

# THE BLUE BOX™ LT

## SYSTEM START-UP & CABLING GUIDE

### INSTRUCTIONS:

#### STEP 1:

Install all equipment and note down their serial numbers on the "System Device Schedule" in The Blue Box LT Master Panel.....(Refer to Installation Guides)

#### STEP 2:

Pull Cat. 5 cable in a daisy-chain between all digital devices. Add "EZ" brand RJ45 connectors to cable ends and crimp using the proper color code. Note: Do not connect contact switches or photocells until Step 5..... Pgs.2-3

#### STEP 3:

Test each cable with a LAN tester and once passed plug each in. Do not power-up devices until Step 6! .....Pgs.3

#### STEP 4:

Verify proper connections and cabling using the Hardware Activation Tests. ....Pg.4

#### STEP 5:

Make up low voltage cabling and connections for contact closure devices or photocells. .... (See Installation Guides)

#### STEP 6:

Start-up and auto-address the digital bus. ....Pg.5

Once the 6 steps are completed you can program schedules, switches, and photocells. Need help? Call Tech Support: (800) 345-4448.

#### Digital Network:

Locate multiple Blue Box LTs and control stations where you need them and then link them all with Cat. 5 cable. One master panel (with a Digital Time Clock) for 16 digital devices. Control stations provide combined manual control and after-hours override.

Note: The photocell is not on the digital bus and should not be connected until Step 5.

Slave Relay Panel



Chelsea Digital Switch



Slave Relay Panel



Master Relay Panel

Outdoor Photocell



## LOW VOLTAGE CABLING

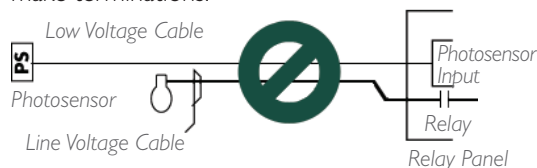
Digital devices have two RJ45 connectors and are daisy-chained using Cat. 5 (see cover). Non-digital devices (photosensors, toggle switches, etc.) are cabled per their installation guides (not daisy-chained).

- ! Adhere to 568A or 568B standards for Cat. 5 cables.
- ! Always use a dedicated pair for the center pins.

Refer to individual product installation guides for line-voltage cabling details and low voltage connection details. Do not "home run" digital switches back to a relay panel. No spurs or T-Taps are allowed. Do not exceed 16 devices on any system with a Blue Box LT Master.

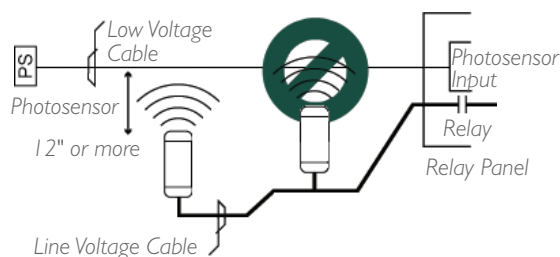
### ELIMINATE INTERFERENCE; ISOLATE CAT. 5 CABLES

...From **Line Voltage Cable**: Cat. 5 cable must be at least 12" from all line voltage conductors, except to cross or make terminations.



Low voltage cabling must not be run in parallel with line voltage cable, and must not share the same conduit, whether digital cable (Cat. 5) or low voltage cable (3#18 from a photosensor).

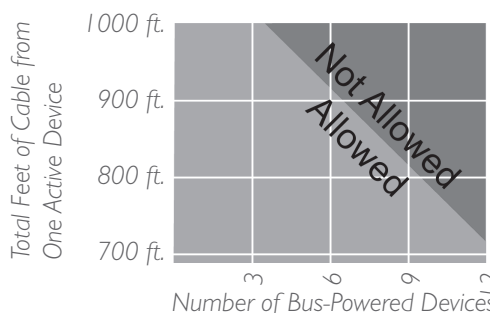
...From **Line Voltage Devices**: Low voltage cabling must avoid EMF or RF from ballasts, arc welders or other "noisy" loads. EMF or RF interference can create an unstable bus.



### DON'T CAUSE VOLTAGE DROP!

There is a limit to how many switches and photocell cards you can add in a row over long runs of Cat. 5 cabling.

### Bus-Powered Devices Allowed for Each Active Device

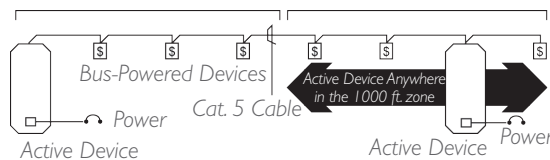


**Active Device** - Device with power supply (a transformer). It acts as a source of electrical energy for the bus.

**Bus-Powered Device** - Any device that relies on the 12v supplied by the bus for its power. Example: digital switches, and photosensor cards.

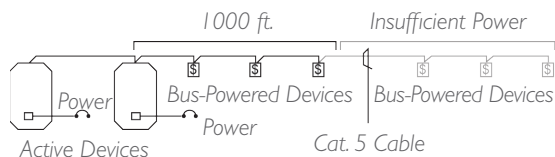
The more feet of Cat. 5 cable used, the fewer bus-powered devices before adding another active device.

**Examples:** Per the above chart, up to 3 bus-powered devices may be powered across 1,000 feet of Cat. 5 cable.



The active device may be located anywhere within the 1,000 foot region.

Multiple active devices in the same location will not increase the distance allowed.



For the above, the correct solution is to connect the active devices (relay panels) as the center of the network and have two runs of cable. Call the Tech Support if cable runs exceed 1000ft without active devices.

## MAKING UP RJ45 CONNECTORS

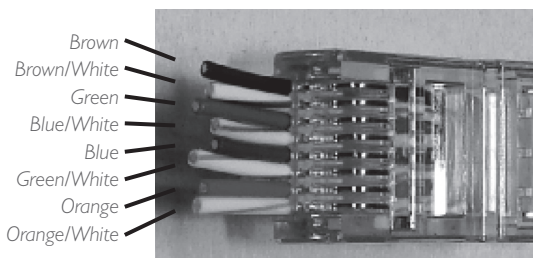
Never made up RJ45 connectors before? Its easy. Just follow the below steps. For a short lesson on making RJ45 connectors, refer to The Blue Box LT "O&M Manual".

To be successful, only use the ratcheting crimping tool recommended by LC&D and a Local Area Network (LAN) cable tester that allows remote testing — the ends of the cable will be remote from each other.

! Only use stranded Cat. 5 cable.

! Only use EZ RJ45 connectors provided by Lighting Control & Design (LC&D).

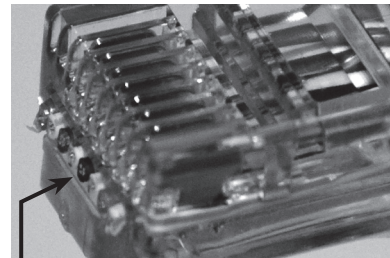
1. Remove two inches of the Cat. 5 jacket - use the wire stripper and cutter provided in our kit. Carefully inspect the conductors for nicks.
2. Untwist all four pairs, and straighten/smooth out each conductor.
3. Reorganize the conductors in the order shown in the illustration below. Bring all conductors together until they touch.



4. Place an EZ connector on the end of the cable with the locking prong facing down.
5. Push conductors completely through and (using flush cutters or box cutters) trim-off all excess cable. Conductors should butt up to the end of the connector — they must not protrude or be too short.

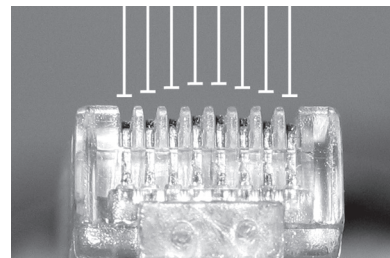
! Always follow acceptable safety procedures when using a sharp cutting tool. Tools must be sharp; dull tools cause more hazards than sharp ones.

6. Using the recommended ratcheting crimp tool, crimp at least five times for the best possible connection.



Contacts not seated properly (sticking out 1/16 of an inch too far).

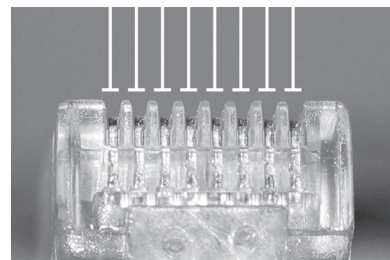
7. Visually inspect each connector: Contacts should be pushed into the insulation of each conductor.
8. Repeat on the other end of the cable for a straight-through cable.



Contacts not seated properly (bowed crimping).

9. Test every cable for continuity with a LAN cable tester. While testing, wiggle and tug on each connector to test for a solid crimp.

Never make "hot" RJ45 crimps (crimping the other end of a cable that has been plugged into a powered device). This can damage equipment.



Contacts properly seated (flat crimping).

## HARDWARE ACTIVATION TESTS

Before starting, note total approximate bus cable length:

|  |
|--|
|  |
|--|

Once each cable has been checked with a LAN cable tester and plugged-in, it is still possible for the entire connected cable structure to become problematic. For instance, dirt may accumulate inside the RJ45 sockets, the strain on the Cat. 5 when pushing switches into the wall may weaken connections or even break the conductors, or the bus length may exceed 4000 ft.

Each test must be passed before moving onto the next. If any readings are out of range, refer to "Hardware Activation Troubleshooting" section at the end of this document or call Technical Support at 1-800-345-4448.

### CONTINUITY TEST

This test is intended to verify bus length, continuity, and detect crossed data-pair wires.

1. De-power every item on the bus and check the voltage at both ends to ensure a reading of 0vdc. Remove any terminators.
2. At one end of the bus, plug in the "Data/Power Jumper."
3. At the other end of the bus, plug in the "Bus Checker Card" and measure resistance across the following terminals:

|          |          |          |          |
|----------|----------|----------|----------|
| Gnd to A | ____ohms | B to +12 | ____ohms |
|----------|----------|----------|----------|

4. All test values must be within 10% of the values in the chart below to be considered valid!

#### Continuity Test Results (Gnd to A & B to +12)

| Length   | Ohms                       | Length   | Ohms                         |
|----------|----------------------------|----------|------------------------------|
| 100 ft.  | 3 $\Omega$ to 6 $\Omega$   | 2000 ft. | 68 $\Omega$ to 80 $\Omega$   |
| 500 ft.  | 12 $\Omega$ to 20 $\Omega$ | 3000 ft. | 102 $\Omega$ to 120 $\Omega$ |
| 1000 ft. | 34 $\Omega$ to 40 $\Omega$ | 4000 ft. | 130 $\Omega$ to 160 $\Omega$ |

### SHORT CIRCUIT TEST

This test is intended to detect any short circuits along the bus. Please use the lowest resistance range (200  $\Omega$ ) setting on your multi-meter. DO NOT use a "beep" test.

5. Remove the "Data Power Jumper" and measure the resistance across the following terminals on the "Bus

Checker Card,"

6. All test values should be greater than 1K ohm!

|            |          |          |          |
|------------|----------|----------|----------|
| Gnd to A   | ____ohms | A to B   | ____ohms |
| Gnd to B   | ____ohms | A to +12 | ____ohms |
| Gnd to +12 | ____ohms | B to +12 | ____ohms |

### EARTH GROUND TEST

This test is intended to detect any pathways to earth ground.

7. Measure resistance between the terminals mentioned below, and "Earth ground" (a metallic enclosure or conduit).

|     |   |
|-----|---|
| Gnd | A |
| +12 | B |

8. All readings between each terminal and "Earth ground" should be infinite or "Open"!

### TERMINATOR TEST

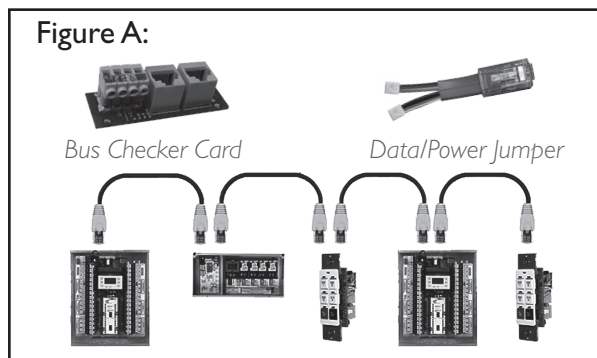
This test is intended to ensure that only 2 terminators exist, one at each end of the bus. If the readings are out of range, it would indicate a missing, misplaced, or an extra terminator (terminators are shipped in the Master Panel).

9. Add a "Terminator" on the first and last device. On the "Bus Checker Card", measure

|        |          |
|--------|----------|
| A to B | ____ohms |
|--------|----------|

10. Test reading should be within 62  $\Omega$  to 92  $\Omega$ !

11. Remove the bus checker card and call our Tech Support with your results at: 1-800-345-4448 x391.



# SYSTEM ACTIVATION

## AUTO ADDRESS DEVICES

Starting up a new system requires a few simple steps. Consider the following steps to set-up and start the system (see page 6 for DTC navigation).

1. After completing the Hardware Activation Tests, power up all slave panels, and active devices (any device with an onboard - 120 or 277 - power supply) first and then power up the master panel. Check that the power-indicator LEDs on all digital devices are lit-up.
2. The main screen will be displayed for a few seconds, after which the "device detection" screen will be displayed. TAB to YES and ENTER to auto-address devices.

Found 1 device on the system that are not used. Would you like to auto-assign them?

**YES** / NO / ->  
Never Ask Again

*If the number of devices detected do not match the number of devices present on the bus, proceed to trouble-shooting section.*

4. To view address assignments in the "Serial Number Scan" screen TAB to YES and ENTER.

Assigned 1 device. Review assignments by scanning all serial numbers?

**YES** / NO

*The "Serial Number Scan" screen displays the serial number, address, and device-type of added device(s)*

## FILL OUT SYSTEM DEVICE SCHEDULE

6. In the "Serial#" field SCROLL to review each device (including DI cards). If collisions are present or if two devices share the same address, contact Tech Support.

SCAN BY SERIAL#  
SERIAL# **CE80**  
ADR: 1  
Item Type: Switch  
Mapd: 6 Btn. Switch  
Address OK  
  
SAVE ADDRESS CHANGES

Fill out the "System Device Schedule" located on the back of the "Panel Schedule" inside the master panel.

If unable to correlate the serial numbers and device locations when filling out the "System Device Schedule", refer to the serial label on each device or follow the "Read Address" section of the Blue Box LT "O&M Manual".

## SYSTEM DEVICE SCHEDULE: (for Master Panels)

|   |  |  |
|---|--|--|
| <b>(Master) LCP1</b><br>Device Type<br><b>elec rm</b><br>Location<br><b>ce80</b><br>Serial #<br><b>1</b><br>Address | <b>3 btn sw</b><br>Device Type<br><b>Hallway</b><br>Location<br><b>8875</b><br>Serial #<br><b>3</b><br>Address | <b>6 btn sw</b><br>Device Type<br><b>lobby</b><br>Location<br><b>4685</b><br>Serial #<br><b>4</b><br>Address |
| <b>DI-6</b><br>Device Type<br><b>LCP 1</b><br>Location<br><b>4055</b><br>Serial #<br><b>7</b><br>Address            | Device Type<br>Location<br>Serial #<br>Address   | Device Type<br>Location<br>Serial #<br>Address   |

## ERROR CHECK

The system is now ready for Error Checking. Press EXIT repeatedly to go back to the main menu.

7. Navigate to the "Error Statistics" screen. Use the path USER MENU > SETUP MENU > RESTRICTED > ADDRESSING-BUS SCAN > ERROR STATISTICS. The password to enter the RESTRICTED area is 900001.
8. TAB to the field that says CLEAR and press ENTER to clear errors. If after 3 minutes no errors accumulate on this screen, your system is stable.
9. If errors continue to accumulate refer to the Error Check Troubleshooting section of the Blue Box LT "O&M Manual" or call Technical Support for assistance at 800-345-4448.

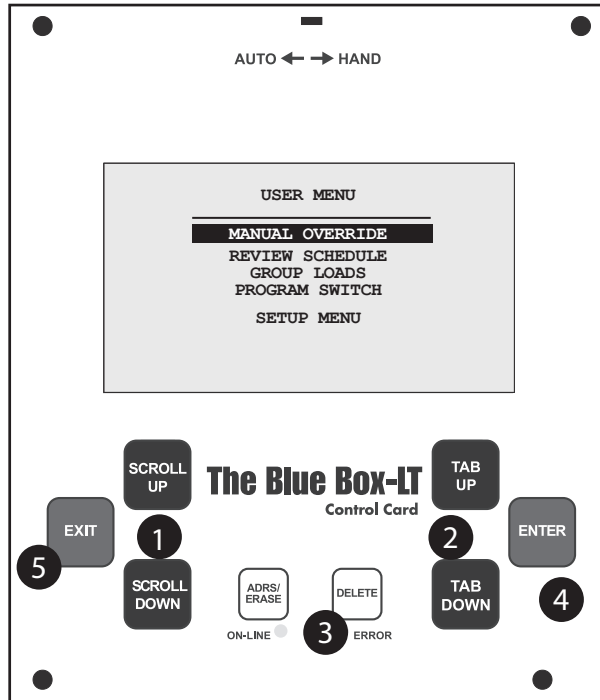
## VERIFY DATE, TIME & LOCATION

To change the factory programmed settings, refer to the Blue Box LT "O&M Manual".

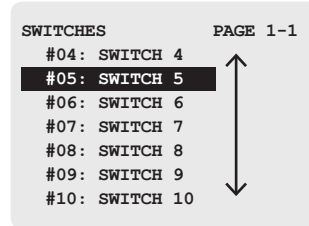
# DIGITAL TIME CLOCK (DTC) NAVIGATION BASICS

## DTC CLOCK NAVIGATION BASICS

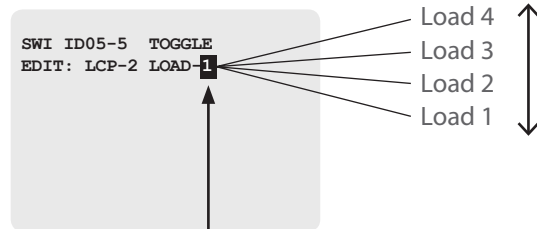
Most devices can be programmed from the DTC (Digital Time Clock) in the master LCP (Lighting Control Panel).



TAB moves the cursor through a screen



SCROLL to choose one item from a field.\*



This "field" contains a list of possible selections, but only displays one item from that list at a time.

### CALL OUT LEGEND:

1. SCROLL through choices in one field\*
2. TAB to position the cursor
3. DELETE information or programming about an item. Use caution.
4. ENTER to select
5. EXIT to leave a screen.

\* A "field" is a display in which many items can be selected.

# HARDWARE ACTIVATION TROUBLESHOOTING

! Always re-check “failed” results. If improperly set or connected a meter can display unusual readings.

! The “Bus-Splitting Technique” is the fastest way to find a bad cable and/or damaged device. Be sure to document the cable path!

! Cat. 5 cables that pass a LAN cable test can still short or break from stress and strain during installation.

If re-testing a suspected cable, roughly wiggle and tug the conductors near the RJ45 while keeping an eye on the LAN tester: conductors should remain properly engaged throughout the test.

## CONTINUITY TEST TROUBLE SHOOTING

1. Fluctuating resistance readings indicate one or more “active” devices are still “hot”. De-power all devices and re-test.
2. High resistance readings indicate broken or resistive connections. Use the “Bus-splitting” technique to find:
  - RJ45 connectors not properly pushed into sockets (check to make sure that the wires are not extended beyond the end of the RJ45 connector)
  - Cable strain can break conductors or pull conductors out of RJ45 contacts (visually inspect cable and connector).
  - Unseated RJ45 sockets (rough install environment)
  - Damaged device (rare)
  - Dirt or paint on RJ45s (rare)
  - Bad data/power jumper cable (rare)

## SHORT CIRCUIT TEST TROUBLE SHOOTING

1. A low resistance reading indicates a crossed or shorted pair or (rarely) a damaged device. Cable strain when pushing switches into a wall can short nicked conductors. Use the bus splitting technique to find the bad cable, crimp or device.
2. Resistance readings below 300Ω on A-B only indicate an extra terminator. Use the bus splitting technique to find the short or extra terminator.
3. After the problem has been resolved, please complete the “Continuity Test” again.

## EARTH GROUND TROUBLE SHOOTING

LAN-tested cables can still have a path to earth ground.

1. An abraded or “folded” cable inside the conduit will cause a short to earth ground.
2. Other low voltage or high voltage wires touching any device on the bus will cause continuity to earth ground

Use the Bus Splitting Technique to locate the problem.

## TERMINATOR TROUBLE-SHOOTING

1. Ensure that the Data/Power Jumper is removed.
2. Visually inspect both terminators are present and properly seated on each bus-end device.

## ERROR CHECK TROUBLESHOOTING

If the hardware activation tests have just been completed and the bus is unstable, consider the following causes:

1. Failure to follow the 568A or 568B color code (or minimally to use a dedicated pair for the center pins) will cause the Error Check test to fail. Visually inspect RJ45 connectors.
2. Occasionally, the flat-cable connecting the clock to the master panel can become damaged. Visually inspect the Cat. 5 cable – if damaged, replace it with a new cable.
3. An external source of EMF (electromagnetic frequency) or RF (radio frequency) interference may be present and affecting the bus (or digital devices). Refer to the beginning of this guide on running low voltage cables across or parallel to line voltage cables or exposing low voltage cables to EMF or RF sources (e.g. welders, ballasts, improperly grounded wireless devices, etc.); any of which can interfere with the bus operation and stability.

Visually inspect and handle any external sources of signal noise - a digital device can also become damaged and create signal noise.

An oscilloscope can be used to locate the source of the bus failure. The “Oscilloscope Test” can be found in The Blue Box LT “O&M Manual”.

If unfamiliar with how to use an oscilloscope or if one is unavailable on-site, contact Tech Support: 1-800-345-4448.



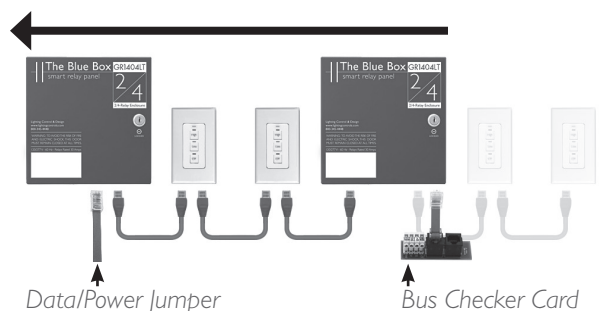
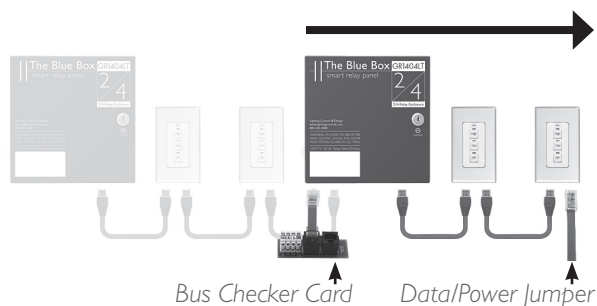
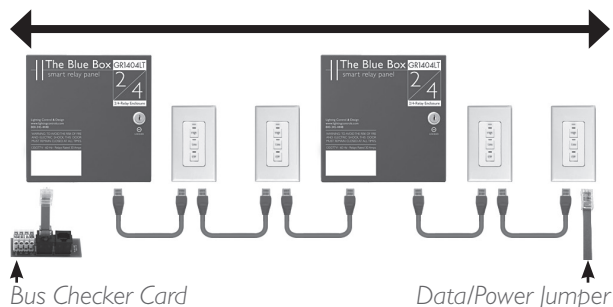
# HARDWARE ACTIVATION TROUBLESHOOTING (Continued)

## BUS SPLITTING TECHNIQUE

! Note: To speed up troubleshooting when readings are less than  $200\Omega$  on the Continuity or Short-Circuit test, refer to the “Bus Length Chart” earlier in this document before splitting the bus; this can provide an approximate distance to a shorted pair or extra terminator from the test point.

1. On the middle device of the bus, disconnect one Cat. 5 cable to create two smaller “half-buses”.
2. Test each “half-bus” to find the side with the out-of-range values.
3. Repeat steps 1 & 2 on the out-of-range “half-bus,” to create another “half-bus” until the cable, crimp or device creating the out of range measurements is located.

*The idea is to split a bus in half and then half again – over and over until the bad area has been located. It is OK to visually inspect each cable, crimp or device to detect the problem.*



## ACUITY CONTROLS

I Lithonia Way • Conyers, GA 30017 • Support 800-535-2465 • [www.acuitycontrols.com](http://www.acuitycontrols.com)