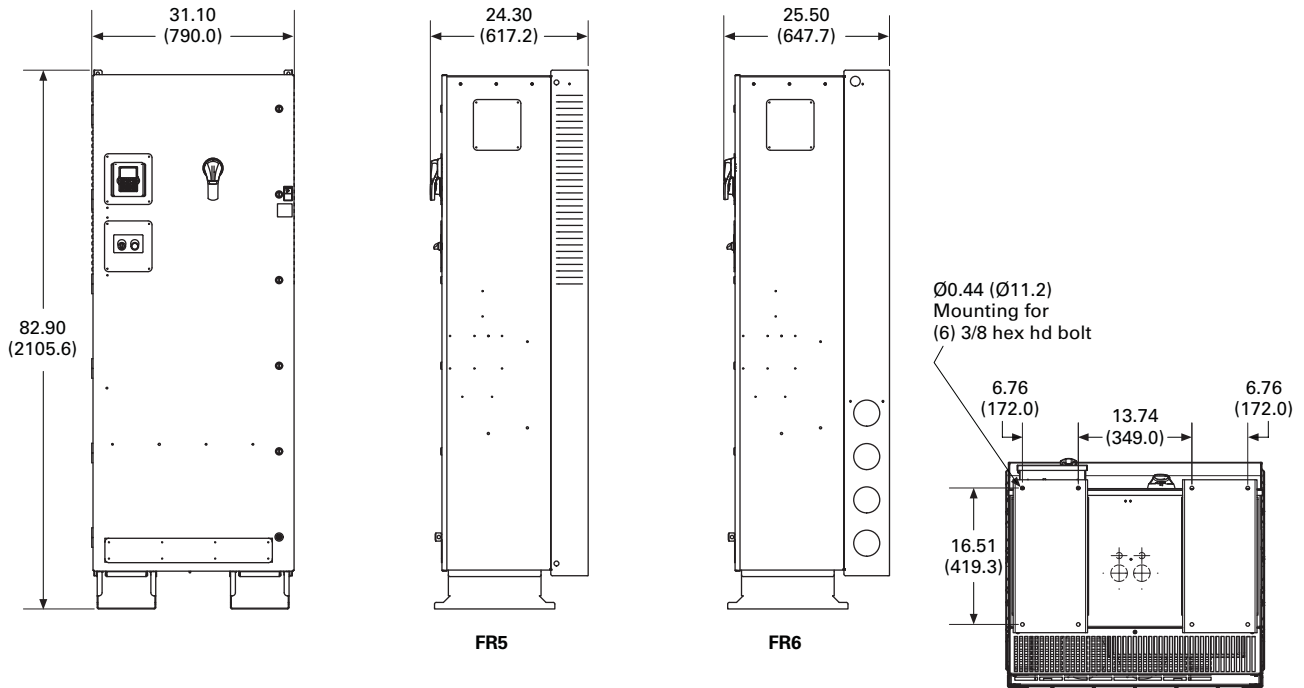


#### CX-XL—Type 3R

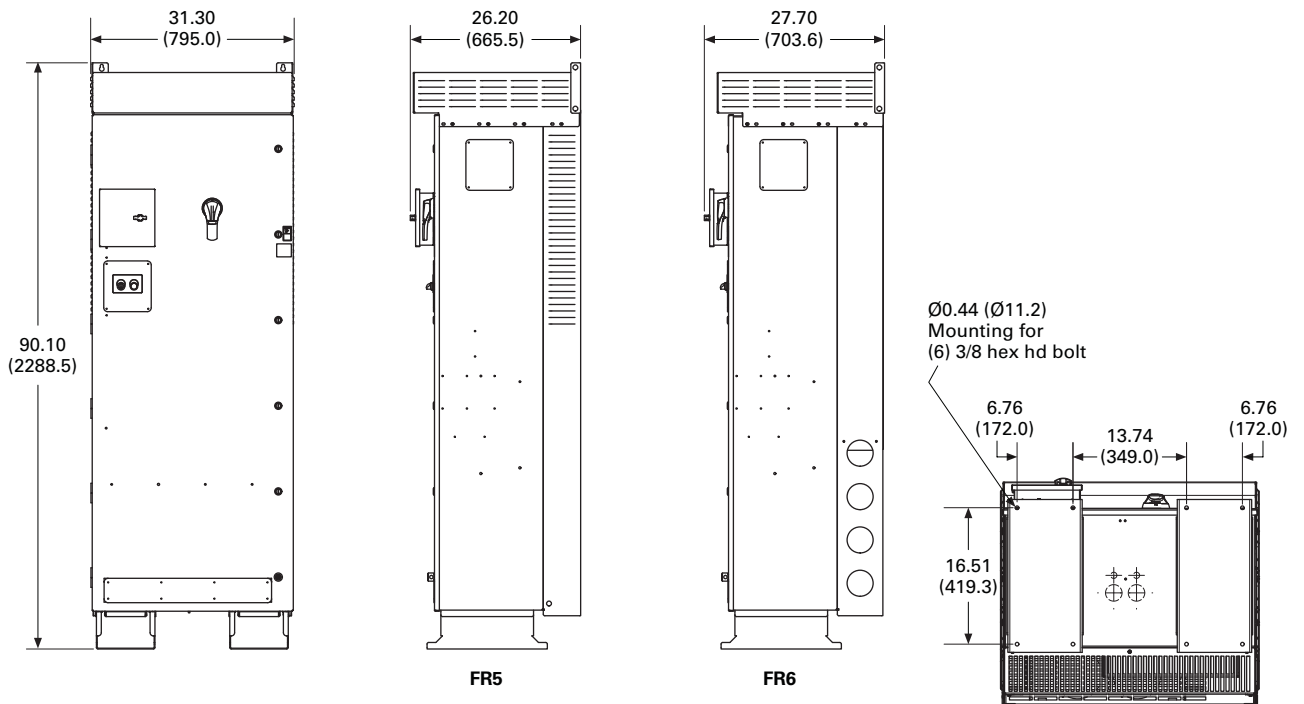


Approximate Dimensions in Inches (mm)

**DX—Type 1 and Type 12 (FR5 and FR6)**



**DX—Type 3R (FR5 and FR6)**





# 2.8

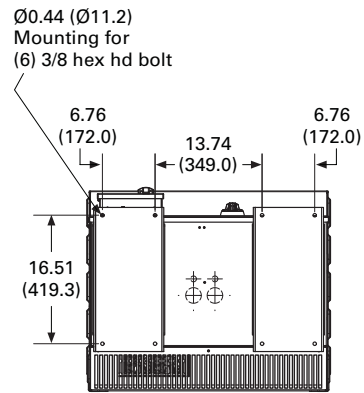
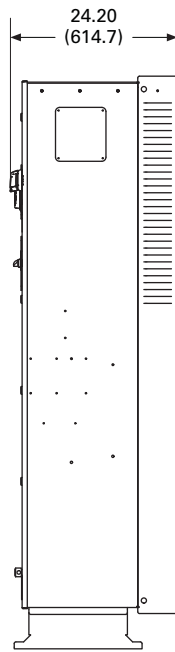
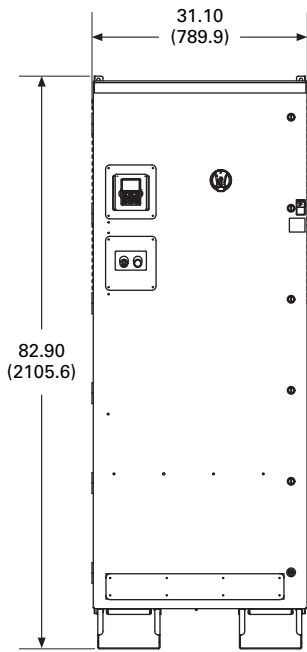
## Adjustable Frequency Drives

### PowerXL DH1 Series Drives

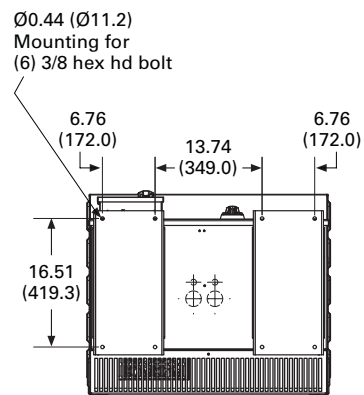
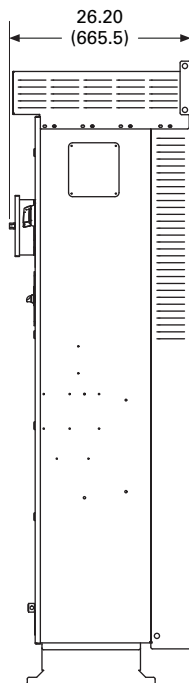
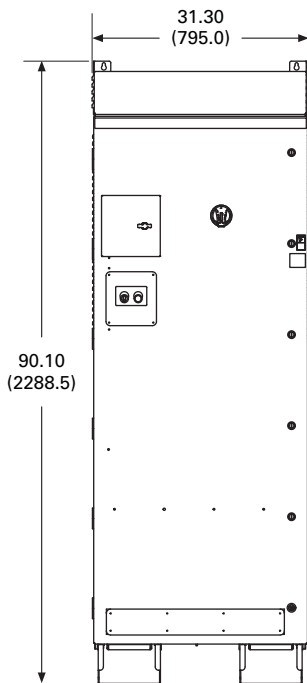
Approximate Dimensions in Inches (mm)

#### DX-XL—Type 1 and Type 12

2

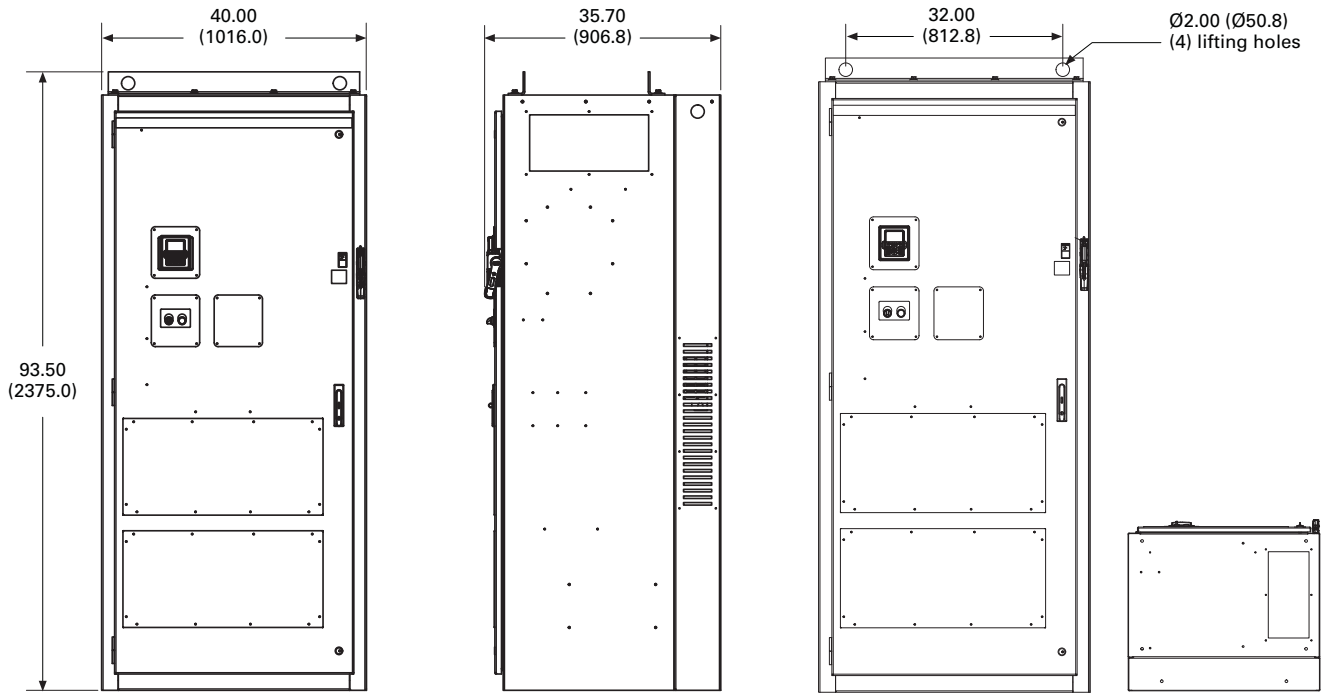


#### DX-XL—Type 3R

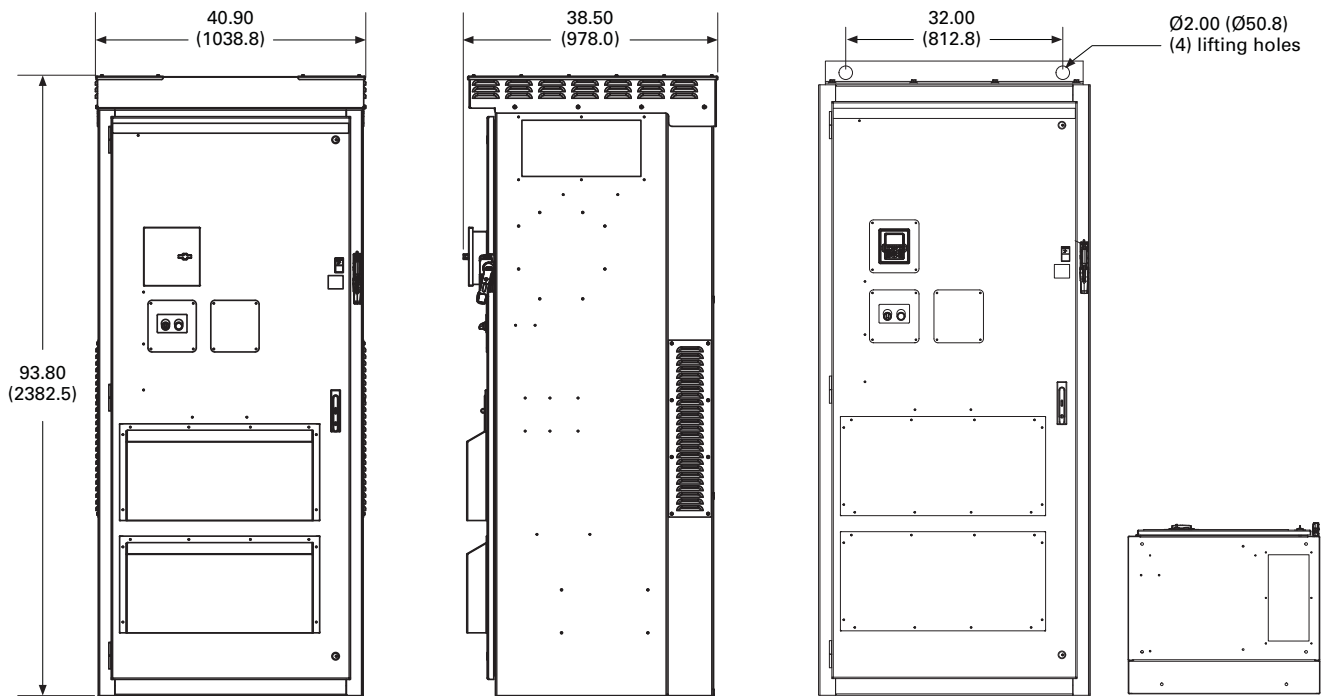


Approximate Dimensions in Inches (mm)

### EX-XL—Type 1 and Type 12



### EX-XL—Type 3R



# 2.8

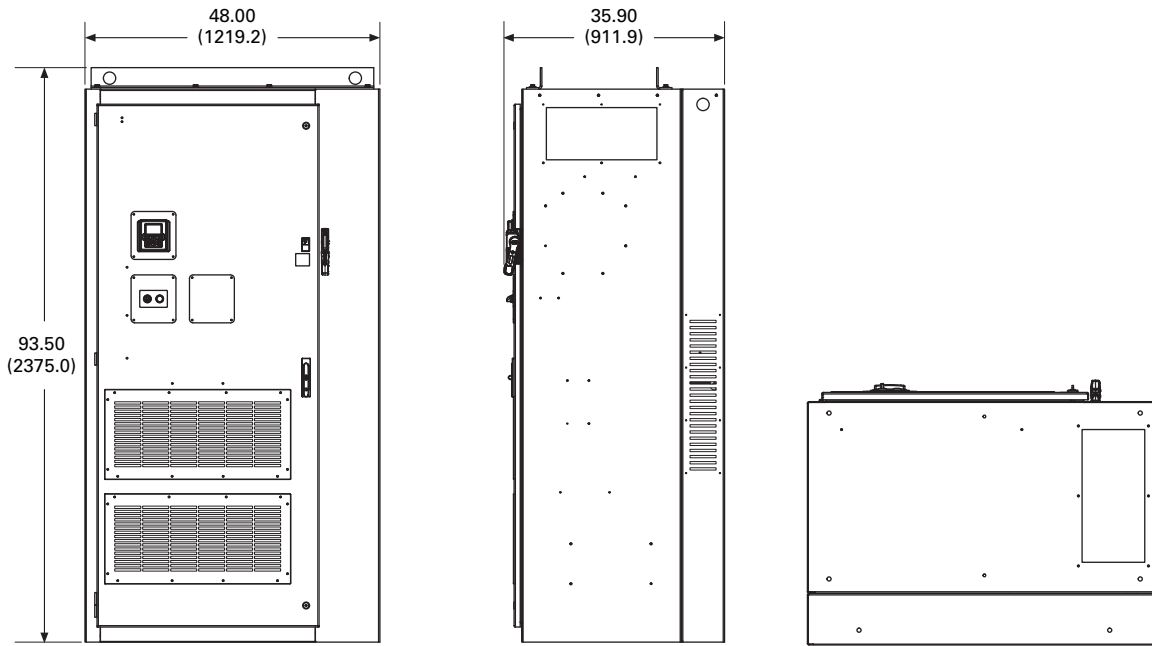
## Adjustable Frequency Drives

### PowerXL DH1 Series Drives

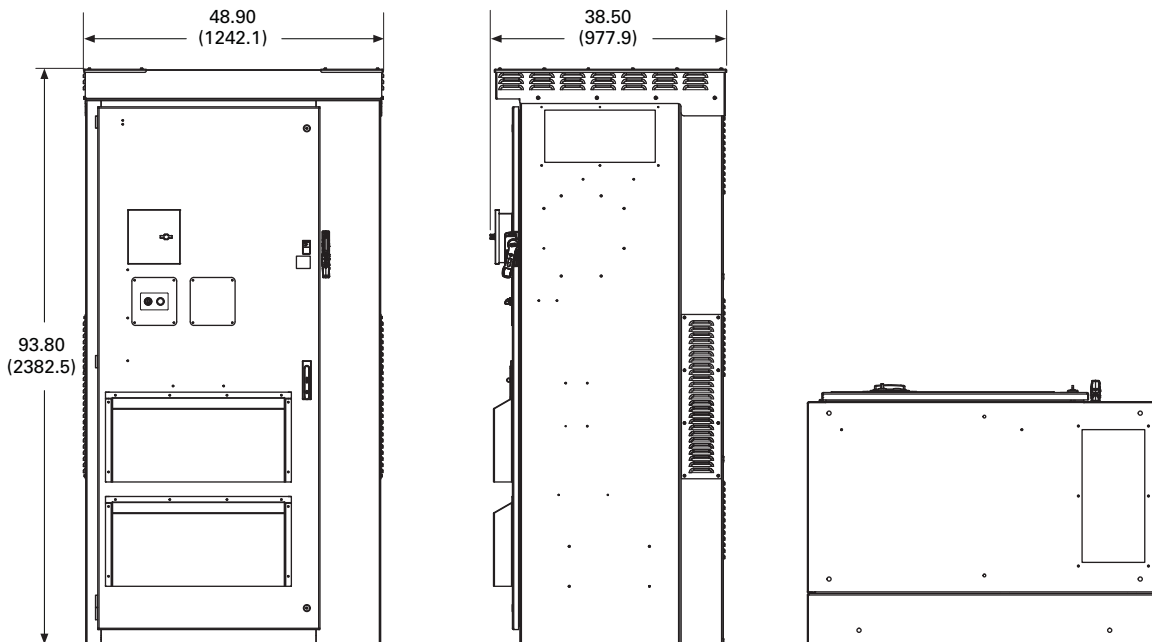
Approximate Dimensions in Inches (mm)

#### FX-XL—Type 1 and Type 12

2



#### FX-XL—Type 3R



## H-Max Drives



## H-Max Drives

## Product Description

Eaton's H-Max Series VFD has software and hardware designed specifically for the HVAC, pump industry. The ultra-efficient DC capacitor and power structure allows the drive to consume less energy, lowering greenhouse gases.

The I/O configuration is designed with wiring ergonomics in mind by including removable terminal blocks. The main, easily removable, control board used for all drive frames with six digital IN, two analog IN, one analog OUT, three relay OUT accepts two additional I/O or communication board. In addition, the control board has built-in RS-485 and Ethernet communication.

These drives continue the tradition of robust performance, and raise the bar on features and functionality, ensuring the best solution at the right price.

In addition to the Active Energy Control Algorithm to maximize motor efficiency, the drive boasts an ultra-efficient DC capacitor and power structure to allow less energy consumption, lowering greenhouse gases.

## Features and Benefits

## Hardware

- Thin metal capacitor design—ultra-efficient drive operation and extended self life (up to five years without reforming)
- Integrated 5% DC link choke with Input surge protection—protects against voltage spikes and provides a clean wave form to the motor
- EMI/RFI filters standard on all drives—meets EMC Category 2 for commercial applications
- Real-time clock—supports calendaring and time stamped fault history
- Graphic LCD display and keypad—supports simple menu navigation as well as on-screen diagnostics and troubleshooting
- HAND-OFF-AUTO and drive-bypass selector on keypad—simplifies control
- Standard I/O: 6DI, 2AI, 1AO, 2 Form C RO (NO/NC), 1 Form A RO (NO)—supports requirements for most installations

## Contents

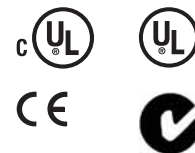
## Description

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Accessories . . . . .	V6-T2-229
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Technical Data and Specifications . . . . .	V6-T2-232
Wiring Diagram . . . . .	V6-T2-233
Dimensions . . . . .	V6-T2-234
H-Max IntelliPass and IntelliDisconnect Drives . . . . .	V6-T2-235

## Standards and Certifications

## Product

- IEC 61800-5-1
- CE
- UL508C
- cUL
- C-Tick Mark
- OSHPD Seismic Certified
- Plenum Rated



- Onboard RS 485: Modbus, N2, BACnet—meets needs of most communication requirements
- Onboard Ethernet: BACnet/IP, Modbus/TCP—meets needs of most communication requirements
- Two expansion slots—intended to support additional I/O or communication protocols as necessary
- Quick disconnect terminals for I/O connections—supports fast easy installation

## Software

- Active energy control—minimizes energy losses in your motor resulting in industry leading energy efficiency for your application
- Quick Start Wizard upon initial power up—supports fast easy installation
- Copy/paste functionality on drive keypad—allows for fast setup of multiple drives
- Pre-programmed I/O—supports fast easy installation for most applications

# 2.9

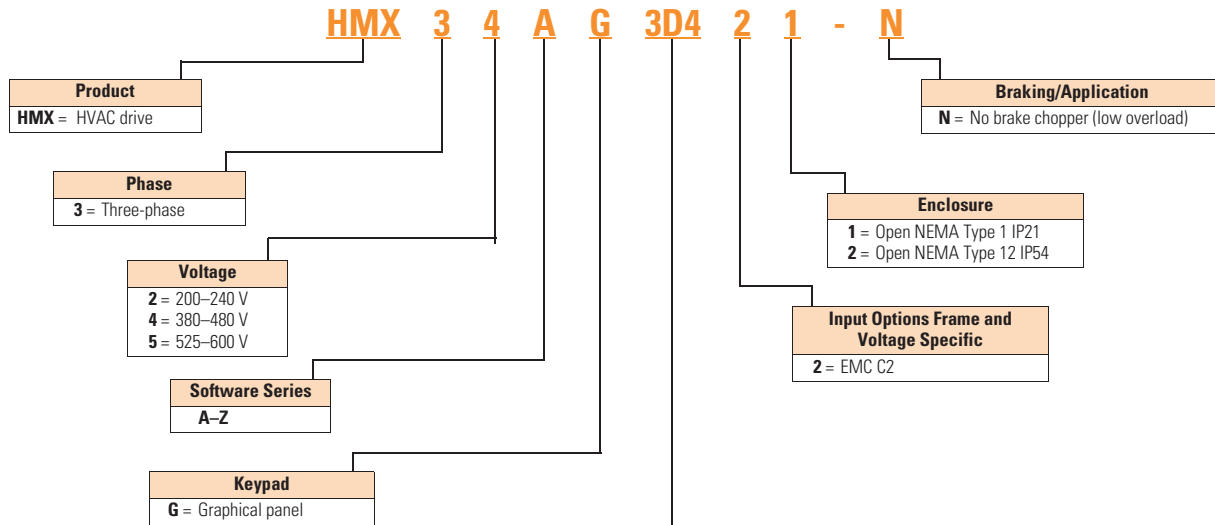
## Adjustable Frequency Drives

### H-Max Series Drives

#### Catalog Number Selection

#### H-Max Series Drives

2



Amperes		
200–240 Volts	380–480 Volts	525–600 Volts
<b>3D7</b> = 3.7 A–0.75 hp, 0.55 kW	<b>3D4</b> = 3.4 A–1.5 hp, 1.1 kW	<b>3D9</b> = 3.9 A, 3 hp, 2.2 kW
<b>4D8</b> = 4.8 A–1 hp, 0.75 kW	<b>4D8</b> = 4.8–2 hp, 1.5 kW	<b>6D1</b> = 6.1 A, 5 hp, 3.7 kW
<b>6D6</b> = 6.6 A–1.5 hp, 1.1 kW	<b>5D6</b> = 5.6 A–3 hp, 2.2 kW	<b>9D0</b> = 9 A, 7.5 hp, 5.5 kW
<b>8D0</b> = 8 A–2 hp, 1.5 kW	<b>8D0</b> = 8 A–4 hp, 3 kW	<b>011</b> = 11 A, 10 hp, 7.5 kW
<b>011</b> = 11 A–3 hp, 2.2 kW	<b>9D6</b> = 9.6 A–5 hp, 4 kW	<b>018</b> = 18 A, 15 hp, 11 kW
<b>012</b> = 12 A–4 hp, 3 kW	<b>012</b> = 12 A–7.5 hp, 5.5 kW	<b>022</b> = 22 A, 20 hp, 15 kW
<b>018</b> = 18 A–5 hp, 4 kW	<b>016</b> = 16 A–10 hp, 7.5 kW	<b>027</b> = 27 A, 25 hp, 18 kW
<b>024</b> = 24 A–7.5 hp, 5.5 kW	<b>023</b> = 23 A–15 hp, 11 kW	<b>034</b> = 34 A, 30 hp, 22 kW
<b>031</b> = 31 A–10 hp, 7.5 kW	<b>031</b> = 31 A–20 hp, 15 kW	<b>041</b> = 41 A, 40 hp, 30 kW
<b>048</b> = 48 A–15 hp, 11 kW	<b>038</b> = 38 A–25 hp, 18.5 kW	<b>052</b> = 52 A, 50 hp, 37 kW
<b>062</b> = 62 A–20 hp, 15 kW	<b>046</b> = 46 A–30 hp, 22 kW	<b>062</b> = 62 A, 60 hp, 45 kW
<b>075</b> = 75 A–25 hp, 18.5 kW	<b>061</b> = 61 A–40 hp, 30 kW	<b>080</b> = 80 A, 75 hp, 55 kW
<b>088</b> = 88 A–30 hp, 22 kW	<b>072</b> = 72 A–50 hp, 37 kW	<b>100</b> = 100 A, 100 hp, 75 kW
<b>105</b> = 105 A–40 hp, 30 kW	<b>087</b> = 87 A–60 hp, 45 kW	<b>125</b> = 125 A, 125 hp, 90 kW
<b>140</b> = 140 A–50 hp, 37 kW	<b>105</b> = 105 A–75 hp, 55 kW	<b>144</b> = 144 A, 150 hp, 110 kW
<b>170</b> = 170 A–60 hp, 45 kW	<b>140</b> = 140 A–100 hp, 75 kW	<b>208</b> = 208 A, 200 hp, 160 kW
<b>205</b> = 205 A–75 hp, 55 kW	<b>170</b> = 170 A–125 hp, 90 kW	
<b>261</b> = 261 A–100 hp, 75 kW	<b>205</b> = 205 A–150 hp, 110 kW	
<b>310</b> = 310 A–125 hp, 90 kW	<b>261</b> = 261 A–200 hp, 132 kW	
	<b>310</b> = 310 A–250 hp, 160 kW	

#### Notes

- All boards are varnished (conformed coated). Corrosion resistant.
- Battery included in all drives for real-time clock.
- Keypad kit includes HOA bypass.
- Keypad kit includes HOA, back reset for Europe application.
- EMI/RFI filters included.
- DC link choke included.

## Product Selection

## H-Max Series Drives—230 Vac

## NEMA Type 1



## NEMA Type 1/IP21

FS Frame Size	Drive Output Current		Assigned Motor Ratings			Catalog Number
	Low Overload Full Load Amps at 40 °C	Horsepower	Drive kW 230 Vac/50 Hz	230 Vac NEC Amps ①	Low Overload Full Load Amps at 50 °C	
4	3.7	0.75	0.55	3.2	2.6	HMX32AG3D721-N
	4.8	1	0.75	4.2	3.7	HMX32AG4D821-N
	6.6	1.5	1.1	6.6	4.8	HMX32AG6D621-N
	8	2	1.5	6.8	6.6	HMX32AG8D021-N
	11	3	2.2	9.6	8	HMX32AG01121-N
	12.5	4	3	N/A	11	HMX32AG01221-N
5	18	5	4	15.2	12.5	HMX32AG01821-N
	24	7.5	5.5	22	18	HMX32AG02421-N
	31	10	7.5	28	24	HMX32AG03121-N
6	48	15	11	42	31	HMX32AG04821-N
	62	20	15	54	48	HMX32AG06221-N
7	75	25	18.5	68	62	HMX32AG07521-N
	88	30	22	80	75	HMX32AG08821-N
	105	40	30	104	88	HMX32AG10521-N
8	140	50	37	130	105	HMX32AG14021-N
	170	60	45	154	140	HMX32AG17021-N
	205	75	55	192	170	HMX32AG20521-N
9	261	100	75	248	205	HMX32AG26121-N
	310	125	90	N/A	261	HMX32AG31021-N

## NEMA Type 12



## NEMA Type 12/IP54

FS Frame Size	Drive Output Current		Assigned Motor Ratings			Catalog Number
	Low Overload Full Load Amps at 40 °C	Horsepower	Drive kW 230 Vac/50 Hz	230 Vac NEC Amps ①	Low Overload Full Load Amps at 50 °C	
4	3.7	0.75	0.55	3.2	2.6	HMX32AG3D722-N
	4.8	1	0.75	4.2	3.7	HMX32AG4D822-N
	6.6	1.5	1.1	6.6	4.8	HMX32AG6D622-N
	8	2	1.5	6.8	6.6	HMX32AG8D022-N
	11	3	2.2	9.6	8	HMX32AG01122-N
	12.5	4	3	N/A	11	HMX32AG01222-N
5	18	5	4	15.2	12	HMX32AG01822-N
	24	7.5	5.5	22	18	HMX32AG02422-N
	31	10	7.5	28	24	HMX32AG03122-N
6	48	15	11	42	31	HMX32AG04822-N
	62	20	15	54	48	HMX32AG06222-N
7	75	25	18.5	68	62	HMX32AG07522-N
	88	30	22	80	75	HMX32AG08822-N
	105	40	30	104	88	HMX32AG10522-N
8	140	50	37	130	105	HMX32AG14022-N
	170	60	45	154	140	HMX32AG17022-N
	205	75	55	192	170	HMX32AG20522-N
9	261	100	75	248	205	HMX32AG26122-N
	310	125	90	N/A	261	HMX32AG31022-N

**Note**

① For sizing reference.

#### H-Max Series Drives—480 Vac

2

##### NEMA Type 1



##### NEMA Type 1/IP21

FS Frame Size	Drive Output Current		Assigned Motor Ratings			Catalog Number
	Low Overload Full Load Amps at 40 °C	Horsepower	Drive kW 400 Vac/50 Hz	480 Vac NEC Amps ①	Low Overload Full Load Amps at 50 °C	
4	3.4	1.5	1.1	2.1	2.6	HMX34AG3D421-N
	4.8	2	1.5	3.4	3.4	HMX34AG4D821-N
	5.6	3	2.2	5.6	4.8	HMX34AG5D621-N
	8.0	4	3.0	N/A	5.6	HMX34AG8D021-N
	9.6	5	4	7.6	8	HMX34AG9D621-N
	12	7.5	5.5	11	9.6	HMX34AG01221-N
5	16	10	7.5	14	12	HMX34AG01621-N
	23	15	11	21	16	HMX34AG02321-N
	31	20	15	27	23	HMX34AG03121-N
6	38	25	18.5	34	31	HMX34AG03821-N
	46	30	22	40	38	HMX34AG04621-N
	61	40	30	52	46	HMX34AG06121-N
7	72	50	37	65	61	HMX34AG07221-N
	87	60	45	77	72	HMX34AG08721-N
	105	75	55	96	87	HMX34AG10521-N
8	140	100	75	124	105	HMX34AG14021-N
	170	125	90	156	140	HMX34AG17021-N
	205	150	110	180	170	HMX34AG20521-N
9	261	200	132	240	205	HMX34AG26121-N
	310	250	160	302	261	HMX34AG31021-N

##### NEMA Type 12



##### NEMA Type 12/IP54

FS Frame Size	Drive Output Current		Assigned Motor Ratings			Catalog Number
	Low Overload Full Load Amps at 40 °C	Horsepower	Drive kW 400 Vac/50 Hz	480 Vac NEC Amps ①	Low Overload Full Load Amps at 50 °C	
4	3.4	1.5	1.1	2.1	2.6	HMX34AG3D422-N
	4.8	2	1.5	3.4	3.4	HMX34AG4D822-N
	5.6	3	2.2	5.6	4.8	HMX34AG5D622-N
	8.0	4	3.0	N/A	5.6	HMX34AG8D022-N
	9.6	5	4	7.6	8	HMX34AG9D622-N
	12	7.5	5.5	11	9.6	HMX34AG01222-N
5	16	10	7.5	14	12	HMX34AG01622-N
	23	15	11	21	16	HMX34AG02322-N
	31	20	15	27	23	HMX34AG03122-N
6	38	25	18.5	34	31	HMX34AG03822-N
	46	30	22	40	38	HMX34AG04622-N
	61	40	30	52	46	HMX34AG06122-N
7	72	50	37	65	61	HMX34AG07222-N
	87	60	45	77	72	HMX34AG08722-N
	105	75	55	96	87	HMX34AG10522-N
8	140	100	75	124	105	HMX34AG14022-N
	170	125	90	156	140	HMX34AG17022-N
	205	150	110	180	170	HMX34AG20522-N
9	261	200	132	240	205	HMX34AG26122-N
	310	250	160	302	261	HMX34AG31022-N

**Note**

① For sizing reference.

## H-Max Series Drives—600 Vac

## NEMA Type 1



## NEMA Type 1/IP21

FS Frame Size	Drive Output Current		Assigned Motor Ratings			Catalog Number
	Low Overload Full Load Amps at 40 °C	Horsepower	Drive kW 575 Vac/50 Hz	575 Vac NEC Amps ①	Low Overload Full Load Amps at 50 °C	
5	3.9	3	2.2	4.6	3.3	HMX35AG3D921-N
	6.1	5	3.7	6.8	5.2	HMX35AG6D121-N
	9	7.5	5.5	9	7.7	HMX35AG9D021-N
	11	10	7.5	10.5	9.4	HMX35AG01121-N
6	18	15	11	19.9	15.3	HMX35AG01821-N
	22	20	15	23.3	18.7	HMX35AG02221-N
	27	25	18	27.2	23	HMX35AG02721-N
	34	30	22	32.8	28.9	HMX35AG03421-N
7	41	40	30	45.3	34.9	HMX35AG04121-N
	52	50	37	53.8	44.2	HMX35AG05221-N
	62	60	45	62.2	52.7	HMX35AG06221-N
8	80	75	55	90	68	HMX35AG08021-N
	100	100	75	106	85	HMX35AG10021-N
	125	125	90	127	106.3	HMX35AG12521-N
9	144	150	110	156	122.4	HMX35AG14421-N
	208	200	160	212	176.8	HMX35AG20821-N

## NEMA Type 12



## NEMA Type 12/IP54

FS Frame Size	Drive Output Current		Assigned Motor Ratings			Catalog Number
	Low Overload Full Load Amps at 40 °C	Horsepower	Drive kW 575 Vac/50 Hz	575 Vac NEC Amps ①	Low Overload Full Load Amps at 50 °C	
5	3.9	3	2.2	4.6	3.3	HMX35AG3D922-N
	6.1	5	3.7	6.8	5.2	HMX35AG6D122-N
	9	7.5	5.5	9	7.7	HMX35AG9D022-N
	11	10	7.5	10.5	9.4	HMX35AG01122-N
6	18	15	11	19.9	15.3	HMX35AG01822-N
	22	20	15	23.3	18.7	HMX35AG02222-N
	27	25	18	27.2	23	HMX35AG02722-N
	34	30	22	32.8	28.9	HMX35AG03422-N
7	41	40	30	45.3	34.9	HMX35AG04122-N
	52	50	37	53.8	44.2	HMX35AG05222-N
	62	60	45	62.2	52.7	HMX35AG06222-N
8	80	75	55	90	68	HMX35AG08022-N
	100	100	75	106	85	HMX35AG10022-N
	125	125	90	127	106.3	HMX35AG12522-N
9	144	150	110	156	122.4	HMX35AG14422-N
	208	200	160	212	176.8	HMX35AG20822-N

**Note**

① For sizing reference.



#### Onboard Network Communications

##### Johnson Controls Metasys N2

H-Max Series provides communication between the drive and a Johnson Controls Metasys™ N2 network. With this connection, the drive can be controlled, monitored and programmed from the Metasys system. N2 can be selected and programmed by the drive keypad.

##### BACnet

H-Max Series provides communication to BACnet networks. Data transfer is master-slave/token passing (MS/TP) RS-485.

##### BACnet/IP

100Base-T interface.

##### Modbus TCP

Ethernet based protocol.

##### Modbus RTU

H-Max Series provides communication to Modbus RTU RS-485 as a slave on a Modbus network. Other communication parameters include an address range from 1–247; a parity of None, Odd or Even; and the stop bit is 1.

#### H-Max Series Option Board Kits Available for Slot B

The factory issued relay option board can be replaced with the following option

boards to customize the drive for your application needs.

The standard board provides 2 Form C RO (NO/NC) and 1 Form A RO (NO).

#### Option Boards Mounted in Slot B

Option Kit Description	Option Kit Catalog Number
I/O expander card, 2 RO and thermistor input	Relay Board 2

#### H-Max Series Option Board Kits Available for Slots D and E

**Note:** Slot C is inactive.

The H-Max Series drives can accommodate a wide selection of expander and adapter option boards to

customize the drive for your application needs. The drive's control unit is designed to accept a total of two option boards.

The H-Max Series factory-installed standard board configuration includes an I/O board and a relay output board.

#### Option Boards Mounted in Slots D and E

Option Kit Description	Option Kit Catalog Number
6 x DI /DO, each digital input can be individually programmed as digital output	XXM-IO-B1-A
1RO Form C (NO/NC), 1RO Form A (NO), 1 thermistor	XXM-IO-B2-A
1 x AI, 2 x AO (isolated)	XXM-IO-B4-A
3 x RO Form A (NO)	XXM-IO-B5-A
1RO Form A (NO), 5DI 42–240 Vac input	XXM-IO-B9-A
1 x AO, 1 x DO, 1 x RO	XXM-IO-BF-A
LonWorks®	XXM-COM-C4-A

#### NEMA Type 1 to NEMA Type 12/IP54 Conversion Kit

The NEMA Type 12/IP54 option kit is used to convert a NEMA Type 1 to a NEMA Type 12 drive.

Kit consists of a drive cover, fan kit and plugs.

#### NEMA Type 12/IP54 Cover

Option Kit Description	Option Kit Catalog Number
FS4-branded N12/IP54 cover with gasket, plastic plug, fans, Eaton logos	FS4-N12KIT
FS5-branded N12/IP54 cover with gasket, plastic plug, fans, Eaton logos	FS5-N12KIT
FS6-branded N12/IP54 cover with gasket, plastic plug, fans, Eaton logos	FS6-N12KIT

## Accessories

### Flange Kits

The flange kit is used when the power section heat sink is mounted through the back panel of an enclosure.

#### Flange Kit NEMA Type 12/IP54

Includes flange, mounting brackets, NEMA Type 12 fan components, air shroud screws and plugs.

### Frames FS4–FS7 <sup>①②</sup>

Description	Catalog Number
<b>NEMA Type 12/IP54</b>	
FS4 N12/IP54 flange kit (mounting N1 drive into N12 enclosure)	<b>FS4-Flange-N12KIT</b>
FS5 N12/IP54 flange kit (mounting N1 drive into N12 enclosure)	<b>FS5-Flange-N12KIT</b>
FS6 N12/IP54 flange kit (mounting N1 drive into N12 enclosure)	<b>FS6-Flange-N12KIT</b>
FS7 N12/IP54 flange kit (mounting N1 drive into N12 enclosure)	<b>FS7-Flange-N12KIT</b>

### Keypad Accessories

#### Remote Mounting Keypad Kit

### Frames FS4–FS9

Description	Catalog Number
Remote mounting keypad kit—bezel and cable	<b>OPTRMT-BP-HMAX-WLABL</b>

### Drive Demo

#### H-Max Series Drive Demo

### Demos and Power Supply

Description	Catalog Number
H-Max Series bypass demo	<b>H-MAX-BYPASS-DEMO</b>
Hand-held 24 V auxiliary power supply—used to supply power to the control module in order to perform keypad programming before the drive is connected to line voltage	<b>9000XAUX24 V</b>

### Notes

- ① For installation of a NEMA Type 1 drive into a NEMA Type 12 oversized enclosure.
- ② Frame size 8 and 9 must be ordered from the factory as a flange mount unit.

## Replacement Parts

### Control Board/Keypad

Description	Current Catalog Number
H-Max series graphic bypass, HOA	<b>KeypadbypassHOA</b>
H-Max series graphic back, HOA	<b>KeypadbackHOA</b>
H-Max control board replacement	<b>HMX-CONTROLBOARD-B</b>

### PC Cable

Description	Catalog Number
Remote download USB to RJ-45 cable with software driver disk	<b>REM-USB-Down</b>

### Replacement Relay Board in Slot B

Description	Catalog Number
Replacement relay board qty 2 Form C relay, qty 1 Form A relay	<b>Relay board 1</b>

### Main Fan

Description	Catalog Number
FS4 main fan	<b>FS4-Main Fan</b>
FS5 main fan	<b>FS5-Main Fan</b>
FS6 main fan	<b>FS6-Main Fan</b>
FS7 main fan	<b>FS7-Main Fan</b>
FS8 main fan	<b>FS8-Main Fan</b>
FS9 main fan	<b>FS9-Main Fan</b>

### Internal Fan

Description	Catalog Number
FS4 internal fan (IP54/NEMA 12)	<b>FS4-Internal Fan</b>
FS5 internal fan (IP54/NEMA 12)	<b>FS5-Internal Fan</b>
FS6 internal fan (IP54/NEMA 12)	<b>FS6-Internal Fan</b>
FS7 internal fan (IP54/NEMA 12)	<b>FS7-Internal Fan</b>
FS8 internal fan (IP54/NEMA 12)	<b>FS8-Internal Fan</b>
FS9 internal fan (IP54/NEMA 12)	<b>FS9-Internal Fan</b>

# 2.9

## Adjustable Frequency Drives

### H-Max Series Drives

2

#### Line and Load Reactors

A line and load reactor is a three-phase inductance filter that can be placed on the line and load side of the AFD to help improve the harmonic performance of the system. Consult the factory for additional filtering options and further technical details.

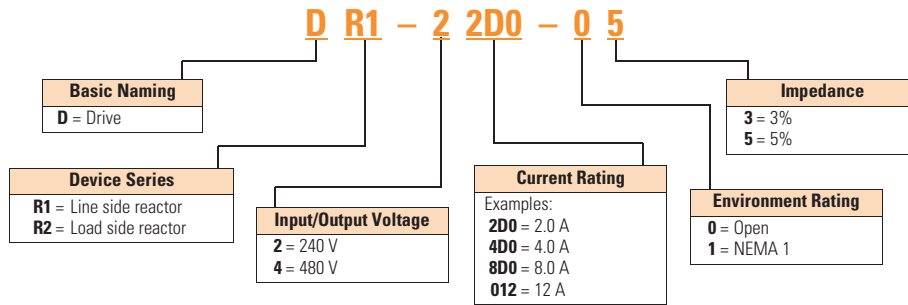
#### DR1 Line Reactor

A line reactor helps to provide a moderate reduction in current harmonics similar to a DC choke. It also provides increased input protection for AFD and its semiconductors from line transients helping to extend the life of the AFD.

#### DR2 Output Reactor

An output filter is used to reduce the transient voltage (dV/dt) at the motor terminals. The output filter is recommended for cable lengths exceeding 100 ft (30 m) with a drive of 3 hp and above and for cable lengths of 33 ft (10 m) with a drive of 2 hp and below.

#### Line and Load Reactors—Catalog Number Selection



#### Line and Load Reactors—240 V

hp (VT)	Open Load Reactor		Line Reactor		NEMA 1 Load Reactor		Line Reactor	
	3%	5%	3%	5%	3%	5%	3%	5%
0.75	DR2-24D0-03	DR2-24D0-05	DR1-23D2-03	DR1-23D2-05	DR2-24D0-13	DR2-24D0-15	DR1-23D2-13	DR1-23D2-15
1	DR2-24D0-03	DR2-28D0-05	DR1-24D2-03	DR1-24D2-05	DR2-24D0-13	DR2-28D0-15	DR1-24D2-13	DR1-24D2-15
1.5	DR2-28D0-03	DR2-28D0-05	DR1-26D0-03	DR1-26D0-05	DR2-28D0-13	DR2-28D0-15	DR1-26D0-13	DR1-26D0-15
2	DR2-28D0-03	DR2-28D0-05	DR1-26D8-03	DR1-26D8-05	DR2-28D0-13	DR2-28D0-15	DR1-26D8-13	DR1-26D8-15
3	DR2-2012-03	DR2-2012-05	DR1-29D6-03	DR1-29D6-05	DR2-2012-13	DR2-2012-15	DR1-29D6-13	DR1-29D6-15
5	DR2-2018-03	DR2-2018-05	DR1-2015-03	DR1-2015-05	DR2-2018-13	DR2-2018-15	DR1-2015-13	DR1-2015-15
7.5	DR2-2025-03	DR2-2025-05	DR1-2022-03	DR1-2022-05	DR2-2025-13	DR2-2025-15	DR1-2022-13	DR1-2022-15
10	DR2-2035-03	DR2-2035-05	DR1-2028-03	DR1-2028-05	DR2-2035-13	DR2-2035-15	DR1-2028-13	DR1-2028-15
15	DR2-2045-03	DR2-2045-05	DR1-2042-03	DR1-2042-05	DR2-2045-13	DR2-2045-15	DR1-2042-13	DR1-2042-15
20	DR2-2055-03	DR2-2055-05	DR1-2054-03	DR1-2054-05	DR2-2055-13	DR2-2055-15	DR1-2054-13	DR1-2054-15
25	DR2-2080-03	DR2-2080-05	DR1-2068-03	DR1-2068-05	DR2-2080-13	DR2-2080-15	DR1-2068-13	DR1-2068-15
30	DR2-2080-03	DR2-2100-05	DR1-2080-03	DR1-2080-05	DR2-2080-13	DR2-2100-15	DR1-2080-13	DR1-2080-15
40	DR2-2100-03	DR2-2100-05	DR1-2104-03	DR1-2104-05	DR2-2100-13	DR2-2100-15	DR1-2104-13	DR1-2104-15
50	DR2-2130-03	DR2-2130-05	DR1-2130-03	DR1-2130-05	DR2-2130-13	DR2-2130-15	DR1-2130-13	DR1-2130-15
60	DR2-2160-03	DR2-2200-15	DR1-2154-03	DR1-2154-05	DR2-2160-13	DR2-2200-15	DR1-2154-13	DR1-2154-15
75	DR2-2200-13	DR2-2200-15	DR1-2192-03	DR1-2192-05	DR2-2200-13	DR2-2200-15	DR1-2192-13	DR1-2192-15
100	DR2-2225-13	DR2-2225-15	DR1-2248-03	DR1-2248-05	DR2-2225-13	DR2-2225-15	DR1-2248-13	DR1-2248-15
125	DR2-2320-13	DR2-2320-15	DR1-2312-03	DR1-2312-05	DR2-2320-13	DR2-2320-15	DR1-2312-13	DR1-2312-15

## Line and Load Reactors—480 V

hp (VT)	Open Load Reactor	
	3%	5%
	1.5	DR2-44D0-05
2	DR2-44D0-03	DR2-44D0-05
3	DR2-48D0-03	DR2-48D0-05
5	DR2-48D0-03	DR2-48D0-05
7.5	DR2-4012-03	DR2-4012-05
10	DR2-4018-03	DR2-4018-05
15	DR2-4025-03	DR2-4025-05
20	DR2-4025-03	DR2-4025-05
25	DR2-4035-03	DR2-4035-05
30	DR2-4045-03	DR2-4045-05
40	DR2-4055-03	DR2-4055-05
50	DR2-4080-03	DR2-4080-05
60	DR2-4100-03	DR2-4080-05
75	DR2-4100-03	DR2-4100-05
100	DR2-4130-03	DR2-4130-05
125	DR2-4160-03	DR2-4160-05
150	DR2-4200-13	DR2-4200-15
200	DR2-4250-13	DR2-4250-15

Line Reactor	
3%	5%
DR1-43D0-03	DR1-43D0-05
DR1-43D4-03	DR1-43D4-05
DR1-44D8-03	DR1-44D8-05
DR1-47D6-03	DR1-47D6-05
DR1-4011-03	DR1-4011-05
DR1-4014-03	DR1-4014-05
DR1-4021-03	DR1-4021-05
DR1-4027-03	DR1-4027-05
DR1-4034-03	DR1-4034-05
DR1-4040-03	DR1-4040-05
DR1-4052-03	DR1-4052-05
DR1-4065-03	DR1-4065-05
DR1-4077-03	DR1-4077-05
DR1-4096-03	DR1-4096-05
DR1-4124-03	DR1-4124-05
DR1-4156-03	DR1-4156-05
DR1-4180-03	DR1-4180-05
DR1-4240-03	DR1-4240-05

NEMA 1 Load Reactor	
3%	5%
DR2-44D0-13	DR2-44D0-15
DR2-44D0-13	DR2-44D0-15
DR2-48D0-13	DR2-48D0-15
DR2-48D0-13	DR2-48D0-15
DR2-4012-13	DR2-4012-15
DR2-4018-13	DR2-4018-15
DR2-4025-13	DR2-4025-15
DR2-4025-13	DR2-4025-15
DR2-4035-13	DR2-4035-15
DR2-4045-13	DR2-4045-15
DR2-4055-13	DR2-4055-15
DR2-4080-13	DR2-4080-15
DR2-4100-13	DR2-4080-15
DR2-4100-13	DR2-4100-15
DR2-4130-13	DR2-4130-15
DR2-4160-13	DR2-4160-15
DR2-4200-13	DR2-4200-15
DR2-4250-13	DR2-4250-15

Line Reactor	
3%	5%
DR1-43D0-13	DR1-43D0-15
DR1-43D4-13	DR1-43D4-15
DR1-44D8-13	DR1-44D8-15
DR1-47D6-13	DR1-47D6-15
DR1-4011-13	DR1-4011-15
DR1-4014-13	DR1-4014-15
DR1-4021-13	DR1-4021-15
DR1-4027-13	DR1-4027-15
DR1-4034-13	DR1-4034-15
DR1-4040-13	DR1-4040-15
DR1-4052-13	DR1-4052-15
DR1-4065-13	DR1-4065-15
DR1-4077-13	DR1-4077-15
DR1-4096-13	DR1-4096-15
DR1-4124-13	DR1-4124-15
DR1-4156-13	DR1-4156-15
DR1-4180-13	DR1-4180-15
DR1-4240-13	DR1-4240-15

## Technical Data and Specifications

## 2

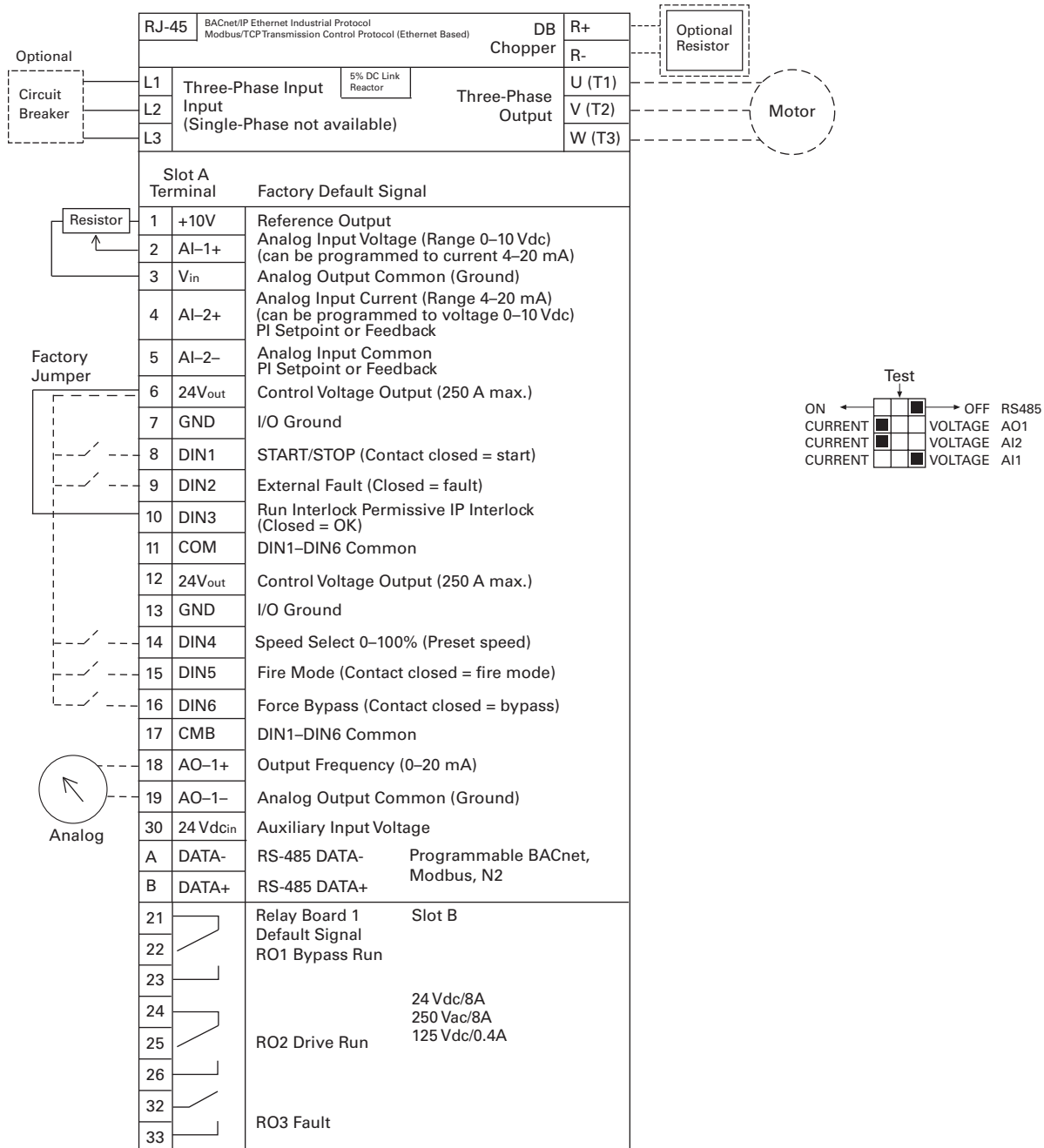
### H-Max Series Drives

Description	Specification
<b>Input Ratings</b>	
Input voltage ( $V_{in}$ )	200–240 Vac, 380–480 Vac, 525–600 Vac, –10%/+10%
Input frequency ( $f_{in}$ )	50/60 Hz (variation up to 47–66 Hz)
Connection to power	Once per minute or less (typical operation)
Short-circuit withstand rating	100 kAIC
<b>Output Ratings</b>	
Output voltage	0 to $V_{in}/U_{in}$ line voltage in
Continuous output current	Ambient temperature max. 104 °F (40 °C)
$I_L$ overload	1.1 x $I_L$ (1 min./10 min.)
Overload current	110% (1 min./10 min.)
Initial output current	150% for two seconds
Output frequency	0 to 320 Hz
Frequency resolution	0.01 Hz
<b>Control Characteristics</b>	
Control method	Frequency control (V/f) open loop sensorless vector control
Switching frequency	1–310 amps FS4–9: default 6 kHz
Frequency reference	Analog input: Resolution 0.1% (10-bit), accuracy $\pm 1\%$ Panel reference: Resolution 0.01 Hz
Field weakening point	8 to 320 Hz
Acceleration time	0.1 to 3000 seconds
Deceleration time	0.1 to 3000 seconds
Braking torque	DC brake: 30% x $T_n$
<b>Ambient Conditions</b>	
Ambient operating temperature	FS4–FS9: 14 °F (–10 °C), no frost to 104 °F (40 °C) (Drive can operate at 122 °F (50 °C), see <b>Pages V6-T2-225 and V6-T2-226</b> )
Storage temperature	–40° to 158 °F (–40° to 70 °C)
Relative humidity	0 to 95% RH, noncondensing, non-corrosive, no dripping water
Air quality	Chemical vapors: IEC 60721-3-3, unit in operation, Class 3C2; Mechanical particles: IEC 60721-3-3, unit in operation, Class 3S2
Altitude	100% load capacity (no derating) up to 3280 ft (1000 m); 1% derating for each 328 ft (100 m) above 3280 ft (1000 m); max. 9842 ft (3000 m); 380–480 V
Vibration	FS4–FS9: EN 61800-5-1, EN 60068-2-6; 5 to 150 Hz, displacement amplitude 1 mm (peak) at 5 to 15.8 Hz, max. acceleration amplitude 1G at 15.8 to 150 Hz
Shock	EN 61800-5-1, EN 60068-2-27 UPS Drop test (for applicable UPS weights) Storage and shipping: max. 15 g, 11 ms (in package)
Enclosure class	NEMA Type 1/IP21 or NEMA Type 12/IP54 (keypad required for IP54/Type 12)
<b>Standards</b>	
EMC	Immunity: Fulfills all EMC immunity requirements; Emissions: EN 61800-3, LEVEL H (EMC C2)
Emissions	EMC level dependent— +EMC 2: EN61800-3 (2004) Category C2 Delivered with Class C2 EMC filtering as default.
Efficiency	97.5% at 480 V 96.6% at 208/230 V

Description	Specification
<b>Control Connections</b>	
Analog input voltage	0 to 10 V, $R = 200$ kohms differential Resolution 0.1%; Accuracy $\pm 1\%$ DIP switch selection (voltage/current)
Analog input current	0(4) to 20 mA; $R_i$ –250 ohms differential
Digital inputs (6)	Positive or negative logic; 18 to 30 Vdc
Auxiliary voltage	+24 V $\pm 10\%$ , max. 250 mA
Output reference voltage	+10 V +3%, max. load 10 mA
Analog output	0–10 V, 0(4) to 20 mA; $R_L$ max. 500 ohms; Resolution 10 bit; Accuracy $\pm 2\%$ DIP switch selection (voltage/current)
Relay outputs	3 programmable, 2 Form C, 1 Form A relay outputs Switching capacity: 24 Vdc/8 A, 250 Vac/8 A, 125 Vdc/0.4 A
Hard wire jumper	Between terminal 6 and 10 factory default
DIP switch setting default	RS-485 = off A01 = current A12 = current A11 = voltage
<b>Protections</b>	
Overcurrent protection	Yes
Overvoltage protection	Yes
DC bus regulation anti-trip	Yes (accelerates or decelerates the load)
Undervoltage protection	Yes
Earth fault protection	Yes (in case of earth fault in motor or motor cable, only the frequency converter is protected)
Input phase supervision	Yes (trips if any of the input phases are missing)
Motor phase supervision	Yes (trips if any of the output phases are missing)
Overtemperature protection	Yes
Motor overload protection	Yes
Motor stall protection	Yes
Motor underload protection	Yes
Short-circuit protection	Yes
Surge protection	Yes (varistor input)
Conformed coated (varnished) boards	Yes (prevents corrosion)

## Wiring Diagram

## Control Input/Output, PID Application

**Standards**

- Digital inputs D1–D6, relay out, analog in/out are freely programmed
- The user can assign a single input to multiple functions

**Includes**

- Six digital input
- Two analog input
- One analog output
- Three relay output
- RS-485
- Ethernet (BACnet and Modbus)

**Reliability**

- Pretested components
- Conformal coated (varnished) boards
- 40 °C rated
- 110% overload for one minute
- Eaton Electrical Services & Systems national network of AF drive specialists

# 2.9

## Adjustable Frequency Drives

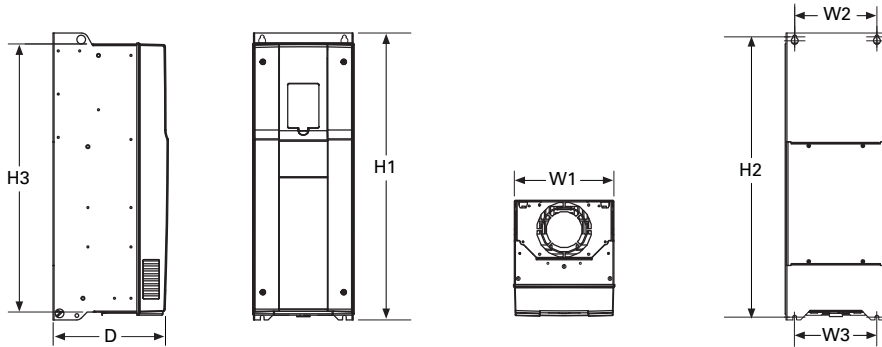
### H-Max Series Drives

#### Dimensions

Approximate Dimensions in Inches (mm)

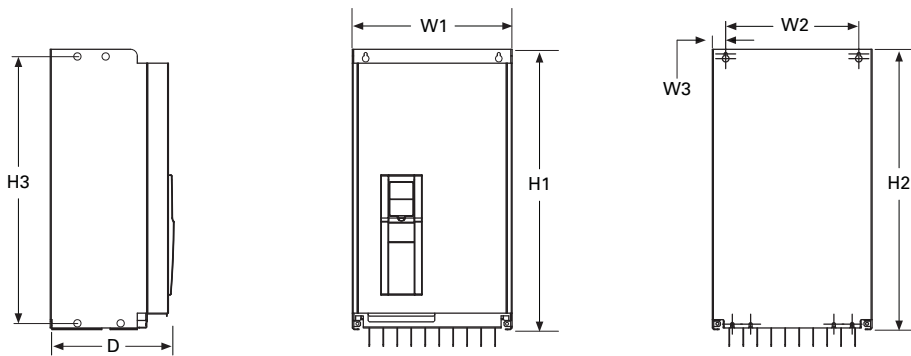
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#### H-Max Series Frames FS4-FS7



Voltage	hp	kW	Amps	D	H1	Hole Center-to-Center H2	H3	W1	W2	W3	Weight in Lbs (kg)
<b>FS4</b>											
230 Vac	0.75-4	0.55-3.0	3.7-12.5	7.77 (197.3)	12.89 (327.5)	12.32 (313.0)	11.22 (285.0)	5.04 (128.0)	3.94 (100.0)	3.94 (100.0)	13.2 (6)
480 Vac	1.5-7.5	1.1-5.5	3.4-12								
<b>FS5</b>											
230 Vac	5-10	4-7.5	18-31	8.73 (221.6)	16.50 (419.0)	15.98 (406.0)	15.04 (382.0)	5.67 (144.0)	4.53 (115.0)	3.94 (100.0)	22.0 (10)
480 Vac	10-20	7.5-15	16-31								
<b>FS6</b>											
230 Vac	15-20	11-15	48-62	9.29 (236.0)	21.93 (557.0)	21.28 (540.5)	20.24 (514.0)	7.68 (195.0)	5.83 (148.0)	5.83 (148.0)	44.1 (20)
480 Vac	25-40	18.5-30	38-61								
<b>FS7</b>											
230 Vac	25-30	18.5-30	75-105	10.49 (266.5)	25.98 (660.0)	25.39 (645.0)	24.29 (617.0)	9.06 (230.0)	7.48 (190.0)	7.48 (190.0)	82.6 (37.5)
480 Vac	50-75	37-55	72-105								

#### H-Max Series Frames FS8 and FS9



Voltage	hp	kW	Amps	D	H1	Hole Center-to-Center H2	H3	W1	W2	W3	Weight in Lbs (kg)
<b>FS8</b>											
230 Vac	50-75	37-55	140-205	13.76 (349.6)	38.02 (965.7)	37.26 (946.4)	37.26 (946.4)	11.42 (290.1)	9.29 (236.0)	1.42 (36.0)	154.3 (70)
480 Vac	100-150	75-110									
<b>FS9</b>											
230 Vac	100-120	75-90	261-310	14.63 (371.6)	33.09 (890.4)	31.89 (810.0)	31.89 (810.0)	18.90 (480.0)	15.75 (400.0)	1.57 (40.0)	238.1 (108)
480 Vac	200-250	132-160									

**Note:** For flange dimension, please reference User Manual.

## H-Max IntelliPass and IntelliDisconnect Drives



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Product Selection . . . . .	V6-T2-237
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## H-Max IntelliPass and IntelliDisconnect Drives

## Product Description

The IntelliPass electronic bypass is a two or optional three contactor design using a 24 Vdc **XT** Series contactor with an optional manual override switch that allows the unit to run in bypass without the H-Max Series drive.

The IntelliPass software parameters utilize engineering units common to the HVAC industry. Onboard startup wizard guarantees flawless commissioning with plug-and-play screen entry. Available in NEMA/UL Type 1, Type 12 and Type 3R with optional pre-engineered operator devices to meet all customized specification requirements.

The IntelliPass construction features allow for easy installation, reliable operation and serviceability with additional onboard wire space, and removable conduit plates with knockouts.

## Features and Benefits

Industry-leading energy saving solution—uses the Eaton H-Max drive with Active Energy Control algorithm.

Built to be as tough as the application—Eaton's robust design boasts an industrial grade enclosure and industry proven components.

- Industrial Power Supply
- **XT** Contactors
- 22 mm Pilot Devices

Built-in electronic bypass capability with external 24 Vdc power supply allows the H-Max drive to control the bypass circuit through the keypad, digital input or BMS communications and in fault conditions.

**Designed with Our Customers in Mind**

- Removable top and bottom entry panels
- Door-mounted graphic display and keypad
- Easily accessible connection terminals with removable I/O terminal connections

**Engineered Product Solution**

- The Eaton H-Max IntelliPass and IntelliDisconnect products are available with a variety of factory tested and certified options meeting or exceeding UL508C requirements

## Standards and Certifications

**Product**

- IEC 61800-5-1
- UL508C
- cUL
- OSHPD Seismic Certified

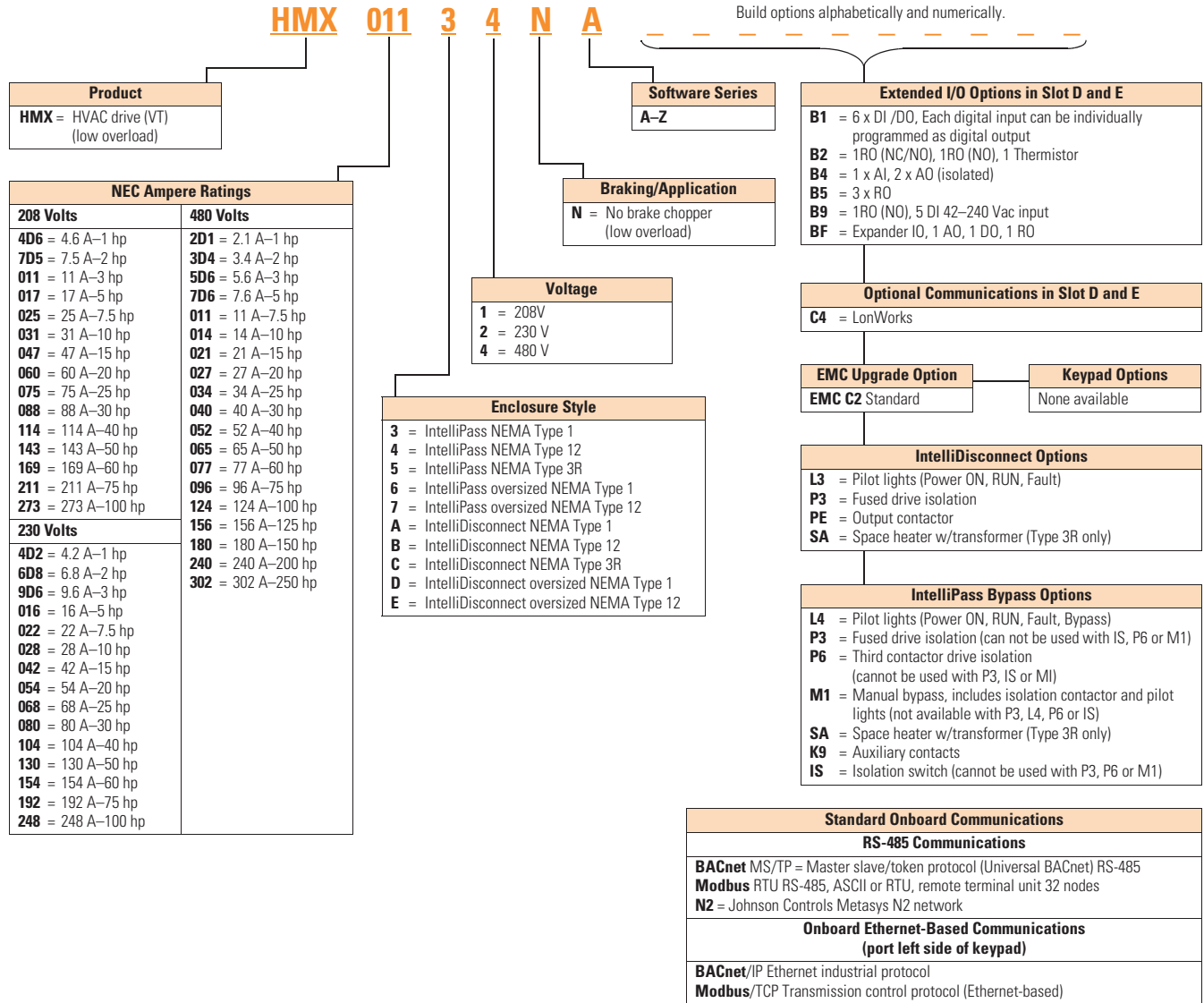




#### Catalog Number Selection

2

#### H-Max Series IntelliPass and IntelliDisconnect Drives



#### Notes

- IntelliPass—two contactor electronic bypass standard.
- All boards are varnished. Corrosion resistant.
- Battery included in all drives for real-time clock. Three year lifetime.
- Keypad kit includes HOA bypass.
- EMI/RFI filters included.
- DC link choke included.
- IntelliDisconnect includes 1 Form C and 1 Form A
- IntelliPass includes 1 Form A.
- When L3 or L4 option is selected, 1 Form A relay is used as well.
- For more relays required, select/order the B5 option card.

## Product Selection

*H-Max Series IntelliPass NEMA Type 1—Two Contactor Bypass Standard*

HMX\_

**208 Vac**

Enclosure Frame Size	Horsepower	Drive Rated NEC Amps	Catalog Number
FS4	1	4.6	HMX4D631NA
	2	7.5	HMX7D531NA
	3	11	HMX01131NA
FS5	5	17	HMX01731NA
	7.5	25	HMX02531NA
	10	31	HMX03131NA
FS6	15	47	HMX04731NA
FS7	20	60	HMX06031NA
	25	75	HMX07531NA
	30	88	HMX08831NA

**230 Vac**

Enclosure Frame Size	Horsepower	Drive Rated NEC Amps	Catalog Number
FS4	1	4.2	HMX4D232NA
	2	6.8	HMX6D832NA
	3	9.6	HMX9D632NA
FS5	5	16	HMX01632NA
	7.5	22	HMX02232NA
	10	28	HMX02832NA
FS6	15	42	HMX04232NA
FS7	20	54	HMX05432NA
	25	68	HMX06832NA
	30	80	HMX08032NA

**480 Vac**

Enclosure Frame Size	Horsepower	Drive Rated NEC Amps	Catalog Number
FS4	1	2.1	HMX2D134NA
	2	3.4	HMX3D434NA
	3	5.6	HMX5D634NA
	5	7.6	HMX7D634NA
	7.5	11	HMX01134NA
FS5	10	14	HMX01434NA
	15	21	HMX02134NA
	20	27	HMX02734NA
FS6	25	34	HMX03434NA
	30	40	HMX04034NA
	40	52	HMX05234NA
FS7	50	65	HMX06534NA
	60	77	HMX07734NA
	75	96	HMX09634NA

**Notes**For Wiring Diagrams, see **Page V6-T2-249**.For NEMA 12 or 3R enclosures, see Catalog Number Selection on **Page V6-T2-236**.

Call Technical Support for NEMA 3R specifics. Enclosure size and weight differ from NEMA 1 and 12 products.

**H-Max Series IntelliPass NEMA Type 12—Two Contactor Bypass Standard**

2

HMX\_

**208 Vac**

Enclosure Frame Size	Horsepower	Drive Rated NEC Amps	Catalog Number
FS4	1	4.6	HMX4D641NA
	2	7.5	HMX7D541NA
	3	11	HMX01141NA
FS5	5	17	HMX01741NA
	7.5	25	HMX02541NA
	10	31	HMX03141NA
FS6	15	47	HMX04741NA
FS7	20	60	HMX06041NA
	25	75	HMX07541NA
	30	88	HMX08841NA
D	40	114	HMX11471NA
	50	143	HMX14371NA
	60	169	HMX16971NA
5	75	211	HMX21171NA
	100	273	HMX27371NA

**230 Vac**

Enclosure Frame Size	Horsepower	Drive Rated NEC Amps	Catalog Number
FS4	1	4.2	HMX4D242NA
	2	6.8	HMX6D842NA
	3	9.6	HMX9D642NA
FS5	5	16	HMX01642NA
	7.5	22	HMX02242NA
	10	28	HMX02842NA
FS6	15	42	HMX04242NA
FS7	20	54	HMX05442NA
	25	68	HMX06842NA
	30	80	HMX08042NA
D	40	104	HMX10472NA
	50	130	HMX13072NA
	60	154	HMX15472NA
	75	192	HMX19272NA
5	100	248	HMX24872NA

**Notes**

For Wiring Diagrams, see **Page V6-T2-249**.

For NEMA 12 or 3R enclosures, see Catalog Number Selection on **Page V6-T2-236**.

Call Technical Support for NEMA 3R specifics. Enclosure size and weight differ from NEMA 1 and 12 products.

HMX\_

## 480 Vac



Enclosure Frame Size	Horsepower	Drive Rated NEC Amps	Catalog Number
FS4	1	2.1	HMX2D144NA
	2	3.4	HMX3D444NA
	3	5.6	HMX5D644NA
	5	7.6	HMX7D644NA
	7.5	11	HMX01144NA
FS5	10	14	HMX01444NA
	15	21	HMX02144NA
	20	27	HMX02744NA
FS6	25	34	HMX03444NA
	30	40	HMX04044NA
	40	52	HMX05244NA
FS7	50	65	HMX06544NA
	60	77	HMX07744NA
	75	96	HMX09644NA
D	100	124	HMX12747NA
	125	156	HMX15674NA
	150	180	HMX18074NA
5	200	240	HMX24074NA
	250	302	HMX30274NA

**H-Max Series IntelliPass NEMA Type 3R—Two Contactor Bypass Standard**

HMX\_

## 208 Vac



Enclosure Frame Size	Horsepower	Drive Rated NEC Amps	Catalog Number
A	1	4.6	HMX4D651NA
	2	7.5	HMX7D551NA
	3	11	HMX01151NA
A	5	17	HMX01751NA
	7.5	25	HMX02551NA
	10	31	HMX03151NA
B	15	47	HMX04751NA
C	20	60	HMX06051NA
	25	75	HMX07551NA
	30	88	HMX08851NA
D	40	114	HMX11451NA
	50	143	HMX14351NA
	60	169	HMX16951NA
F	75	211	HMX21151NA
	100	273	HMA27351NA

**Notes**For Wiring Diagrams, see **Page V6-T2-249**.For NEMA 12 or 3R enclosures, see Catalog Number Selection on **Page V6-T2-236**.

Call Technical Support for NEMA 3R specifics. Enclosure size and weight differ from NEMA 1 and 12 products.

HMX\_

**230 Vac**

Enclosure Frame Size	Horsepower	Drive Rated NEC Amps	Catalog Number
A	1	4.2	HMX4D252NA
	2	6.8	HMX6D852NA
	3	9.6	HMX9D652NA
A	5	16	HMX01652NA
	7.5	22	HMX02252NA
	10	28	HMX02852NA
	15	42	HMX04252NA
B	20	54	HMX05452NA
C	25	68	HMX06852NA
	30	80	HMX08052NA
D	40	104	HMX10452NA
	50	130	HMX13052NA
	60	154	HMX15452NA
	75	192	HMX19252NA
F	100	248	HMX24852NA

**480 Vac**

Enclosure Frame Size	Horsepower	Drive Rated NEC Amps	Catalog Number
A	1	2.1	HMX2D154NA
	2	3.4	HMX3D454NA
	3	5.6	HMX5D654NA
	5	7.6	HMX7D654NA
	7.5	11	HMX01154NA
A	10	14	HMX01454NA
	15	21	HMX02154NA
	20	27	HMX02754NA
B	25	34	HMX03454NA
	30	40	HMX04054NA
	40	52	HMX05254NA
C	50	65	HMX06554NA
	60	77	HMX07754NA
	75	96	HMX09654NA
D	100	124	HMX12544NA
	125	156	HMX15654NA
	150	180	HMX18054NA
F	200	240	HMX24054NA
	250	302	HMX30254NA

**Notes**

For Wiring Diagrams, see **Page V6-T2-249**.

For NEMA 12 or 3R enclosures, see Catalog Number Selection on **Page V6-T2-236**.

Call Technical Support for NEMA 3R specifics. Enclosure size and weight differ from NEMA 1 and 12 products.

**H-Max Series IntelliDisconnect NEMA Type 1—Main Disconnect Standard**

HMX

**208 Vac**

Enclosure Frame Size	Horsepower	Drive Rated NEC Amps	Catalog Number
FS4	1	4.6	HMX4D6A1NA
	2	7.5	HMX7D5A1NA
	3	11	HMX011A1NA
FS5	5	17	HMX017A1NA
	7.5	25	HMX025A1NA
	10	31	HMX031A1NA
FS6	15	47	HMX047A1NA
FS7	20	60	HMX060A1NA
	25	75	HMX075A1NA
	30	88	HMX088A1NA

**230 Vac**

Enclosure Frame Size	Horsepower	Drive Rated NEC Amps	Catalog Number
FS4	1	4.2	HMX4D2A2NA
	2	6.8	HMX6D8A2NA
	3	9.6	HMX9D6A2NA
FS5	5	16	HMX016A2NA
	7.5	22	HMX022A2NA
	10	28	HMX028A2NA
FS6	15	42	HMX042A2NA
FS7	20	54	HMX054A2NA
	25	68	HMX068A2NA
	30	80	HMX080A2NA

**480 Vac**

Enclosure Frame Size	Horsepower	Drive Rated NEC Amps	Catalog Number
FS4	1	2.1	HMX2D1A4NA
	2	3.4	HMX3D4A4NA
	3	5.6	HMX5D6A4NA
	5	7.6	HMX7D6A4NA
	7.5	11	HMX011A4NA
FS5	10	14	HMX014A4NA
	15	21	HMX021A4NA
	20	27	HMX027A4NA
FS6	25	34	HMX034A4NA
	30	40	HMX040A4NA
	40	52	HMX052A4NA
FS7	50	65	HMX065A4NA
	60	77	HMX077A4NA
	75	96	HMX096A4NA

**Notes**

For Wiring Diagrams, see [Page V6-T2-249](#).

For NEMA 12 or 3R enclosures, see Catalog Number Selection on [Page V6-T2-236](#).

Call Technical Support for NEMA 3R specifics. Enclosure size and weight differ from NEMA 1 and 12 products.

**H-Max Series IntelliDisconnect NEMA Type 12—Main Disconnect Standard**

2

HMX\_

**208 Vac**

Enclosure Frame Size	Horsepower	Drive Rated NEC Amps	Catalog Number
FS4	1	4.6	HMX4D6B1NA
	2	7.5	HMX7D5B1NA
	3	11	HMX011B1NA
FS5	5	17	HMX017B1NA
	7.5	25	HMX025B1NA
	10	31	HMX031B1NA
FS6	15	47	HMX047B1NA
FS7	20	60	HMX060B1NA
	25	75	HMX075B1NA
	30	88	HMX088B1NA
D	40	114	HMX114E1NA
	50	143	HMX143E1NA
	60	169	HMX169E1NA
5	75	211	HMX211E1NA
	100	273	HMA273E1NA

**230 Vac**

Enclosure Frame Size	Horsepower	Drive Rated NEC Amps	Catalog Number
FS4	1	4.2	HMX4D2B2NA
	2	6.8	HMX6D8B2NA
	3	9.6	HMX9D6B2NA
FS5	5	16	HMX016B2NA
	7.5	22	HMX022B2NA
	10	28	HMX028B2NA
FS6	15	42	HMX042B2NA
FS7	20	54	HMX054B2NA
	25	68	HMX068B2NA
	30	80	HMX080B2NA
D	40	104	HMX104E2NA
	50	130	HMX130E2NA
	60	154	HMX154E2NA
	75	192	HMX192E2NA
5	100	248	HMX248E2NA

**Notes**

For Wiring Diagrams, see **Page V6-T2-249**.

For NEMA 12 or 3R enclosures, see Catalog Number Selection on **Page V6-T2-236**.

Call Technical Support for NEMA 3R specifics. Enclosure size and weight differ from NEMA 1 and 12 products.

HMX\_

**480 Vac**

Enclosure Frame Size	Horsepower	Drive Rated NEC Amps	Catalog Number
FS4	1	2.1	HMX2D1B4NA
	2	3.4	HMX3D4B4NA
	3	5.6	HMX5D6B4NA
	5	7.6	HMX7D6B4NA
	7.5	11	HMX011B4NA
FS5	10	14	HMX014B4NA
	15	21	HMX021B4NA
	20	27	HMX027B4NA
FS6	25	34	HMX034B4NA
	30	40	HMX040B4NA
	40	52	HMX052B4NA
FS7	50	65	HMX065B4NA
	60	77	HMX077B4NA
	75	96	HMX096B4NA
D	100	124	HMX12E44NA
	125	156	HMX156E4NA
	150	180	HMX180E4NA
5	200	240	HMX240E4NA
	250	302	HMX302E4NA

**Notes**

For Wiring Diagrams, see **Page V6-T2-249**.

For NEMA 12 or 3R enclosures, see Catalog Number Selection on **Page V6-T2-236**.

Call Technical Support for NEMA 3R specifics. Enclosure size and weight differ from NEMA 1 and 12 products.



**H-Max Series IntelliDisconnect NEMA Type 3R—Main Disconnect Standard**

2

HMX\_

**208 Vac**

Enclosure Frame Size	Horsepower	Drive Rated NEC Amps	Catalog Number
A	1	4.6	HMX4D6C1NA
	2	7.5	HMX7D5C1NA
	3	11	HMX011C1NA
A	5	17	HMX017C1NA
	7.5	25	HMX025C1NA
	10	31	HMX031C1NA
	15	47	HMX047C1NA
B	20	60	HMX060C1NA
C	25	75	HMX075C1NA
	30	88	HMX088C1NA
D	40	114	HMX114C1NA
	50	143	HMX143C1NA
	60	169	HMX169C1NA
F	75	211	HMX211C1NA
	100	273	HMA273C1NA

**230 Vac**

Enclosure Frame Size	Horsepower	Drive Rated NEC Amps	Catalog Number
A	1	4.2	HMX4D2C2NA
	2	6.8	HMX6D8C2NA
	3	9.6	HMX9D6C2NA
A	5	16	HMX016C2NA
	7.5	22	HMX022C2NA
	10	28	HMX028C2NA
	15	42	HMX042C2NA
B	20	54	HMX054C2NA
C	25	68	HMX068C2NA
	30	80	HMX080C2NA
D	40	104	HMX104C2NA
	50	130	HMX130C2NA
	60	154	HMX154C2NA
F	75	192	HMX192C2NA
	100	248	HMX248C2NA

**Notes**

For Wiring Diagrams, see **Page V6-T2-249**.

For NEMA 12 or 3R enclosures, see Catalog Number Selection on **Page V6-T2-236**.

Call Technical Support for NEMA 3R specifics. Enclosure size and weight differ from NEMA 1 and 12 products.

HMX\_

## 480 Vac



Enclosure Frame Size	Horsepower	Drive Rated NEC Amps	Catalog Number
A	1	2.1	HMX2D1C4NA
	2	3.4	HMX3D4C4NA
	3	5.6	HMX5D6C4NA
	5	7.6	HMX7D6C4NA
	7.5	11	HMX011C4NA
A	10	14	HMX014C4NA
	15	21	HMX021C4NA
	20	27	HMX027C4NA
B	25	34	HMX034C4NA
	30	40	HMX040C4NA
	40	52	HMX052C4NA
C	50	65	HMX065C4NA
	60	77	HMX077C4NA
	75	96	HMX096C4NA
D	100	124	HMX124C4NA
	125	156	HMX156C4NA
	150	180	HMX180C4NA
F	200	240	HMX240C4NA
	250	302	HMX302C4NA

**Notes**

For Wiring Diagrams, see **Page V6-T2-249**.

For NEMA 12 or 3R enclosures, see Catalog Number Selection on **Page V6-T2-236**.

Call Technical Support for NEMA 3R specifics. Enclosure size and weight differ from NEMA 1 and 12 products.

**Onboard Network Communications****Johnson Controls Metasys N2**

H-Max Series provides communication between the drive and a Johnson Controls Metasys™ N2 network. With this connection, the drive can be controlled, monitored and programmed from the Metasys system. N2 can be selected and programmed by the drive keypad.

**BACnet**

H-Max Series provides communication to BACnet networks. Data transfer is master-slave/token passing (MS/TP) RS-485.

**BACnet/IP**

100Base-T interface.

**Modbus TCP**

Ethernet based protocol.

**Modbus RTU**

H-Max Series provides communication to Modbus RTU RS-485 as a slave on a Modbus network. Other communication parameters include an address range from 1 to 247; a parity of None, Odd or Even; and the stop bit is 1.

# 2.9

## Adjustable Frequency Drives

### H-Max Series Drives

2

#### H-Max Series Option Board Kits Available for Slots D and E

The H-Max Series drives can accommodate a wide selection of expander and adapter option boards to

customize the drive for your application needs. The drive's control unit is designed to accept a total of two option boards.

The H-Max Series factory-installed standard board configuration includes an I/O board and a relay output board.

#### Option Boards Mounted in Slots D and E

Option Kit Description	Option Kit Catalog Number
6 x DI /DO, each digital input can be individually programmed as digital output	<b>XXM-IO-B1-A</b>
1RO Form C (NO/NC), 1RO Form A (NO), 1 thermistor	<b>XXM-IO-B2-A</b>
1 x AI, 2 x AO (isolated)	<b>XXM-IO-B4-A</b>
3 x RO Form A (NO)	<b>XXM-IO-B5-A</b>
1RO Form A (NO), 5DI 42–240 Vac input	<b>XXM-IO-B9-A</b>
LonWorks	<b>XXM-COM-C4-A</b>
1 x AO, 1 x DO, 1 x RO	<b>XXM-IO-BF-A</b>

#### Extended I/O Options in Slot D and E

Description	Suffix Number
6 x DI /DO, Each digital input can be individually programmed as digital output	<b>B1</b>
1RO (NC/NO), 1RO (NO), 1 Thermistor	<b>B2</b>
1 x AI, 2 x AO (isolated)	<b>B4</b>
3 x RO	<b>B5</b>
1RO (NO), 5 DI 42–240 Vac input	<b>B9</b>
Expander IO, 1 AO, 1 DO, 1 RO	<b>BF</b>

#### Optional Communications in Slot D and E

Description	Suffix Number
LonWorks	<b>C4</b>

#### IntelliDisconnect Options

Description	Suffix Number
Pilot lights (Power ON, RUN, Fault)	<b>L3</b>
Fused drive isolation (cannot be used with PE)	<b>P3</b>
Output contactor (cannot be used with P3)	<b>PE</b>
Space heater w/transformer (Type 3R only)	<b>SA</b>

#### IntelliPass Bypass Options

Description	Suffix Number
Pilot lights (Power ON, RUN, Fault)	<b>L4</b>
Fused drive isolation (can not be used with P6)	<b>P3</b>
Third contactor drive isolation (cannot be used with P3 or IS)	<b>P6</b>
Manual bypass switch located on front door	<b>M1</b>
Space heater w/transformer (Type 3R only)	<b>SA</b>
Auxiliary contacts	<b>K9</b>
Isolation switch	<b>IS</b>

#### Standard Onboard Communications

Description	Suffix Number
<b>RS-485 Communications</b>	
BACnet MS/TP = Master slave/token protocol (Universal BACnet) RS-485	<b>BACnet</b>
Modbus RTU RS-485, ASCII or RTU, remote terminal unit 32 nodes	<b>Modbus</b>
Johnson Controls Metasys N2 network	<b>N2</b>
<b>Onboard Ethernet-Based Communications (port left side of keypad)</b>	
BACnet/IP Ethernet industrial protocol	<b>BACnet</b>
Modbus/TCP Transmission control protocol (Ethernet-based)	<b>Modbus</b>

## Technical Data and Specifications

### Primary Design Features

Description	IntelliPass	IntelliDisconnect
CB MMP	Standard	Standard
2 contactor bypass	Standard	N/A
Electrical interlock	Standard	N/A
Third contactor (isolation)	Optional	N/A

### H-Max Series Drives

Description	Specification
<b>Input Ratings</b>	
Input voltage ( $V_{in}$ )	208, 230, 480 Vac, -10%/+10%
Input frequency ( $f_{in}$ )	50/60 Hz (variation up to 47–66 Hz)
Connection to power	Once per minute or less (typical operation)
Short-circuit withstand rating	65 kAIC combination
<b>Output Ratings</b>	
Output voltage	0 to $V_{in}/U_{in}$ line voltage in
Continuous output current	Ambient temperature max. 104 °F (40 °C)
$I_L$ overload	1.1 x $I_L$ (1 min./10 min.)
Overload current	110% (1 min./10 min.)
Initial output current	150% for two seconds
Output frequency	0 to 320 Hz
Frequency resolution	0.01 Hz
<b>Control Characteristics</b>	
Control method	Frequency control (V/f) open loop sensorless vector control
Switching frequency	1–310 amps; adjustable with parameter 2.6.9 FS4–FS7: default 6 kHz
Frequency reference	Analog input: Resolution 0.1% (10-bit), accuracy $\pm 1\%$ Panel reference: Resolution 0.01 Hz
Field weakening point	8 to 320 Hz
Acceleration time	0.1 to 3000 seconds
Deceleration time	0.1 to 3000 seconds
Braking torque	DC brake: 30% x $T_n$
<b>Ambient Conditions</b>	
Ambient operating temperature	FS4–FS7: 14 °F (-10 °C), no frost to 104 °F (40 °C) (Drive can operate at 122 °F (50 °C))
Storage temperature	-40° to 158 °F (-40° to 70 °C)
Relative humidity	0 to 95% RH, noncondensing, non-corrosive, no dripping water
Air quality	Chemical vapors: IEC 60721-3-3, unit in operation, Class 3C2; Mechanical particles: IEC 60721-3-3, unit in operation, Class 3S2
Altitude	100% load capacity (no derating) up to 3280 ft (1000 m); 1% derating for each 328 ft (100 m) above 3280 ft (1000 m); max. 9842 ft (3000 m); 380–480 V
Enclosure class	NEMA Type 1/IP21 or NEMA Type 12/IP54 (keypad required for IP54/Type 12)

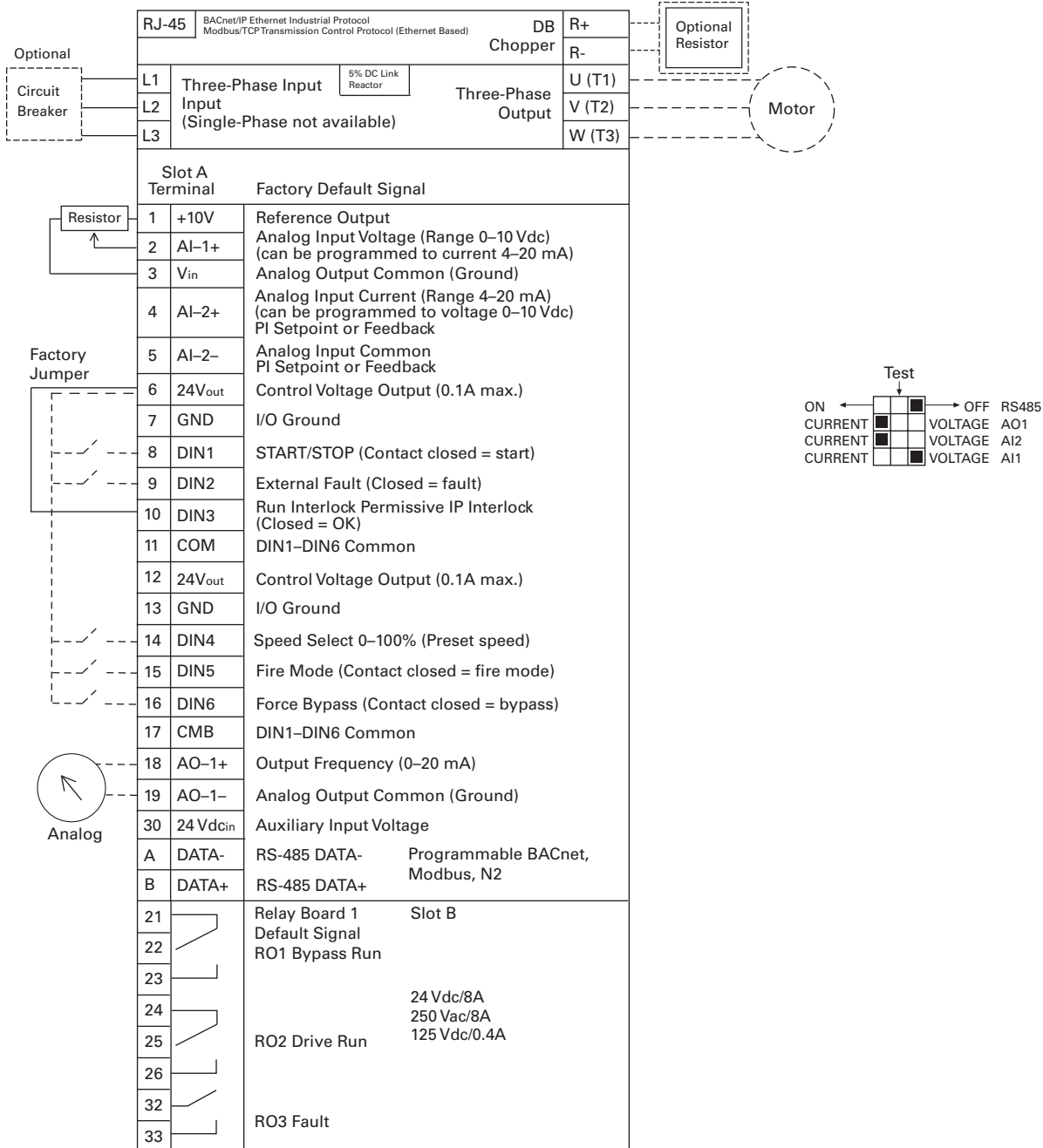
Description	IntelliPass	IntelliDisconnect
Isolation switch	Optional	N/A
Top entry (power)	Standard	Standard
Bottom entry (power)	Standard	Standard
Output contactor	Standard	Optional

Description	Specification
<b>Standards</b>	
EMC	Immunity: Fulfills all EMC immunity requirements; Emissions: EN 61800-3, LEVEL H (EMC C2)
Emissions	EMC level dependent— +EMC 2: EN61800-3 (2004) Category C2 Delivered with Class C2 EMC filtering as default.
<b>Control Connections</b>	
Analog input voltage	0 to 10 V, $R = 200$ kohms differential Resolution 0.1%; Accuracy $\pm 1\%$ DIP switch selection (voltage/current)
Analog input current	0(4) to 20 mA; $R_i = 250$ ohms differential
Digital inputs (6)	Positive or negative logic; 18 to 30 Vdc
Auxiliary voltage	+24 V $\pm 10\%$ , max. load 10 mA
Output reference voltage	+10 V $\pm 3\%$ , max. load 10 mA
Analog output	0–10 V, 0(4) to 20 mA; $R_L$ max. 500 ohms; Resolution 10 bit; Accuracy $\pm 2\%$ ; DIP switch selection (voltage/current)
Relay outputs	IntelliDisconnect: 2 programmable, 1 Form C, 1 Form A IntelliPass: 1 programmable, 1 Form A With L3 or L4 option, 1 Form A relay is used Switching capacity: 24 Vdc/8 A, 250 Vac/8 A, 125 Vdc/0.4 A
Hard wire jumper	Between terminal 6 and 10 factory default
DIP switch setting default	RS-485 = off A01 = current A12 = current A11 = voltage
<b>Protections</b>	
Overcurrent protection	Yes
Overvoltage protection	Yes
DC bus regulation anti-trip	Yes (accelerates or decelerates the load)
Undervoltage protection	Yes
Earth fault protection	Yes (in case of earth fault in motor or motor cable, only the frequency converter is protected)
Input phase supervision	Yes (trips if any of the input phases are missing)
Motor phase supervision	Yes (trips if any of the output phases are missing)
Overtemperature protection	Yes
Motor overload protection	Yes
Motor stall protection	Yes
Motor underload protection	Yes
Short-circuit protection	Yes
Surge protection	Yes (varistor input)
Conformed coated (varnished) board	Yes (prevents corrosion)

### Wiring Diagrams

#### Control Input/Output, PID Application

2



#### Standards

- Digital inputs D1–D6, relay out, analog in/out are freely programmed
- The user can assign a single input to multiple functions

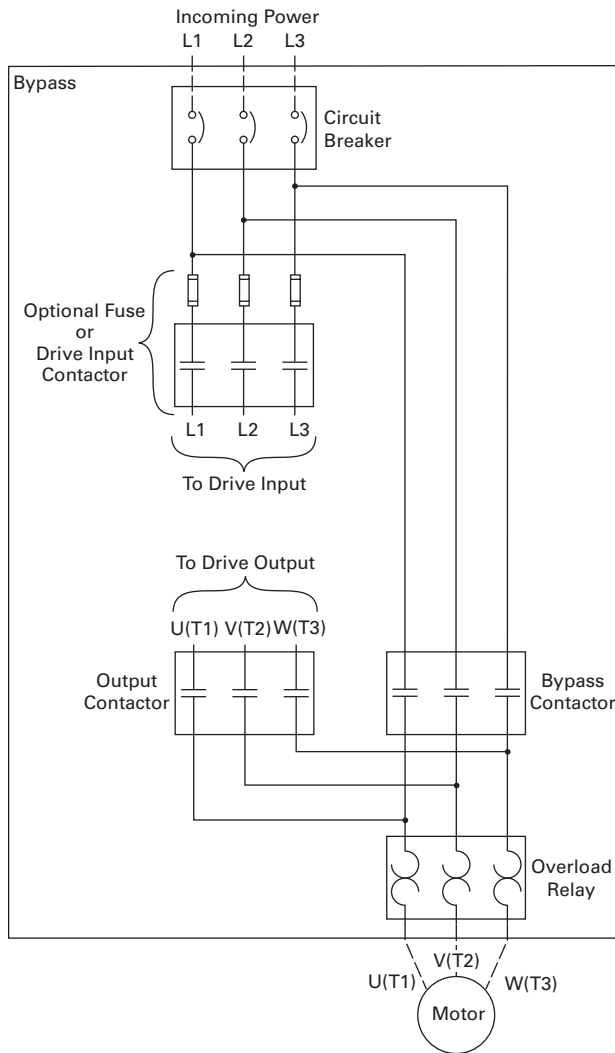
#### Includes

- Six digital input
- Two analog input
- One analog output
- Three relay outputs (2 relays are factory wired for bypass operation in IntelliPass configurations)
- RS-485
- Ethernet

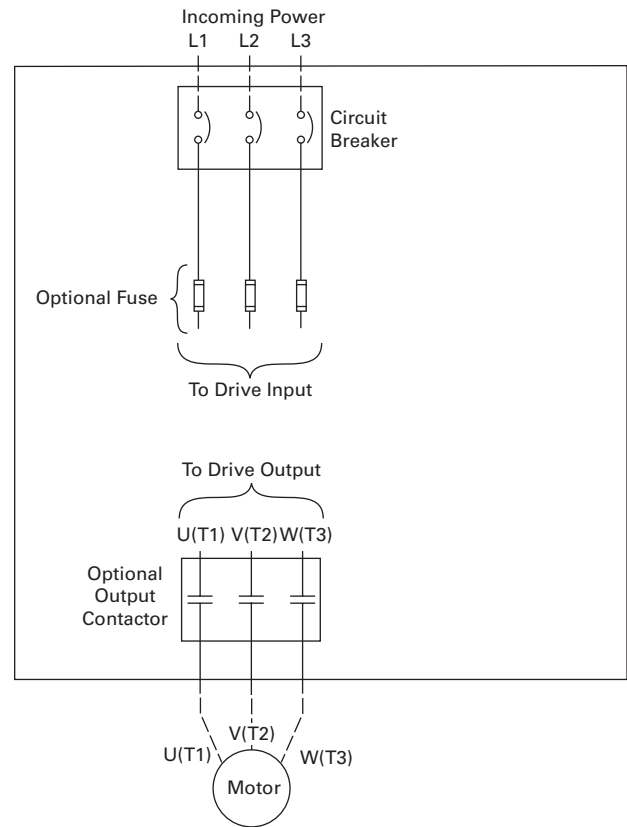
#### Reliability

- Pretested components
- Conformal coated (varnished) boards
- 40 °C rated
- 110% overload for one minute
- Eaton Electrical Services & Systems national network of AF drive specialists

### H-Max Series IntelliPass



### H-Max Series IntelliDisconnect Power Wiring

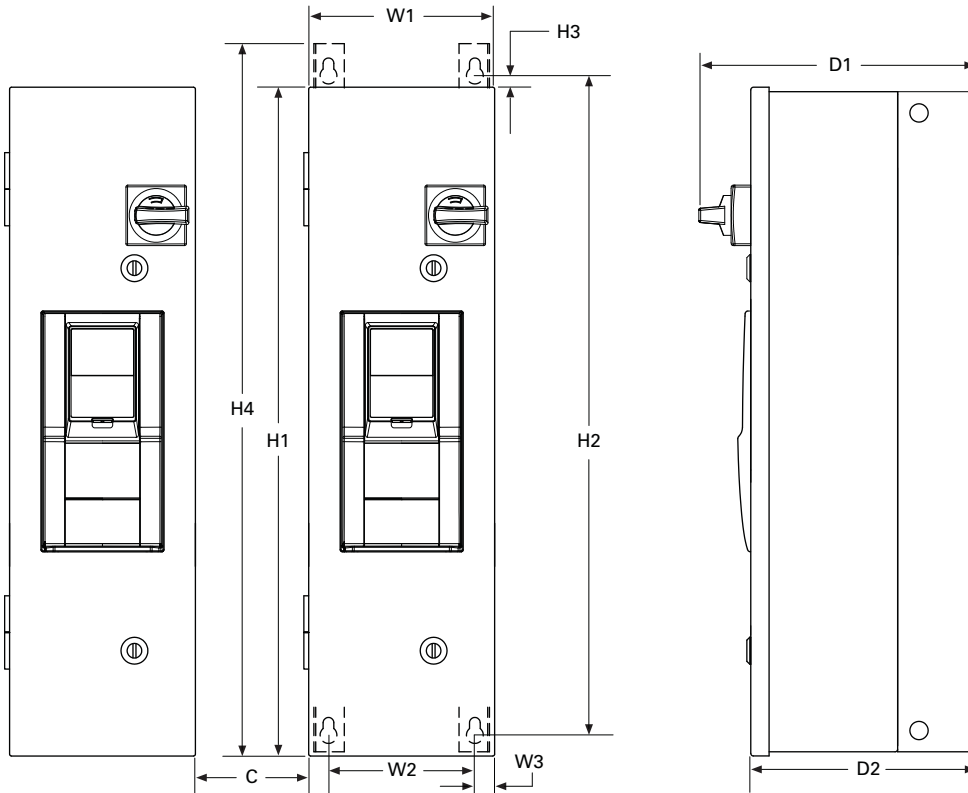


#### Dimensions

Approximate Dimensions in Inches (mm)

2

#### H-Max Series IntelliPass and IntelliDisconnect Drives



Distance to mount multiple drives.

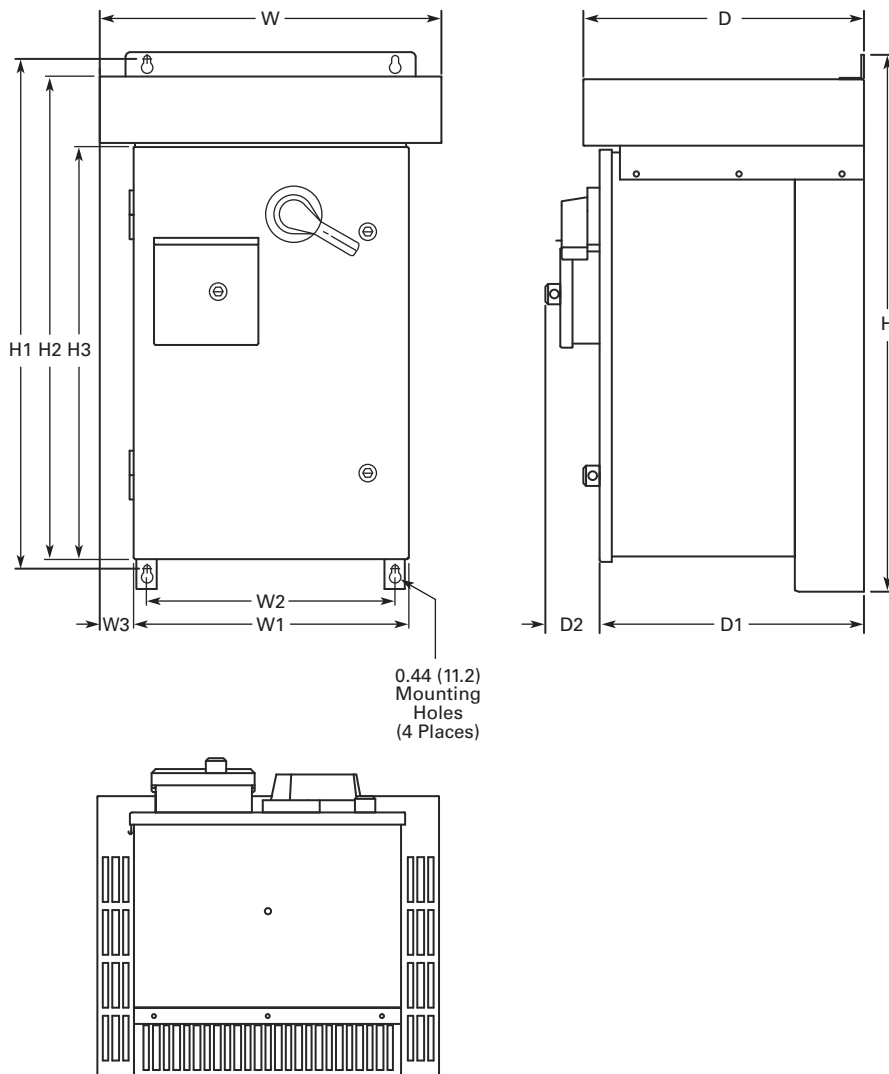
	Top	Bottom
FR4	4.00 (101.6)	2.00 (50.8)
FR5	4.75 (120.7)	2.50 (63.5)
FR6	6.50 (165.1)	3.25 (82.6)
FR7	10.00 (254.0)	4.00 (101.6)

Consult factory or use manual for final dimensions.

Frame Size	Voltage	Horsepower (I <sub>L</sub> )	H1	H2	H3	H4	C	W1	W2	W3	D1	D2	Weight in Lbs (kg)
FS4	208	1-3	30.00 (762.0)	29.41 (747.1)	0.25 (6.35)	31.00 (787.4)	3.00 (76.2)	7.88 (200.2)	6.25 (158.8)	0.75 (19.1)	12.49 (317.2)	10.36 (263.1)	45 (20.41)
	230	1-3											
	480	1-7.5											
FS5	208	5-10	37.00 (939.8)	36.72 (932.7)	0.25 (6.35)	38.31 (973.0)	3.00 (76.2)	9.60 (243.8)	7.97 (202.4)	0.75 (19.1)	15.35 (390.0)	13.22 (335.8)	57.5 (26.10)
	230	5-10											
	480	10-20											
FS6	208	15-20	45.45 (1154.4)	44.81 (1138.2)	0.25 (6.35)	46.4 (1178.6)	4.00 (101.6)	11.44 (290.6)	9.75 (247.6)	0.75 (19.1)	15.80 (401.3)	13.67 (347.2)	98.0 (44.45)
	230	15-20											
	480	25-40											
FS7	208	25-30	58.51 (1486.2)	57.87 (1470.0)	0.25 (6.35)	59.46 (1510.3)	5.00 (127.0)	14.52 (368.8)	12.83 (325.9)	0.75 (19.1)	15.68 (398.3)	13.72 (348.5)	165.0 (74.84)
	230	25-30											
	480	50-75											

**Note:** C distance is spacing required to mount multiple drives.

Approximate Dimensions in Inches (mm)

**Enclosure Box A NEMA Type 3R**

Voltage AC	hp (I <sub>L</sub> )	H	H1	H2	H3	W	W1	W2	W3	D	D1	D2	Approx. Weight Lbs (kg)	Approx. Shipping Weight Lbs (kg)
<b>Three-Phase</b>														
208 V	1-10	33.00	31.36	29.67	25.35	21.05	16.92	15.30	2.07	17.24	16.26	3.31	170 (77)	215 (98)
230 V	1-10	(838.2)	(796.5)	(753.6)	(643.9)	(534.7)	(429.8)	(388.6)	(52.6)	(437.9)	(413.0)	(84.1)		
480 V	1-20													



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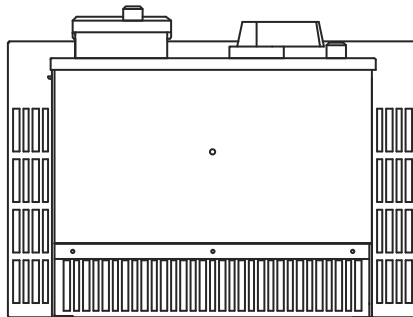
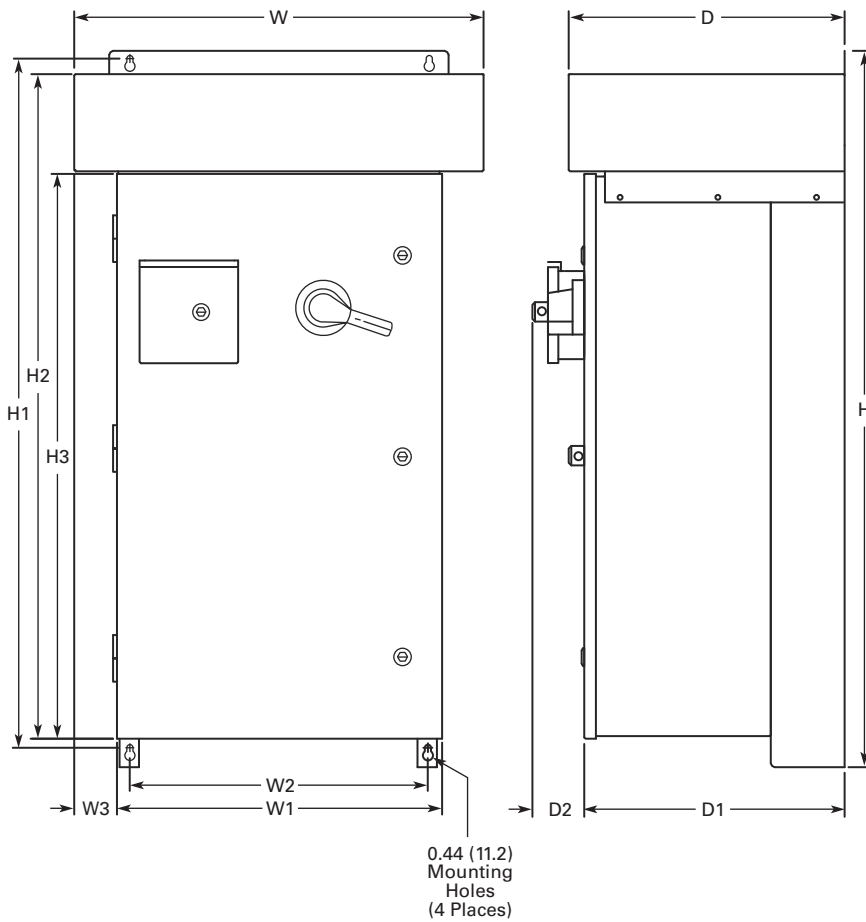
## Adjustable Frequency Drives

### H-Max Series Drives

Approximate Dimensions in Inches (mm)

#### Enclosure Box B NEMA Type 3R

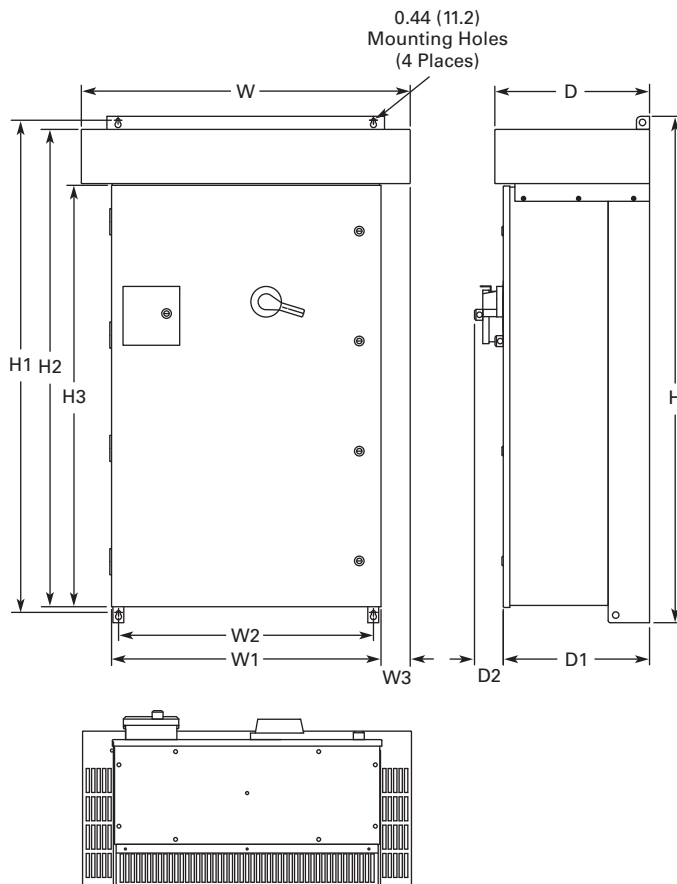
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Voltage AC	hp (I <sub>L</sub> )	H	H1	H2	H3	W	W1	W2	W3	D	D1	D2	Approx. Weight Lbs (kg)	Approx. Shipping Weight Lbs (kg)
<b>Three-Phase</b>														
208 V	15	46.09 (1170.7)	44.45 (1129.0)	42.77 (1086.4)	36.35 (923.3)	26.31 (668.3)	20.92 (531.4)	19.30 (490.2)	2.69 (68.3)	17.74 (450.6)	16.76 (425.7)	3.31 (84.1)	235 (107)	290 (132)
230 V	15													
480 V	25-40													

Approximate Dimensions in Inches (mm)

### Enclosure Box C NEMA Type 3R



Voltage AC	hp (I <sub>L</sub> )	H	H1	H2	H3	W	W1	W2	W3	D	D1	D2	Approx. Weight Lbs (kg)
<b>Three-Phase</b>													
208	20–30	58.09 (1475.5)	56.45 (1433.8)	54.77 (1391.2)	48.35 (1228.1)	37.73 (958.3)	30.92 (785.4)	29.30 (744.2)	3.34 (84.8)	17.74 (450.6)	16.77 (426.0)	3.31 (84.1)	①
230	20–30												
480	50–75												

**Note**

① Consult factory.

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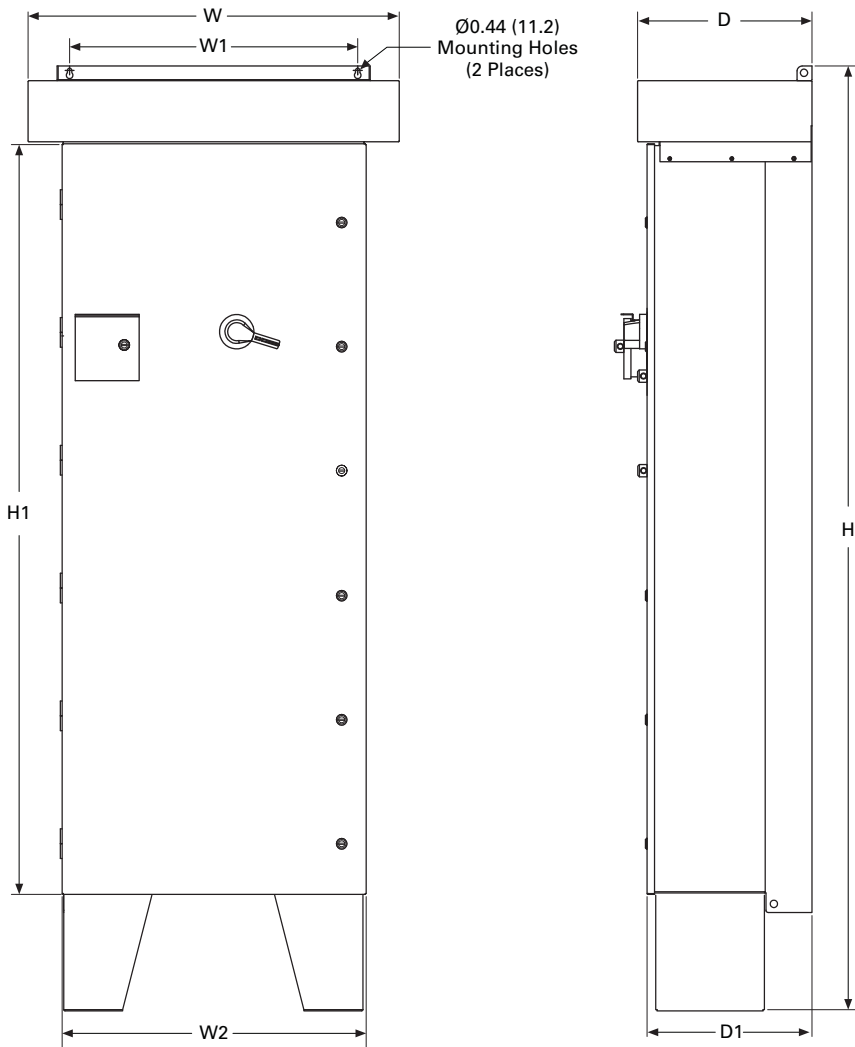
## Adjustable Frequency Drives

### H-Max Series Drives

Approximate Dimensions in Inches (mm)

#### Enclosure Box D

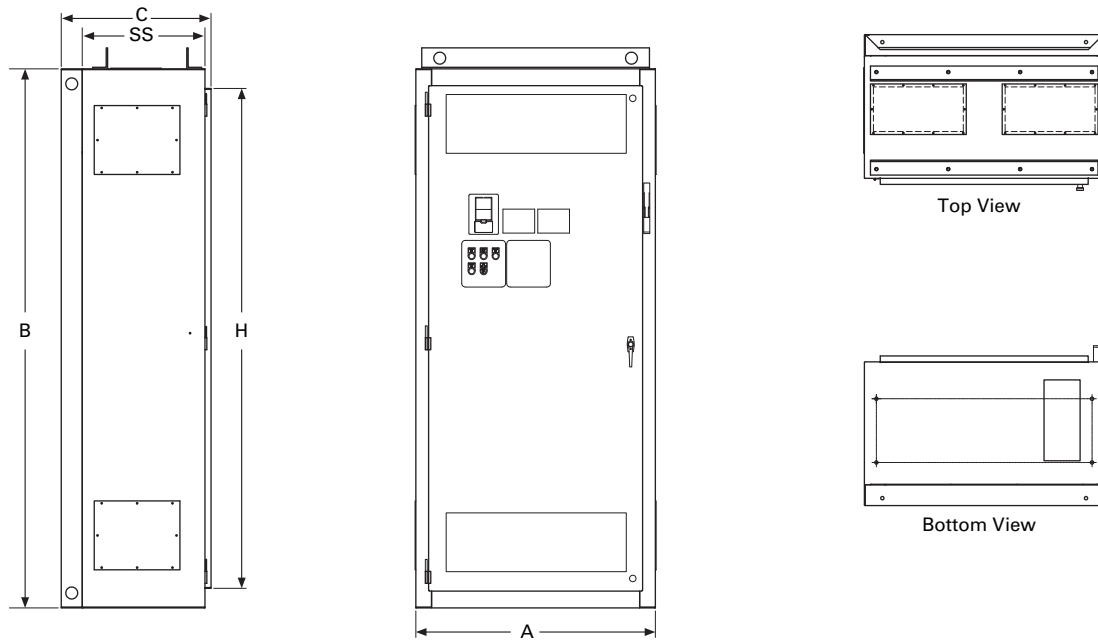
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Voltage AC	hp (I <sub>L</sub> )	H	H1	W	W1	W2	D	D1	Approx. Weight Lbs (kg)
<b>NEMA Type 12</b>									
208	40-60	80.00	76.27	31.00	29.30	30.92	16.76	16.76	850
230	40-75	(2032.0)	(1937.3)	(787.4)	(744.2)	(785.4)	(425.7)	(425.7)	(386)
480	100-150								
<b>NEMA Type 3R</b>									
208	40-60	96.00	76.27	37.73	29.30	30.92	17.74	16.76	900
230	40-75	(2438.4)	(1937.3)	(958.3)	(744.2)	(785.4)	(450.6)	(425.7)	(409)
480	100-150								

Approximate Dimensions in Inches (mm)

### Enclosure Box 5



Voltage AC	hp (I <sub>L</sub> )	Wide A	High B	Deep C	SS	Mounting D	D1	F	G	Door Height (H)	Approx. Weight Lbs (kg)
<b>Three-phase</b>											
208	75–100	40.00 (1016.0)	90.00 (2286.0)	25.00 (635.0)	20.50 (520.7)	36.00 (914.4)	2.00 (50.8)	8.00 (203.2)	10.80 (274.3)	83.45 (2119.6)	1275 (578)
230	100										
480	200–250										

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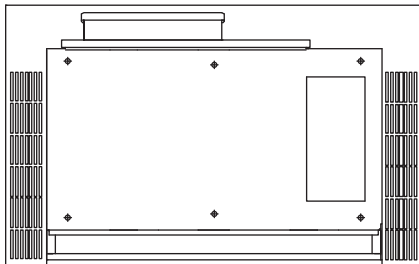
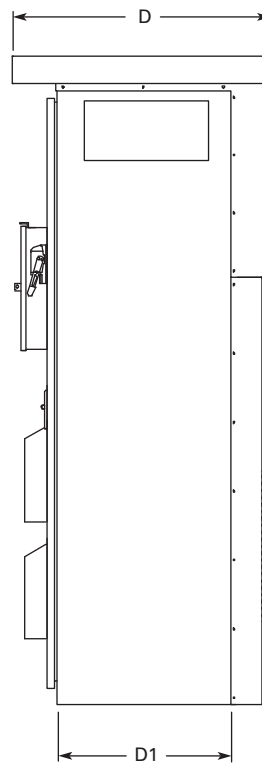
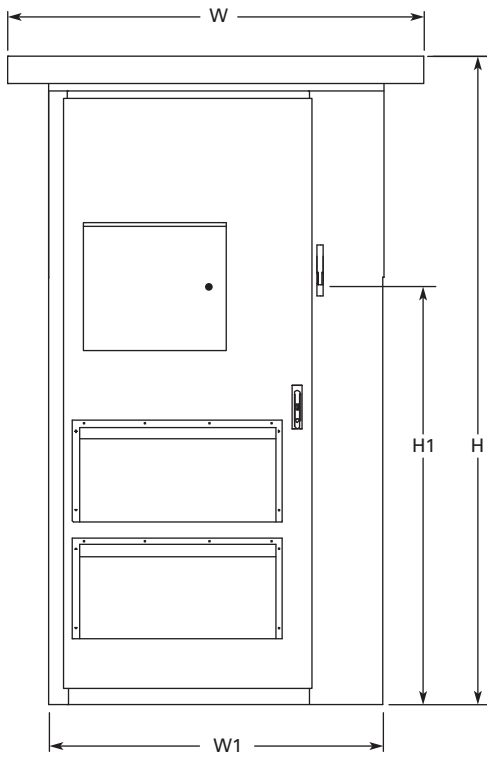
## Adjustable Frequency Drives

### H-Max Series Drives

Approximate Dimensions in Inches (mm)

#### Enclosure Box F

2



Voltage AC	hp (I <sub>L</sub> )	H	H1	W	W1	D	D1	Approx. Weight Lbs (kg)
<b>Three-Phase</b>								
208	75–100	93.58 (2377.0)	69.51 (1765.5)	60.00 (1524.0)	48.00 (1219.2)	37.50 (952.5)	26.00 (660.4)	1700 (772)
230	100							
480	200–250							

## SPX Drives



## Product Description

The SPX Series Adjustable Frequency Drives from Eaton's Electrical Sector are specifically designed for high performance applications. Equipped with high processing power, the SPX can use information from an encoder or a resolver in order to provide very precise motor control. Sensorless vector and simple frequency control are also supported. Typical applications requiring high performance are: master-slave drives, positioning applications, winder tension control and synchronization.

The core of the SPX is a fast microprocessor, providing high dynamic performance for applications where good motor handling and reliability are required. It can be used both in open loop applications as well as in applications requiring encoder feedback.

The SPX supports fast drive-to-drive communication. It also offers an integrated data logger functionality for analysis of dynamic events without the need of additional hardware. Simultaneous fast monitoring of several drives can be done by using the 9000Xdrive tool and CAN communication. In applications where reliability and quality are essential for high-performance, the SPX is the logical choice.

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Options	<b>V6-T2-266</b>
Replacement Parts	<b>V6-T2-273</b>
Technical Data and Specifications	<b>V6-T2-280</b>
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The Eaton family of drives includes DA1, DC1, H-Max, M-Max, SVX and SPX. 9000X Series drive ratings are rated for either high overload ( $I_H$ ) or low overload ( $I_L$ ).  $I_L$  indicates 110% overload capacity for 1 minute out of 10 minutes.  $I_H$  indicates 150% overload capacity for 1 minute out of 10 minutes.

### Features and Benefits

- Speed error <0.01 %, depending on the encoder
- Incremental or absolute encoder support
- Encoder voltages of 5 V (RS-422), 15 V or 24 V, depending on the option card
- Full torque control at all speeds, including zero
- Torque accuracy <2%; <5% down to zero speed
- Starting torque >200%, depending on motor and drive sizing
- Integrated datalogger for system analysis
- Fast multiple drive monitoring with PC
- Full capability for master/slave configurations
- High-speed bus (12 Mbit/s) for fast inter-drive communication
- High-speed applications (up to 7200 Hz) possible with special software
- Robust design—proven 500,000 hours MTBF
- Integrated 3% line reactors standard on drives from FR4 through FR9
- Line reactor is included but is separated from chassis
- EMI/RFI Filters H standard up to 200 hp I<sub>H</sub> 480 V, 100 hp I<sub>H</sub> 230 V
- Simplified operating menu allows for typical programming changes, while programming mode provides control of everything
- Quick Start Wizard built into the programming of the drive ensures a smooth start-up
- Keypad can display up to three monitored parameters simultaneously
- LOCAL/REMOTE operation from keypad
- Copy/paste function allows transfer of parameter settings from one drive to the next
- Standard NEMA Type 12/IP54 keypad on all drives
- Hand-held auxiliary 240 power supply allows programming/monitoring of control module without applying full power to the drive
- The SPX can be flexibly adapted to a variety of needs using our pre-installed “Seven in One” precision application programs consisting of:
  - Basic
  - Standard
  - Local/remote
  - Multi-step speed control
  - PID control
  - Multi-purpose control
  - Pump and fan control with auto change
- Additional I/O and communication cards provide plug and play functionality
- I/O connections with simple quick connection terminals
- Control logic can be powered from an external auxiliary control panel, internal drive functions and fieldbus if necessary
- Brake chopper standard from: 1–30 hp/380–500 V 3/4–15 hp/208–230 V
- NEMA Type 1/IP21 enclosures available Frame Sizes FR4–FR11, NEMA Type 12/IP54 enclosures available Frame Sizes FR4–FR10 (FR10 and FR11 freestanding drives)
- Open chassis FR10 and greater
- Standard option board configuration includes an A9 I/O board and an A2 relay output board installed in slots A and B

### Standards and Certifications

#### Product

- IEC 61800-2

#### Safety

- UL 508C

#### EMC (at default settings)

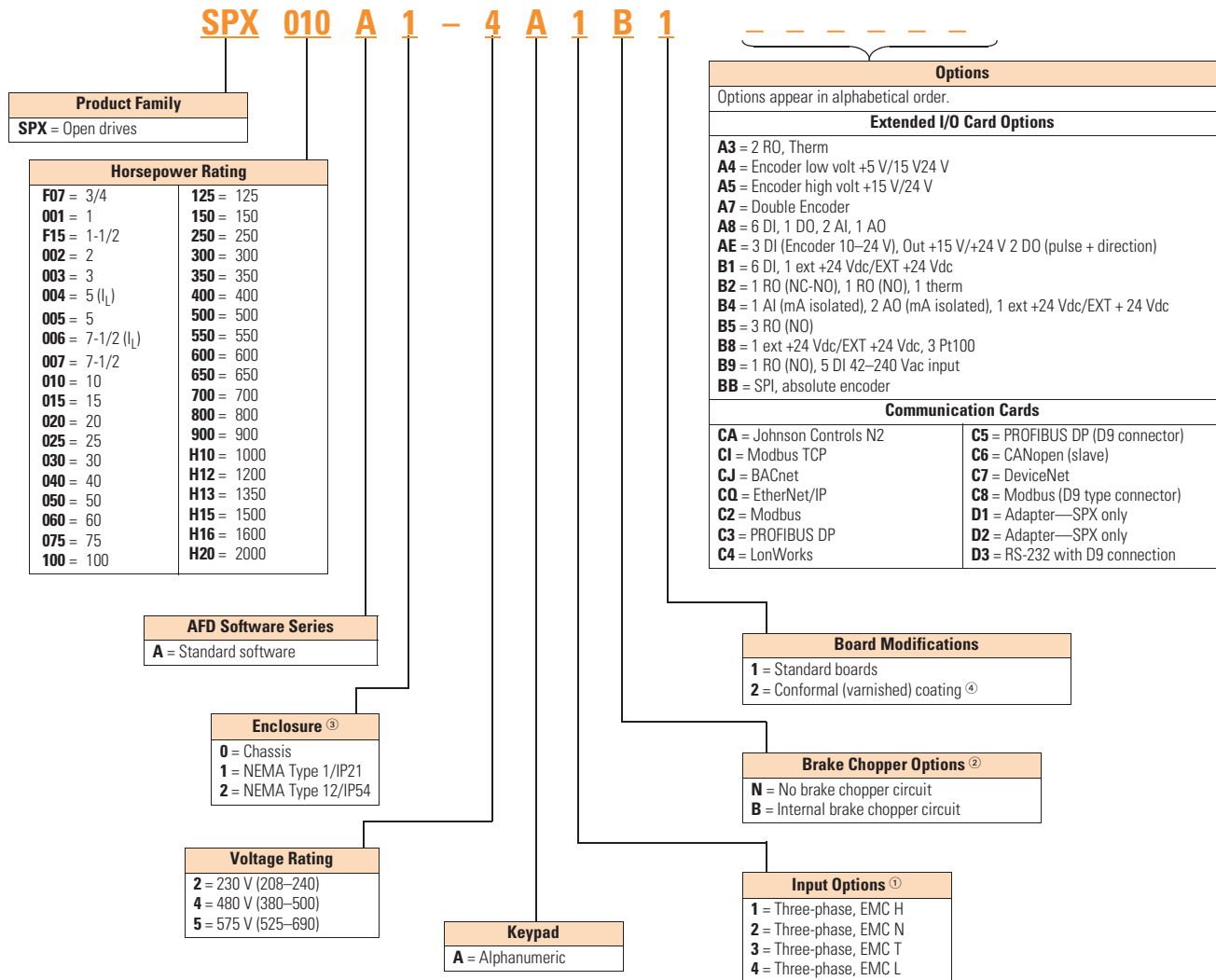
- Immunity: Fulfills all EMC immunity requirements; Emissions: EN 61800-3, LEVEL H

- UL Listed
- CE



## Catalog Number Selection

## SPX Adjustable Frequency Drives



## Notes

- ① All 230 V drives and 480 V drives up to 200 hp (I<sub>H</sub>) are only available with input option **1** (EMC level H). 480 V drives 250 hp (I<sub>H</sub>) or larger are available with input option **2** (EMC level N). 575 V drives 200 hp (I<sub>H</sub>) or larger are available with input option **2**. 575 V drives up to 150 hp (I<sub>H</sub>) are available with input option **4** (EMC level L). 480 V and 690 V freestanding drives are available with input option **4** (EMC level L).
- ② 480 V drives up to 30 hp (I<sub>H</sub>) are only available with brake chopper option **B**. 480 V drives 40 hp (I<sub>H</sub>) or larger come standard with brake chopper option **N**. 230 V drives up to 15 hp (I<sub>H</sub>) are only available with brake chopper option **B**. 230 V drives 20 hp and larger come standard with brake chopper option **N**. All 575 V drives come standard without brake chopper option (**N**). **N = No** brake chopper.
- ③ 480 V drives 250–350 hp (I<sub>H</sub>) and 690 V drives 200–300 hp (I<sub>H</sub>) are available with enclosure style **0** (chassis). 480 V and 690 V FR10 freestanding drives are available with **1** (NEMA Type 1/IP21) or **2** (NEMA Type 12/IP54). FR11 freestanding drives are only available with enclosure style **1** (NEMA Type 1/IP21).
- ④ Factory promise delivery. Consult sales office for availability.
- ⑤ For High-Resistance Ground systems, any SVX/SPX drive can be used if the HRG system has ground supervision. If no ground supervision feature is available, use EMC class N or T.



## Product Selection

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## 230 V Drives

## SPX Open Drives



## 208–240 V, NEMA Type 1/IP21 Drives

Frame Size	hp (I <sub>H</sub> )	Current (I <sub>H</sub> )	hp (I <sub>L</sub> )	Current (I <sub>L</sub> )	Catalog Number
FR4	3/4	3.7	1	4.8	SPXF07A1-2A1B1
	1	4.8	1-1/2	6.6	SPX001A1-2A1B1
	1-1/2	6.6	2	7.8	SPXF15A1-2A1B1
	2	7.8	3	11	SPX002A1-2A1B1
	3	11	—	12.5	SPX003A1-2A1B1
FR5	—	12.5	5	17.5	SPX004A1-2A1B1
	5	17.5	7-1/2	25	SPX005A1-2A1B1
	7-1/2	25	10	31	SPX007A1-2A1B1
FR6	10	31	15	48	SPX010A1-2A1B1
	15	48	20	61	SPX015A1-2A1B1
FR7	20	61	25	75	SPX020A1-2A1N1
	25	75	30	88	SPX025A1-2A1N1
	30	88	40	114	SPX030A1-2A1N1
FR8	40	114	50	140	SPX040A1-2A1N1
	50	140	60	170	SPX050A1-2A1N1
	60	170	75	205	SPX060A1-2A1N1
FR9	75	205	100	261	SPX075A1-2A1N1
	100	261	—	—	SPX100A1-2A1N1

## 208–240 V, NEMA Type 12/IP54 Drives

Frame Size	hp (I <sub>H</sub> )	Current (I <sub>H</sub> )	hp (I <sub>L</sub> )	Current (I <sub>L</sub> )	Catalog Number
FR4	3/4	3.7	1	4.8	SPXF07A2-2A1B1
	1	4.8	1-1/2	6.6	SPX001A2-2A1B1
	1-1/2	6.6	2	7.8	SPXF15A2-2A1B1
	2	7.8	3	11	SPX002A2-2A1B1
	3	11	—	12.5	SPX003A2-2A1B1
FR5	—	12.5	5	17.5	SPX004A2-2A1B1
	5	17.5	7-1/2	25	SPX005A2-2A1B1
	7-1/2	25	10	31	SPX007A2-2A1B1
FR6	10	31	15	48	SPX010A2-2A1B1
	15	48	20	61	SPX015A2-2A1B1
FR7	20	61	25	75	SPX020A2-2A1N1
	25	75	30	88	SPX025A2-2A1N1
	30	88	40	114	SPX030A2-2A1N1
FR8	40	114	50	140	SPX040A2-2A1N1
	50	140	60	170	SPX050A2-2A1N1
	60	170	75	205	SPX060A2-2A1N1
FR9	75	205	100	261	SPX075A2-2A1N1
	100	261	—	—	SPX100A2-2A1N1

## 480 V Drives

## SPX Open Drives



## 380–500 V, NEMA Type 1/IP21 Drives

Frame Size	hp (I <sub>H</sub> )	Current (I <sub>H</sub> )	hp (I <sub>L</sub> )	Current (I <sub>L</sub> )	Catalog Number
FR4	1	2.2	1-1/2	3.3	SPX001A1-4A1B1
	1-1/2	3.3	2	4.3	SPXF15A1-4A1B1
	2	4.3	3	5.6	SPX002A1-4A1B1
	3	5.6	5	7.6	SPX003A1-4A1B1
	5	7.6	—	9	SPX005A1-4A1B1
	—	9	7-1/2	12	SPX006A1-4A1B1
FR5	7-1/2	12	10	16	SPX007A1-4A1B1
	10	16	15	23	SPX010A1-4A1B1
	15	23	20	31	SPX015A1-4A1B1
FR6	20	31	25	38	SPX020A1-4A1B1
	25	38	30	46	SPX025A1-4A1B1
	30	46	40	61	SPX030A1-4A1B1
FR7	40	61	50	72	SPX040A1-4A1N1
	50	72	60	87	SPX050A1-4A1N1
	60	87	75	105	SPX060A1-4A1N1
FR8	75	105	100	140	SPX075A1-4A1N1
	100	140	125	170	SPX100A1-4A1N1
	125	170	150	205	SPX125A1-4A1N1
FR9	150	205	200	261	SPX150A1-4A1N1
	200	245	250	300	SPX200A1-4A1N1

## 380–500 V, NEMA Type 1/IP21 Freestanding Drives

Frame Size	hp (I <sub>H</sub> )	Current (I <sub>H</sub> )	hp (I <sub>L</sub> )	Current (I <sub>L</sub> )	Catalog Number
FR10	250	330	300	385	SPX250A1-4A4N1
	300	385	350	460	SPX300A1-4A4N1
	350	460	400	520	SPX350A1-4A4N1
FR11	400	520	500	590	SPX400A1-4A4N1
	500	590	550	650	SPX500A1-4A4N1
	550	650	600	730	SPX550A1-4A4N1

**Note**

Integrated fuses as standard. Limited option selection available; 115 V transformer (KB), light kit (L1), HOA (K4), speed potentiometer w/HOA (K2), Disconnect switch (P2). See Freestanding Option selection on **Page V6-T2-272**.

## SPX Open Drives

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## 380–500 V, NEMA Type 12/IP54 Drives

Frame Size	hp (I <sub>H</sub> )	Current (I <sub>H</sub> )	hp (I <sub>L</sub> )	Current (I <sub>L</sub> )	Catalog Number
FR4	1	2.2	1-1/2	3.3	SPX001A2-4A1B1
	1-1/2	3.3	2	4.3	SPXF15A2-4A1B1
	2	4.3	3	5.6	SPX002A2-4A1B1
	3	5.6	5	7.6	SPX003A2-4A1B1
	5	7.6	—	9	SPX005A2-4A1B1
	—	9	7-1/2	12	SPX006A2-4A1B1
FR5	7-1/2	12	10	16	SPX007A2-4A1B1
	10	16	15	23	SPX010A2-4A1B1
	15	23	20	31	SPX015A2-4A1B1
FR6	20	31	25	38	SPX020A2-4A1B1
	25	38	30	46	SPX025A2-4A1B1
	30	46	40	61	SPX030A2-4A1B1
FR7	40	61	50	72	SPX040A2-4A1N1
	50	72	60	87	SPX050A2-4A1N1
	60	87	75	105	SPX060A2-4A1N1
FR8	75	105	100	140	SPX075A2-4A2N1
	100	140	125	170	SPX100A2-4A1N1
	125	170	150	205	SPX125A2-4A1N1
FR9	150	205	200	261	SPX150A2-4A1N1
	200	245	250	300	SPX200A2-4A1N1

## 380–500 V, NEMA Type 12/IP54 Freestanding Drives

Frame Size	hp (I <sub>H</sub> )	Current (I <sub>H</sub> )	hp (I <sub>L</sub> )	Current (I <sub>L</sub> )	Catalog Number
FR10	250	330	300	385	SPX250A2-4A4N1
	300	385	350	460	SPX300A2-4A4N1
	350	460	400	520	SPX350A2-4A4N1

## 380–500 V, Open Chassis Drives

Frame Size	hp (I <sub>H</sub> )	Current (I <sub>H</sub> )	hp (I <sub>L</sub> )	Current (I <sub>L</sub> )	Catalog Number
FR10	250	330	300	385	SPX250A0-4A2N1
	300	385	—	460	SPX300A0-4A2N1
	350	460	400	520	SPX350A0-4A2N1
FR11	400	520	500	590	SPX400A0-4A2N1
	500	590	—	650	SPX500A0-4A2N1
	—	650	600	730	SPX550A0-4A2N1
FR12	600	730	—	820	SPX600A0-4A2N1
	—	820	700	920	SPX650A0-4A2N1
	700	920	800	1030	SPX700A0-4A2N1
FR13	800	1030	900	1150	SPX800A0-4A2N1
	900	1150	1000	1300	SPX900A0-4A2N1
	1000	1300	1200	1450	SPXH10A0-4A2N1
FR14	1200	1600	1500	1770	SPXH12A0-4A2N1
	1600	1940	1800	2150	SPXH16A0-4A2N1

**Notes**

Integrated fuses as standard. Limited option selection available; 115 V transformer (KB), light kit (L1), HOA (K4), speed potentiometer w/HOA (K2), disconnect switch (P2). See Freestanding Option selection on [Page V6-T2-272](#).

① FR10–FR14 includes 3% line reactor, but it is not integral to chassis.

## 575 V Drives

## SPX Open Drives



## 525–690 V, NEMA Type 1/IP21 Drives

Frame Size	hp (I <sub>H</sub> )	Current (I <sub>H</sub> )	hp (I <sub>L</sub> )	Current (I <sub>L</sub> )	Catalog Number
FR6	2	3.3	3	4.5	SPX002A1-5A4N1
	3	4.5	—	5.5	SPX003A1-5A4N1
	—	5.5	5	7.5	SPX004A1-5A4N1
	5	7.5	7-1/2	10	SPX005A1-5A4N1
	7-1/2	10	10	13.5	SPX007A1-5A4N1
	10	13.5	15	18	SPX010A1-5A4N1
	15	18	20	22	SPX015A1-5A4N1
	20	22	25	27	SPX020A1-5A4N1
	25	27	30	34	SPX025A1-5A4N1
FR7	30	34	40	41	SPX030A1-5A4N1
	40	41	50	52	SPX040A1-5A4N1
FR8	50	52	60	62	SPX050A1-5A4N1
	60	62	75	80	SPX060A1-5A4N1
	75	80	100	100	SPX075A1-5A4N1
FR9	100	100	125	125	SPX100A1-5A4N1
	125	125	150	144	SPX125A1-5A4N1
	150	144	—	170	SPX150A1-5A4N1
	—	170	200	208	SPX175A1-5A4N1

## 525–690 V, NEMA Type 1/IP21 Freestanding Drives

Frame Size	hp (I <sub>H</sub> )	Current (I <sub>H</sub> )	hp (I <sub>L</sub> )	Current (I <sub>L</sub> )	Catalog Number
FR10	200	208	250	261	SPX200A1-5A4N1
	250	261	300	325	SPX250A1-5A4N1
	300	325	400	385	SPX300A1-5A4N1
FR11	400	385	450	460	SPX400A1-5A4N1
	450	460	500	502	SPX450A1-5A4N1
	500	502	550	590	SPX500A1-5A4N1

**Note**

Integrated fuses as standard. Limited option selection available; 115 V transformer (KB), light kit (L1), HOA (K4), speed potentiometer w/HOA (K2), disconnect switch (P2). See Freestanding Option selection on **Page V6-T2-272**.

# 2.10

## Adjustable Frequency Drives

### SPX Drives

#### SPX Open Drives

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#### 525–690 V, NEMA Type 12/IP54 Drives

Frame Size	hp (I <sub>H</sub> )	Current (I <sub>H</sub> )	hp (I <sub>L</sub> )	Current (I <sub>L</sub> )	Catalog Number
FR6	2	3.3	3	4.5	SPX002A2-5A4N1
	3	4.5	—	5.5	SPX003A2-5A4N1
	—	5.5	5	7.5	SPX004A2-5A4N1
	5	7.5	7-1/2	10	SPX005A2-5A4N1
	7-1/2	10	10	13.5	SPX007A2-5A4N1
	10	13.5	15	18	SPX010A2-5A4N1
	15	18	20	22	SPX015A2-5A4N1
	20	22	25	27	SPX020A2-5A4N1
FR7	25	27	30	34	SPX025A2-5A4N1
	30	34	40	41	SPX030A2-5A4N1
	40	41	50	52	SPX040A2-5A4N1
FR8	50	52	60	62	SPX050A2-5A4N1
	60	62	75	80	SPX060A2-5A4N1
	75	80	100	100	SPX075A2-5A4N1
FR9	100	100	125	125	SPX100A2-5A4N1
	125	125	150	144	SPX125A2-5A4N1
	150	144	—	170	SPX150A2-5A4N1
	—	170	200	208	SPX175A2-5A4N1

#### 525–690 V, NEMA Type 12/IP54 Freestanding Drives

Frame Size	hp (I <sub>H</sub> )	Current (I <sub>H</sub> )	hp (I <sub>L</sub> )	Current (I <sub>L</sub> )	Catalog Number
FR10	200	208	250	261	SPX200A2-5A4N1
	250	261	300	325	SPX250A2-5A4N1
	300	325	400	385	SPX300A2-5A4N1

#### 525–690 V, Open Chassis Drives

Frame Size	hp (I <sub>H</sub> )	Current (I <sub>H</sub> )	hp (I <sub>L</sub> )	Current (I <sub>L</sub> )	Catalog Number
FR10	200	208	250	261	SPX200A0-5A2N1
	250	261	300	325	SPX250A0-5A2N1
	300	325	400	385	SPX300A0-5A2N1
FR11	400	385	450	460	SPX400A0-5A2N1
	450	460	500	502	SPX450A0-5A2N1
	500	502	—	590	SPX500A0-5A2N1
FR12	—	590	600	650	SPX550A0-5A2N1
	600	650	700	750	SPX600A0-5A2N1
	700	750	800	820	SPX700A0-5A2N1
FR13	800	820	900	920	SPX800A0-5A2N1
	900	920	1000	1030	SPX900A0-5A2N1
	1000	1030	1250	1180	SPXH10A0-5A2N1
FR14	1350	1300	1500	1500	SPXH13A0-5A2N1
	1500	1500	2000	1900	SPXH15A0-5A2N1
	2000	1900	2300	2250	SPXH20A0-5A2N1

#### Notes

Integrated fuses as standard. Limited option selection available; 115 V transformer (KB), light kit (L1), HOA (K4), speed potentiometer w/HOA (K2), disconnect switch (P2). See Freestanding Option selection on [Page V6-T2-272](#).

Ⓞ FR10–FR14 includes 3% line reactor, but it is not integral to chassis.

## Accessories

### Demo Drive and Power Supply

#### Demo Drive and Power Supply

Description	Catalog Number
9000X demo drive	9000XDEMO

### 9000X Series—SVX/SPX Conversion and Flange Kits

The Type 12/IP54 option kit is used to convert a Type 1/IP21 to a Type 12/IP54 drive. The kit includes:

#### NEMA Type 12 / IP54 Conversion Kits

Frame Size	Catalog Number
Frame 4 Type 12/IP54 kit	OPTN12FR4
Frame 5 Type 12/IP54 kit	OPTN12FR5
Frame 6 Type 12/IP54 kit	OPTN12FR6

### Flange Kits

The flange kit is used when the power section heat sink is mounted through the back panel of an enclosure. The kit includes hardware and supporting steel plates.

#### NEMA Type 12 / IP54 Conversion Kits

##### Kit

Frame Size	Catalog Number
Frame 4 flange kit Type 12/IP54	OPTTHR4
Frame 5 flange kit Type 12/IP54	OPTTHR5
Frame 6 flange kit Type 12/IP54	OPTTHR6
Frame 7 flange kit Type 12/IP54	OPTTHR7
Frame 8 flange kit Type 12/IP54	OPTTHR8
Frame 9 flange kit Type 12/IP54	OPTTHR9

# 2.10

## Adjustable Frequency Drives

### SPX Drives

#### Options

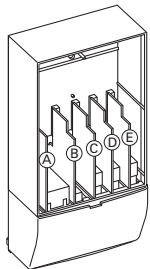
##### 9000X Series Option Board Kits

2

The 9000X Series drives can accommodate a wide selection of expander and adapter option boards to customize the drive for your application needs. The drive's control unit is designed to accept a total of five option boards.

The 9000X Series factory installed standard board configuration includes an A9 I/O board and an A2 relay output board, which are installed in slots A and B.

#### Option Boards



#### Option Board Kits

Option Kit Description <sup>①</sup>	Allowed Slot Locations <sup>②</sup>	Field Installed Catalog Number	Factory Installed Option Designator	SVX Ready Programs						
				Basic	Local/Remote	Standard	MSS	PID	Multi-P.	PFC
<b>Standard I/O Cards</b>										
6 DI, 1 DO, 2 AI, 1 AO, 1 +10 Vdc ref, 2 ext +24 Vdc/EXT +24 Vdc	A	<b>OPTA9</b>	—	■	■	■	■	■	■	■
2 RO (NC-NO)	B	<b>OPTA2</b>	—	■	■	■	■	■	■	■
<b>Extended I/O Cards</b>										
2 RO, therm	B	<b>OPTA3</b>	<b>A3</b>	—	■	■	■	■	■	■
Encoder low volt +5 V/15 V/24 V	C	<b>OPTA4</b>	<b>A4</b>	—	■	■	■	■	■	■
Encoder high volt +15 V/24 V	C	<b>OPTA5</b>	<b>A5</b>	—	■	■	■	■	■	■
Double encoder—SPX only	C	<b>OPTA7</b>	<b>A7</b>	■	■	■	■	■	■	■
6 DI, 1 DO, 2 AI, 1 AO	A	<b>OPTA8</b>	<b>A8</b>	—	■	■	■	■	■	■
6 DI, 1 DO, 2 AI, 1 AO, 1 +10 Vdc ref, 2 ext +24 Vdc/EXT +24 Vdc	A	<b>OPTA1</b>	—	■	■	■	■	■	■	■
3 DI (encoder 10–24 V), out +15 V/+24 V, 2 DO (pulse+direction)—SPX only	C	<b>OPTAE</b>	<b>AE</b>	■	■	■	■	■	■	■
6 DI, 1 DO, 2 AI, 1 AO, 1 +10 Vdc ref, 2 ext +24 Vdc/EXT +24 Vdc	A	<b>OPTAFA1</b>	—	■	■	■	■	■	■	■
6 DI, 1 ext +24 Vdc/EXT +24 Vdc	B, C, <b>D</b> , E	<b>OPTB1</b>	<b>B1</b>	—	—	—	—	—	■	■
1 RO (NC-NO), 1 RO (NO), 1 therm	B, C, <b>D</b> , E	<b>OPTB2</b>	<b>B2</b>	—	—	—	—	—	■	■
1 AI (mA isolated), 2 AO (mA isolated), 1 ext +24 Vdc/EXT +24 Vdc	B, C, <b>D</b> , E	<b>OPTB4</b>	<b>B4</b>	—	■	■	■	■	■	■
3 RO (NO)	B, C, <b>D</b> , E	<b>OPTB5</b>	<b>B5</b>	—	—	—	—	—	■	■
1 ext +24 Vdc/EXT +24 Vdc, 3 Pt100	B, C, <b>D</b> , E	<b>OPTB8</b>	<b>B8</b>	—	—	—	—	—	—	—
1 RO (NO), 5 DI 42–240 Vac input	B, C, <b>D</b> , E	<b>OPTB9</b>	<b>B9</b>	—	—	—	—	—	■	■
SPI, absolute encoder	C	<b>OPTBB</b>	<b>BB</b>	—	—	—	—	—	—	—
<b>Communication Cards</b>										
Modbus RTU	D, E	OPTC2	C2	■	■	■	■	■	■	■
Modbus RTU (D9 connector)	D, E	OPTC8	C8	■	■	■	■	■	■	■
PROFIBUS DP	D, E	OPTC3	C3	■	■	■	■	■	■	■
PROFIBUS DP (D9 connector)	D, E	OPTC5	C5	■	■	■	■	■	■	■
Johnson Controls N2	D, E	OPTC2	CA	—	—	—	—	—	—	—
BACnet MSTP	D, E	OPTCJ	CJ	■	■	■	■	■	■	■
LonWorks	D, E	OPTC4	C4	■	■	■	■	■	■	■
CANopen (slave)	D, E	OPTC6	C6	■	■	■	■	■	■	■
DeviceNet	D, E	OPTC7	C7	■	■	■	■	■	■	■
Modbus TCP	D, E	OPTCI	CI	■	■	■	■	■	■	■
EtherNet/IP	D, E	OPTCQ	CQ	■	■	■	■	■	■	■
PROFINET, Modbus TCP, EtherNet/IP (dual-port) <sup>④</sup>	D, E	OPTC9	E9	■	■	■	■	■	■	■
EtherCAT (dual-port) <sup>④</sup>	D, E	OPTCQ	EC	■	■	■	■	■	■	■
SPX adapter	D, E	OPTD1	D1	■	■	■	■	■	■	■
SPX adapter	D, E	OPTD2	D2	■	■	■	■	■	■	■
RS-232 adapter	D, E	OPTD3	D3	■	■	■	■	■	■	■

#### Notes

- ① AI = Analog Input; AO = Analog Output, DI = Digital Input, DO = Digital Output, RO = Relay Output
- ② Option card must be installed in one of the slots listed for that card. Slot indicated in bold is the preferred location.
- ③ OPTC2 is a multi-protocol option card.

### Modbus RTU Network Communications

The Modbus Network Card OPTC2 is used for connecting the SVX Drive as a slave on a Modbus network. The interface is connected by a 9-pin DSUB connector (female) and the baud rate ranges from 300 to 19,200 baud. Other communication parameters include an address range from 1 to 247; a parity of None, Odd or Even; and the stop bit is 1.

### PROFIBUS Network Communications

The PROFIBUS Network Card OPTC3 is used for connecting the SVX Drive as a slave on a PROFIBUS-DP network. The interface is connected by a 9-pin DSUB connector (female). The baud rates range from 9.6 Kbaud to 12 Mbaud, and the addresses range from 1 to 127.

### LonWorks Network Communications

The LonWorks Network Card OPTC4 is used for connecting the SVX Drive on a LonWorks network. This interface uses Standard Network Variable Types (SNVT) as data types. The channel connection is achieved using a FTT-10 A Free Topology transceiver via a single twisted transfer cable. The communication speed with LonWorks is 78 kBits/s.

### CANopen (Slave) Communications

The CANopen (Slave) Network Card OPTC6 is used for connecting the SVX Drive to a host system. According to ISO11898 standard cables to be chosen for CANbus should have a nominal impedance of 120 ohms, and specific line delay of nominal 5 nS/m. 120 ohms line termination resistors required for installation.

### DeviceNet Network Communications

The DeviceNet Network Card OPTC7 is used for connecting the SVX Drive on a DeviceNet Network. It includes a 5.08 mm pluggable connector. Transfer method is via CAN using a two-wire twisted shielded cable with two-wire bus power cable and drain. The baud rates used for communication include 125 Kbaud, 250 Kbaud and 500 Kbaud.

### Johnson Controls Metasys N2 Network Communications

The OPTC2 fieldbus board provides communication between the SVX Drive and a Johnson Controls Metasys™ N2 network. With this connection, the drive can be controlled, monitored and programmed from the Metasys system. The N2 fieldbus is available as a factory installed option and as a field installable kit.

### Modbus/TCP Network Communications

The Modbus/TCP Network Card OPTCI is used for connecting the SVX Drive to Ethernet networks utilizing Modbus protocol. It includes an RJ-45 pluggable connector. This interface provides a selection of standard and custom register values to communicate drive parameters. The board supports 10 Mbps and 100 Mbps communication speeds. The IP address of the board is configurable over Ethernet using a supplied software tool.

### BACnet Network Communications

The BACnet Network Card OPTCJ is used for connecting the SVX Drive to BACnet networks. It includes a 5.08 mm pluggable connector. Data transfer is Master-Slave/Token Passing (MS/TP) RS-485. This interface uses a collection of 30 Binary Value Objects (BVOs) and 35 Analog Value Objects (AVOs) to communicate drive parameters. The card supports 9.6, 19.2 and 38.4 Kbaud communication speeds and supports network addresses 1–127.

### EtherNet/IP Network Communications

The OPTCQ is used for connecting the SVX Drive to Ethernet/Industrial Protocol networks. It includes an RJ-45 pluggable connector. The interface uses CIP objects to communicate drive parameters (CIP is "Common Industrial Protocol", the same protocol used by DeviceNet). The board supports 10 Mbps and 100 Mbps communication speeds. The IP address of the board is configurable by Static, BOOTP and DHCP methods.



## Control Panel Options

## Factory Options

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Description	Factory Installed Option Code	Field Installed NEMA Type 1/IP21 Catalog Number
<b>Local/Remote Keypad SVX Control Panel</b> —This option is standard on all drives and consists of an RS-232 connection, backlit alphanumeric LCD display with nine indicators for the RUN status and two indicators for the control source. The nine pushbuttons on the panel are used for panel programming and monitoring of all SVX parameters. The panel is detachable and isolated from the input line potential. Include LOC/REM key to choose control location.	<b>A</b>	<b>KEYPAD-LOC/REM</b>
<b>Keypad Remote Mounting Kit</b> —This option is used to remote mount the SVX keypad. The footprint is compatible to the SV9000 remote mount kit. Includes 10 ft cable, keypad holder and mounting hardware.	—	<b>OPTRMT-KIT-9000X</b>
<b>Keypad Blank</b> —9000X Series select keypad for use with special and custom applications.	—	<b>KEYPAD-BLANK</b>

## Miscellaneous Options

Description	Catalog Number
<b>9000XDrive</b> —A PC-based tool for controlling and monitoring of the SVX. Features include: loading parameters that can be saved to a file or printed, setting references, starting and stopping the motor, monitoring signals in graphical or text form, and real-time display. To avoid damage to the drive or computer, SVDrivecable must be used.	<b>9000XDRIVE</b>
<b>SVDrivecable</b> —6 ft (1.8 m) RS-232 cable (22 gauge) with a 7-pin connector on each end. Should be used in conjunction with the 9000XDrive option to avoid damage to the SVX or computer. The same cable can be used for downloading specialized applications to the drive.	<b>SVDRIVECABLE</b>
<b>External Dynamic Braking Resistors</b> —Used with the dynamic braking chopper circuit to absorb motor regenerative energy for stopping the load and to dissipate the energy flowing back into the drive. Resistors are separated into standard duty and heavy-duty. Standard duty is defined as 20% duty or less with 100% braking torque, while heavy-duty is defined as 50% duty or less with 150% braking torque.	See <b>Page V6-T2-269</b>

## SPX Drive Options

### Brake Chopper Options

The brake chopper circuit option is used for applications that require dynamic braking. Dynamic braking resistors are not included with drive purchase. Consult the factory for additional dynamic braking resistor selections that are supplied separately. A list of common resistors are listed below and are complete indoor assemblies, include a pre-wired terminal block and a thermal switch, and are not UL Listed.

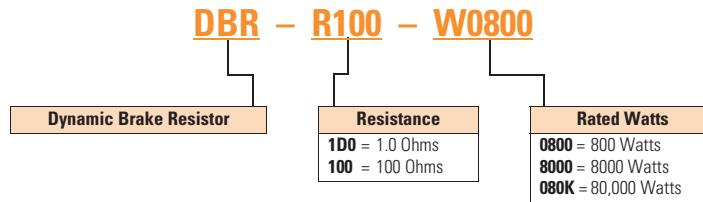
#### Duty Cycle

The duty cycle rating is based on a 60-second period. For example, the 20% duty cycle resistor can carry 100% current for 12 seconds out of every 60 seconds, while the 50% duty cycle resistor can carry 150% current for 30 seconds out of every 60 seconds.

#### Torque

If the braking torque required is less than 15%, dynamic braking is not required because the regenerated energy will be dissipated in the drive and motor losses.

### Dynamic Brake Resistor—Catalog Number Selection



### 230 V Brake Resistors

Drive hp (CT/I <sub>H</sub> )	Minimum Ohms	20% Duty Cycle, 100% Torque		50% Duty Cycle, 150% Torque	
		Catalog Number	Dimensions (Inches)	Catalog Number	Dimensions (Inches)
0.75	30.0	DBR-R100-W0400	12W x 5D x 5H	DBR-R100-W0800	12W x 7D x 5H
1	30.0	DBR-R100-W0400	12W x 5D x 5H	DBR-R100-W0800	12W x 7D x 5H
1.5	30.0	DBR-R100-W0400	12W x 5D x 5H	DBR-R036-W1200	12W x 10D x 5H
2	30.0	DBR-R100-W0400	12W x 5D x 5H	DBR-R036-W1200	12W x 10D x 5H
3	30.0	DBR-R036-W0800	12W x 7D x 5H	DBR-R036-W2000	12W x 16D x 5H
4	30.0	DBR-R036-W0800	12W x 7D x 5H	DBR-R030-W2400	19W x 10D x 5H
5	30.0	DBR-R036-W0800	12W x 7D x 5H	DBR-R030-W2800	19W x 13D x 5H
7.5	20.0	DBR-R020-W1200	12W x 10D x 5H	DBR-R020-W4800	26.5W x 13D x 5H
10	10.0	DBR-R015-W1600	12W x 13D x 5H	DBR-R112-W6000	26.5W x 13D x 5H
15	10.0	DBR-R012-W2400	19W x 10D x 5H	DBR-R010-W9000	28W x 10D x 10H
20	3.3	DBR-R9D3-W3200	19W x 10D x 5H	DBR-R3D4-W012K	28W x 10D x 10H
25	3.3	DBR-R5D5-W4000	26.5W x 10D x 5H	DBR-R5D1-W015K	28W x 16D x 10H
30	3.3	DBR-R4D8-W4800	26.5W x 10D x 5H	DBR-R4D1-W020K	28W x 16D x 10H
40	1.4	DBR-R004-W6000	26.5W x 13D x 5H	DBR-R3D4-W025K	30W x 18D x 16H
50	1.4	DBR-R3D1-W7500	26.5W x 16D x 5H	DBR-R2D1-W030K	30W x 18D x 24H
60	1.4	DBR-R2D8-W9000	26.5W x 16D x 5H	DBR-R002-W036K	30W x 18D x 24H
75	1.4	DBR-R2D6-W012K	28W x 10D x 10H	DBR-R1D5-W045K	30W x 18D x 32H
100	1.4	DBR-R002-W015K	28W x 16D x 10H	DBR-R1D4-W060K	30W x 18D x 40H

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## Adjustable Frequency Drives

### SPX Drives

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#### 480 V Brake Resistors

Drive hp (CT/l <sub>H</sub> )	Minimum Ohms	20% Duty Cycle, 100% Torque		50% Duty Cycle, 150% Torque	
		Catalog Number	Dimensions (Inches)	Catalog Number	Dimensions (Inches)
1	63.0	<b>DBR-R100-W0400</b>	12W x 5D x 5H	<b>DBR-R100-W0800</b>	12W x 7D x 5H
1.5	63.0	<b>DBR-R100-W0400</b>	12W x 5D x 5H	<b>DBR-R100-W1200</b>	12W x 10D x 5H
2	63.0	<b>DBR-R100-W0400</b>	12W x 5D x 5H	<b>DBR-R100-W1200</b>	12W x 10D x 5H
3	63.0	<b>DBR-R100-W0800</b>	12W x 7D x 5H	<b>DBR-R100-W2000</b>	12W x 16D x 5H
5	63.0	<b>DBR-R100-W0800</b>	12W x 7D x 5H	<b>DBR-R100-W2800</b>	19W x 13D x 5H
6	63.0	<b>DBR-R100-W1200</b>	12W x 10D x 5H	<b>DBR-R070-W4000</b>	19W x 16D x 5H
7.5	63.0	<b>DBR-R100-W1200</b>	12W x 10D x 5H	<b>DBR-R063-W4800</b>	26.5W x 13D x 5H
10	63.0	<b>DBR-R063-W1600</b>	12W x 13D x 5H	<b>DBR-R063-W6000</b>	26.5W x 16D x 5H
15	42.0	<b>DBR-R042-W2400</b>	19W x 10D x 5H	<b>DBR-R042-W9000</b>	28W x 10D x 10H
20	21.0	<b>DBR-R030-W3200</b>	19W x 13D x 5H	<b>DBR-R023-W012K</b>	28W x 13D x 10H
25	21.0	<b>DBR-R030-W4000</b>	19W x 16D x 5H	<b>DBR-R021-W015K</b>	28W x 13D x 10H
30	14.0	<b>DBR-R020-W4800</b>	26.5W x 13D x 5H	<b>DBR-R014-W020K</b>	30W x 18D x 24H
40	6.5	<b>DBR-R112-W6000</b>	26.5W x 13D x 5H	<b>DBR-R007-W025K</b>	30W x 18D x 16H
50	6.5	<b>DBR-R013-W7500</b>	26.5W x 16D x 5H	<b>DBR-R8D5-W030K</b>	30W x 18D x 24H
60	6.5	<b>DBR-R010-W9000</b>	28W x 10D x 10H	<b>DBR-R7D3-W036K</b>	30W x 18D x 24H
75	3.3	<b>DBR-R009-W012K</b>	28W x 13D x 10H	<b>DBR-R3D3-W045K</b>	30W x 18D x 32H
100	3.3	<b>DBR-R5D1-W015K</b>	28W x 16D x 10H	<b>DBR-R004-W060K</b>	30W x 18D x 40H
125	3.3	<b>DBR-R4D1-W020K</b>	28W x 16D x 10H	<b>DBR-R004-W070K</b>	30W x 18D x 48H
150	3.3	<b>DBR-R3D4-W025K</b>	30W x 18D x 16H	<b>DBR-R3D5-W085K</b>	30W x 18D x 56H
200	3.3	<b>DBR-R3D3-W030K</b>	30W x 18D x 24H	<b>DBR-R3D3-W110K</b>	30W x 18D x 72H
250	1.4	<b>DBR-R2D5-W036K</b>	30W x 18D x 24H	Ⓢ	—
300	1.4	<b>DBR-R1D5-W045K</b>	30W x 18D x 32H	Ⓢ	—
350	1.4	<b>DBR-R1D4-W060K</b>	30W x 18D x 40H	Ⓢ	—
400	0.9	<b>DBR-R1D4-W060K</b>	30W x 18D x 40H	Ⓢ	—
500	0.9	<b>DBR-R0D9-W080K</b>	30W x 18D x 48H	Ⓢ	—
550	0.9	<b>DBR-R001-W085K</b>	30W x 18D x 56H	Ⓢ	—

**Note**

Ⓢ Consult factory.

## 575 V Brake Resistors

Drive hp (CT/Hz)	Minimum Ohms	20% Duty Cycle, 100% Torque		50% Duty Cycle, 150% Torque	
		Catalog Number	Dimensions (Inches)	Catalog Number	Dimensions (Inches)
2	100.0	<b>DBR-R100-W0400</b>	12W x 5D x 5H	<b>DBR-R100-W1200</b>	12W x 10D x 5H
3	100.0	<b>DBR-R100-W0800</b>	12W x 7D x 5H	<b>DBR-R100-W2000</b>	12W x 16D x 5H
4	100.0	<b>DBR-R100-W0800</b>	12W x 7D x 5H	<b>DBR-R100-W2400</b>	19W x 10D x 5H
5	100.0	<b>DBR-R100-W0800</b>	12W x 7D x 5H	<b>DBR-R100-W2800</b>	19W x 13D x 5H
7.5	100.0	<b>DBR-R100-W1200</b>	12W x 10D x 5H	<b>DBR-R100-W4800</b>	26.5W x 13D x 5H
10	30.0	<b>DBR-R063-W1600</b>	12W x 13D x 5H	<b>DBR-R063-W6000</b>	26.5W x 16D x 5H
15	30.0	<b>DBR-R042-W2400</b>	19W x 10D x 5H	<b>DBR-R042-W9000</b>	28W x 10D x 10H
20	30.0	<b>DBR-R030-W3200</b>	19W x 13D x 5H	<b>DBR-R030-W012K</b>	28W x 13D x 10H
25	30.0	<b>DBR-R030-W4000</b>	19W x 16D x 5H	<b>DBR-R030-W015K</b>	28W x 16D x 10H
30	18.0	<b>DBR-R020-W4800</b>	26.5W x 13D x 5H	<b>DBR-R020-W020K</b>	30W x 18D x 16H
40	18.0	<b>DBR-R030-W6000</b>	26.5W x 16D x 5H	<b>DBR-R184-W025K</b>	30W x 18D x 16H
50	9.0	<b>DBR-R013-W7500</b>	26.5W x 16D x 5H	<b>DBR-R012-W030K</b>	30W x 18D x 24H
60	9.0	<b>DBR-R010-W9000</b>	28W x 10D x 10H	<b>DBR-R010-W036K</b>	30W x 18D x 24H
75	9.0	<b>DBR-R009-W012K</b>	28W x 13D x 10H	<b>DBR-R009-W045K</b>	30W x 18D x 24H
100	7.0	<b>DBR-R013-W015K</b>	28W x 16D x 10H	<b>DBR-R8D4-W060K</b>	30W x 18D x 40H
125	7.0	<b>DBR-R8D2-W020K</b>	30W x 18D x 10H	<b>DBR-R007-W070K</b>	30W x 18D x 40H
150	7.0	<b>DBR-R007-W025K</b>	30W x 18D x 16H	<b>DBR-R006-W085K</b>	30W x 18D x 56H
175	7.0	<b>DBR-R007-W030K</b>	30W x 18D x 24H	<b>DBR-R007-W100K</b>	30W x 18D x 72H
200	2.5	<b>DBR-R3D3-W030K</b>	30W x 18D x 24H	<b>DBR-R2D6-W110K</b>	30W x 18D x 64H
250	2.5	<b>DBR-R2D5-W036K</b>	30W x 18D x 24H	<b>DBR-R003-W140K</b>	30W x 18D x 72H
300	2.5	<b>DBR-R3D3-W045K</b>	30W x 18D x 32H	Ⓢ	—
400	1.7	<b>DBR-R002-W060K</b>	30W x 18D x 48H	Ⓢ	—
450	1.7	<b>DBR-R1D8-W070K</b>	30W x 18D x 48H	Ⓢ	—
500	1.7	<b>DBR-R002-W080K</b>	30W x 18D x 56H	Ⓢ	—

**Note**

Ⓢ Consult factory.

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## Adjustable Frequency Drives

### SPX Drives

#### Control/Communication Options

#### Available Control/Communications Options

2

Option	Description	Option Type
K2	<b>Door-Mounted Speed Potentiometer with HOA Selector Switch</b> —Provides the SPX with the ability to start/stop and adjust the speed reference from door-mounted control devices or remotely from customer supplied inputs. In HAND position, the drive will start and the speed is controlled by the door-mounted speed potentiometer. The drive will be disabled in the OFF position. When AUTO is selected, the drive run and speed control commands are via user-supplied dry contact and 4–20 mA signal.	Control
K4	<b>HAND/OFF/AUTO Switch for Non-Bypass Configurations</b> —Provides a three-position selector switch that allows the user to select either a HAND or AUTO mode of operation. HAND mode is defaulted to keypad operation, and AUTO mode is defaulted to control from an external terminal source. These modes of operation can be configured via programming to allow for alternate combinations of start and speed sources. Start and speed sources include keypad, I/O and fieldbus.	Control
KB	<b>115 V Control Transformer, 550 VA</b> —Provides a fused control power transformer with additional 550 VA at 115 V for customer use.	Control
L1	<b>Power On and Fault Pilot Lights</b> —Provide a white power on light that indicates power to the enclosed cabinet and a red fault light that indicates a drive fault has occurred.	Light
P2	<b>Disconnect Switch</b> —Disconnect switch option is applicable only with NEMA Type 1/IP21 and NEMA Type 12/IP54 Freestanding drives. Allows a convenient means of disconnecting the SPX from the line, and the operating mechanism can be padlocked in the OFF position. This is factory-mounted in the enclosure.	Input

#### SPX Freestanding Options

#### 480 V and 690 V Control Options, 200–550 hp <sup>①</sup>

Description	Catalog Number Suffix
Door-mounted speed potentiometer with HOA selector switch	K2
HAND/OFF/AUTO switch (22 mm)	K4
115 volt control transformer 550 VA	KB

#### 480 V and 690 V Light Options, 200–550 hp <sup>①</sup>

Description	Catalog Number Suffix
Power on/fault pilot lights	L1

#### Input Options, 200–550 hp <sup>①</sup>

Description	Catalog Number Suffix
Disconnect switch	P2 <sup>②</sup>

#### Notes

<sup>①</sup> Consult factory for adder information.

<sup>②</sup> Applicable with FR10 and FR11 freestanding designs only.

## Replacement Parts

### FR4 Spare Parts

Category	Description	Quantity/ Drive	230 V Catalog Number	480 V Catalog Number	575 V Catalog Number
Control fan	NEMA Type 12 control fan <sup>①</sup>	1	PP01086	PP01086	—
Control module <sup>②</sup>	SPX control module	1	CPBS0000000000	CPBS0000000000	—
	Standard slot A I/O card	1	OPTA9	OPTA9	—
	Standard slot B I/O card	1	OPTA2	OPTA2	—
Keypad <sup>②</sup>	SVX/SPX keypad	1	KEYPAD-LOC/REM	KEYPAD-LOC/REM	—
Main fan <sup>②</sup>	DC fan (main)	1	PP01060	PP01060	—
Other	Mounting kit, fixing kit	1	FR00040	FR00040	—
	Mounting kit, fixing kit, N12 <sup>①</sup>	1	FR00079	FR00079	—
	Control cover, plastic, N1	1	FR00006	FR00006	—

### FR5 Spare Parts

Category	Description	Quantity/ Drive	230 V Catalog Number	480 V Catalog Number	575 V Catalog Number
Control fan	NEMA Type 12 control fan <sup>①</sup>	1	PP01088	PP01088	—
Control module <sup>②</sup>	SPX control module	1	CPBS0000000000	CPBS0000000000	—
	Standard slot A I/O card	1	OPTA9	OPTA9	—
	Standard slot B I/O card	1	OPTA2	OPTA2	—
Keypad <sup>②</sup>	SVX/SPX keypad	1	KEYPAD-LOC/REM	KEYPAD-LOC/REM	—
Main fan <sup>②</sup>	DC fan (main)	1	PP01061	PP01061	—
Other	Mounting kit, fixing kit	1	FR00050	FR00050	—
	Mounting kit, fixing kit, N12 <sup>①</sup>	1	FR00081	FR00081	—
	Control cover, plastic, N1	1	FR05011	FR05011	—

### FR6 Spare Parts

Category	Description	Quantity/ Drive	230 V Catalog Number	480 V Catalog Number	575 V Catalog Number
Control fan	NEMA Type 12 control fan <sup>①</sup>	1	PP01049	PP01049	—
Control module <sup>②</sup>	SPX control module	1	CPBS0000000000	CPBS0000000000	CPBS0000000000
	Standard slot A I/O card	1	OPTA9	OPTA9	OPTA9
	Standard slot B I/O card	1	OPTA2	OPTA2	OPTA2
Keypad <sup>②</sup>	SVX/SPX keypad	1	KEYPAD-LOC/REM	KEYPAD-LOC/REM	KEYPAD-LOC/REM
Main fan <sup>②</sup>	DC fan (main)	1	PP01062	PP01062	—
Other	Mounting kit, fixing kit	1	FR00060	FR00060	FR00060
	Mounting kit, fixing kit, N12 <sup>①</sup>	1	FR00082	FR00082	FR00082
	Control cover, plastic, N1	1	FR06011	FR06011	FR06011

### FR7 Spare Parts

Category	Description	Quantity/ Drive	230 V Catalog Number	480 V Catalog Number	575 V Catalog Number
Control fan	NEMA Type 12 control fan <sup>①</sup>	1	PP01049	PP01049	PP01049
Control module <sup>②</sup>	SPX control module	1	CPBS0000000000	CPBS0000000000	CPBS0000000000
	Standard slot A I/O card	1	OPTA9	OPTA9	OPTA9
	Standard slot B I/O card	1	OPTA2	OPTA2	OPTA2
Keypad <sup>②</sup>	SVX/SPX keypad	1	KEYPAD-LOC/REM	KEYPAD-LOC/REM	KEYPAD-LOC/REM
Main fan <sup>②</sup>	DC fan (main)	1	PP01063	PP01063	PP01063
Other	Mounting kit, fixing kit	1	FR07071	FR07071	FR07071
	Mounting kit, fixing kit, N12 <sup>①</sup>	1	FR07072	FR07072	FR07072
	Control cover, plastic, N1	1	FR07011	FR07011	FR07011

#### Notes

<sup>①</sup> Only for NEMA Type 12/IP54 Type drives.

<sup>②</sup> Factory recommended spare parts.

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## Adjustable Frequency Drives

### SPX Drives

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#### FR8 Spare Parts

Category	Description	Quantity/ Drive	230 V Catalog Number	480 V Catalog Number	575 V Catalog Number
Control fan	NEMA Type 12 control fan <sup>①</sup>	1	CP01180	CP01180	CP01180
Control module <sup>②</sup>	SPX control module	1	CPBS0000000000	CPBS0000000000	CPBS0000000000
	Standard slot A I/O card	1	OPTA9	OPTA9	OPTA9
	Standard slot B I/O card	1	OPTA2	OPTA2	OPTA2
Keypad <sup>②</sup>	SVX/SPX keypad	1	KEYPAD-LOC/REM	KEYPAD-LOC/REM	KEYPAD-LOC/REM
Main AC fan	Fan AC	1	PP01123	PP01123	PP01123
	Fan fuse	2	PP20202	PP20202	PP20202
	Starting cap	1	S00734	S00734	S00734
	Fan driver board AC	1	VB00599	VB00799	VB00799
	Isolation transformer (fan)	1	S0000113	S0000113	S0000113
Main DC fan <sup>②</sup>	DC fan	1	PP00071	PP00071	PP00071
	DC power supply	1	S01016	S01016	S01016
Other	Front cover, N12 <sup>①</sup>	1	FR08079	FR08079	FR08079
	Conduit plate, N12	1	FR08082	FR08082	FR08082
	Front cover, N1	1	FR08106	FR08106	FR08106

#### FR9 Spare Parts

Category	Description	Quantity/ Drive	230 V Catalog Number	480 V Catalog Number	575 V Catalog Number
Control fan	50 mm fan	1	PP09041	PP09041	PP09041
	80 mm fan	1	PP01068	PP01068	PP01068
Control module <sup>①</sup>	SPX control module	1	CPBS0000000000	CPBS0000000000	CPBS0000000000
	Standard slot A I/O card	1	OPTA9	OPTA9	OPTA9
	Standard slot B I/O card	1	OPTA2	OPTA2	OPTA2
Converter	Power module <sup>②</sup>	1	FR09-0261-2-ANV	FR09-0261-4-ANV	FR09-0125-5-ANV
		1	FR09-0300-2-ANV	FR09-0300-4-ANV	FR09-0144-5-ANV
		1	—	—	FR09-0170-5-ANV
	Driver board	1	S00583	S00583	S00583
	Shunt board <sup>②</sup>	6	—	VB00535	VB00537
		6	—	VB00536	VB00542
6		—	—	VB00543	
DC section	Balancing resistor	3	PP00052	PP00052	PP00052
	Bus capacitor	8	S00335	S00335	PP01041
	DC busbars DC-	1	FR09043	FR09043	FR09043
	DC busbars DC+	1	FR09044	FR09044	FR09044
	DC busbars connection	1	FR09045	FR09045	FR09045
	DC busbars +/- insulator	1	FR09046	FR09046	FR09046
	DC busbars -/con insulator	1	FR09047	FR09047	FR09047
Inverter	Rectifier module	1	FR09826	FR09822	FR09823
	Diode	3	CP01268	CP01268	CP01268
	Rectifier board	1	—	VB00459	VB00460
Keypad <sup>①</sup>	SVX/SPX keypad	1	KEYPAD-LOC/REM	KEYPAD-LOC/REM	KEYPAD-LOC/REM
Main DC fan <sup>①</sup>	DC fan	1	PP00072	PP00072	PP00072
	DC power supply	1	S01017	S01017	S01017
Other	Front cover power	1	FR09012	FR09012	FR09012
	Front cover connection	1	FR09013	FR09013	FR09013
	Front power conduit	1	FR09014	FR09014	FR09014

#### Notes

- ① Only for NEMA Type 12/IP54 Type drives.
- ② Factory recommended spare parts.
- ③ Select one part number based on the amperage rating of the drive. Please contact EatonCare at 877-ETN-CARE for assistance.

## FR10 Spare Parts

Category	Description	Quantity/ Drive	230 V Catalog Number	480 V Catalog Number	575 V Catalog Number
Control	Fiber board	1	—	S00451	S00451
	ASIC board	1	—	S00457	S00457
Control fan	ASIC fan	1	—	PP01096	PP01096
Control module ①	SPX control module	1	—	CPBS0000000000	CPBS0000000000
	Standard slot A I/O card	1	—	OPTA9	OPTA9
	Standard slot B I/O card	1	—	OPTA2	OPTA2
Converter	Power module ②	1	—	FR10-0385-4-ANV	FR10-0261-5-ANV
		1	—	FR10-0460-4-ANV	FR10-0325-5-ANV
		1	—	FR10-0520-4-ANV	FR10-0385-5-ANV
		1	—	—	FR10-0416-5-ANV
	Driver board	1	—	S00450	S00450
	Driver adapter board	1	—	VB00330	VB00330
	Shunt board ②	6	—	VB00497	VB00510
		6	—	VB00498	VB00511
		6	—	VB00537	VB00545
	Covers	Top cover	1	—	FR10340
Side cover		2	—	FR10341	FR10341
DC section	Balancing resistor	2	—	PP13027	PP13028
	DC busbars kit (right)	1	—	S0000005	S0000005
	Bus capacitor	12	—	S00335	S00336
Inverter	Rectifier module	1	—	FR10823	FR10823
	Charging resistor	1	—	PP00066	PP00066
	Diode	3	—	PP01177	PP01177
	Rectifier board	1	—	S00591	S00592
Keypad ①	SVX/SPX keypad	1	—	KEYPAD-LOC/REM	KEYPAD-LOC/REM
Main DC fan ①	DC fan	2	—	PP00072	PP00072
	DC power supply	2	—	S01017	S01017

**Notes**

① Factory recommended spare parts.

② Select one part number based on the amperage rating of the drive. Please contact EatonCare at 877-ETN-CARE for assistance.



# 2.10

## Adjustable Frequency Drives

### SPX Drives

#### FR11 Spare Parts

2

Category	Description	Quantity/ Drive	230 V Catalog Number	480 V Catalog Number	575 V Catalog Number
Control	Fiber board	1	—	S00451	S00451
	ASIC board	1	—	S00457	S00457
Control fan	ASIC fan	1	—	PP01096	PP01096
Control module ①	SPX control module	1	—	CPBS0000000000	CPBS0000000000
	Standard slot A I/O card	1	—	OPTA9	OPTA9
	Standard slot B I/O card	1	—	OPTA2	OPTA2
Converter	Power module ②	1	—	FR11-0590-4-ANV	FR11-0460-5-ANV
		1	—	FR11-0650-4-ANV	FR11-0502-5-ANV
		1	—	FR11-0730-4-ANV	FR11-0590-5-ANV
	Driver board	1	—	S00452	S00452
	Driver adapter board	1	—	VB00330	VB00330
	Shunt board ②	9	—	VB00513	VB00512
		9	—	VB00514	VB00546
		9	—	VB00538	VB00547
	Covers	Top cover	1	—	FR11345
DC section	Balancing resistor	3	—	PP13027	PP13027
	DC busbars kit (right)	3	—	S0000005	S0000005
	Bus capacitor	18	—	S00335	S00335
Inverter	Rectifier module	1	—	FR10823	FR10823
	Diode	3	—	PP01177	PP01177
	Rectifier board	1	—	S00591	S00591
Keypad ①	SVX/SPX keypad	1	—	KEYPAD-LOC/REM	KEYPAD-LOC/REM
Main DC fan ①	DC fan	2	—	PP00072	PP00072
	DC power supply	2	—	S01017	S01017

#### Notes

① Factory recommended spare parts.

② Select one part number based on the amperage rating of the drive. Please contact EatonCare at 877-ETN-CARE for assistance.

## FR12 Spare Parts

Category	Description	Quantity/ Drive	230 V Catalog Number	480 V Catalog Number	575 V Catalog Number
Control	Fiber board	2	—	S00451	S00451
	ASIC board	2	—	S00457	S00457
	Star coupler	1	—	S00593	S00593
Control fan	ASIC fan	2	—	PP01096	PP01096
Control module <sup>①</sup>	SPX control module	1	—	CPBS0000000000	CPBS0000000000
	Standard slot A I/O card	1	—	OPTA9	OPTA9
	Standard slot B I/O card	1	—	OPTA2	OPTA2
Converter	Power module <sup>②</sup>	1	—	FR12-0820-4-ANV	FR12-0650-5-ANV
		1	—	FR12-0920-4-ANV	FR12-0750-5-ANV
		1	—	FR12-1030-4-ANV	FR12-0820-5-ANV
	Driver board	2	—	S00450	S00450
	Driver adapter board	2	—	VB00330	VB00330
	Shunt board	12	—	VB00498	VB00511
	Covers	Top cover	2	—	FR10340
Side cover		4	—	FR10341	FR10341
DC section	Balancing resistor	4	—	PP13027	PP13027
	DC busbars kit (right)	2	—	S0000005	S0000005
	Bus capacitor	24	—	S00335	S00336
Inverter	Rectifier module	2	—	FR10823	FR10823
	Diode	3	—	PP01177	PP01177
	Rectifier board	2	—	S00591	S00591
Keypad <sup>①</sup>	SVX/SPX keypad	1	—	KEYPAD-LOC/REM	KEYPAD-LOC/REM
Main DC fan <sup>①</sup>	DC fan	4	—	PP00072	PP00072
	DC power supply	4	—	S01017	S01017

**Notes**

<sup>①</sup> Factory recommended spare parts.

<sup>②</sup> Select one part number based on the amperage rating of the drive. Please contact EatonCare at 877-ETN-CARE for assistance.

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## Adjustable Frequency Drives

### SPX Drives

#### FR13 Spare Parts

2

Category	Description	Quantity/ Drive	230 V Catalog Number	480 V Catalog Number	575 V Catalog Number
Control	ASIC board	1	—	<b>S00457</b>	<b>S00457</b>
	ASIC assembly	1	—	<b>60S01030</b>	<b>60S01030</b>
Control fan	ASIC fan	1	—	<b>PP01096</b>	<b>PP01096</b>
Control module ①	SPX control module	1	—	<b>CPBS0000000000</b>	<b>CPBS0000000000</b>
	Standard slot A I/O card	1	—	<b>OPTA9</b>	<b>OPTA9</b>
	Standard slot B I/O card	1	—	<b>OPTA2</b>	<b>OPTA2</b>
Converter	Power module ②	3	—	<b>FI13-1150-4-ANV</b>	<b>FR13-1030-5-ANV</b>
		3	—	<b>FI13-1300-4-ANV</b>	<b>FR13-1180-5-ANV</b>
		3	—	<b>FI13-1450-4-ANV</b>	<b>FR13-920-5-ANV</b>
	Driver board	3	—	<b>S00454</b>	<b>S00454</b>
	Driver adapter board	2	—	<b>VB00330</b>	<b>VB00330</b>
	Shunt board ②	18	—	<b>VB00505</b>	<b>VB00516</b>
		18	—	<b>VB00514</b>	<b>VB00517</b>
18		—	<b>VB00541</b>	<b>VB00547</b>	
Covers	Top cover	3	—	<b>FI10001</b>	<b>FI10001</b>
	Side cover	3	—	<b>FI10003</b>	<b>FI10003</b>
DC section	Balancing resistor	6	—	<b>PP13034</b>	<b>PP13034</b>
	Bus capacitor	36	—	<b>S00335</b>	<b>S00336</b>
	DC busbars kit	3	—	<b>FI13329</b>	<b>FI13329</b>
Inverter	Rectifier module	2	—	<b>FR10823</b>	<b>FR10823</b>
	Diode	3	—	<b>PP01177</b>	<b>PP01177</b>
	Rectifier board	2	—	<b>S00591</b>	<b>S00591</b>
Keypad ①	SVX/SPX keypad	1	—	<b>KEYPAD-LOC/REM</b>	<b>KEYPAD-LOC/REM</b>
Main DC fan ①	DC fan	4	—	<b>PP00072</b>	<b>PP00072</b>
	DC power supply	4	—	<b>S01017</b>	<b>S01017</b>

#### Notes

① Factory recommended spare parts.

② Select one part number based on the amperage rating of the drive. Please contact EatonCare at 877-ETN-CARE for assistance.

## FR14 Spare Parts

Category	Description	Quantity/ Drive	230 V Catalog Number	480 V Catalog Number	575 V Catalog Number
Control	ASIC board	2	—	S00457	S00457
	Star coupler	1	—	S00593	S00593
	ASIC assembly	2	—	60S01030	60S01030
	Star coupler kit	1	—	FR10860	FR10860
Control fan	ASIC fan	2	—	PP01096	PP01096
Control module <sup>①</sup>	SPX control module	1	—	CPBS0000000000	CPBS0000000000
	Standard slot A I/O card	1	—	OPTA9	OPTA9
	Standard slot B I/O card	1	—	OPTA2	OPTA2
Converter	Power module <sup>②</sup>	1	—	FR14-1770-4-ANV	FR14-1500-5-ANV
		1	—	FR14-2150-4-ANV	FR14-1900-5-ANV
		1	—	FR14-2700-4-ANV	FR14-2250-5-ANV
	Driver board	6	—	S00454	S00454
	Driver adapter board	2	—	VB00330	VB00330
	Shunt board <sup>②</sup>	36	—	VB00541	VB00516
		36	—	—	VB00517
Covers	Top cover	6	—	FI10001	FI10001
	Side cover	6	—	FI10003	FI10003
DC section	Balancing resistor	6	—	PP13034	PP13034
	Bus capacitor	72	—	S00335	S00336
	DC busbars kit	6	—	FI13329	FI13329
Inverter	Rectifier module	2	—	FR10823	FR10823
	Diode	3	—	PP01177	PP01177
	Rectifier board	2	—	S00591	S00591
Keypad <sup>①</sup>	SVX/SPX keypad	1	—	KEYPAD-LOC/REM	KEYPAD-LOC/REM
Main DC fan <sup>①</sup>	DC fan	6	—	PP00072	PP00072
	DC power supply	6	—	S01017	S01017

**Notes**

<sup>①</sup> Factory recommended spare parts.

<sup>②</sup> Select one part number based on the amperage rating of the drive. Please contact EatonCare at 877-ETN-CARE for assistance.

## Technical Data and Specifications

2

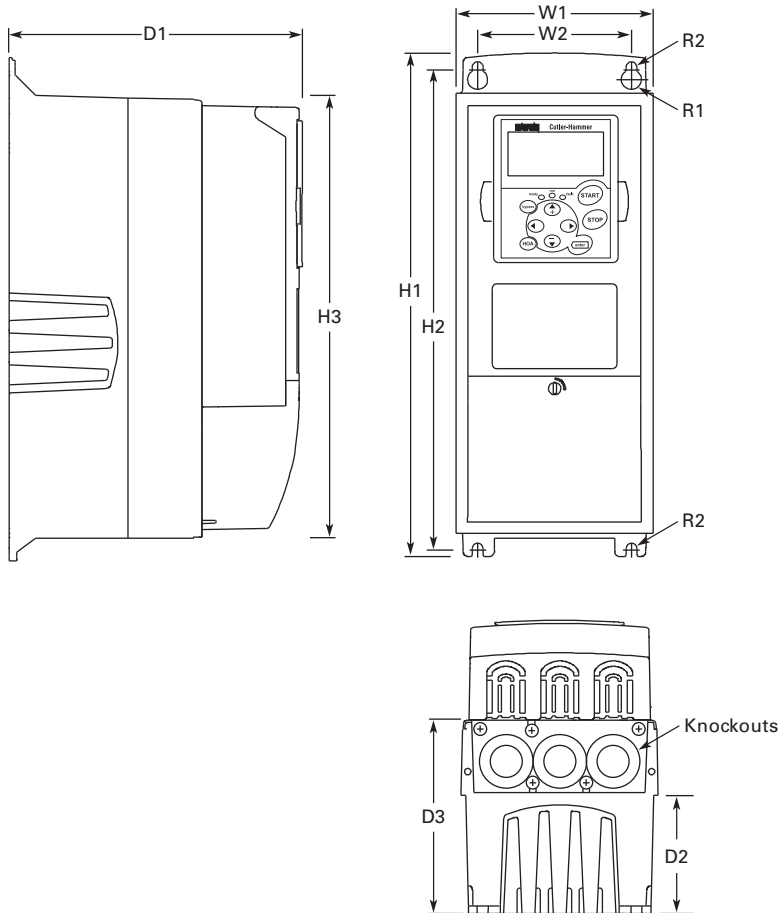
### SPX Drives

Description	Specification
<b>Input Ratings</b>	
Input voltage ( $V_{in}$ )	+10%/–15%
Input frequency ( $f_{in}$ )	50/60 Hz (variation up to 45–66 Hz)
Connection to power	Once per minute or less (typical operation)
High withstand rating	100 kAIC
<b>Output Ratings</b>	
Output voltage	0 to $V_{in}$
Continuous output current	$I_H$ rated 100% at 122 °F (50 °C), FR9 and below $I_L$ rated 100% at 104 °F (40 °C), FR9 and below $I_H/I_L$ 100% at 104 °F (40 °C), FR10 and above
Overload current ( $I_H/I_L$ )	150% $I_H$ , 110% $I_L$ for 1 min.
Output frequency	0 to 320 Hz
Frequency resolution	0.01 Hz
Initial output current ( $I_H$ )	250% for 2 seconds
Efficiency	>96%
<b>Control Characteristics</b>	
Control method	Frequency control (V/f) Open loop: sensorless vector control Closed loop: frequency control Closed loop: vector control
Switching frequency	Adjustable with parameter 2.6.9
Frame 4–6	1 to 16 kHz; default 10 kHz
Frame 7–12	1 to 10 kHz; default 3.6 kHz
Frequency reference	Analog input: Resolution 0.1% (10-bit), accuracy $\pm 1\%$ V/Hz Panel reference: Resolution 0.01 Hz
Field weakening point	30 to 320 Hz
Acceleration time	0 to 3000 sec.
Deceleration time	0 to 3000 sec.
Braking torque	DC brake: 30% $\times T_n$ (without brake option)
<b>Ambient Conditions</b>	
Ambient operating temperature	14 °F (–10 °C), no frost to 122 °F (50 °C) $I_H$ (FR4–FR9) 14 °F (–10 °C), no frost to 104 °F (40 °C) $I_L$ (FR10 and up) 14 °F (–10 °C), no frost to 104 °F (40 °C) $I_L$ (all frames)
Storage temperature	–40° to 158 °F (–40° to 70 °C)
Relative humidity	0 to 95% RH, noncondensing, non-corrosive, no dripping water
Air quality	Chemical vapors: IEC 721-3-3, unit in operation, class 3C2; Mechanical particles: IEC 721-3-3, unit in operation, class 3S2
Altitude	100% load capacity (no derating) up to 3280 ft (1000 m); 1% derating for each 328 ft (100 m) above 3280 ft (1000 m); max. 9842 ft (3000 m)
Vibration	EN 50178, EN 60068-2-6; 5 to 50 Hz, displacement amplitude 1 mm (peak) at 3 to 15.8 Hz, max. acceleration amplitude 1G at 15.8 to 150 Hz
Shock	EN 50178, EN 60068-2-27 UPS Drop test (for applicable UPS weights) Storage and shipping: max. 15 g, 11 ms (in package)
Enclosure class	NEMA 1/IP21 or NEMA 12/IP54, open chassis/IP20

Description	Specification
<b>Control Connections</b>	
Analog input voltage	0 to 10 V, $R = 200$ kohms (–10 to 10 V joystick control) resolution 0.1%; accuracy $\pm 1\%$
Analog input current	0(4) to 20 mA; $R_i$ —250 ohms differential
Digital inputs (6)	Positive or negative logic; 18 to 30 Vdc
Auxiliary voltage	+24 V $\pm 15\%$ , max. 250 mA
Output reference voltage	+10 V +3%, max. load 10 mA
Analog output	0(4) to 20 mA; $R_L$ max. 500 ohms; resolution 10 bit; Accuracy $\pm 2\%$
Digital outputs	Open collector output, 50 mA/48V
Relay outputs	2 programmable Form C relay outputs switching capacity: 24 Vdc/8 A, 250 Vac/8 A, 125 Vdc/0.4 A
<b>Protections</b>	
Overcurrent protection	Trip limit 4.0 $\times I_H$ instantaneously
Overvoltage protection	Yes
Undervoltage protection	Yes
Earth fault protection	In case of earth fault in motor or motor cable, only the frequency converter is protected
Input phase supervision	Trips if any of the input phases are missing
Motor phase supervision	Trips if any of the output phases are missing
Overtemperature protection	Yes
Motor overload protection	Yes
Motor stall protection	Yes
Motor underload protection	Yes
Short-circuit protection	Yes (+24 V and +10 V reference voltages)
<b>High Performance Features</b>	
Speed error	<0.01%, depending on the encoder
Encoder support	Incremental or absolute
Encoder voltages	5 V (RS-422), 15 V or 24 V, depending on the option card
Torque control	Full torque control at all speeds, including zero
Torque accuracy	<2%; <5% down to zero speed
Starting torque	>200%, depending on motor and drive sizing
Master/slave configurations	Full capability
System analysis	Integrated data logger
PC communication	Fast multiple drive monitoring with PC
Inter-drive communication	High-speed bus (12 Mbits/s)
High-speed applications	Up to 7200 Hz (special software required)

**Dimensions**

Approximate Dimensions in Inches (mm)

**9000X Drives****NEMA Type 1/IP21 and NEMA Type 12/IP54, FR4, FR5 and FR6**

Voltage	hp (I <sub>H</sub> )	H1	H2	H3	D1	D2	D3	W1	W2	R1 Dia.	R2 Dia.	Weight Lbs (kg)	Knockouts at Inches (mm) N1 (O.D.)
<b>FR4</b>													
230 V	3/4–3	12.9	12.3	11.5	7.5	3.0	5.0	5.04	3.9	0.5	0.3	11.0 (5)	3 at 10.1 (28)
480 V	1–5	(327)	(313)	(292)	(190)	(77)	(126)	(128)	(100)	(13)	(7)		
<b>FR5</b>													
230 V	5–7-1/2	16.5	16.0	15.3	8.4	3.9	5.8	5.7	3.9	0.5	0.3	17.9 (8)	2 at 1.5 (37)
480 V	7-1/2–15	(419)	(406)	(389)	(214)	(100)	(148)	(144)	(100)	(13)	(7)		1 at 10.1 (28)
<b>FR6</b>													
230 V	10–15	22.0	21.3	20.4	9.3	4.2	6.5	7.7	5.8	0.6	0.4	40.8 (19)	3 at 1.5 (37)
480 V	20–30	(558)	(541)	(519)	(237)	(105)	(165)	(195)	(148)	(15.5)	(9)		
575 V	2–25												

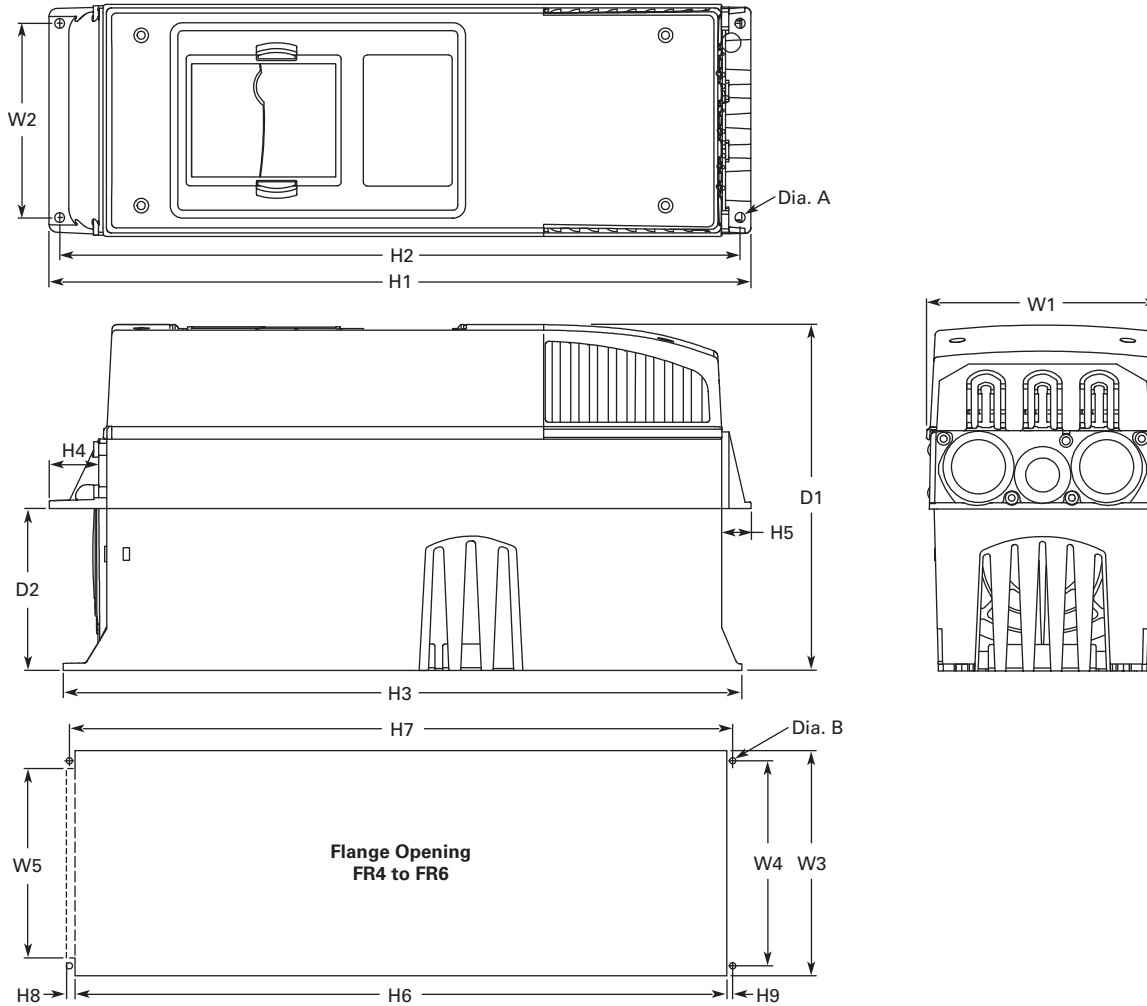
# 2.10 Adjustable Frequency Drives

## SPX Drives

Approximate Dimensions in Inches (mm)

### NEMA Type 1/IP21 and NEMA Type 12/IP54 with Flange Kit, FR4, FR5 and FR6

2



#### FR4, FR5 and FR6 with Flange Kit

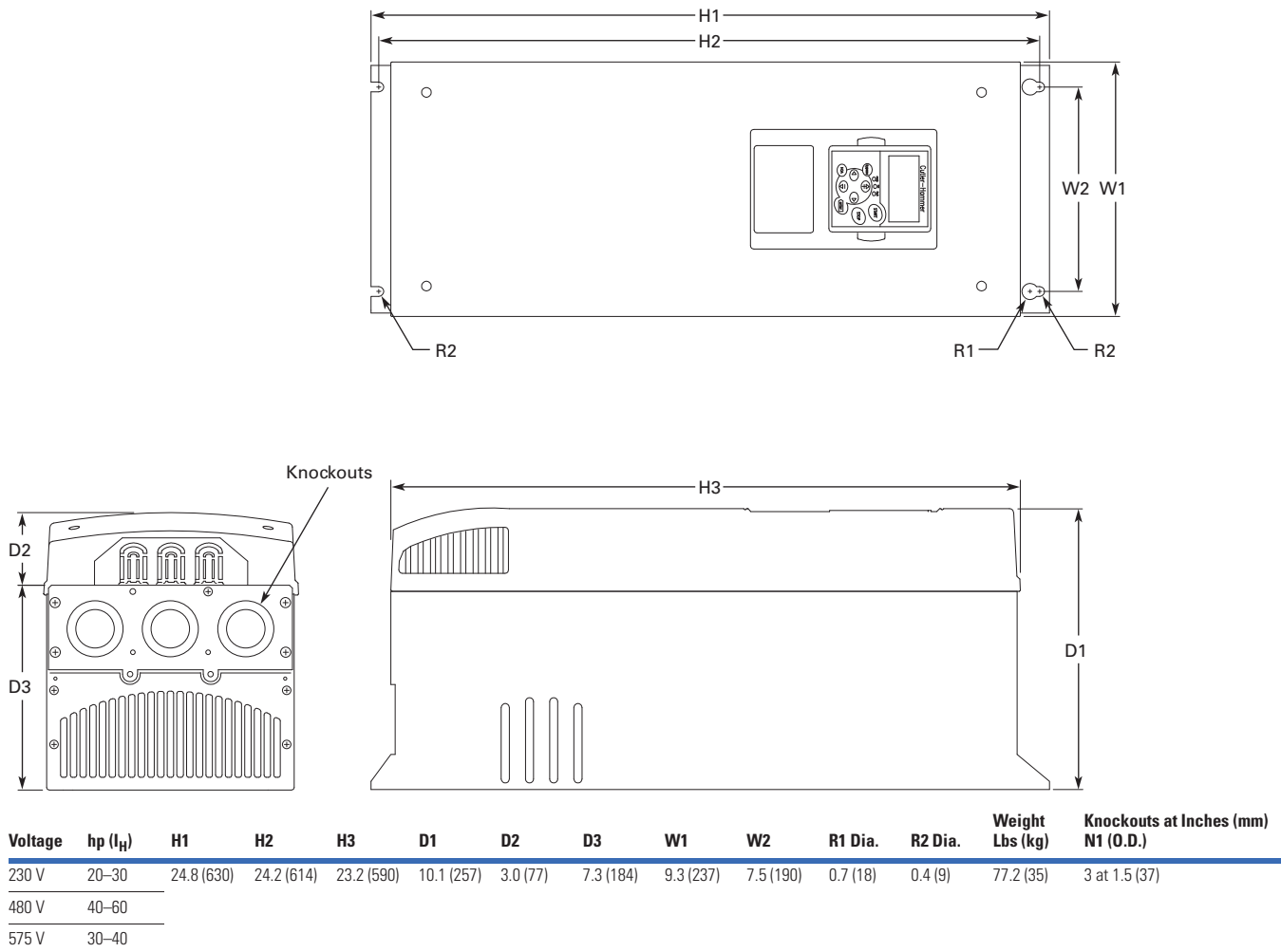
W1	W2	H1	H2	H3	H4	H5	D1	D2	Dia. A
<b>FR4</b>									
5.0 (128)	4.5 (113)	13.3 (337)	12.8 (325)	12.9 (327)	1.2 (30)	0.9 (22)	7.5 (190)	3.0 (77)	0.3 (7)
<b>FR5</b>									
5.6 (143)	4.7 (120)	17.0 (434)	16.5 (420)	16.5 (419)	1.4 (36)	0.7 (18)	8.4 (214)	3.9 (100)	0.3 (7)
<b>FR6</b>									
7.7 (195)	6.7 (170)	22.0 (560)	21.6 (549)	22.0 (558)	1.2 (30)	0.8 (20)	9.3 (237)	4.2 (106)	0.3 (7)

#### Flange Opening, FR4 to FR6

W3	W4	W5	H6	H7	H8	H9	Dia. B
<b>FR4</b>							
4.8 (123)	4.5 (113)	—	12.4 (315)	12.8 (325)	—	0.2 (5)	0.3 (7)
<b>FR5</b>							
5.3 (135)	4.7 (120)	—	16.2 (410)	16.5 (420)	—	0.2 (5)	0.3 (7)
<b>FR6</b>							
7.3 (185)	6.7 (170)	6.2 (157)	21.2 (539)	21.6 (549)	0.3 (7)	0.2 (5)	0.3 (7)

Approximate Dimensions in Inches (mm)

**NEMA Type 1/IP21 and NEMA Type 12/IP54, FR7**





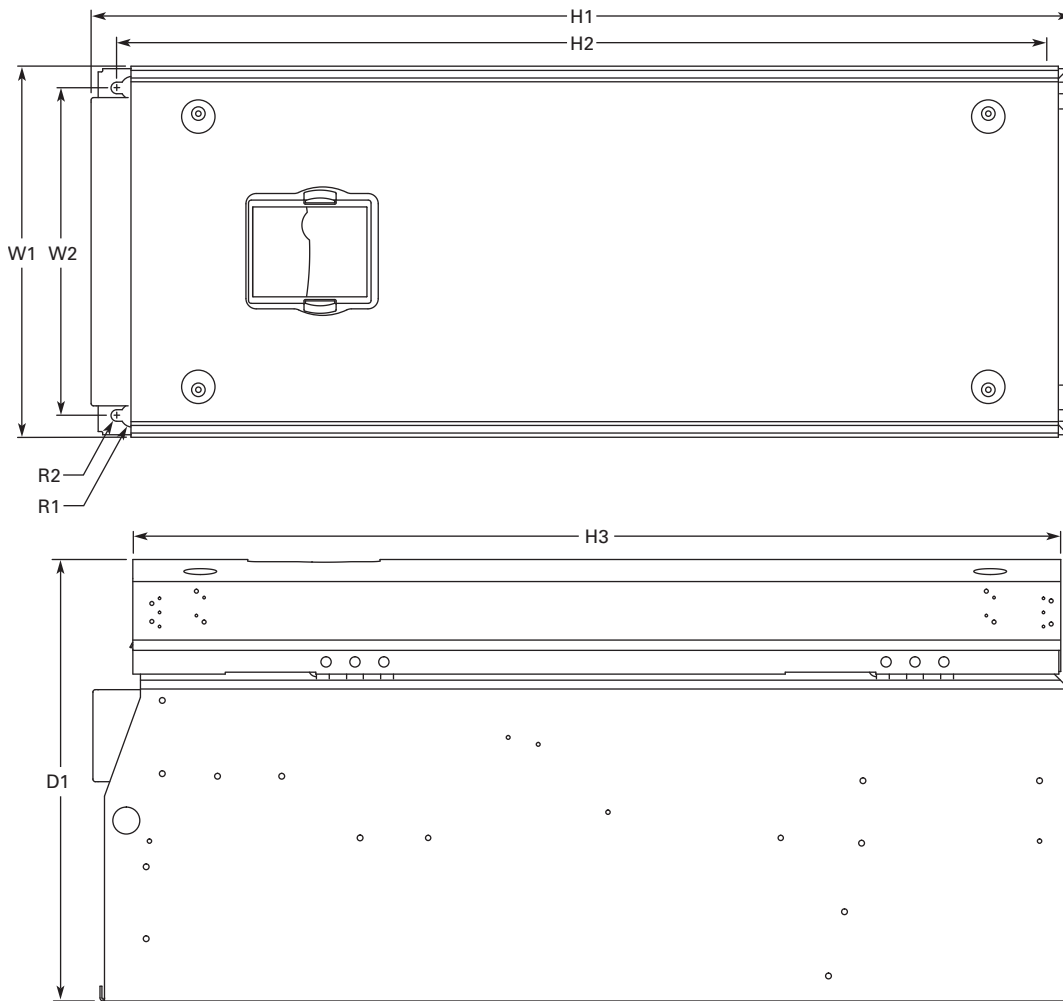
# 2.10 Adjustable Frequency Drives

## SPX Drives

Approximate Dimensions in Inches (mm)

**NEMA Type 1/IP21 and NEMA Type 12/IP54, FR8**

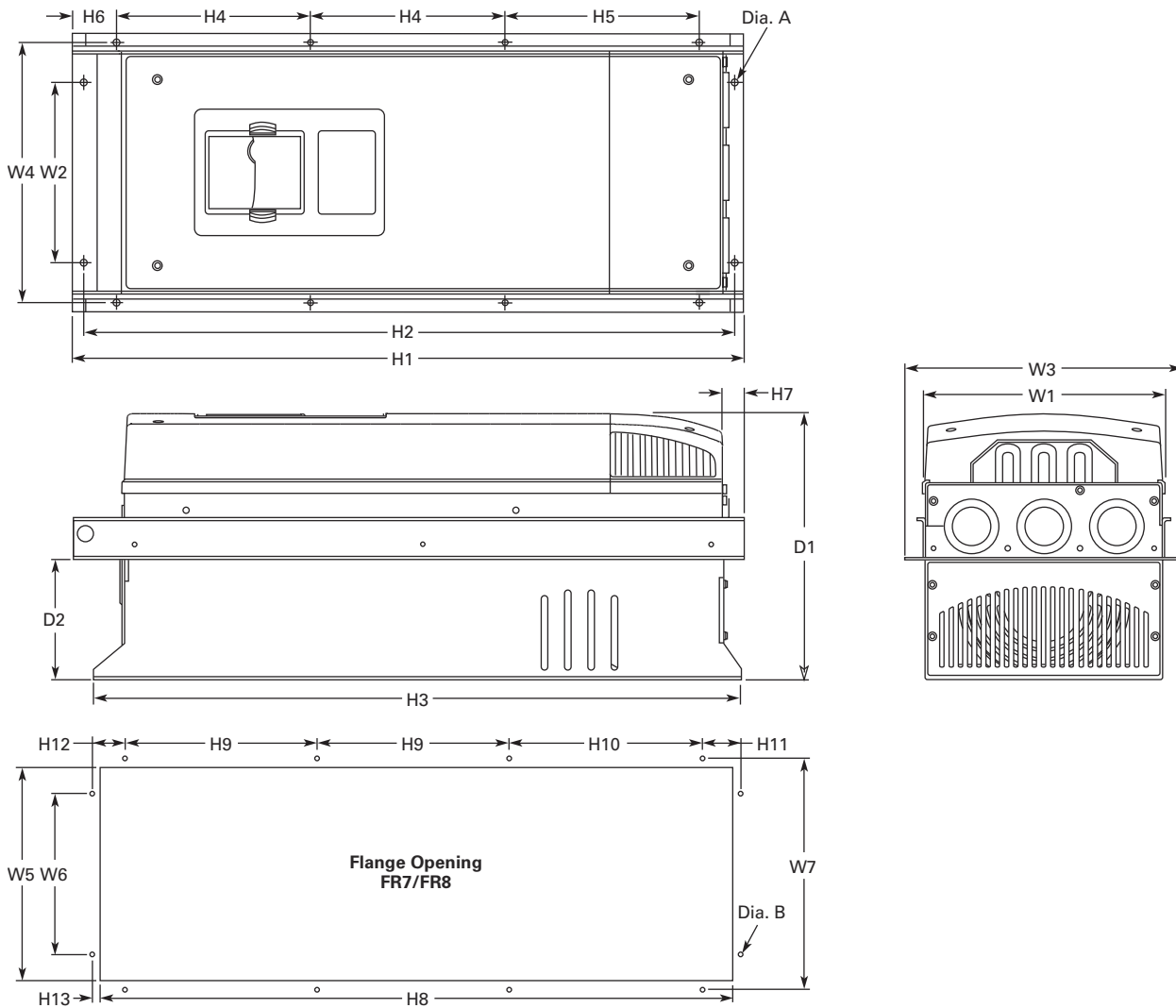
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Voltage	hp (I <sub>H</sub> )	D1	H1	H2	H3	W1	W2	R1 Dia.	R2 Dia.	Weight Lbs (kg)
230 V	40–60	13.5 (344)	30.1 (764)	28.8 (732)	28.4 (721)	11.5 (291)	10 (255)	0.7 (18)	0.4 (9)	127 (58)
480 V	75–125									
575 V	50–75									

Approximate Dimensions in Inches (mm)

**NEMA Type 1/IP21 and NEMA Type 12/IP54, with Flange Kit, FR7 and FR8**



W1	W2	W3	W4	H1	H2	H3	H4	H5	H6	H7	D1	D2	Dia. A
<b>FR7</b>													
9.3 (237)	6.8 (175)	10.6 (270)	10.0 (253)	25.6 (652)	24.9 (632)	24.8 (630)	7.4 (189)	7.4 (189)	0.9 (23)	0.8 (20)	10.1 (257)	4.6 (117)	0.3 (6)
<b>FR8</b>													
11.2 (285)	—	14.0 (355)	13.0 (330)	32.8 (832)	—	29.3 (745)	10.2 (258)	10.4 (265)	1.7 (43)	2.2 (57)	13.5 (344)	4.3 (110)	0.4 (9)

**Flange Opening, FR7 and FR8**

W5	W6	W7	H8	H9	H10	H11	H12	H13	Dia. B
<b>FR7</b>									
9.2 (233)	6.9 (175)	10.0 (253)	24.4 (619)	7.4 (189)	7.4 (189)	1.4 (35)	1.3 (32)	1.0 (25)	0.3 (6)
<b>FR8</b>									
11.9 (301)	—	13.0 (330)	31.9 (810)	10.2 (258)	10.4 (265)	—	—	1.3 (33)	0.4 (9)

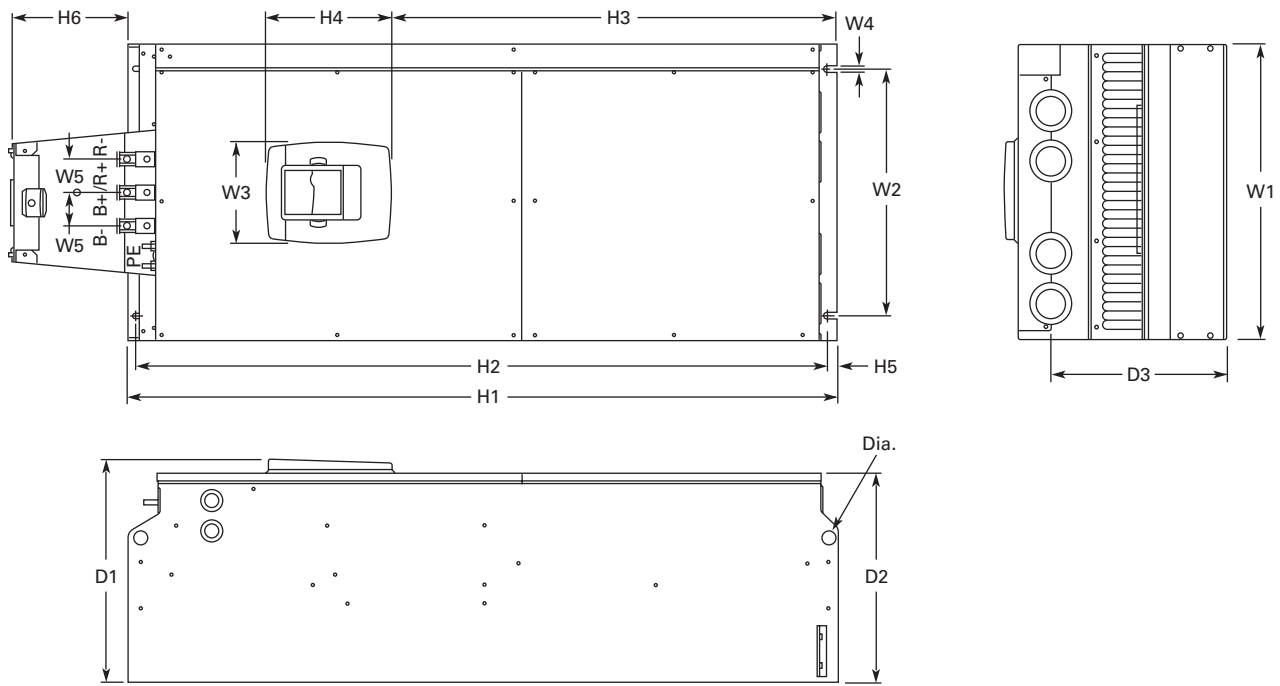
# 2.10 Adjustable Frequency Drives

## SPX Drives

Approximate Dimensions in Inches (mm)

### NEMA Type 1/IP21 and NEMA Type 12/IP54, FR9

2



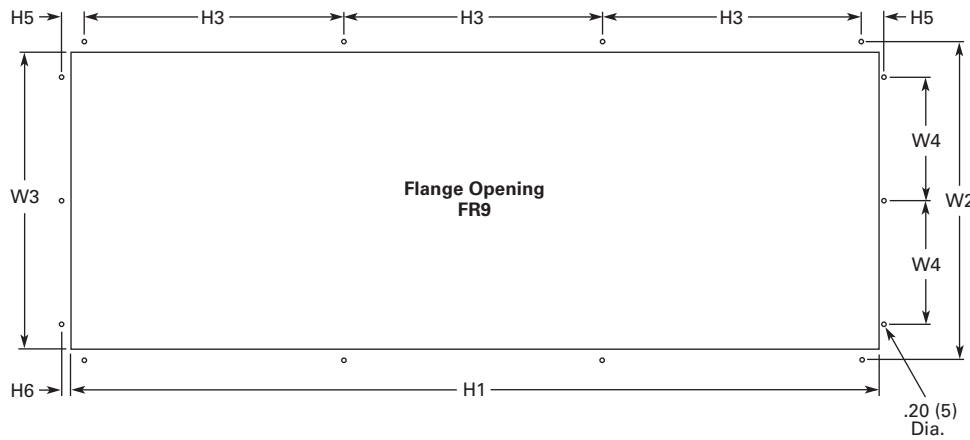
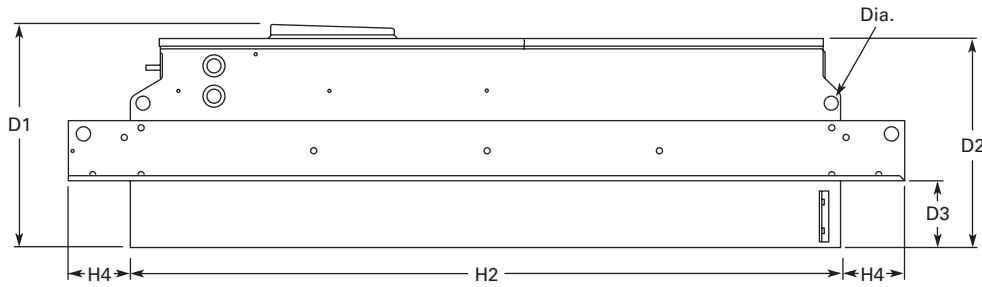
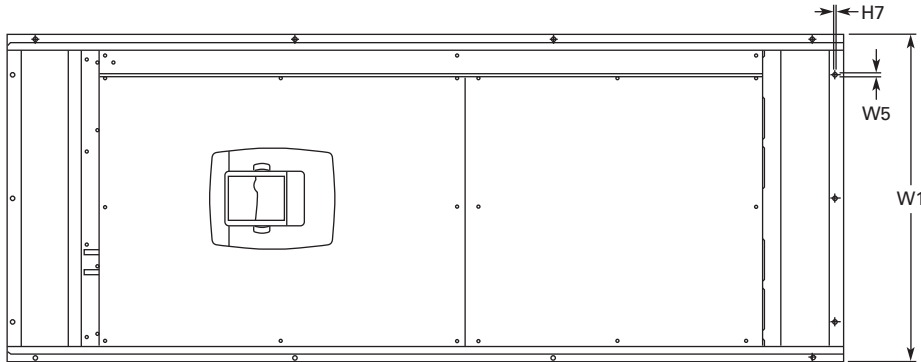
Voltage	hp (I <sub>H</sub> )	W1	W2	W3	W4	H1	H2	H3	H4 ①	D1	D2	D3	Dia.	Weight Lbs (kg)
230 V	75–100	18.9 (480)	15.7 (400)	0.4 (9)	2.1 (54)	45.3 (1150)	44.1 (1120)	0.6 (16)	7.4 (188)	14.2 (361.5)	13.4 (340)	11.2 (285)	0.8 (21)	321.9 (146)
480 V	150–200													
575 V	100–175													

**Note**

① Brake resistor terminal box (H6) included when brake chopper ordered.

Approximate Dimensions in Inches (mm)

**NEMA Type 1/IP21 and NEMA Type 12/IP54, FR9 with Flange Kit**



W1	W2	W3	W4	W5	H1	H2	H3	H4	H5	H6	H7	D1	D2	D3	Dia.
20.9 (530)	20.0 (510)	19.1 (485)	7.9 (200)	0.2 (5.5)	51.7 (1312)	45.3 (1150)	16.5 (420)	3.9 (100)	1.4 (35)	0.4 (9)	0.1 (2)	24.9 (362)	13.4 (340)	4.3 (109)	0.8 (21)

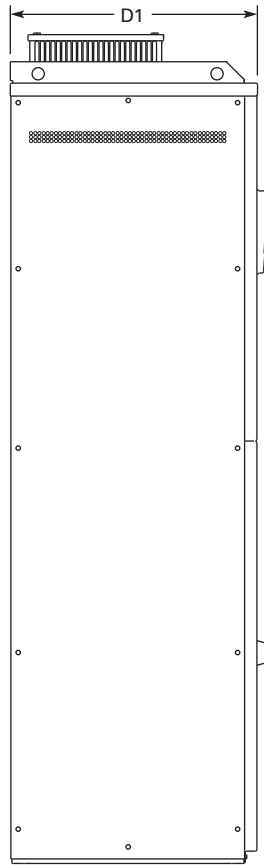
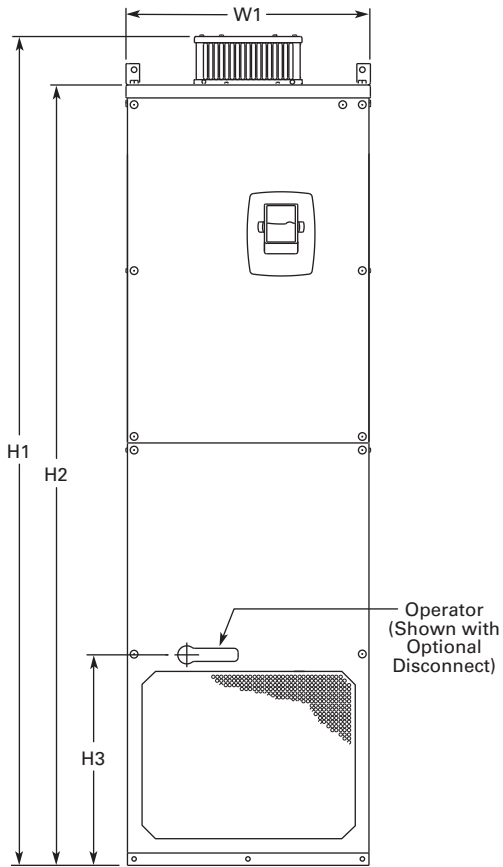
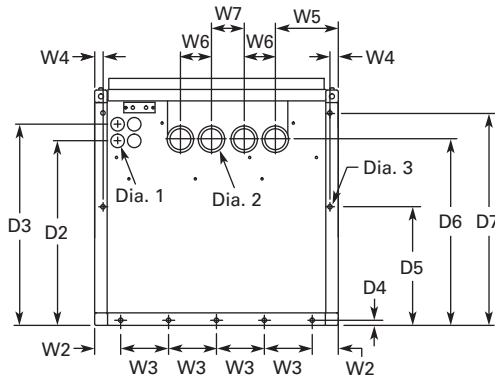
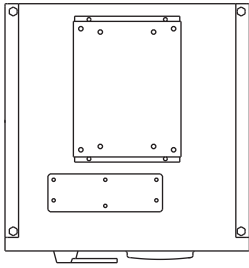
# 2.10 Adjustable Frequency Drives

## SPX Drives

Approximate Dimensions in Inches (mm)

### NEMA Type 1/IP21 and NEMA Type 12/IP54, FR10 Freestanding

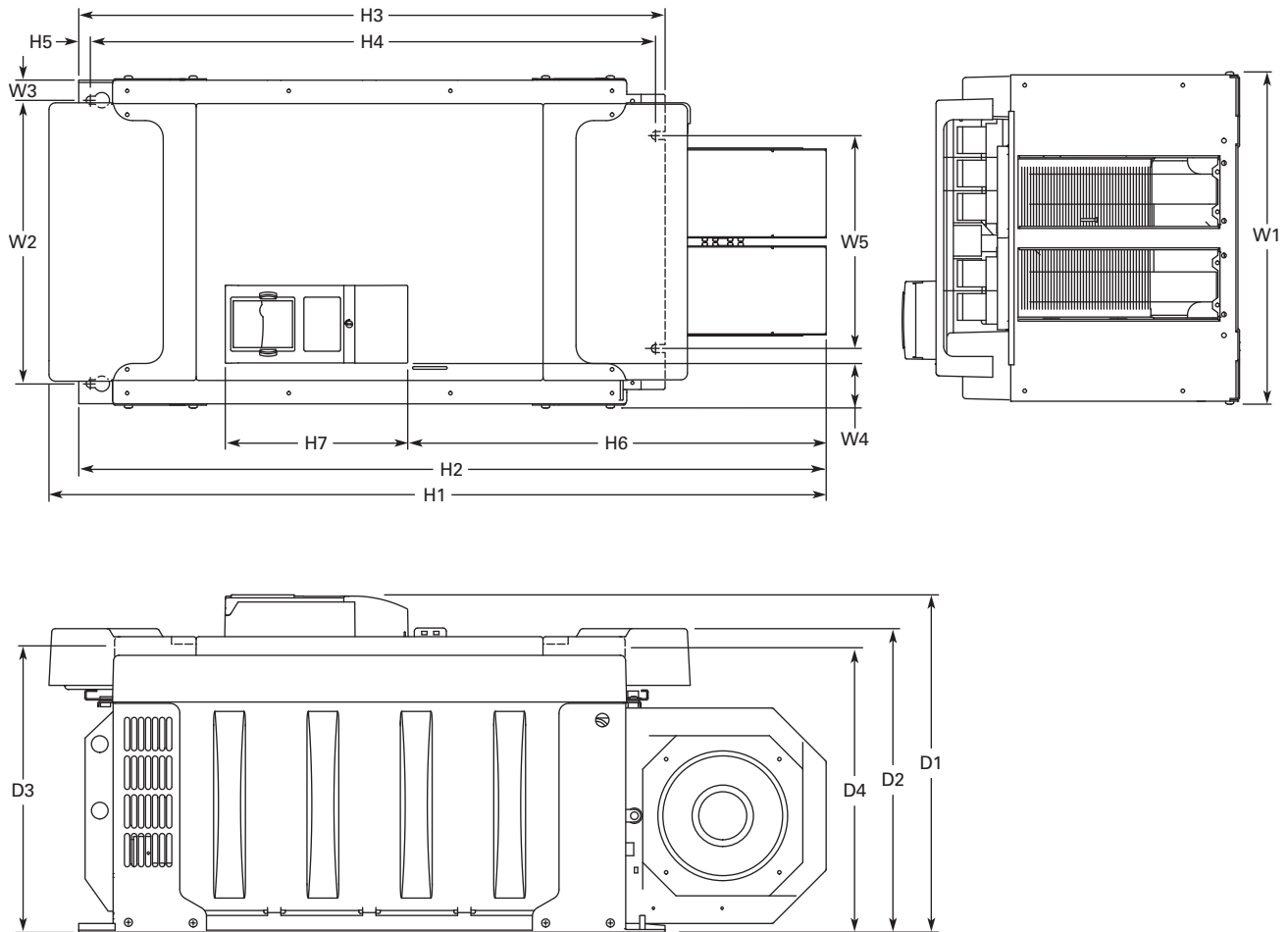
2



Volts	hp (I <sub>H</sub> )	W1	W2	W3	W4	W5	W6	W7	H1	H2	H3	D1	D2	D3	D4	D5	D6	D7	Dia. 1	Dia. 2	Dia. 3	Weight Lbs (kg)
480 V	250–350	23.43	2.46	4.53	0.79	5.95	2.95	30.11	79.45	74.80	20.18	23.70	17.44	19.02	0.47	11.22	17.60	20.08	0.83	1.89	0.43	875 (389)
690 V	200–300	(595)	(62.5)	(115)	(20)	(151)	(75)	(79)	(2018)	(1900)	(512.5)	(602)	(443)	(483)	(12)	(285)	(447)	(510)	(21)	(48)	(11)	

Approximate Dimensions in Inches (mm)

**FR10 Open Chassis** ①



Voltage	hp (I <sub>H</sub> )	W1	W2	W3	W4	W5	H1	H2	H3	H4	H5	H6	H7	D1	D2	D3	D4	Weight Lbs (kg)
480 V	250–350	19.7	16.7	1.2	2.6	12.8	45.9	44.1	34.6	33.5	0.7	24.7	10.8	19.9	17.9	16.7	16.6	518
575 V	200–300	(500)	(425)	(30)	(67)	(325)	(1165)	(1121)	(879)	(850)	(17)	(627)	(275)	(506)	(455)	(423)	(421)	(235)

**Note**

① SPXX FR12 is built of two FR10 modules. Please refer to SPX installation manual for mounting instructions.

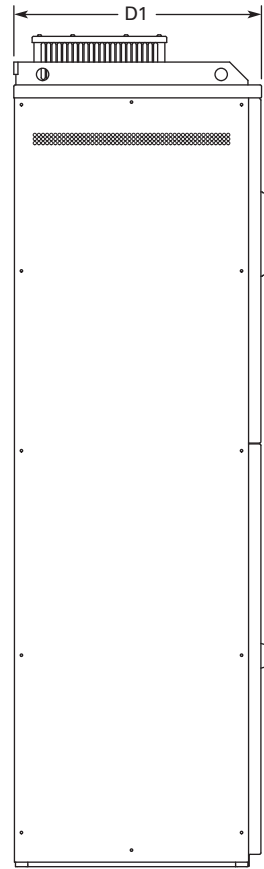
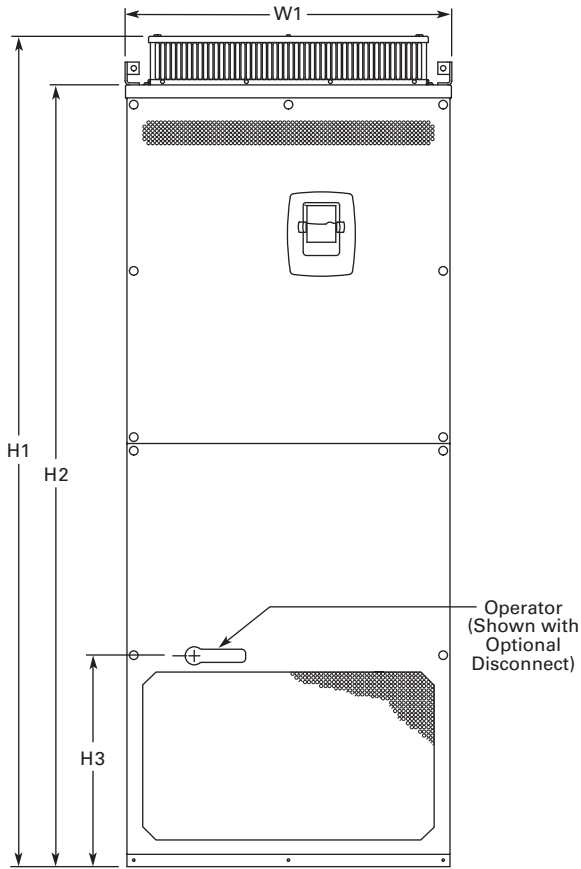
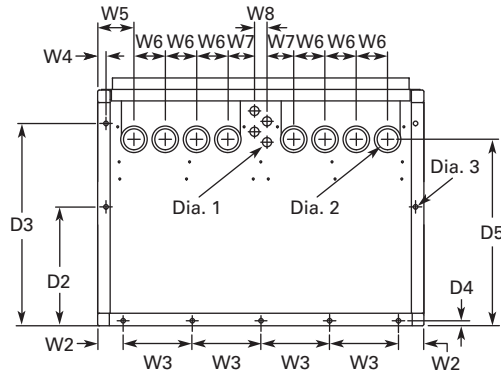
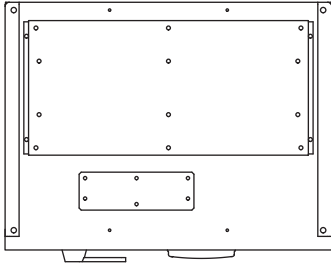
# 2.10 Adjustable Frequency Drives

## SPX Drives

Approximate Dimensions in Inches (mm)

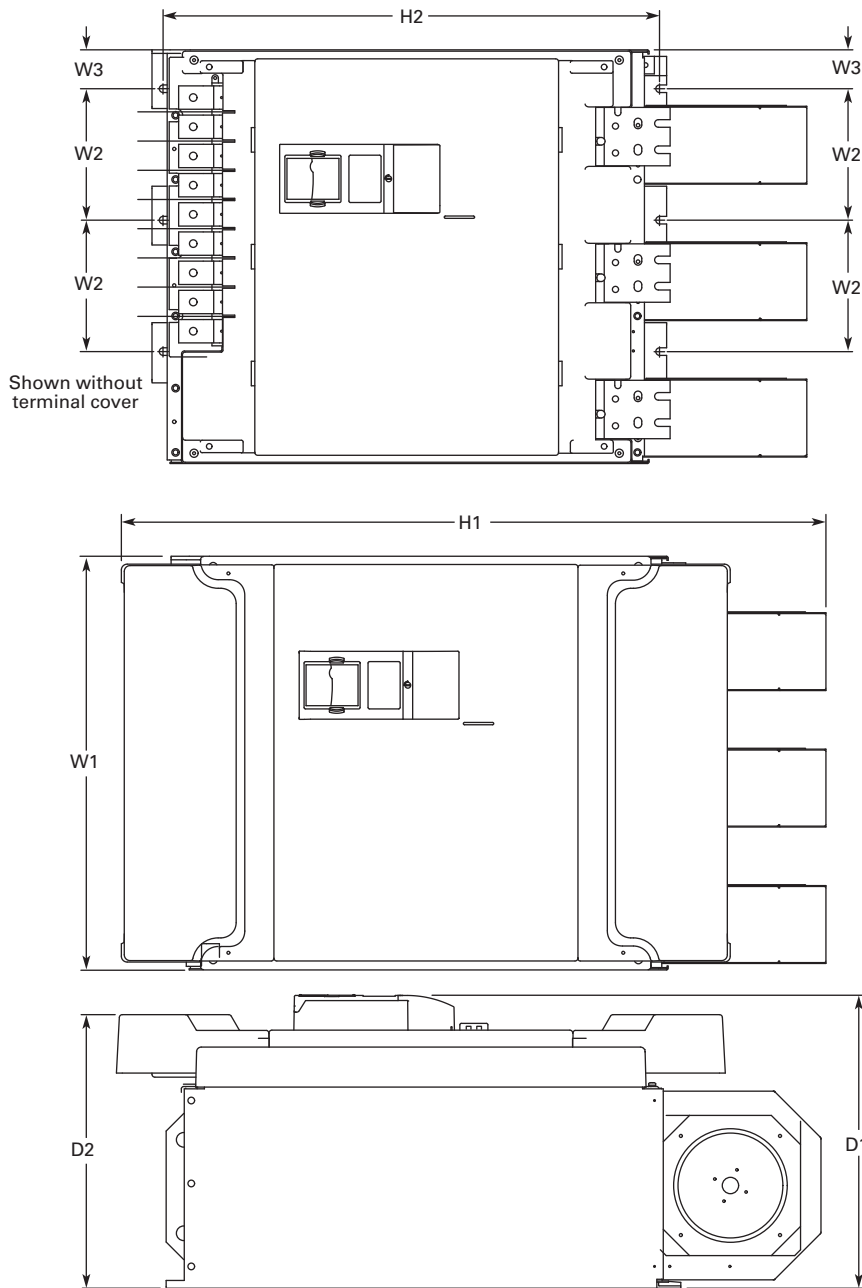
### NEMA Type 1/IP21, FR11 Freestanding Drive

2



Voltage	hp (I <sub>H</sub> )	W1	W2	W3	W4	W5	W6	W7	W8	H1	H2	H3	D1	D2	D3	D4	D5	Dia. 1	Dia. 2	Dia. 3	Weight Lbs (kg)
480 V	400–550	31.26 (794)	2.40 (61)	6.50 (165)	0.79 (20)	3.43 (87)	2.95 (75)	2.52 (64)	1.18 (30)	79.45 (2018)	74.80 (1900)	20.18 (512.5)	23.70 (602)	11.22 (285)	19.09 (485)	0.47 (12)	17.60 (447)	0.83 (21)	1.89 (48)	0.35 x 0.43 (9 x 11)	526 (239)
690 V	400–500																				

Approximate Dimensions in Inches (mm)

**FR11 Open Chassis**

Voltage	hp (I <sub>H</sub> )	W1	W2	W3	H1	H2	D1	D2	Weight Lbs (kg)
480 V	400-550	27.9 (709)	8.6 (225)	2.6 (67)	45.5 (1155)	33.5 (850)	19.8 (503)	18.4 (468)	833 (378)
575 V	400-500								



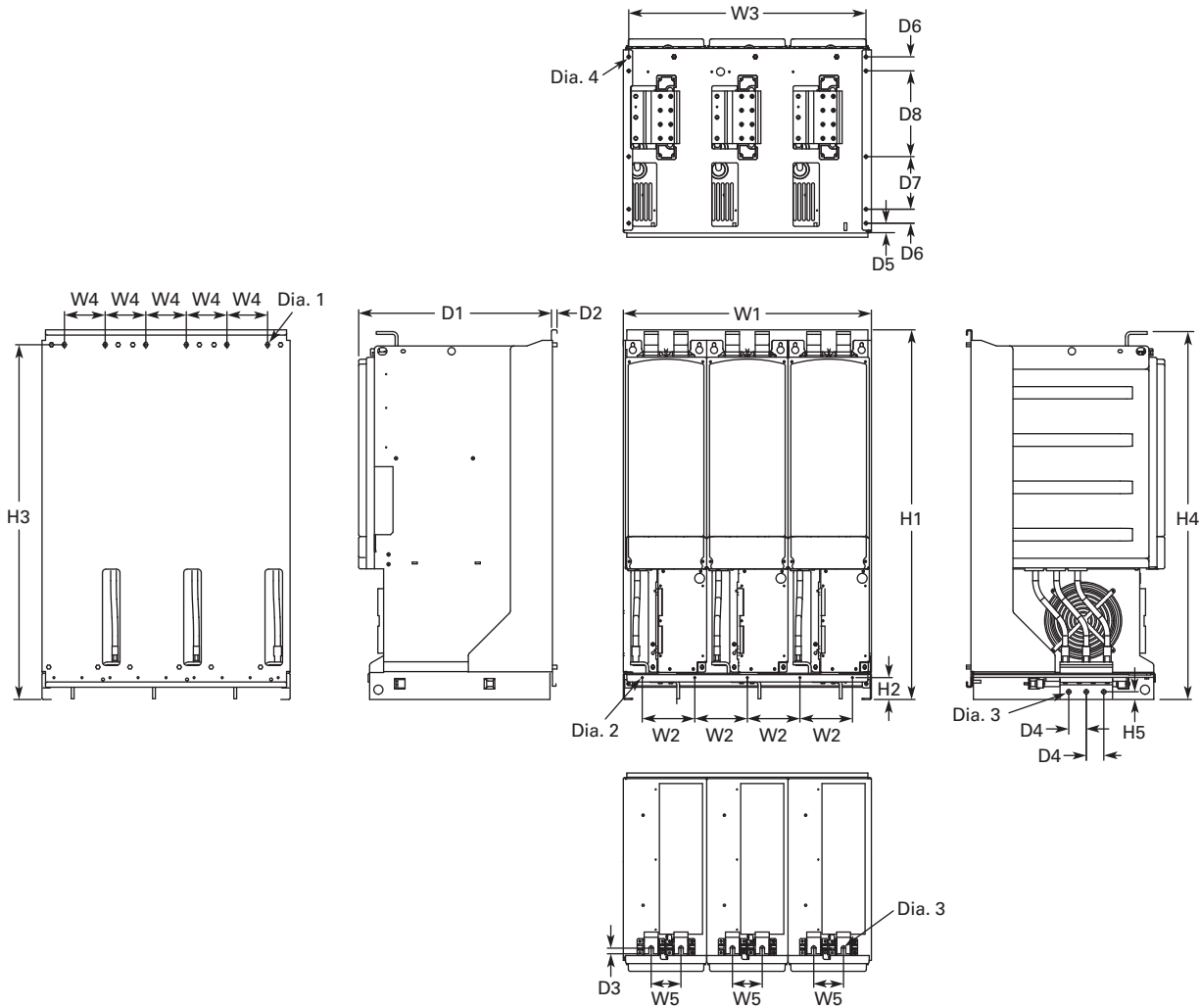
# 2.10 Adjustable Frequency Drives

## SPX Drives

Approximate Dimensions in Inches (mm)

### FR13, Open Chassis Inverter

2



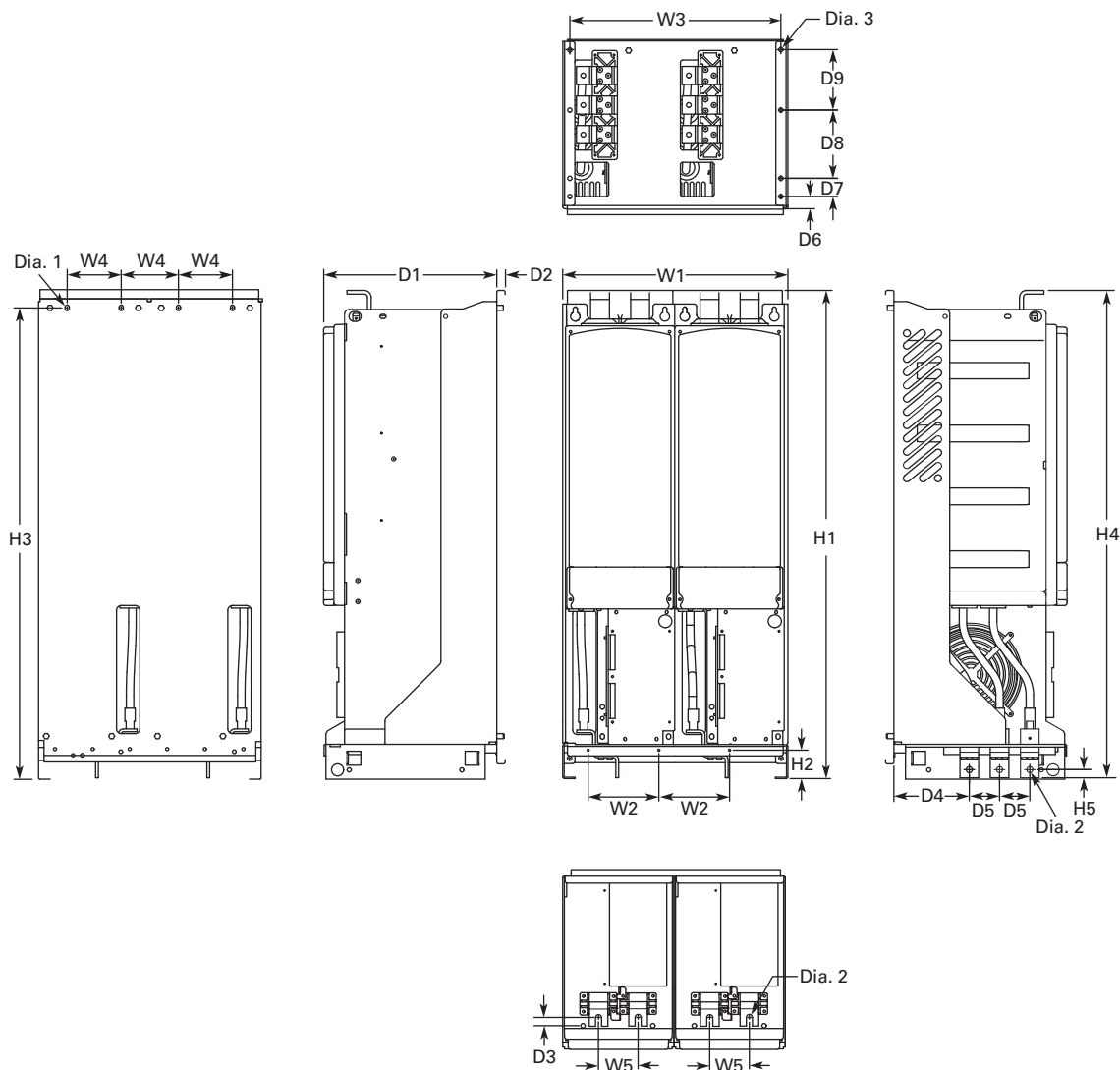
W1	W2	W3	W4	W5	H1	H2	H3	H4	H5	D1	D2	D3	D4	D5	D6	D7	D8	Dia. 1	Dia. 2	Dia. 3	Dia. 4	Weight Lbs (kg)
27.87 (708)	5.91 (150)	26.65 (677)	4.57 (116)	3.35 (85)	41.54 (1055)	2.46 (62.5)	39.86 (1012.5)	41.34 (1050)	0.79 (20)	21.77 (553)	0.51 (13)	0.63 (16)	1.97 (50)	1.06 (27)	1.57 (40)	5.91 (150)	9.64 (244.8)	0.35x0.59 (9x15)	0.18 (4.6)	0.51 (13)	0.37 (9.5)	683 (310)

#### Notes

9000X FR14 is built of two FR13 modules. Please refer to SPX installation manual for mounting instructions.

FR13 is built from an inverter module and a converter module. Please refer to SPX installation manual for mounting instructions.

Approximate Dimensions in Inches (mm)

**FR13, Open Chassis Converter**

W1	W2	W3	W4	W5	H1	H2	H3	H4	H5	D1	D2	D3	D4	D5	D6	D7	D8	D9	Dia. 1	Dia. 2	Dia. 3	Weight Lbs (kg)
18.74 (476)	5.91 (150)	17.52 (445)	4.57 (116)	3.35 (85)	41.54 (1055)	2.46 (62.5)	39.86 (1012.5)	41.34 (1050)	0.69 (17.5)	14.69 (373)	0.51 (13)	0.73 (18.5)	6.42 (163)	2.56 (65)	1.06 (27)	1.57 (40)	5.91 (150)	5.24 (133)	0.35x0.59 (9x15)	0.51 (13)	0.37 (9.5)	295 (134)

**Number of Input Units**

480 V			690 V		
Catalog Number	hp	Input Modules	Catalog Number	hp	Input Modules
SPX800 A0-4 A2N1	800	2	SPX800 A0-5 A2N1	800	2
			SPX900 A0-5 A2N1	900	2
			SPXH10 A0-5 A2N1	1000	2

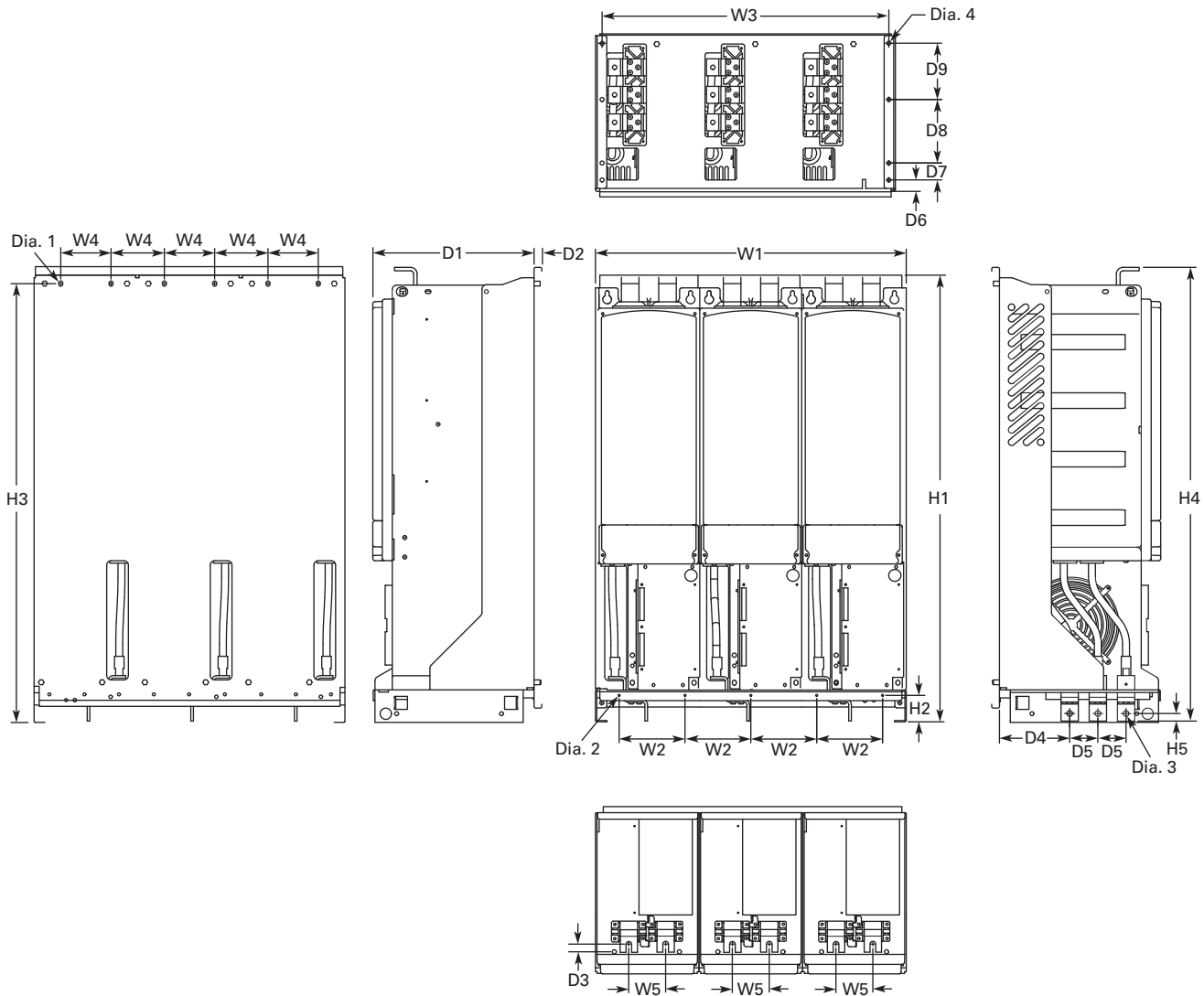
# 2.10 Adjustable Frequency Drives

## SPX Drives

Approximate Dimensions in Inches (mm)

### FR13, Open Chassis Converter—900/1000 hp 480 V

2



W1	W2	W3	W4	W5	H1	H2	H3	H4	H5	D1	D2	D3	D4	D5	D6	D7	D8	D9	Dia. 1	Dia. 2	Dia. 3	Dia. 4	Weight Lbs (kg)
27.87 (708)	5.91 (150)	26.65 (677)	4.57 (116)	3.35 (85)	41.54 (1055)	2.46 (62.5)	39.86 (1012.5)	41.34 (1050)	0.69 (17.5)	14.69 (373)	0.51 (13)	0.73 (18.5)	6.42 (163)	2.56 (65)	1.06 (27)	1.57 (40)	5.91 (150)	5.24 (133)	0.35x0.59 (9x15)	0.18 (4.6)	0.51 (13)	0.37 (9.5)	443 (201)

#### Number of Input Units

480 V Catalog Number	hp	Input Modules
SPX900 A0-4 A2N1	900	3
SPXH10 A0-4 A2N1	1000	3

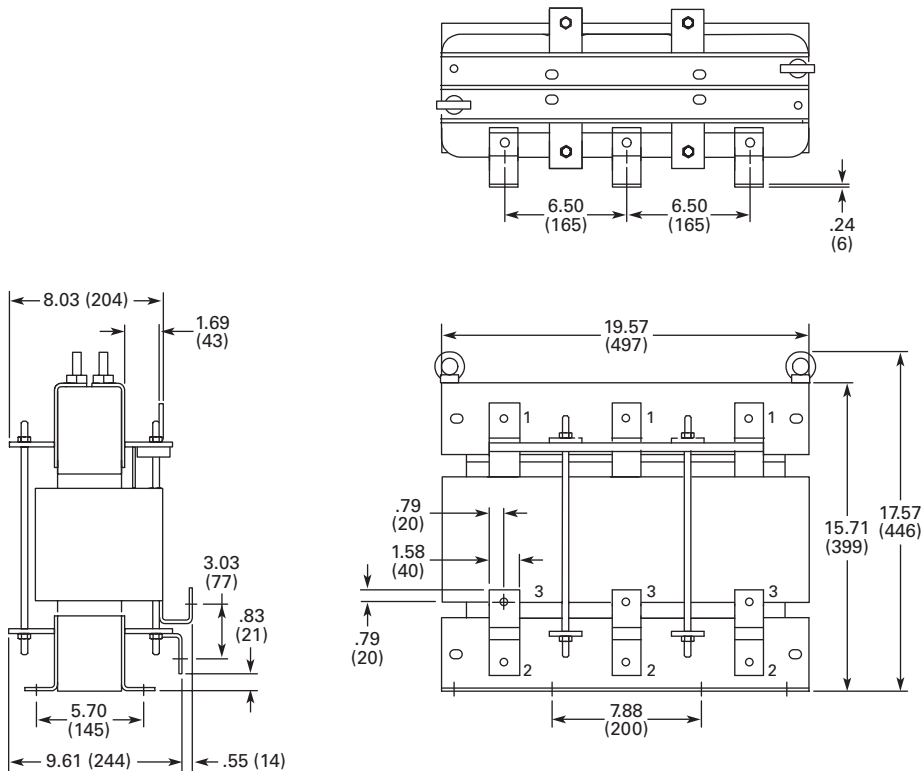
Approximate Dimensions in Inches (mm)

### AC Choke Dimensions

#### Choke Types

Catalog Number	Frame Size	Choke Type ①	Catalog Number	Frame Size	Choke Type ①
<b>Voltage Range 380–500 V</b>			<b>Voltage Range 525–690 V</b>		
SPX 250 4	FR10	CHK0400	SPX 200 5	FR10	CHK0261
SPX 300 4		CHK0520	SPX 250 5		CHK0400
SPX 350 4		CHK0520	SPX 300 5		CHK0400
SPX 400 4	FR11	2 x CHK0400	SPX 400 5	FR11	CHK0520
SPX 500 4		2 x CHK0400	SPX 450 5		CHK0520
SPX 550 4		2 x CHK0400	SPX 500 5		2 x CHK0400
SPX 600 4	FR12	2 x CHK0520	SPX 550 5	FR12	2 x CHK0400
SPX 650 4		2 x CHK0520	SPX 600 5		2 x CHK0400
SPX 700 4		2 x CHK0520	SPX 700 5		2 x CHK0400
SPX 800 4	FR13	2 x CHK0400	SPX 800 5	FR13	2 x CHK0400
SPX 900 4		3 x CHK0520	SPX 900 5		2 x CHK0400
SPX H10 4		3 x CHK0520	SPX H10 5		2 x CHK0400
SPX H12 4	FR14	4 x CHK0520	SPX H13 5	FR14	4 x CHK0400
SPX H16 4		6 x CHK0400	SPX H15 5		6 x CHK0400

#### CHK0520



#### Note

① Chokes are provided with all FR10–FR14 drives.

# 2.10

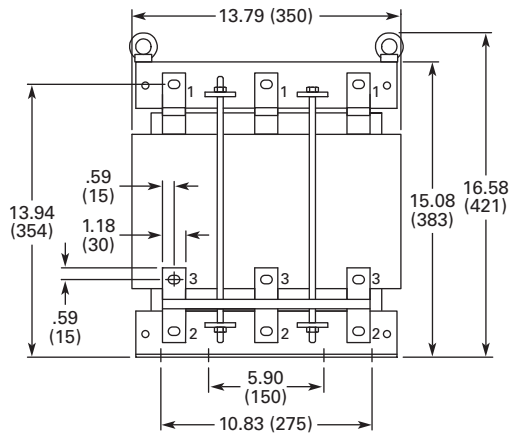
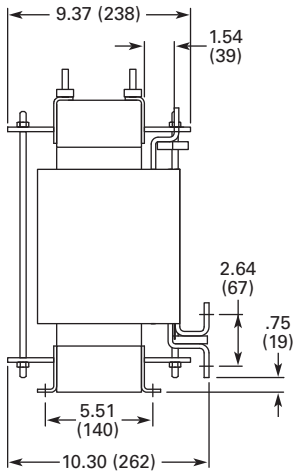
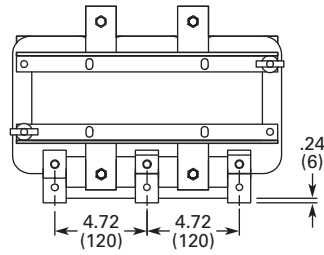
## Adjustable Frequency Drives

### SPX Drives

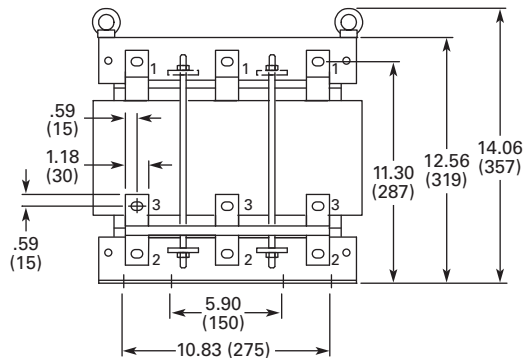
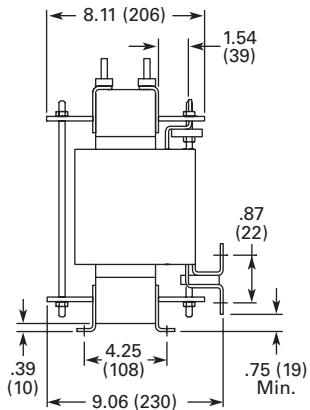
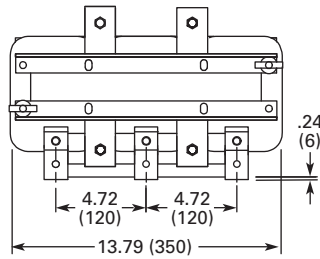
Approximate Dimensions in Inches (mm)

#### CHK0400

2



#### CHK0261



## Clean Power Drives



## Contents

**Description****Page**

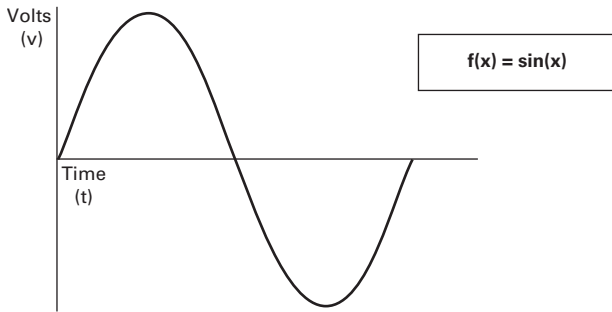
Clean Power Drives Overview .....	<b>V6-T2-298</b>
Enclosed Passive Filtered Drives	
EGF Enclosed Drives .....	<b>V6-T2-305</b>
CFX Enclosed Drives .....	<b>V6-T2-325</b>
HCX Enclosed 12-Pulse Drives .....	<b>V6-T2-351</b>
CPX Enclosed 18-Pulse Drives .....	<b>V6-T2-355</b>
RGX Enclosed Regenerative Drives .....	<b>V6-T2-379</b>

## Clean Power Drives Overview

### What Are Harmonics?

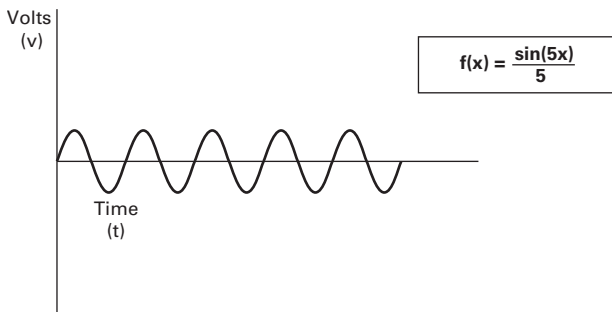
Take a perfect wave with a fundamental frequency of 60 Hz, which is close to what is supplied by the power company.

#### Perfect Wave



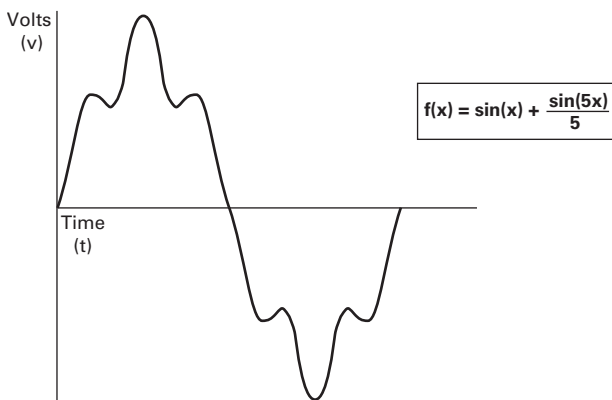
Add a second wave that is five times the fundamental frequency—300 Hz (typical of frequency added to the line by a fluorescent light).

#### Second Wave



Combine the two waves. The result is a 60 Hz supply rich in fifth harmonics.

#### Resulting Supply



### What Causes Harmonics?

Harmonics are the result of nonlinear loads that convert AC line voltage to DC. Examples of equipment that are non-linear loads are listed below:

- AC variable frequency drives
- DC drives
- Fluorescence lighting, computers, UPS systems
- Industrial washing machines, punch presses, welders, etc.

### How Can Harmonics Due to VFDs Be Diminished?

By applying drives from the Eaton Clean Power drives family: EGF and CFX passive filtered drives, HCX 12-pulse drives, EGP and CPX 18-pulse drives, and RGX regenerative drives.

### What Are Linear Loads?

Linear loads are primarily devices that run across the line and do not add harmonics. Motors are prime examples. The downside to having large motor linear loads is that they draw more energy than a VFD, because of their inability to control motor speed. In most applications there is a turn down valve used with the motor which will reduce the flow of the material, without significantly reducing the load to the motor. While this provides some measure of speed control, it is extremely inefficient.

### Why Be Concerned About Harmonics?

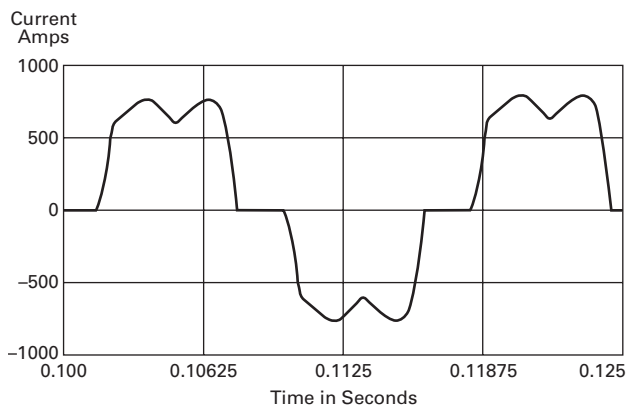
1. **Installation and utility costs increase.** Harmonics cause damage to transformers and lower efficiencies due to the voltage drop. These losses can become significant (from 16.6–21.6%) which can have a dramatic effect on the HVAC systems that are controlling the temperatures of the building where the transformer and drive equipment reside.
2. **Downtime and loss of productivity.** Telephones and data transmissions links may not be guaranteed to work on the same power grids polluted with harmonics.
3. **Downtime and nuisance trips of drives and other equipment.** Emergency generators have up to three times the impedance that is found in a conventional utility source. Thus the harmonic voltage can be up to three times as large, causing risk of operation problems.
4. **Larger motors must be used.** Motors running across the line that are connected on polluted power distribution grids can overheat or operate at lower efficiency due to harmonics.
5. **Higher installation costs.** Transformers and power equipment must be oversized to accommodate the loss of efficiencies. This is due to the harmonic currents circulating through the distribution without performing useful work.

### How Does a VFD Convert Three-Phase AC to a Variable Output Voltage and Frequency?

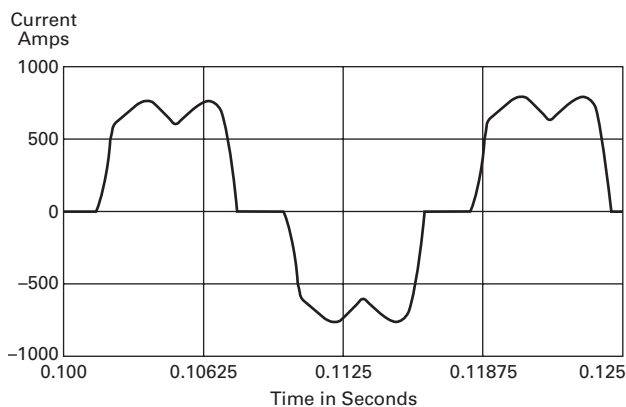
The six-pulse VFD: The majority of all conventional drives that are built consist of a six-pulse configuration. The figure below represents a six-diode rectifier design that converts three-phase utility power to DC. The inverter section uses IGBTs to convert DC power to a simulated AC sine wave that can vary in frequency from 0–400 Hz.

The six-pulse VFD drive creates harmonic current distortion. The harmonic current that is created is energy that can not be used by customers and causes external heat and losses to all components including other drives that are on the same power distribution. The figure is a 100 hp drive with 45 A of damaging harmonic current.

#### 100 hp Six-Diode Rectifier Design



#### 100 hp Six-Pulse Nonproductive Harmonic Current



#### Six-Pulse Nonproductive Harmonic Current

##### Six-Pulse Circuit

Current harmonics

$I_1 = 100\%$	$I_{11} = 6.10\%$	$I_{19} = 1.77\%$
$I_5 = 22.5\%$	$I_{13} = 4.06\%$	$I_{23} = 1.12\%$
$I_7 = 9.38\%$	$I_{17} = 2.26\%$	$I_{25} = 0.86\%$

Power = 100 hp

Harmonic current = 45 amps

### Guidelines of Meeting IEEE Std. 519-2014 Harmonic Distortion Limits

The IEEE 519-2014 Specification is a standard that provides guidelines for commercial and industrial

users that are implementing medium and low voltage equipment.

#### Current Distortion Limits for Systems Rated 120 V through 69 kV

##### Maximum Harmonic Current Distortion in percent of $I_L$

##### Individual Harmonic Order (Odd Harmonics) <sup>①②</sup>

$I_{sc}/I_L$	$3 \leq h < 11$	$11 \leq h < 17$	$17 \leq h < 23$	$23 \leq h < 35$	$35 \leq h \leq 50$	TDD
$< 20$ <sup>③</sup>	4.0	2.0	1.5	0.6	0.3	5.0
$20 < 50$	7.0	3.5	2.5	1.0	0.5	8.0
$50 < 100$	10.0	4.5	4.0	1.5	0.7	12.0
$100 < 1000$	12.0	5.5	5.0	2.0	1.0	15.0
$> 1000$	15.0	7.0	6.0	2.5	1.4	20.0

##### Notes

- ① Even harmonics are limited to 25% of the odd harmonic limits shown in table above.
- ② Current distortions that result in a DC offset, e.g., half-wave converters, are not allowed.
- ③ All power generation equipment is limited to these values of current distortion, regardless of actual  $I_{sc}/I_L$ .

where

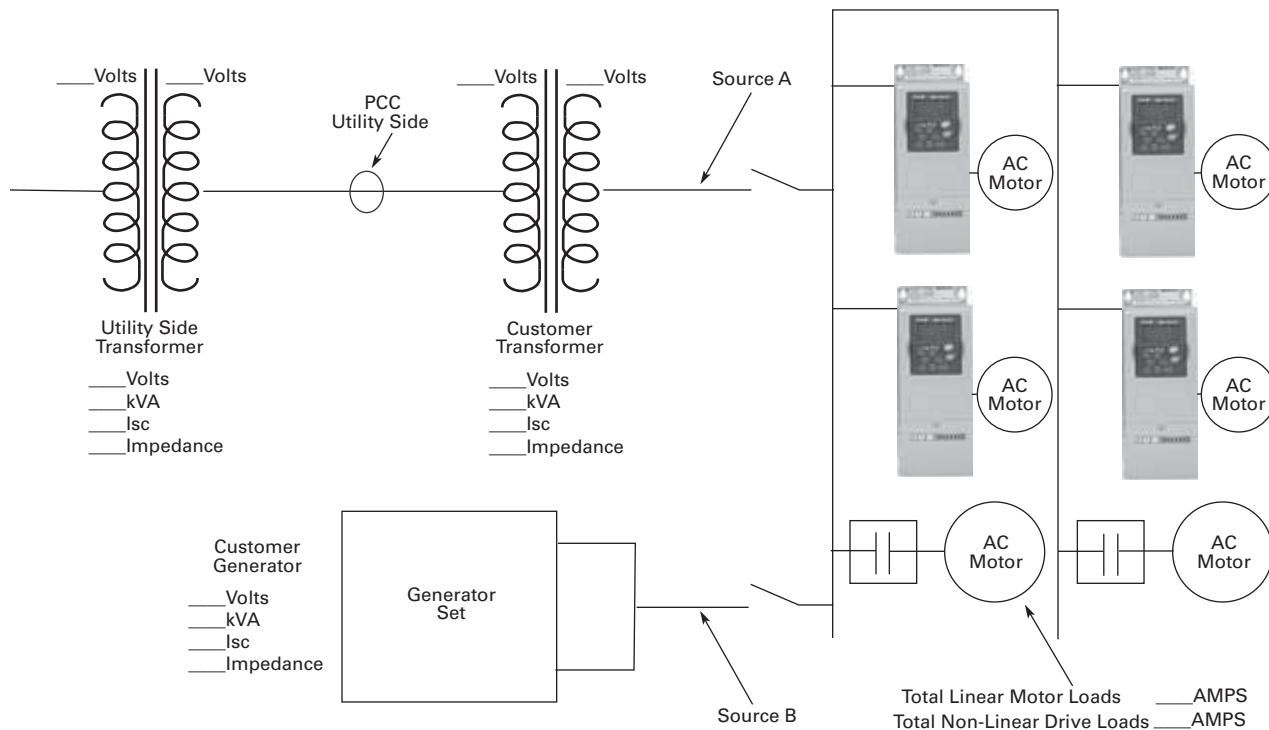
$I_{sc}$  = maximum short-circuit current at PCC.

$I_L$  = maximum demand load current (fundamental frequency component) at the PCC under normal load operating conditions.



#### One-Line Diagram for Harmonic Analysis

2



**The best way to estimate AFD harmonic contribution to an electrical system is to perform a harmonic analysis based on known system characteristics. The one line in this figure would provide the data to complete the calculations.**

#### Terms

- PCC (Point of Common Coupling) is defined as the electrical connecting point between the utility and multiple customers per the specifications in IEEE 519
- POA (Point of Analysis) is defined as where the harmonic calculations are taken

An oscilloscope can make all measurements at the PCC or POA to do an on-site harmonic evaluation.

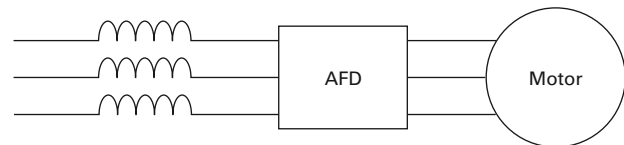
#### Harmonic Reduction Methods to Meet IEEE 519

##### 1. Line Reactor

A line reactor is a three-phase series inductance on the line side of an AFD. If a line reactor is applied on all AFDs, it is possible to meet IEEE guidelines where 10–25% of system loads are AFDs, depending on the stiffness of the line and the value of line reactance. Line reactors are available in various values of percent impedance, most typically 1–1.5%, 3% and 5%.

**Note:** The SVX/SPX drives come standard with a nominal 3% input impedance.

#### Line Reactor



#### Advantages

- Low cost
- Can provide moderate reduction in voltage and current harmonics
- Available in various values of percent impedance
- Provides increased input protection for AFD and its semiconductors from line transients

#### Disadvantages

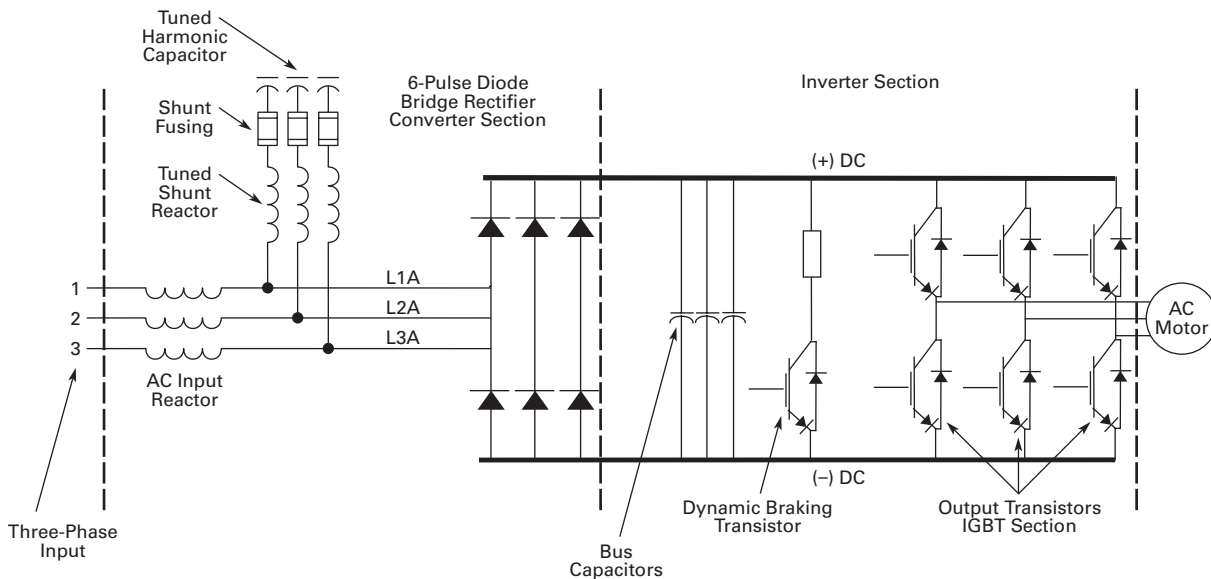
- May not reduce harmonic levels to below IEEE 519-2014 guidelines
- Voltage drop due to IR loss

## 2. Passive Filters

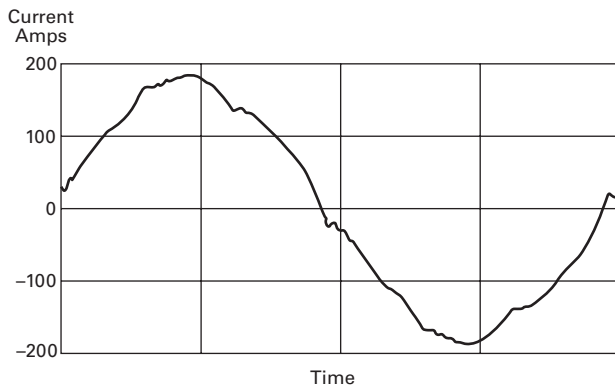
Tuned harmonic filters involve the series connection of an inductor with the shunt connection of an inductor and capacitor to form a low impedance path to ground for

a specific range of frequencies. This path presents an alternative to the flow of harmonic currents back into the utility source.

### Enclosed Drive with Integrated Passive Filter



### 100 hp Enclosed 480 V Drive with Integrated Passive Filter



### 100 hp Enclosed 480 V Drive with Integrated Passive Filter

#### Passive Filter

##### Current harmonics

$I_1 = 100\%$	$I_{11} = 0.24\%$	$I_{19} = 0.50\%$
$I_5 = 3.76\%$	$I_{13} = 1.1\%$	$I_{23} = 0.55\%$
$I_7 = 1.65\%$	$I_{17} = 0.80\%$	$I_{25} = 0.80\%$

Power = 100 hp

$H_c = 8.6$  Amps

#### Advantages

- Low cost for smaller horsepower applications
- More effective harmonic attenuation than 12-pulse drives
- Provides increased input protection for AFD from line transients

#### Disadvantages

- Capacitors age over time, unlike magnetics
- Not as effective as 18-pulse drives
- Challenging to retrofit with bypass applications

# 2.11

## Adjustable Frequency Drives

### Clean Power Drives

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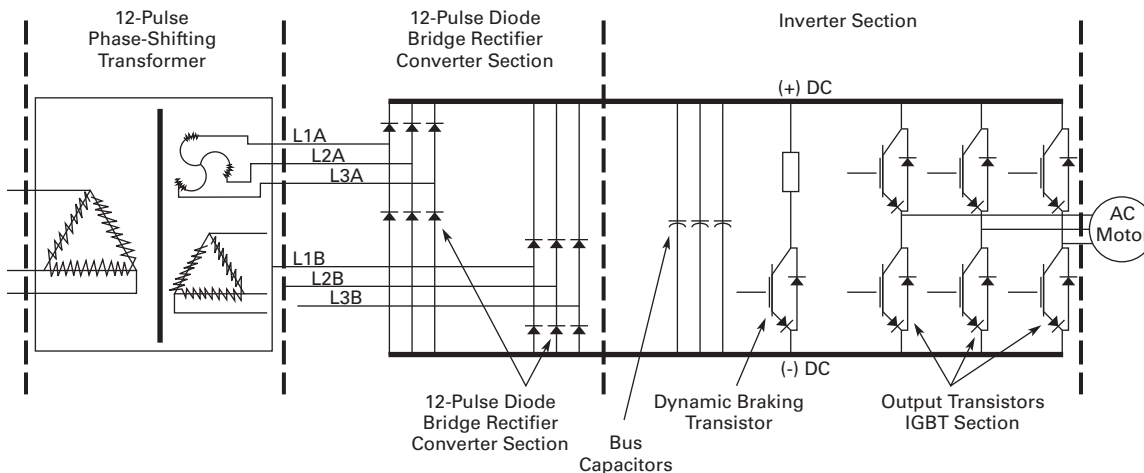
#### 3. 12-Pulse Converters

A 12-pulse converter incorporates two separate AFD input semiconductor bridges, which are fed from 30° phase shifted power sources with identical impedance. The sources may be two isolation transformers, where one is a delta/wye design (which provides the phase shift) and

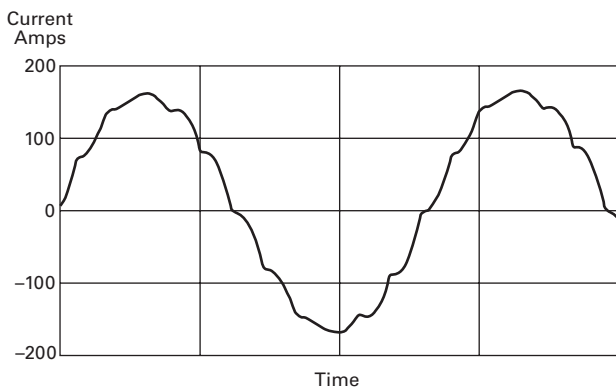
the second a delta/delta design (which does not phase shift). The 12-pulse arrangement allows the harmonics from the first converter to cancel the harmonics of the second. Up to approximately 85% reduction of harmonic current and voltage distortion may be achieved (over standard

six-pulse converter). This permits a facility to use a larger percentage of AFD loads under IEEE 519-2014 guidelines than allowable using line reactors or DC chokes. A harmonic analysis is required to guarantee compliance with guidelines.

#### Basic 12-Pulse Rectifier with "Phase Shifting" Transformer



#### 100 hp 480 V Drive with 12-Pulse Rectifier



#### 100 hp 480 V Drive with 12-Pulse Rectifier

##### 12-Pulse Circuit

##### Current harmonics

$I_1 = 100\%$	$I_{11} = 4.19\%$	$I_{19} = 0.06\%$
$I_5 = 1.25\%$	$I_{13} = 2.95\%$	$I_{23} = 0.87\%$
$I_7 = 0.48\%$	$I_{17} = 0.21\%$	$I_{25} = 0.73\%$

Power = 100 hp

$H_c = 20$  Amps

##### Advantages

- Reasonable cost, although significantly more than reactors or chokes
- Substantial reduction (up to approx. 85%) in voltage and current harmonics
- Provides increased input protection for AFD and its semiconductors from line transients

##### Disadvantages

- Impedance matching of phase shifted sources is critical to performance
- Transformers often require separate mounting or larger AFD enclosures
- May not reduce distribution harmonic levels to below IEEE 519-2014 guidelines
- Cannot retrofit for most AFDs

#### 4. 18-Pulse Converters

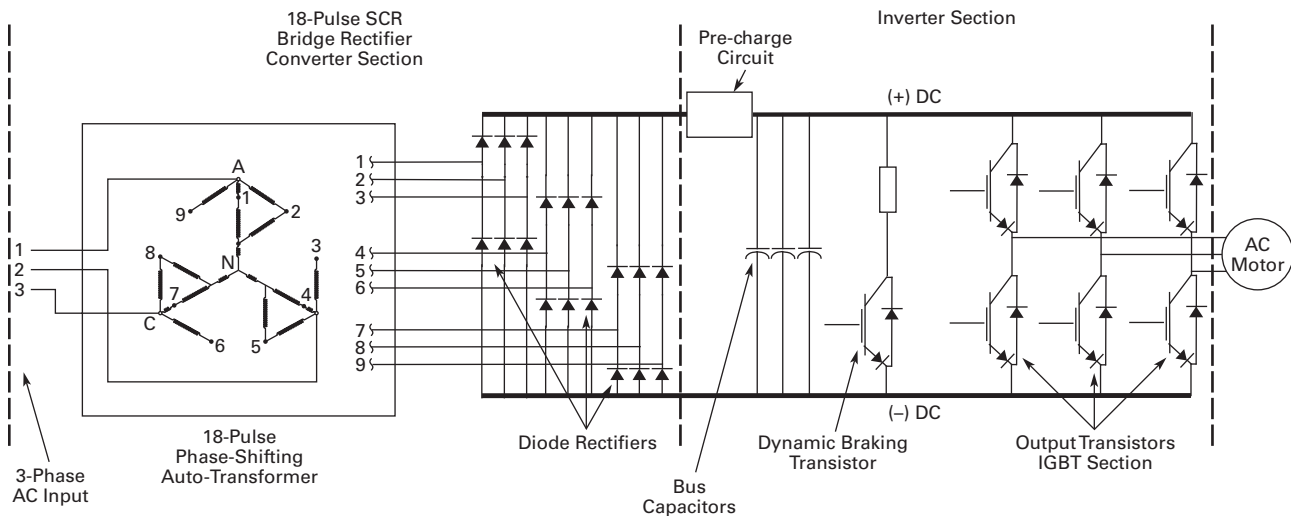
When the total load is comprised of non-linear load such as drives, and the ratio is  $I_{SC}/I_L$ , the greatest harmonic mitigation is required. Under these conditions, the currents drawn from the supply need to be sinusoidal and “clean” such that system interference and additional

losses are negligible. Eaton’s enclosed 18-pulse drive uses a phase-shifting auto-transformer with delta-connected winding that carries only the ampere-turns caused by the difference in load currents. This results in nine separate phases. In this type of configuration, the

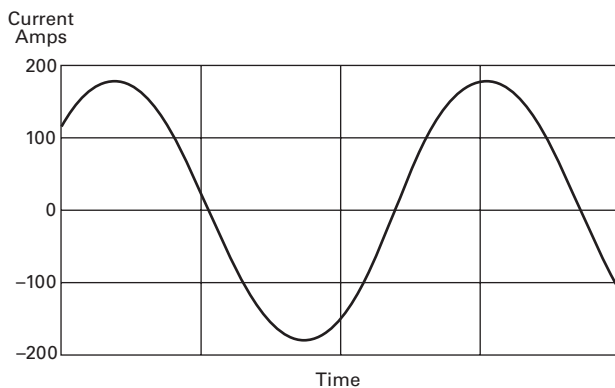
total kVA rating of the transformer magnetic system was only 48% that of the motor load. A traditional isolated transformer system, with multipulse windings, would require the full kVA rating to be supported, which is more common in an MV step-down transformer.

The integrated 18-pulse drive, with near sine wave input current and low harmonics will meet the requirements of IEEE 519-2014 under all practical operating conditions. The comparisons with six-pulse passive filter and 12-pulse systems are shown on **Pages V6-T2-299, V6-T2-301** and below.

#### Basic 18-Pulse Rectifier with Phase-Shifting Auto-Transformer



#### 100 hp 480 V Drive with 18-Pulse Rectifiers



#### 100 hp 480 V Drive with 18-Pulse Rectifiers

##### 18-Pulse Clean Power

##### Current harmonics

$I_1 = 100\%$	$I_{11} = 0.24\%$	$I_{19} = 1.00\%$
$I_5 = 0.16\%$	$I_{13} = 0.10\%$	$I_{23} = 0.01\%$
$I_7 = 0.03\%$	$I_{17} = 0.86\%$	$I_{25} = 0.01\%$

Power = 100 hp

$H_c = 5.9$  Amps

##### Advantages

- Effectively guarantees compliance with IEEE 519-2014
- Provides increased input protection for AFD and its semiconductors from line transients
- Up to 4 times the harmonic reduction of 12-pulse methods
- Smaller transformer than isolation transformer used in 12-pulse converter
- Minimizes ripple current in capacitors, doubling expected capacitor life

##### Disadvantages

- Not as cost effective as some other methods at small (<50) horsepower

# 2.11

## Adjustable Frequency Drives

Clean Power Drives

### Enclosed Passive Filtered Drives

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#### *Description*

#### *Page*

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EGX Enclosed Drives .....	<b>V6-T2-305</b>
CFX Enclosed Drives .....	<b>V6-T2-325</b>
Enclosed 12-Pulse Drives .....	<b>V6-T2-351</b>
Enclosed 18-Pulse Drives .....	<b>V6-T2-355</b>
Enclosed Regenerative Drives .....	<b>V6-T2-379</b>

## EGF Enclosed Drives



## EGF Enclosed Drives

## Product Description

Eaton's Enclosed EGF Drives combine harmonic distortion reduction and true power factor performance with the latest in Eaton adjustable frequency drive technology to deliver an industry-leading solution. This pre-engineered passive filtered solution prevents transformer overheating and overloading of breakers and feeders, which enables the application of adjustable frequency drives on generators and other high impedance power systems.

## Features and Benefits

- Tuned passive filter
- Delivers 5–8% THD
- Generator compatible
- Uses the same DG1, SVX or SPX drive that is stocked in the warehouse
- Simple to retrofit
- Provides a low-impedance path to ground for the harmonic frequencies
- Meets IEEE 519-2014
- Excellent cost for performance
- Small footprint, compact enclosure design
- Insensitive to voltage imbalance
- Customizable cover control options
- Padlockable disconnect
- The PowerXL DG1 comes standard with the following communication protocols:
  - EtherNet/IP
  - Modbus/TCP
  - Modbus RTU
  - BACnet MS/TP

## Standards and Certifications

- UL 508C



## Contents

## Description

Description	Page
Clean Power Drives Overview .....	V6-T2-298
Enclosed Passive Filtered Drives	
EGF Enclosed Drives	
Product Identification .....	V6-T2-326
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Enclosure Selection .....	V6-T2-309
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Dimensions .....	V6-T2-314
CFX Enclosed Drives .....	V6-T2-325
Enclosed 12-Pulse Drives .....	V6-T2-351
Enclosed 18-Pulse Drives .....	V6-T2-355
Enclosed Regenerative Drives .....	V6-T2-379

## Communication Options

- PROFIBUS-DP
- LonWorks
- CANopen
- DeviceNet

## Enclosure Ratings

- NEMA Type 1
- NEMA Type 12
- NEMA Type 3R

## Mounting

- Wall mount
- Floor mount: 12-inch legs
- Floor mount: 22-inch legs

## Product Range

- 480 V: 1–250 hp

# 2.11

## Adjustable Frequency Drives

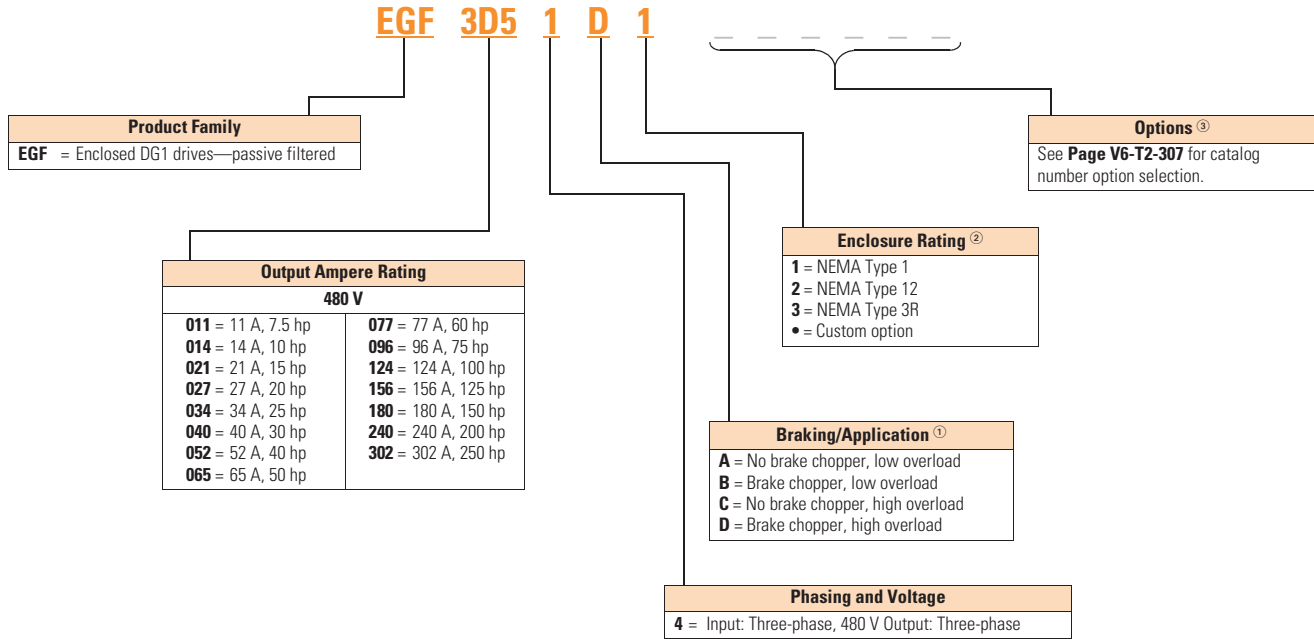
### Clean Power Drives

#### Catalog Number Selection

Catalog Number Selection is for reference only. Not all option combinations may be available.

2

#### EGF Enclosed—Base Catalog Number



#### Notes

- ① Brake chopper is a factory-installed option only. Braking resistors sold separately. See DG1 drives starting on **Page V6-T2-59** for selection.
- ② Additional enclosure options including NEMA 4 and 4X are available. Please contact the factory for configuration and pricing.
- ③ Part number configuration continued on the following page.

Catalog Number Selection is for reference only. Not all option combinations may be available.

### EGF Enclosed—Catalog Number Options

**EGF 3D5 1 D 1**

#### Base Catalog Number Example

See **Page V6-T2-306** for base catalog number selection.

#### Power Disconnect Options

- 0 = None
- 1 = MCP disconnect <sup>①</sup>
- 2 = Circuit breaker
- 3 = Circuit breaker/isolation fusing
- 5 = Circuit breaker/isolation fusing/SPD
- 8 = Circuit breaker/SPD
- A = Fused disconnect
- B = Fused disconnect/SPD
- E = Isolation fuses
- G = Isolation fuses/SPD
- = Custom option <sup>②</sup>

#### Bypass Options <sup>③</sup>

- 0 = None
- 1 = Manual HOA bypass
- 2 = Manual HOA bypass/isolation fusing
- 4 = Manual HOA bypass/isolation fusing/SPD
- 7 = Manual HOA bypass/SPD
- H = Manual HOA RVSS bypass
- J = Manual HOA RVSS bypass/isolation fusing
- L = Manual HOA RVSS bypass/isolation fusing/SPD
- P = Manual HOA RVSS bypass/SPD
- = Custom option <sup>②</sup>

#### Output Power Options <sup>④</sup>

- 0 = None
- A = Output contactor
- B = 3% Output reactor
- D = dV/dt filter
- E = 3% Output Reactor/output contactor
- G = dV/dt/output contactor
- = Custom option <sup>②</sup>

#### Control Options <sup>⑤</sup>

- 0 = None
- 1 = Speed pot
- 2 = Start-stop pushbutton
- 3 = Start-stop pushbutton with speed pot
- A = HOA switch
- B = Start-stop pushbutton with speed pot & HOA switch
- C = Start-stop pushbutton with HOA switch
- D = HOA switch with speed pot
- = Custom option <sup>②</sup>

**2 0 0 B 1 0 0 0 0**

#### Option Boards 2

Same options and codes as Option Boards 1

#### Option Boards 1

- 0 = No option
- 1 = 3 x DI, 3 x DO, 1 Thermistor, 24 Vdc/EXT
- 2 = 1 x AI, 2 x AO (isolated to control board)
- 3 = 3 x relay dry contact (2NO + 1NO/NC)
- 4 = 3 x PT100 RTD thermistor input
- 5 = 6 DI 240 Vac input
- = Custom option <sup>②</sup>

#### Communication Options

- 0 = No option
- 1 = PROFIBUS-DP
- 3 = CANopen (slave)
- 4 = DeviceNet
- 5 = PROFIBUS-DP (D9 connector)
- D = SmartWire-DT
- = Custom option <sup>②</sup>

#### Enclosure Options

- 0 = None
- 1 = Floor stand—12 inches
- 2 = Floor stand—22 inches
- A = Space heater
- B = Space heater & 12-inch floor stands
- C = Space heater & 22-inch floor stands
- = Custom option <sup>②</sup>

#### Light Options <sup>⑤</sup>

- 0 = None
- 1 = Non-bypass light kit—Power On, Run, Fault
- 2 = Bypass light kit—On, VFD Run, Fault, Bypass Run
- = Custom option <sup>②</sup>

#### Notes

- ① HMCP disconnect option required and only available when bypass is selected.
- ② More options are available as Engineered to Order through the Bid Manager tool.
- ③ All bypass options include third contactor for drive isolation when in bypass mode.
- ④ Output contactor not available with bypass. Bypass comes standard with output contactor.
- ⑤ Pilot devices are 22 mm standard. 30 mm options are available as engineered to order through the Bid Manager tool.



## Production Selection

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## EGF Enclosed Drive

## 480 V Drives—Constant Torque (CT)/High Overload (IH) Enclosed Drives



hp	Current (A)	Drive Frame Size	NEMA Type 1 Base Catalog Number <sup>①</sup>	NEMA Type 12 Base Catalog Number <sup>①</sup>	NEMA Type 3R Base Catalog Number <sup>①</sup>
7.5	11	2	EGF0114D1	EGF0114D2	EGF0114D3
10	14	2	EGF0144D1	EGF0144D2	EGF0144D3
15	21	2	EGF0214D1	EGF0214D2	EGF0214D3
20	27	3	EGF0274D1	EGF0274D2	EGF0274D3
25	34	3	EGF0344D1	EGF0344D2	EGF0344D3
30	40	3	EGF0404D1	EGF0404D2	EGF0404D3
40	52	4	EGF0524C1	EGF0524C2	EGF0524C3
50	65	4	EGF0654C1	EGF0654C2	EGF0654C3
60	77	4	EGF0774C1	EGF0774C2	EGF0774C3
75	96	5	EGF0964C1	EGF0964C2	EGF0964C3
100	124	5	EGF1244C1	EGF1244C2	EGF1244C3
125	156	5	EGF1564C1	EGF1564C2	EGF1564C3
150 <sup>②</sup>	180	6	EGF1804C1 <sup>②</sup>	EGF1804C2 <sup>②</sup>	EGF1804C3 <sup>②</sup>
200 <sup>②</sup>	240	6	EGF2404C1 <sup>②</sup>	EGF2404C2 <sup>②</sup>	EGF2404C3 <sup>②</sup>

## EGF Enclosed Drive

## 480 V Drives—Variable Torque (VT)/Low Overload (L) Enclosed Drives



hp	Current (A)	Drive Frame Size	NEMA Type 1 Base Catalog Number <sup>①</sup>	NEMA Type 12 Base Catalog Number <sup>①</sup>	NEMA Type 3R Base Catalog Number <sup>①</sup>
7.5	11	1	EGF0114B1	EGF0114B2	EGF0114B3
10	14	2	EGF0144B1	EGF0144B2	EGF0144B3
15	21	2	EGF0214B1	EGF0214B2	EGF0214B3
20	27	2	EGF0274B1	EGF0274B2	EGF0274B3
25	34	3	EGF0344B1	EGF0344B2	EGF0344B3
30	40	3	EGF0404B1	EGF0404B2	EGF0404B3
40	52	3	EGF0524B1	EGF0524B2	EGF0524B3
50	65	4	EGF0654A1	EGF0654A2	EGF0654A3
60	77	4	EGF0774A1	EGF0774A2	EGF0774A3
75	96	4	EGF0964A1	EGF0964A2	EGF0964A3
100	124	5	EGF1244A1	EGF1244A2	EGF1244A3
125	156	5	EGF1564A1	EGF1564A2	EGF1564A3
150	180	5	EGF1804A1	EGF1804A2	EGF1804A3
200 <sup>②</sup>	240	6	EGF2404A1 <sup>②</sup>	EGF2404A2 <sup>②</sup>	EGF2404A3 <sup>②</sup>
250 <sup>②</sup>	302	6	EGF3024A1 <sup>②</sup>	EGF3024A2 <sup>②</sup>	EGF3024A3 <sup>②</sup>

**Notes**

<sup>①</sup> Table is for base catalog number reference only. For complete catalog number selection, see **Page V6-T2-306**.

<sup>②</sup> Available in 2017.

## Enclosure Selection

### EGF Enclosed Drives

Enclosure selection charts are based on physical space limitations only and only to be used as a reference. For actual enclosure sizing, refer to Bid Manager.

**Note:** Filtered enclosure sizing includes dedicated space for passive filter, input fuses, circuit breaker or fusible disconnect, CPT, SPD, heater/thermostat, control relay and terminal blocks.

### Filtered Enclosure X-Space

Enclosure Size	Frame 1	Frame 2	Frame 3	Frame 4	Frame 5
AX	—	—	—	—	—
BX	0	0	—	—	—
CX	3	3	2	2	—
DX	14	14	13	13	10

### Filtered Power Options X-Space

Power Options	Frame 1	Frame 2	Frame 3	Frame 4	Frame 5
3% Output reactor	1	1	3	5	6
dV/dt filter	3	3	3	5	6
Output contactor	1	1	1	1	1

**Note:** Filtered bypass enclosure sizing includes dedicated space for a passive filter, input fuses, MCP, CPT, input contactor, output bypass contactors, overload relay, SPD, heater/thermostat, control relay and terminal blocks.

### Filtered Bypass Enclosure X-Space

Enclosure Size	Frame 1	Frame 2	Frame 3	Frame 4	Frame 5
AX	—	—	—	—	—
BX	—	—	—	—	—
CX	2	1	0	—	—
DX	13	12	11	10	6

### Filtered Bypass Power Options X-Space

Power Options	Frame 1	Frame 2	Frame 3	Frame 4	Frame 5
RVSS Bypass	1	1	3	5	6
3% Output reactor	2	2	2	3	4
dV/dt filter	3	3	3	5	6

## Accessories

The PowerXL Series—DG1 drives can accommodate a wide selection of expander and adapter option boards to customize the drive for your application needs. The drive's control unit is designed to accept a total of two additional option boards.

The PowerXL Series—DG1 drives come with a factory-installed standard board configuration including the following:

- Standard I/O:
  - 8DI, 1DO
  - 2AI, 2AO
  - 2FC, 1FA relays
- Standard communications:
  - EtherNet/IP, Modbus TCP
  - RS-485: Modbus RTU, BACnet MS/TP

### PowerXL Series—DG1 I/O Card Kits

Description	Catalog Number
3 x DI, 3 x DO, 1 x thermistor, 24 Vdc/EXT option card	DXG-EXT-3DI3DO1T
1 x AI, 2 x AO (isolated to control board) option card	DXG-EXT-1AI2AO
3 x relay dry contact (2NO + 1NO/NC) option card	DXG-EXT-3RO
3 x PT100 RTD thermistor input option card	DXG-EXT-THER1
6 x DI 240 Vac input option card	DXG-EXT-6DI

### PowerXL Series—DG1 Communication Card Kits

Description	Catalog Number
PROFIBUS-DP communication card	DXG-NET-PROFB
CANopen communication card	DXG-NET-CANOPEN
DeviceNet communication card	DXG-NET-DEVICENET
PROFIBUS DB9 to 5-pin adapter card	DXG-NET-PROAD
SmartWire communication card and module	DXG-NET-SWD <sup>①</sup>

#### Note

<sup>①</sup> Available January 2017.

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## Adjustable Frequency Drives

### Clean Power Drives

#### Options

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#### Input Power Options

Option	Description
HMCP Disconnect	The HMCP motor protection circuit breaker uses an electronic trip unit to provide typical motor overload relay functionality and short-circuit protection against potential phase-to-phase or phase-to-ground faults.
Circuit Breaker	Utilizes a circuit breaker to provide a means of short-circuit protection for the power cables between it and the drive, and protection from high-level ground faults on the power cable. Allows a convenient means of disconnecting the drive from the line, and the operating mechanism can be padlocked in the OFF position. This is factory mounted in the enclosure.
Isolation Fusing	Provides high-level fault protection of the drive input power circuit from the load side of the fuses to the input side of the power transistors. This option consists of three 200 kA fuses that are factory mounted in the enclosure.
3% Input Reactor	The input reactor is a three-phase series inductance on the line side of an AFD. It is used to provide a reduction in voltage and current harmonics. It also provides increased input protection for AFD and its semiconductors from line transients.
SPD	Provides a UL 1449 surge protection device (SPD) rated for 40 kA/ph that is connected to the line side terminals.
Fused Disconnect	Utilizes fusing to provide a means of short-circuit protection for the power cables between it and the drive, and protection from high-level ground faults on the power cable. Allows a convenient means of disconnecting the drive from the line, and the operating mechanism can be padlocked in the OFF position. This is factory mounted in the enclosure.

#### Bypass Options

Option	Description
Manual HOA Bypass	Provides a three-position selector switch that allows the user to select either a HAND or AUTO mode of operation. HAND mode is defaulted keypad operation, and AUTO mode is defaulted to control from an external terminal source. These modes of operation can be configured via programming to allow for alternate combinations of start and speed sources. Start and speed sources include keypad, I/O and fieldbus.
Manual HOA RVSS Bypass	This option adds a reduced voltage soft starter to bypass assembly for soft starting in bypass mode.

#### Output Power Options

Option	Description
Output Contactor	Provides a means for positive disconnection of the drive output from the motor terminals. The contactor coil is controlled by the drive's run or permissive logic. NC and NO auxiliary contacts rated at 10 A, 600 Vac are provided for customer use. This option includes a low VA 115 Vac fused control power transformer and is factory mounted in the enclosure.
3% Output Reactor	The output reactor is a three-phase series inductance on the load side of a VFD. It is used to reduce transient voltage (dv/dt) and peak voltages at the motor terminals. A 3% output filter is recommended for motor cable lengths up to 300 ft (10 m).
dV/dt Filter	Used to reduce the transient voltage (dV/dt) at the motor terminals. Recommended for motor cable lengths over 300 ft (10 m) and up to 1000 ft (304.8 m). This option is mounted in the enclosure.

#### Control Options

Option	Description
Speed Pot	Provides the ability to adjust the frequency reference using a door-mounted potentiometer. This option uses the 10 Vdc reference to generate a 0–10 V signal at the analog voltage input signal terminal. When the HOA bypass option is added, the speed is controlled when the HOA switch is in the HAND position. Without the HOA bypass option, a two-position switch (labeled local/remote) is provided on the keypad to select speed reference from the speed potentiometer or a remote speed signal.
HOA Switch	Provides a three-position selector switch that allows the user to select either a HAND or AUTO mode of operation. HAND mode is defaulted to keypad operation, and AUTO mode is defaulted to control from an external terminal source. These modes of operation can be configured via drive programming to allow for alternate combinations of start and speed sources. Start and speed sources include Keypad, I/O and fieldbus.
Start-Stop Pushbutton	Provides door-mounted START and STOP pushbuttons for either bypass or non-bypass configurations.

#### Light Options

Option	Description
Non-Bypass Light Kit—Power On, Run, Fault	Provides a white POWER ON light that indicates power to the enclosed cabinet, a green RUN light that indicates the drive is running and a red FAULT light that indicates a drive fault has occurred.
Bypass Light Kit—On, VFD Run, Fault, Bypass Run	Provides a white POWER ON light that indicates power to the enclosed cabinet, a green RUN light that indicates the drive is running, a red FAULT light that indicates a drive fault has occurred and an amber light that indicates when the motor is running in Bypass mode.

#### Enclosure Options

Option	Description
Floor Stand 12 in	Converts a normally wall-mounted enclosure to a floor-standing enclosure with a height of 12 in (304.8 mm).
Floor Stand 22 in	Converts a normally wall-mounted enclosure to a floor-standing enclosure with a height of 22 in (558.8 mm).

## Technical Data and Specifications

### PowerXL Series—DG1 Technical Data and Specifications

Attribute	Description	Specification	
Input ratings	Input voltage $U_{in}$	208 V, 230 V, 480 V, 575 V, –15 to 10%	
	Input frequency	50 Hz to 60 Hz (variation up to 45 Hz to 66 Hz)	
	Connection to power	Once per minute or less	
	Starting delay	3 s (FR1 to FR2), 4 s (FR3), 5 s (FR4), 6 s (FR5 and FR6)	
	Short-circuit withstand rating	100 kAIC (fuses and circuit breakers)	
Output ratings	Output voltage	0 to $U_{in}$	
	Output current	$I_L$ : ambient temperature maximum 40 °C, up to 60 °C with derating, overload 1.1 x $I_L$ (1 min./10 min.) $I_H$ : ambient temperature maximum 50 °C, up to 60 °C with derating, overload 1.5 x $I_H$ (1 min./10 min.)	
	Initial output current	200% (2 s / 20 s)	
	Output frequency	0–400 Hz (standard)	
	Frequency resolution	0.01 Hz	
Control characteristics	Control methods	Frequency control Speed control Open-loop speed control Open-loop torque control	
	Switching frequency	230 V / 480 V range: FR1–3: 1 kHz to 12 kHz FR4–6: 1 kHz to 10 kHz  230 V / 480 V defaults: FR1–3: 4 kHz FR4–5: 3.6 kHz FR6: 2 kHz  575 V range: FR1–6: 1 kHz to 6 kHz  575 V defaults: FR1–4: 3 kHz FR5–6: 2 kHz  Automatic switching frequency derating in case of overload.	
	Frequency reference	Analog input: resolution 0.1% (10-bit), accuracy +1% Analog output: resolution 0.1% (10-bit), accuracy +1% Panel reference: resolution 0.01 Hz	
	Field weakening point	20 Hz to 400 Hz	
	Acceleration time	0.1 s to 3000 s	
	Deceleration time	0.1 s to 3000 s	
	Braking torque	DC brake: 30% x Motor Rated Torque ( $T_n$ ) (without brake chopper) Dynamic braking (with optional brake chopper using an external brake resistor): 100% continuous maximum rating	
	Ambient conditions	Ambient operating temperature	–10 °C (no frost) to +40 °C
		Storage temperature	–40 °C to +70 °C
		Relative humidity	0–95% RH, noncondensing, non-corrosive
Air quality: • Chemical vapors • Mechanical particles		Tested according to IEC 60068-2-60 Test Key: Flowing mixed gas corrosion test, Method 1 (H <sub>2</sub> S [hydrogen sulfide] and SO <sub>2</sub> [sulfur dioxide]) Designed according to: IEC 60721-3-3, unit in operation, class 3C2 IEC 60721-3-3, unit in operation, class 3S2	
Altitude		100% load capacity (no derating) up to 3280 ft (1000 m); 1% derating for each 328 ft (100 m) above 3280 ft (1000 m); max. 9842 ft (3000 m) (2000 m for corner grounded earth main systems) For 575 V product, maximum altitude is 6561 ft (2000 m) regardless of main system	

## PowerXL Series—DG1 Technical Data and Specifications, continued

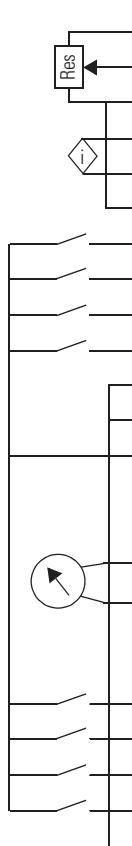
Attribute	Description	Specification
2 Ambient conditions, continued	Overvoltage	Overvoltage Category III
	Pollution degree	Pollution Degree 2
	Enclosure class	NEMA Type 1, 12, 3R
	Immunity	Fulfills EN 61800-3 (2004), first and second environment
Standards	Safety	UL 508C, EN 61800-5-1
	Approvals	UL and cUL
Fieldbus connections		Onboard: EtherNet/IP, Modbus® TCP, Modbus RTU, BACnet
Safety/protections	Overvoltage protection	Yes
	Overvoltage trip limit	230 V drives: 456 V 480 V drives: 911 V 575 V drives: 1100 V
	Undervoltage protection	Yes
	Undervoltage trip limit	230 V drives: 211 V 480 V drives: 370 V 575 V drives: 550 V
	Earth fault protection	Yes Default: 15% motor FLA Minimum: 0% motor FLA Maximum: 30% motor FLA
	Input phase supervision	Yes
	Motor phase supervision	Yes
	Overcurrent protection	Yes
	Unit overtemperature protection	Yes
	Motor overload protection	Yes
	Motor stall protection	Yes
	Motor underload protection	Yes
	DC bus overvoltage control	Yes
	Short-circuit protection of 24 V reference voltages	Yes
	Surge protection	Yes (differential mode 2 kV; common mode 4 kV 230 V drives: 275 Vac, 10,000 A 480 V drives: 320 Vac, 8000 A 575 V drives: 385 Vac, 10,000 A
Common coated boards	Yes (prevents corrosion)	
Efficiency	Drive efficiency ratings ①	480 V: FR1 = 97.7% FR2 = 97.9% FR3 = 97.7% FR4 = 98.0% FR5 = 98.2%
		230 V: FR1 = 96.7% FR2 = 97.4% FR3 = 97.2% FR4 = 97.4% FR5 = 97.7%

**Note**

① Based on DG1 efficiency ratings in an enclosure with no options.

## Wiring Diagram

## PowerXL Series—DG1 Control Wiring Diagram



Pin	Signal Name	Signal	Default Setting	Description
1	+10 V	Ref. Output Voltage	—	10 Vdc Supply Source
2	AI1+	Analog Input 1	0–10 V	Voltage Speed Reference (Programmable to 4 mA to 20 mA)
3	AI1–	Analog Input 1 Ground	—	Analog Input 1 Common (Ground)
4	AI2+	Analog Input 2	4 mA to 20 mA	Current Speed Reference (Programmable to 0–10 V)
5	AI2–	Analog Input 2 Ground	—	Analog Input 2 Common (Ground)
6	GND	I/O Signal Ground	—	I/O Ground for Reference and Control
7	DIN5	Digital Input 5	Preset Speed B0	Sets frequency output to Preset Speed 1
8	DIN6	Digital Input 6	Preset Speed B1	Sets frequency output to Preset Speed 2
9	DIN7	Digital Input 7	Emergency Stop (TI–)	Input forces VFD output to shut off
10	DIN8	Digital Input 8	Force Remote (TI+)	Input takes VFD from Local to Remote
11	CMB	DI5 to DI8 Common	Grounded	Allows source input
12	GND	I/O Signal Ground	—	I/O Ground for Reference and Control
13	24 V	+24 Vdc Output	—	Control voltage output (100 mA max.)
14	DO1	Digital Output 1	Ready	Shows the drive is ready to run
15	24 Vo	+24 Vdc Output	—	Control voltage output (100 mA max.)
16	GND	I/O Signal Ground	—	I/O Ground for Reference and Control
17	AO1+	Analog Output 1	Output Frequency	Shows Output frequency to motor 0–60 Hz (4 mA to 20 mA)
18	AO2+	Analog Output 2	Motor Current	Shows Motor current of motor 0–FLA (4 mA to 20 mA)
19	24 Vi	+24 Vdc Input	—	External control voltage input
20	DIN1	Digital Input 1	Run Forward	Input starts drive in forward direction (start enable)
21	DIN2	Digital Input 2	Run Reverse	Input starts drive in reverse direction (start enable)
22	DIN3	Digital Input 3	External Fault	Input causes drive to fault
23	DIN4	Digital Input 4	Fault Reset	Input resets active faults
24	CMA	DI1 to DI4 Common	Grounded	Allows source input
25	A	RS-485 Signal A	—	Fieldbus Communication (Modbus, BACnet)
26	B	RS-485 Signal B	—	Fieldbus Communication (Modbus, BACnet)
27	R3NO	Relay 3 Normally Open	At Speed	Relay output 3 shows VFD is at Ref. Frequency
28	R1NC	Relay 1 Normally Closed	Run	Relay output 1 shows VFD is in a run state
29	R1CM	Relay 1 Common		
30	R1NO	Relay 1 Normally Open		
31	R3CM	Relay 3 Common	At Speed	Relay output 3 shows VFD is at Ref. Frequency
32	R2NC	Relay 2 Normally Closed	Fault	Relay output 2 shows VFD is in a fault state
33	R2CM	Relay 2 Common		
34	R2NO	Relay 2 Normally Open		

# 2.11

## Adjustable Frequency Drives

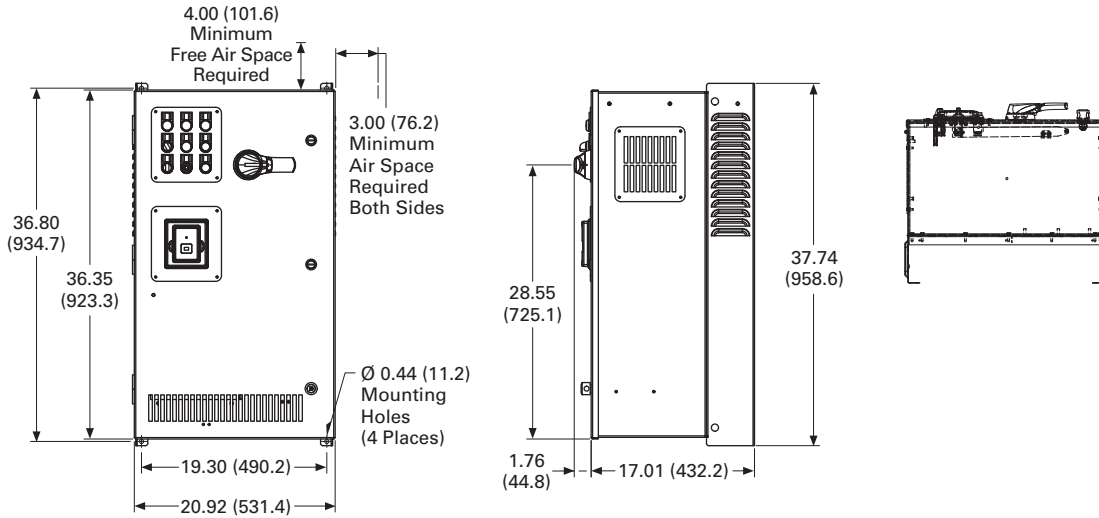
### Clean Power Drives

#### Dimensions

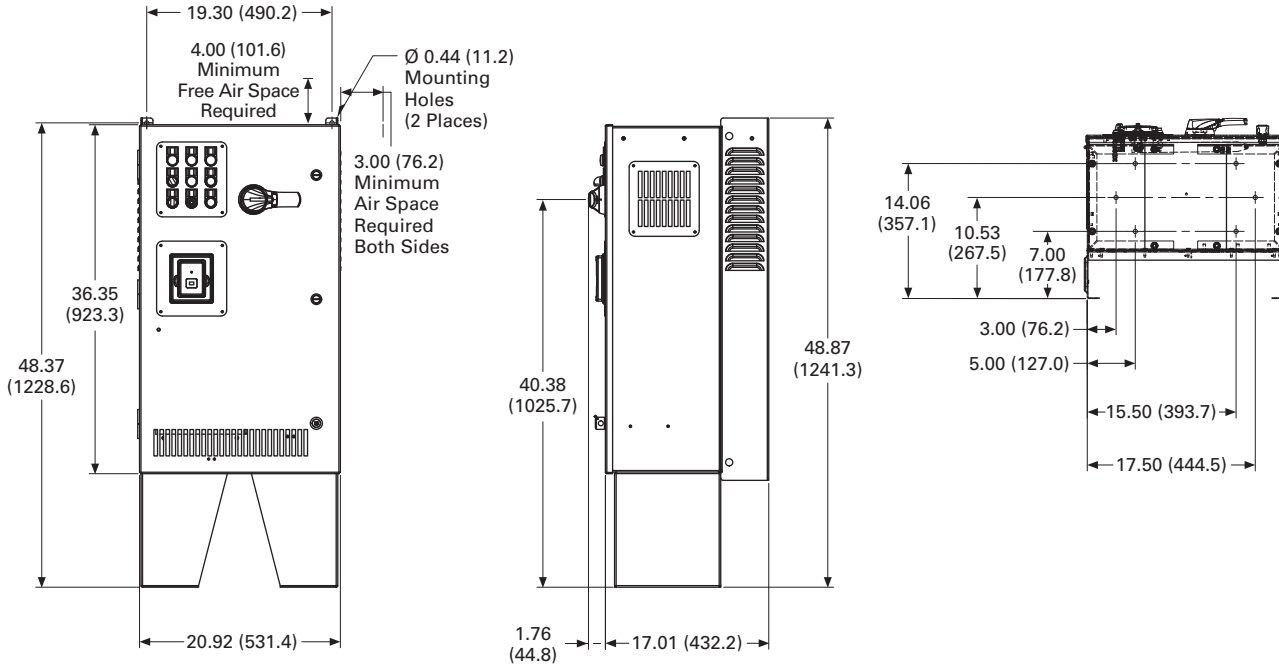
Approximate Dimensions in Inches (mm)

2

#### BX Box Type 1

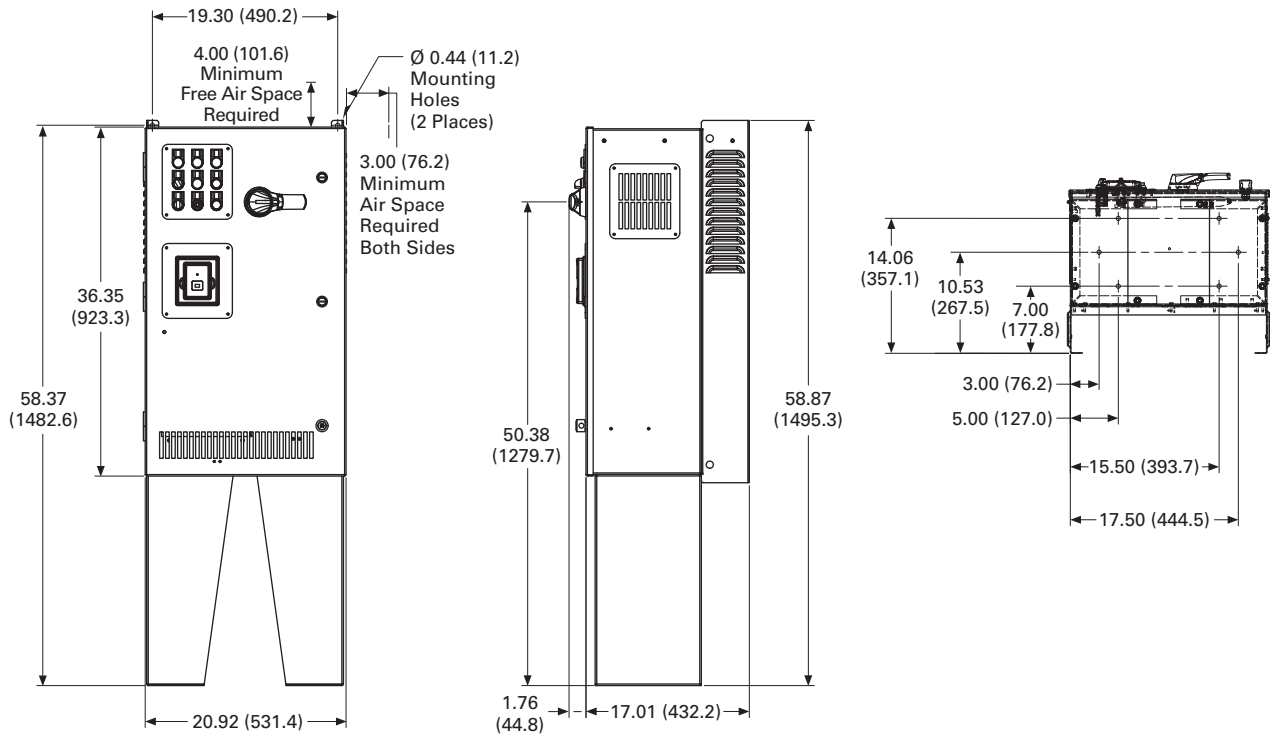


#### BX Box Type 1—12 Inch Floor Stands

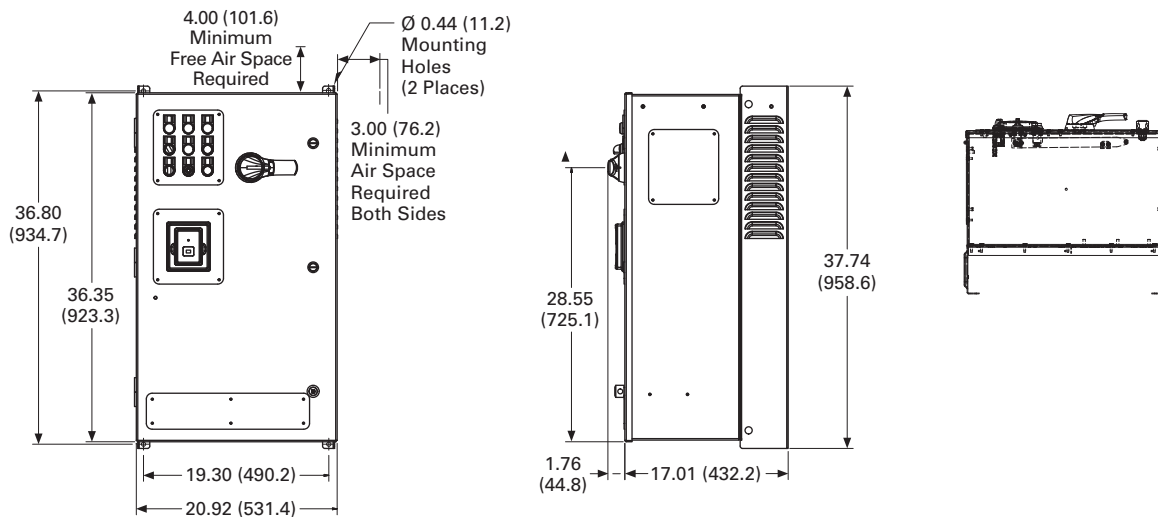


Approximate Dimensions in Inches (mm)

### BX Box Type 1—22 Inch Floor Stands



### BX Box Type 12





# 2.11

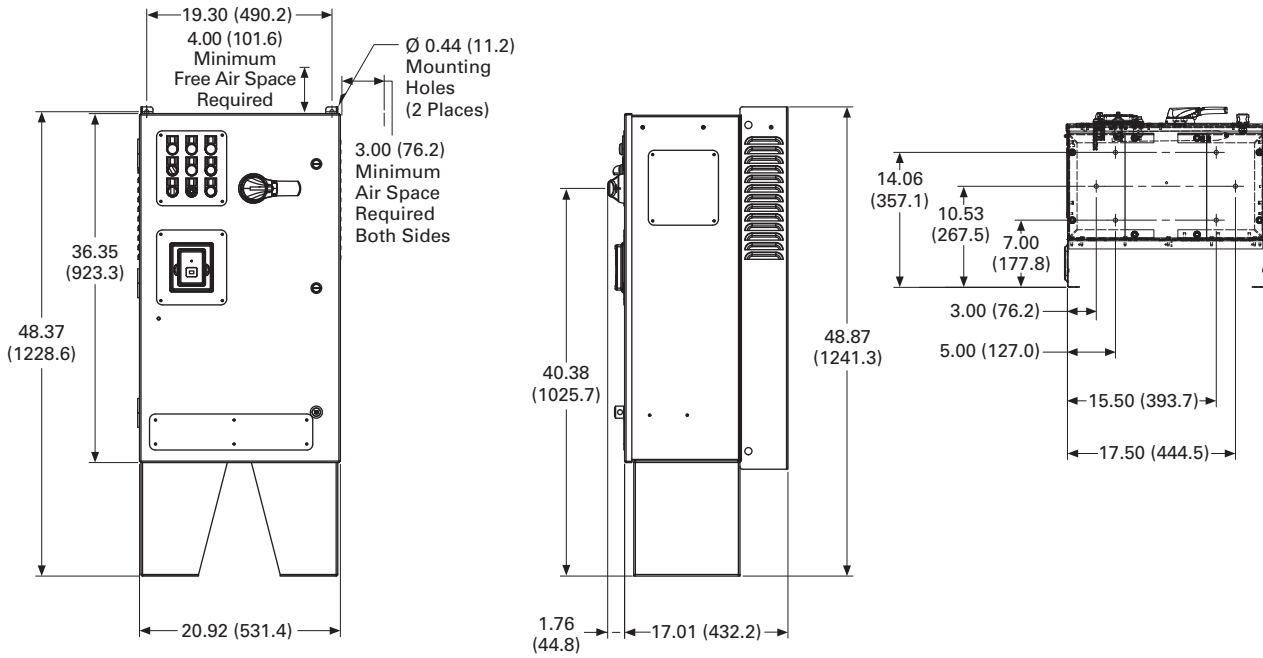
## Adjustable Frequency Drives

### Clean Power Drives

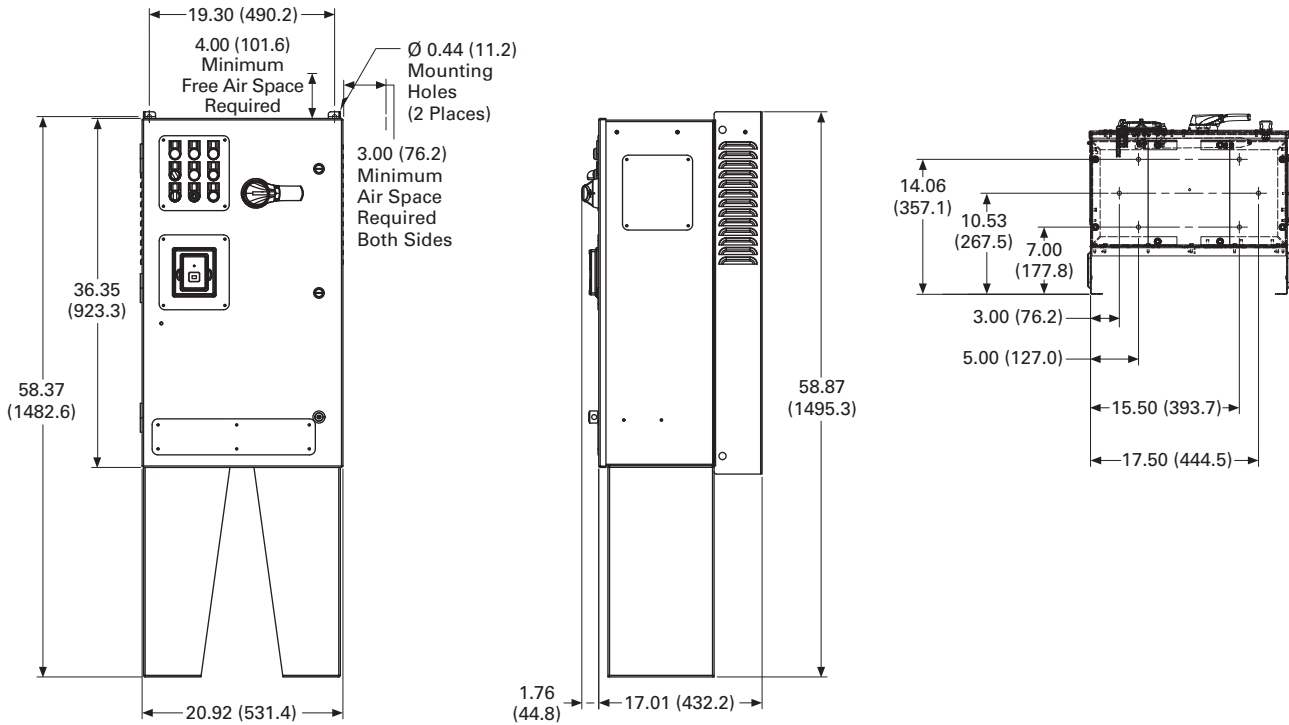
Approximate Dimensions in Inches (mm)

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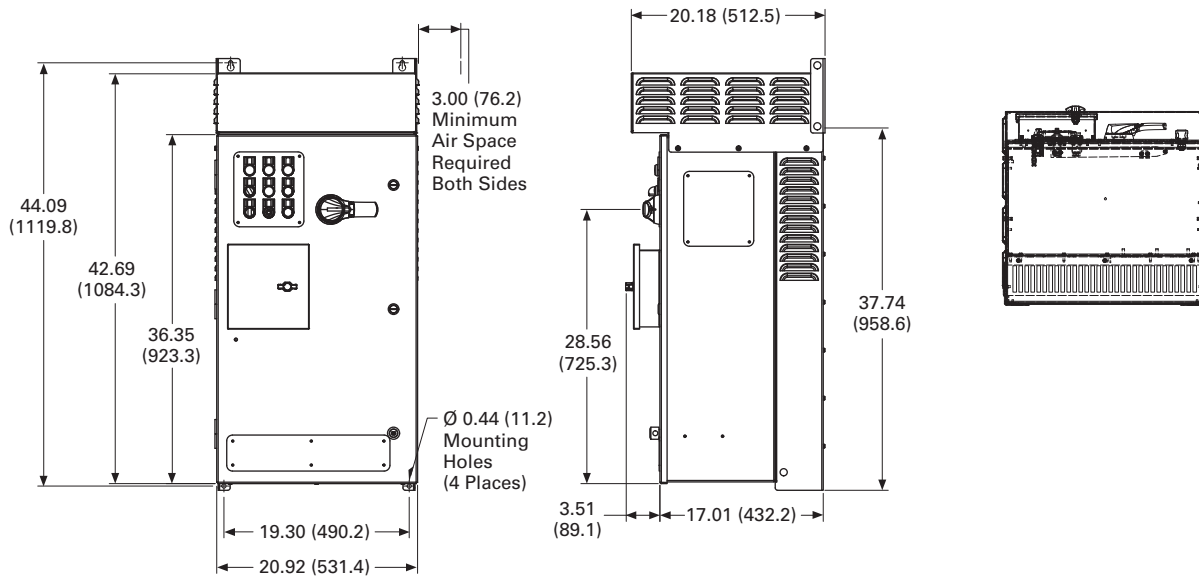
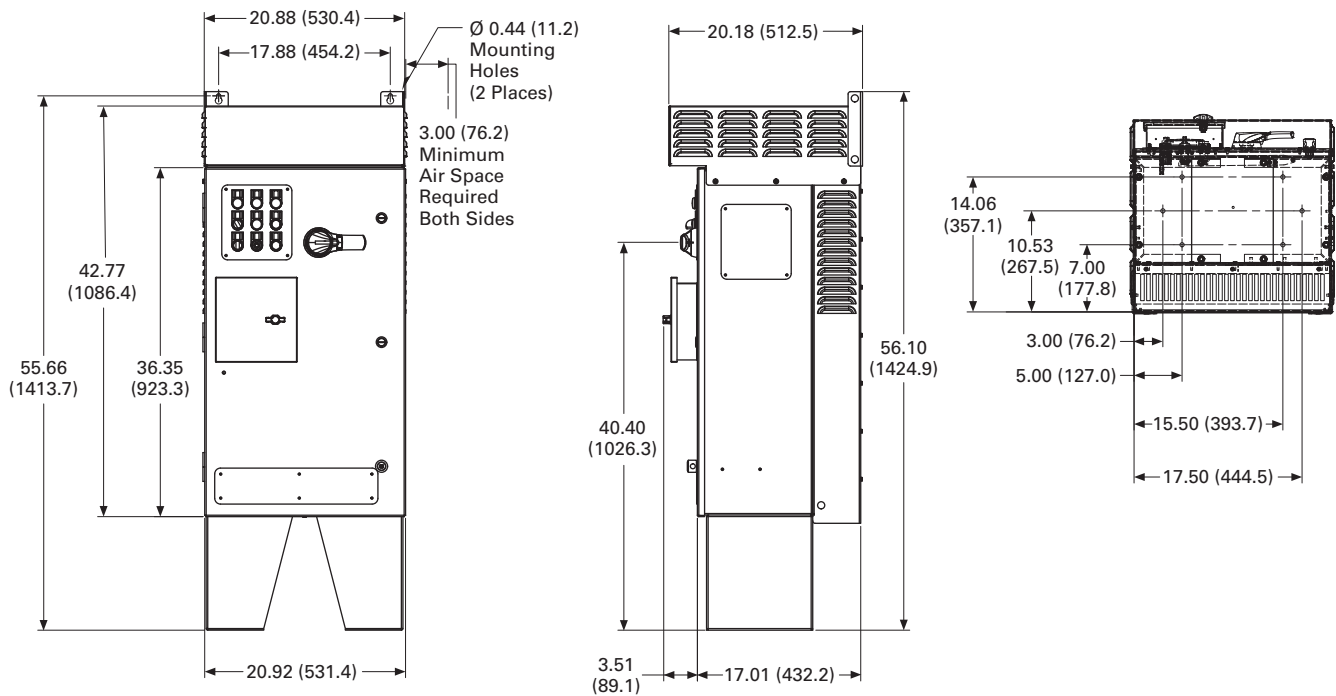
#### BX Box Type 12—12 Inch Floor Stands



#### BX Box Type 12—22 Inch Floor Stands



Approximate Dimensions in Inches (mm)

**BX Box Type 3R****BX Box Type 3R—12 Inch Floor Stands**

# 2.11

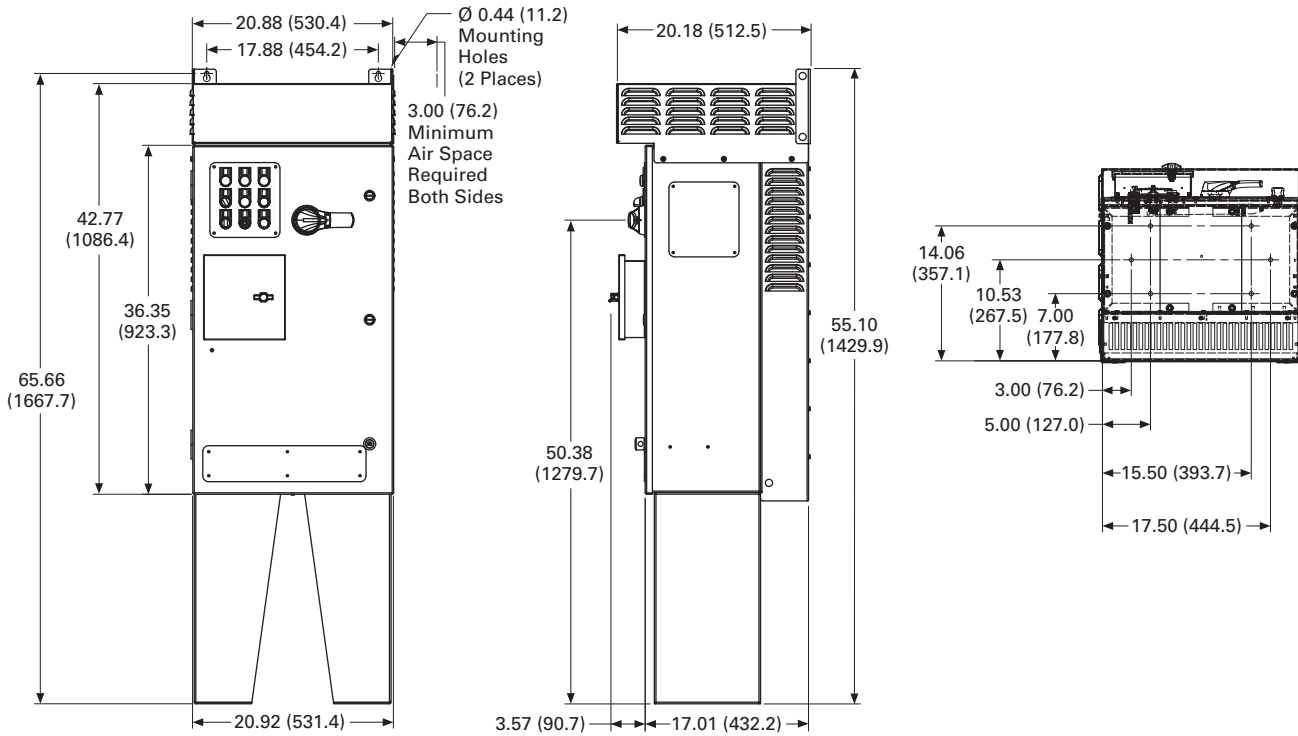
## Adjustable Frequency Drives

### Clean Power Drives

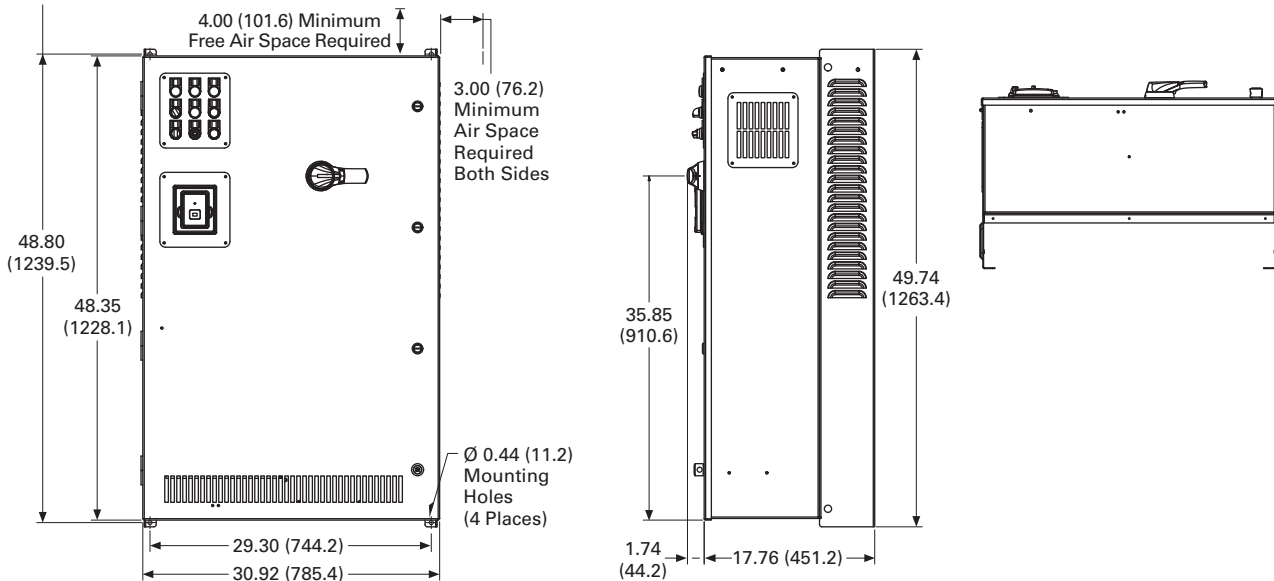
Approximate Dimensions in Inches (mm)

#### BX Box Type 3R—22 Inch Floor Stands

2

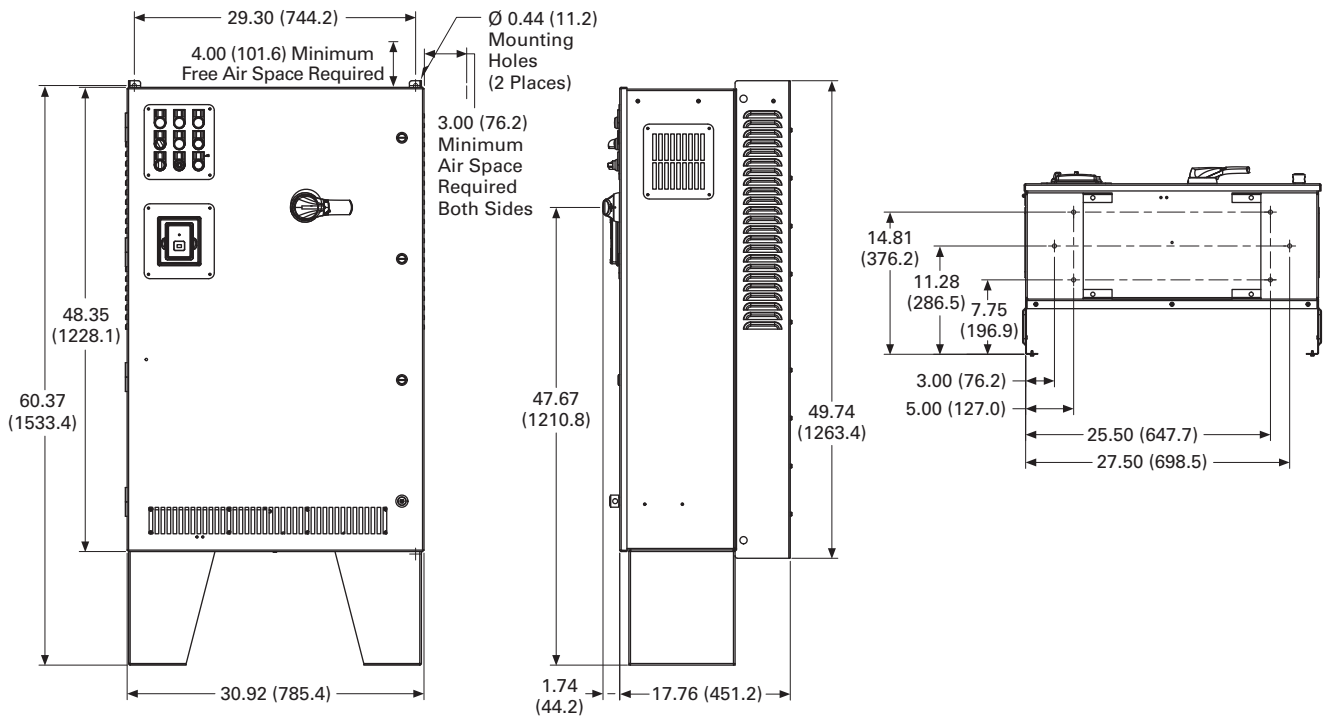


#### CX Box Type 1

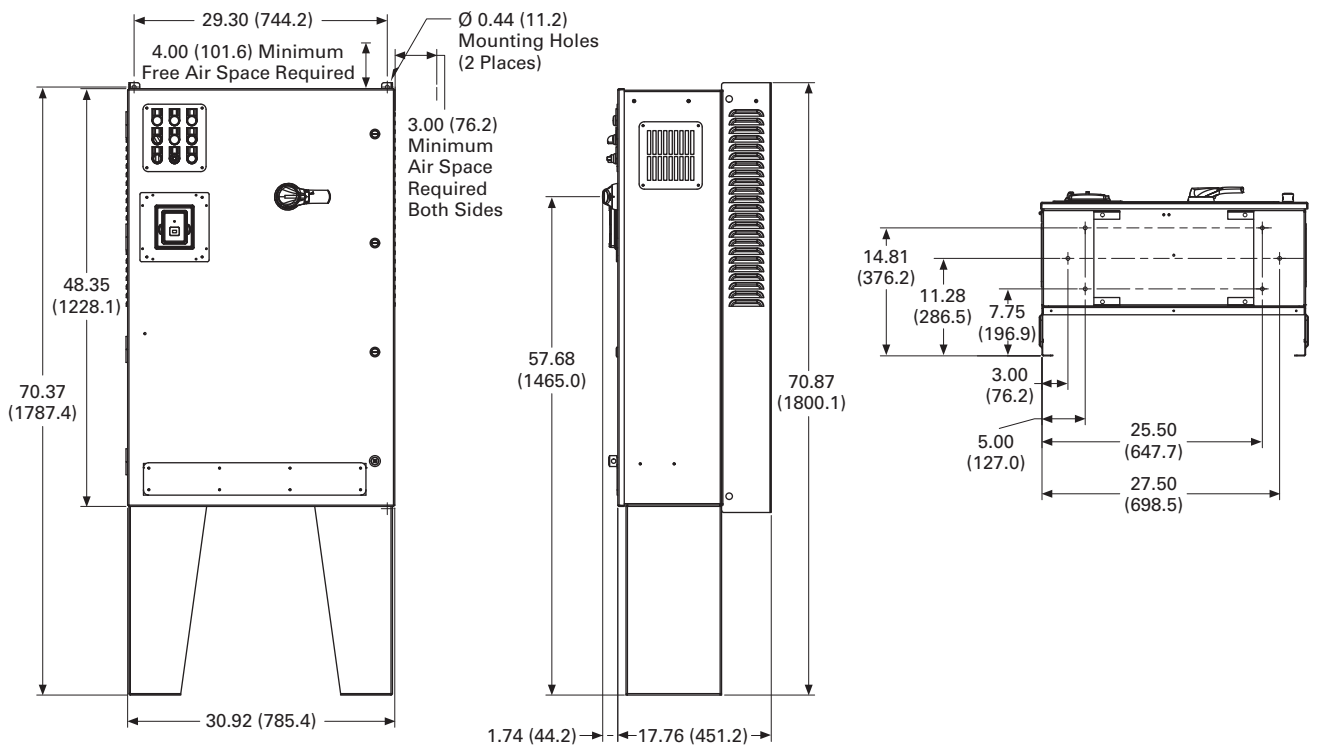


Approximate Dimensions in Inches (mm)

### CX Box Type 1—12 Inch Floor Stands



### CX Box Type 1—22 Inch Floor Stands



# 2.11

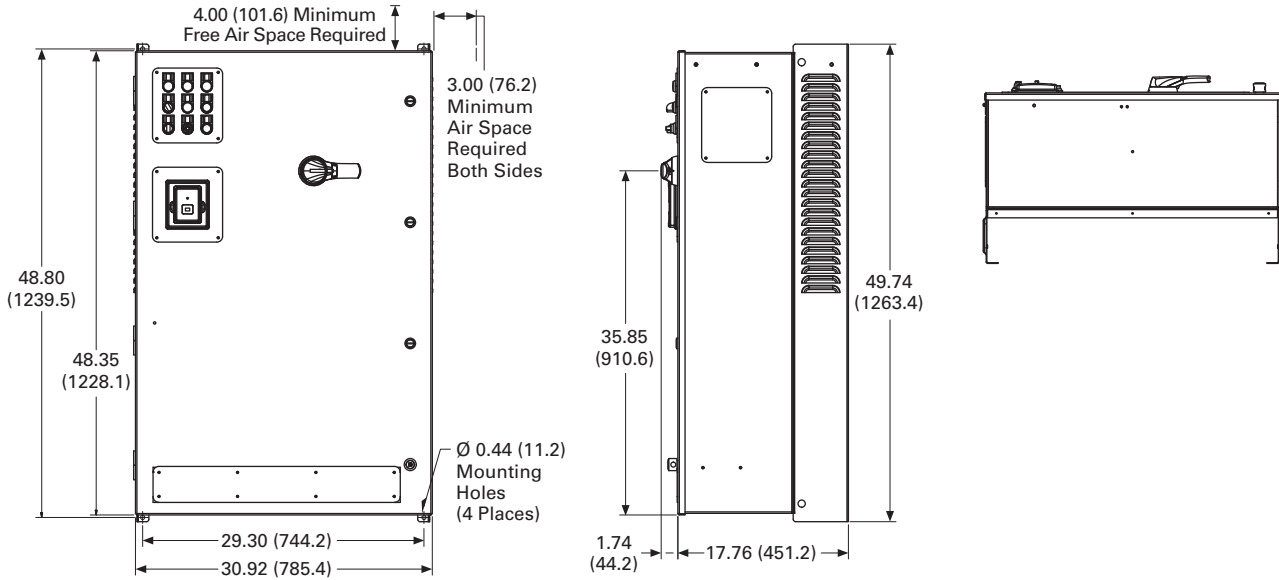
## Adjustable Frequency Drives

### Clean Power Drives

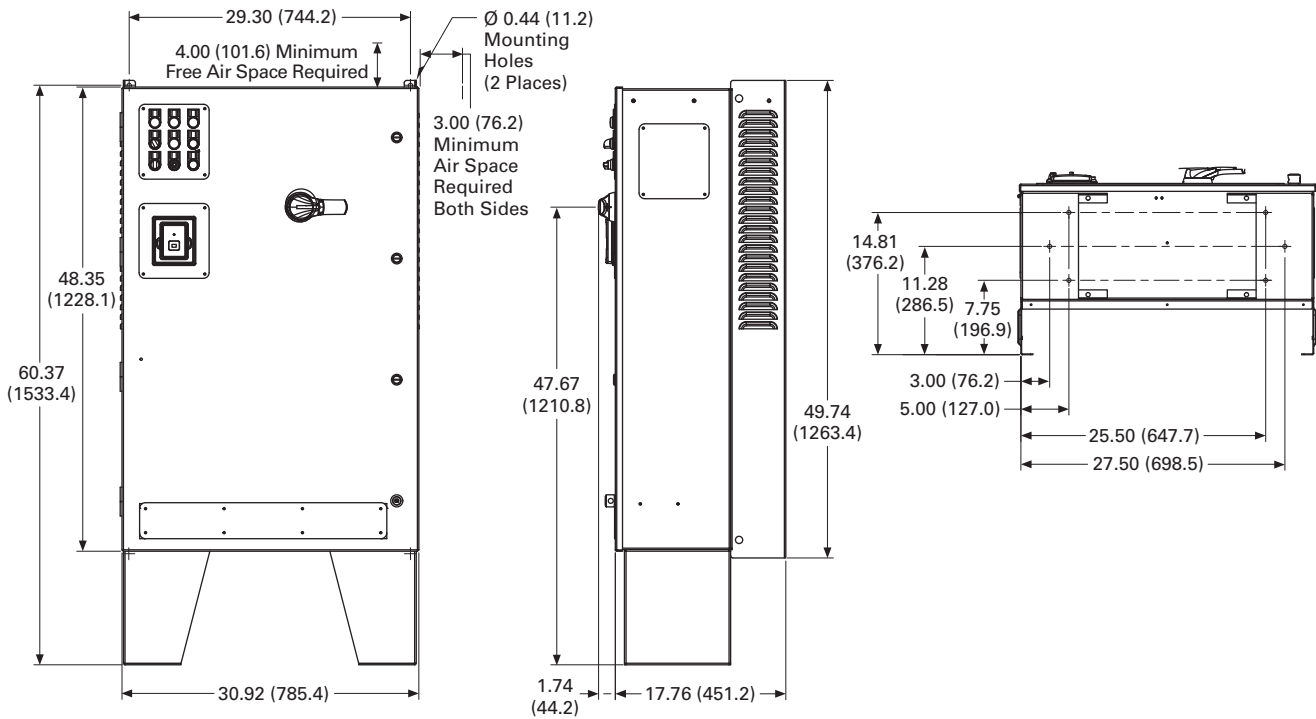
Approximate Dimensions in Inches (mm)

2

#### CX Box Type 12

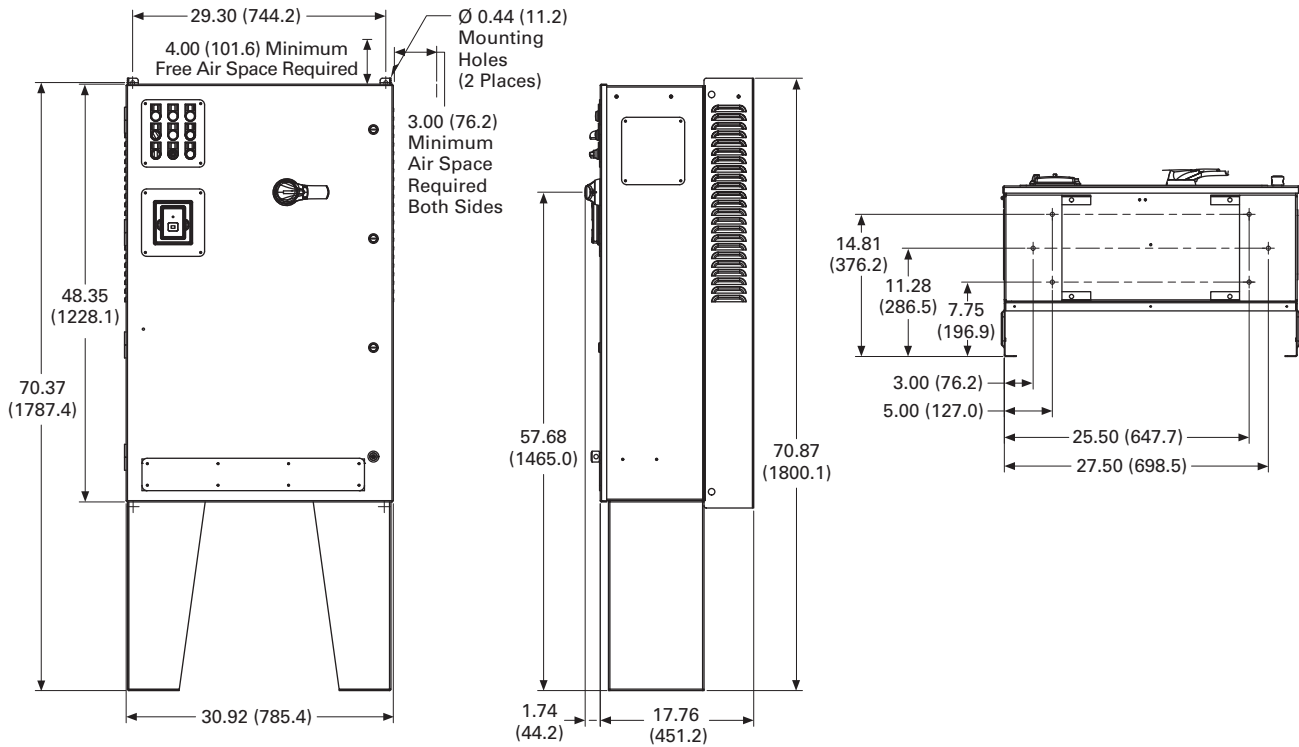


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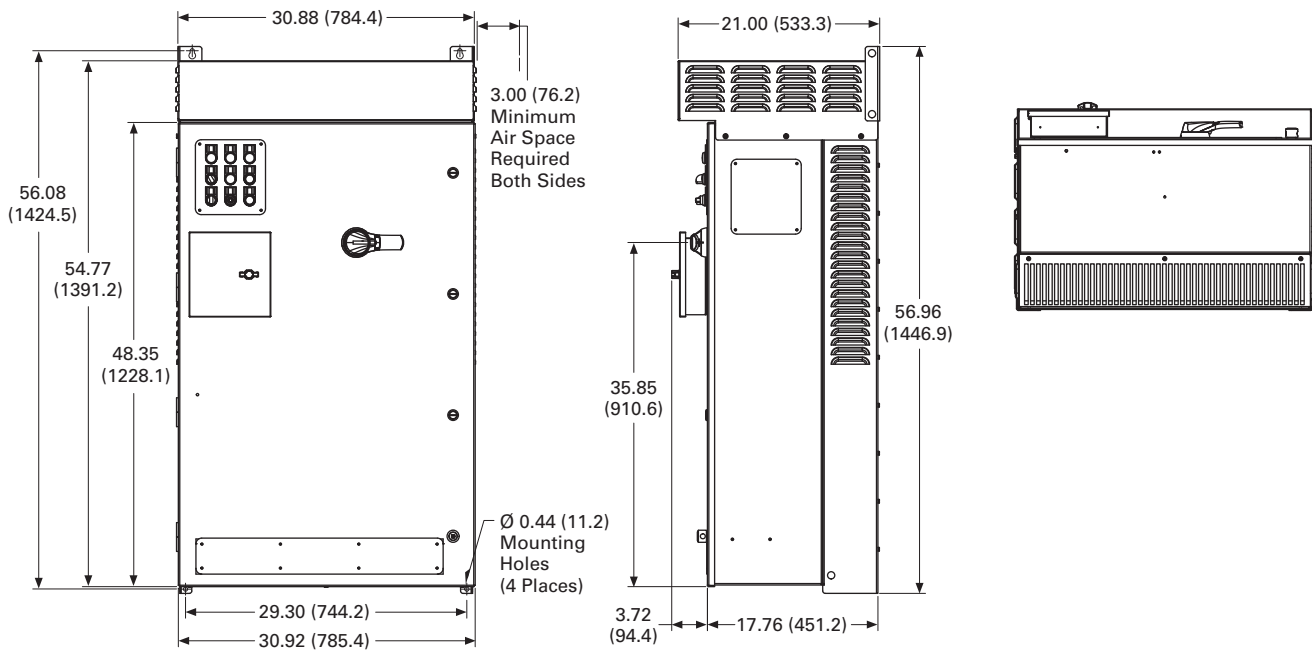


Approximate Dimensions in Inches (mm)

### CX Box Type 12–22 Inch Floor Stands



### CX Box Type 3R



# 2.11

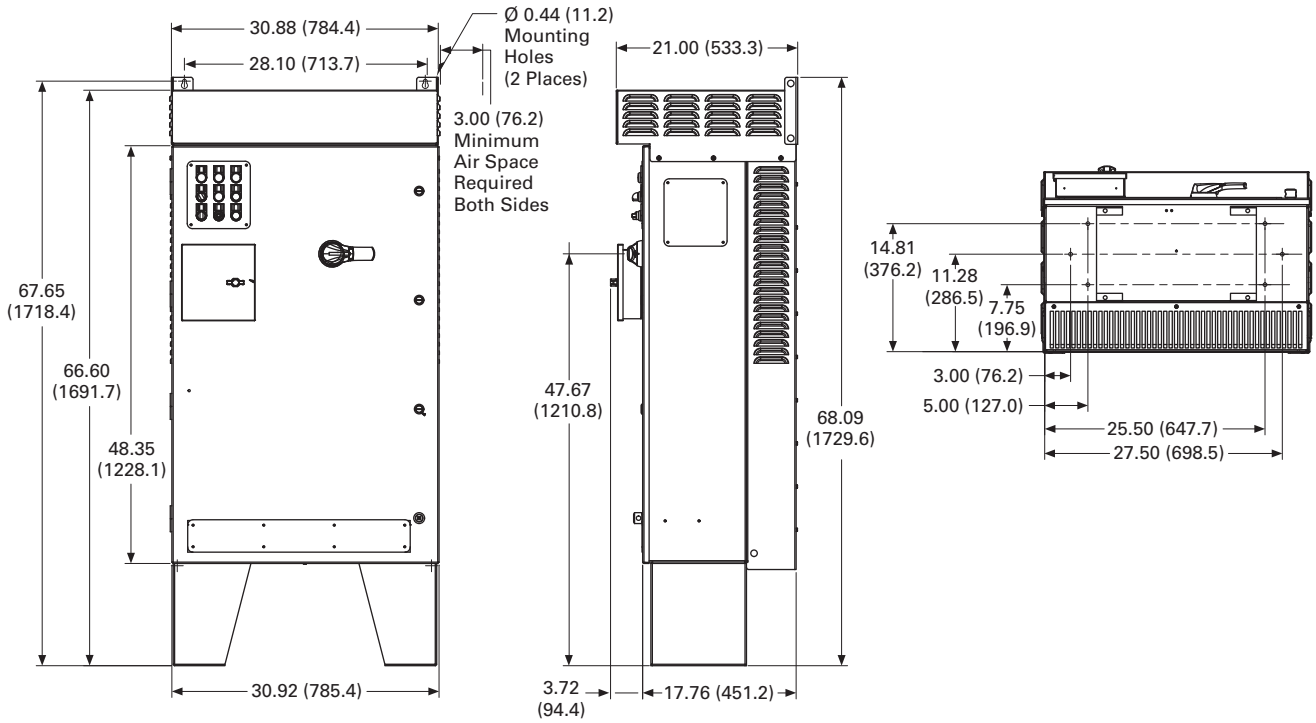
## Adjustable Frequency Drives

### Clean Power Drives

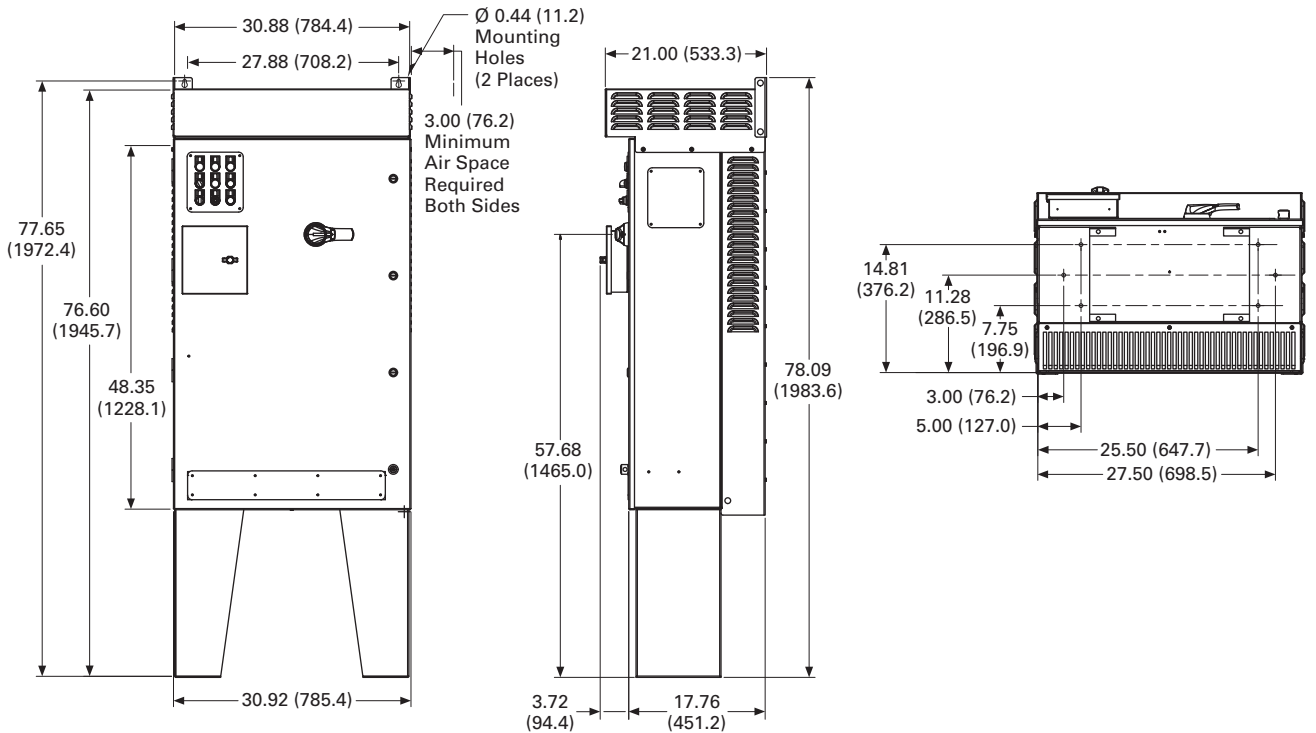
Approximate Dimensions in Inches (mm)

2

#### CX Box Type 3R—12 Inch Floor Stands

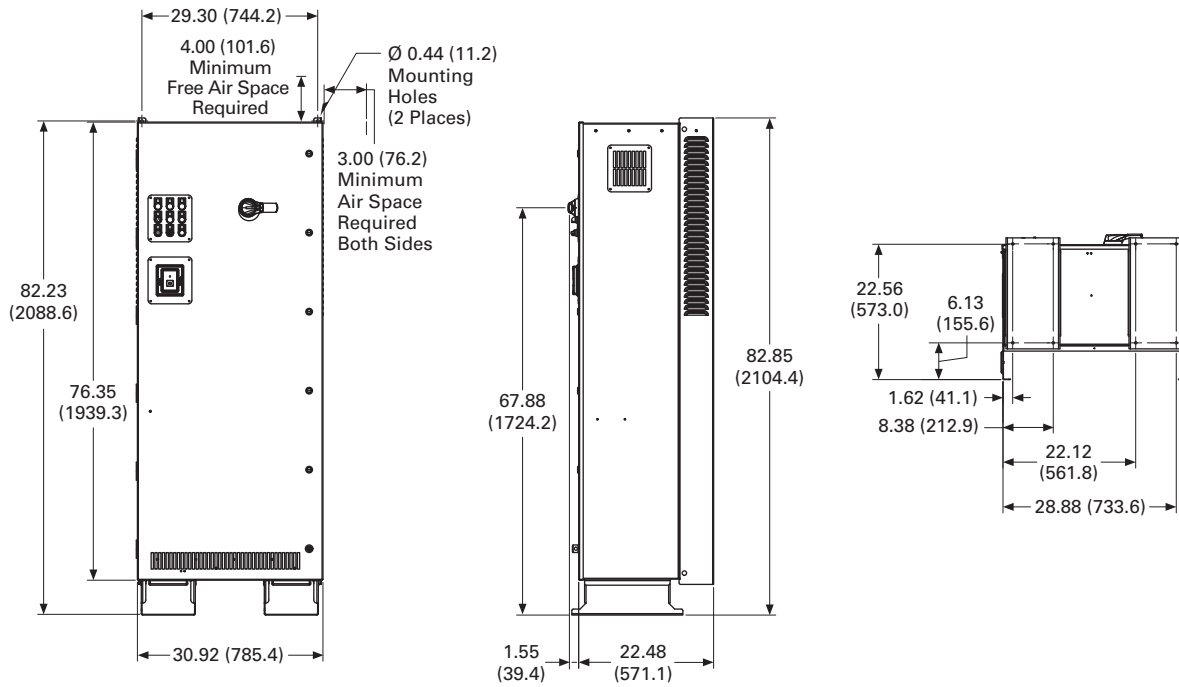


#### CX Box Type 3R—22 Inch Floor Stands

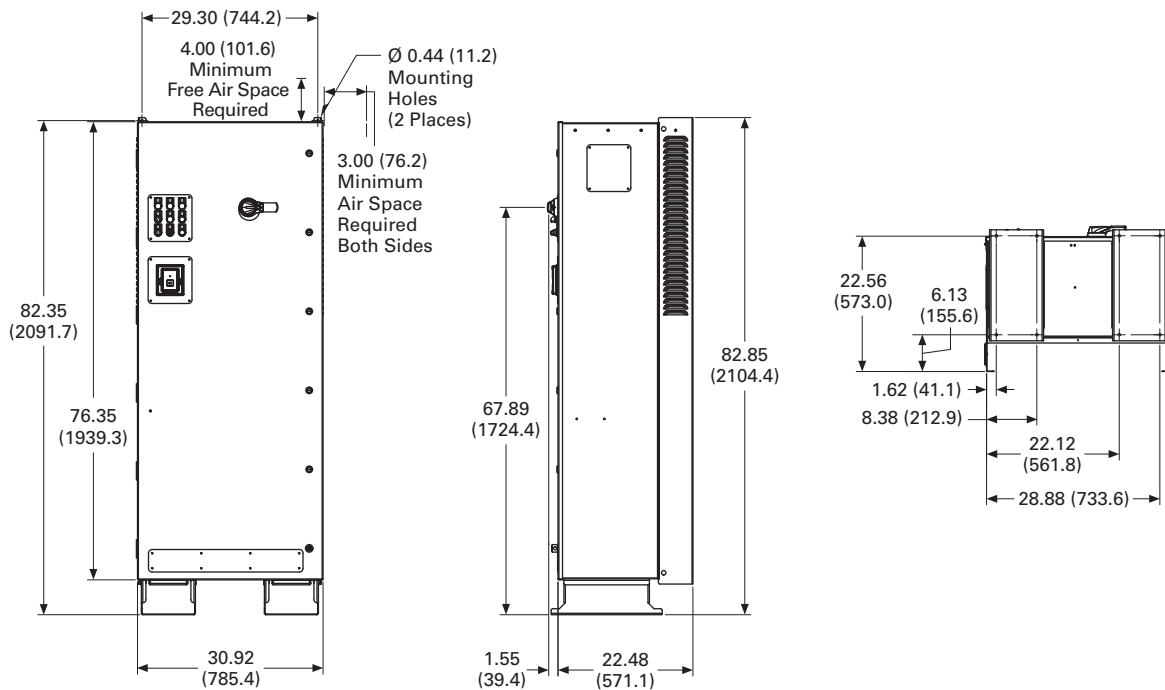


Approximate Dimensions in Inches (mm)

### DX Box Type 1



### DX Box Type 12





# 2.11

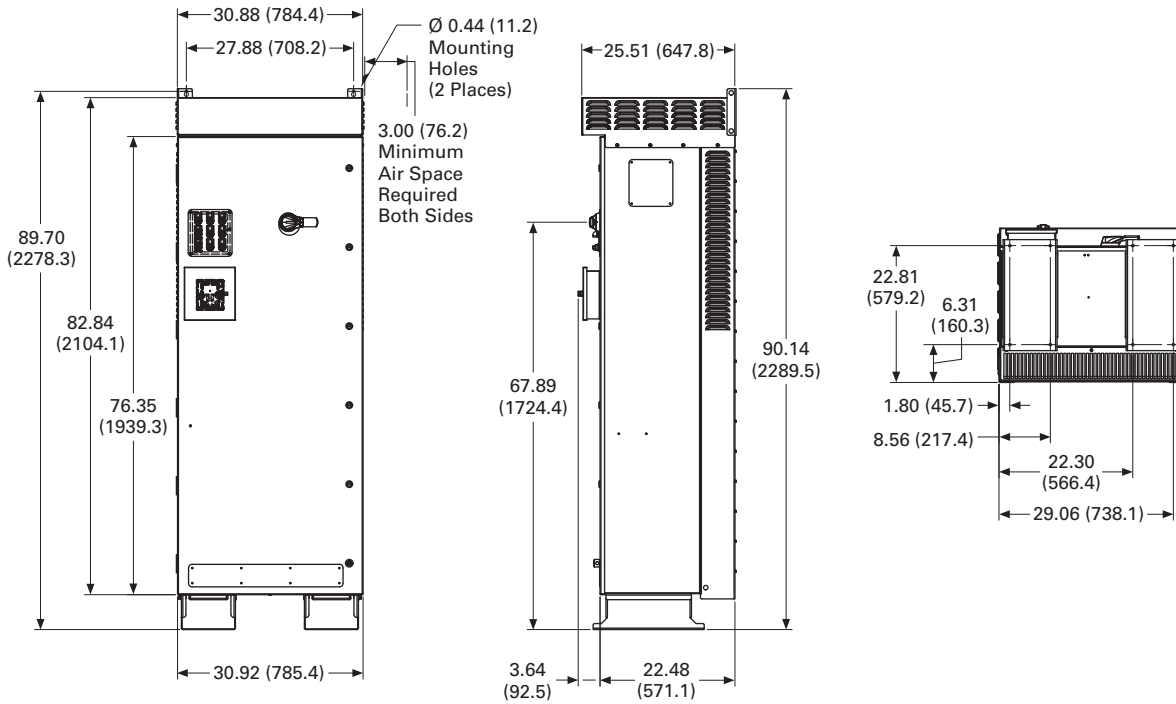
## Adjustable Frequency Drives

### Clean Power Drives

Approximate Dimensions in Inches (mm)

#### DX Box Type 3R

2



**CFX Enclosed Drives****CFX Enclosed Drives****Product Description**

The enclosed passive filtered drive also delivers True Power Factor—in addition to reducing harmonic distortion, the enclosed passive filtered drive prevents transformer overheating and overloading of breakers and feeders, which enables the application of adjustable frequency drives on generators and other high impedance power systems.

**Features and Benefits**

The CFX passive filtered drive features include (at 480 V):

- UL Type 1, UL Type 12, UL Type 3R and NEMA 1 with gaskets and filters
- Input voltage: 480 V
- Complete range of control, network and power options
- Horsepower range:
  - 480 V, 7-1/2–400 hp  $I_L$
- Single enclosure for both drive and filter reduces field wiring and enables convenient bypass installation
- Packaged solution ensures optimal coordination of drive and filter

**Contents****Description****Page**

Clean Power Drives Overview .....	<b>V6-T2-298</b>
Enclosed Passive Filtered Drives	
EGF Enclosed Drives .....	<b>V6-T2-305</b>
CFX Enclosed Drives	
Product Identification .....	<b>V6-T2-326</b>
Catalog Number Selection .....	<b>V6-T2-327</b>
Product Selection .....	<b>V6-T2-329</b>
Enclosure Selection .....	<b>V6-T2-332</b>
Options .....	<b>V6-T2-333</b>
Technical Data and Specifications .....	<b>V6-T2-334</b>
Wiring Diagram .....	<b>V6-T2-336</b>
Dimensions .....	<b>V6-T2-337</b>
Enclosed 12-Pulse Drives .....	<b>V6-T2-351</b>
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Enclosed Regenerative Drives .....	<b>V6-T2-379</b>

**Standards and Certifications**

- UL
- cUL
- 508C



# 2.11

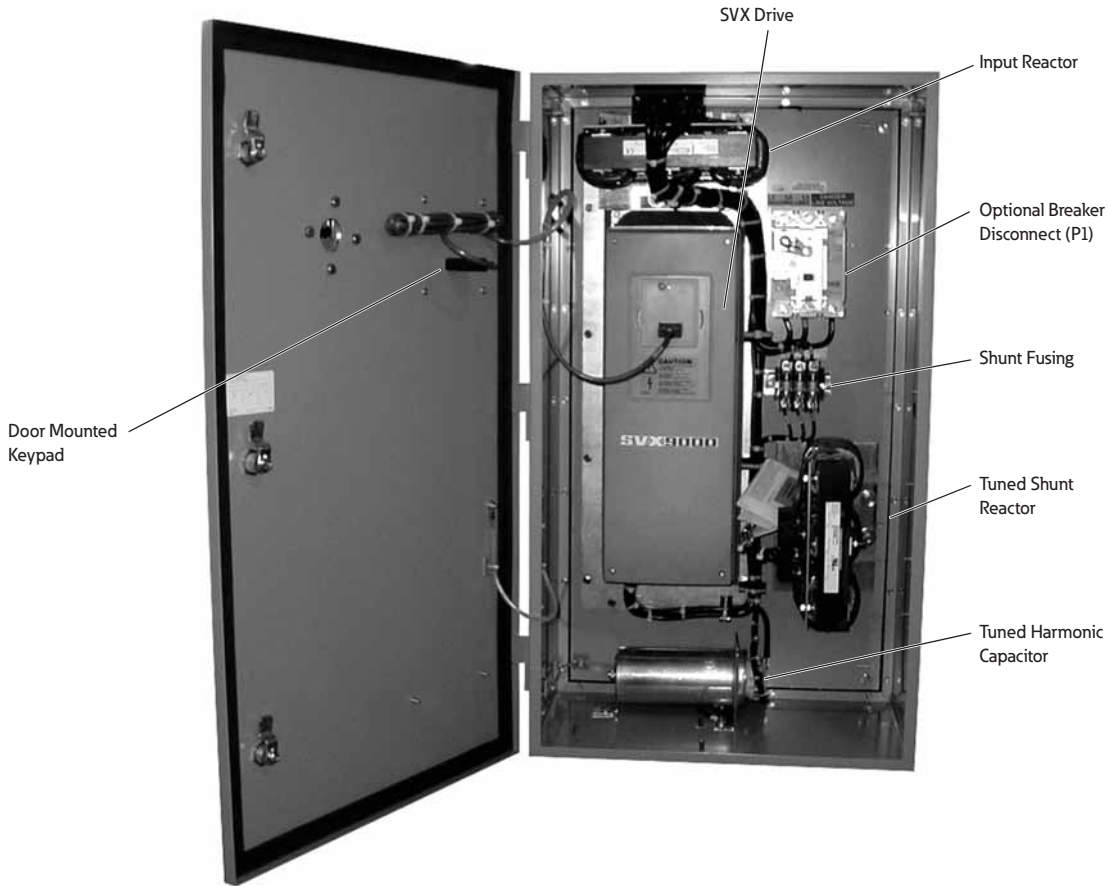
## Adjustable Frequency Drives

Clean Power Drives

### Product Identification

2

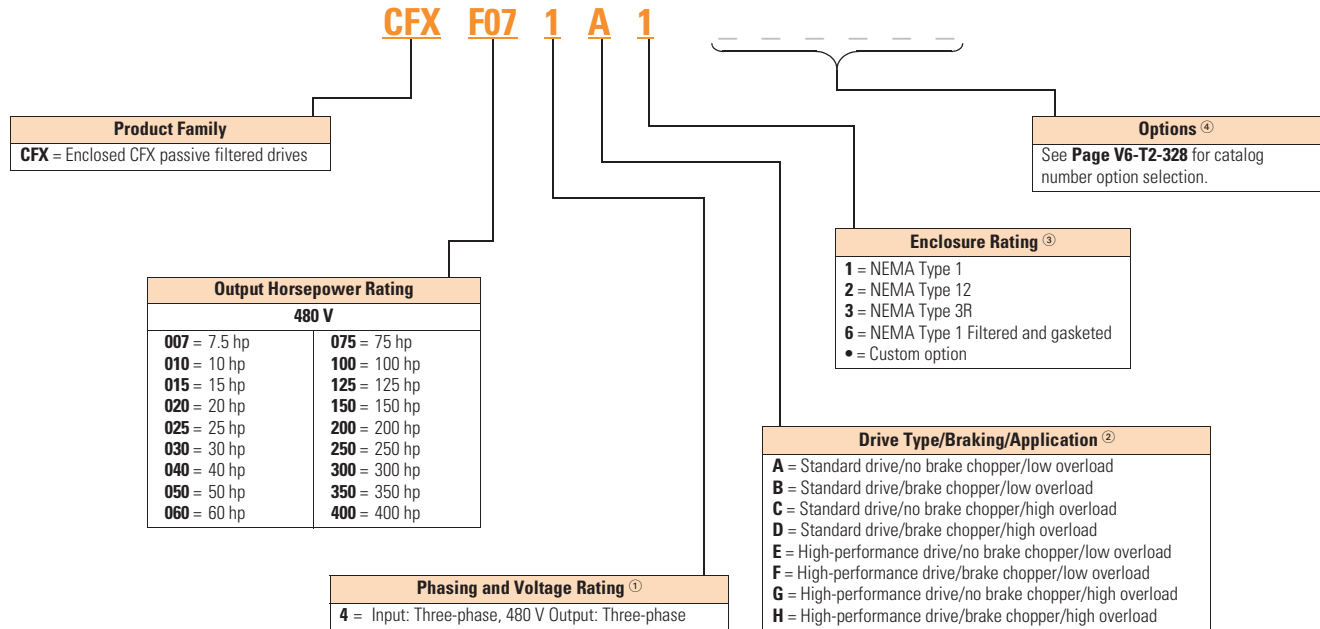
#### Enclosed Passive Filtered Drive—UL Type 12, 40 hp



## Catalog Number Selection

Catalog Number Selection is for reference only. Not all option combinations may be available.

### CFX Enclosed—Base Catalog Number



#### Notes

- ① Single-phase voltage refers to the supply voltage. Output voltage will be three-phase and equal to the magnitude of the input voltage.
- ② Brake chopper is a factory-installed option only. Braking resistors sold separately. See SVX catalog section for selection.
- ③ Additional enclosure options including NEMA 4 and 4X are available. Please contact the factory for configuration and pricing.
- ④ Part number configuration continued on the following page.

# 2.11

## Adjustable Frequency Drives

### Clean Power Drives

Catalog Number Selection is for reference only. Not all option combinations may be available.

#### CFX Enclosed—Catalog Number Options

2

**CFX F07 1 A 1**

**2 0 0 B 1 0 0 0 0**

**Base Catalog Number Example**  
See **Page V6-T2-327** for base catalog number selection.

**Power Disconnect Options**

- 0 = None
- 1 = MCP disconnect ①
- 2 = Circuit breaker
- 3 = Circuit breaker/isolation fusing
- 5 = Circuit breaker/isolation fusing/SPD
- 8 = Circuit breaker/SPD
- E = Isolation fuses
- G = Isolation fuses/SPD
- = Custom option ②

**Bypass Options ③**

- 0 = None
- 1 = Manual HOA bypass
- 2 = Manual HOA bypass/isolation fusing
- 4 = Manual HOA bypass/isolation fusing/SPD
- 7 = Manual HOA bypass/SPD
- H = Manual HOA RVSS bypass
- J = Manual HOA RVSS bypass/isolation fusing
- L = Manual HOA RVSS bypass/isolation fusing/SPD
- P = Manual HOA RVSS bypass/SPD
- = Custom option ②

**Output Power Options ④**

- 0 = None
- A = Output contactor
- B = 3% Output reactor
- D = dV/dt filter
- E = 3% Output Reactor/output contactor
- G = dV/dt/output contactor
- = Custom option ②

**Control Options ⑤**

- 0 = None
- 1 = Speed pot
- 2 = Start-stop pushbutton
- 3 = Start-stop pushbutton with speed pot
- A = HOA switch
- B = Start-stop pushbutton with speed pot & HOA switch
- C = Start-stop pushbutton with HOA switch
- D = HOA switch with speed pot
- = Custom option ②

**Option Boards 2**  
Same options and codes as Option Boards 1

**Option Boards 1**

- 0 = No option
- 6 = 6 DI, 1 ext +24 Vdc/EXT +24 Vdc
- 7 = 1 RO (NC-NO), 1 RO (NO), 1 therm
- 8 = 1 AI (mA isolated), 2 AO (mA isolated), 1 ext +24 Vdc/EXT +24 Vdc
- 9 = 3 RO (NO)
- A = 1 ext +24 Vdc/EXT +24 Vdc, 3 Pt100
- B = 1 RO (NO), 5 DI 42–240 Vac input
- C = Encoder low volt +5 V / 15 V / 24 V (high-performance drive only)
- D = Encoder high volt +15 V / 24 V (high-performance drive only)
- E = Double encoder (high-performance drive only)
- = Custom option ②

**Communication Options**

- 0 = No option
- 1 = PROFIBUS-DP
- 2 = LonWorks
- 3 = CANopen (slave)
- 4 = DeviceNet
- 5 = PROFIBUS-DP (D9 connector)
- 6 = Modbus
- 7 = Modbus (D9 connector)
- 8 = Johnson Controls N2
- 9 = Modbus TCP
- A = BACnet
- B = EtherNet/IP
- C = RS-232 with D9 connector
- = Custom option ②

**Enclosure Options**

- 0 = None
- 1 = Floor stand—12 inches
- 2 = Floor stand—22 inches
- A = Space heater
- B = Space heater & 12-inch floor stands
- C = Space heater & 22-inch floor stands
- = Custom option ②

**Light Options ⑥**

- 0 = None
- 1 = Non-bypass light kit—Power On, Run, Fault
- 2 = Bypass light kit—On, VFD Run, Fault, Bypass Run
- = Custom option ②

**Notes**

- ① HMCP disconnect option required and only available when bypass is selected.
- ② More options are available as Engineered to Order through the Bid Manager tool.
- ③ All bypass options include third contactor for drive isolation when in bypass mode.
- ④ Output contactor not available with bypass. Bypass comes standard with output contactor.
- ⑤ Pilot devices are 22 mm standard. 30 mm options are available as engineered to order through the Bid Manager tool.

## Product Selection

## 480 V Drives

## CFX Enclosed Drives



## 480 V Drives—Constant Torque (CT)/High Overload (H) Enclosed Drives

hp	Current (A)	Drive Frame Size	NEMA Type 1	NEMA Type 12	NEMA Type 3R
			Base Catalog Number ①	Base Catalog Number ①	Base Catalog Number ①
7.5	11	5	CFX0074D1	CFX0074D2	CFX0074D3
10	14	5	CFX0104D1	CFX0104D2	CFX0104D3
15	21	5	CFX0154D1	CFX0154D2	CFX0154D3
20	27	6	CFX0204D1	CFX0204D2	CFX0204D3
25	34	6	CFX0254D1	CFX0254D2	CFX0254D3
30	40	6	CFX0304D1	CFX0304D2	CFX0304D3
40	52	7	CFX0404C1	CFX0404C2	CFX0404C3
50	65	7	CFX0504C1	CFX0504C2	CFX0504C3
60	77	7	CFX0604C1	CFX0604C2	CFX0604C3
75	96	8	CFX0754C1	CFX0754C2	CFX0754C3
100	124	8	CFX1004C1	CFX1004C2	CFX1004C3
125	156	8	CFX1254C1	CFX1254C2	CFX1254C3
150	180	9	CFX1504C1	CFX1504C2	CFX1504C3
200	240	9	CFX2004C1	CFX2004C2	CFX2004C3
250	302	10	CFX2504G1	CFX2504G2	CFX2504G3
300	361	10	CFX3004G1	CFX3004G2	CFX3004G3
350	414	10	CFX3504G1	CFX3504G2	CFX3504G3

## CFX Enclosed Drives



## 480 V Drives—Variable Torque (VT)/Low Overload (L) Enclosed Drives

hp	Current (A)	Drive Frame Size	NEMA Type 1	NEMA Type 12	NEMA Type 3R
			Base Catalog Number ①	Base Catalog Number ①	Base Catalog Number ①
7.5	11	4	CFX0074B1	CFX0074B2	CFX0074B3
10	14	5	CFX0104B1	CFX0104B2	CFX0104B3
15	21	5	CFX0154B1	CFX0154B2	CFX0154B3
20	27	5	CFX0204B1	CFX0204B2	CFX0204B3
25	34	6	CFX0254B1	CFX0254B2	CFX0254B3
30	40	6	CFX0304B1	CFX0304B2	CFX0304B3
40	52	6	CFX0404B1	CFX0404B2	CFX0404B3
50	65	7	CFX0504A1	CFX0504A2	CFX0504A3
60	77	7	CFX0604A1	CFX0604A2	CFX0604A3
75	96	7	CFX0754A1	CFX0754A2	CFX0754A3
100	124	8	CFX1004A1	CFX1004A2	CFX1004A3
125	156	8	CFX1254A1	CFX1254A2	CFX1254A3
150	180	8	CFX1504A1	CFX1504A2	CFX1504A3
200	240	9	CFX2004A1	CFX2004A2	CFX2004A3
250	302	10	CFX2504E1	CFX2504E2	CFX2504E3
300	361	10	CFX3004E1	CFX3004E2	CFX3004E3
350	414	10	CFX3504E1	CFX3504E2	CFX3504E3
400	477	10	CFX4004E1	CFX4004E2	CFX4004E3

**Note**

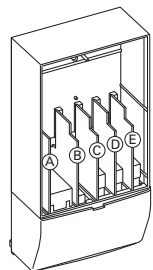
① Table is for base catalog number reference only. For complete catalog number selection, see Page V6-T2-327.

### Enclosed Passive Filtered Drive Option Board Kits

The enclosed passive filtered drive series can accommodate a wide selection of expander and adapter option boards to customize the drive for your application needs. The drive's control unit is designed to accept a total of five option boards.

The enclosed passive filtered drive series factory-installed standard board configuration includes an A9 I/O board and an A2 relay output board, which are installed in slots A and B.

#### Option Boards



#### Option Board Kits

Option Kit Description <sup>①</sup>	Allowed Slot Locations <sup>②</sup>	Field Installed Catalog Number	Factory Installed Option Designator	SVX Ready Programs						
				Basic	Local/Remote	Standard	MSS	PID	Multi-P.	PFC
<b>Standard I/O Cards</b>										
2 RO (NC/NO)	B	<b>OPTA2</b>	—	■	■	■	■	■	■	■
6 DI, 1 DO, 2 AI, 1 AO, 1 +10 Vdc ref, 2 ext +24 Vdc/ext +24 Vdc	A	<b>OPTA9</b>	—	■	■	■	■	■	■	■
<b>Extended I/O Cards</b>										
6 DI	B, C, <b>D</b> , E	<b>OPTB1</b>	<b>B1</b>	—	—	—	—	—	■	■
1 RO (NC/NO), 1 RO (NO), 1 therm	B, C, <b>D</b> , E	<b>OPTB2</b>	<b>B2</b>	—	—	—	—	—	■	■
1 AI (mA isolated), 2 AO (mA isolated)	B, C, <b>D</b> , E	<b>OPTB4</b>	<b>B4</b>	■	■	■	■	■	■	■
3 RO (NO)	B, C, <b>D</b> , E	<b>OPTB5</b>	<b>B5</b>	—	—	—	—	—	■	■
3 Pt100 RTD board	B, C, <b>D</b> , E	<b>OPTB8</b>	<b>B8</b>	—	—	—	—	—	■	—
1 RO (NO), 5 DI 42–240 Vac input	B, C, <b>D</b> , E	<b>OPTB9</b>	<b>B9</b>	—	—	—	—	—	■	■
<b>Communication Cards <sup>③</sup></b>										
Modbus	D, <b>E</b>	<b>OPTC2</b>	<b>C2</b>	■	■	■	■	■	■	■
Modbus TCP	D, <b>E</b>	<b>OPTC1</b>	<b>C1</b>	■	■	■	■	■	■	■
BACnet	D, <b>E</b>	<b>OPTCJ</b>	<b>CJ</b>	■	■	■	■	■	■	■
EtherNet/IP	D, <b>E</b>	<b>OPTCQ</b>	<b>CQ</b>	■	■	■	■	■	■	■
Johnson Controls N2	D, <b>E</b>	<b>OPTC2</b>	<b>CA</b>	■	■	■	■	■	■	■
PROFIBUS DP	D, <b>E</b>	<b>OPTC3</b>	<b>C3</b>	■	■	■	■	■	■	■
LonWorks	D, <b>E</b>	<b>OPTC4</b>	<b>C4</b>	■	■	■	■	■	■	■
PROFIBUS DP (D9 connector)	D, <b>E</b>	<b>OPTC5</b>	<b>C5</b>	■	■	■	■	■	■	■
CANopen (slave)	D, <b>E</b>	<b>OPTC6</b>	<b>C6</b>	■	■	■	■	■	■	■
DeviceNet	D, <b>E</b>	<b>OPTC7</b>	<b>C7</b>	■	■	■	■	■	■	■
Modbus (D9 type connector)	D, <b>E</b>	<b>OPTC8</b>	<b>C8</b>	■	■	■	■	■	■	■
RS-232 with D9 connection	D, <b>E</b>	<b>OPTD3</b>	<b>D3</b>	■	■	■	■	■	■	■

#### Notes

- ① AI = Analog Input; AO = Analog Output; DI = Digital Input; DO = Digital Output; RO = Relay Output  
 ② Option card must be installed in one of the slots listed for that card. Slot indicated in bold is the preferred location.  
 ③ OPTC2 is a multi-protocol option card.

**Modbus RTU Network Communications**

The Modbus Network Card OPTC2 is used for connecting the SVX Drive as a slave on a Modbus network. The interface is connected by a 9-pin DSUB connector (female) and the baud rate ranges from 300 to 19,200 baud. Other communication parameters include an address range from 1 to 247; a parity of None, Odd or Even; and the stop bit is 1.

**PROFIBUS Network Communications**

The PROFIBUS Network Card OPTC3 is used for connecting the SVX Drive as a slave on a PROFIBUS-DP network. The interface is connected by a 9-pin DSUB connector (female). The baud rates range from 9.6 Kbaud to 12 Mbaud, and the addresses range from 1 to 127.

**LonWorks Network Communications**

The LonWorks Network Card OPTC4 is used for connecting the SVX Drive on a LonWorks network. This interface uses Standard Network Variable Types (SNVT) as data types. The channel connection is achieved using a FTT-10 A Free Topology transceiver via a single twisted transfer cable. The communication speed with LonWorks is 78 kBits/s.

**CANopen (Slave) Communications**

The CANopen (Slave) Network Card OPTC6 is used for connecting the SVX Drive to a host system. According to ISO11898 standard cables to be chosen for CANbus should have a nominal impedance of 120 ohms, and specific line delay of nominal 5 as/m. 120 ohm line termination resistors required for installation.

**DeviceNet Network Communications**

The DeviceNet Network Card OPTC7 is used for connecting the SVX Drive on a DeviceNet Network. It includes a 5.08 mm pluggable connector. Transfer method is via CAN using a two-wire twisted shielded cable with two-wire bus power cable and drain. The baud rates used for communication include 125 Kbaud, 250 Kbaud and 500 Kbaud.

**Johnson Controls Metasys N2 Network Communications**

The OPTC2 fieldbus board provides communication between the SVX Drive and a Johnson Controls Metasys™ N2 network. With this connection, the drive can be controlled, monitored and programmed from the Metasys system. The N2 fieldbus is available as a factory-installed option and as a field-installable kit.

**Modbus/TCP Network Communications**

The Modbus/TCP Network Card OPTC1 is used for connecting the SVX Drive to Ethernet networks using Modbus protocol. It includes an RJ-45 pluggable connector. This interface provides a selection of standard and custom register values to communicate drive parameters. The board supports 10 Mbps and 100 Mbps communication speeds. The IP address of the board is configurable over Ethernet using a supplied software tool.

**BACnet Network Communications**

The BACnet Network Card OPTCJ is used for connecting the SVX Drive to BACnet networks. It includes a 5.08 mm pluggable connector. Data transfer is Master-Slave/Token Passing (MS/TP) RS-485. This interface uses a collection of 30 Binary Value Objects (BVOs) and 35 Analog Value Objects (AVOs) to communicate drive parameters. The card supports 9.6, 19.2 and 38.4 Kbaud communication speeds and supports network addresses 1 to 127.

**EtherNet/IP Network Communications**

The EtherNet/IP Network Card OPTCK is used for connecting the SVX Drive to Ethernet/Industrial Protocol networks. It includes an RJ-45 pluggable connector. The interface uses CIP objects to communicate drive parameters (CIP is "Common Industrial Protocol," the same protocol used by DeviceNet). The board supports 10 Mbps and 100 Mbps communication speeds. The IP address of the board is configurable by Static, BOOTP and DHCP methods.



# 2.11

## Adjustable Frequency Drives

### Clean Power Drives

#### Enclosure Selection

2

##### CFX Drives

Enclosure selection charts are based on physical space limitations only and only to be used as a reference. For actual enclosure sizing, refer to Bid Manager.

**Note:** Filtered enclosure sizing includes dedicated space for passive filter, input fuses, circuit breaker or fusible disconnect, CPT, SPD, heater/thermostat, control relay and terminal blocks.

##### Filtered Enclosure X-Space

Enclosure Size	Frame 4	Frame 5	Frame 6	Frame 7	Frame 8
AX	—	—	—	—	—
BX	0	0	—	—	—
CX	3	3	2	2	—
DX	14	14	13	13	10

##### Filtered Power Options X-Space

Power Options	Frame 4	Frame 5	Frame 6	Frame 7	Frame 8
3% Output reactor	1	1	3	5	6
dV/dt filter	3	3	3	5	6
Output contactor	1	1	1	1	1

##### Larger Frame Enclosure Sizes

Frame Size	Type 1	Type 12	Type 1 Filtered and Gasketed	Type 3R
Frame 9	Size 8	—	Size 8	Size F
Frame 10	Size 9	Size 9	—	①

**Note:** Filtered bypass enclosure sizing includes dedicated space for a passive filter, input fuses, MCP, CPT, input contactor, output bypass contactors, overload relay, SPD, heater/thermostat, control relay and terminal blocks.

##### Filtered Bypass Enclosure X-Space

Enclosure Size	Frame 4	Frame 5	Frame 6	Frame 7	Frame 8
AX	—	—	—	—	—
BX	—	—	—	—	—
CX	2	1	0	—	—
DX	13	12	11	10	6

##### Filtered Bypass Power Options X-Space

Power Options	Frame 4	Frame 5	Frame 6	Frame 7	Frame 8
RVSS Bypass	1	1	3	5	6
3% Output reactor	2	2	2	3	4
dV/dt filter	3	3	3	5	6

##### Larger Frame Enclosure Sizes

Frame Size	Type 1	Type 12	Type 1 Filtered and Gasketed	Type 3R
Frame 9	Size 8	—	Size 8	Size F
Frame 10	Size 9	Size 9	—	①

**Note**

① Consult factory.

## Options

### Input Power Options

Option	Description
HMCP Disconnect	The HMCP motor protection circuit breaker uses an electronic trip unit to provide typical motor overload relay functionality and short-circuit protection against potential phase-to-phase or phase-to-ground faults.
Circuit Breaker	Utilizes a circuit breaker to provide a means of short-circuit protection for the power cables between it and the drive, and protection from high-level ground faults on the power cable. Allows a convenient means of disconnecting the drive from the line, and the operating mechanism can be padlocked in the OFF position. This is factory mounted in the enclosure.
Isolation Fusing	Provides high-level fault protection of the drive input power circuit from the load side of the fuses to the input side of the power transistors. This option consists of three 200 kA fuses that are factory mounted in the enclosure.
3% Input Reactor	The input reactor is a three-phase series inductance on the line side of an AFD. It is used to provide a reduction in voltage and current harmonics. It also provides increased input protection for AFD and its semiconductors from line transients.
SPD	Provides a UL 1449 surge protection device (SPD) rated for 40 kA/ph that is connected to the line side terminals.
Fused Disconnect	Utilizes fusing to provide a means of short-circuit protection for the power cables between it and the drive, and protection from high-level ground faults on the power cable. Allows a convenient means of disconnecting the drive from the line, and the operating mechanism can be padlocked in the OFF position. This is factory mounted in the enclosure.

### Bypass Options

Option	Description
Manual HOA Bypass	Provides a three-position selector switch that allows the user to select either a HAND or AUTO mode of operation. HAND mode is defaulted keypad operation, and AUTO mode is defaulted to control from an external terminal source. These modes of operation can be configured via programming to allow for alternate combinations of start and speed sources. Start and speed sources include keypad, I/O and fieldbus.
Manual HOA RVSS Bypass	This option adds a reduced voltage soft starter to bypass assembly for soft starting in bypass mode.

### Output Power Options

Option	Description
Output Contactor	Provides a means for positive disconnection of the drive output from the motor terminals. The contactor coil is controlled by the drive's run or permissive logic. NC and NO auxiliary contacts rated at 10 A, 600 Vac are provided for customer use. This option includes a low VA 115 Vac fused control power transformer and is factory mounted in the enclosure.
3% Output Reactor	The output reactor is a three-phase series inductance on the load side of a VFD. It is used to reduce transient voltage (dv/dt) and peak voltages at the motor terminals. A 3% output filter is recommended for motor cable lengths up to 300 ft (10 m).
dV/dt Filter	Used to reduce the transient voltage (dV/dt) at the motor terminals. Recommended for motor cable lengths over 300 ft (10 m) and up to 1000 ft (304.8 m). This option is mounted in the enclosure.

### Control Options

Option	Description
Speed Pot	Provides the ability to adjust the frequency reference using a door-mounted potentiometer. This option uses the 10 Vdc reference to generate a 0–10 V signal at the analog voltage input signal terminal. When the HOA bypass option is added, the speed is controlled when the HOA switch is in the HAND position. Without the HOA bypass option, a two-position switch (labeled local/remote) is provided on the keypad to select speed reference from the speed potentiometer or a remote speed signal.
HOA Switch	Provides a three-position selector switch that allows the user to select either a HAND or AUTO mode of operation. HAND mode is defaulted to keypad operation, and AUTO mode is defaulted to control from an external terminal source. These modes of operation can be configured via drive programming to allow for alternate combinations of start and speed sources. Start and speed sources include Keypad, I/O and fieldbus.
Start-Stop Pushbutton	Provides door-mounted START and STOP pushbuttons for either bypass or non-bypass configurations.

### Light Options

Option	Description
Non-Bypass Light Kit—Power On, Run, Fault	Provides a white POWER ON light that indicates power to the enclosed cabinet, a green RUN light that indicates the drive is running and a red FAULT light that indicates a drive fault has occurred.
Bypass Light Kit—On, VFD Run, Fault, Bypass Run	Provides a white POWER ON light that indicates power to the enclosed cabinet, a green RUN light that indicates the drive is running, a red FAULT light that indicates a drive fault has occurred and an amber light that indicates when the motor is running in Bypass mode.

### Enclosure Options

Option	Description
Floor Stand 12 in	Converts a normally wall-mounted enclosure to a floor-standing enclosure with a height of 12 in (304.8 mm).
Floor Stand 22 in	Converts a normally wall-mounted enclosure to a floor-standing enclosure with a height of 22 in (558.8 mm).

## Technical Data and Specifications

## 2

### Enclosed Passive Filtered Drives

Description	Specification
<b>Primary Design Features</b>	
45–66 Hz input frequency	Standard
Output: AC volts maximum	Input Voltage Base
Output frequency range	0–320 Hz
Initial output current ( $I_H$ )	250% for 2 seconds
Overload (1 minute [ $I_H/I_L$ ])	150%/110%
Enclosure space heater	Optional
Oversize enclosure	Standard
Output contactor	Optional
Bypass motor starter	Optional
Listings	UL, cUL, 508C
<b>Protection Features</b>	
Incoming line fuses	Optional
AC input circuit disconnect	Optional
Phase rotation insensitive	Standard
EMI filter	Standard—FR6 thru FR9 <sup>①</sup>
Input phase loss protection	Standard
Input overvoltage protection	Standard
Line surge protection	Standard
Output short-circuit protection	Standard
Output ground fault protection	Standard
Output phase protection	Standard
Overtemperature protection	Standard
DC overvoltage protection	Standard
Drive overload protection	Standard
Motor overload protection	Standard
Programmer software	Optional
Local/remote keypad	Standard
Keypad lockout	Standard
Fault alarm output	Standard
Built-in diagnostics	Standard
Surge protective device	Optional

Description	Specification
<b>Input/Output Interface Features</b>	
Setup adjustment provisions	
Remote keypad/display	Standard
Personal computer	Standard
Operator control provisions	
Drive mounted keypad/display	Standard
Remote keypad/display	Standard
Conventional control elements	Standard
Serial communications	Optional
115 Vac control circuit	Optional
Speed setting inputs	
Keypad	Standard
0–10 Vdc potentiometer/voltage signal	Standard
4–20 mA isolated	Configurable
4–20 mA differential	Configurable
3–15 psig	Optional
Analog outputs	
Speed/frequency	Standard
Torque/load/current	Programmable
Motor voltage	Programmable
Kilowatts	Programmable
0–10 Vdc signals	Configurable w/jumpers
4–20 mA DC signals	Standard
Isolated signals	Optional
Discrete outputs	
Fault alarm	Standard
Drive running	Standard
Drive at set speed	Programmable
Optional parameters	14
Dry contacts	2 relays Form C
Open collector outputs	1
Additional discrete outputs	Optional
<b>Communications</b>	
RS-232	Standard
RS-422/485	Optional
DeviceNet™	Optional
Modbus RTU	Optional
CANopen (slave)	Optional
PROFIBUS-DP	Optional
Lonworks®	Optional
Johnson Controls Metasys™ N2	Optional
EtherNet/IP/Modbus TCP	Optional
BACnet	Optional

#### Note

<sup>①</sup> The EMI filter is optional in FR10.

## Enclosed Passive Filtered Drives, continued

Description	Specification
<b>Performance Features</b>	
Sensorless vector control	Standard
Volts/hertz control	Standard
IR and slip compensation	Standard
Electronic reversing	Standard
Dynamic braking	Optional
DC braking	Standard
PID setpoint controller	Programmable
Critical speed lockout	Standard
Current (torque) limit	Standard
Adjustable acceleration/deceleration	Standard
Linear or S curve accel/decel	Standard
Jog at preset speed	Standard
Thread/preset speeds	7
Automatic restart	Selectable
Coasting motor start	Standard
Coast or ramp stop selection	Standard
Elapsed time meter	Optional
<b>Standard Conditions for Application and Service</b>	
Maximum operating ambient temperature	0 to 40 °C
Storage temperature	-40 to 60 °C
Humidity (maximum), non-condensing	95%
Altitude	100% load capacity (no derating) up to 3280 ft (1000 m); 1% derating for each 328 ft (100 m) above 3280 ft (1000 m); max. 9842 ft (3000 m)
Line voltage variation	+10/-15%
Line frequency variation	45-66 Hz
Efficiency	>96%
Power factor (displacement)	0.99

## Standard I/O Specifications

Description	Specification
Six-digital input programmable	24 V: "0" ≤10 V, "1" ≥18V, R <sub>i</sub> >5 kohms
Two-analog input configurable w/ jumpers	Voltage: 0-±10 V, R <sub>i</sub> >200 kohms Current: 0 (4)-20 mA, R <sub>i</sub> = 250 kohms
Two-digital output programmable	Form C relays 250 Vac or 30 Vdc 2 Amp resistive
One-digital output programmable	Open collector 48 Vdc 50 mA
One-analog output programmable configurable w/jumper	0-20 mA, R <sub>L</sub> max. 500 ohms 10 bits ±2%

## I/O Specifications for Control/Communication Options

Description	Specification
Analog voltage, input	0-±10 V, R <sub>i</sub> ≥200 kilohms
Analog current, input	0 (4)-20 mA, R <sub>i</sub> = 250 ohms
Digital input	24 V: "0" ≤10 V, "1" ≥18V, R <sub>i</sub> >5 kohms
Auxiliary voltage	24 V (±20%), max. 50 mA
Reference voltage	10 V ±3%, max. 10 mA
Analog current, output	0 (4)-20 mA, R <sub>L</sub> = 500 kilohms, resolution 10 bit, accuracy ≤±2%
Analog voltage, output	0 (2)-10 V, R <sub>L</sub> ≥1 kohm, resolution 10 bit, accuracy ≤±2%
Relay output max. switching voltage	300 Vdc, 250 Vac
Relay output max. switching load	3 A/24 Vdc, 300 Vdc, 250 Vac ②
Relay output max. continuous load	2 A rms
Thermistor input	R <sub>trip</sub> = 4.7 kohms

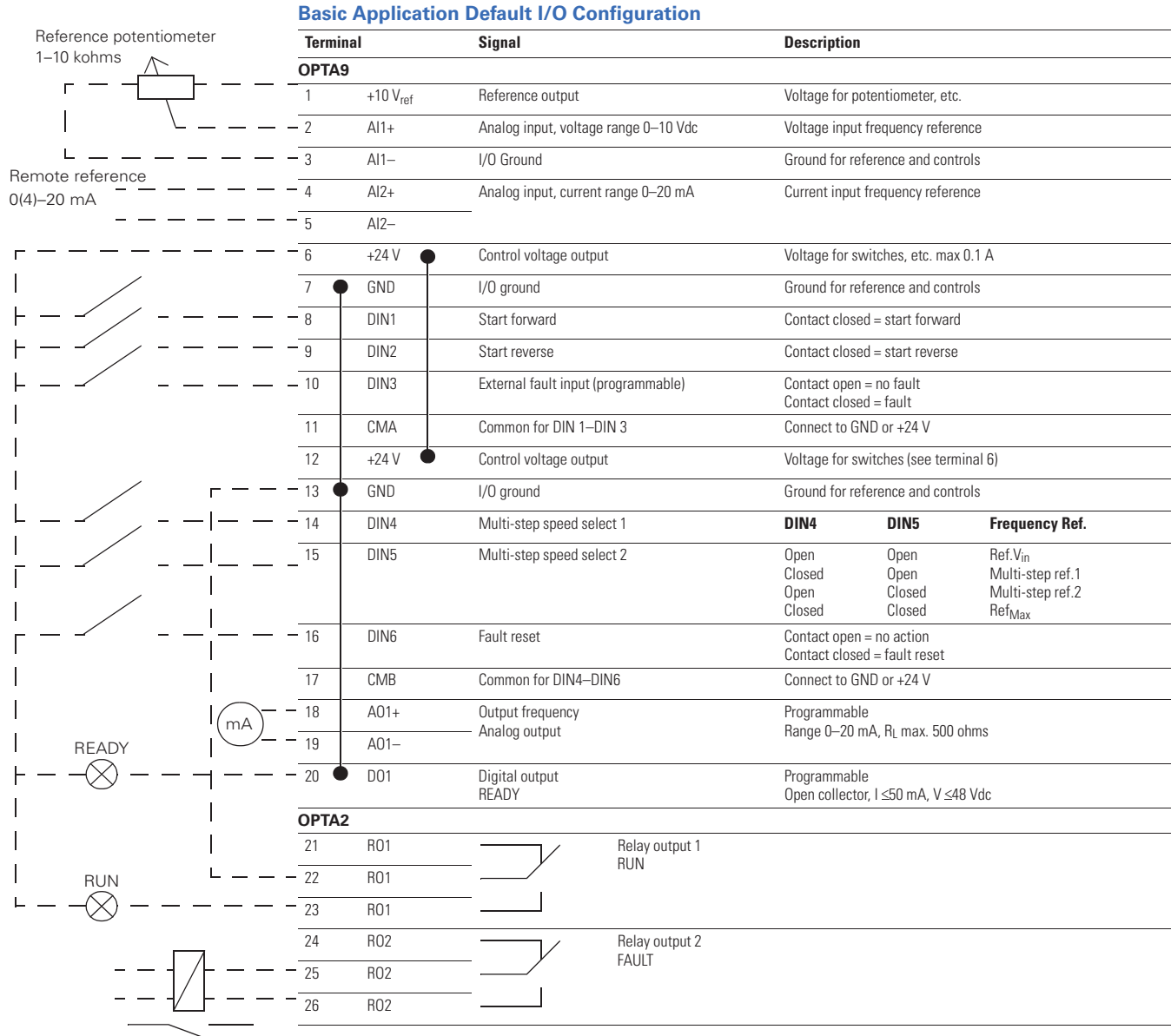
**Notes**

- ① Units FR10 rated 40 °C.  
② For applications above 3 A consult instruction manual.

#### Wiring Diagram

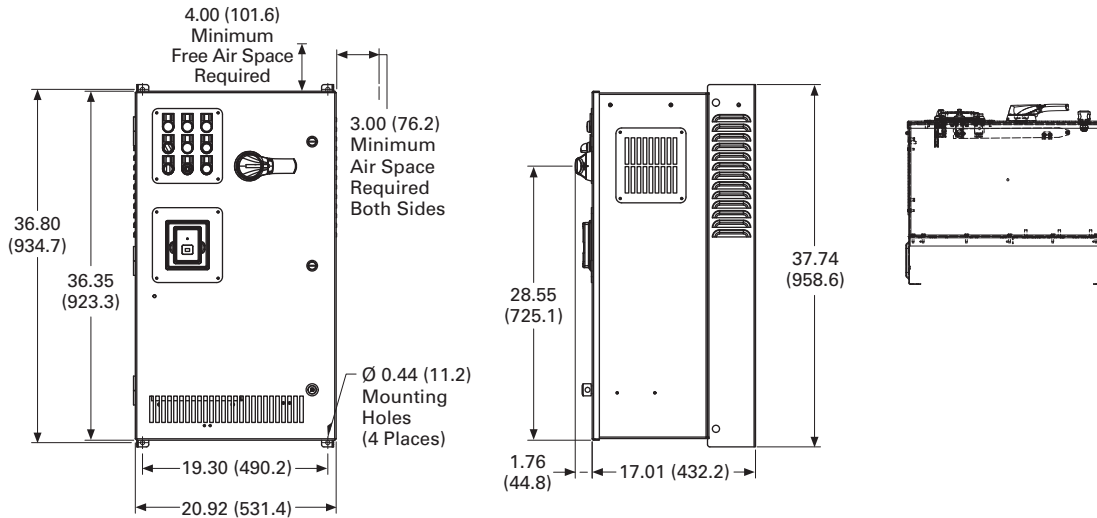
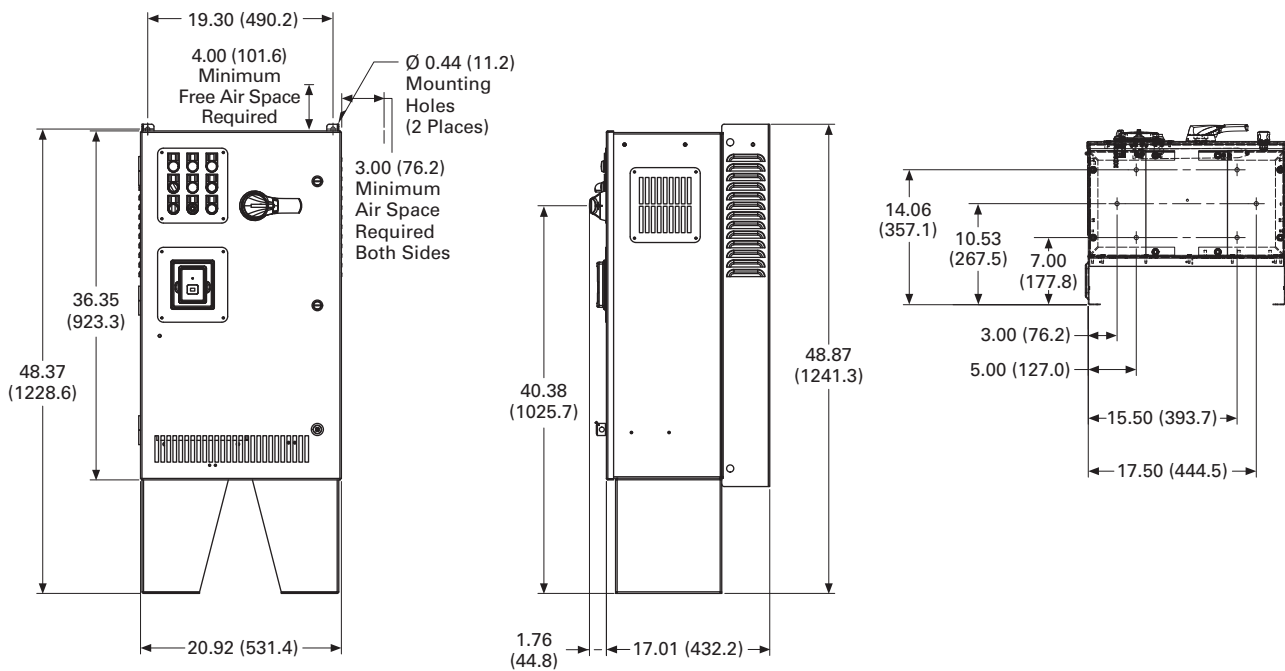
#### Control Input/Output

2



**Dimensions**

Approximate Dimensions in Inches (mm)

**BX Box Type 1****BX Box Type 1—12 Inch Floor Stands**

# 2.11

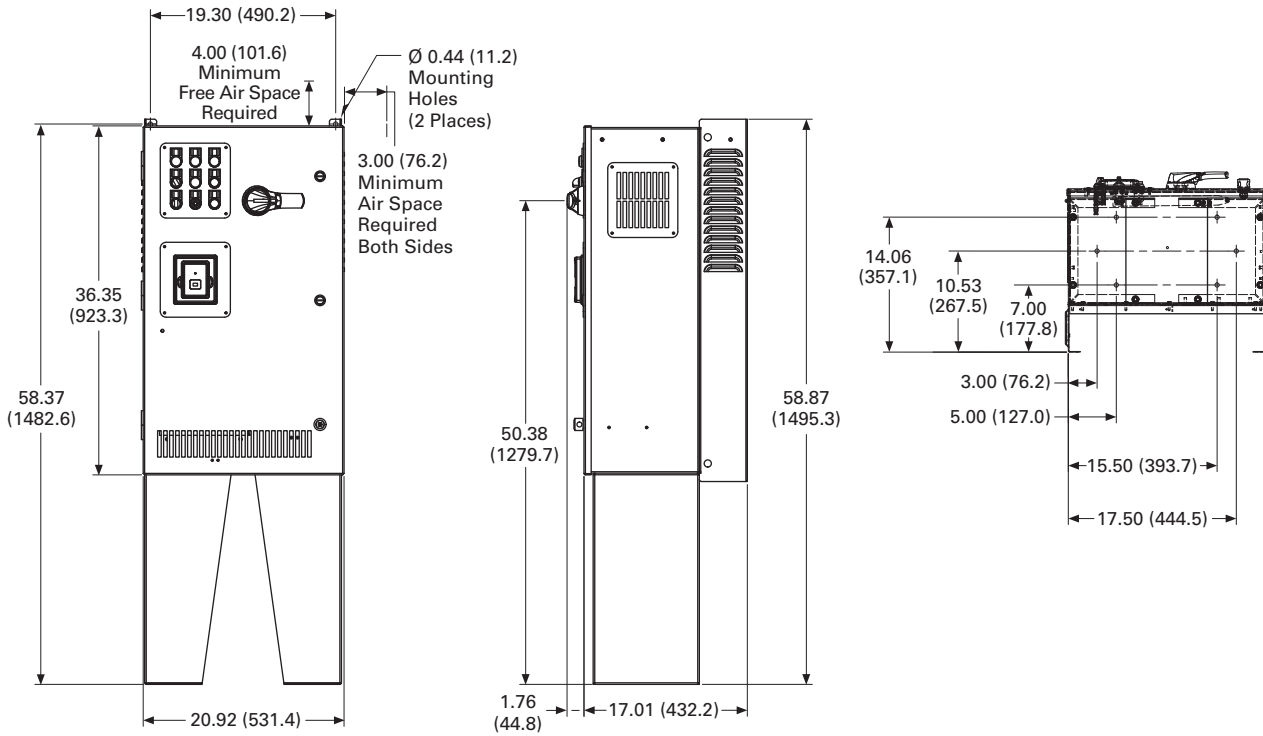
## Adjustable Frequency Drives

### Clean Power Drives

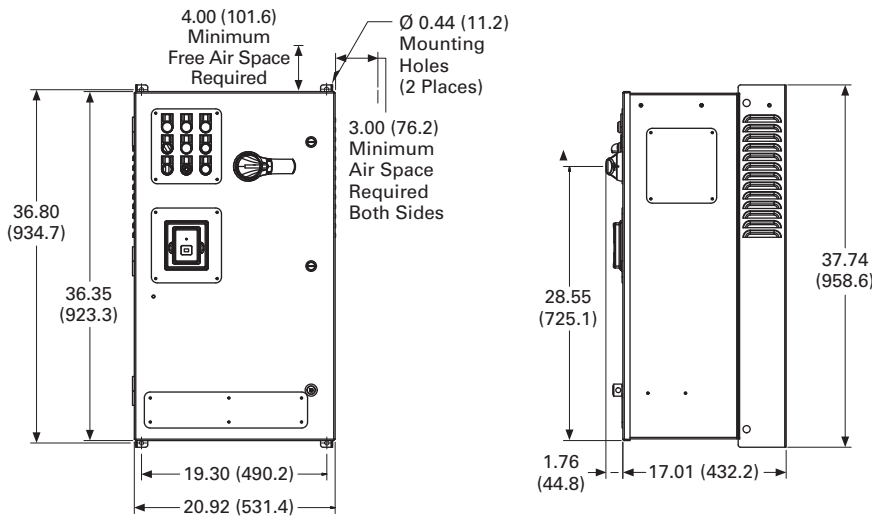
Approximate Dimensions in Inches (mm)

2

#### BX Box Type 1—22 Inch Floor Stands

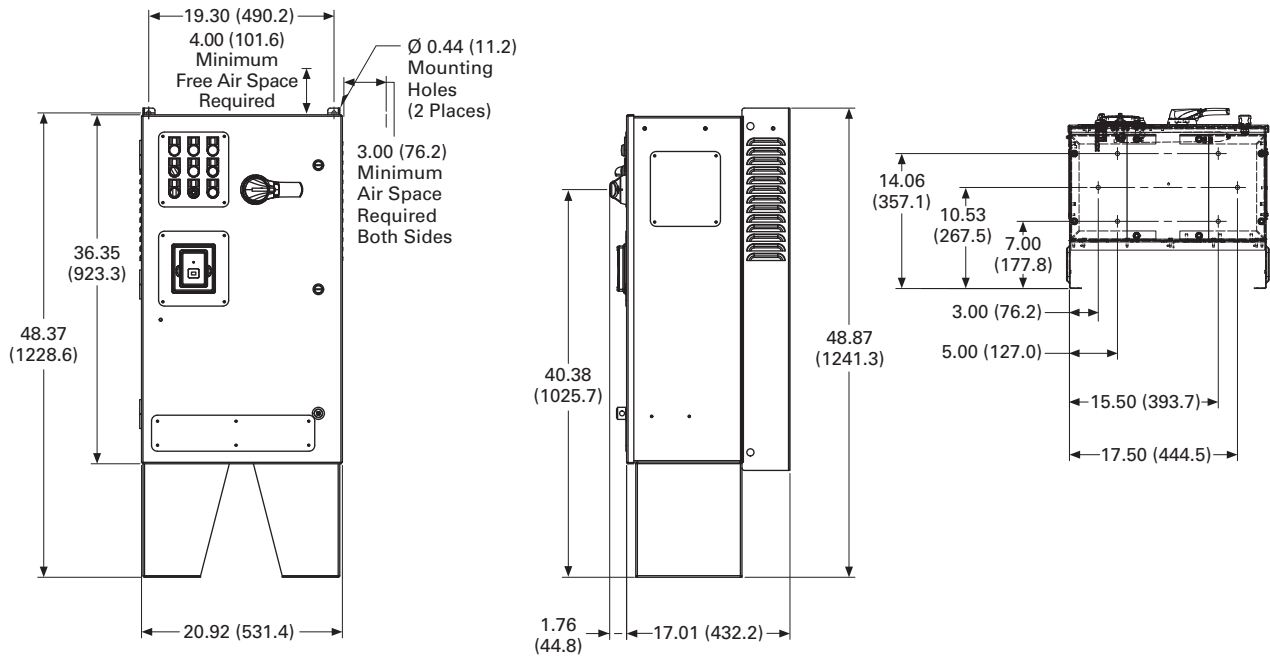


#### BX Box Type 12

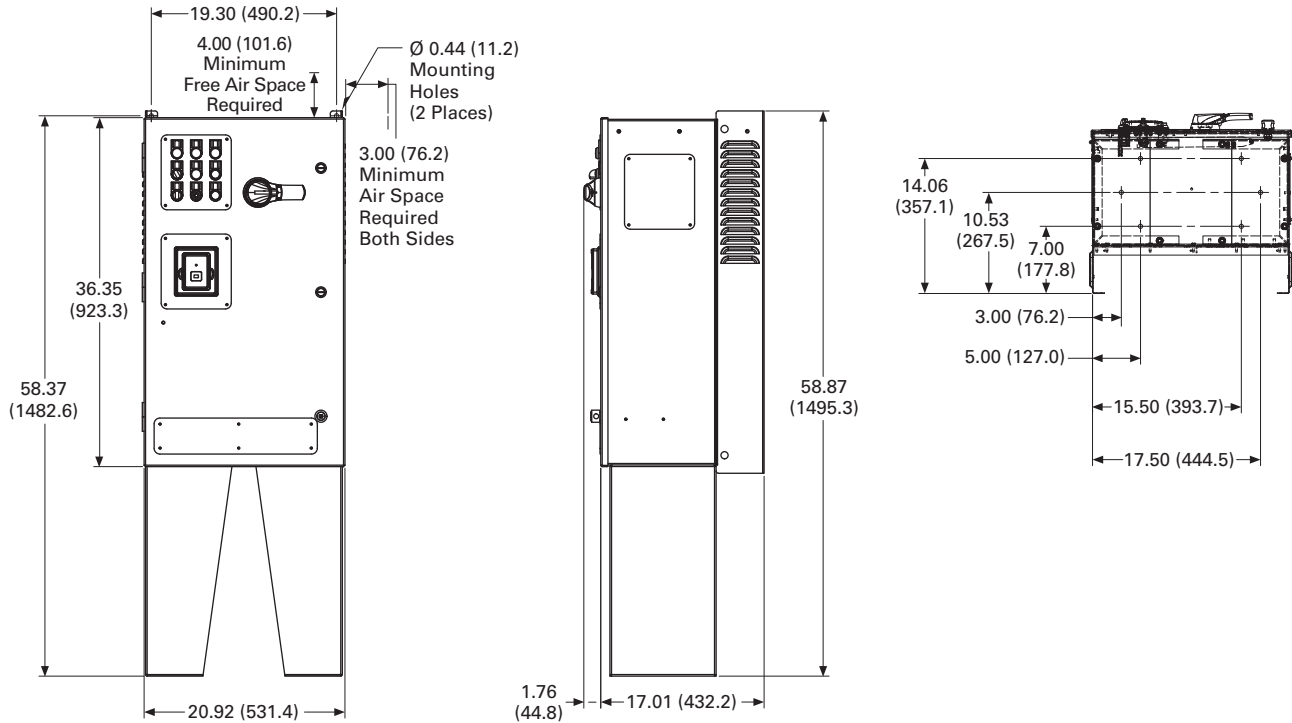


Approximate Dimensions in Inches (mm)

### BX Box Type 12—12 Inch Floor Stands



### BX Box Type 12—22 Inch Floor Stands





# 2.11

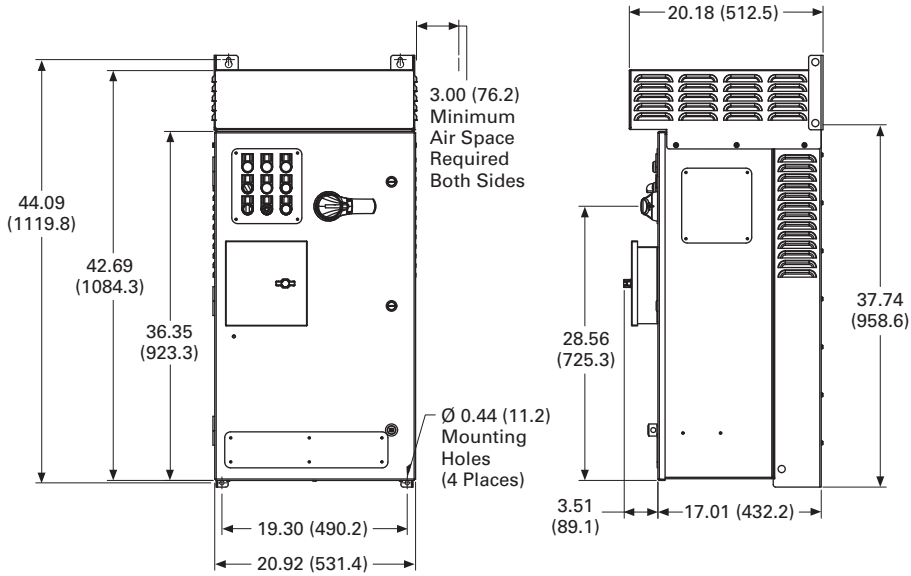
## Adjustable Frequency Drives

### Clean Power Drives

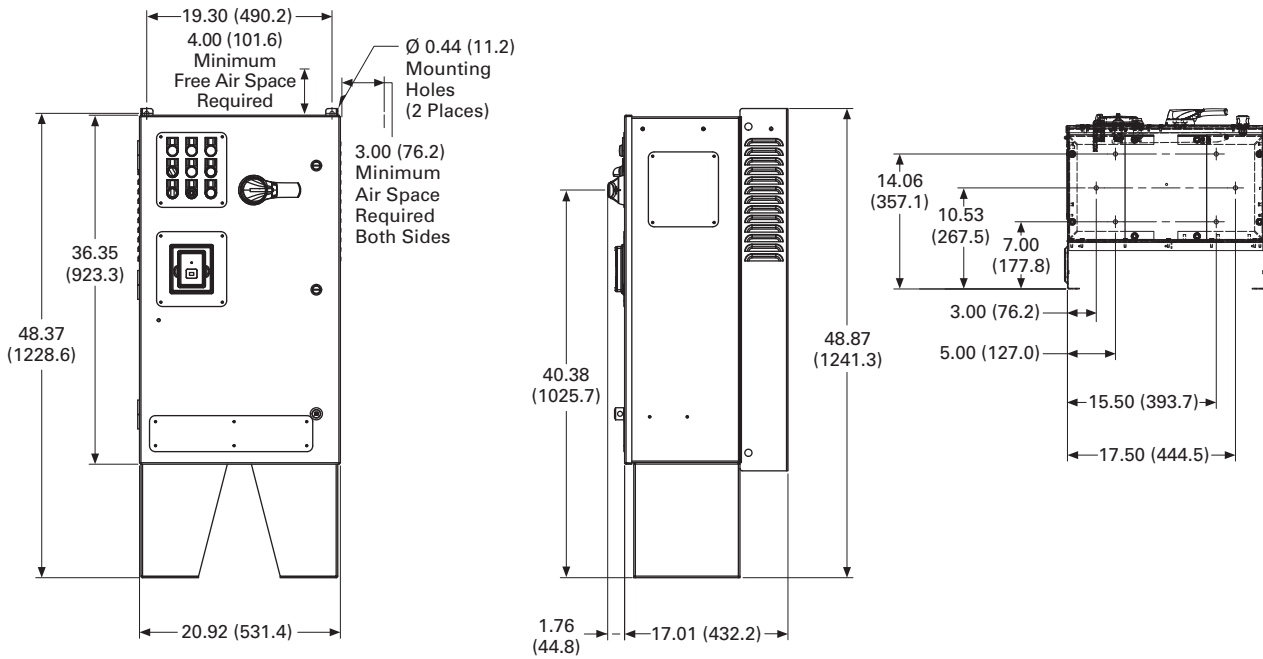
Approximate Dimensions in Inches (mm)

#### BX Box Type 3R

2

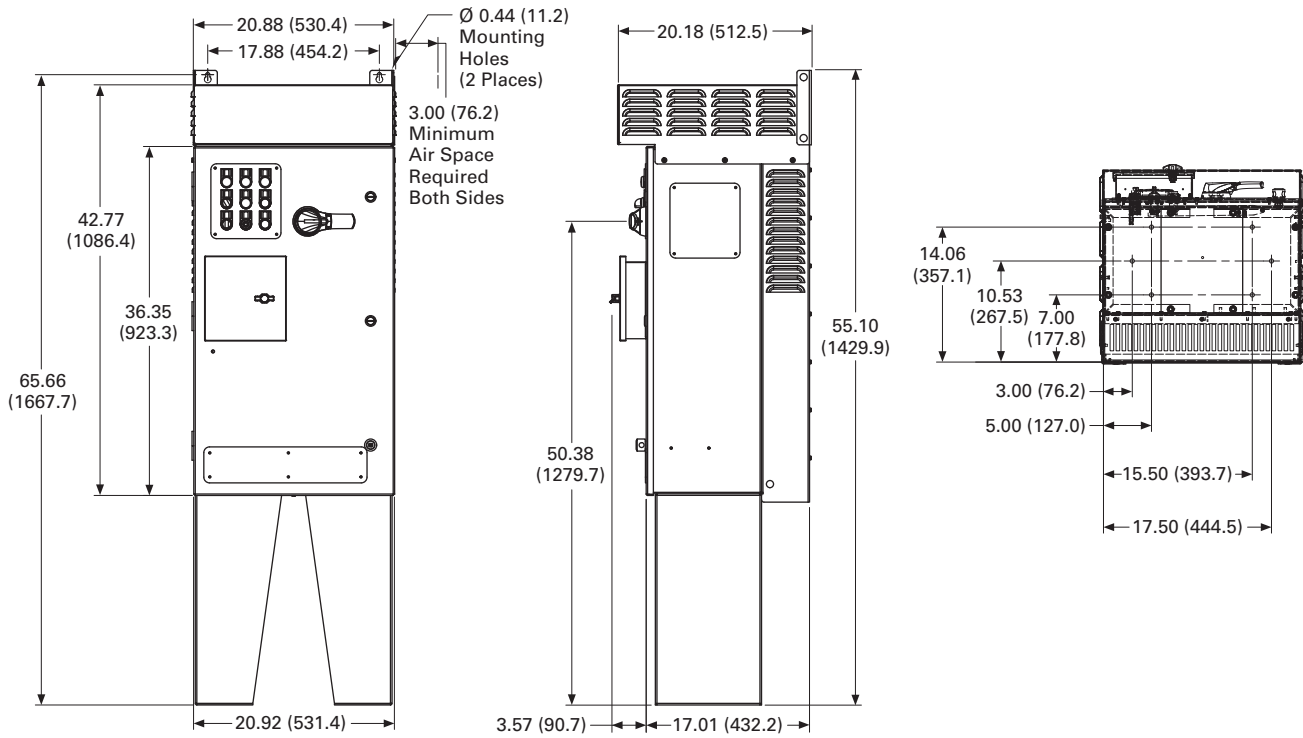


#### BX Box Type 3R—12 Inch Floor Stands

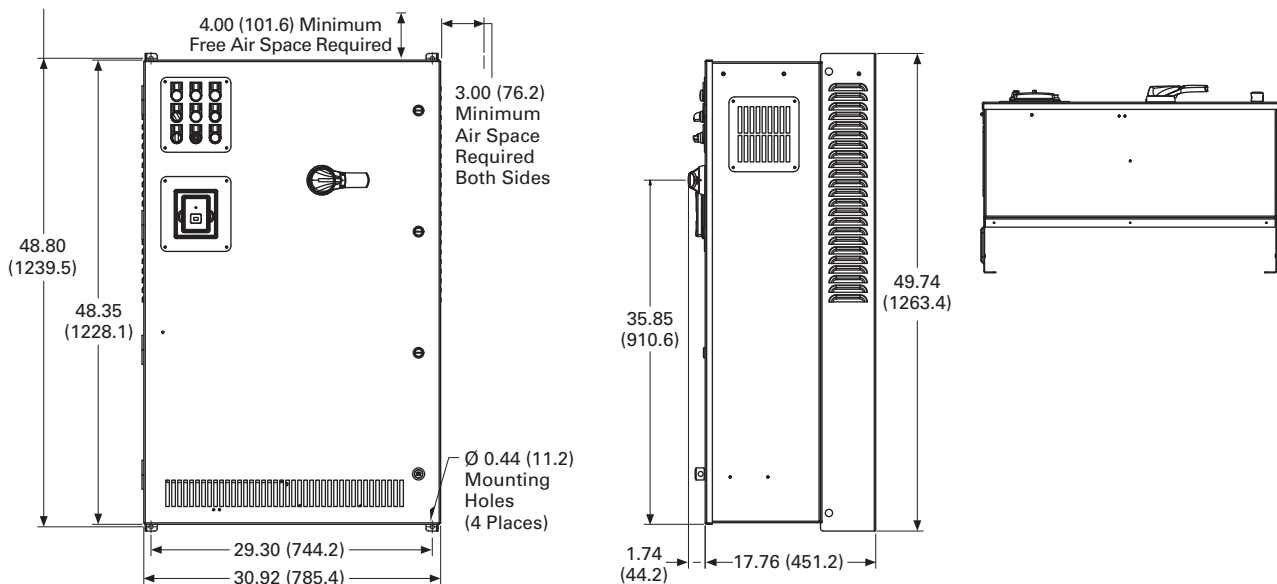


Approximate Dimensions in Inches (mm)

### BX Box Type 3R—22 Inch Floor Stands



### CX Box Type 1



# 2.11

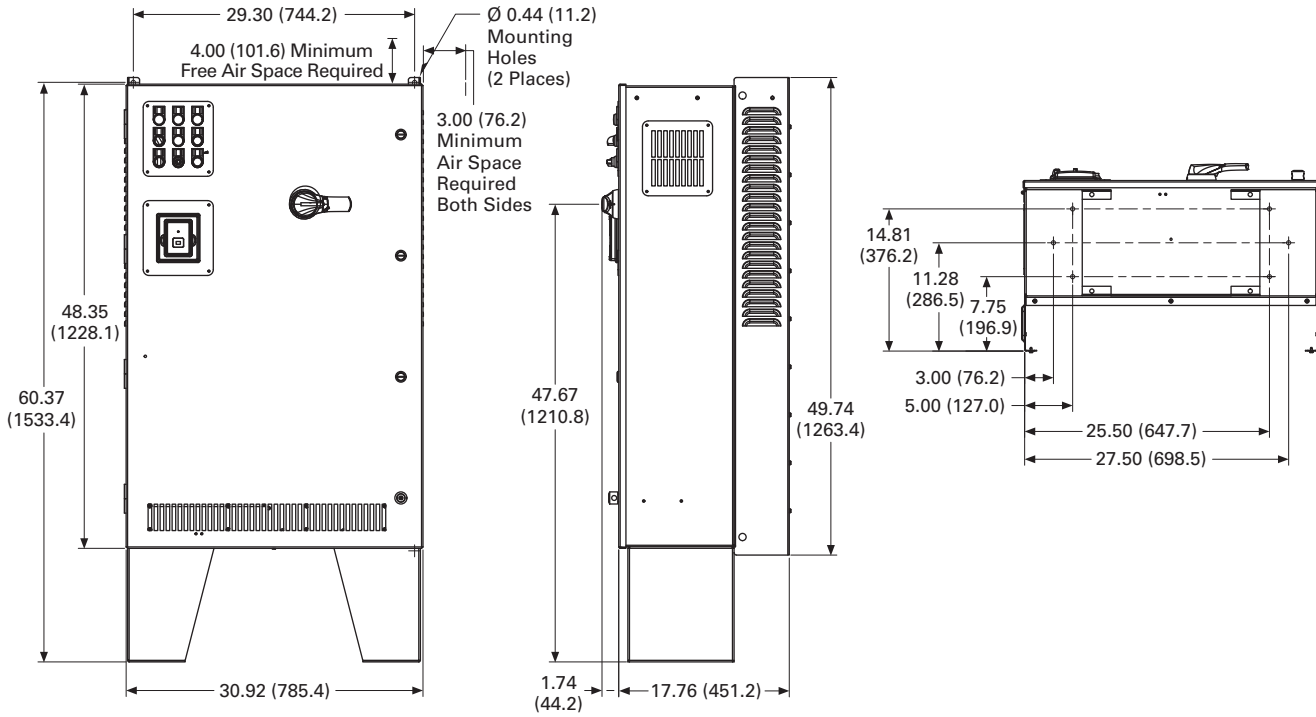
## Adjustable Frequency Drives

### Clean Power Drives

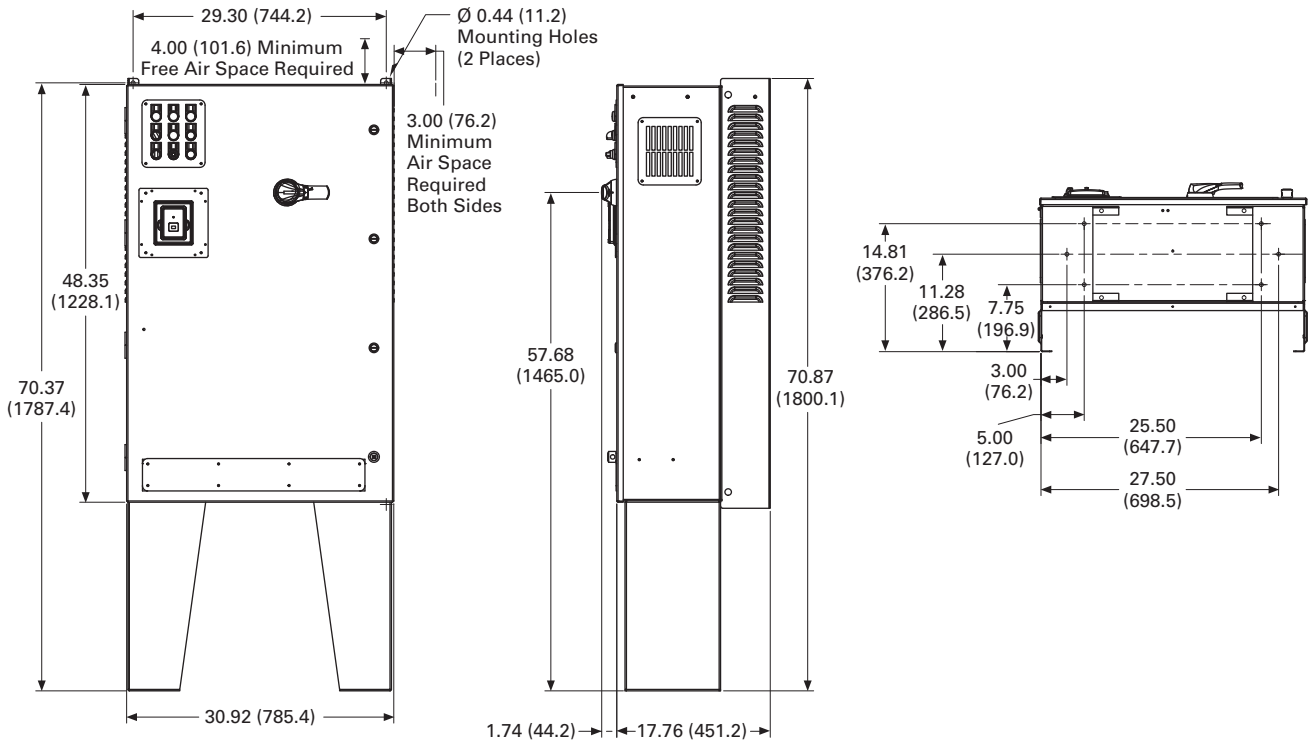
Approximate Dimensions in Inches (mm)

2

#### CX Box Type 1—12 Inch Floor Stands

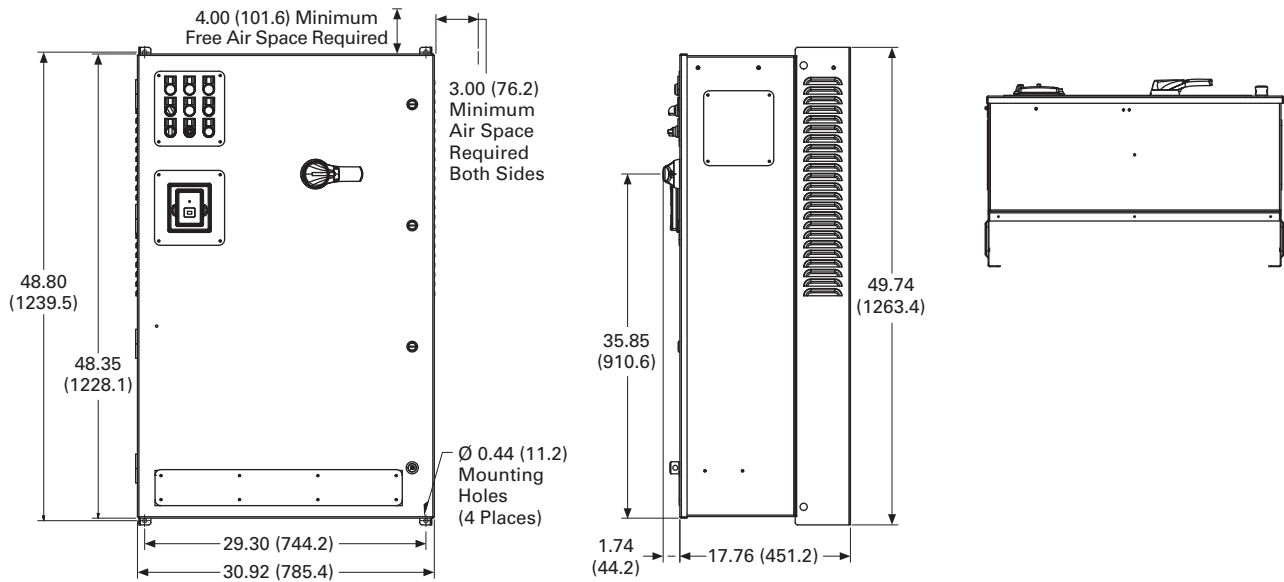


#### CX Box Type 1—22 Inch Floor Stands

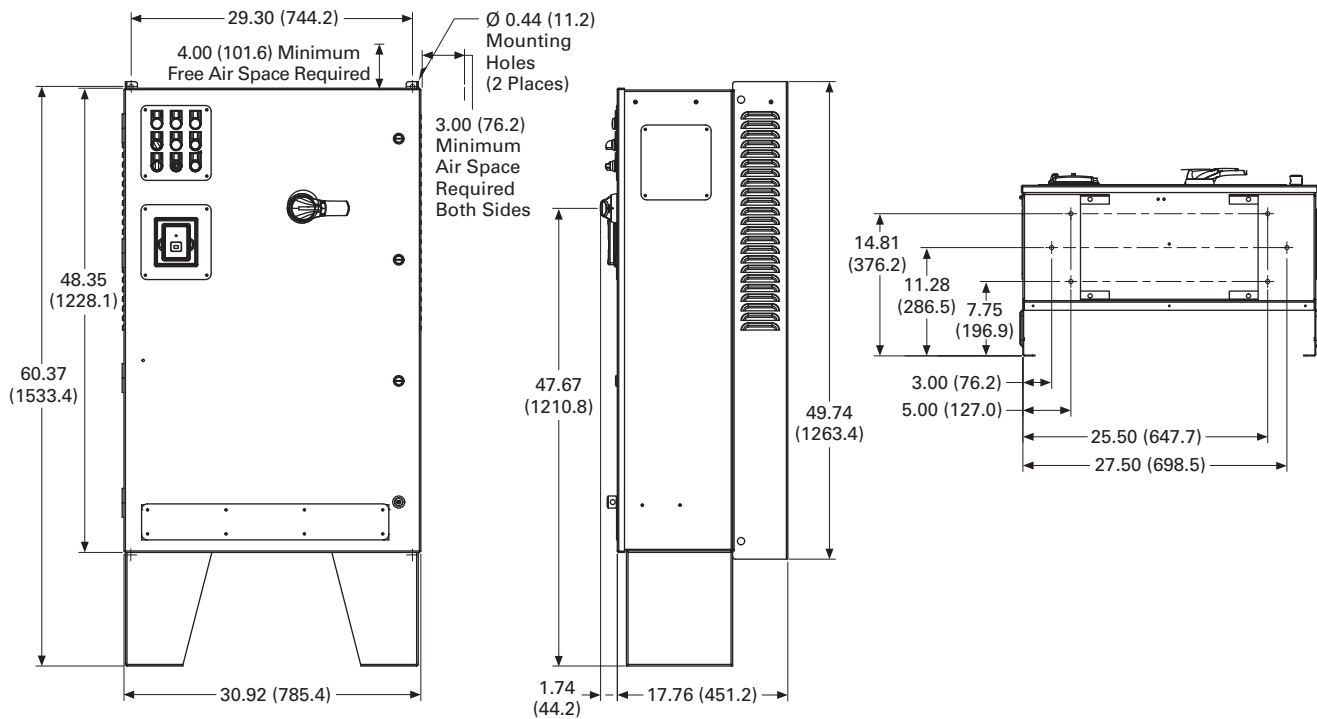


Approximate Dimensions in Inches (mm)

### CX Box Type 12



### CX Box Type 12—12 Inch Floor Stands



# 2.11

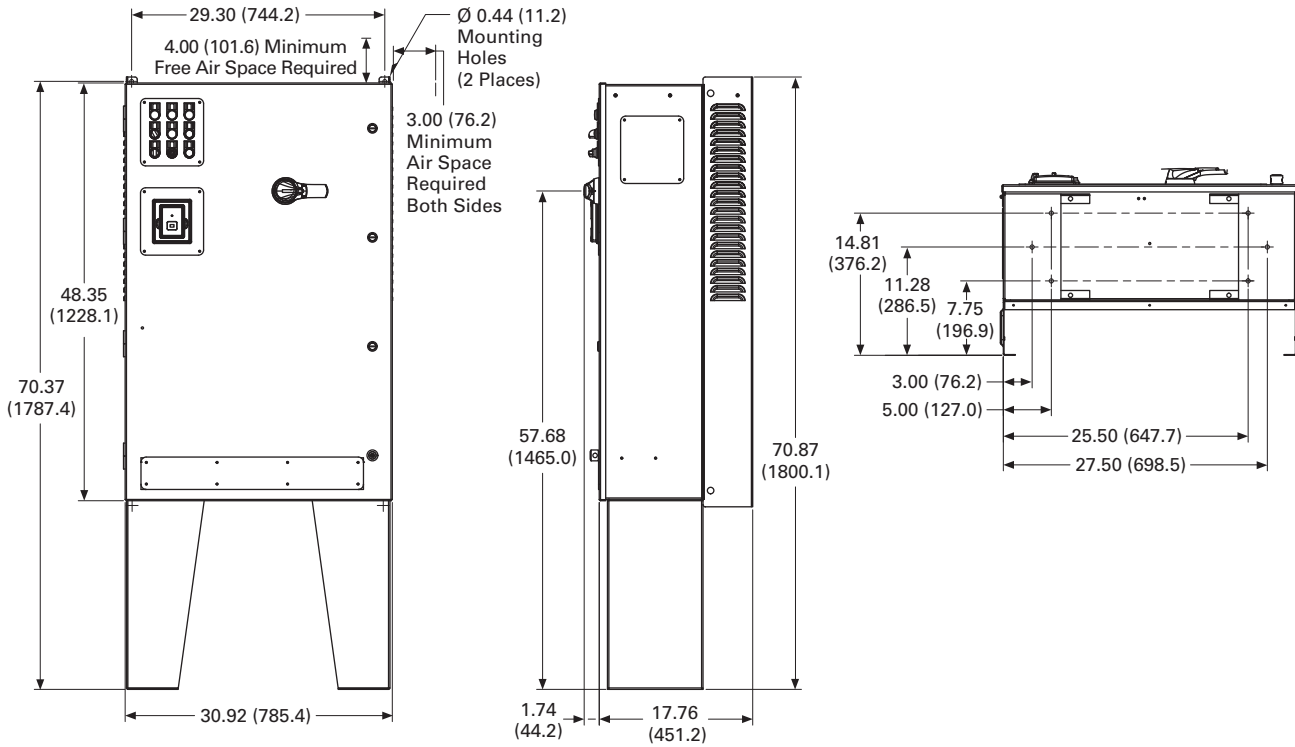
## Adjustable Frequency Drives

### Clean Power Drives

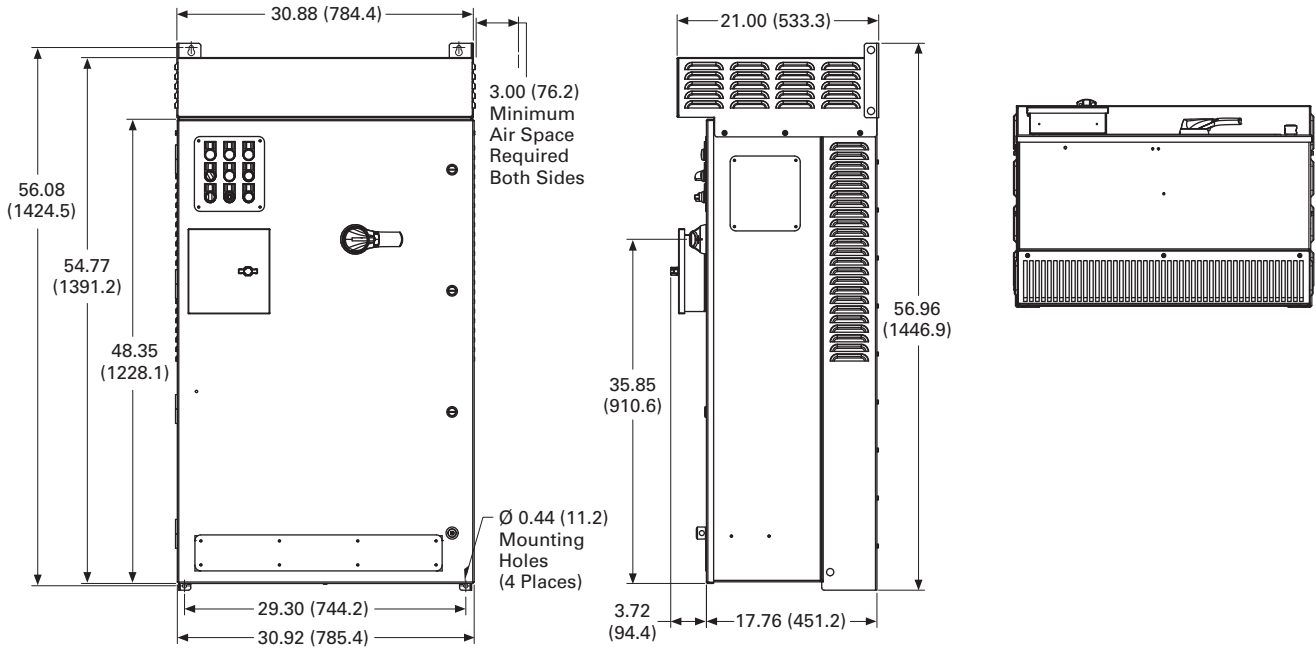
Approximate Dimensions in Inches (mm)

#### CX Box Type 12–22 Inch Floor Stands

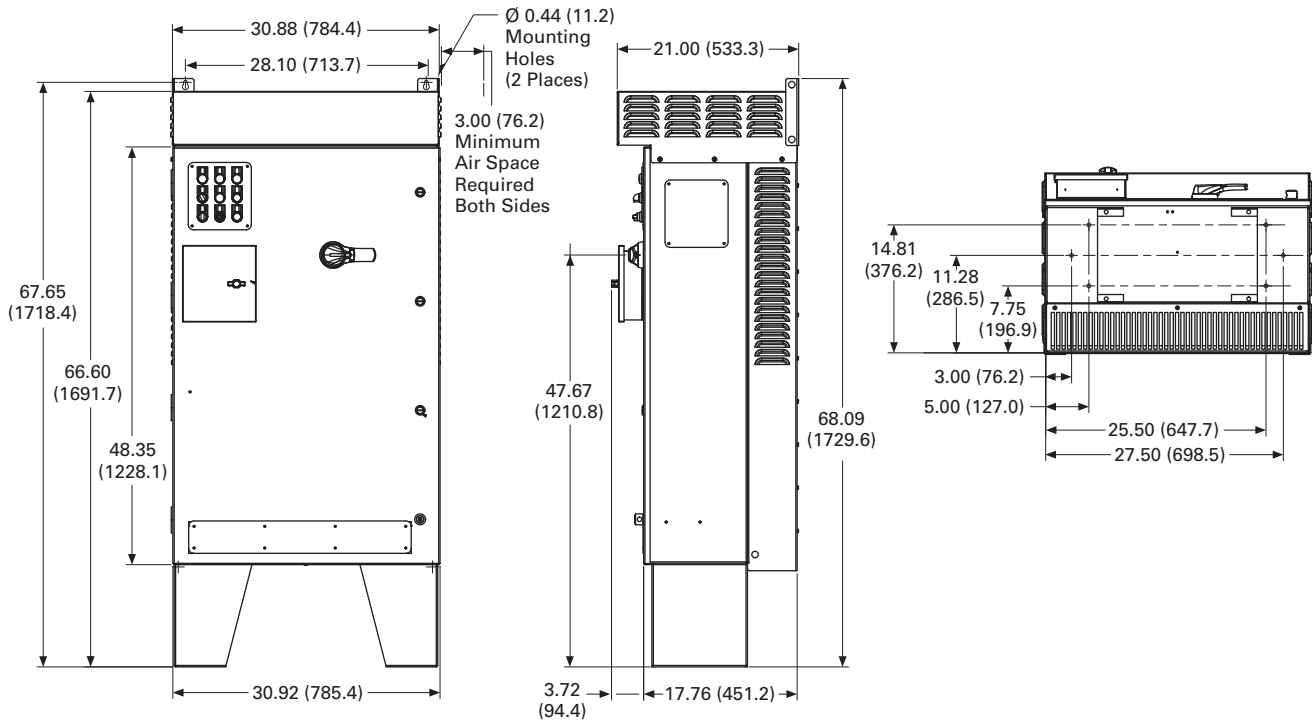
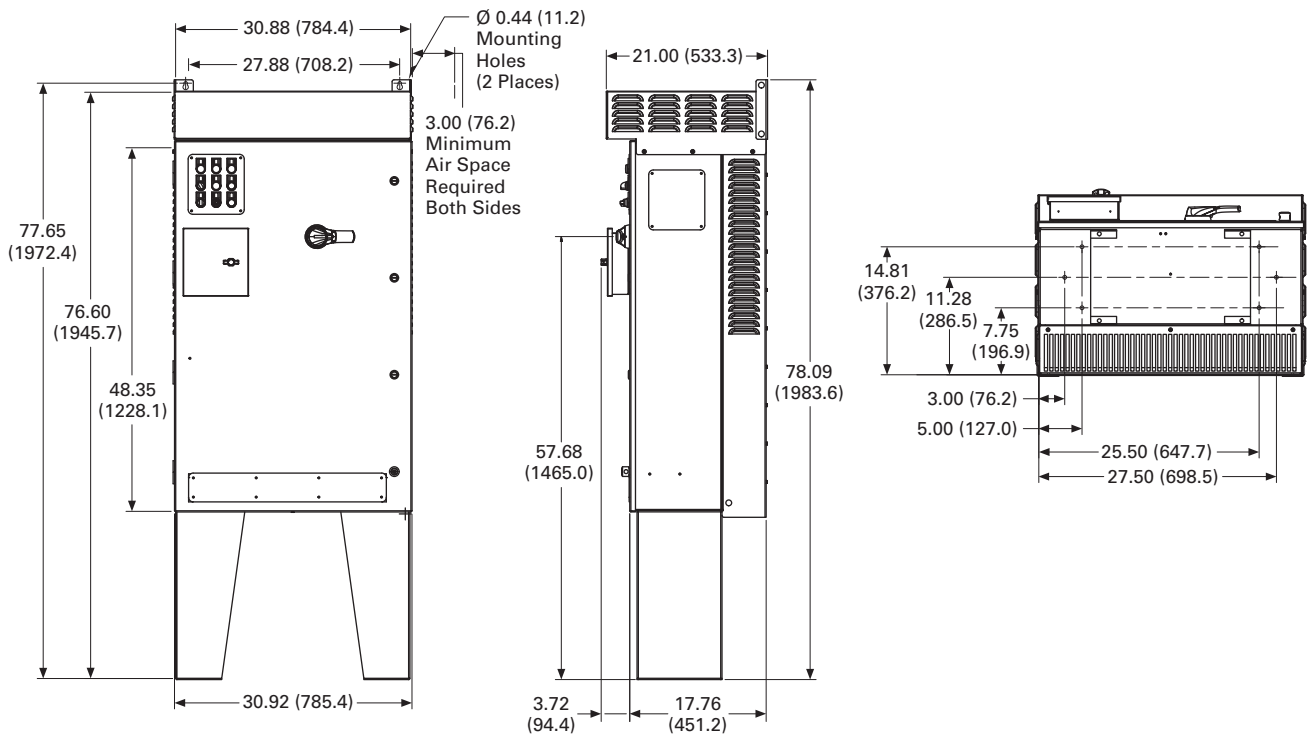
2



#### CX Box Type 3R



Approximate Dimensions in Inches (mm)

**CX Box Type 3R—12 Inch Floor Stands****CX Box Type 3R—22 Inch Floor Stands**

# 2.11

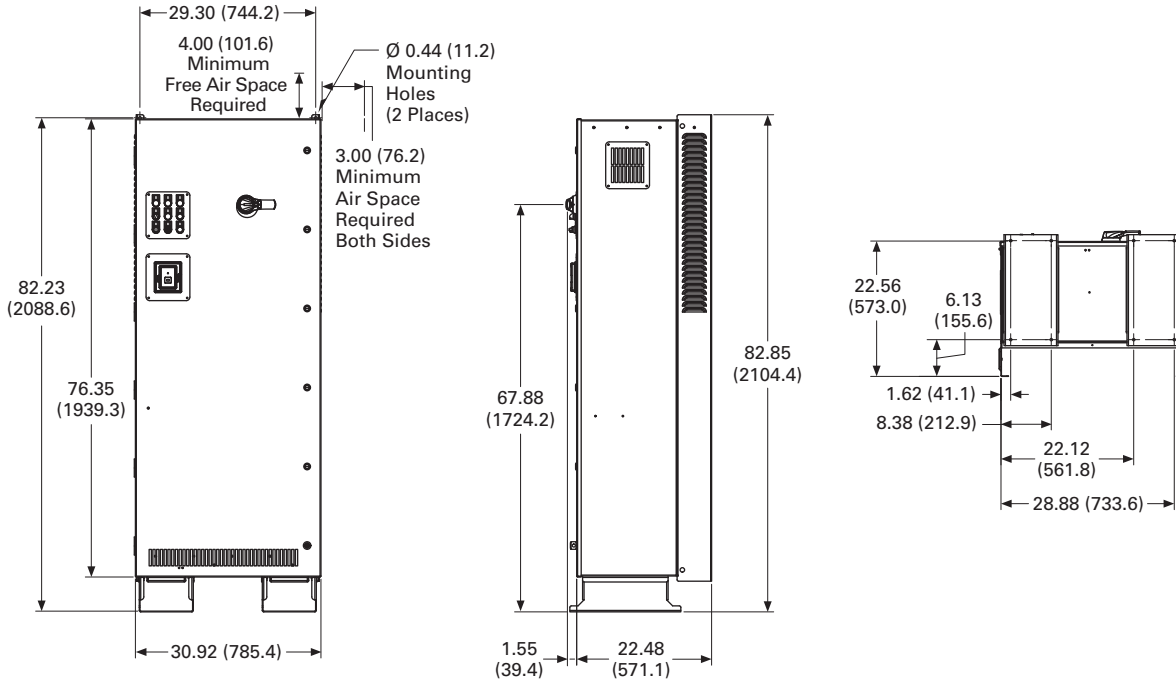
## Adjustable Frequency Drives

### Clean Power Drives

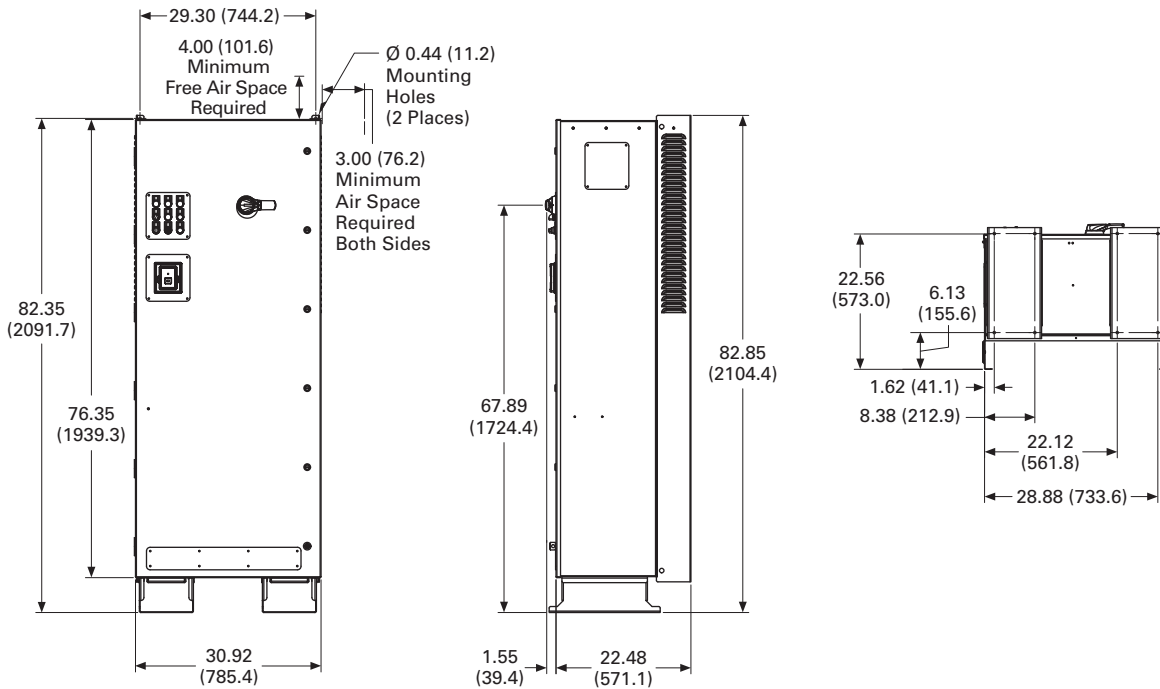
Approximate Dimensions in Inches (mm)

#### DX Box Type 1

2

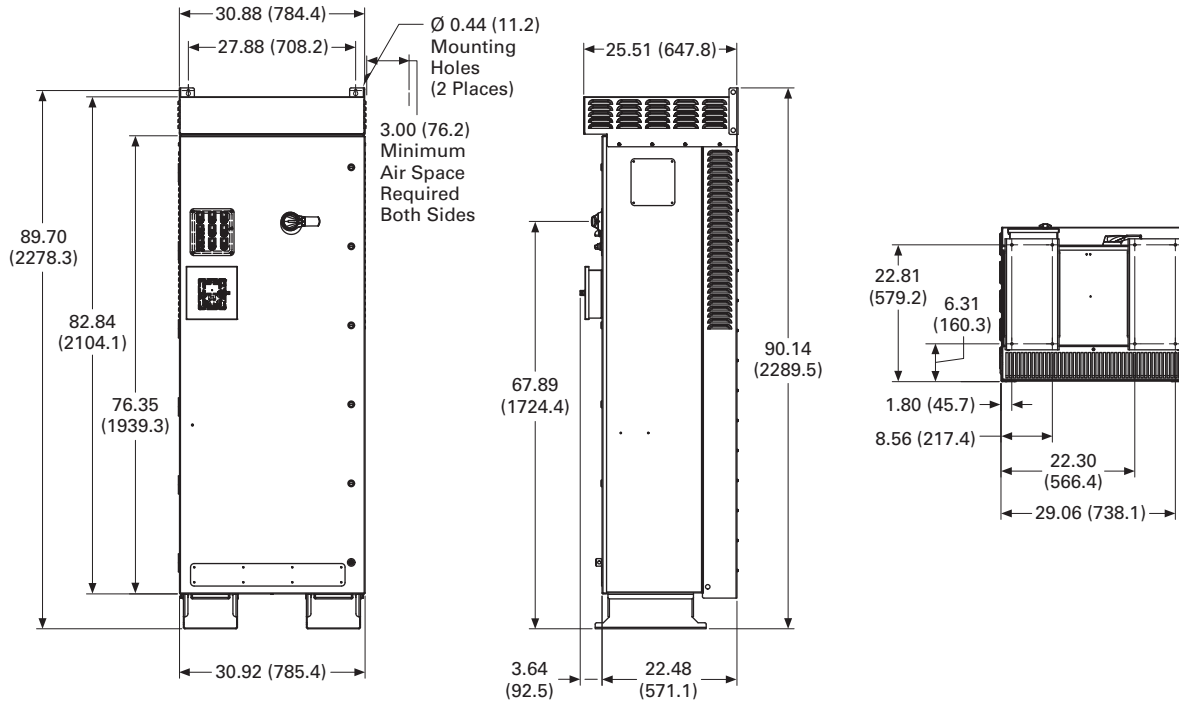


#### DX Box Type 12



Approximate Dimensions in Inches (mm)

**DX Box Type 3R**





# 2.11

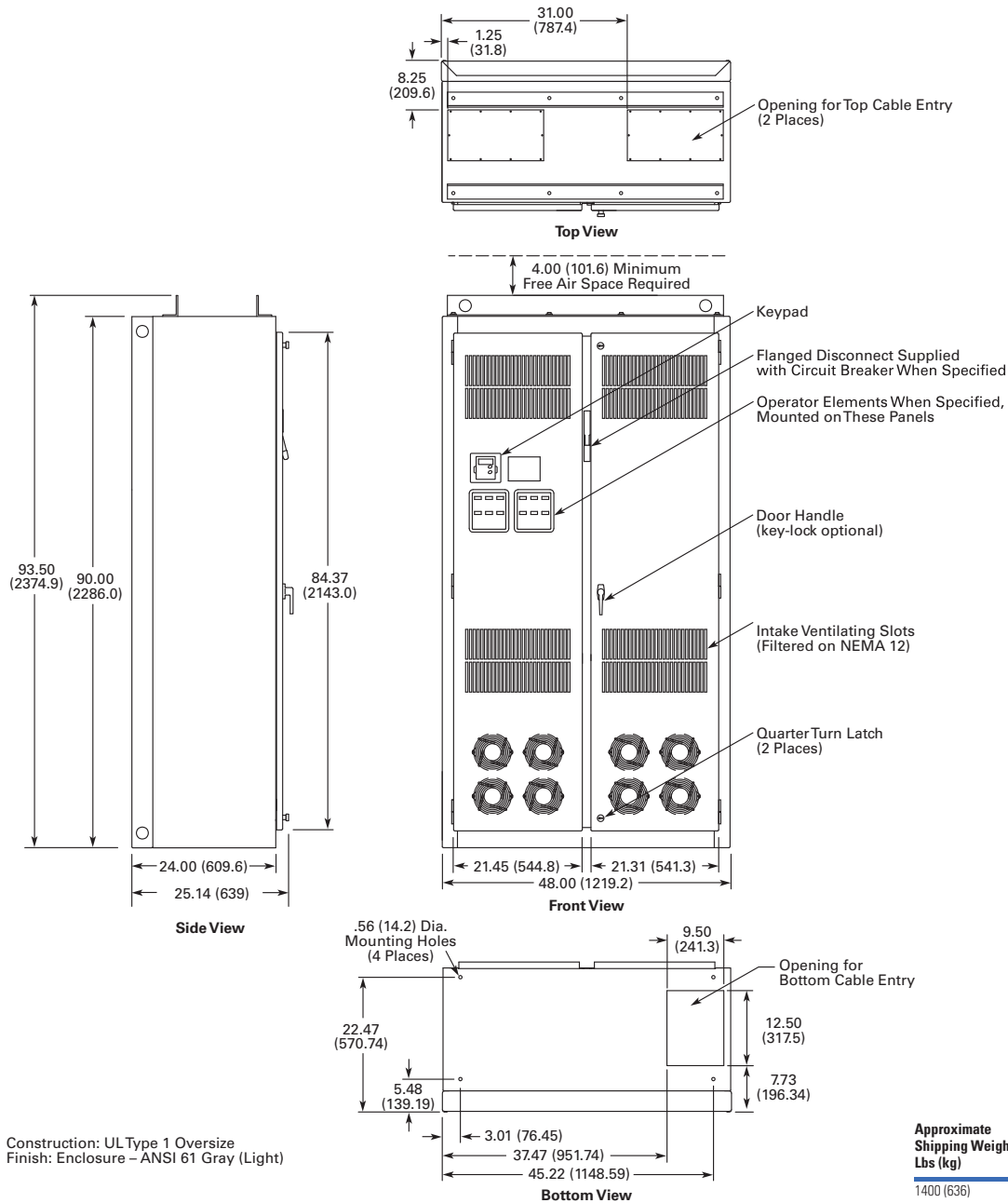
## Adjustable Frequency Drives

### Clean Power Drives

Approximate Dimensions in Inches (mm)

#### Size 8

2



For reference only, dimensions are subject to change. See **Page V6-T2-329**, notes 3 and 5 for enclosure and option selection.

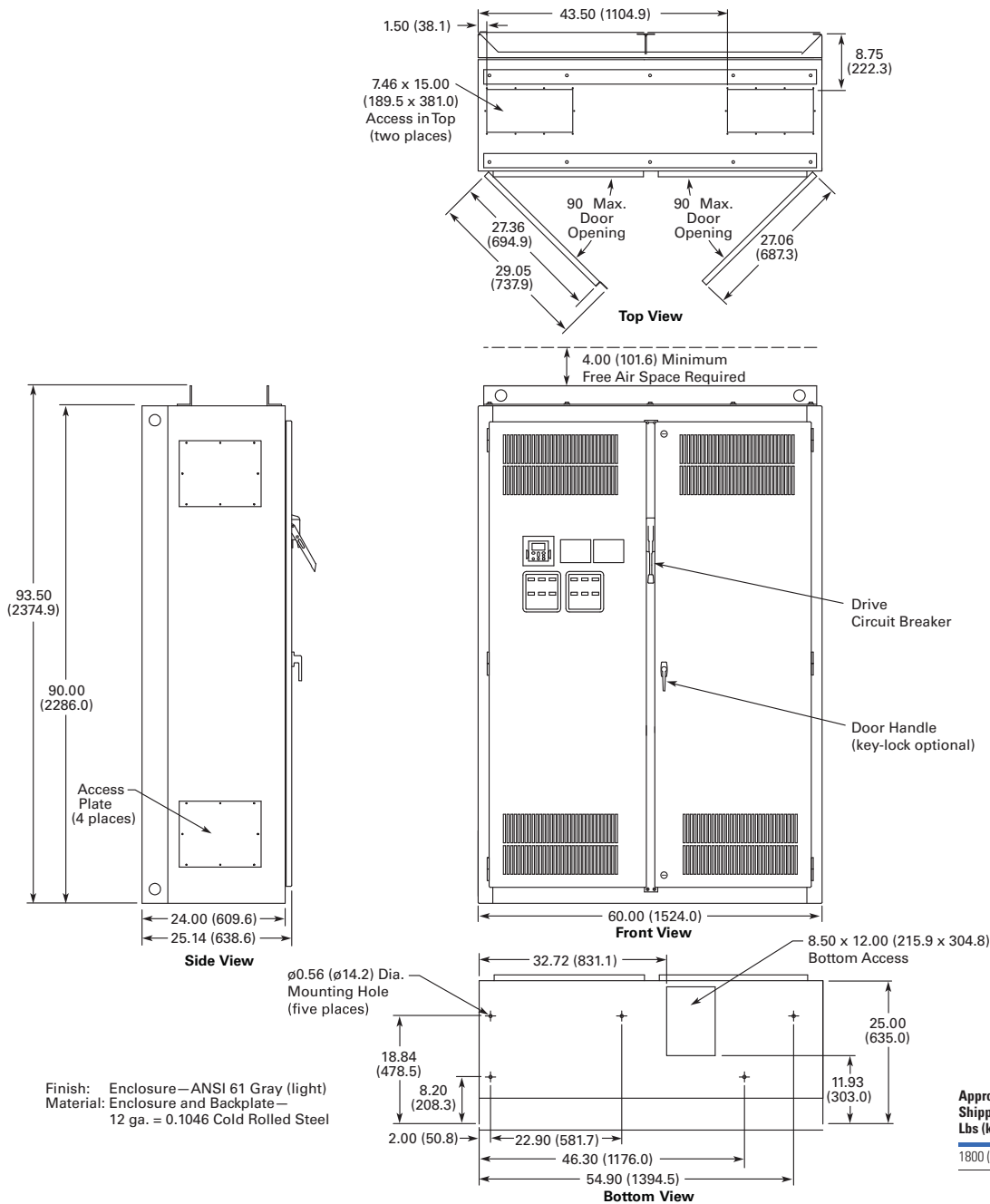
Wide A	High B	Deep C	Mounting D		E	E1	F	G	G1	Door Height H	Min. Air Space J	K
48.0 (1219)	90.0 (2286)	24.0 (610)	42.2 (1072)	3.0 (77)	—	—	—	5.5 (139)	—	84.4 (2143)	4.0 (102)	—

Cable Entry															Max. Approx. Shipping Weight Lbs (kg)
L	M	N	P	R	S	T	U	V	W	RR	SS	TT	UU	VV	
9.5 (241)	37.5 (952)	12.5 (318)	7.7 (196)	8.3 (210)	1.3 (32)	31.0 (787)	21.5 (545)	21.3 (541)	—	93.5 (2375)	—	—	—	—	2000 (908)

Approximate Dimensions in Inches (mm)

### Size 9



For reference only, dimensions are subject to change. See **Page V6-T2-329**, notes 3 and 5 for enclosure and option selection.

Wide A	High B	Deep C	Mounting D		E	E1	F	G	G1	Door Height H	Min. Air Space J	K
60.0 (1524)	90.0 (2286)	260.1 (664)	22.9 (582)	2.0 (51)	30.0 (762)	44.3 (1125)	10.6 (270)	10.6 (270)	8.2 (208)	—	4.0 (102)	—

Cable Entry															Max. Approx. Shipping Weight Lbs (kg)
L	M	N	P	R	S	T	U	V	W	RR	SS	TT	UU	VV	
8.5 (216)	32.7 (831)	12.0 (305)	11.9 (303)	9.8 (249)	1.5 (38)	43.5 (1105)	15.0 (381)	7.5 (191)	25.0 (635)	93.5 (2375)	27.4 (696)	290.1 (738)	270.1 (687)	—	2500 (1135)

# 2.11

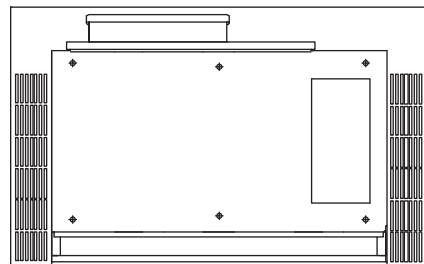
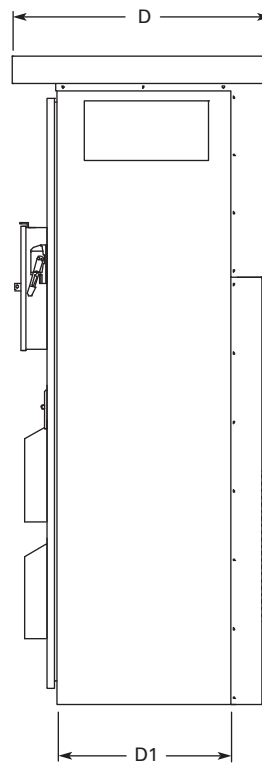
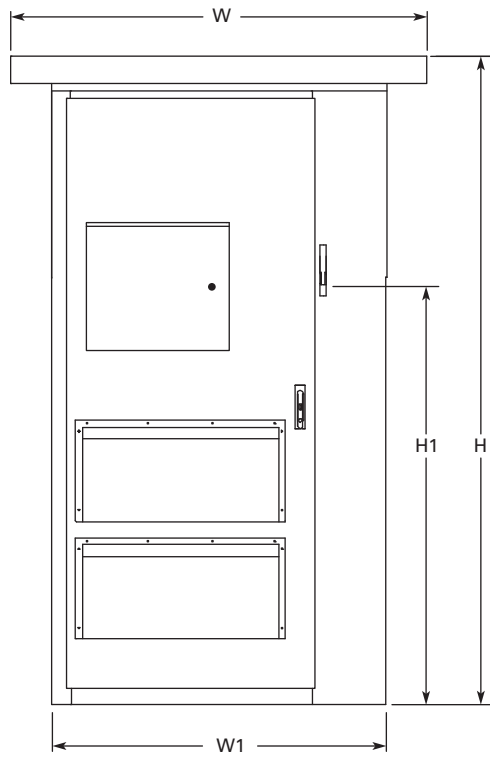
## Adjustable Frequency Drives

### Clean Power Drives

Approximate Dimensions in Inches (mm)

#### Enclosure Size F

2



H	H1	W	W1	D	D1	Approximate Weight Lbs (kg)	Approximate Shipping Weight Lbs (kg)
93.58 (2376.9)	69.51 (1765.60)	60.00 (1524.0)	48.00 (1219.2)	37.50 (952.5)	26.00 (660.4)	1700 (771)	1850 (839)

**Enclosed 12-Pulse Drives****Contents**

<b>Description</b>	<b>Page</b>
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Enclosed Passive Filtered Drives	
EGF Enclosed Drives .....	<b>V6-T2-305</b>
CFX Enclosed Drives .....	<b>V6-T2-325</b>
Enclosed 12-Pulse Drives	
Catalog Number Selection .....	<b>V6-T2-352</b>
Product Selection .....	<b>V6-T2-353</b>
Dimensions .....	<b>V6-T2-354</b>
Enclosed 18-Pulse Drives .....	<b>V6-T2-355</b>
Enclosed Regenerative Drives .....	<b>V6-T2-379</b>

**HCX Enclosed 12-Pulse Drives****Product Description**

The Enclosed HCX Drives is specifically tailored for HVAC applications where clean power is necessary. The Enclosed HCX Drive uses Eaton's SVX drive with a 12-pulse phase shifting transformer to deliver a substantial reduction in voltage and current harmonics.

**Standards and Certifications**

- UL 508C



# 2.11

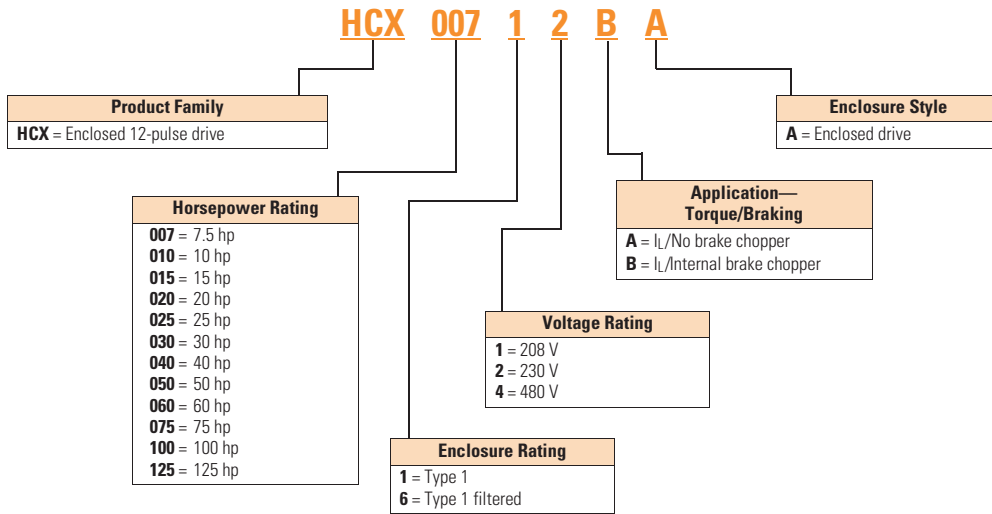
## Adjustable Frequency Drives

Clean Power Drives

### Catalog Number Selection

#### HCX Enclosed 12-Pulse Drives

2



## Product Selection

## 208 V Drives

## HCX Enclosed Drives



## 208 V Drives—Variable Torque (VT)/Low Overload (L) Enclosed Drives

hp	Current (A)	Drive Frame Size	NEMA Type 1 Base Catalog Number ①	NEMA Type 1 Filtered Base Catalog Number ①
7.5	24.2	5	HCX00711BA	HCX00761BA
10	30.8	5	HCX01011BA	HCX01061BA
15	46.2	6	HCX01511BA	HCX01561BA
20	59.4	6	HCX02011BA	HCX02061BA
25	74.8	7	HCX02511AA	HCX02561AA
30	88	7	HCX03011AA	HCX03061AA
40	114	7	HCX04011AA	HCX04061AA
50	143	8	HCX05011AA	HCX05061AA
60	169	8	HCX06011AA	HCX06061AA

## 230 V Drives

## HCX Enclosed Drives



## 230 V Drives—Variable Torque (VT)/Low Overload (L) Enclosed Drives

hp	Current (A)	Drive Frame Size	NEMA Type 1 Base Catalog Number ①	NEMA Type 1 Filtered Base Catalog Number ①
7.5	22	5	HCX00712BA	HCX00762BA
10	28	5	HCX01012BA	HCX01062BA
15	42	6	HCX01512BA	HCX01562BA
20	54	6	HCX02012BA	HCX02062BA
25	68	7	HCX02512AA	HCX02562AA
30	80	7	HCX03012AA	HCX03062AA
40	104	7	HCX04012AA	HCX04062AA
50	130	8	HCX05012AA	HCX05062AA
60	154	8	HCX06012AA	HCX06062AA

## 480 V Drives

## HCX Enclosed Drives



## 480 V Drives—Variable Torque (VT)/Low Overload (L) Enclosed Drives

hp	Current (A)	Drive Frame Size	NEMA Type 1 Base Catalog Number ①	NEMA Type 1 Filtered Base Catalog Number ①
25	34	6	HCX02514BA	HCX02564BA
30	40	6	HCX03014BA	HCX03064BA
40	52	6	HCX04014BA	HCX04064BA
50	65	7	HCX05014AA	HCX05064AA
60	77	7	HCX06014AA	HCX06064AA
75	96	7	HCX07514AA	HCX07564AA
100	124	8	HCX10014AA	HCX10064AA
125	156	8	HCX12514AA	HCX12564AA

**Note**

① Table is for base catalog number reference only. For complete catalog number selection, see [Page V6-T2-352](#).

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## Adjustable Frequency Drives

Clean Power Drives

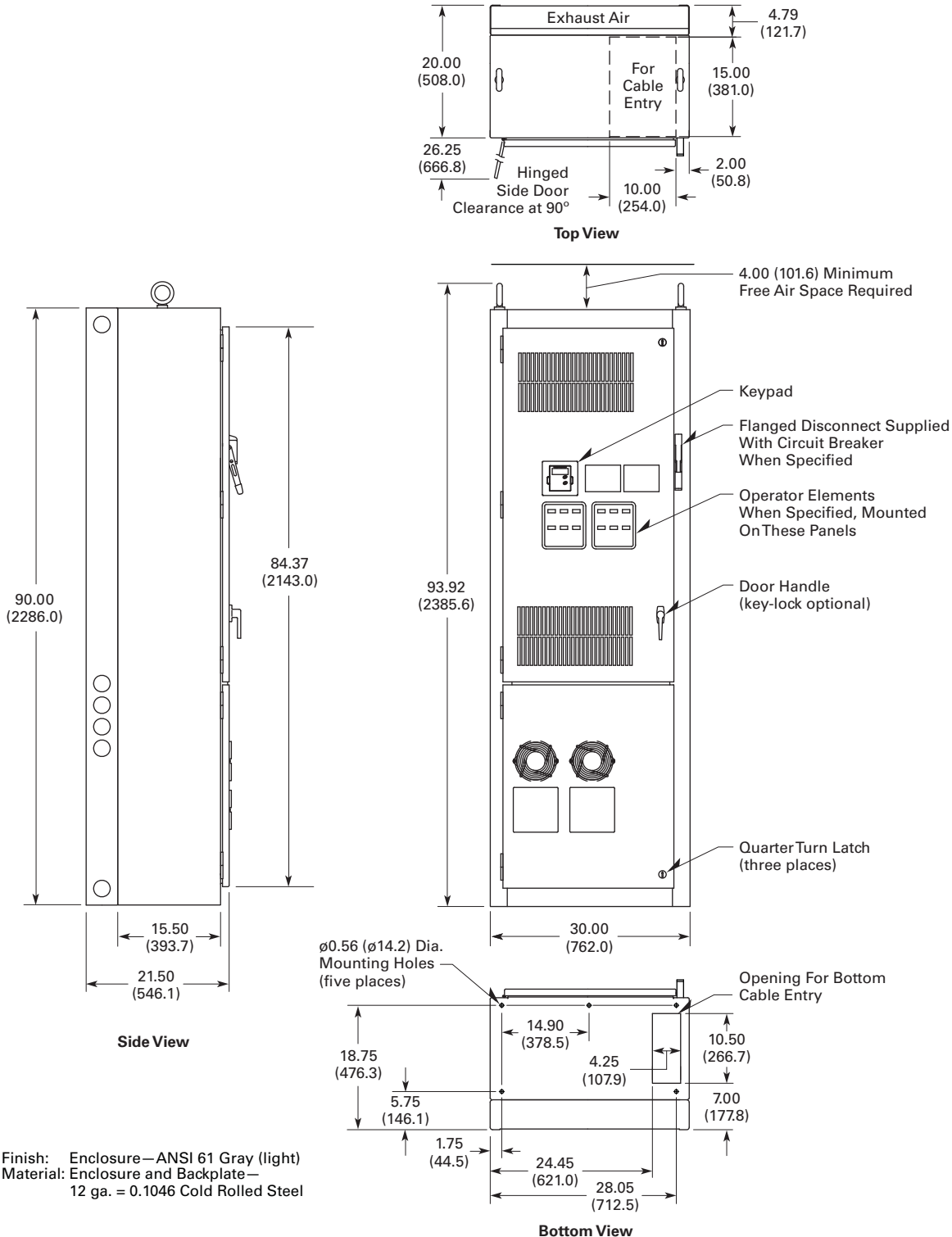
### Dimensions

Approximate Dimensions in Inches (mm)

2

### Enclosure Size 7

25–150 hp I<sub>L</sub> and 25–125 hp I<sub>H</sub> 480 V—25–100 hp I<sub>L</sub> and 25–75 hp I<sub>H</sub> 575 V



**Enclosed 18-Pulse Drives****Contents**

<b>Description</b>	<b>Page</b>
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Options . . . . .	V6-T2-366
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Dimensions . . . . .	V6-T2-374

**CPX Enclosed 18-Pulse Drives****Product Description**

Eaton's enclosed 18-pulse drives use advanced 18-pulse technology that significantly reduces line harmonics at the drive input terminals, resulting in one of the purest sinusoidal waveforms available.

The enclosed 18-pulse drive also delivers True Power Factor—in addition to reducing harmonic distortion, the enclosed 18-pulse drive prevents upstream transformer overheating and overloading of breakers and feeders, enabling the application of adjustable frequency drives on generators and other high impedance power systems.

**Features and Benefits**

Enclosed 18-pulse drive features include:

- Space optimized enclosure
- Simple layout for power options
- NEMA Type 1, Type 1 filtered and gasketed, Type 3R
- Input voltage: 480 V, 208 V, 575 V
- Complete range of control, network and power options
- Horsepower range:
  - 480 V, 25–800 hp (consult factory for larger sizes)
  - 208/230 V, 25–200 hp
  - 575 V, 25–800 hp (consult factory for larger sizes)
- Over 15 years of 18-pulse clean power experience
- 65 kAIC Standard at 480 V and 208 V
- 100 kAIC optional

**Standards and Certifications**

UL 508C





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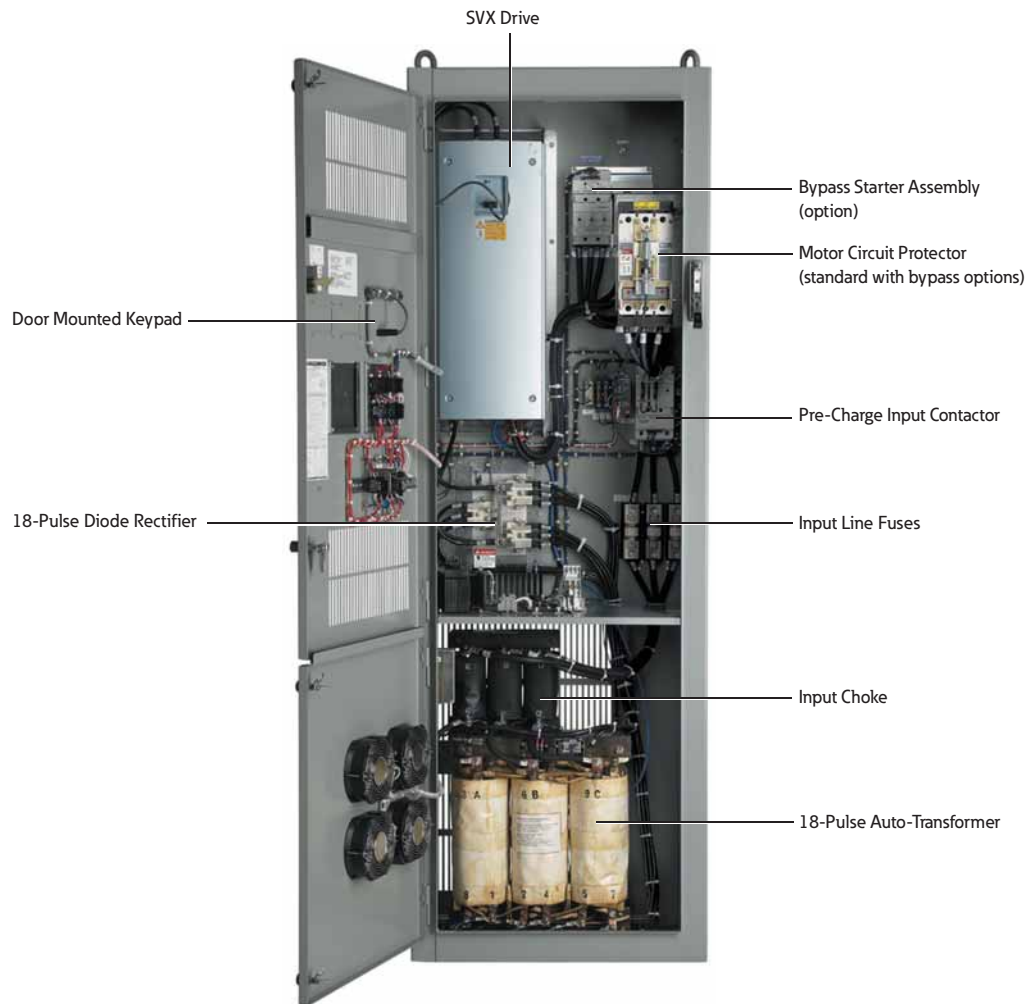
## Adjustable Frequency Drives

Clean Power Drives

### Product Identification

2

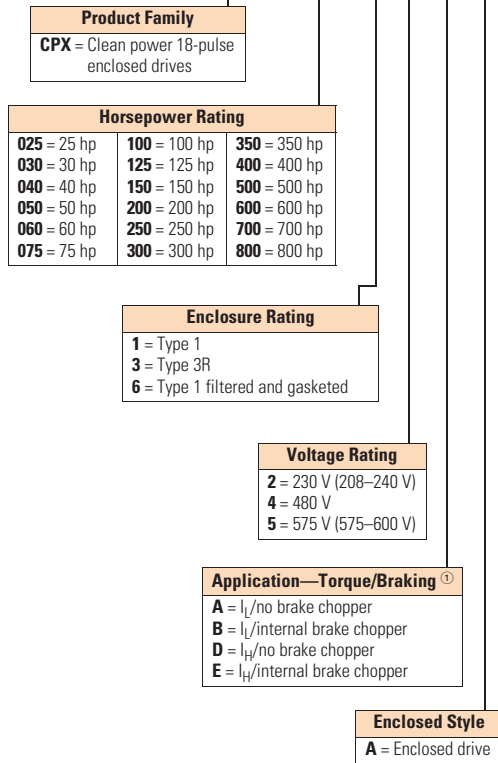
Type 1, 25–150 hp (30 x 90 x 21.50)



## Catalog Number Selection

## Enclosed 18-Pulse Drive

CPX 100 1 4 A A



Build options alphabetically and numerically.

Enclosed Options <sup>②③④</sup>		Type
<b>K1</b>	Door-mounted speed potentiometer <sup>⑤</sup>	Control
<b>K2</b>	Door-mounted speed potentiometer with HOA selector switch <sup>⑤</sup>	Control
<b>K4</b>	HAND/OFF/AUTO switch 0.87-inch (22 mm)	Control
<b>K5</b>	MANUAL/AUTO reference switch 0.87-inch (22 mm)	Control
<b>K6</b>	START/STOP pushbuttons 0.87-inch (22 mm)	Control
<b>KF</b>	Bypass test switch for RA	Addl. bypass
<b>K0</b>	Standard elapsed time meter	Control
<b>L1</b>	Power, RUN and fault pilot lights	Light
<b>L2</b>	Bypass pilot lights for RA, RB, bypass options	Addl. bypass
<b>LE</b>	Red RUN light	Light
<b>P1</b>	Input disconnect	Input
<b>P8</b>	Surge protective device	Input
<b>PE</b>	Output contactor	Output
<b>PF</b>	Output filter	Output
<b>PG</b>	MotoRx (up to 600 ft [182.9 m]) 1000 V/ $\mu$ S dV/dt filter	Output
<b>PH</b>	Single overload relay	Output
<b>PI</b>	Dual overload relays	Output
<b>PN</b>	Dual overloads for bypass	Addl. bypass
<b>RA</b>	Manual HOA bypass controller	Bypass
<b>RC</b>	Auto transfer HOA bypass controller	Bypass
<b>RG</b>	Reduced voltage starter for bypass	Bypass
<b>S7</b>	10.00-inch (254.0 mm) expansion	Enclosure
<b>S8</b>	20.00-inch (508.0 mm) expansion	Enclosure
<b>S9</b>	Space heater	Enclosure

Communication Options <sup>⑥</sup>	
<b>C2</b> = Modbus <sup>®</sup>	<b>CA</b> = Johnson Controls N2
<b>C3</b> = PROFIBUS <sup>®</sup> DP	<b>CI</b> = Modbus TCP
<b>C4</b> = LonWorks <sup>®</sup>	<b>CJ</b> = BACnet
<b>C5</b> = PROFIBUS DP (D9 connector)	<b>CO</b> = EtherNet/IP
<b>C6</b> = CANopen (slave)	<b>D3</b> = RS-232 with D9 connection
<b>C7</b> = DeviceNet <sup>™</sup>	
<b>C8</b> = Modbus (D9 Type connector)	

Control Options
<b>B1</b> = 6 DI, 1 ext +24 Vdc/ext +24 Vdc
<b>B2</b> = 1 RO (NC/NO), 1 RO (NO), 1 therm
<b>B4</b> = 1 AI (mA isolated), 2 AO (mA isolated), 1 ext +24 Vdc/EXT +24 Vdc
<b>B5</b> = 3 RO (NO)
<b>B8</b> = 1 ext +24 Vdc/ext +24 Vdc, 3 Pt100
<b>B9</b> = 1 RO (NO), 5 DI 42–240 Vac input

Engineered Options
<b>VB</b>   Varnished boards

## Notes

- ① Brake chopper is standard in drives up to 30 hp  $I_H$  or 40 hp  $I_L$  at 480 V. It is optional in larger drives.
- ② Local/remote keypad is included as the standard control panel.
- ③ Some options are voltage and/or horsepower specific. Consult your Eaton representative for details.
- ④ See **Pages V6-T2-368** and **V6-T2-369** for complete descriptions.
- ⑤ Includes local/remote speed reference switch.
- ⑥ See **Pages V6-T2-366** and **V6-T2-367** for complete descriptions.

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## Adjustable Frequency Drives

### Clean Power Drives

#### Product Selection

2

#### When Ordering

- Select a base catalog number that meets the application requirements—nominal horsepower, voltage and enclosure rating. (The enclosed drive's continuous output amp rating should be equal to or greater than the motor's full load amp rating.) The base-enclosed package includes a standard drive, door-mounted alphanumeric panel and enclosure.

#### Ambient Temperature Ratings

Frame Size	I <sub>H</sub>	I <sub>L</sub>
FR4–FR9	50 °C	50 °C
FR10 and above	40 °C	40 °C

- If dynamic brake chopper or control/communication option is desired, change the appropriate code in the base catalog number.
- All of the programming is exactly the same as the standard SVX drive.
- Select enclosed options. Add the codes as suffixes to the base catalog number in alphabetical and numeric order.

#### 208 V Drives

##### Enclosed 18-Pulse Drive



#### Enclosed 18-Pulse Base Drive Type 1

Enclosure Size <sup>①</sup>	hp <sup>②</sup>	Current (A)	Chassis Frame	Base Catalog Number <sup>③</sup>
<b>Low Overload Drive</b>				
7	25	75	FR7	<b>CPX02512AA</b>
	30	88	FR7	<b>CPX03012AA</b>
	40	114	FR7	<b>CPX04012AA</b>
	50	143	FR8	<b>CPX05012AA</b>
	60	169	FR8	<b>CPX06012AA</b>
	75	211	FR8	<b>CPX07512AA</b>
8	100	273	FR9	<b>CPX10012AA</b>
9	125	343	FR8T	<b>CPX12512AA</b>
	150	396	FR8T	<b>CPX15012AA</b>
10	200	480	FR9T	<b>CPX20012AA</b>
<b>High Overload Drive</b>				
7	25	75	FR7	<b>CPX02512DA</b>
	30	88	FR7	<b>CPX03012DA</b>
	40	114	FR8	<b>CPX04012DA</b>
	50	143	FR8	<b>CPX05012DA</b>
	60	169	FR8	<b>CPX06012DA</b>
	75	211	FR9	<b>CPX07512DA</b>
8	100	273	FR8T	<b>CPX10012DA</b>
9	125	343	FR8T	<b>CPX12512DA</b>
	150	396	FR9T	<b>CPX15012DA</b>
10	200	480	FR9T	<b>CPX20012DA</b>

#### Notes

- ① See enclosure dimensions beginning on **Page V6-T2-374**.
- ② hp ratings are provided as a guideline. Drives should be sized per motor nameplate FLA.
- ③ The 18-pulse clean power assembly includes a standard drive, door-mounted local/remote keypad and enclosure.

## Enclosed 18-Pulse Drive



## Enclosed 18-Pulse Base Drive NEMA 12 Filtered

Enclosure Size <sup>①</sup>	hp <sup>②</sup>	Current (A)	Chassis Frame	Base Catalog Number <sup>③</sup>
<b>Low Overload Drive</b>				
7	25	75	FR7	CPX02562AA
	30	88	FR7	CPX03062AA
	40	114	FR7	CPX04062AA
	50	143	FR8	CPX05062AA
	60	169	FR8	CPX06062AA
	75	211	FR8	CPX07562AA
8	100	273	FR9	CPX10062AA
9	125	343	FR8T	CPX12562AA
	150	396	FR8T	CPX15052AA
10	200	480	FR9T	CPX20062AA
<b>High Overload Drive</b>				
7	25	75	FR7	CPX02562DA
	30	88	FR7	CPX03062DA
	40	114	FR8	CPX04062DA
	50	143	FR8	CPX05062DA
	60	169	FR8	CPX06062DA
	75	211	FR8	CPX07562DA
8	100	273	FR9	CPX10062DA
9	125	343	FR8T	CPX12562DA
	150	396	FR8T	CPX15062DA
10	200	480	FR9T	CPX20062DA

Enclosed 18-Pulse Base Drive Type 3R <sup>④</sup>

Enclosure Size <sup>①</sup>	hp <sup>②</sup>	Current (A)	Chassis Frame	Base Catalog Number <sup>③</sup>
<b>Low Overload Drive</b>				
7	25	75	FR7	CPX02532AA
	30	88	FR7	CPX03032AA
	40	114	FR7	CPX04032AA
	50	143	FR8	CPX05032AA
	60	169	FR8	CPX06032AA
	75	211	FR8	CPX07532AA
8	100	273	FR9	CPX10032AA
9	125	343	FR8T	CPX12532AA
<b>High Overload Drive</b>				
7	25	75	FR7	CPX02532DA
	30	88	FR7	CPX03032DA
	40	114	FR8	CPX04032DA
	50	143	FR8	CPX05032DA
	60	169	FR8	CPX06032DA
	75	211	FR8	CPX07532DA
8	100	273	FR9	CPX10032DA
9	125	343	FR8T	CPX12532DA

**Notes**

- ① See enclosure dimensions beginning on **Page V6-T2-374**.
- ② hp ratings are provided as a guideline. Drives should be sized per motor nameplate FLA.
- ③ The 18-pulse clean power assembly includes a standard drive, door-mounted local/remote keypad and enclosure.
- ④ All Type 3R drives use the Size F enclosure.

## 480 V Drives

2

## Enclosed 18-Pulse Drive



## Enclosed 18-Pulse Base Drive Type 1

Enclosure Size <sup>①</sup>	hp <sup>②</sup>	Current (A)	Chassis Frame	Base Catalog Number <sup>③</sup>
<b>Low Overload Drive</b>				
7	25	34	FR6	CPX02514BA
	30	40	FR6	CPX03014BA
	40	52	FR6	CPX04014BA
	50	65	FR7	CPX05014AA
	60	77	FR7	CPX06014AA
	75	96	FR7	CPX07514AA
	100	124	FR8	CPX10014AA
	125	156	FR8	CPX12514AA
	150	180	FR8	CPX15014AA
8	200	240	FR9	CPX20014AA
	250	300	FR9	CPX25014AA
9	300	361	FR10	CPX30014AA
	350	414	FR10	CPX35014AA
	400	477	FR10	CPX40014AA
10	500	590	FR11	CPX50014AA
	550	650	FR11	CPX55014AA
	600	730	FR11	CPX60014AA
11	650	820	FR12	CPX65014AA
	700	920	FR12	CPX70014AA
	800	1030	FR12	CPX80014AA
<b>High Overload Drive</b>				
7	25	34	FR6	CPX02514EA
	30	40	FR6	CPX03014EA
	40	52	FR7	CPX04014DA
	50	65	FR7	CPX05014DA
	60	77	FR7	CPX06014DA
	75	96	FR8	CPX07514DA
	100	124	FR8	CPX10014DA
	125	156	FR8	CPX12514DA
	8	150	180	FR9
200		240	FR9	CPX20014DA
9	250	302	FR10	CPX25014DA
	300	361	FR10	CPX30014DA
	350	414	FR10	CPX35014DA
10	400	477	FR11	CPX40014DA
	500	590	FR11	CPX50014DA
	550	650	FR11	CPX55014DA
11	600	730	FR12	CPX60014DA
	650	820	FR12	CPX65014DA
	700	920	FR12	CPX70014DA

**Notes**

① See enclosure dimensions beginning on [Page V6-T2-374](#).

② hp ratings are provided as a guideline. Drives should be sized per motor nameplate FLA.

③ The 18-pulse clean power assembly includes a standard drive, door-mounted local/remote keypad and enclosure.

## Enclosed 18-Pulse Drive



## Enclosed 18-Pulse Base Drive NEMA 12 Filtered

Enclosure Size <sup>①</sup>	hp <sup>②</sup>	Current (A)	Chassis Frame	Base Catalog Number <sup>③</sup>
<b>Low Overload Drive</b>				
7	25	34	FR6	CPX02564BA
	30	40	FR6	CPX03064BA
	40	52	FR6	CPX04064BA
	50	65	FR7	CPX05064AA
	60	77	FR7	CPX06064AA
	75	96	FR7	CPX07564AA
	100	124	FR8	CPX10064AA
	125	156	FR8	CPX12564AA
8	200	240	FR9	CPX20064AA
	250	300	FR9	CPX25064AA
9	300	361	FR10	CPX30064AA
	350	414	FR10	CPX35064AA
	400	477	FR10	CPX40064AA
10	500	590	FR11	CPX50064AA
	550	650	FR11	CPX55064AA
	600	730	FR11	CPX60064AA
11	650	820	FR11	CPX65064AA
	700	920	FR12	CPX70064AA
	800	1030	FR12	CPX80064AA
<b>High Overload Drive</b>				
7	25	34	FR6	CPX02564EA
	30	40	FR6	CPX03064EA
	40	52	FR7	CPX04064DA
	50	65	FR7	CPX05064DA
	60	77	FR7	CPX06064DA
	75	96	FR8	CPX07564DA
	100	124	FR8	CPX10064DA
	125	156	FR8	CPX12564DA
8	150	180	FR9	CPX15064DA
	200	240	FR9	CPX20064DA
9	250	302	FR10	CPX25064DA
	300	361	FR10	CPX30064DA
	350	414	FR10	CPX35014DA
10	400	477	FR11	CPX40064DA
	500	590	FR11	CPX50064DA
	550	650	FR11	CPX55064DA
11	600	730	FR12	CPX60064DA
	650	820	FR12	CPX65064DA
	700	920	FR12	CPX70064DA

**Notes**

① See enclosure dimensions beginning on **Page V6-T2-374**.

② hp ratings are provided as a guideline. Drives should be sized per motor nameplate FLA.

③ The 18-pulse clean power assembly includes a standard drive, door-mounted local/remote keypad and enclosure.

Enclosed 18-Pulse Drive



#### Enclosed 18-Pulse Base Drive Type 3R <sup>①</sup>

Enclosure Size <sup>②</sup>	hp <sup>③</sup>	Current (A)	Chassis Frame	Base Catalog Number <sup>④</sup>
<b>Low Overload Drive</b>				
7	25	34	FR6	<b>CPX02534AA</b>
	30	40	FR6	<b>CPX03034AA</b>
	40	52	FR6	<b>CPX04034AA</b>
	50	65	FR7	<b>CPX05034AA</b>
	60	77	FR7	<b>CPX06034AA</b>
	75	96	FR7	<b>CPX07534AA</b>
	100	124	FR8	<b>CPX10034AA</b>
	125	156	FR8	<b>CPX12534AA</b>
	150	180	FR8	<b>CPX15034AA</b>
8	200	240	FR9	<b>CPX20034AA</b>
	250	300	FR9	<b>CPX25034AA</b>
<b>High Overload Drive</b>				
7	25	34	FR6	<b>CPX02534DA</b>
	30	40	FR6	<b>CPX03034DA</b>
	40	52	FR7	<b>CPX04034DA</b>
	50	65	FR7	<b>CPX05034DA</b>
	60	77	FR7	<b>CPX06034DA</b>
	75	96	FR8	<b>CPX07534DA</b>
	100	124	FR8	<b>CPX10034DA</b>
	125	156	FR8	<b>CPX12534DA</b>
	150	180	FR8	<b>CPX15034DA</b>
8	200	240	FR9	<b>CPX20034DA</b>
	250	300	FR9	<b>CPX25034DA</b>

**Notes**

- ① All Type 3R drives use the Size F enclosure.
- ② See enclosure dimensions beginning on **Page V6-T2-374**.
- ③ hp ratings are provided as a guideline. Drives should be sized per motor nameplate FLA.
- ④ The 18-pulse clean power assembly includes a standard drive, door-mounted local/remote keypad and enclosure.

## 575 V Drives

## Enclosed 18-Pulse Drive



## Enclosed 18-Pulse Base Drive Type 1

Enclosure Size <sup>①</sup>	hp <sup>②</sup>	Current (A)	Chassis Frame	Base Catalog Number <sup>③</sup>
<b>Low Overload Drive</b>				
7	25	27	FR6	CPX02515AA
	30	32	FR6	CPX03015AA
	40	41	FR7	CPX04015AA
	50	52	FR7	CPX05015AA
	60	62	FR8	CPX06015AA
	75	77	FR8	CPX07515AA
	100	99	FR8	CPX10015AA
8	125	125	FR9	CPX12515AA
	150	144	FR9	CPX15015AA
	200	192	FR9	CPX20015AA
9	250	242	FR10	CPX25015AA
	300	289	FR10	CPX30015AA
	400	382	FR10	CPX40015AA
10	500	472	FR11	CPX50015AA
	600	730	FR11	CPX60015AA
11	650	820	FR12	CPX65015AA
	700	920	FR12	CPX70015AA
	800	1030	FR12	CPX80015AA
<b>High Overload Drive</b>				
7	25	27	FR6	CPX02515DA
	30	32	FR7	CPX03015DA
	40	41	FR7	CPX04015DA
	50	52	FR8	CPX05015DA
	60	62	FR8	CPX06015DA
	75	77	FR8	CPX07515DA
8	100	99	FR9	CPX10015DA
	125	125	FR9	CPX12515DA
	150	144	FR9	CPX15015DA
9	200	192	FR10	CPX20015DA
	250	242	FR10	CPX25015DA
	300	289	FR10	CPX30015DA
10	400	382	FR11	CPX40015DA
	450	472	FR11	CPX45015DA
	500	730	FR11	CPX50015DA
11	600	820	FR12	CPX60015DA
	650	920	FR12	CPX65015DA
	700	1030	FR12	CPX70015DA

**Notes**

① See enclosure dimensions beginning on **Page V6-T2-374**.

② hp ratings are provided as a guideline. Drives should be sized per motor nameplate FLA.

③ The 18-pulse clean power assembly includes a standard drive, door-mounted local/remote keypad and enclosure.



## Enclosed 18-Pulse Drive

2



## Enclosed 18-Pulse Base Drive NEMA 12 Filtered

Enclosure Size <sup>①</sup>	hp <sup>②</sup>	Current (A)	Chassis Frame	Base Catalog Number <sup>③</sup>
<b>Low Overload Drive</b>				
7	25	27	FR6	CPX02565AA
	30	32	FR6	CPX03065AA
	40	41	FR7	CPX04065AA
	50	52	FR7	CPX05065AA
	60	62	FR8	CPX06065AA
	75	77	FR8	CPX07565AA
	100	99	FR8	CPX10065AA
8	125	125	FR9	CPX12565AA
	150	144	FR9	CPX15065AA
	200	192	FR9	CPX20065AA
9	250	242	FR10	CPX25065AA
	300	289	FR10	CPX30065AA
	400	382	FR10	CPX40065AA
10	500	472	FR11	CPX50065AA
	600	730	FR11	CPX60065AA
11	650	820	FR12	CPX65065AA
	700	920	FR12	CPX70065AA
	800	1030	FR12	CPX80065AA
<b>High Overload Drive</b>				
7	25	27	FR6	CPX02565DA
	30	32	FR7	CPX03065DA
	40	41	FR7	CPX04065DA
	50	52	FR8	CPX05065DA
	60	62	FR8	CPX06065DA
	75	77	FR8	CPX07565DA
	8	100	99	FR9
125		125	FR9	CPX12565DA
150		144	FR9	CPX15065DA
9	200	192	FR10	CPX20065DA
	250	242	FR10	CPX25065DA
	300	289	FR10	CPX30065DA
10	400	382	FR11	CPX40065DA
	450	472	FR11	CPX45065DA
	500	730	FR11	CPX50065DA
11	600	820	FR12	CPX60065DA
	650	920	FR12	CPX65065DA
	700	1030	FR12	CPX70065DA

**Notes**

<sup>①</sup> See enclosure dimensions beginning on **Page V6-T2-374**.

<sup>②</sup> hp ratings are provided as a guideline. Drives should be sized per motor nameplate FLA.

<sup>③</sup> The 18-pulse clean power assembly includes a standard drive, door-mounted local/remote keypad and enclosure.

## Enclosed 18-Pulse Drive

Enclosed 18-Pulse Base Drive Type 3R <sup>①</sup>

Enclosure Size <sup>②</sup>	hp <sup>③</sup>	Current (A)	Chassis Frame	Base Catalog Number <sup>④</sup>
<b>Low Overload Drive</b>				
7	25	27	FR6	CPX02535AA
	30	32	FR6	CPX03035AA
	40	41	FR7	CPX04035AA
	50	52	FR7	CPX05035AA
	60	62	FR8	CPX06035AA
	75	77	FR8	CPX07535AA
	100	99	FR8	CPX10035AA
8	125	125	FR9	CPX12535AA
	150	144	FR9	CPX15035AA
	200	192	FR9	CPX20035AA
<b>High Overload Drive</b>				
7	25	27	FR6	CPX02535DA
	30	32	FR7	CPX03035DA
	40	41	FR7	CPX04035DA
	50	52	FR8	CPX05035DA
	60	62	FR8	CPX06035DA
	75	77	FR8	CPX07535DA
8	100	99	FR9	CPX10035DA
	125	125	FR9	CPX12535DA
	150	144	FR9	CPX15035DA

**Notes**

- ① All Type 3R drives use the Size F enclosure.
- ② See enclosure dimensions beginning on **Page V6-T2-374**.
- ③ hp ratings are provided as a guideline. Drives should be sized per motor nameplate FLA.
- ④ The 18-pulse clean power assembly includes a standard drive, door-mounted local/remote keypad and enclosure.

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## Adjustable Frequency Drives

### Clean Power Drives

#### Options

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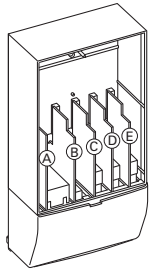
#### Enclosed 18-Pulse Drive Option Board Kits

The enclosed 18-pulse drives can accommodate a wide selection of expander and adapter option boards to customize the drive for your application needs. The drive's control unit is designed to accept a total of five option boards (see figure below).

The enclosed 18-pulse drives factory-installed standard board configuration includes an A9 I/O board and an A2 relay output board, which are installed in slots A and B.

#### SVX Series Option Board Kits

##### Option Boards



#### Option Board Kits

Option Kit Description <sup>①</sup>	Allowed Slot Locations <sup>②</sup>	Field Installed Catalog Number	Factory Installed Option Designator	SVX Ready Programs						
				Basic	Local/Remote	Standard	MSS	PID	Multi-P.	PFC
<b>Standard I/O Cards</b>										
2 RO (NC/NO)	B	<b>OPTA2</b>	—	■	■	■	■	■	■	■
6 DI, 1 DO, 2 AI, 1 AO, 1 +10 Vdc ref, 2 ext +24 Vdc/ext +24 Vdc	A	<b>OPTA9</b>	—	■	■	■	■	■	■	■
<b>Extended I/O Cards</b>										
6 DI	B, C, <b>D</b> , E	<b>OPTB1</b>	<b>B1</b>	—	—	—	—	—	■	■
1 RO (NC/NO), 1 RO (NO), 1 therm	B, C, <b>D</b> , E	<b>OPTB2</b>	<b>B2</b>	—	—	—	—	—	■	■
1 AI (mA isolated), 2 AO (mA isolated)	B, C, <b>D</b> , E	<b>OPTB4</b>	<b>B4</b>	■	■	■	■	■	■	■
3 RO (NO)	B, C, <b>D</b> , E	<b>OPTB5</b>	<b>B5</b>	—	—	—	—	—	■	■
3 Pt100 RTD board	B, C, <b>D</b> , E	<b>OPTB8</b>	<b>B8</b>	—	—	—	—	—	■	—
1 RO (NO), 5 DI 42–240 Vac input	B, C, <b>D</b> , E	<b>OPTB9</b>	<b>B9</b>	—	—	—	—	—	■	■
<b>Communication Cards <sup>③</sup></b>										
Modbus	D, <b>E</b>	<b>OPTC2</b>	<b>C2</b>	■	■	■	■	■	■	■
Modbus TCP	D, <b>E</b>	<b>OPTCI</b>	<b>CI</b>	■	■	■	■	■	■	■
BACnet	D, <b>E</b>	<b>OPTCJ</b>	<b>CJ</b>	■	■	■	■	■	■	■
EtherNet/IP	D, <b>E</b>	<b>OPTCQ</b>	<b>CQ</b>	■	■	■	■	■	■	■
Johnson Controls N2	D, <b>E</b>	<b>OPTC2</b>	<b>CA</b>	■	■	■	■	■	■	■
PROFIBUS DP	D, <b>E</b>	<b>OPTC3</b>	<b>C3</b>	■	■	■	■	■	■	■
LonWorks	D, <b>E</b>	<b>OPTC4</b>	<b>C4</b>	■	■	■	■	■	■	■
PROFIBUS DP (D9 connector)	D, <b>E</b>	<b>OPTC5</b>	<b>C5</b>	■	■	■	■	■	■	■
CANopen (slave)	D, <b>E</b>	<b>OPTC6</b>	<b>C6</b>	■	■	■	■	■	■	■
DeviceNet	D, <b>E</b>	<b>OPTC7</b>	<b>C7</b>	■	■	■	■	■	■	■
Modbus (D9 type connector)	D, <b>E</b>	<b>OPTC8</b>	<b>C8</b>	■	■	■	■	■	■	■
RS-232 with D9 connection	D, <b>E</b>	<b>OPTD3</b>	<b>D3</b>	■	■	■	■	■	■	■

#### Notes

- ① AI = Analog Input; AO = Analog Output, DI = Digital Input, DO = Digital Output, RO = Relay Output
- ② Option card must be installed in one of the slots listed for that card. Slot indicated in bold is the preferred location.
- ③ OPTC2 is a multi-protocol option card.

**Modbus RTU Network Communications**

The Modbus Network Card OPTC2 is used for connecting the SVX Drive as a slave on a Modbus network. The interface is connected by a 9-pin DSUB connector (female) and the baud rate ranges from 300 to 19,200 baud. Other communication parameters include an address range from 1 to 247; a parity of None, Odd or Even; and the stop bit is 1.

**PROFIBUS Network Communications**

The PROFIBUS Network Card OPTC3 is used for connecting the SVX Drive as a slave on a PROFIBUS-DP network. The interface is connected by a 9-pin DSUB connector (female). The baud rates range from 9.6 Kbaud to 12 Mbaud, and the addresses range from 1 to 127.

**LonWorks Network Communications**

The LonWorks Network Card OPTC4 is used for connecting the SVX Drive on a LonWorks network. This interface uses Standard Network Variable Types (SNVT) as data types. The channel connection is achieved using a FTT-10 A Free Topology transceiver via a single twisted transfer cable. The communication speed with LonWorks is 78 kBits/s.

**CANopen (Slave) Communications**

The CANopen (Slave) Network Card OPTC6 is used for connecting the SVX Drive to a host system. According to ISO11898 standard cables to be chosen for CANbus should have a nominal impedance of 120 ohms, and specific line delay of nominal 5 nS/m. 120 ohm line termination resistors required for installation.

**DeviceNet Network Communications**

The DeviceNet Network Card OPTC7 is used for connecting the SVX Drive on a DeviceNet Network. It includes a 5.08 mm pluggable connector. Transfer method is via CAN using a two-wire twisted shielded cable with two-wire bus power cable and drain. The baud rates used for communication include 125 Kbaud, 250 Kbaud and 500 Kbaud.

**Johnson Controls Metasys N2 Network Communications**

The OPTC2 fieldbus board provides communication between the SVX Drive and a Johnson Controls Metasys™ N2 network. With this connection, the drive can be controlled, monitored and programmed from the Metasys system. The N2 fieldbus is available as a factory-installed option and as a field-installable kit.

**Modbus/TCP Network Communications**

The Modbus/TCP Network Card OPTC1 is used for connecting the SVX Drive to Ethernet networks using Modbus protocol. It includes an RJ-45 pluggable connector. This interface provides a selection of standard and custom register values to communicate drive parameters. The board supports 10 Mbps and 100 Mbps communication speeds. The IP address of the board is configurable over Ethernet using a supplied software tool.

**BACnet Network Communications**

The BACnet Network Card OPTCJ is used for connecting the SVX Drive to BACnet networks. It includes a 5.08 mm pluggable connector. Data transfer is Master-Slave/Token Passing (MS/TP) RS-485. This interface uses a collection of 30 Binary Value Objects (BVOs) and 35 Analog Value Objects (AVOs) to communicate drive parameters. The card supports 9.6, 19.2 and 38.4 Kbaud communication speeds and supports network addresses 1 to 127.

**EtherNet/IP Network Communications**

The EtherNet/IP Network Card OPTCK is used for connecting the SVX Drive to Ethernet/Industrial Protocol networks. It includes an RJ-45 pluggable connector. The interface uses CIP objects to communicate drive parameters (CIP is "Common Industrial Protocol," the same protocol used by DeviceNet). The board supports 10 Mbps and 100 Mbps communication speeds. The IP address of the board is configurable by Static, BOOTP and DHCP methods.

## Control/Communication Option Descriptions

For availability, see Product Selection for base drive voltage required.

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## Available Control/Communications Options

Option	Description	Option Type
K1	<b>Door-Mounted Speed Potentiometer</b> —Provides the enclosed 18-pulse drive with the ability to adjust the frequency reference using a door-mounted potentiometer. This option uses the 10 Vdc reference to generate a 0–10 V signal at the analog voltage input signal terminal. When the HOA bypass option is added, the speed is controlled when the HOA switch is in the HAND position. Without the HOA bypass option, a two-position switch (labeled local/remote) is provided on the keypad to select speed reference from the speed potentiometer or a remote speed signal.	Control
K2	<b>Door-Mounted Speed Potentiometer with HOA Selector Switch</b> —Provides the enclosed 18-pulse drive with the ability to start/stop and adjust the speed reference from door-mounted control devices or remotely from customer-supplied inputs. In HAND position, the drive will start and the speed is controlled by the door-mounted speed potentiometer. The drive will be disabled in the OFF position. When AUTO is selected, the drive run and speed control commands are via user-supplied dry contact and 4–20 mA signal.	Control
K4	<b>HAND/OFF/AUTO Switch for Non-Bypass Configurations</b> —Provides a three-position selector switch that allows the user to select either a HAND or AUTO mode of operation. HAND mode is defaulted to keypad operation, and AUTO mode is defaulted to control from an external terminal source. These modes of operation can be configured via drive programming to allow for alternate combinations of start and speed sources. Start and speed sources include Keypad, I/O and fieldbus.	Control
K5	<b>MANUAL/AUTO Speed Reference Switch</b> —Provides door-mounted selector switch for MANUAL/AUTO speed reference.	Control
K6	<b>START/STOP Pushbuttons</b> —Provide door-mounted START and STOP pushbuttons for either bypass or non-bypass configurations.	Control
KF	<b>Bypass Test Switch for RA</b> —Allows the user to energize the AF drive for testing while operating the motor on the bypass controller. The Test Switch is mounted on the inside of the enclosure door.	Addl. bypass
K0	<b>Standard Elapsed Time Meter</b> —Provides a door-mounted elapsed run-time meter.	Control
L1	<b>Power On and Fault Power Lights</b> —Provide a white Power On light that indicates power to the enclosed cabinet and a red fault light that indicates a drive fault has occurred.	Light
L2	<b>Bypass Pilot Lights for RA Bypass Options</b> —A green light indicates when the motor is running in Inverter mode and an amber light indicates when the motor is running in Bypass mode. The lights are mounted on the enclosure door, above the switches.	Addl. bypass
LE	<b>Red Run Pilot Light 0.87-Inch (22 mm)</b> —Provides a red Run pilot light that indicates the drive is running.	Light
P1	<b>Input Circuit Breaker</b> —High interrupting circuit breaker that provides a means of short-circuit protection for the power cables between it and the enclosed 18-pulse drive, and protection from high-level ground faults on the power cable. Allows a convenient means of disconnecting the enclosed 18-pulse drive from the line, and the operating mechanism can be padlocked in the OFF position. This is factory mounted in the enclosure. Standard rating is 65 kAIC at 208/480 V. 100 kAIC is available as an option.	Input
PE	<b>Output Contactor</b> —Provides a means for positive disconnection of the drive output from the motor terminals. The contactor coil is controlled by the drive's run or permissive logic. NC and NO auxiliary contacts rated at 10 A, 600 Vac are provided for customer use. Bypass options <b>RB</b> and <b>RA</b> include an output contactor as standard. This option includes a low VA 115 Vac fused control power transformer and is factory mounted in the enclosure.	Output
PF	<b>Output Filter</b> —Used to reduce the transient voltage (dV/dt) at the motor terminals. The output filter is recommended for cable lengths exceeding 100 ft (30.5 m) with a drive of 3 hp and above, for cable lengths of 33 ft (10.1 m) with a drive of 2 hp and below, or for a drive rated at 525–690 V. This option is mounted in the enclosure.	Output
PG	<b>MotoRx (300–600 Ft) 1000 V/μs dV/dt Filter</b> —Used to reduce transient voltage (dV/dt) and peak voltages at the motor terminals. This option is comprised of a 0.5% line reactor, followed by capacitive filtering and an energy recovery/clamping circuit. Unlike the output filter (see option PF), the MotoRx recovers most of the energy from the voltage peaks, resulting in a lower voltage drop to the motor, and therefore conserving power. This option is used when the distance between a single motor and the drive is 300–600 ft (91.4–182.9 m).	Output
PH	<b>Single Overload Relay</b> —Uses a bimetallic overload relay to provide additional overload current protection to the motor on configurations without bypass options. It is included with the bypass configurations for overload current protection in the bypass mode. The overload relay is mounted within the enclosure, and is manually resettable. Heater pack included.	Output
PI	<b>Dual Overload Relays</b> —This option is recommended when a single drive is operating two motors and overload current protection is needed for each of the motors. The standard configuration includes two bimetallic overload relays, each sized to protect a motor with 50% of the drive hp rating. For example, a 100 hp drive would include two overload relays sized to protect two 50 hp motors. The relays are mounted within the enclosure, and are manually resettable. Heater packs not included.	Output
PN	<b>Dual Overloads for Bypass</b> —This option is recommended when a single drive is operating two motors in the Bypass mode and overload current protection is needed for each of the motors. The standard configuration includes two bimetallic overload relays, each sized to protect a motor with 50% of the drive hp rating. For example, a 100 hp drive would include two overload relays sized to protect two 50 hp motors. The relays are mounted within the enclosure, and are manually resettable.	Addl. bypass
RA	<b>Manual HOA Bypass Controller</b> —The manual HAND/OFF/AUTO (HOA)—three-contactor—bypass option provides a means of bypassing the enclosed 18-pulse drive, allowing the AC motor to be operated at full speed directly from the AC supply line. This option consists of an input HMCP, a fused control power transformer, and a full voltage bypass starter with a door-mounted HOA selector switch and an INVERTER/BYPASS switch. The HOA switch provides the ability to start and stop the drive in the inverter mode. IEC type input, bypass and input contactors are provided. The contactors are mechanically and electrically interlocked (see wiring diagram on <b>Page V6-T2-373</b> ).	Bypass
RC	<b>Auto Transfer HOA Bypass Controller</b> —The manual HAND/OFF/AUTO (HOA)—three-contactor—bypass option provides a means of bypassing the enclosed 18-pulse drive, allowing the AC motor to be operated at full speed directly from the AC supply line. The circuitry provides an automatic transfer of the load to “across the line” operation after a drive trip. This option consists of an input HMCP, a fused control power transformer, and a full voltage bypass starter with a door-mounted HOA selector switch and an INVERTER/BYPASS switch. The HOA switch provides the ability to start and stop the drive in either mode. IEC type input, bypass and input contactors are provided. The contactors are mechanically and electrically interlocked (see wiring diagram on <b>Page V6-T2-373</b> ). Door-mounted pilot lights are provided that indicate bypass or inverter operation. A green light indicates when the motor is running in inverter mode and an amber light indicates when the motor is running in bypass mode. <b>WARNING:</b> The motor may restart when the overcurrent relay is reset when operating in bypass, unless the IOB selector switch is turned to the OFF position.	Bypass
RG	<b>Reduced Voltage Starter for Bypass</b> —Used in conjunction with bypass option RA or RC. This option adds reduced voltage soft starter to bypass assembly for soft starting in bypass mode.	Bypass

For availability, see Product Selection for base drive voltage required.

### Available Control/Communications Options, continued

Option	Description	Option Type
<b>S7</b>	<b>10.00-Inch (254.0 mm) Expansion</b> —Expansion cabinet allows for special components, customer-supplied components or oversized cables. <b>NOTE:</b> Enclosure expansion rated Type 1 only.	Enclosure
<b>S8</b>	<b>20.00-Inch (508.0 mm) Expansion</b> —Expansion cabinet allows for special components, customer-supplied components or oversized cables. <b>NOTE:</b> Enclosure expansion rated Type 1 only.	Enclosure
<b>S9</b>	<b>Space Heater</b> —Prevents condensation from forming in the enclosure when the drive is inactive or in storage. Includes a thermostat for variable temperature control. The heater requires a customer-supplied 115 V remote supply source.	Enclosure

### Dissipated Watt Losses

Horsepower	40	50	60	75	100	125	150	200	250	300	350	400	450	500	600	700	800
<b>Watts</b>	1844	2170	2540	3040	4011	4940	5730	8020	9383	11600	13600	15700	16250	17976	20393	27200	31400

### Conformal (Varnished) Coating <sup>①</sup>

Chassis Frame	Delivery Code	Chassis Frame	Delivery Code
FR6	FP	FR9	FP
FR7	FP	FR10	FP
FR8	FP	FR11	FP
—	—	FR12	FP

### 480 V Input Disconnect Selection <sup>②</sup>

Horsepower	P1 Input Breaker	Bypass Motor Circuit Protector (RA, RB, RC, RD)
25	HFD3050	HMCP050K2C
30	HFD3060	HMCP100R3C
40	HFD3080	HMCP100R3C
50	HFD3100	HMCP100R3C
60	HFD3100	HMCP150T4C
75	HFD3125	HMCP150T4C
100	HFD3150	HMCP150U4C
125	HFD3200	HMCP250W5C
150	HFD3225	HMCP250W5C
200	HKD3300	HMCP400X5C
250	HKD3400	HMCP400X5C
300–400	HLD3600	HMCP600L6W
500–600	NGH308033E	HMCP800X7W
650–800	NGH312033E	<sup>③</sup>

### Enclosed Drive Options

#### Light Options

Description	Catalog Number Suffix
Power on, run, fault LED lights (22 mm)	<b>L1</b>
Power on, fault LED lights (22 mm)	<b>L3</b>
Green LED run light (22 mm)	<b>LA</b>
Green LED stop light (22 mm)	<b>LD</b>
Red LED run light (22 mm)	<b>LE</b>
Red LED stop light (22 mm)	<b>LF</b>
Red LED fault light (22 mm)	<b>LG</b>
Power on white LED light (22 mm)	<b>LJ</b>
Miscellaneous LED light (22 mm)	<b>LU</b>

#### Control Options

Description	Catalog Number Suffix
Door-mounted speed potentiometer	<b>K1</b>
Door-mounted speed potentiometer with HOA selector switch	<b>K2</b>
HOA selector switch	<b>K4</b>
MANUAL/AUTO reference switch	<b>K5</b>
START-STOP pushbuttons	<b>K6</b>
Type D2 control relay	<b>SD</b>
On-delay relay	<b>SE</b>
Off-delay relay	<b>SF</b>
Additional terminal blocks per 4 points	<b>SD</b>

#### Notes

- <sup>①</sup> See catalog number description to order.
- <sup>②</sup> Contact factory for 208 V and 575 V applications.
- <sup>③</sup> Contact factory.

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## Adjustable Frequency Drives

### Clean Power Drives

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#### Bypass Control Options

Description	Catalog Number Suffix
Bypass test switch used with RA	KF
Inverter/bypass pilot lights	L2

#### Meter Options

Description	Catalog Number Suffix
Standard elapsed time meter	K0
Frequency meter	KS
MP-3000 relay with URTD	KV
MP-3000 relay with URTD and CTs	KU

#### Enclosure Options

Enclosure Size	Catalog Number Suffix
<b>10.00 Inch (254.0 mm) Expansion</b>	
7	S7
8	S7
9	S7
10	S7
11	S7
<b>20.00 Inch (508.0 mm) Expansion</b>	
7	S8
8	S8
9	S8
10	S8
11	S8
<b>Space Heater <sup>①</sup></b>	
7	S9
8	S9
9	S9
10	S9
11	S9
<b>Plastic Nameplate</b>	
7	SN
8	SN
9	SN
10	SN
11	SN

#### 208 and 230 V Power Options, 25–200 hp

Description	Catalog Number Suffix
Input breaker	P1
Output contactor	PE
Single overload relay	PH
Dual overload relays	PI
MOV	P7
50 kA surge protective device	P8
100 kA surge protective device	PA

#### 480 and 575 V Power Options, 25–800 hp

Description	Catalog Number Suffix
Input breaker	P1
Output contactor	PE
Output filter	PF
MotoRx (300–600 Ft) dV/dt filter	PG
Single overload relay	PH
Dual overload relays	PI
Input MOV	P7
50 kA surge protective device	P8
100 kA surge protective device	PA

#### 208 and 230 V Bypass Options, 25–200 hp

Description	Catalog Number Suffix
Manual HOA bypass controller	RA
Auto transfer HOA bypass controller	RC
Reduced voltage starter for bypass	RG
Dual overloads for bypass	PN

#### 480 and 575 V Bypass Options, 25–800 hp

Description	Catalog Number Suffix
Manual HOA bypass controller	RA
Auto transfer HOA bypass controller	RC
Reduced voltage starter for bypass	RG
Dual overloads for bypass	PN

#### Note

<sup>①</sup> Requires customer-supplied 115 Vac supply.

## Technical Data and Specifications

### Enclosed 18-Pulse Drives

Description	Specification
<b>Primary Design Features</b>	
45–66 Hz input frequency	Standard
Output: AC volts maximum	Input voltage base
Output frequency range	0–320 Hz
Initial output current ( $I_H$ )	250% for 2 seconds
Overload (1 minute [ $I_H/I_L$ ])	150%/110%
Enclosure space heater	Optional
Oversize enclosure	Standard
Output contactor	Optional
Bypass motor starter	Optional
Listings	UL, cUL, 508C
<b>Protection Features</b>	
Incoming line fuses	Standard 200 kAIC rating
AC input circuit disconnect	Optional
Phase rotation insensitive	Standard
EMI filter	Standard FR6 thru FR9 <sup>①</sup>
Input phase loss protection	Standard
Input overvoltage protection	Standard
Line surge protection	Standard
Output short-circuit protection	Standard
Output ground fault protection	Standard
Output phase protection	Standard
Overtemperature protection	Standard
DC overvoltage protection	Standard
Drive overload protection	Standard
Motor overload protection	Standard
Programmer software	Optional
Local/remote keypad	Standard
Keypad lockout	Standard
Fault alarm output	Standard
Built-in diagnostics	Standard
Surge protective device	Optional

Description	Specification
<b>Input/Output Interface Features</b>	
Setup adjustment provisions	
Remote keypad/display	Standard
Personal computer	Standard
Operator control provisions	
Drive mounted keypad/display	Standard
Remote keypad/display	Standard
Conventional control elements	Standard
Serial communications	Optional
115 Vac control circuit	Optional
Speed setting inputs	
Keypad	Standard
0–10 Vdc potentiometer/voltage signal	Standard
4–20 mA isolated	Configurable
4–20 mA differential	Configurable
3–15 psig	Optional
Analog outputs	
Speed/frequency	Standard
Torque/load/current	Programmable
Motor voltage	Programmable
Kilowatts	Programmable
0–10 Vdc signals	Configurable w/jumpers
4–20 mA DC signals	Standard
Isolated signals	Standard
Discrete outputs	
Fault alarm	Standard
Drive running	Standard
Drive at set speed	Programmable
Optional parameters	14
Dry contacts	2 Form C contacts available
Additional discrete outputs	Optional
<b>Communications</b>	
RS-232	Standard
RS-422/485	Optional
DeviceNet™	Optional
Modbus RTU	Optional
CANopen (slave)	Optional
PROFIBUS-DP	Optional
LonWorks	Optional
Johnson Controls Metasys N2	Optional
EtherNet/IP/Modbus TCP	Optional
BACnet	Optional

#### Note

<sup>①</sup> The EMI filter is optional in FR10 and larger.



## Enclosed 18-Pulse Drives

Description	Specification
<b>Performance Features</b>	
Sensorless vector control	Standard
Volts/hertz control	Standard
IR and slip compensation	Standard
Electronic reversing	Standard
Dynamic braking	Optional
DC braking	Standard
PID set point controller	Programmable
Critical speed lockout	Standard
Current (torque) limit	Standard
Adjustable acceleration/deceleration	Standard
Linear or S curve accel/decel	Standard
Jog at preset speed	Standard
Thread/preset speeds	7
Automatic restart	Selectable
Coasting motor start	Standard
Coast or ramp stop selection	Standard
Elapsed time meter	Optional
Carrier frequency adjustment	1–16 kHz
<b>Standard Conditions for Application and Service</b>	
Maximum operating ambient temperature	0–50 °C up to FR9 0–40 °C FR10 and larger, consult factory for 50 °C rating above FR9
Storage temperature	–40 to 60 °C
Humidity (maximum), noncondensing	95%
Altitude (maximum without derate)	3300 ft (1000 m)
Line voltage variation	+10/–15%
Line frequency variation	45–66 Hz
Efficiency	>95%
Power factor (displacement)	0.99+
Power factor (apparent)	0.99

## Standard I/O Specifications

Description	Specification
Six–digital input programmable	24 V: “0” ≤10 V, “1” ≥18V, R <sub>i</sub> >5 kohms
Two–analog input configurable w/jumpers	Voltage: 0–±10 V, R <sub>i</sub> >200 kohms Current: 0 (4)–20 mA, R <sub>i</sub> = 250 ohms
Two–digital output programmable	Form C relays 250 Vac 30 Vdc 2 amp resistive
One–analog output programmable configurable w/jumper	0–20 mA, R <sub>L</sub> max. 500 ohms 10 bits ±2%

## I/O Specifications for Control/Communication Options

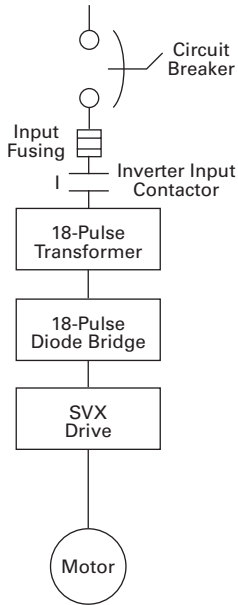
Description	Specification
Analog voltage, input	0–±10 V, R <sub>i</sub> ≥200 kilohms
Analog current, input	0 (4)–20 mA, R <sub>i</sub> = 250 ohms
Digital input	24 V: “0” ≤10 V, “1” ≥18V, R <sub>i</sub> >5 kilohms
Auxiliary voltage	24 V (±20%), max. 50 mA
Reference voltage	10 V ±3%, max. 10 mA
Analog current, output	0 (4)–20 mA, R <sub>L</sub> = 500 kilohms, resolution 10 bit, accuracy ≤±2%
Analog voltage, output	0 (2)–10 V, R <sub>L</sub> ≥1 kilohm, resolution 10 bit, accuracy ≤±2%
Relay output max. switching voltage	300 Vdc, 250 Vac
Relay output max. switching load	3 A/24 Vdc, 300 Vdc, 250 Vac ①
Relay output max. continuous load	2 A rms
Thermistor input	R <sub>trip</sub> = 4.7 kohms

**Note**

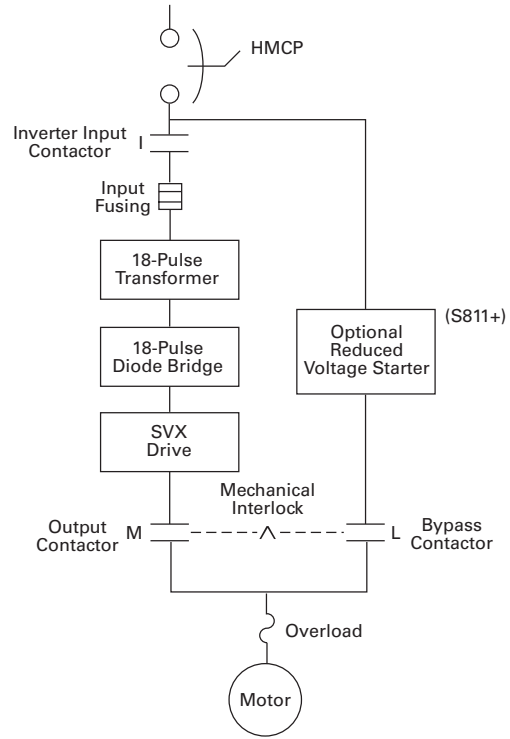
① For applications above 3 A consult instruction manual.

### Wiring Diagrams

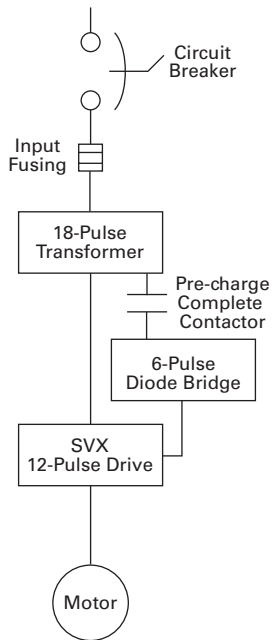
Power Diagram Up to FR9



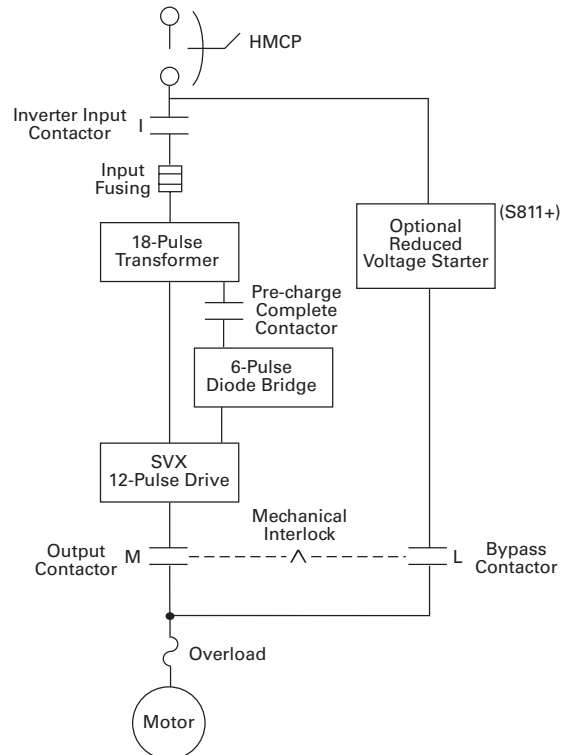
Power Diagram Up to FR9 with Bypass



Power Diagram FR10 and Larger



Power Diagram FR10 and Larger with Bypass



# 2.11

## Adjustable Frequency Drives

### Clean Power Drives

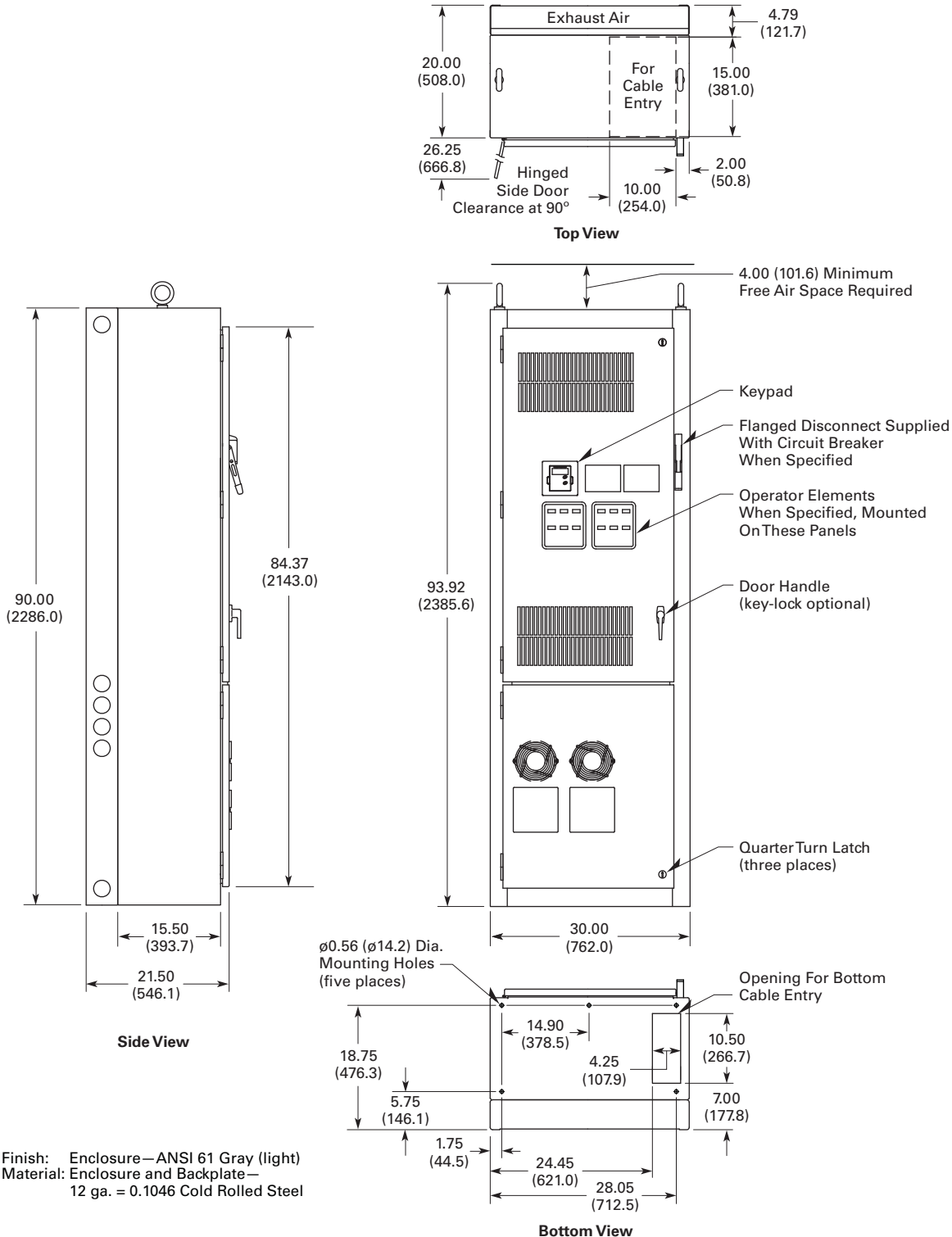
#### Dimensions

Approximate Dimensions in Inches (mm)

2

#### Enclosure Size 7

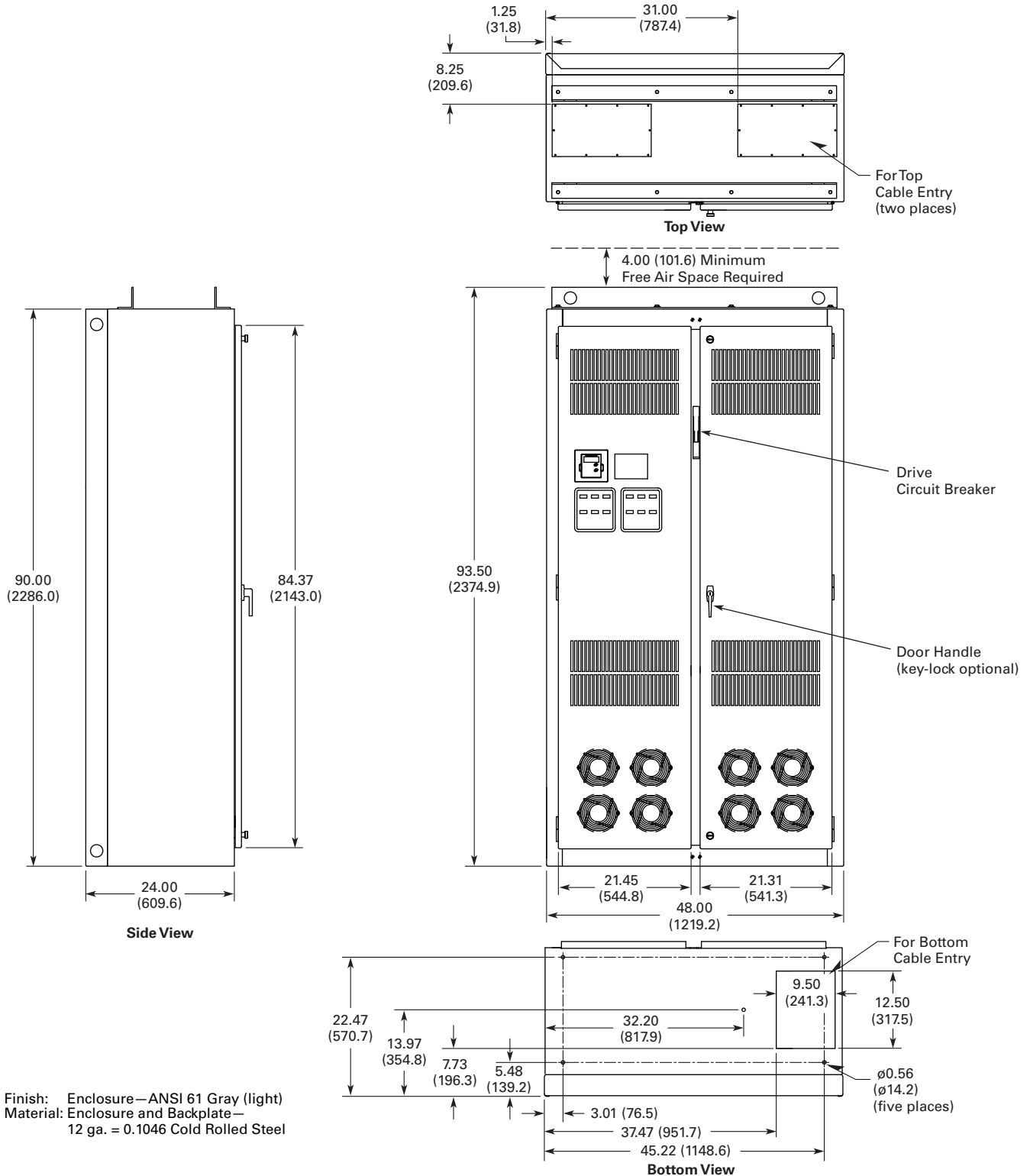
25–150 hp  $I_L$  and 25–125 hp  $I_H$  480 V—25–100 hp  $I_L$  and 25–75 hp  $I_H$  575 V



Approximate Dimensions in Inches (mm)

### Enclosure Size 8

200–250 hp  $I_L$  and 150–200 hp  $I_H$  480 V — 125–200 hp  $I_L$  and 100–150 hp  $I_H$  575 V



# 2.11

## Adjustable Frequency Drives

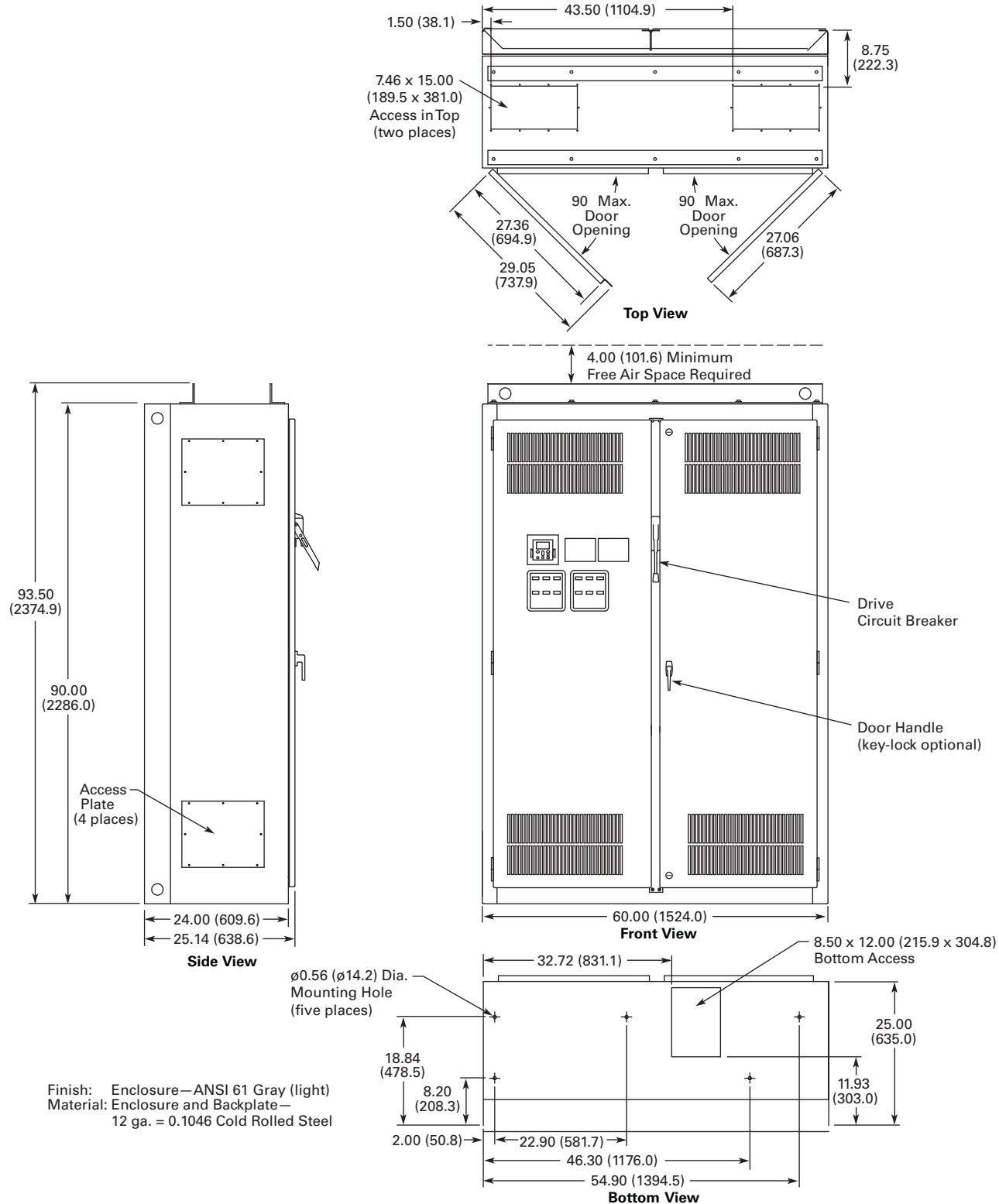
### Clean Power Drives

Approximate Dimensions in Inches (mm)

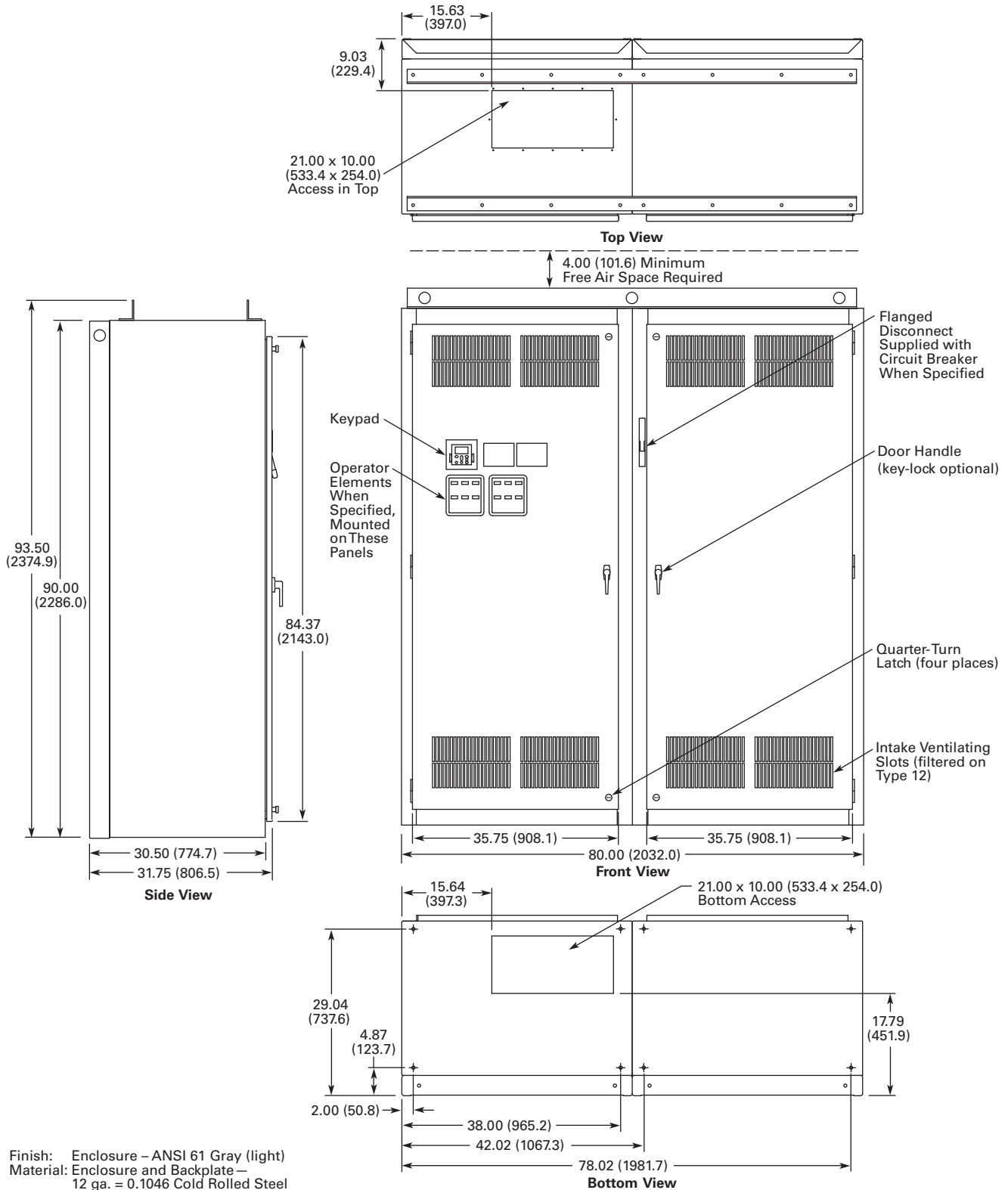
#### Enclosure Size 9

2

300–400 hp I<sub>L</sub> and 250–350 hp I<sub>H</sub> 480 V—250–400 hp I<sub>L</sub> and 200–300 hp I<sub>H</sub> 575 V



Approximate Dimensions in Inches (mm)

**Enclosure Size 10**500–600 hp I<sub>L</sub> and 400–500 hp I<sub>H</sub> 480 V—500–600 hp I<sub>L</sub> and 400–500 hp I<sub>H</sub> 575 V

# 2.11

## Adjustable Frequency Drives

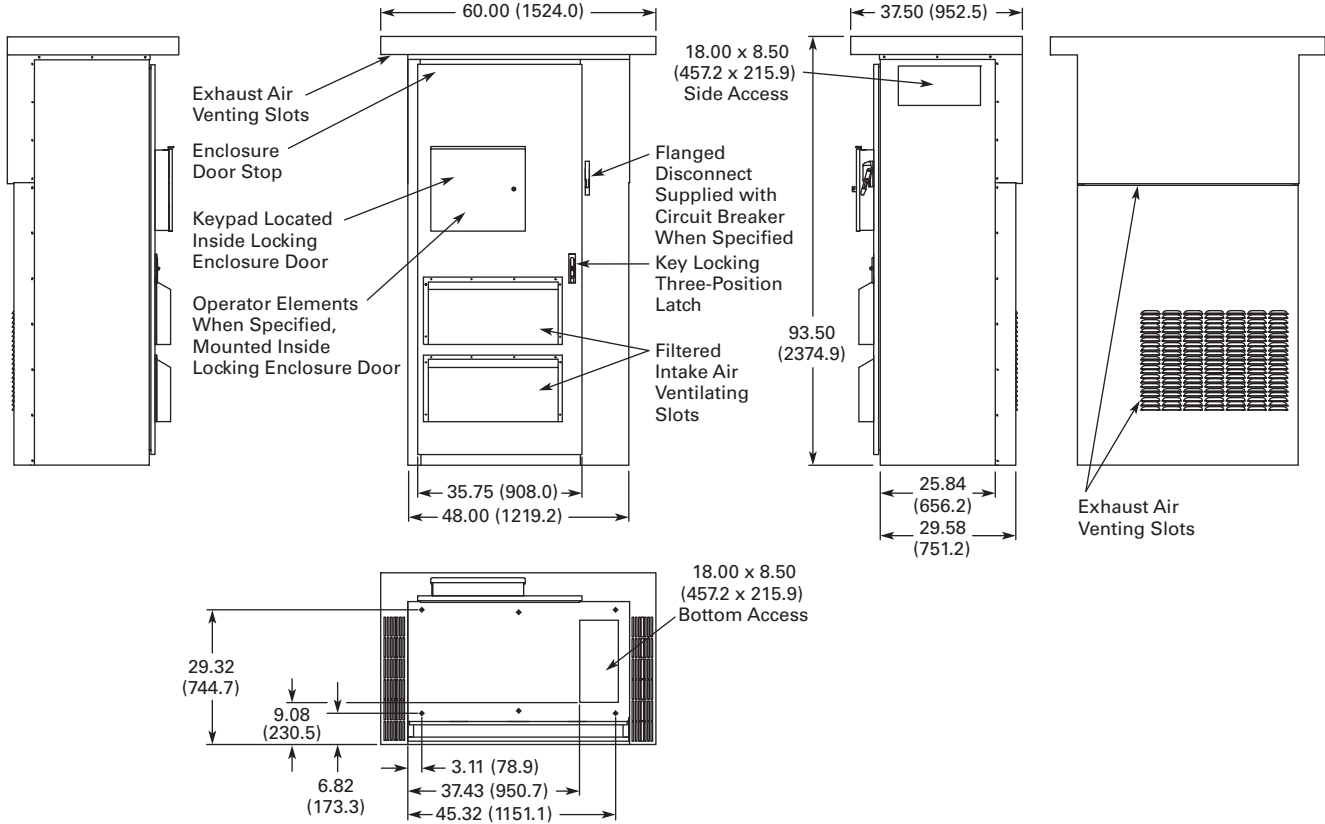
### Clean Power Drives

Approximate Dimensions in Inches (mm)

#### Enclosure Size F Type 3R Drives

2

#### 25–250 hp I<sub>L</sub> and 25–200 hp I<sub>H</sub> 480 V – 25–200 hp I<sub>L</sub> and 25–150 hp I<sub>H</sub> 575 V Type 3R Drives



#### Enclosed 18-Pulse Drive Enclosure Dimensions

Enclosure Size ①	Width	Height	Depth	Approx. Shipping Weight in Lbs (kg)
7	30.00 (762.0)	90.00 (2286.0)	21.50 (546.1)	1000 (454)
8	48.00 (1219.2)	90.00 (2286.0)	26.14 (664.0)	1400 (636)
9	60.00 (1524.0)	90.00 (2286.0)	25.74 (653.8)	1800 (817)
10	80.00 (2032.0)	90.00 (2286.0)	31.75 (806.5)	2100 (953)
11 ②③	120.00 (3048.0)	90.00 (2286.0)	25.74 (653.8)	2500 (1,135)
F ④	60.00 (1524.0)	93.50 (2374.9)	37.50 (952.5)	2500 (1,135)

#### Notes

- ① Enclosure sizes accommodate drive and options, including bypass and disconnect. For other power options, consult your Eaton representative.
- ② Consult factory. Limited power options available.
- ③ Enclosure size 11 consists of two of the enclosure size 9.
- ④ All Type 3R drives use the Size F enclosure.

## Enclosed Regenerative Drives



## Contents

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CPX Enclosed 18-Pulse Drives . . . . .	V6-T2-355
RGX Enclosed Regenerative Drives	
Catalog Number Selection . . . . .	V6-T2-381
Product Selection . . . . .	V6-T2-382
Options . . . . .	V6-T2-384
Technical Data and Specifications . . . . .	V6-T2-385
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## RGX Enclosed Regenerative Drives

## Product Description

The RGX is an enclosed solution to meet the needs of customer's regenerative load applications. It combines Eaton's comprehensive family of DC common DC bus drive products together with the necessary circuit protection and filtering to give the customer an all-in-one package. The RGX is available in 480 V and 575 V configurations in sizes up through 900 hp.

## Base Assembly Components

## LCL Filter

An LCL filter is applied on the line side of the of the front end unit and integrated into the enclosed solution. This unit corrects the voltage wave form to return clean power back to the power system.

## Front-End Unit

The RGX uses the SPA drive module, which is an active bi-directional converter. This converter allows power to flow from the main voltage to the DC bus and back from the DC bus to the main voltage.

## Inverter Unit

The RGX uses an SPI drive module, which is a DC-fed power inverter for the supply and control of AC motors. This inverter is specifically designed to also allow power to flow back to the DC bus in a regenerative load application.

## Harmonic Distortion

Harmonics are distorted electrical waveforms that produce inefficiencies, which could negatively affect your system. These inefficiencies can cause increased electrical usage, power quality problems, increased machine wear and utility penalties. The RGX takes control of high harmonics and reduces distortion to below the IEEE 519 recommendations. This minimal harmonic output allows the RGX drive to increase user energy efficiency, extend system life and reduce maintenance costs.

## Regeneration

The active front end module gives the system power regeneration capabilities. Through the use of IGBT bridge components, power

flows bi-directionally through the drive unit and can be converted back to an AC voltage. Additionally, the LCL filter corrects distorted voltage wave form on the output, thus producing clean power with low harmonics suitable to be returned to utility line. With power regeneration, the system does not need large resistor banks for ridding excess energy. Eliminating resistors increases energy savings while simplifying design.

## Energy Savings

The RGX provides exceptional energy savings through the use of regenerative braking. Regenerative braking uses the electric motor as a generator when slowing, and in turn, power is regenerated. Recovered, clean power can then be returned to the line or utility for other uses. Comparatively, regenerative braking reduces energy consumption greatly over traditional mechanical and resistive braking because power is returned to the line rather than released as heat.

## Application Description

The RGX Series encompasses a wide range of application solutions, including belt conveyor, ball mill, extruder, centrifugal pump, center driver winder and a variety of test stands.

## Standards and Certifications

- UL
- cUL
- EN 61800-5-1 (2003)





# 2.11

## Adjustable Frequency Drives

### Clean Power Drives

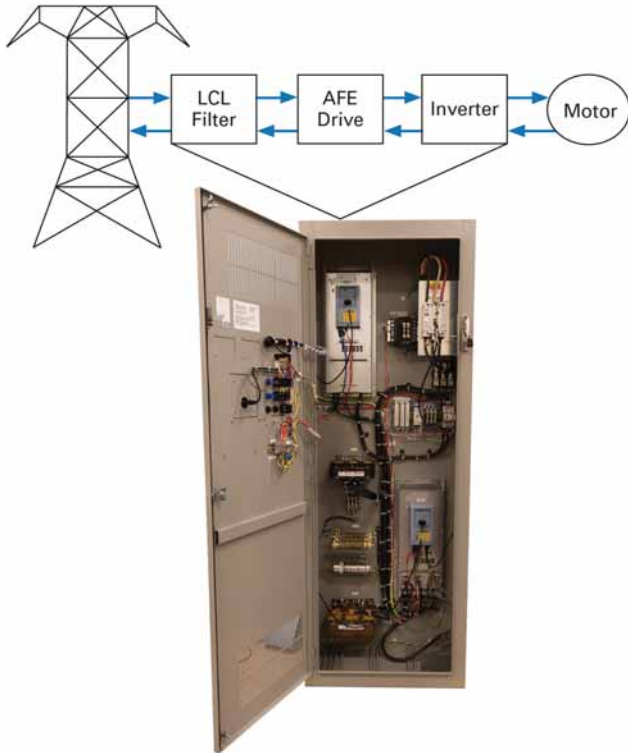
#### Product Identification <sup>①</sup>

2

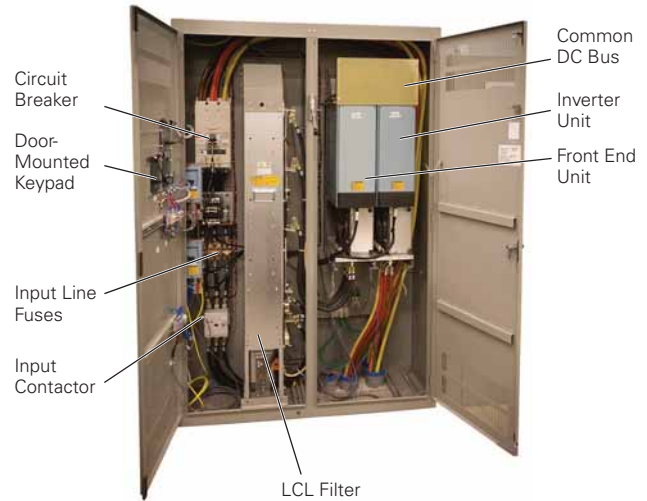
#### Power Flow Diagram and Components

- Power flows from the utility through the LCL filter, active-front end IGBT bridge and component inverter to the motor
- IGBT bridge components allow bi-directional current conversion and flow for power regeneration needs
- The active rectifier draws linear current off of the line, reducing peak currents on the input and reducing THDI to 2–3%
- During regeneration, the LCL filter corrects the voltage wave form to return clean power back to the utility

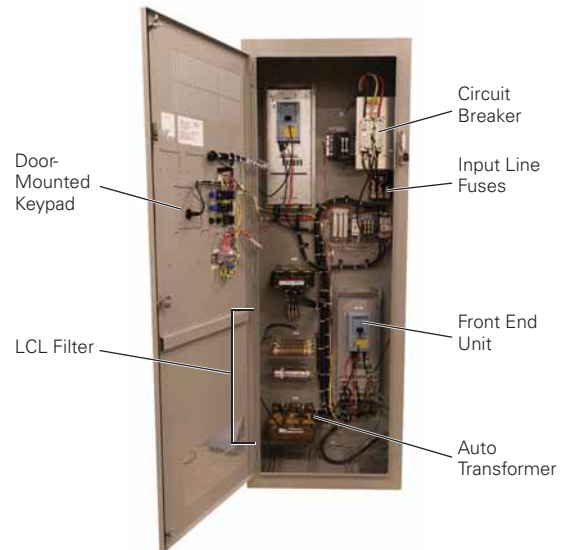
#### Power Flow Diagram and Components



#### RGX Size 9 Enclosure <sup>②</sup>



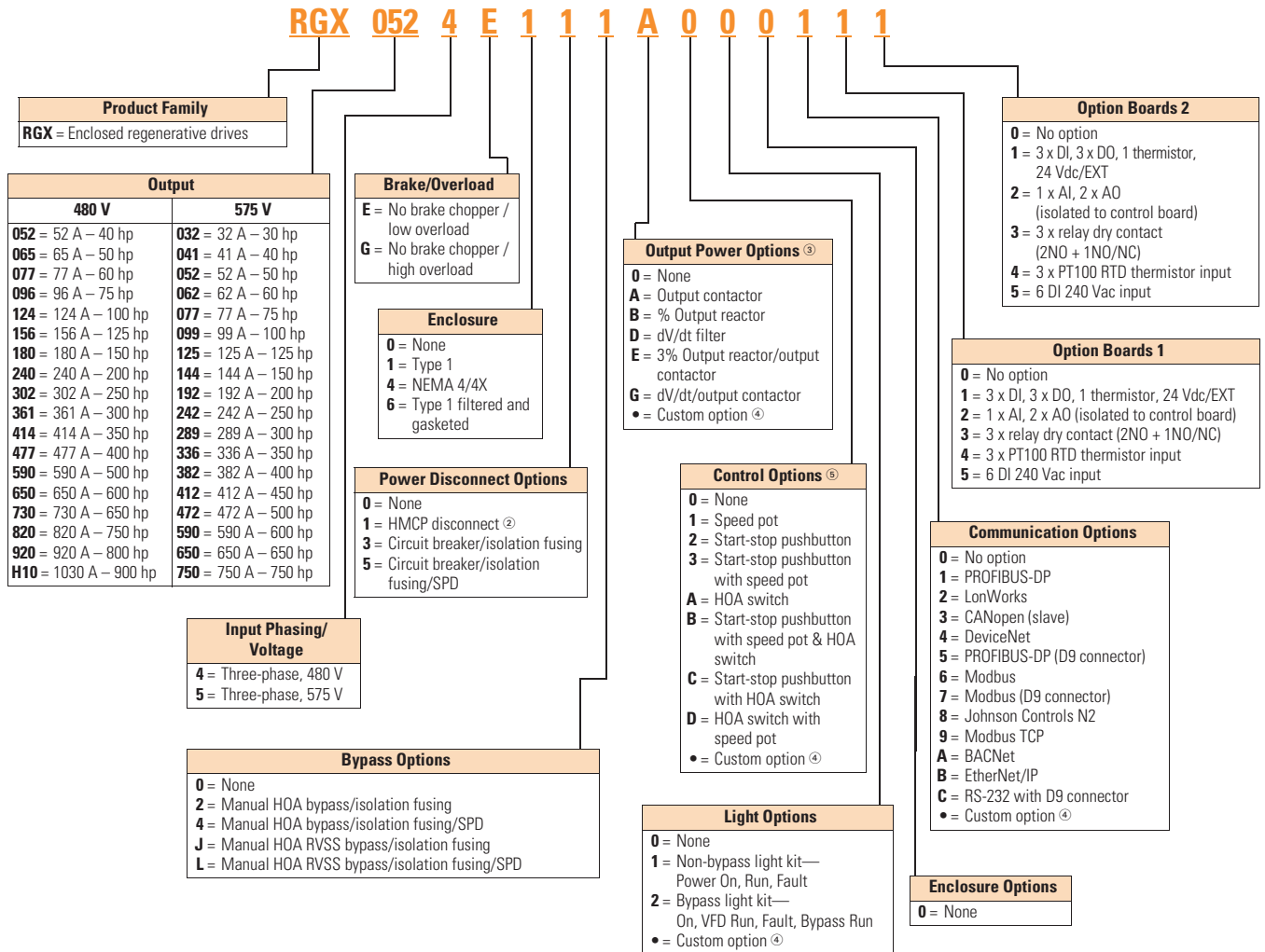
#### RGX Size 3 Enclosure <sup>③</sup>



#### Notes

- <sup>①</sup> Product identification section serves as example products and does not encompass full RGX product range.
- <sup>②</sup> Size 9 enclosure example is used as a solution for the RGX product range of 100–250 hp.
- <sup>③</sup> Size 3 enclosure example is used as a solution for a 30 hp RGX product.

## Catalog Number Selection

Enclosed Regenerative Drives <sup>①</sup>

## Notes

- <sup>①</sup> Catalog number selection is for illustration purpose only and not to be used to create new catalog numbers.  
<sup>②</sup> HMCP disconnect is standard when bypass is selected.  
<sup>③</sup> Output contactor not available with bypass. Bypass comes standard with output contactor.  
<sup>④</sup> More options are available as Engineered to Order (ETO) through the BidManager tool.  
<sup>⑤</sup> Pilot devices are 22 mm standard. 30 mm options are available as Engineered to Order (ETO) through the BidManager tool.

## Product Selection

2

## 480 V Drives

## RGX Drive



## RGX 480 V—NEMA Type 1/IP21

Enclosure Size	hp	Current (A)	Frame Size	Catalog Number <sup>①</sup>
<b>Low Overload Drive and Enclosure (VT)</b>				
7	50	65	7	RGX0654E1
	60	77	7	RGX0774E1
	75	96	7	RGX0964E1
5	100	124	8	RGX1244E1
	125	156	9	RGX1564E1
	150	180	9	RGX1804E1
	200	240	9	RGX2404E1
8	250	302	9	RGX3024E1
	300	361	10	RGX3614E1
	350	414	10	RGX4144E1
	400	477	10	RGX4774E1
Consult factory	500	590	12	RGX5904E1
	600	650	12	RGX6504E1
	650	730	12	RGX7304E1
	750	820	12	RGX8204E1
	800	920	12	RGX9204E1
	900	1030	12	RGX10304E1
<b>High Overload Drive and Enclosure (CT)</b>				
7	40	52	7	RGX0524G1
	50	65	7	RGX0654G1
	60	77	7	RGX0774G1
	75	96	8	RGX0964G1
5	100	124	9	RGX1244G1
	125	156	9	RGX1564G1
	150	180	9	RGX1804G1
	200	240	9	RGX2404G1
8	250	300	10	RGX3004G1
	300	361	10	RGX3614G1
	350	414	10	RGX4144G1
Consult factory	450	515	12	RGX5154G1
	500	590	12	RGX5904G1
	600	650	12	RGX6504G1
	650	730	12	RGX7304G1
	750	820	12	RGX8204G1
	800	920	12	RGX9204G1

**Note**

<sup>①</sup> “\_” denotes that catalog numbers are incomplete, base catalog numbers.

## 575 V Drives

## RGX Drive



## RGX 575 V—NEMA Type 1/IP21

Enclosure Size	hp	Current (A)	Frame Size	Catalog Number <sup>①</sup>
<b>Low Overload Drive and Enclosure (VT)</b>				
7	40	41	7	RGX0415E1
	50	52	7	RGX0525E1
	50	62	8	RGX0625E1
	75	77	8	RGX0775E1
	100	99	8	RGX0995E1
5	125	125	9	RGX1255E1
	150	144	9	RGX1445E1
	150	192	9	RGX1925E1
	200	242	9	RGX2425E1
	250	289	10	RGX2895E1
8	300	336	10	RGX3365E1
	400	382	10	RGX3825E1
Consult factory	450	412	12	RGX4125E1
	500	472	12	RGX4725E1
	600	590	12	RGX5905E1
	650	650	12	RGX6505E1
	750	750	12	RGX7505E1
<b>High Overload Drive and Enclosure (CT)</b>				
7	30	032	7	RGX0325G1
	40	041	7	RGX0415G1
	50	052	8	RGX0525G1
	60	062	8	RGX0625G1
	75	077	8	RGX0775G1
5	100	099	9	RGX0995G1
	125	125	9	RGX1255G1
	150	144	9	RGX1445G1
	150	170	9	RGX1705G1
8	200	192	10	RGX1925G1
	250	242	10	RGX2425G1
	300	289	10	RGX2895G1
Consult factory	400	382	12	RGX3825G1
	450	412	12	RGX4125G1
	500	472	12	RGX4725G1
	600	590	12	RGX5905G1
	650	650	12	RGX6505G1

**Note**

① “\_” denotes that catalog numbers are incomplete, base catalog numbers.

# 2.11

## Adjustable Frequency Drives

### Clean Power Drives

#### Options

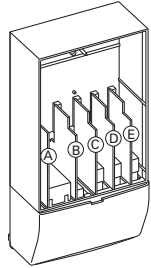
2

#### RGX Series Option Board Kits

The RGX Series drives can accommodate a wide selection of expander and adapter option boards to customize the drive for your application needs. The drive's control unit is designed to accept a total of five option boards.

The RGX Series factory installed standard board configuration includes an A9 I/O board and an A2 relay output board, which are installed in slots A and B.

#### Option Boards



#### Option Board Kits

Option Kit Description <sup>①</sup>	Allowed Slot Locations <sup>②</sup>	Field Installed Catalog Number
<b>Standard I/O Cards</b>		
2 RO (NC-NO)	B	<b>OPTA2</b>
6 DI, 1 DO, 2 AI, 1 AO, 1 +10 Vdc ref, 2 ext +24 Vdc/EXT +24 Vdc	A	<b>OPTA9</b>
<b>Extended I/O Cards</b>		
2 RO, therm	B	<b>OPTA3</b>
Encoder low volt +5 V/15 V/24 V	C	<b>OPTA4</b>
Encoder high volt +15 V/24 V	C	<b>OPTA5</b>
Double encoder	C	<b>OPTA7</b>
6 DI, 1 DO, 2 AI, 1 AO	A	<b>OPTA8</b>
3 DI (encoder 10–24 V), out +15 V/+24 V, 2 DO (pulse+direction)	C	<b>OPTAE</b>
6 DI, 1 ext +24 Vdc/EXT +24 Vdc	B, C, <b>D</b> , E	<b>OPTB1</b>
1 RO (NC-NO), 1 RO (NO), 1 therm	B, C, <b>D</b> , E	<b>OPTB2</b>
1 AI (mA isolated), 2 AO (mA isolated), 1 ext +24 Vdc/EXT +24 Vdc	B, C, <b>D</b> , E	<b>OPTB4</b>
3 RO (NO)	B, C, <b>D</b> , E	<b>OPTB5</b>
1 ext +24 Vdc/EXT +24 Vdc, 3 Pt100	B, C, <b>D</b> , E	<b>OPTB8</b>
1 RO (NO), 5 DI 42–240 Vac input	B, C, <b>D</b> , E	<b>OPTB9</b>
SPI, absolute encoder	C	<b>OPTBB</b>
<b>Communication Cards <sup>③</sup></b>		
Modbus	D, <b>E</b>	<b>OPTC2</b>
Johnson Controls N2	D, <b>E</b>	<b>OPTC2</b>
Modbus TCP	D, <b>E</b>	<b>OPTC1</b>
BACnet	D, <b>E</b>	<b>OPTCJ</b>
EtherNet/IP	D, <b>E</b>	<b>OPTCQ</b>
PROFIBUS-DP	D, <b>E</b>	<b>OPTC3</b>
LonWorks	D, <b>E</b>	<b>OPTC4</b>
PROFIBUS-DP (D9 connector)	D, <b>E</b>	<b>OPTC5</b>
CANopen (slave)	D, <b>E</b>	<b>OPTC6</b>
DeviceNet	D, <b>E</b>	<b>OPTC7</b>
Modbus (D9 type connector)	D, <b>E</b>	<b>OPTC8</b>
Adapter	D, <b>E</b>	<b>OPTD1</b>
Adapter	D, <b>E</b>	<b>OPTD2V</b>
RS-232 with D9 connection	D, <b>E</b>	<b>OPTD3</b>

#### Notes

- ① AI = Analog Input; AO = Analog Output; DI = Digital Input; DO = Digital Output; RO = Relay Output
- ② Option card must be installed in one of the slots listed for that card. Slot indicated in bold is the preferred location.
- ③ OPTC2 is a multi-protocol option card.

## Technical Data and Specifications

### Enclosed Regenerative Drives

Description	Specification
<b>Supply Connection</b>	
Input voltage $U_{in}$ (AC) front end modules	380–500 Vac/525–690 Vac –10% to +10%
Input voltage $U_{in}$ (DC) inverter	465–800 Vdc/640–1100 Vdc –0% to 0%, the waviness of the inverter supply voltage, formed in rectification of the electric network's alternating voltage in basic frequency, must be less than 50 V peak-to-peak
Output voltage $U_{out}$ (AC) inverter	$3 \sim 0 - U_{in}/1.4$
Output voltage $U_{out}$ (DC) active front end module	$1.35 \times U_{in}$ (factory default)
Output voltage $U_{out}$ (DC) non-regenerative front end module	$1.35 \times U_{in}$
<b>Ambient Conditions</b>	
Ambient operating temperature	14 (no frost) to +104 °F (–10 °C to +40 °C)
Storage temperature	–40 °F to +158 °F (–40 °C to +70 °C)
Relative humidity	0 to 95% RH, non-condensing, non-corrosive, no dripping water
Air quality	
Chemical vapors	IEC 721-3-3, unit in operation, class 3C2
Mechanical particles	IEC 721-3-3, unit in operation, class 3S2
Altitude	100% load capacity (no derating) up to 1000 m 1% derating for each 100 m above 1000 m; max. 3000 m
Vibration	5–150 Hz
EN50178/EN60068-2-6	Displacement amplitude 0.25 mm (peak) at 3–15.8 Hz Max. acceleration amplitude 1 G at 15.8–150 Hz
Shock EN50178, EN60068-2-27	UPS Drop Test (for applicable UPS weights) Storage and shipping: max. 15 G, 11 ms (in package)
Cooling capacity required	Approximately 2%
Cooling air required	FR4 41 cfm, FR6 250 cfm, FR7 250 cfm, FR8 383 cfm FR9 677 cfm, FR10 824 cfm, FR12 1648 cfm, FR13 2472 cfm
Unit enclosure class	FR4–FR7 NEMA Type 1/IP21; FR8, FR9–FR14 chassis (IP00)
<b>EMC (at fault settings)</b>	
Immunity	Fulfill all EMC immunity requirements
<b>Safety</b>	
Approvals	UL, cUL, EN 61800-5-1 (2003), see unit nameplate for more detailed approvals
<b>Control Connections</b>	
Analog input voltage	0–10 V, $R_i = 200$ kohms, (–10 V to +10 V joystick control) Resolution 0.1%, accuracy $\pm 1\%$
Analog input current	0(4)–20 mA, $R_i = 250$ ohms differential
Digital inputs	6, positive or negative logic; 18–30 Vdc
Auxiliary voltage	+24 V, $\pm 15\%$ , max. 250 mA
Output reference voltage	+10 V, +3%, max. load 10 mA
Analog output	0(4)–20 mA; RL max. 500 ohms; resolution 10 bits Accuracy $\pm 2\%$
Digital outputs	Open collector output, 50 mA/48 V
Relay outputs	2 programmable change-over relay outputs Switching capacity: 24 Vdc/8 A, 250 Vac/8 A, 125 Vdc/0.4 A Min. switching load: 5 V/10 mA

# 2.11

## Adjustable Frequency Drives

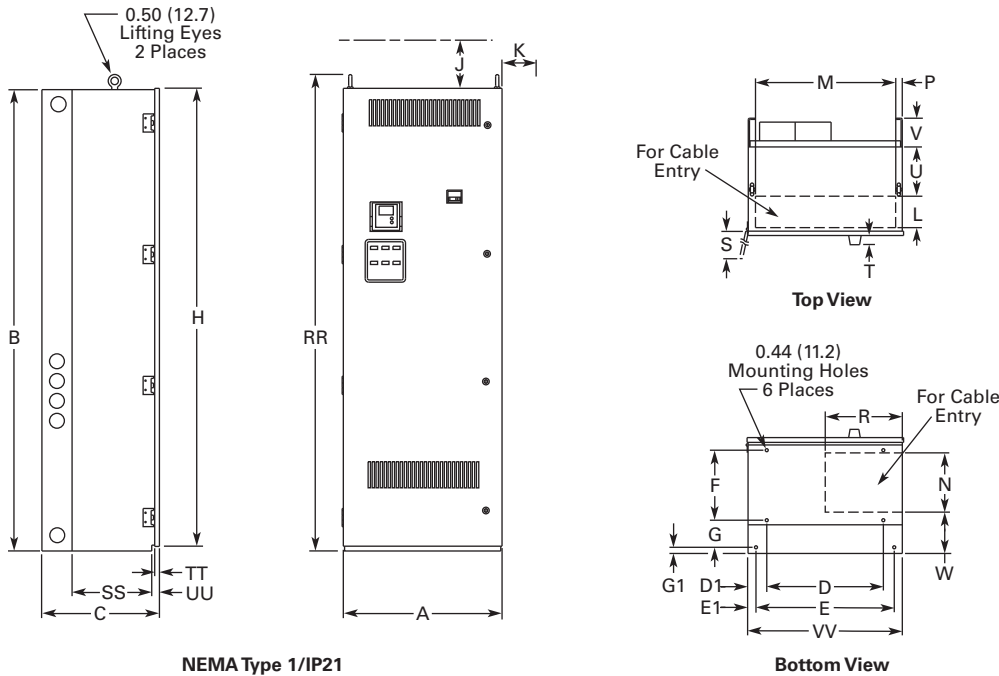
### Clean Power Drives

#### Dimensions

Approximate Dimensions in Inches (mm)

2

#### Enclosure Size 3



For reference only, dimensions are subject to change.

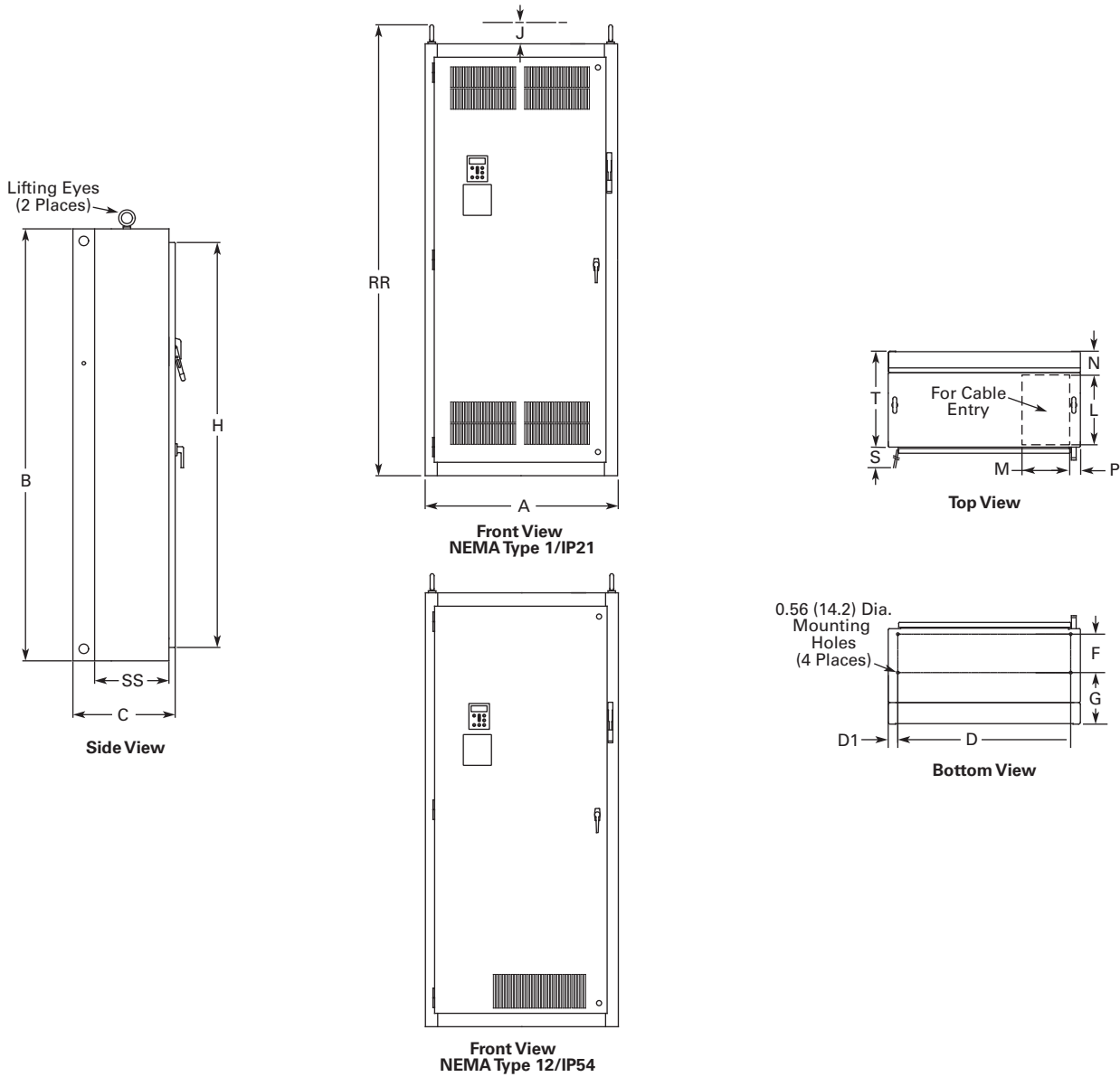
Wide	High	Deep	Mounting								Door Height	Min. Air Space	
A	B	C	D	D1	E	E1	F	G	G1	H	J	K	
26.4 (671)	77.0 (1956)	19.4 (493)	19.5 (495)	3.3 (83)	23.0 (584)	1.5 (38)	11.7 (298)	5.5 (140)	0.9 (24)	76.4 (1939)	4.0 (102)	3.0 (76)	

Cable Entry		Door Clearance			CB Handle									Max. Approx. Shipping Weight	
L	M	N	P	R	S	T	U	V	W	RR	SS	TT	UU	VV	Lbs (kg)
5.3 (133)	23.4 (594)	10.0 (254)	1.3 (32)	12.9 (328)	26.4 (669)	1.5 (38)	8.0 (203)	4.8 (121)	6.8 (173)	79.5 (2018)	13.40 (340)	0.8 (19)	1.3 (32)	26.0 (660)	690 (313)

Approximate Dimensions in Inches (mm)

### Enclosure Size 5



For reference only, dimensions are subject to change.

Wide	High	Deep	Mounting							Door Height	Min. Air Space	
A	B	C	D	D1	E	E1	F	G	G1	H	J	K
40.0 (1016)	90.0 (2286)	21.3 (541)	36.0 (914)	2.0 (51)	—	—	8.0 (203)	10.8 (273)	—	84.4 (2143)	4.0 (102)	—

Cable Entry			Door Clearance										Max. Approx. Shipping Weight		
L	M	N	P	R	S	T	U	V	W	RR	SS	TT	UU	VV	Lbs (kg)
15.0 (381)	10.0 (254)	4.8 (122)	2.0 (51)	—	36.3 (921)	20.0 (508)	—	—	—	94.0 (2387)	15.5 (394)	—	—	—	1275 (579)



# 2.11

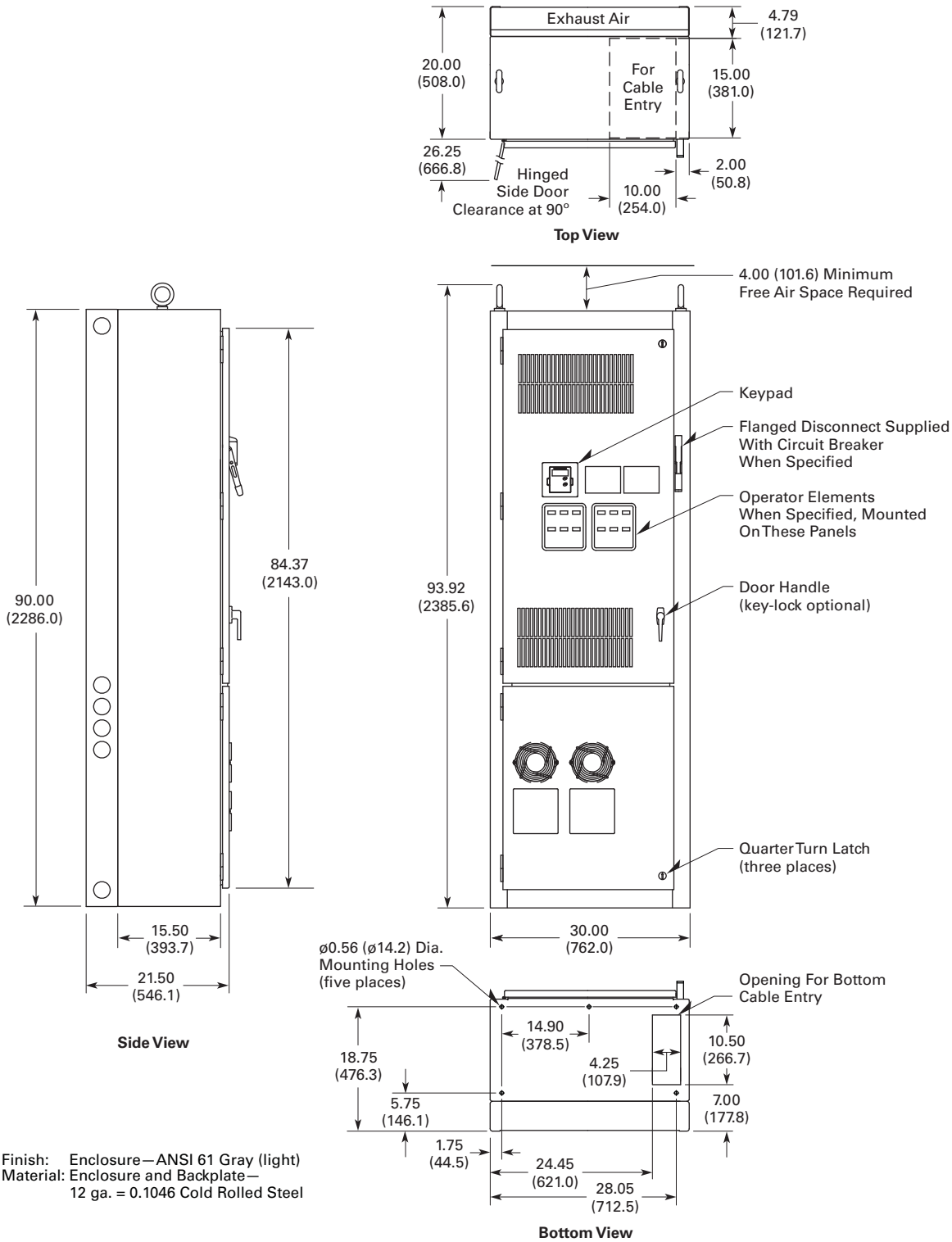
## Adjustable Frequency Drives

### Clean Power Drives

Approximate Dimensions in Inches (mm)

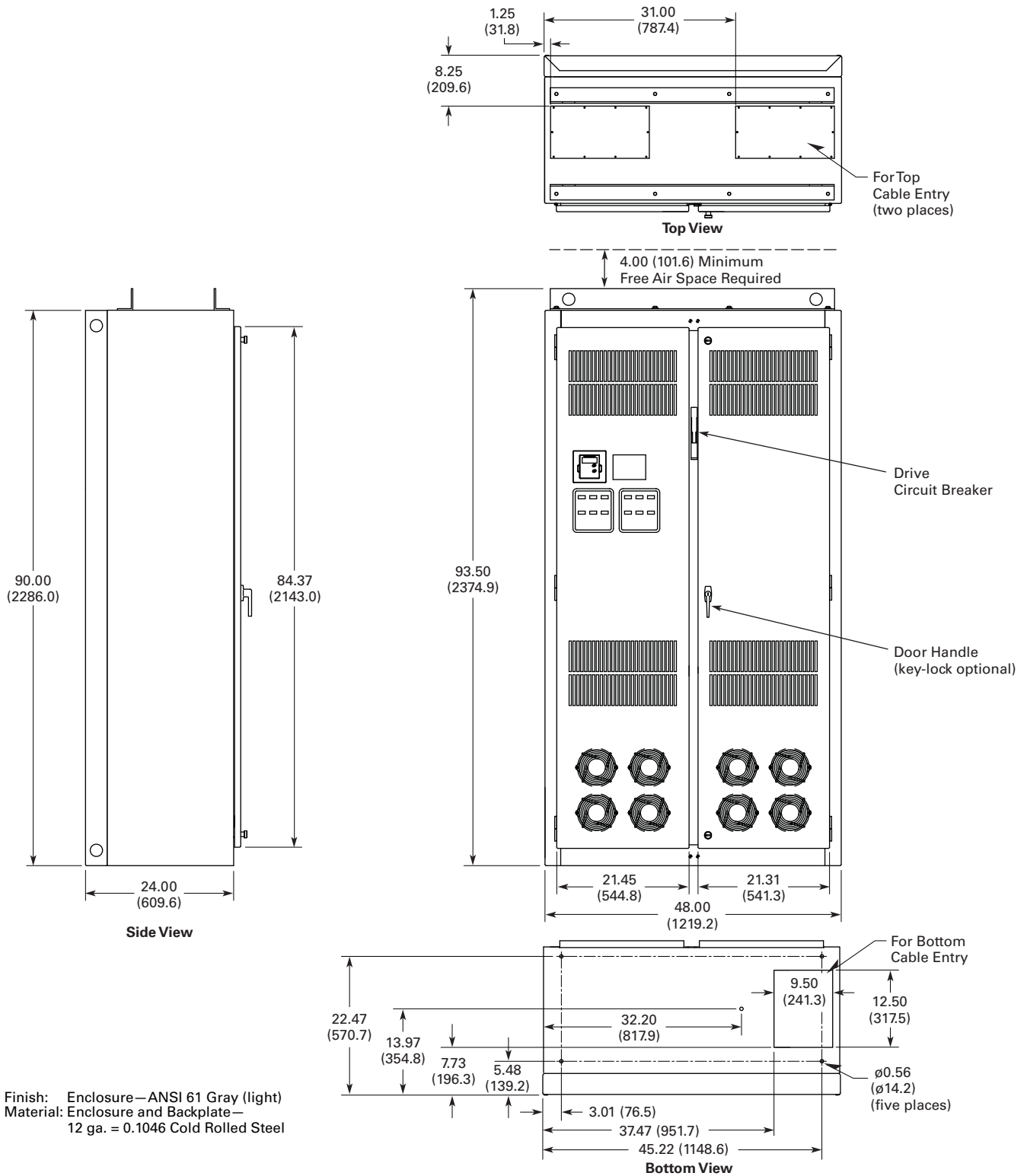
#### Enclosure Size 7

2



Approximate Dimensions in Inches (mm)

### Enclosure Size 8



Finish: Enclosure—ANSI 61 Gray (light)  
 Material: Enclosure and Backplate—  
 12 ga. = 0.1046 Cold Rolled Steel

# 2.11

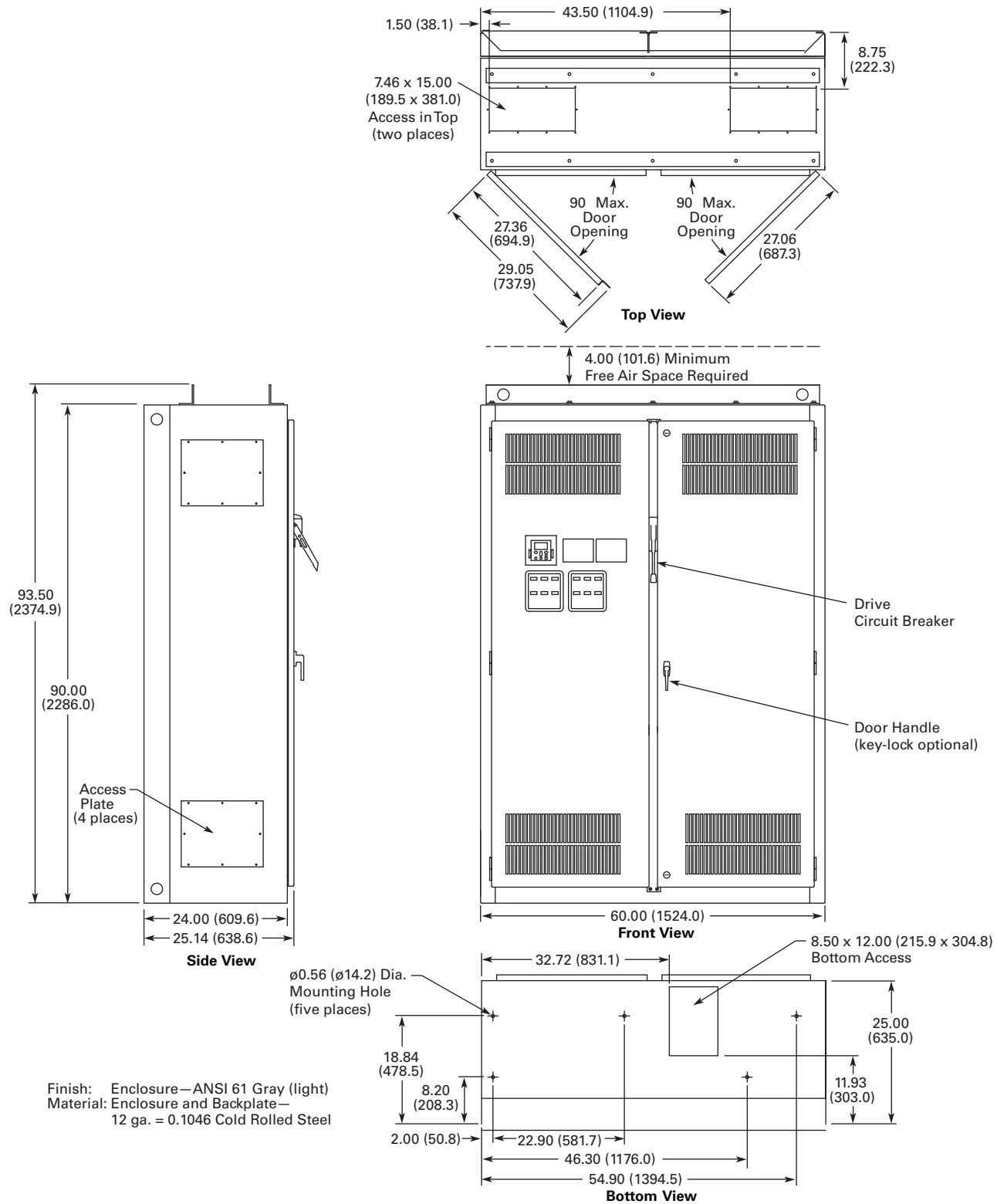
## Adjustable Frequency Drives

### Clean Power Drives

Approximate Dimensions in Inches (mm)

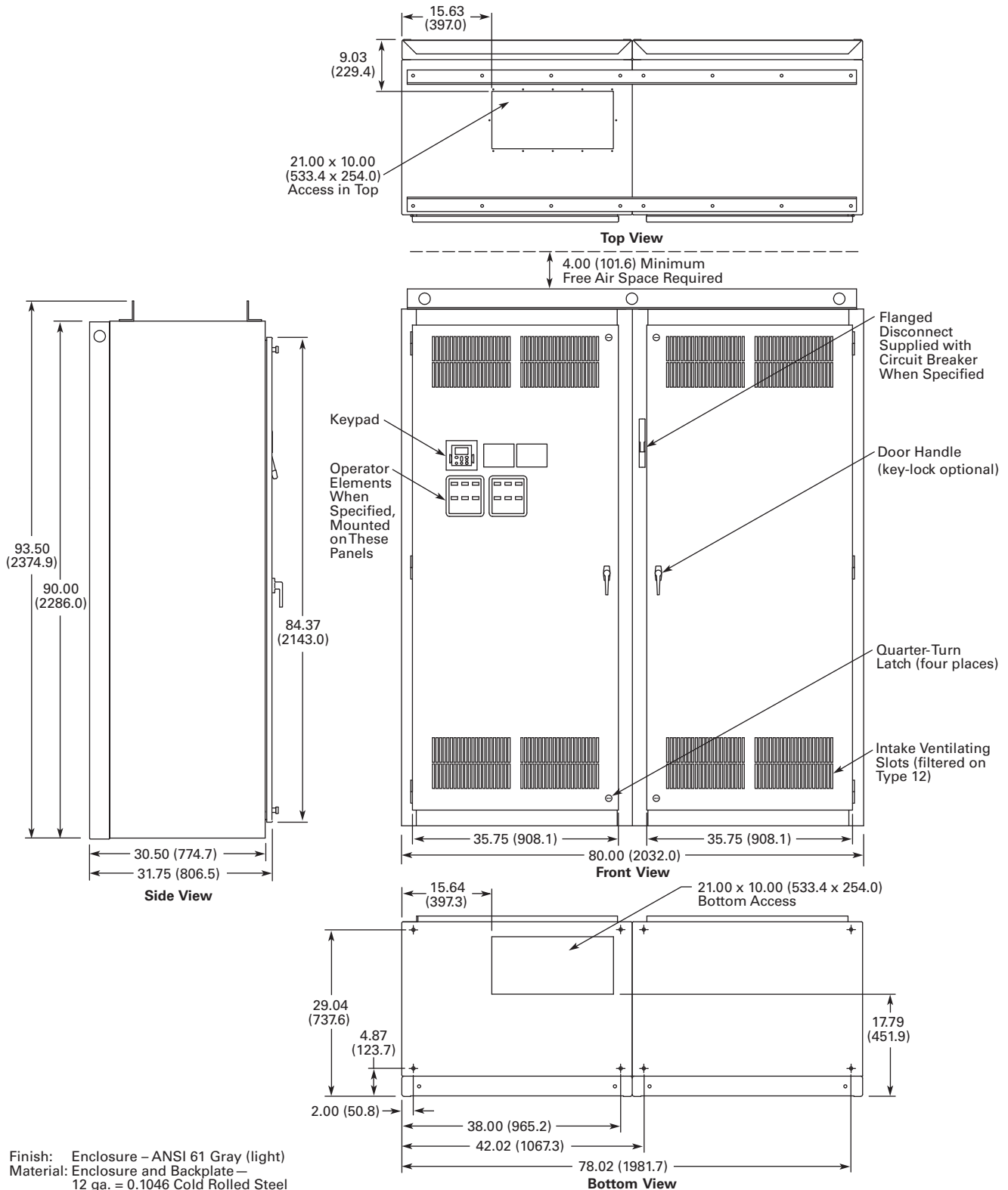
#### Enclosure Size 9

2



Approximate Dimensions in Inches (mm)

### Enclosure Size 10



Finish: Enclosure – ANSI 61 Gray (light)  
 Material: Enclosure and Backplate –  
 12 ga. = 0.1046 Cold Rolled Steel

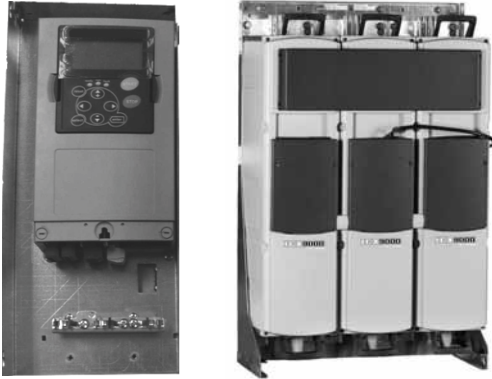
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## Adjustable Frequency Drives

### LCX Liquid Cooled Drives

#### LCX Liquid Cooled Adjustable Frequency Drives

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#### Description

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### Product Description

The LCX Liquid Cooled Drive family continues Eaton's tradition of providing state-of-the-industry products, by taking advantage of liquid cooling technology in lieu of air-cooling techniques.

The LCX drives are liquid-cooled products that utilize potable water or a water-glycol mixture as a cooling medium.

### Features and Benefits

- Compact size and low heat transfer rates allow enclosure size to be greatly reduced, which is especially beneficial in UL Type 4X applications
- Design is modular, with control and power modules independent of each other. Connection between power and control modules can be direct or extended via a fiber optic cable
- Same reliable control module and operating system as the SPX air-cooled drives
- CE mark ensures compliance with the Electromagnetic Compatibility Directive (EMC) and the Low Voltage Directive (LVD)
- Reliable drive with over 500,000 hours MTBF based on MIL 217
- Currently supports DeviceNet, PROFIBUS-DP, Modbus RTU and Modbus TCP communication protocols
- Separately mounted line reactor included with AC fed models

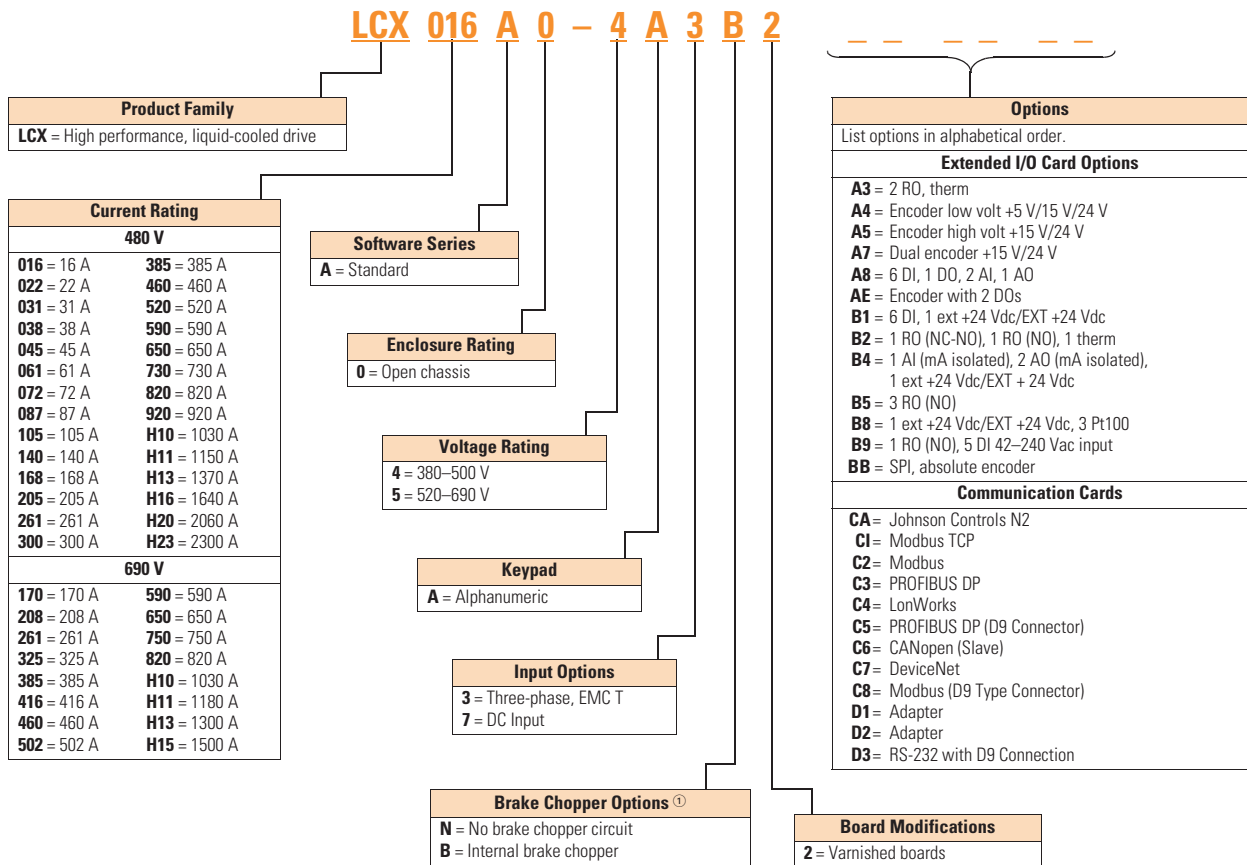
### Standards and Certifications

- UL
- cUL
- CE
- IEC



## Catalog Number Selection

## LCX Liquid Cooled Adjustable Frequency Drives

**Note**

① Brake chopper is only available in 480 V CH3 drives.

## Product Selection

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LCX Liquid Cooled  
Drives

## 380–500 Vac Liquid Cooled Drives

## Motor Output

## Current

Thermal, $I_{th}$ (A)	$I_L$ (A)	$I_H$ (A)	kW	Chassis	Catalog Number
16	15	11	7.5	CH3	LCX016A0-4A3N2
22	20	15	11	CH3	LCX022A0-4A3N2
31	28	21	15	CH3	LCX031A0-4A3N2
38	35	25	18.5	CH3	LCX038A0-4A3N2
45	41	30	22	CH3	LCX045A0-4A3N2
61	55	41	30	CH3	LCX061A0-4A3N2
72	65	48	37	CH4	LCX072A0-4A3N2
87	79	58	45	CH4	LCX087A0-4A3N2
105	95	70	55	CH4	LCX105A0-4A3N2
140	127	93	75	CH4	LCX140A0-4A3N2
168	153	112	90	CH5	LCX168A0-4A3N2
205	186	137	110	CH5	LCX205A0-4A3N2
261	237	174	132	CH5	LCX261A0-4A3N2
300	273	200	160	CH61	LCX300A0-4A3N2
385	350	257	200	CH61	LCX385A0-4A3N2
460	418	307	250	CH72	LCX460A0-4A3N2
520	473	347	250	CH72	LCX520A0-4A3N2
590	536	393	315	CH72	LCX590A0-4A3N2
650	591	433	355	CH72	LCX650A0-4A3N2
730	664	487	400	CH72	LCX730A0-4A3N2
820	745	547	450	CH63	LCX820A0-4A3N2
920	836	613	500	CH63	LCX920A0-4A3N2
1030	936	687	560	CH63	LCXH10A0-4A3N2
1150	1045	766	600	CH63	LCXH11A0-4A3N2
1370	1245	913	700	CH74	LCXH13A0-4A3N2
1640	1491	1093	900	CH74	LCXH16A0-4A3N2
2060	1873	1373	1100	CH74	LCXH20A0-4A3N2
2300	2091	1533	1200	CH74	LCXH23A0-4A3N2

## LCX Liquid Cooled Drives



## 525–690 Vac Liquid Cooled Drives

## Motor Output

## Current

Thermal, I <sub>th</sub> (A)	I <sub>L</sub> (A)	I <sub>H</sub> (A)	kW	Chassis	Catalog Number
170	155	113	110	CH61	LCX170A0-5A3N2
208	189	139	132	CH61	LCX208A0-5A3N2
261	237	174	160	CH72	LCX261A0-5A3N2
325	295	217	200	CH72	LCX325A0-5A3N2
385	350	257	250	CH72	LCX385A0-5A3N2
416	378	277	250	CH72	LCX416A0-5A3N2
460	418	307	300	CH72	LCX460A0-5A3N2
502	456	335	355	CH72	LCX502A0-5A3N2
590	536	393	400	CH63	LCX590A0-5A3N2
650	591	433	450	CH63	LCX650A0-5A3N2
750	682	500	500	CH63	LCX750A0-5A3N2
820	745	547	560	CH74	LCX820A0-5A3N2
920	836	613	650	CH74	LCX920A0-5A3N2
1030	936	687	700	CH74	LCXH10A0-5A3N2
1180	1073	787	800	CH74	LCXH11A0-5A3N2
1300	1182	867	900	CH74	LCXH13A0-5A3N2
1500	1364	1000	1000	CH74	LCXH15A0-5A3N2

## 540–675 Vdc Liquid Cooled Inverter Units

## Drive Output

## Current

Thermal I <sub>th</sub> (A)	Rated Cont. I <sub>L</sub> (A)	Rated Cont. I <sub>H</sub> (A)	Motor Output Power		Power Loss c/a/T (kW)	Chassis	Catalog Number
			Optimum Motor at I <sub>th</sub> 400 V (kW)	Optimum Motor at I <sub>th</sub> 500 V (kW)			
16	15	11	7.5	11	0.4/0.2/0.6	CH3	LCX016A0-4A7B2
22	20	15	11	15	0.5/0.2/0.7	CH3	LCX022A0-4A7B2
31	28	21	15	18.5	0.7/0.2/0.9	CH3	LCX031A0-4A7B2
38	35	25	18.5	22	0.8/0.2/1.0	CH3	LCX038A0-4A7B2
45	41	30	22	30	1.0/0.3/1.3	CH3	LCX045A0-4A7B2
61	55	41	30	37	1.3/0.3/1.5	CH3	LCX061A0-4A7B2
72	65	48	37	45	1.2/0.3/1.5	CH4	LCX072A0-4A7N2
87	79	58	45	55	1.5/0.3/1.8	CH4	LCX087A0-4A7N2
105	95	70	55	75	1.8/0.3/2.1	CH4	LCX105A0-4A7N2
140	127	93	75	90	2.3/0.3/2.6	CH4	LCX140A0-4A7N2
168	153	112	90	110	2.5/0.3/2.8	CH5	LCX168A0-4A7N2
205	186	137	110	132	3.0/0.4/3.4	CH5	LCX205A0-4A7N2
261	237	174	132	160	4.0/0.4/4.4	CH5	LCX261A0-4A7N2
300	273	200	160	200	4.5/0.4/4.9	CH61	LCX300A0-4A7N2
385	350	257	200	250	5.5/0.5/6.0	CH61	LCX385A0-4A7N2
460	418	307	250	315	5.5/0.5/6.0	CH62	LCX460A0-4A7N2
520	473	347	250	355	6.5/0.5/7.0	CH62	LCX520A0-4A7N2
590	536	393	315	400	7.5/0.6/8.1	CH62	LCX590A0-4A7N2



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## Adjustable Frequency Drives

### LCX Liquid Cooled Drives

LCX Liquid Cooled Drives

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#### 540–675 Vdc Liquid Cooled Inverter Units, continued

##### Drive Output

Current			Motor Output Power		Power Loss c/a/T (kW)	Chassis	Catalog Number
Thermal $I_{th}$ (A)	Rated Cont. $I_L$ (A)	Rated Cont. $I_H$ (A)	Optimum Motor at $I_{th}$ 400 V (kW)	Optimum Motor at $I_{th}$ 500 V (kW)			
650	591	433	355	450	8.5/0.6/9.1	CH62	LCX650A0-4A7N2
730	664	487	400	500	10.0/0.7/10.7	CH62	LCX730A0-4A7N2
820	745	547	450	560	12.5/0.8/13.3	CH63	LCX820A0-4A7N2
920	836	613	500	600	14.4/0.9/15.3	CH63	LCX920A0-4A7N2
1030	936	687	560	700	16.5/1.0/17.5	CH63	LCXH10A0-4A7N2
1150	1045	766	600	750	18.4/1.0/19.5	CH63	LCXH11A0-4A7N2
1370	1245	913	700	900	15.5/1.0/16.5	CH64	LCXH13A0-4A7N2
1640	1491	1093	900	1100	19.5/1.2/20.7	CH64	LCXH16A0-4A7N2
2060	1873	1373	1100	1400	26.5/1.5/28.0	CH64	LCXH20A0-4A7N2
2300	2091	1533	1250	1500	29.6/1.7/31.3	CH64	LCXH23A0-4A7N2
2470	2245	1647	1300	1600	36.0/2.0/38.0	2*CH64	LCXH24A0-4A7N2
2950	2681	1967	1550	1950	39.0/2.4/41.4	2*CH64	LCXH29A0-4A7N2
3710	3372	2473	1950	2450	48.0/2.7/50.7	2*CH64	LCXH37A0-4A7N2
4140	3763	2760	2150	2700	53.0/3.0/66.0	2*CH64	LCXH41A0-4A7N2

#### 710–930 Vdc Liquid Cooled Inverter Unit

##### Drive Output

Current			Motor Output Power		Power Loss c/a/T (kW)	Chassis	Catalog Number
Thermal $I_{th}$ (A)	Rated Cont. $I_L$ (A)	Rated Cont. $I_H$ (A)	Optimum Motor at $I_{th}$ 400 V (kW)	Optimum Motor at $I_{th}$ 500 V (kW)			
170	155	113	110	160	4.5/0.2/4.7	CH61	LCX170A0-5A7N2
208	189	139	132	200	5.5/0.3/5.8	CH61	LCX208A0-5A7N2
261	237	174	160	250	5.5/0.3/5.8	CH61	LCX261A0-5A7N2
325	295	217	200	300	6.5/0.3/6.8	CH62	LCX325A0-5A7N2
385	350	257	250	355	7.5/0.4/7.9	CH62	LCX385A0-5A7N2
416	378	277	250	355	8.0/0.4/8.4	CH62	LCX416A0-5A7N2
460	418	307	300	400	8.5/0.4/8.9	CH62	LCX460A0-5A7N2
502	456	335	355	450	10.0/0.5/10.5	CH62	LCX502A0-5A7N2
590	536	393	400	560	10.0/0.5/10.5	CH63	LCX590A0-5A7N2
650	591	433	450	600	13.5/0.7/14.2	CH63	LCX650A0-5A7N2
750	682	500	500	700	16.0/0.8/16.8	CH63	LCX750A0-5A7N2
820	745	547	560	800	16.0/0.8/16.8	CH64	LCX820A0-5A7N2
920	836	613	650	850	18.0/0.9/18.9	CH64	LCX920A0-5A7N2
1030	936	687	700	1000	19.0/1.0/20.0	CH64	LCXH10A0-5A7N2
1180	1073	787	800	1100	21.0/1.0/20.1	CH64	LCXH11A0-5A7N2
1300	1182	867	900	1200	27.0/1.4/28.4	CH64	LCXH13A0-5A7N2
1500	1364	1000	1050	1400	32.0/1.6/33.6	CH64	LCXH15A0-5A7N2
1700	1545	1133	1150	1550	N/A	CH64	LCXH17A0-5A7N2
1850	1682	1233	1250	1650	34.2/1.8/36.0	2*CH64	LCXH18A0-5A7N2
2120	1927	1413	1450	1900	37.8/2.0/39.8	2*CH64	LCXH21A0-5A7N2
2340	2127	1560	1600	2100	48.6/2.5/51.1	2*CH64	LCXH23A0-5A7N2
2700	2455	1800	1850	2450	57.6/3.0/60.6	2*CH64	LCXH27A0-5A7N2
3100	2818	2066	2150	2800	N/A	2*CH64	LCXH31A0-5A7N2

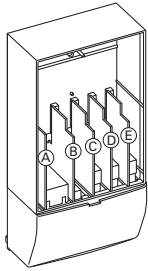
## Options

### 9000X Series Option Board Kits

The 9000X Series drives can accommodate a wide selection of expander and adapter option boards to customize the drive for your application needs. The drive's control unit is designed to accept a total of five option boards.

The 9000X Series factory installed standard board configuration includes an A9 I/O board and an A2 relay output board, which are installed in slots A and B.

#### Option Boards



#### Option Board Kits

Option Kit Description <sup>①</sup>	Allowed Slot Locations <sup>②</sup>	Field Installed Catalog Number	Factory Installed Option Designator	SVX Ready Programs						
				Basic	Local/Remote	Standard	MSS	PID	Multi-P.	PFC
<b>Standard I/O Cards</b>										
2 RO (NC-NO)	B	<b>OPTA2</b>	—	■	■	■	■	■	■	■
6 DI, 1 DO, 2 AI, 1 AO, 1 +10 Vdc ref, 2 ext +24 Vdc/EXT +24 Vdc	A	<b>OPTA9</b>	—	■	■	■	■	■	■	■
<b>Extended I/O Cards</b>										
2 RO, therm	B	<b>OPTA3</b>	<b>A3</b>	—	■	■	■	■	■	■
Encoder low Volt +5 V/15 V/24 V	C	<b>OPTA4</b>	<b>A4</b>	—	■	■	■	■	■	■
Encoder high Volt +15 V/24 V	C	<b>OPTA5</b>	<b>A5</b>	—	■	■	■	■	■	■
Dual encoder +15 V/24 V	C	<b>OPTA7</b>	<b>A7</b>	—	■	■	■	■	■	■
6 DI, 1 DO, 2 AI, 1 AO	A	<b>OPTA8</b>	<b>A8</b>	—	■	■	■	■	■	■
3 DI (encoder 10–24 V), out +15 V/+24 V, 2 DO (pulse+direction)—SPX only	C	<b>OPTAE</b>	<b>AE</b>	■	■	■	■	■	■	■
6 DI, 1 ext +24 Vdc/EXT +24 Vdc	B, C, D, E	<b>OPTB1</b>	<b>B1</b>	—	—	—	—	—	■	■
1 RO (NC-NO), 1 RO (NO), 1 therm	B, C, D, E	<b>OPTB2</b>	<b>B2</b>	—	—	—	—	—	■	■
1 AI (mA isolated), 2 AO (mA isolated), 1 ext +24 Vdc/EXT +24 Vdc	B, C, D, E	<b>OPTB4</b>	<b>B4</b>	—	■	■	■	■	■	■
3 RO (NO)	B, C, D, E	<b>OPTB5</b>	<b>B5</b>	—	—	—	—	—	■	■
1 ext +24 Vdc/EXT +24 Vdc, 3 Pt100	B, C, D, E	<b>OPTB8</b>	<b>B8</b>	—	—	—	—	—	—	—
1 RO (NO), 5 DI 42–240 Vac input	B, C, D, E	<b>OPTB9</b>	<b>B9</b>	—	—	—	—	—	■	■
SPI, absolute encoder	C	<b>OPTBB</b>	<b>BB</b>	—	—	—	—	—	—	—
<b>Communication Cards <sup>③</sup></b>										
Modbus	D, E	<b>OPTC2</b>	<b>C2</b>	■	■	■	■	■	■	■
Johnson Controls N2	D, E	<b>OPTC2</b>	<b>CA</b>	—	—	—	—	—	—	—
PROFIBUS DP	D, E	<b>OPTC3</b>	<b>C3</b>	■	■	■	■	■	■	■
LonWorks	D, E	<b>OPTC4</b>	<b>C4</b>	■	■	■	■	■	■	■
PROFIBUS DP (D9 connector)	D, E	<b>OPTC5</b>	<b>C5</b>	■	■	■	■	■	■	■
CANopen (slave)	D, E	<b>OPTC6</b>	<b>C6</b>	■	■	■	■	■	■	■
DeviceNet	D, E	<b>OPTC7</b>	<b>C7</b>	■	■	■	■	■	■	■
Modbus (D9 Type connector)	D, E	<b>OPTC8</b>	<b>C8</b>	■	■	■	■	■	■	■
Modbus TCP	D, E	<b>OPTC1</b>	<b>C1</b>	■	■	■	■	■	■	■
Adapter—SPX only	D, E	<b>OPTD1</b>	<b>D1</b>	■	■	■	■	■	■	■
Adapter—SPX only	D, E	<b>OPTD2V</b>	<b>D2</b>	■	■	■	■	■	■	■
RS-232 with D9 connection	D, E	<b>OPTD3</b>	<b>D3</b>	■	■	■	■	■	■	■
<b>Keypad</b>										
9000X Series standard keypad	—	<b>KEYPAD-STD</b>	—	—	—	—	—	—	—	■
9000X Series remote mount keypad unit (keypad not included, includes 10 ft cable, keypad holder, mounting hardware)	—	<b>OPTRMT-KIT-9000X</b>	—	—	—	—	—	—	—	—

#### Notes

① AI = Analog Input; AO = Analog Output, DI = Digital Input, DO = Digital Output, RO = Relay Output

② Option card must be installed in one of the slots listed for that card. Slot indicated in bold is the preferred location.

③ OPTC2 is a multi-protocol option card.

## Technical Data and Specifications

## 2

### LCX Products

Description	Specification
<b>General Specifications</b>	
Line voltage	400 to 500 Vac; 525 to 690 Vac; (–10% to 10%) 465 to 800 Vdc; 640 to 1100 Vdc; (–0 to 0%)
Frequency	50/60 Hz
Line voltage variation	–10% to 10%
Input frequency variation	45–66 Hz
Continuous output current	Rated current at incoming cooling liquid temperature of 30 °C
Output frequency	0–320 Hz
Drive efficiency	>95%
Power factor (displacement)	0.96
Liquid coolant pressure	87 psi (6 bar) maximum
Liquid coolant flow rate	1.3 to 7.9 gal./min. (5 to 30 liter/min.) minimum depending on drive size
Liquid coolant fittings	Standard quick connect, NPT
Operating ambient temperature	–10/50 °C
Storage temperature	–40/70 °C
Humidity	95% maximum (non-condensing)
Altitude	3300 ft (1000 m) maximum without derating
Enclosure	IP00
Warranty	Standard terms, 3 years with certified start-up
<b>Mains Connection</b>	
Input voltage ( $V_{in}$ )	400–500 Vac; 525–690 Vac; (–10%–10%) 465–800 Vdc; 640–1100 Vdc; (–0–0%)
Input frequency ( $f_{in}$ )	45–66 Hz
Connection to mains	Once per minute or less (normal case)
<b>Motor Connection</b>	
Output voltage	0– $V_{in}$
Continuous output current	Rated current at nominal inflow cooling water temperature of 30 °C; Overload 2 sec./20 sec.
Starting current	Rated current at 2 sec./20 sec. if output frequency <30 Hz and temperature of heatsink <149 °F (65 °C)
Output frequency	0–320 Hz (standard); 7200 Hz (special software)
Frequency resolution	Application dependent
<b>Control Characteristics</b>	
Control method	Frequency control (V/f) Open loop: Sensorless vector control Closed loop: Frequency control Closed loop: Vector control
Switching frequency 480 V ①	Adjustable with parameter 2.6.9 Up to and including 61-Amp size: 1–16 kHz (factory default, 10 kHz) From 72-Amp size: 1–12 kHz (factory default, 3.6 kHz)
575 V ①	1–6 kHz (factory default, 1.5 kHz)
Frequency reference	Analog input: resolution 0.1% (10 bits); accuracy ±1% Panel reference: resolution 0.01 Hz
Field weakening point	30–320 Hz
Acceleration time	0.1–3000 seconds
Deceleration time	0.1–3000 seconds
Braking torque	DC brake: 30% x $T_n$ (without brake option)

Description	Specification
<b>Ambient Conditions</b>	
Ambient operating temperature	14 °F (–10 °C), no frost to 122 °F (50 °C) at $I_{th}$ 122 to 158 °F (50 to 70 °C), derating required
Storage temperature	–40 °F to 158 °F (–40 to 70 °C) No liquid in heatsink under 32 °F (0 °C)
Relative humidity	5–96% RH, noncondensing, no dripping water
Air quality	Chemical vapors: IEC 721-3-3, unit in operation, class 3C2 Mechanical particles: IEC 721-3-3, unit in operation, class 3S2 (no conductive dust allowed); No corrosive gases
Altitude	Up to 1,000 m: 100% load capacity (no derating) Above 1,000 m: Derating of 1% per each 100 m required
Vibration	EN 50178, EN 60068-2-6; 5–150 Hz Displacement amplitude: 0.25 mm (peak) at 3–31 Hz Max. acceleration amplitude: 1G at 31–150 Hz
Shock	EN 50178, EN 60068-2-27, UPS drop test (for applicable UPS weights) Storage and shipping: Max. 15 g, 11 ms (in package)
Enclosure class	IP00 open frame standard in entire kW/hp range
<b>EMC</b>	
Immunity	Fulfills all EMC immunity requirements
Emissions	EMC level N; EMC level T for IT networks
<b>Safety</b>	
Approvals	EN 50178, EN 60204-1, CE, UL, CUL, FI, GOST R, IEC 61800-5 (See unit nameplate for more detailed approvals.)
<b>Control Connections</b>	
Analog input voltage	0 to +10 V, $R_i = 200$ kohm (–10 V to +10 V joystick control) Resolution 0.1%; accuracy ±1%
Analog input current	0(4)–20 mA, $R_i = 250$ ohm differential
Digital inputs	6 positive or negative logic; 18–24 Vdc
Auxiliary voltage	+24 V, ±15%, max. 250 mA
Output reference voltage	+10 V, +3%, max. load 10 mA
Analog output	0(4)–20 mA, $R_i$ max. 500 ohm Resolution 10 bits; accuracy ±2%
Digital outputs	Open collector output, 50 mA/48V
Relay outputs	Two programmable change-over relay outputs Switching capacity: 24 Vdc/8 A, 250 Vac/8 A, 125 Vdc/0.4 A Min. switching load: 5 V/10 mA

#### Note

① Derating required if higher switching frequency than the default is used.

## LCX Products, continued

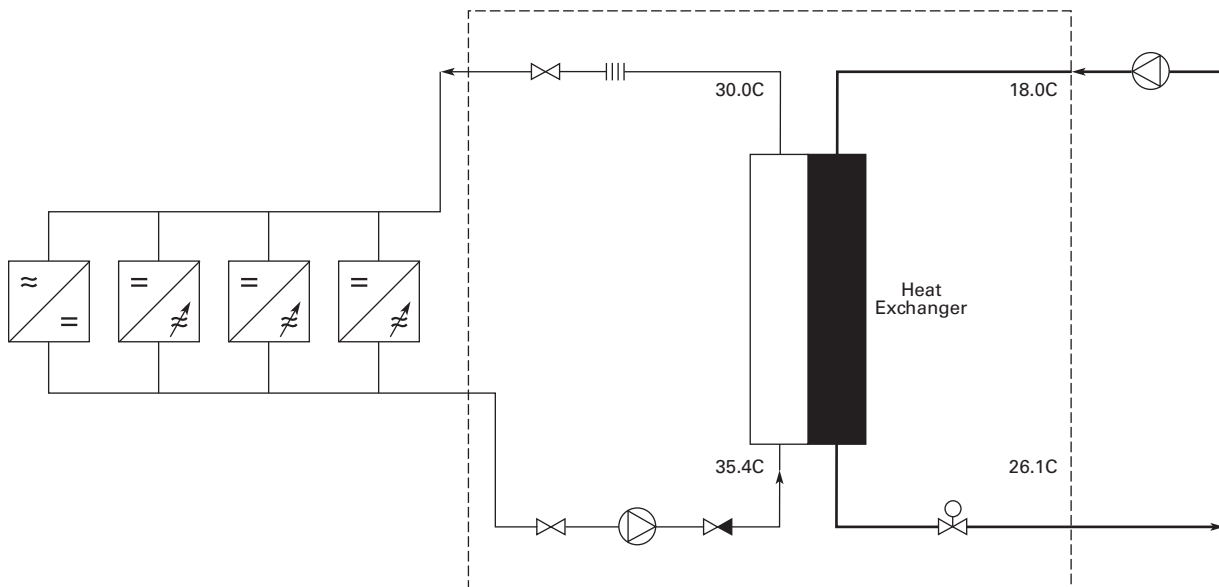
Description	Specification
<b>Protections</b>	
Overvoltage protection	
480 V	911 V
575 V	1200 V
Undervoltage protection	
480 V	333 V
575 V	461 V
Ground fault protection	In case of ground fault in motor or motor cable, only the drive is protected
Mains supervision	Trips if any of the input phases are missing (drives only)
Motor phase supervision	Trips if any of the output phases are missing
Unit overtemperature protection	
Alarm limit	149 °F (65 °C) for heatsink, 158 °F (70 °C) for circuit boards
Trip limit	158 °F (70 °C) for heatsink, 185 °F (85 °C) for circuit boards

Description	Specification
<b>Protections, continued</b>	
Overcurrent protection	Yes
Motor overload protection	Yes
Motor stall protection	Yes
Motor underload protection	Yes
Short-circuit protection	Yes (+24 V and +10 V reference voltages)
<b>Liquid Cooling</b>	
Allowed cooling agents	Drinking water Water-glycol mixture
Temperature of cooling agent	32 to 86 °F (0 to 30 °C) at I <sub>th</sub> for input; 86 to 149 °F (30 to 65 °C) Max. temperature rise during circulation: 9 °F (5 °C), no condensation allowed
System max. working pressure	87 psi (6 bar)
System max. peak pressure	580 psi (40 bar)
Pressure loss (at nominal flow)	Varies according to size

## Wiring Diagrams

## Cooling System Diagrams

## Example of a Typical Cooling System



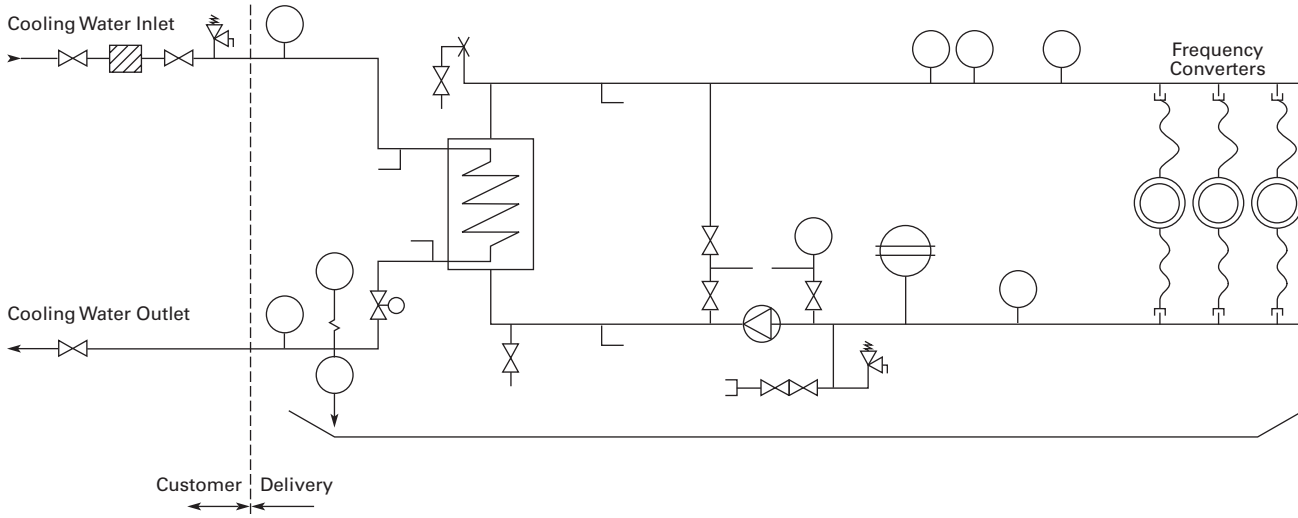
# 2.12

## Adjustable Frequency Drives

### LCX Liquid Cooled Drives

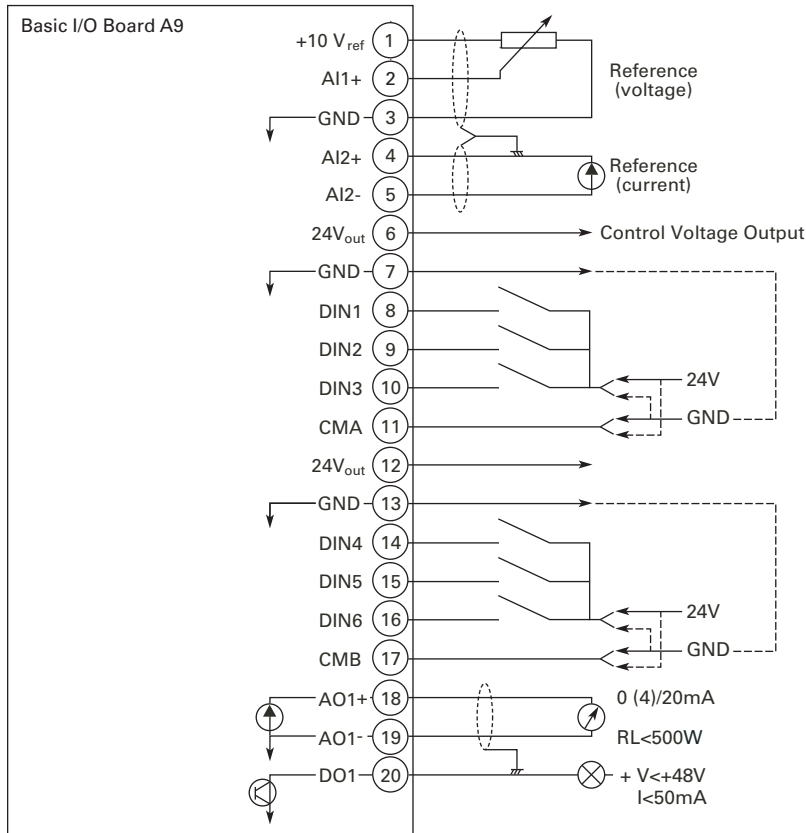
#### Example PI-Diagram of a Typical Cooling System and Connections

2



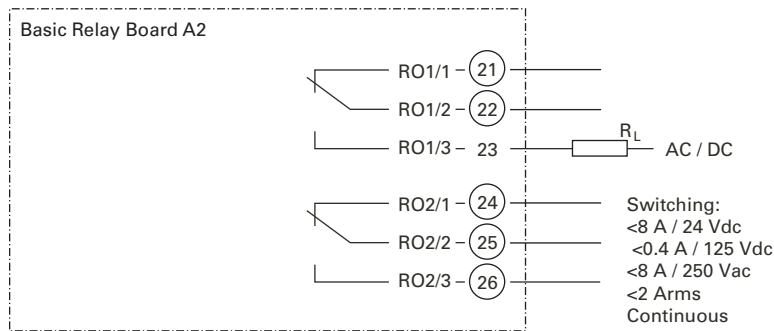
#### I/O Board Diagrams

##### A9 Option Board Control Wiring



Dotted lines indicate the connections for inverted signals

## A2 Option Board Wiring

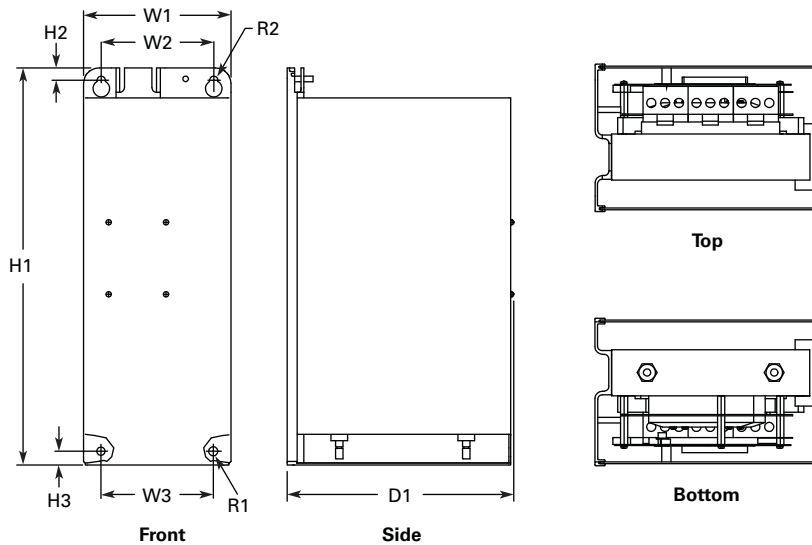


## Dimensions

Approximate Dimensions in Inches (mm)

## LCX Drives

## Chassis Size, CH3



Voltage	Amps	H1	H2	H3	D1	W1	W2	W3	R1 Dia.	R2 Dia.	Weight Lbs (kg)
380-500 Vac	16-61	16.97 (431.0)	0.53 (13.5)	0.59 (15.0)	9.69 (246.0)	6.30 (160.0)	4.80 (122.0)	4.80 (122.0)	0.39 (10.0)	0.35 (9.0)	66 (30)

# 2.12

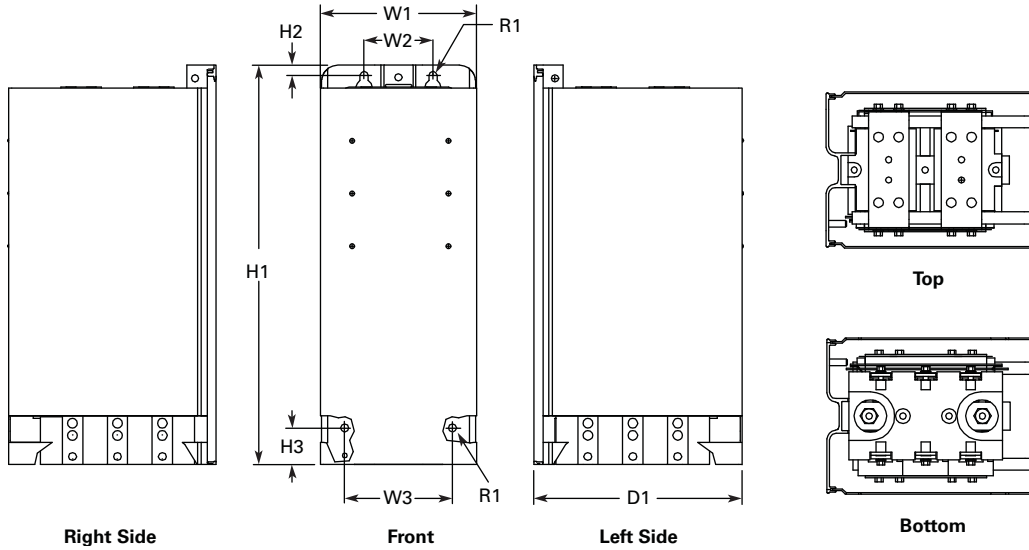
## Adjustable Frequency Drives

### LCX Liquid Cooled Drives

Approximate Dimensions in Inches (mm)

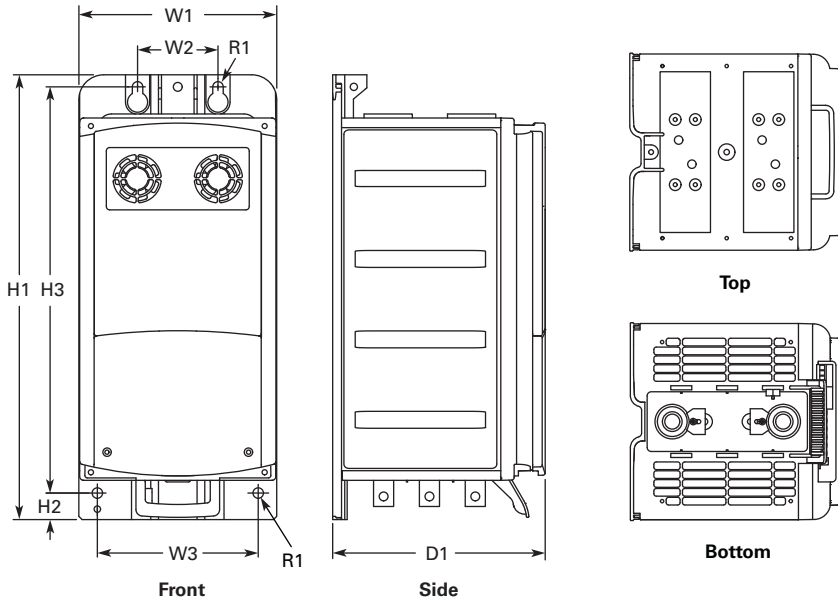
#### Chassis Size, CH4

2



Voltage	Amps	H1	H2	H3	D1	W1	W2	W3	R1 Dia.	R2 Dia.	Weight Lbs (kg)
380–500 Vac	72–140	19.41 (493.0)	0.49 (12.5)	1.77 (45.0)	10.14 (257.5)	7.60 (193.0)	3.35 (85.0)	5.24 (133.0)	0.39 (10.0)	—	77 (35)

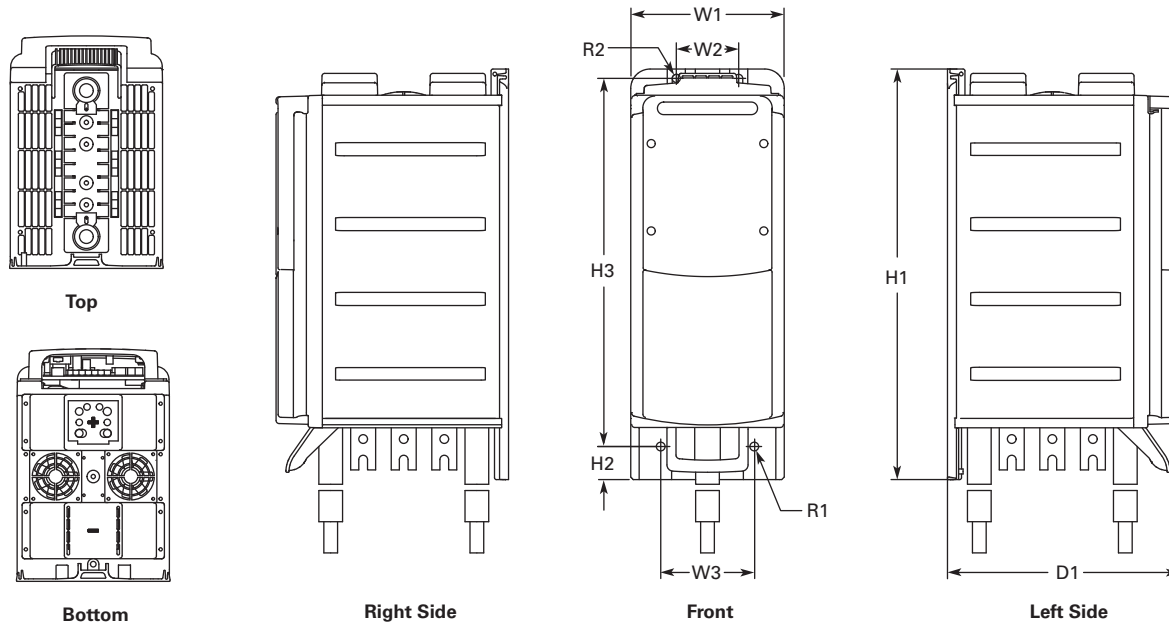
#### Chassis Size, CH5



Voltage	Amps	H1	H2	H3	D1	W1	W2	W3	R1 Dia.	R2 Dia.	Weight Lbs (kg)
380–500 Vac	168–261	21.77 (553.0)	1.30 (33.0)	19.88 (505.0)	10.39 (264.0)	9.69 (246)	3.94 (100.0)	7.87 (200.0)	0.51 (13.0)	—	88 (40)

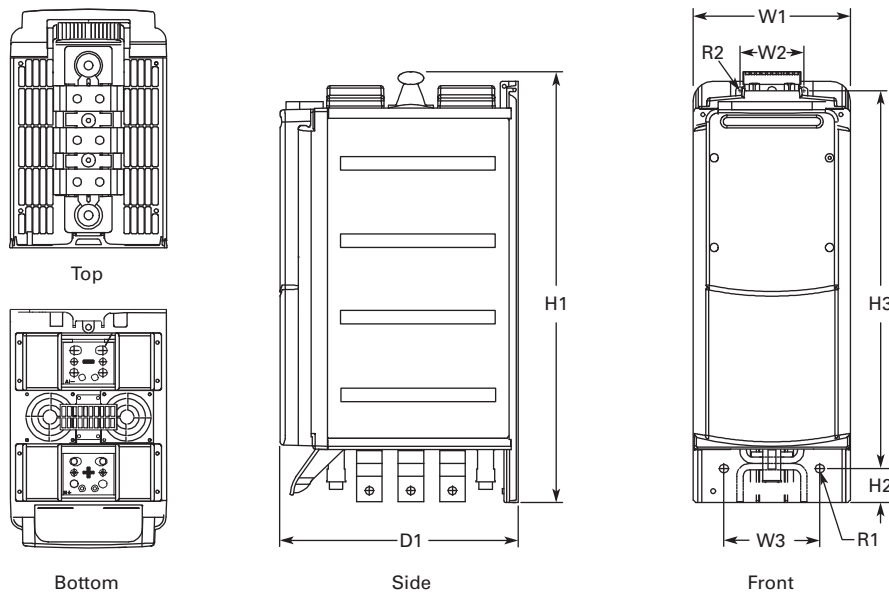
Approximate Dimensions in Inches (mm)

## Chassis Size, CH61



Voltage	Amps	H1	H2	H3	D1	W1	W2	W3	R1 Dia.	R2 Dia.	Weight Lbs (kg)
380–500 Vac	300–385	25.91 (658.0)	2.09 (53.0)	23.23 (590.0)	14.69 (373.0)	9.69 (246.0)	3.94 (100.0)	5.91 (150.0)	0.55 (14.0)	0.51 (13.0)	121 (55)
525–690 Vac	170–208										

## Liquid-Cooled Inverter—Chassis Size, CH62



Voltage	Amps	H1	H2	H3	D1	W1	W2	W3	R1 Dia.	R2 Dia.
540–675 Vdc	460–730	26.50 (673)	2.0 (53)	23.23 (590)	14.69 (373)	9.69 (246)	3.94 (100)	5.91 (150)	0.55 (14)	0.51 (13)
710–930 Vdc	325–502									



# 2.12

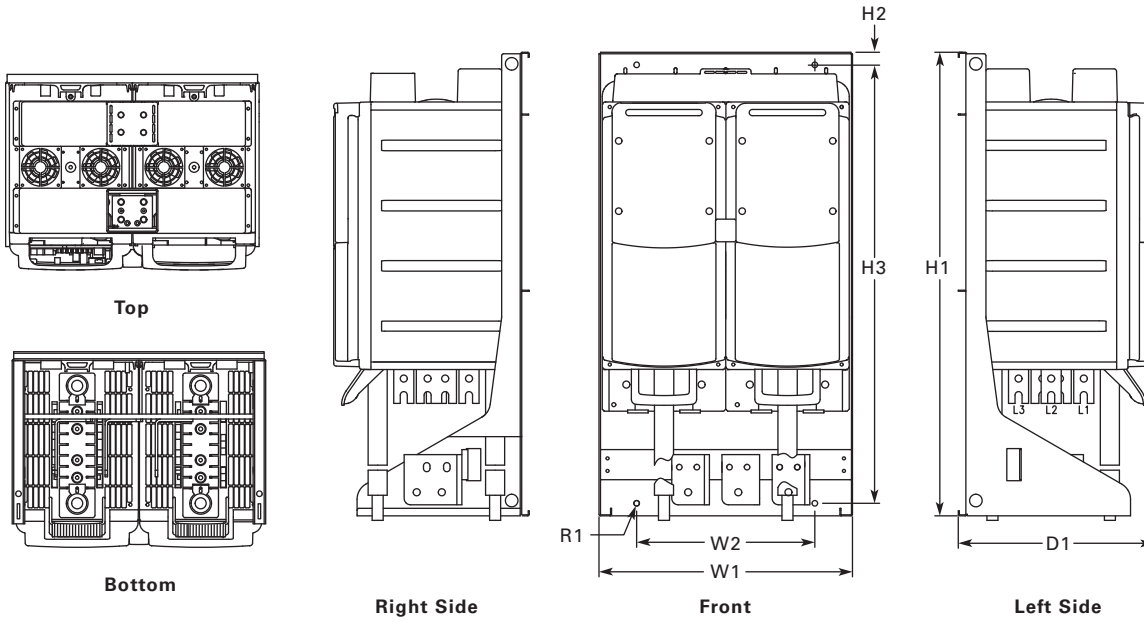
## Adjustable Frequency Drives

### LCX Liquid Cooled Drives

Approximate Dimensions in Inches (mm)

2

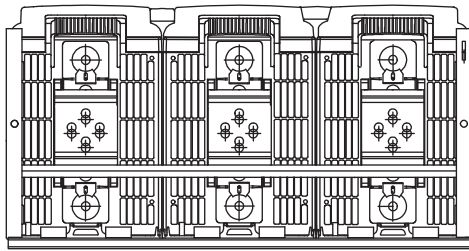
#### Chassis Size, CH63



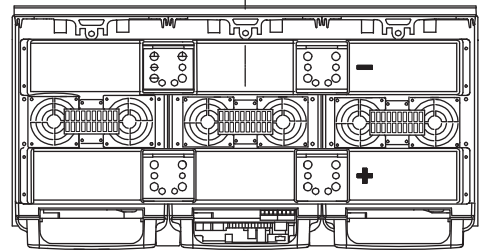
Voltage	Amps	H1	H2	H3	D1	W1	W2	R1 Dia.	Weight Lbs (kg)
380–500 Vac	820–1030	36.36 (923.5)	0.91 (23.0)	34.39 (873.5)	15.35 (390.0)	19.88 (505.0)	13.98 (355.0)	0.43 (11.0)	264 (120)
525–690 Vac	590–750								

Approximate Dimensions in Inches (mm)

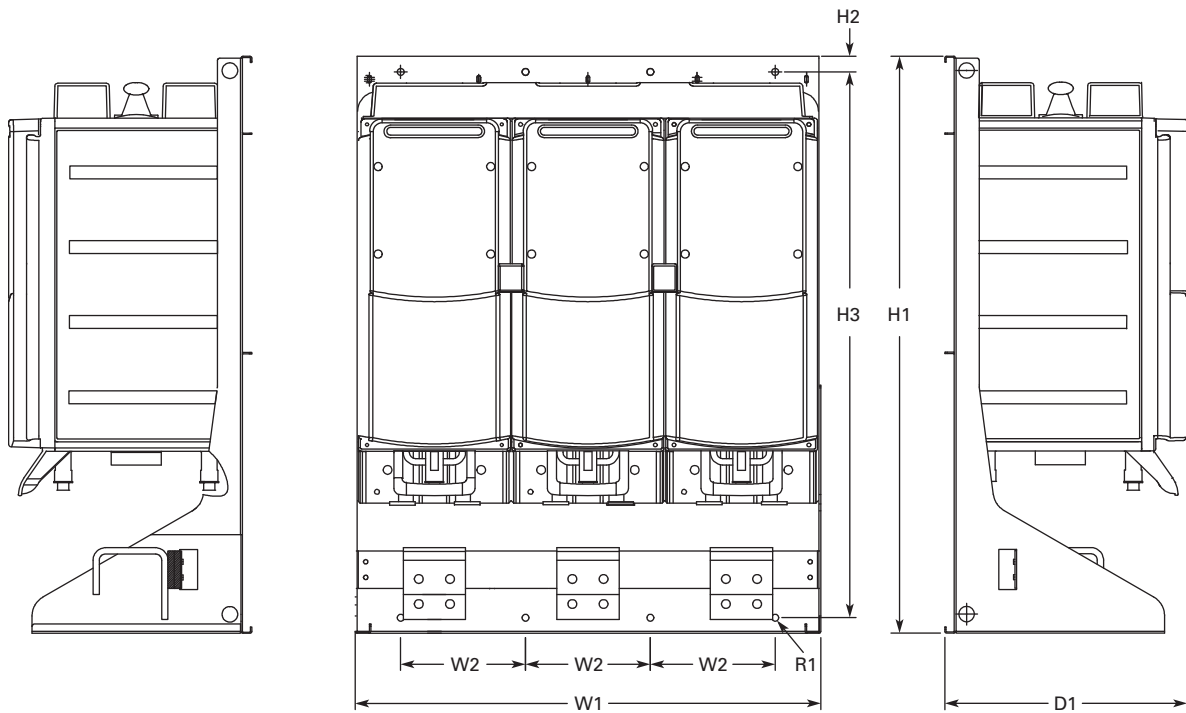
### Liquid-Cooled Inverter with Mounting Bracket, Chassis Size CH64, IP90



Bottom



Top



Right Side

Front

Left Side

Voltage	Amps	H1	H2	H3	D1	W1	W2	R1 Dia.
540–675 Vdc	1370–4140	36.38	1.03	34.37	15.35	29.37	7.87	0.43
710–930 Vdc	820–3100	(924)	(26)	(873)	(390)	(746)	(200)	(11)

# 2.12

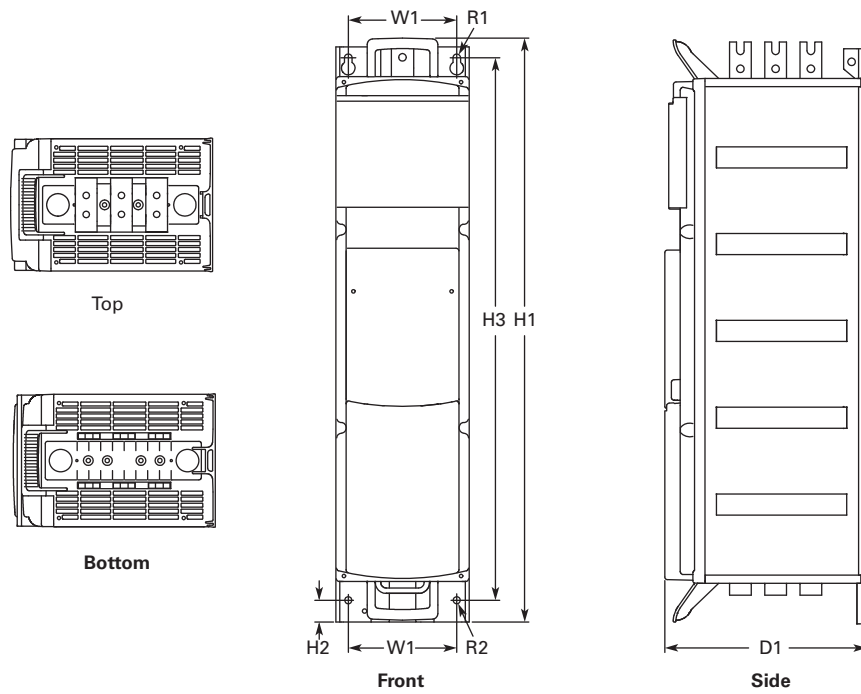
## Adjustable Frequency Drives

### LCX Liquid Cooled Drives

Approximate Dimensions in Inches (mm)

#### Chassis Size, CH72

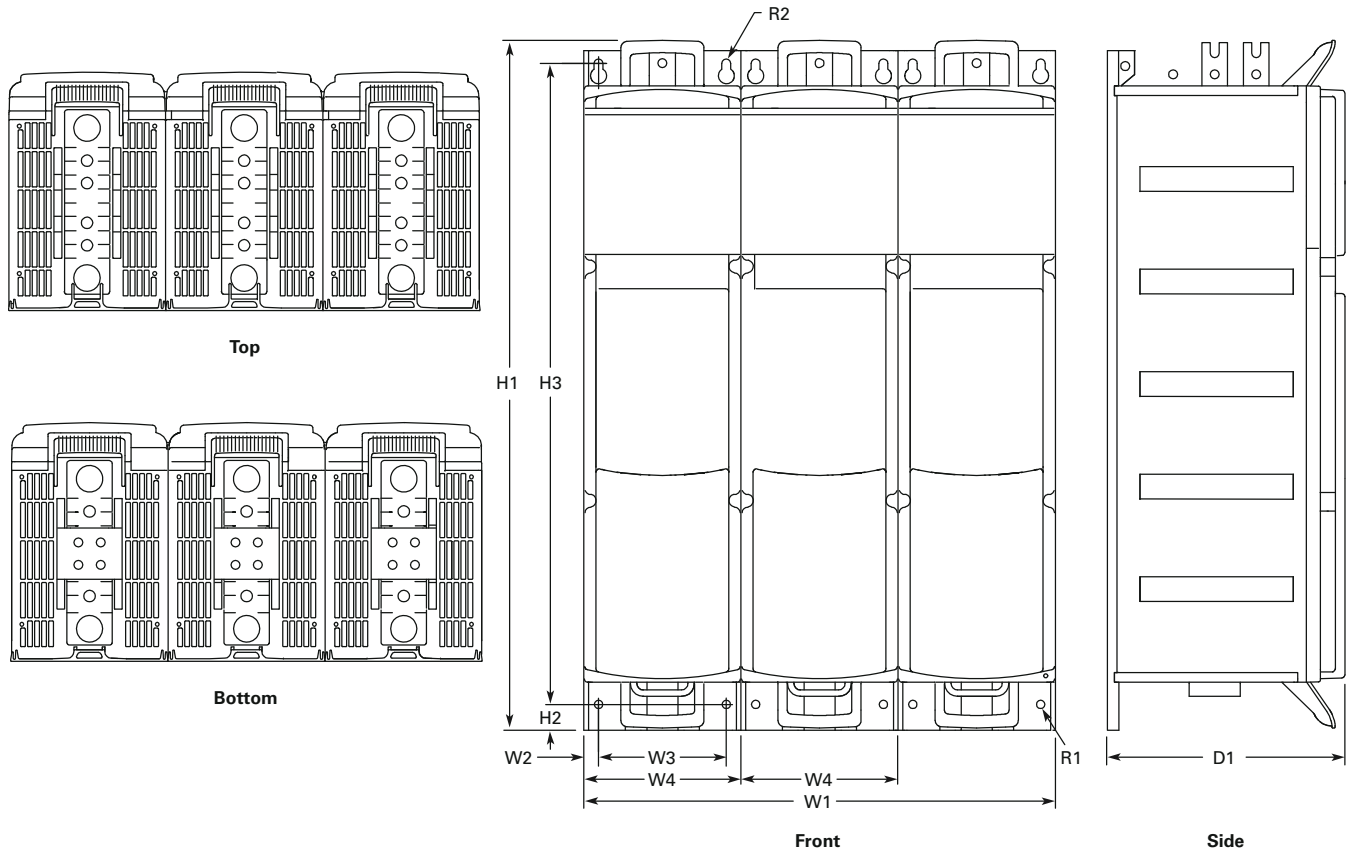
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Voltage	Amps	H1	H2	H3	D1	W1	R1 Dia.	R2 Dia.	Weight Lbs (kg)
380–500 Vac	460–730	42.38	1.57	39.37	14.65	7.87	0.55	0.51	198 (90)
525–690 Vac	261–502	(1076.5)	(40.0)	(1000.0)	(372.0)	(200.0)	(14.0)	(13.0)	

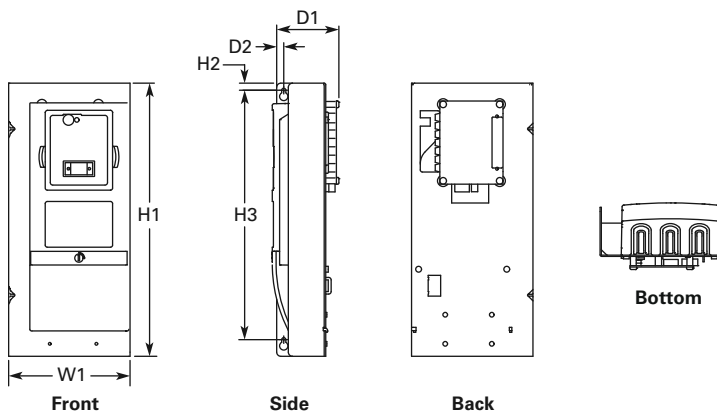
Approximate Dimensions in Inches (mm)

### Chassis Size, CH74



Voltage	Amps	H1	H2	H3	D1	W1	W2	W3	W4	R1 Dia.	R2 Dia.	Weight Lbs (kg)
380–500 Vac	1370–2300	42.38 (1076.5)	1.57 (40.0)	39.37 (1000.0)	14.65 (372.0)	29.06 (738.0)	0.91 (23.0)	7.87 (200.0)	9.69 (246)	0.51 (13.0)	0.55 (14.0)	617 (280)
525–690 Vac	820–1500											

### Control Unit



H1	H2	H3	D1	D2	W1
12.93 (328.5)	0.33 (8.5)	11.81 (300.0)	2.95 (75.0)	0.33 (8.5)	5.75 (146.0)

#### SPA/SPN/SPI Common DC Bus Drive Products

2



#### Contents

##### Description

Page

SPA/SPN/SPI Common DC Bus Drives	
Application Description	<b>V6-T2-409</b>
Product Comparison	<b>V6-T2-409</b>
Features	<b>V6-T2-410</b>
Standards and Certifications	<b>V6-T2-410</b>
Catalog Number Selection	<b>V6-T2-410</b>
Product Selection	<b>V6-T2-412</b>
Options	<b>V6-T2-414</b>
Technical Data and Specifications	<b>V6-T2-415</b>
Wiring Diagrams	<b>V6-T2-417</b>
Dimensions	<b>V6-T2-418</b>

#### Product Description

Eaton offers a comprehensive range of common DC bus drive products. The product family covers a number of front-end units and inverter units in the entire power range from 1-1/2 to 2000 horsepower at 460 V and 690 V. The drive components are built on the SPX technology.

#### Front-End Units

The front-end units convert a mains AC voltage and current into a DC voltage and current. The power is transferred from the mains to a common DC bus (and, in certain cases, vice versa).

The SPA (active front-end) unit is a bidirectional (regenerative) power converter for the front end of a common DC bus drive line up. An external LCL filter is used at the input. This unit is suitable in applications where low mains harmonics are required.

The SPN (non-regenerative front-end) unit is a unidirectional (motoring) power converter for the front-end of a common DC bus drive line-up. The device operates as a diode bridge using diode/thyristor components. A dedicated external choke is used at the input. The unit has the capacity to charge a common DC bus. This unit is suitable as a rectifying device when a "normal" level of harmonics is accepted and no regeneration to the mains is required.

#### Inverter Unit

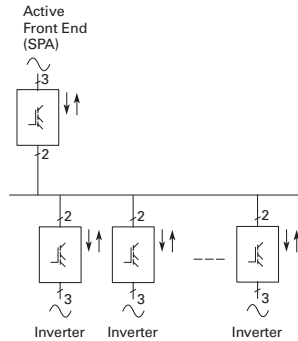
The SPI Inverter Unit is a bidirectional DC-fed power inverter for the supply and control of AC motors. The inverter is supplied from a common DC bus drive line-up. A charging circuit is needed in case a connection to a live DC bus is required. The DC side charging circuit is integrated up to 75 kW (FR4-FR8) and external for higher power ratings (F19-F114).

## Application Description

The common DC bus product portfolio fulfills all solution demands with a flexible architecture.

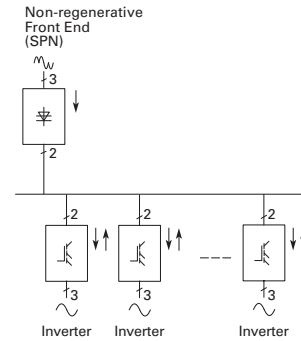
Front end units are selected according to the level of harmonics and power requirements. Typical drive system configurations are illustrated the following figures.

### SPA + Inverters



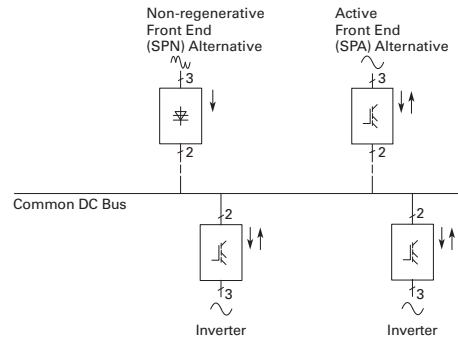
- Low harmonics,  $-P_{\text{mains}} \approx +P_{\text{mains}}/P_{\text{mains}} \leq \Sigma P_{\text{INU}}$
- Suitable for almost every application

### SPN + Inverters



- Low total mains power,  $P_{\text{mains}} \leq \Sigma P_{\text{INU}}$
- Suitable e.g. for small processing line with un- and recoiler, em-stop coasting

### Combination Configuration



Common DC bus components are used in a multitude of combinations. Drives which are braking can transfer the energy directly to the drives in motoring mode.

## Product Comparison

### Advantages over Conventional Front Ends

#### Eaton Front Ends vs. Conventional

	Non-Regenerative Front End	Active Front End	Conventional Regenerative Front End ①
Input device	Choke (L)	Filter (LCL)	Choke or auto-transformer (L)
Bridge type	Diode/thyristor bridge	IGBT bridge, two-level type	Anti-parallel connected thyristor bridge
Type of operation	Controlled half-bridge	High frequency modulation (1.5 to 3.6 kHz)	Firing angle controlled
Direction of power	Motoring	Motoring and regenerating	Motoring and regenerating
Charging	Constant current	External required	Usually internal
DC voltage	Nominal (approx. 1.35 alternative $U_N$ )	Stable at +10% of nominal (approx. 110% of 1.35 alternative $U_N$ )	Lowered DC voltage for commutation margin (e.g. 17% if approx. 83% of 1.35 alternative $U_N$ ) or autotransformer on regenerative bridge
THD	Similar to six-pulse bridge normal <40%	Very low	Similar to six-pulse bridge or worse

#### Note

① Conventional regenerative front end (a.k.a. "anti-parallel thyristor bridge") is not available from Eaton.

# 2.13

## Adjustable Frequency Drives

SPA/SPN/SPI Common DC Bus Drives

### Features

2

#### Standard Features

Feature	SPI		SPA		SPN
	FR4, 6, 7	FR8	F19-F114	F19-F114	F19
IP00	—	■	■	■	■
IP21	■	—	—	—	—
Air cooling	■	■	■	■	■
Standard board	■	■	■	■	—
Varnished board	—	—	—	—	—
Alphanumeric keypad	■	■	■	■	—
EMC class T (EN 61800-3 for IT networks)	■	■	■	■	■
Safety CE/UL	■	■	■	■	■
Input choke	—	—	—	—	■
LCL filter	—	—	—	■	—
No integrated charging	—	—	■	■	—
Integrated charging (DC side)	■	■	—	—	■
Diode/thyristor rectifier	—	—	—	—	■
IGBT	■	■	■	■	—

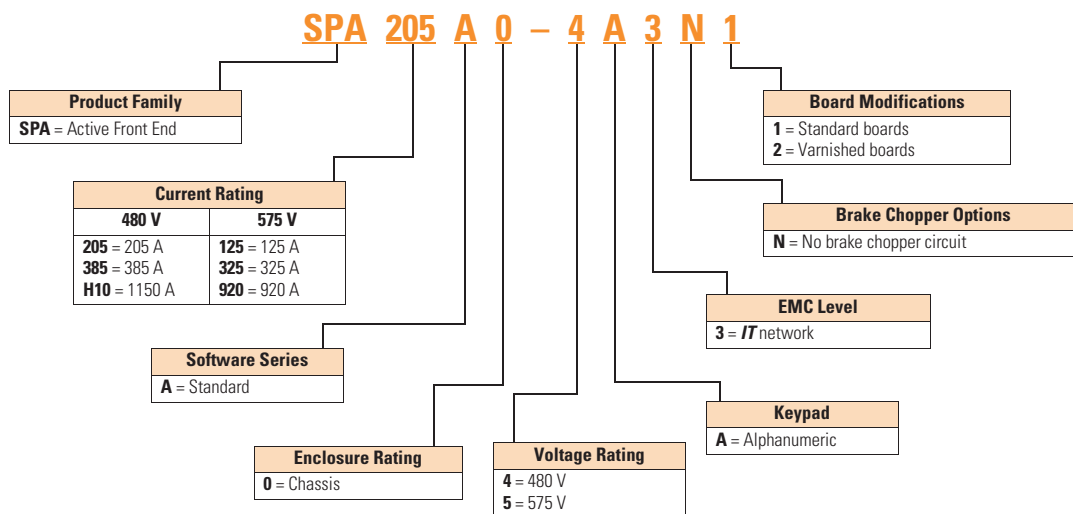
### Standards and Certifications

- CE
- UL
- cUL
- EN 61800-5-1 (2003)

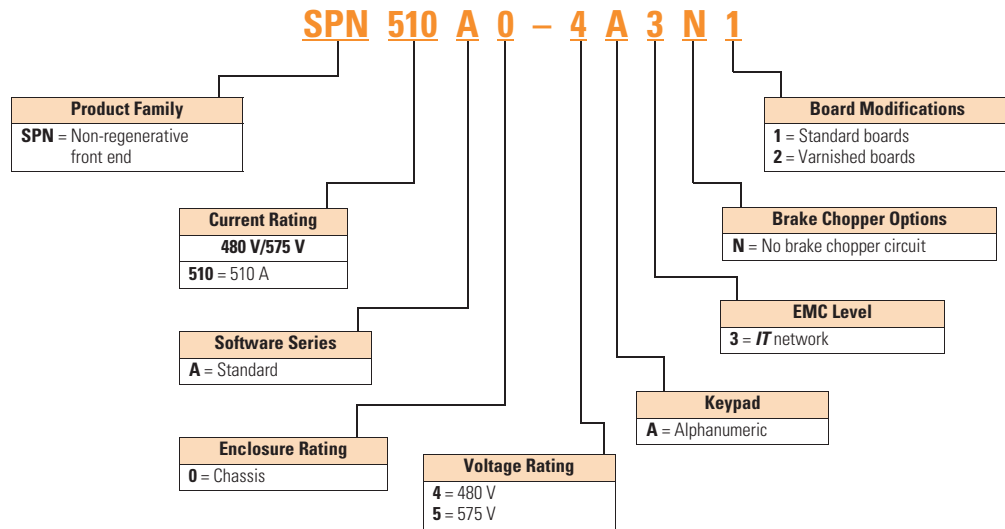


### Catalog Number Selection

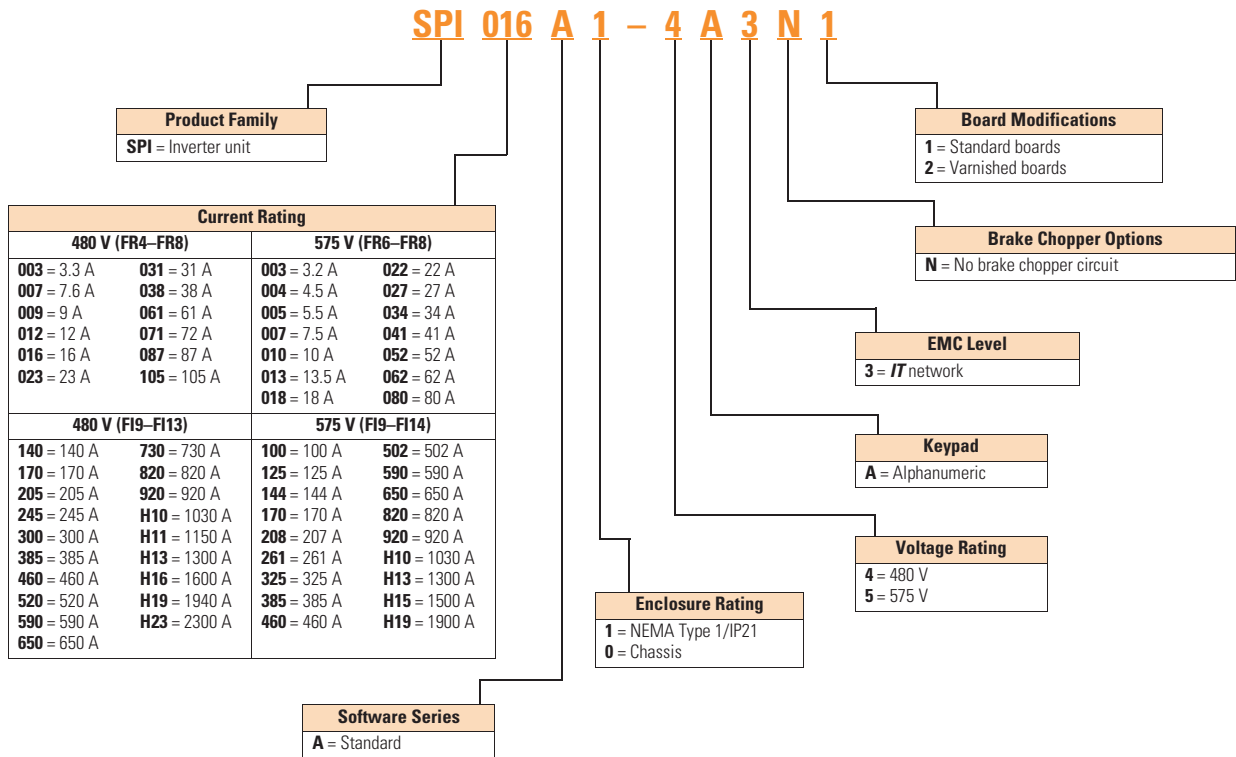
#### Active Front End



### Non-Regenerative Front End



### SPI Inverter Unit





## Product Selection

2

Common DC Bus Drive Products



## SPA Active Front End 480 V

Frame	Low Overload (AC Current)		High Overload (AC Current)		I <sub>max</sub> I <sub>2s</sub> (A)	Catalog Number
	I <sub>L-cont</sub> (A)	I <sub>1 min</sub> (A)	I <sub>H-cont</sub> (A)	I <sub>1 min</sub> (A)		
FI9	261	287	205	308	349	SPA205A0-4A3N1
FI10	460	506	385	578	693	SPA385A0-4A3N1
FI13	1300	1430	1150	1725	2070	SPAH11A0-4A3N1

## SPN Non-Regenerative Front End 480 V

Frame	Low Overload (AC Current)		High Overload (AC Current)		I <sub>max</sub> I <sub>2s</sub> (A)	Catalog Number
	I <sub>L-cont</sub> (A)	I <sub>1 min</sub> (A)	I <sub>H-cont</sub> (A)	I <sub>1 min</sub> (A)		
FI9	520	572	460	690	828	SPN460A0-4A3N1

## SPI Inverter Unit 480 V

Frame	Low Overload (AC Current)		High Overload (AC Current)		I <sub>max</sub> I <sub>2s</sub> (A)	Catalog Number
	I <sub>L-cont</sub> (A)	I <sub>1 min</sub> (A)	I <sub>H-cont</sub> (A)	I <sub>1 min</sub> (A)		
FR4	4.3	4.7	3.3	5	6.2	SPI003A1-4A3N1
	9	9.9	7.6	11.4	14	SPI007A1-4A3N1
	12	13.2	9	13.5	18	SPI009A1-4A3N1
FR6	16	17.6	12	18	24	SPI012A1-4A3N1
	23	25.3	16	24	32	SPI016A1-4A3N1
	31	34	23	35	46	SPI023A1-4A3N1
	38	42	31	47	62	SPI031A1-4A3N1
	46	51	38	57	76	SPI038A1-4A3N1
FR7	72	79	61	92	122	SPI061A1-4A3N1
	87	96	72	108	144	SPI072A1-4A3N1
	105	116	87	131	174	SPI087A1-4A3N1
FR8	140	154	105	158	210	SPI105A0-4A3N1
FI9	170	187	140	210	280	SPI140A0-4A3N1
	205	226	170	255	336	SPI170A0-4A3N1
	261	287	205	308	349	SPI205A0-4A3N1
	300	330	245	379	444	SPI245A0-4A3N1
FI10	385	424	300	450	540	SPI300A0-4A3N1
	460	506	385	578	693	SPI385A0-4A3N1
	520	572	460	690	828	SPI460A0-4A3N1
FI12	590	649	520	780	936	SPI520A0-4A3N1
	650	715	590	885	1062	SPI590A0-4A3N1
	730	803	650	975	1170	SPI650A0-4A3N1
	820	902	730	1095	1314	SPI730A0-4A3N1
	920	1012	820	1230	1476	SPI820A0-4A3N1
FI13	1030	1133	920	1380	1656	SPI920A0-4A3N1
	1150	1265	1030	1545	1854	SPIH10A0-4A3N1
	1300	1430	1150	1720	2070	SPIH11A0-4A3N1
FI14	1450	1595	1300	1950	2340	SPIH13A0-4A3N1
	1770	1947	1600	2400	2880	SPIH16A0-4A3N1
	2150	2365	1940	2910	3492	SPIH19A0-4A3N1

## Common DC Bus Drive Products



## SPA Active Front End 575 V

Frame	Low Overload (AC Current)		High Overload (AC Current)		I <sub>max</sub> I <sub>2s</sub> (A)	Catalog Number
	I <sub>L-cont</sub> (A)	I <sub>1 min</sub> (A)	I <sub>H-cont</sub> (A)	I <sub>1 min</sub> (A)		
FI9	144	158	125	188	213	SPA125A0-5A3N1
FI10	385	424	325	488	585	SPA325A0-5A3N1
FI13	1030	1133	920	1380	1656	SPA920A0-5A3N1

## SPN Non-Regenerative Front End 575 V

Frame	Low Overload (AC Current)		High Overload (AC Current)		I <sub>max</sub> I <sub>2s</sub> (A)	Catalog Number
	I <sub>L-cont</sub> (A)	I <sub>1 min</sub> (A)	I <sub>H-cont</sub> (A)	I <sub>1 min</sub> (A)		
FI9	600	660	510	732	888	SPN510A0-5A3N1

## SPI Inverter Unit 575 V

Frame	Low Overload (AC Current)		High Overload (AC Current)		I <sub>max</sub> I <sub>2s</sub> (A)	Catalog Number
	I <sub>L-cont</sub> (A)	I <sub>1 min</sub> (A)	I <sub>H-cont</sub> (A)	I <sub>1 min</sub> (A)		
FR6	4.5	5	3.2	5	6.4	SPI003A1-5A3N1
	5.5	6	4.5	7	9	SPI004A1-5A3N1
	7.5	8	5.5	8	11	SPI005A1-5A3N1
	10	11	7.5	11	15	SPI007A1-5A3N1
	13.5	15	10	15	20	SPI010A1-5A3N1
	18	20	13.5	20	27	SPI013A1-5A3N1
	22	24	18	27	36	SPI018A1-5A3N1
	27	30	22	33	44	SPI022A1-5A3N1
FR7	34	37	27	41	54	SPI027A1-5A3N1
	41	45	34	51	68	SPI034A1-5A3N1
FR8	52	57	41	62	82	SPI041A1-5A3N1
	62	68	52	78	104	SPI052A0-5A3N1
FR9	80	88	62	93	124	SPI062A0-5A3N1
	100	110	80	120	160	SPI080A0-5A3N1
	125	138	100	150	200	SPI100A0-5A3N1
FI9	144	158	125	188	213	SPI125A0-5A3N1
	170	187	144	216	245	SPI144A0-5A3N1
	208	229	170	255	289	SPI170A0-5A3N1
	261	287	208	312	375	SPI208A0-5A3N1
FI10	325	358	261	392	470	SPI261A0-5A3N1
	385	424	325	488	585	SPI325A0-5A3N1
	460	506	385	578	693	SPI385A0-5A3N1
FI12	502	552	460	690	828	SPI460A0-5A3N1
	590	649	502	753	904	SPI502A0-5A3N1
	650	715	590	885	1062	SPI590A0-5A3N1
	750	825	650	975	1170	SPI650A0-5A3N1
	920	1012	820	1230	1476	SPI820A0-5A3N1
FI13	1030	1133	920	1380	1656	SPI920A0-5A3N1
	1180	1298	1030	1464	1755	SPIH10A0-5A3N1
	1500	1650	1300	1950	2340	SPIH13A0-5A3N1
FI14	1900	2090	1500	2250	2700	SPIH15A0-5A3N1
	2250	2475	1900	2782	3335	SPIH19A0-5A3N1

## Line Reactor

## Line Reactor for Non-Regenerative Front End (480/575 VV)

Amps	Watts Losses	Catalog Number
600	493	CHK600

#### Options

#### SVX Series Option Board Kits

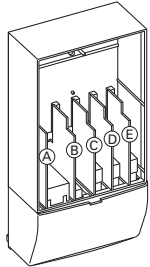
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The SVX Series drives can accommodate a wide selection of expander and adapter option boards to customize the drive for your application needs. The drive's control unit is designed to accept a total of five option boards.

The SVX Series factory installed standard board configuration includes an A9 I/O board and an A2 relay output board, which are installed in slots A and B.

#### Option Boards

#### Option Board Kits



Option Kit Description <sup>①</sup>	Allowed Slot Locations <sup>②</sup>	Field Installed Catalog Number	Factory Installed Option Designator	SVX Ready Programs						
				Basic	Local/Remote	Standard	MSS	PID	Multi-P.	PFC
<b>Standard I/O Cards</b>										
2 RO (NC-NO)	B	<b>OPTA2</b>	—	■	■	■	■	■	■	■
6 DI, 1 DO, 2 AI, 1 AO, 1 +10 Vdc ref, 2 ext +24 Vdc/EXT +24 Vdc	A	<b>OPTA9</b>	—	■	■	■	■	■	■	■
<b>Extended I/O Cards</b>										
2 RO, therm	B	<b>OPTA3</b>	<b>A3</b>	—	■	■	■	■	■	■
Encoder low volt +5 V/15 V/24 V	C	<b>OPTA4</b>	<b>A4</b>	—	■	■	■	■	■	■
Encoder high volt +15 V/24 V	C	<b>OPTA5</b>	<b>A5</b>	—	■	■	■	■	■	■
Double encoder	C	<b>OPTA7</b>	<b>A7</b>	■	■	■	■	■	■	■
6 DI, 1 DO, 2 AI, 1 AO	A	<b>OPTA8</b>	<b>A8</b>	—	■	■	■	■	■	■
3 DI (encoder 10–24 V), out +15 V/+24 V, 2 DO (pulse+direction)	C	<b>OPTAE</b>	<b>AE</b>	■	■	■	■	■	■	■
6 DI, 1 ext +24 Vdc/EXT +24 Vdc	B, C, <b>D</b> , E	<b>OPTB1</b>	<b>B1</b>	—	—	—	—	—	■	■
1 RO (NC-NO), 1 RO (NO), 1 therm	B, C, <b>D</b> , E	<b>OPTB2</b>	<b>B2</b>	—	—	—	—	—	■	■
1 AI (mA isolated), 2 AO (mA isolated), 1 ext +24 Vdc/EXT +24 Vdc	B, C, <b>D</b> , E	<b>OPTB4</b>	<b>B4</b>	—	■	■	■	■	■	■
3 RO (NO)	B, C, <b>D</b> , E	<b>OPTB5</b>	<b>B5</b>	—	—	—	—	—	■	■
1 ext +24 Vdc/EXT +24 Vdc, 3 Pt100	B, C, <b>D</b> , E	<b>OPTB8</b>	<b>B8</b>	—	—	—	—	—	—	—
1 RO (NO), 5 DI 42–240 Vac input	B, C, <b>D</b> , E	<b>OPTB9</b>	<b>B9</b>	—	—	—	—	—	■	■
SPI, absolute encoder	C	<b>OPTBB</b>	<b>BB</b>	—	—	—	—	—	—	—
<b>Communication Cards <sup>③</sup></b>										
Modbus	D, <b>E</b>	<b>OPTC2</b>	<b>C2</b>	■	■	■	■	■	■	■
Johnson Controls N2	D, <b>E</b>	<b>OPTC2</b>	<b>CA</b>	—	—	—	—	—	—	—
Modbus TCP	D, <b>E</b>	<b>OPTCI</b>	<b>CI</b>	■	■	■	■	■	■	■
BACnet	D, <b>E</b>	<b>OPTCJ</b>	<b>CJ</b>	■	■	■	■	■	■	■
EtherNet/IP	D, <b>E</b>	<b>OPTCQ</b>	<b>CQ</b>	■	■	■	■	■	■	■
PROFIBUS DP	D, <b>E</b>	<b>OPTC3</b>	<b>C3</b>	■	■	■	■	■	■	■
LonWorks	D, <b>E</b>	<b>OPTC4</b>	<b>C4</b>	■	■	■	■	■	■	■
PROFIBUS DP (D9 connector)	D, <b>E</b>	<b>OPTC5</b>	<b>C5</b>	■	■	■	■	■	■	■
CANopen (slave)	D, <b>E</b>	<b>OPTC6</b>	<b>C6</b>	■	■	■	■	■	■	■
DeviceNet	D, <b>E</b>	<b>OPTC7</b>	<b>C7</b>	■	■	■	■	■	■	■
Modbus (D9 type connector)	D, <b>E</b>	<b>OPTC8</b>	<b>C8</b>	■	■	■	■	■	■	■
Adapter	D, <b>E</b>	<b>OPTD1</b>	<b>D1</b>	■	■	■	■	■	■	■
Adapter	D, <b>E</b>	<b>OPTD2V</b>	<b>D2</b>	■	■	■	■	■	■	■
RS-232 with D9 connection	D, <b>E</b>	<b>OPTD3</b>	<b>D3</b>	■	■	■	■	■	■	■
<b>Keypad</b>										
9000X Series local/remote keypad (replacement keypad)	—	<b>KEYPAD-LOC/REM</b>	—	—	—	—	—	—	—	■
9000X Series remote mount keypad unit (keypad not included, includes 10 ft cable, keypad holder, mounting hardware)	—	<b>OPTRMT-KIT-9000X</b>	—	—	—	—	—	—	—	—
9000X Series RS-232 cable, 13 ft	—	<b>PP00104</b>	—	—	—	—	—	—	—	—

#### Notes

- ① AI = Analog Input; AO = Analog Output; DI = Digital Input; DO = Digital Output; RO = Relay Output
- ② Option card must be installed in one of the slots listed for that card. Slot indicated in bold is the preferred location.
- ③ OPTC2 is a multi-protocol option card.

## Technical Data and Specifications

### SPA/SPN/SPI

Description	Specification
<b>Supply Connection</b>	
Input voltage $U_{in}$ (AC) front end modules	380–500 Vac/525–690 Vac –10% to 10%
Input voltage $U_{in}$ (DC) inverter	465–800 Vdc/640–1100 Vdc –0% to 0%, the waviness of the inverter supply voltage, formed in rectification of the electric network's alternating voltage in basic frequency, must be less than 50 V peak-to-peak
Output voltage $U_{out}$ (AC) inverter	$3 \sim 0 - U_{in}/1.4$
Output voltage $U_{out}$ (DC) active front end module	$10.10 \times 1.35 \times U_{in}$ (factory default)
Output voltage $U_{out}$ (DC) non-regenerative front end module	$1.35 \times U_{in}$
<b>Ambient Conditions</b>	
Ambient operating temperature	14 (no frost) to 122 °F (–10 to 50 °C): $I_H$ 14 (no frost) to 104 °F (–10 to 40 °C): $I_L$
Storage temperature	–40 to 158 °F (–40 to 70 °C)
Relative humidity	0 to 95% RH, non-condensing, non-corrosive, no dripping water
Air quality	
Chemical vapors	IEC 721-3-3, unit in operation, class 3C2
Mechanical particles	IEC 721-3-3, unit in operation, class 3S2
Altitude	100% load capacity (no derating) up to 1000 m 1% derating for each 100 m above 1000 m; max. 3000 m
Vibration	5–150 Hz
EN50178/EN60068-2-6	Displacement amplitude 0.25 mm (peak) at 3–15.8 Hz Max acceleration amplitude 1G at 15.8–150 Hz
Shock EN50178, EN60068-2-27	UPS Drop Test (for applicable UPS weights) Storage and shipping: max 15 g, 11 ms (in package)
Cooling capacity required	Approximately 2%
Cooling air required	FR4 41 cfm, FR6 250 cfm, FR7 250 cfm, FR8 383 cfm FI9 677 cfm, FI10 824 cfm, FI12 1648 cfm, FI13 2472 cfm
Unit enclosure class	FR4–FR7 NEMA Type 1/IP21; FR8, FI9–FI14 chassis (IP00)
<b>EMC (at fault settings)</b>	
Immunity	Fulfill all EMC immunity requirements
<b>Safety</b>	
Approvals	CE, UL, cUL, EN 61800-5-1 (2003), see unit nameplate for more detailed approvals
<b>Control Connections</b>	
Analog input voltage	0–10 V, $R_i = 200$ kohms, (–10 V to 10 V joystick control) Resolution 0.1%, accuracy $\pm 1\%$
Analog input current	0(4)–20 mA, $R_i = 250$ ohms differential
Digital inputs	6, positive or negative logic; 18–30 Vdc
Auxiliary voltage	+24 V, $\pm 15\%$ , max. 250 mA
Output reference voltage	+10 V, +3%, max. load 10 mA
Analog output	0(4)–20 mA; RL max. 500 ohms; resolution 10 bits Accuracy $\pm 2\%$
Digital outputs	Open collector output, 50 mA/48V
Relay outputs	2 programmable change-over relay outputs Switching capacity: 24 Vdc/8 A, 250 Vac/8 A, 125 Vdc/0.4 A Min. switching load: 5 V/10 mA

## SPA/SPN/SPI, continued

Description	Specification
<b>Protections</b>	
Overvoltage protection	480 V/911 Vdc, 575 V/1200 Vdc
Undervoltage protection	480 V/333 Vdc, 575 V/460 Vdc
Ground fault protection	In case of ground fault in motor or motor cable, only the inverter is protected
Motor phase supervision	Trips if any of the output phases is missing
Overcurrent protection	Yes
Unit overtemperature protection	Yes
Motor overload protection	Yes
Motor stall protection	Yes
Motor underload protection	Yes
Short-circuit protection of 24 V and 10 V reference voltages	Yes

## Input Fuses

SHT fuses can be assembled into same-size DIN fuse base.

## SPA/SPN/SPI

Module Component	Frame	Bussmann Fuse Type (aR)	Size	U <sub>N</sub> (V)	I <sub>N</sub> (A)	Qty.
<b>Inverter Units</b>						
SPI003A1-4	FR4	170M1560	0	690	20	2
SPI007A1-4	FR4	170M1562	0	690	63	2
SPI009A1-4	FR4	170M1562	0	690	63	2
SPI012A1-4	FR6	170M1565	0	690	63	2
SPI016A1-4	FR6	170M1565	0	690	63	2
SPI023A1-4	FR6	170M1565	0	690	63	2
SPI031A1-4	FR6	170M1567	0	690	100	2
SPI038A1-4	FR6	170M1567	0	690	100	2
SPI061A1-4	FR7	170M1570	0	690	200	2
SPI072A1-4	FR7	170M1570	0	690	200	2
SPI087A1-4	FR7	170M1571	0	690	250	2
SPI105A0-4	FR8	170M3819	DIN1	690	400	2
SPI140A0-4	FR8	170M3819	DIN1	690	400	2
SPI170A0-4	FR8	170M3819	DIN1	690	400	2
SPI205A0-4	FI9	170M6812	DIN3	690	800	2
SPI245A0-4	FI9	170M6812	DIN3	690	800	2
SPI300A0-4	FI10	170M8547	3SHT	690	1250	2
SPI385A0-4	FI10	170M8547	3SHT	690	1250	2
SPI460A0-4	FI10	170M8547	3SHT	690	1250	2
SPI520A0-4	FI12	170M8547	3SHT	690	1250	2 x 2
SPI590A0-4	FI12	170M8547	3SHT	690	1250	2 x 2
SPI650A0-4	FI12	170M8547	3SHT	690	1250	2 x 2
SPI730A0-4	FI12	170M8547	3SHT	690	1250	2 x 2
SPI820A0-4	FI12	170M8547	3SHT	690	1250	2 x 2
SPI920A0-4	FI12	170M8547	3SHT	690	1250	2 x 2
SPIH10A0-4	FI13	170M8547	3SHT	690	1250	6
SPIH11A0-4	FI13	170M8547	3SHT	690	1250	6
SPIH13A0-4	FI13	170M8547	3SHT	690	1250	6
SPIH16A0-4	FI14	170M8547	3SHT	690	1250	2 x 6
SPIH19A0-4	FI14	170M8547	3SHT	690	1250	2 x 6
SPIH23A0-4	FI14	170M8547	3SHT	690	1250	2 x 6

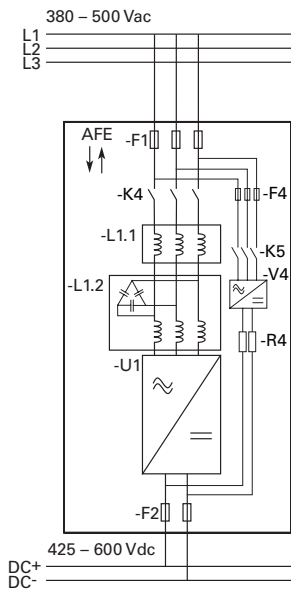
SHT fuses can be assembled into same-size DIN fuse base.

### SPA/SPN/SPI, continued

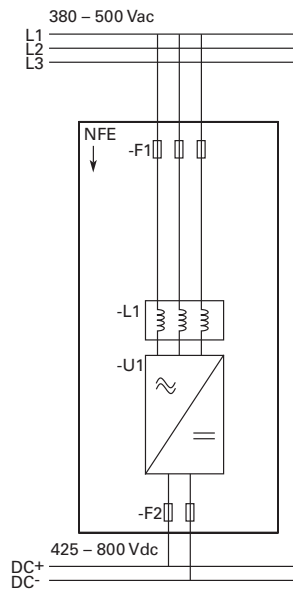
Module Component	Frame	Bussmann Fuse Type (aR)	Size	$U_N$ (V)	$I_N$ (A)	Qty.
<b>Active Front Ends</b>						
SPA205 A0-4	FI9	170 m6202	3SHT	1250	500	3
SPA385 A0-4	FI10	170 m6277	3SHT	1250	1000	3
SPAH10 A0-4	FI13	170 m6277	3SHT	1250	1000	3 x 3
<b>Non-Regenerative Front Ends</b>						
SPN468 A0-4	FI9	170 m8547	3SHT	690	1250	3

## Wiring Diagrams

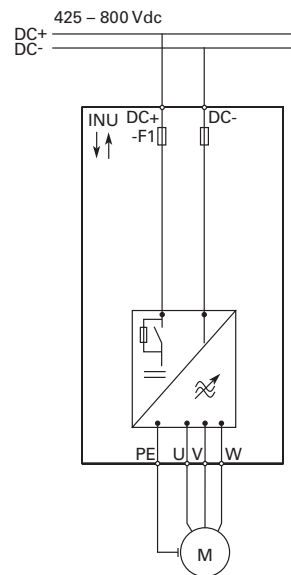
### SPA – Active Front End



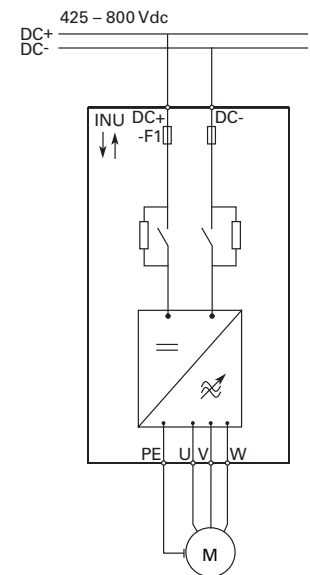
### SPN – Non-Regenerative Front End



### SPI – Inverter Unit (FR4–FR8)



### SPI – Inverter Unit (F19–F114)



# 2.13

## Adjustable Frequency Drives

### SPA/SPN/SPI Common DC Bus Drives

#### Dimensions

Approximate Dimensions in Inches (mm)

2

#### SPA/SPN/SPI

Frame	Height	Width	Depth	Weight Lbs (kg)
<b>Active Front Ends</b>				
FI9	40.6 (1030)	9.4 (239)	14.6 (372)	148 (67)
FI10	40.6 (1032)	9.4 (239)	21.7 (552)	220 (100)
FI12	40.6 (1032)	2 x 9.4 (2 x 239)	21.7 (552)	441 (200)
FI13	40.6 (1032)	27.9 (708)	21.8 (553)	674 (306)
FI14	40.6 (1032)	2 x 27.9 (2 x 708)	21.8 (553)	1348 (612)
<b>Non-Regenerative Front Ends</b>				
FI9	40.6 (1030)	9.4 (239)	14.6 (372)	148 (67)
<b>Inverter Units</b>				
FR4	11.5 (292)	5.0 (128)	7.5 (190)	11 (5)
FR6	20.4 (519)	7.7 (195)	9.3 (237)	35 (16)
FR7	23.3 (591)	9.3 (237)	10.1 (257)	64 (29)
FR8	29.8 (758)	11.4 (289)	13.5 (344)	106 (48)
FI9	40.6 (1030)	9.4 (239)	14.6 (372)	148 (67)
FI10	40.6 (1032)	9.4 (239)	21.7 (552)	220 (100)
FI12	40.6 (1032)	2 x 9.4 (2 x 239)	21.7 (552)	441 (200)
FI13	40.6 (1032)	27.9 (708)	21.8 (553)	674 (306)
FI14	40.6 (1032)	2 x 27.9 (2 x 708)	21.8 (553)	1348 (612)

Eaton Terms & Conditions



## Terms & Conditions



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### Selling Policy (Supersedes Selling Policy 25-000, dated November 1, 2008)

#### Terms and Conditions of Sale

The Terms and Conditions of Sale set forth herein, and any supplements which may be attached hereto, constitute the full and final expression of the contract for the sale of products or services (hereinafter referred to as Product(s) or Services by Eaton Corporation (hereinafter referred to as Seller) to the Buyer, and supersedes all prior quotations, purchase orders, correspondence or communications whether written or oral between the Seller and the Buyer. Notwithstanding any contrary language in the Buyer's purchase order, correspondence or other form of acknowledgment, Buyer shall be bound by these Terms and Conditions of Sale when it sends a purchase order or otherwise indicates acceptance of this contract, or when it accepts delivery from Seller of the Products or Services.

THE CONTRACT FOR SALE OF THE PRODUCTS OR SERVICES IS EXPRESSLY LIMITED TO THE TERMS AND CONDITIONS OF SALE STATED HEREIN. ANY ADDITIONAL OR DIFFERENT TERMS PROPOSED BY BUYER ARE REJECTED UNLESS EXPRESSLY AGREED TO IN WRITING BY SELLER. No contract shall exist except as herein provided.

#### **Complete Agreement**

No amendment or modification hereto nor any statement, representation or warranty not contained herein shall be binding on the Seller unless made in writing by an authorized representative of the Seller. Prior dealings, usage of the trade or a course of performance shall not be relevant to determine the meaning of this contract even though the accepting or acquiescing party had knowledge of the nature of the performance and opportunity for objection.

#### **Quotations**

Written quotations are valid for 30 days from its date unless otherwise stated in the quotation or terminated sooner by notice.

Verbal quotations, unless accepted, expire the same day they are made.

A complete signed order must be received by Seller within 20 calendar days of notification of award, otherwise the price and shipment will be subject to re-negotiation.

#### **Termination and Cancellation**

##### **Products**

Any order may be terminated by the Buyer only by written notice and upon payment of reasonable termination charges, including all progress billings and all incurred direct manufacturing costs.

##### **Services**

Any order may be terminated by the Buyer only by written notice and upon payment of reasonable termination charges including all costs plus profit.

Seller shall have the right to cancel any order at any time by written notice if Buyer breaches any of the terms hereof, becomes the subject of any proceeding under state or federal law for the relief of debtors, or otherwise becomes insolvent or bankrupt, generally does not pay its debts as they become due or makes an assignment for the benefit of creditors.



# Appendix 1—General Terms and Conditions of Sale

Effective Date: November 1, 2017

## **Prices**

All prices are subject to change without notice. In the event of a price change, the effective date of the change will be the date of the new price or discount sheet, letter or telegram. All quotations made or orders accepted after the effective date will be on the new basis. For existing orders, the price of the unshipped portion of an order will be the price in effect at time of shipment.

## **Price Policy—Products and Services**

When prices are quoted as firm for quoted shipment, they are firm provided the following conditions are met:

1. The order is released with complete engineering details.
2. Shipment of Products are made, and Services purchased are provided within the quoted lead time.
3. When drawings for approval are required for any Products, the drawings applicable to those Products must be returned within 30\* calendar days from the date of the original mailing of the drawings by Seller. The return drawings must be released for manufacture and shipment and must be marked "APPROVED" or "APPROVED AS NOTED." Drawing re-submittals which are required for any other reason than to correct Seller errors will not extend the 30-day period.

\* 60 days for orders through contractors to allow time for their review and approval before and after transmitting them to their customers.

If the Buyer initiates or in any way causes delays in shipment, provision of Services or return of approval drawings beyond the periods stated above, the price of the Products or Services will be increased 1% per month or fraction thereof up to a maximum of 18 months from the date of the Buyer's order. For delays resulting in shipment or provision of Services beyond 18 months from the date of the Buyer's order, the price must be renegotiated.

## **Price Policy—BLS**

Refer to Price Policy 25-050.

## **Minimum Billing**

Orders less than \$1,000 will be assessed a shipping and handling charge of 5% of the price of the order, with a minimum charge of \$25.00 unless noted differently on Product discount sheets.

## **Taxes**

The price does not include any taxes. Buyer shall be responsible for the payment of all taxes applicable to, or arising from the transaction, the Products, its sale, value, or use, or any Services performed in connection therewith regardless of the person or entity actually taxed.

## **Terms of Payment**

### **Products**

Acceptance of all orders is subject to the Buyer meeting Seller's credit requirements. Terms of payment are subject to change for failure to meet such requirements. Seller reserves the right at any time to demand full or partial payment before proceeding with a contract of sale as a result of changes in the financial condition of the Buyer. Terms of Payment are either Net 30 days from the date of invoice of each shipment or carry a cash discount based on Product type. Specific payment terms for Products are outlined in the applicable Product discount schedules.

### **Services**

Terms of payment are net within 30 days from date of invoice for orders amounting to less than \$50,000.00.

Terms of payment for orders exceeding \$50,000.00 shall be made according to the following:

1. Twenty percent (20%) of order value with the purchase order payable 30 days from date of invoice.
2. Eighty percent (80%) of order value in equal monthly payments over the performance period payable 30 days from date of invoice.

Except for work performed (i) under a firm fixed price basis or (ii) pursuant to terms of a previously priced existing contract between Seller and Buyer, invoices for work performed by Seller shall have added and noted on each invoice a charge of 3% (over and above the price of the work) which is related to Seller compliance with present and proposed environmental, health, and safety regulations associated with prescribed requirements covering hazardous materials management and employee training, communications, personal protective equipment, documentation and record keeping associated therewith.

### **Adequate Assurances**

If, in the judgment of Seller, the financial condition of the Buyer, at any time during the period of the contract, does not justify the terms of payment specified, Seller may require full or partial payment in advance.

### **Delayed Payment**

If payments are not made in accordance with these terms, a service charge will, without prejudice to the right of Seller to immediate payment, be added in an amount equal to the lower of 1.5% per month or fraction thereof or the highest legal rate on the unpaid balance.

## Freight

Freight policy will be listed on the Product discount sheets, or at option of Seller one of the following freight terms will be quoted.

### **F.O.B.—P/S—Frt./Ppd. and Invoiced**

Products are sold F.O.B. point of shipment freight prepaid and invoiced to the Buyer.

### **F.O.B.—P/S—Frt./Ppd. and Allowed**

Products sold are delivered F.O.B. point of shipment, freight prepaid and included in the price.

### **F.O.B. Destination—Frt./Ppd. and Allowed**

At Buyer's option, Seller will deliver the Products F.O.B. destination freight prepaid and 2% will be added to the net price.

The term "freight prepaid" means that freight charges will be prepaid to the accessible common carrier delivery point nearest the destination for shipments within the United States and Puerto Rico unless noted differently on the Product discount sheets. For any other destination, contact Seller's representative.

### **Shipment and Routing**

Seller shall select the point of origin of shipment, the method of transportation, the type of carrier equipment and the routing of the shipment.

If the Buyer specifies a special method of transportation, type of carrier equipment, routing, or delivery requirement, Buyer shall pay all special freight and handling charges.

When freight is included in the price, no allowance will be made in lieu of transportation if the Buyer accepts shipment at factory, warehouse, or freight station or otherwise supplies its own transportation.

## Risk of Loss

Risk of loss or damage to the Products shall pass to Buyer at the F.O.B. point.

### **Concealed Damage**

Except in the event of F.O.B. destination shipments, Seller will not participate in any settlement of claims for concealed damage.

When shipment has been made on an F.O.B. destination basis, the Buyer must unpack immediately and, if damage is discovered, must:

1. Not move the Products from the point of examination.
2. Retain shipping container and packing material.
3. Notify the carrier in writing of any apparent damage.
4. Notify Seller representative within 72 hours of delivery.
5. Send Seller a copy of the carrier's inspection report.

### **Witness Tests/Customer Inspection**

Standard factory tests may be witnessed by the Buyer at Seller's factory for an additional charge calculated at the rate of \$2,500 per day (not to exceed eight (8) hours) per Product type. Buyer may final inspect Products at the Seller's factory for \$500 per day per Product type.

Witness tests will add one (1) week to the scheduled shipping date. Seller will notify Buyer fourteen (14) calendar days prior to scheduled witness testing or inspection. In the event Buyer is unable to attend, the Parties shall mutually agree on a rescheduled date. However, Seller reserves the right to deem the witness tests waived with the right to ship and invoice Products.

## Held Orders

For any order held, delayed or rescheduled at the request of the Buyer, Seller may, at its sole option (1) require payment to be based on any reasonable basis, including but not limited to the contract price, and any additional expenses, or cost resulting from such a delay; (2) store Products at the sole cost and risk of loss of the Buyer; and/ or (3) charge to the Buyer those prices under the applicable price policy. Payment for such price, expenses and costs, in any such event, shall be due by Buyer within thirty (30) days from date of Seller's invoice. Any order so held delayed or rescheduled beyond six (6) months will be treated as a Buyer termination.

### **Drawing Approval**

Seller will design the Products in line with, in Seller's judgment, good commercial practice. If at drawing approval Buyer makes changes outside of the design as covered in their specifications, Seller will then be paid reasonable charges and allowed a commensurate delay in shipping date based on the changes made.

### **Drawing Re-Submittal**

When Seller agrees to do so in its quotation, Seller shall provide Buyer with the first set of factory customer approval drawing(s) at Seller's expense. The customer approval drawing(s) will be delivered at the quoted delivery date. If Buyer requests drawing changes or additions after the initial factory customer approval drawing(s) have been submitted by Seller, the Seller, at its option, may assess Buyer drawing charges. Factory customer approval drawing changes required due to misinterpretation by Seller will be at Seller's expense. Approval drawings generated by Bid Manager are excluded from this provision.

## Warranty

### **Warranty for Products**

Seller warrants that the Products manufactured by it will conform to Seller's applicable specifications and be free from failure due to defects in workmanship and material for one (1) year from the date of installation of the Product or eighteen (18) months from the date of shipment of the Product, whichever occurs first.

In the event any Product fails to comply with the foregoing warranty, Seller will, at its option, either (a) repair or replace the defective Product, or defective part or component thereof, F.O.B. Seller's facility freight prepaid, or (b) credit Buyer for the purchase price of the Product. All warranty claims shall be made in writing.

Seller requires all non-conforming Products be returned at Seller's expense for evaluation unless specifically stated otherwise in writing by Seller.

This warranty does not cover failure or damage due to storage, installation, operation or maintenance not in conformance with Seller's recommendations and industry standard practice or due to accident, misuse, abuse or negligence. This warranty does not cover reimbursement for labor, gaining access, removal, installation, temporary power or any other expenses, which may be incurred in connection with repair or replacement.

This warranty does not apply to equipment not manufactured by Seller. Seller limits itself to extending the same warranty it receives from the supplier.

# Appendix 1—General Terms and Conditions of Sale

Effective Date: November 1, 2017

## **Extended Warranty for Products**

If requested by the Buyer and specifically accepted in writing by Seller, the foregoing standard warranty for Products will be extended from the date of shipment for the period and price indicated below:

- 24 months—2% of Contract Price
- 30 months—3% of Contract Price
- 36 months—4% of Contract Price

## **Special Warranty (In and Out) for Products**

If requested by the Buyer and specifically accepted in writing by Seller, Seller will, during the warranty period for Products, at an additional cost of 2% of the contract price, be responsible for the direct cost of:

1. Removing the Product from the installed location.
2. Transportation to the repair facility and return to the site.
3. Reinstallation on site.

The total liability of Seller for this Special Warranty for Products is limited to 50% of the contract price of the particular Product being repaired and excludes expenses for removing adjacent apparatus, walls, piping, structures, temporary service, etc.

## **Warranty for Services**

Seller warrants that the Services performed by it hereunder will be performed in accordance with generally accepted professional standards.

The Services, which do not so conform, shall be corrected by Seller upon notification in writing by the Buyer within one (1) year after completion of the Services.

Unless otherwise agreed to in writing by Seller, Seller assumes no responsibility with respect to the suitability of the Buyer's, or its customer's, equipment or with respect to any latent defects in equipment not supplied by Seller. This warranty does not cover damage to Buyer's, or its customer's, equipment, components or parts resulting in whole or in part from improper maintenance or operation or from their deteriorated condition. Buyer will, at its cost, provide Seller with unobstructed access to the defective Services, as well as adequate free working space in the immediate vicinity of the defective Services and such facilities and systems, including, without limitation, docks, cranes and utility disconnects and connects, as may be necessary in order that Seller may perform its warranty obligations. The conducting of any tests shall be mutually agreed upon and Seller shall be notified of, and may be present at, all tests that may be made.

## **Warranty for Power Systems Studies**

Seller warrants that any power systems studies performed by it will conform to generally accepted professional standards. Any portion of the study, which does not so conform, shall be corrected by Seller upon notification in writing by the Buyer within six (6) months after completion of the study. All warranty work shall be performed in a single shift straight time basis Monday through Friday. In the event that the study requires correction of warranty items on an overtime schedule, the premium portion of such overtime shall be for the Buyer's account.

## **Limitation on Warranties for Products, Services and Power Systems Studies**

THE FOREGOING WARRANTIES ARE EXCLUSIVE EXCEPT FOR WARRANTY OF TITLE. SELLER DISCLAIMS ALL OTHER WARRANTIES INCLUDING ANY IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

CORRECTION OF NON-CONFORMITIES IN THE MANNER AND FOR THE PERIOD OF TIME PROVIDED ABOVE SHALL CONSTITUTE SELLER'S SOLE LIABILITY AND BUYER'S EXCLUSIVE REMEDY FOR FAILURE OF SELLER TO MEET ITS WARRANTY OBLIGATIONS, WHETHER CLAIMS OF THE BUYER ARE BASED IN CONTRACT, IN TORT (INCLUDING NEGLIGENCE OR STRICT LIABILITY), OR OTHERWISE.

## **Asbestos**

Federal Law requires that building or facility owners identify the presence, location and quantity of asbestos containing material (hereinafter "ACM") at work sites. Seller is not licensed to abate ACM. Accordingly, for any contract which includes the provision of Services, prior to (i) commencement of work at any site under a specific Purchase Order, (ii) a change in the work scope of any Purchase Order, the Buyer will certify that the work area associated with the Seller's scope of work includes the handling of Class II ACM, including but not limited to generator wedges and high temperature gaskets which include asbestos materials. The Buyer shall, at its expense, conduct abatement should the removal, handling, modification or reinstallation, or some or all of them, of said Class II ACM be likely to generate airborne asbestos fibers; and should such abatement affect the cost of or time of performance of the work, then Seller shall be entitled to an equitable adjustment in the schedule, price and other pertinent affected provisions of the contract.

## **Compliance with Nuclear Regulation**

Seller's Products are sold as commercial grade Products not intended for application in facilities or activities licensed by the United States Nuclear Regulatory Commission for atomic purposes. Further certification will be required for use of the Products in any safety-related application in any nuclear facility licensed by the U.S. Nuclear Regulatory Commission.

## **Returning Products**

Authorization and shipping instructions for the return of any Products must be obtained from Seller before returning the Products.

When return is occasioned due to Seller error, full credit including all transportation charges will be allowed.

## **Product Notices**

Buyer shall provide the user (including its employees) of the Products with all Seller supplied Product notices, warnings, instructions, recommendations, and similar materials.

## **Force Majeure**

Seller shall not be liable for failure to perform or delay in performance due to fire, flood, strike or other labor difficulty, act of God, act of any governmental authority or of the Buyer, riot, embargo, fuel or energy shortage, car shortage, wrecks or delays in transportation, or due to any other cause beyond Seller's reasonable control. In the event of delay in performance due to any such cause, the date of delivery or time for completion will be extended by a period of time reasonably necessary to overcome the effect of such delay.

## **Liquidated Damages**

Contracts which include liquidated damage clauses for failure to meet shipping or job completion promises are not acceptable or binding on Seller, unless such clauses are specifically accepted in writing by an authorized representative of the Seller at its headquarters office.

## **Patent Infringement**

Seller will defend or, at its option, settle any suit or proceeding brought against Buyer, or Buyer's customers, to the extent it is based upon a claim that any Product or part thereof, manufactured by Seller or its subsidiaries and furnished hereunder, infringes any United States patent, other than a claim of infringement based upon use of a Product or part thereof in a process, provided Seller is notified in reasonable time and given authority, information and assistance (at Seller's expense) for the defense of same. Seller shall pay all legal and court costs and expenses and court-assessed damages awarded therein against Buyer resulting from or incident to such suit or proceeding. In addition to the foregoing, if at any time Seller determines there is a substantial question of infringement of any United States patent, and the use of such Product is or may be enjoined, Seller may, at its option and expense: either (a) procure for Buyer the right to continue using and selling the Product; (b) replace the Product with non-infringing apparatus; (c) modify the Product so it becomes non-infringing; or (d) as a last resort, remove the Product and refund the purchase price, equitably adjusted for use and obsolescence. In no case does Seller agree to pay any recovery based upon its Buyer's savings or profit through use of Seller's Products whether the use be special or ordinary. The foregoing states the entire liability of Seller for patent infringement.

The preceding paragraph does not apply to any claim of infringement based upon: (a) any modification made to a Product other than by Seller; (b) any design and/or specifications of Buyer to which a Product was manufactured; or (c) the use or combination of Product with other products where the Product does not itself infringe. As to the above-identified claim situations where the preceding paragraph does not apply, Buyer shall defend and hold Seller harmless in the same manner and to the extent as Seller's obligations described in the preceding paragraph. Buyer shall be responsible for obtaining (at Buyer's expense) all license rights required for Seller to be able to use software products in the possession of Buyer where such use is required in order to perform any Service for Buyer.

With respect to a Product or part thereof not manufactured by Seller or its subsidiaries, Seller will attempt to obtain for Buyer, from the supplier(s), the patent indemnification protection normally provided by the supplier(s) to customers.

## **Compliance with OSHA**

Seller offers no warranty and makes no representation that its Products comply with the provisions or standards of the Occupational Safety and Health Act of 1970, or any regulation issued thereunder. In no event shall Seller be liable for any loss, damage, fines, penalty or expenses arising under said Act.

## **Limitation of Liability**

THE REMEDIES OF THE BUYER SET FORTH IN THIS CONTRACT ARE EXCLUSIVE AND ARE ITS SOLE REMEDIES FOR ANY FAILURE OF SELLER TO COMPLY WITH ITS OBLIGATIONS HEREUNDER.

NOTWITHSTANDING ANY PROVISION IN THIS CONTRACT TO THE CONTRARY, IN NO EVENT SHALL SELLER BE LIABLE IN CONTRACT, IN TORT (INCLUDING NEGLIGENCE OR STRICT LIABILITY) OR OTHERWISE FOR DAMAGE TO PROPERTY OR EQUIPMENT OTHER THAN PRODUCTS SOLD HEREUNDER, LOSS OF PROFITS OR REVENUE, LOSS OF USE OF PRODUCTS, COST OF CAPITAL, CLAIMS OF CUSTOMERS OF THE BUYER OR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES WHATSOEVER, REGARDLESS OF WHETHER SUCH POTENTIAL DAMAGES ARE FORESEEABLE OR IF SELLER HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

THE TOTAL CUMULATIVE LIABILITY OF SELLER ARISING FROM OR RELATED TO THIS CONTRACT WHETHER THE CLAIMS ARE BASED IN CONTRACT, IN TORT (INCLUDING NEGLIGENCE OR STRICT LIABILITY) OR OTHERWISE, SHALL NOT EXCEED THE PRICE OF THE PRODUCT OR SERVICES ON WHICH SUCH LIABILITY IS BASED.

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