C-Bus Quick-Start Guide

Clipsal© C-Bus™ Products

Version A1, July 2008

SQUARE D by Schneider Electric

Schneider Electric

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HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- This equipment must be installed and serviced by qualified electrical personnel.
- Turn off all electrical power supplying this equipment before working on or inside the equipment.
- Always use a properly rated voltage sensing device to confirm that power is off.
- Replace all devices, doors, and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

SUPPORT AND TRAINING

For product support of your C-Bus network, contact Square D Lighting Control Technical Support or the Square D Customer Information Center.

Square D Lighting Control Technical Support

Phone: 615-287-3400 (when connected, select Option 4, then Option 1).

Support E-mail: lightingcontrol.support@us.schneider-electric.com

Training E-mail: lightingcontrol.training@us.schneider-electric.com

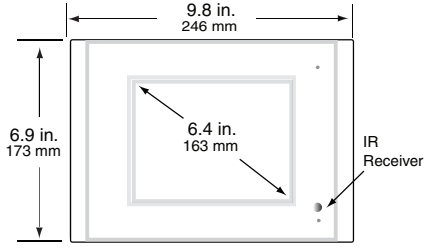
Website: www.squaredlightingcontrol.com

Square D Customer Information Center

Phone: 1-888-778-2733

MODELS AND DIMENSIONS

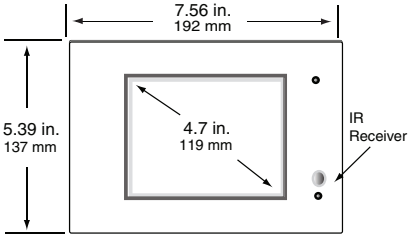
COLOR TOUCH SCREEN



Many cover-plate styles (Neo shown):
- 100 pages
- Scenes and schedules
- Security
- Logic and astronomical clock
- Light sensor
- IR receiver

Requires separate 5 V Power Supply.
Draws 20 mA from network.

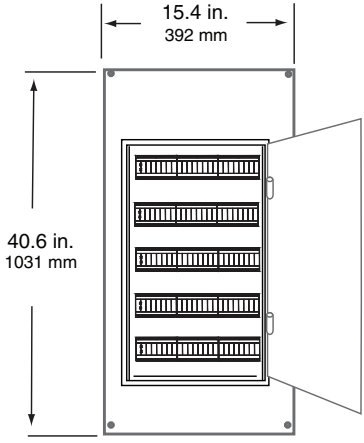
BLACK & WHITE TOUCH SCREEN



Many cover-plate styles (white shown):
- 100 pages
- Scenes and schedules
- Logic and astronomical clock
- Light sensor
- IR receiver

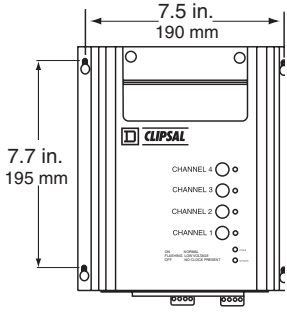
Draws 65 mA from network.

60M ENCLOSURE



Five rows for mounting DIN-rail units.
Each row can hold:
- one 12M unit
- one 8M unit + one 4M unit
- three 4M units

PRO DIMMER

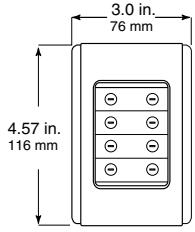


Models (120 V):
- 1 channel @ 20 A
- 2 channels @ 10 A ea
- 4 channels @ 5 A ea

Sources 60 mA to network.

MODELS AND DIMENSIONS (CONTINUED)

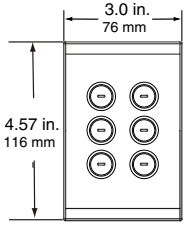
NEO™ KEYPADS



Neo Keypad assemblies:
- 2-, 4-, and 8-button models
- Scene control
- ON/OFF toggles, dimmers, and timers

Requires wallbox approx. 2.125 in. wide.
Draws 22 mA from network.

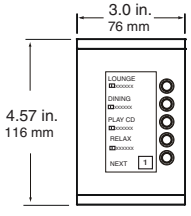
SATURN™ KEYPADS



Saturn Keypad assemblies:
- 2-, 4-, and 6-button models
- Glass cover plate
- Scene control
- ON/OFF toggles, dimmers, and timers

Requires wallbox approx. 2.125 in. wide.
Draws 22 mA from network.

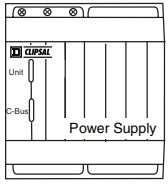
DLT™ KEYPADS



Dynamic Labeling Technology (DLT) in Saturn (shown) and Neo cover-plate models:
- Multi-point switching and dimming
- Two pages
- Scene control
- Clock and timers

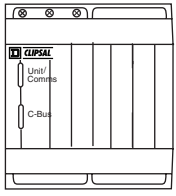
Draws 22 mA from network.

DIN-RAIL POWER SUPPLY



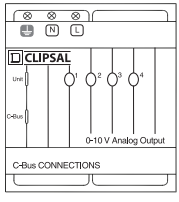
- 120 V and 277 V models
- 34 V DC
- Sources 350 mA to network.
- 4M

PC INTERFACE



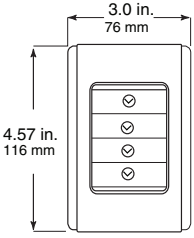
- Models:
  - RS-232 (standard)
  - USB
  - Ethernet
- Draws 32 mA from the network
- 4M

0–10 V ANALOG OUTPUT



- 120 V and 277 V models
- 4 channels @ 0–10 V DC ea
- Draws 22 mA from network.
- 4M

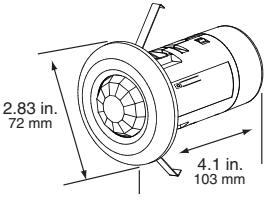
DECORATOR KEYPADS



Neo (shown) and Saturn cover plates:
- 1-, 2-, 3-, and 4-button models
- Scene control
- ON/OFF toggles, dimmers, and timers

Draws 22 mA from network.

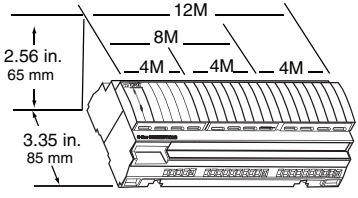
360° PIR OCCUPANCY SENSOR & MULTI-SENSOR



Indoor Occupancy Sensor or Multi-Sensor:
- Passive infrared receiver (PIR)
- Light-level sensor (0.1 ftcl–full sun)
- Range of 800 sq ft (74 sq m)
- 0 sec–18 hr timer
- IR receiver (Multi-Sensor only)

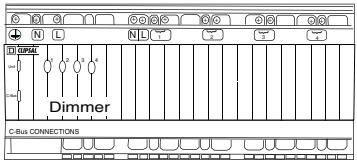
Draws 18 mA from network.

DIN UNIT DIMENSIONS



1M = 0.69 in. (17.5 mm)
4M = 2.83 in. (72 mm)
8M = 5.67 in. (144 mm)
12M = 8.46 in. (215 mm)

DIN-RAIL DIMMERS

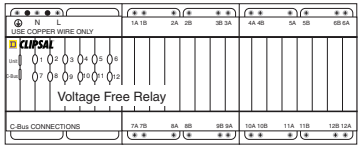


Models (120 V) with or without on-board C-Bus network Power Supply:
- 4 channels @ 4 A ea (12M)
- 8 channels @ 2 A ea (12M)

Models with a network Power Supply source 200 mA to the network.

Line-voltage supplies to the Control and Switching stages must be wired from the same voltage phase.

DIN-RAIL RELAYS

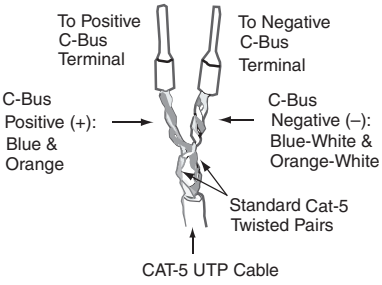


Models (120 V or 277 V) with or without on-board C-Bus network Power Supply:
- 4 channels @ 10 A ea (8M)
- 4 channels @ 20 A ea (12M)
- 12 channels @ 10 A ea (12M)

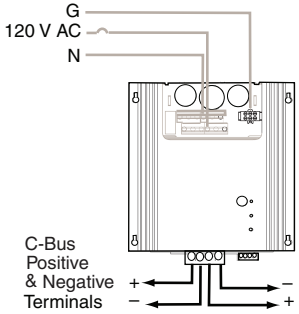
Models with network Power Supply source 200 mA to network.

C-BUS NETWORK WIRING

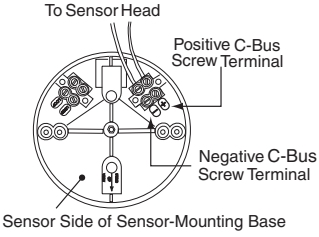
SCREW TERMINAL CONNECTORS



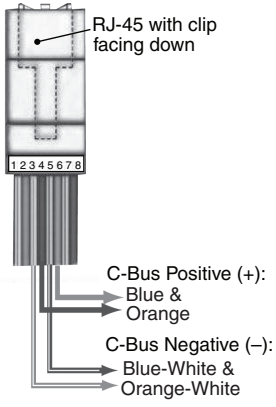
PRO DIMMER



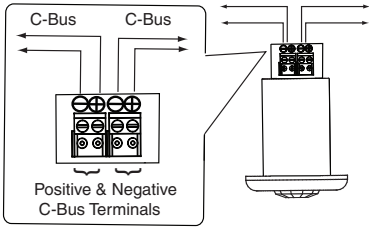
90˚ INDOOR PIR OCCUPANCY SENSOR



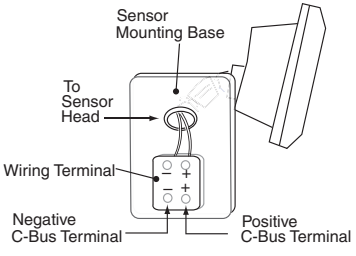
RJ-45 CONNECTORS



360˚ INDOOR PIR / MULTI-SENSOR



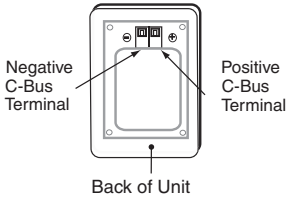
110˚ OUTDOOR PIR



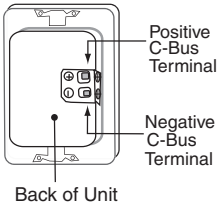
C-Bus Cable Conductor Assignments

RJ Pin	C-Bus Network Connection	Wire Color
1	Remote ON	Green-White
2	Remote ON	Green
3	C-Bus Neg (–)	Orange-White
4	C-Bus Pos (+)	Blue
5	C-Bus Neg (–)	Blue-White
6	C-Bus Pos (+)	Orange
7	Remote OFF	Brown-White
8	Remote OFF	Brown

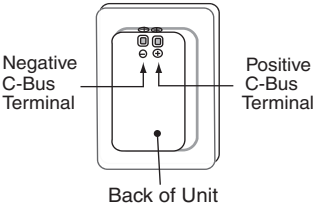
NEO & SATURN KEYPADS & INDOOR LIGHT-LEVEL SENSOR



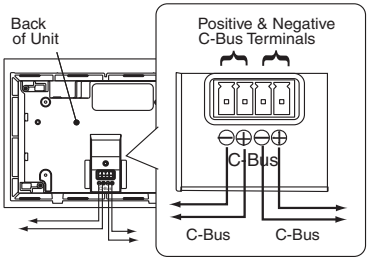
DECORATOR KEYPADS



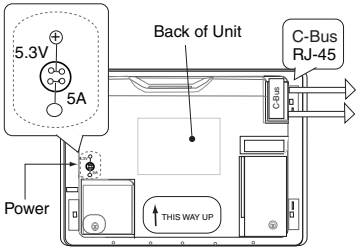
DLT KEYPADS



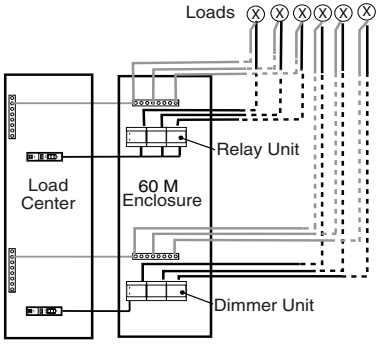
BLACK & WHITE TOUCH SCREEN



COLOR TOUCH SCREEN

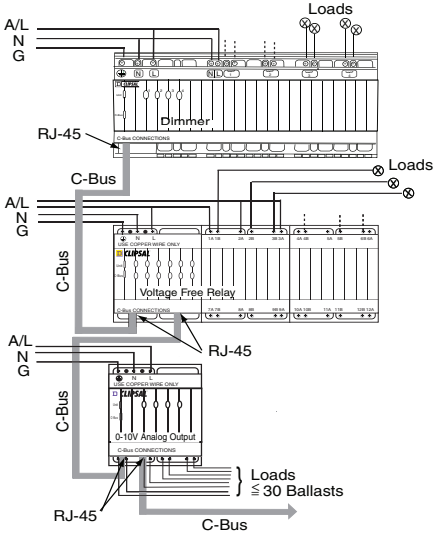


TYPICAL PANEL WIRING



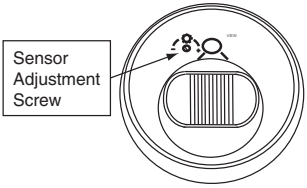
- Load circuits pulled to enclosure
- Load neutrals terminate on neutral bar in enclosure
- Single feed from load center
- Neutral bar in load center

TYPICAL DIN UNIT WIRING

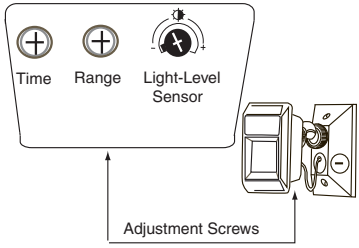


ADJUSTING SENSORS

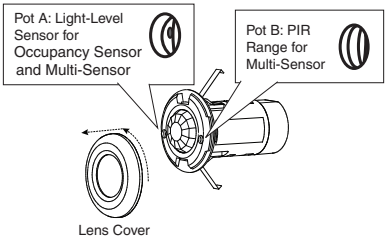
90˚ INDOOR PIR ADJUSTMENT SCREW



110° OUTDOOR PIR ADJUSTMENT SCREWS



360˚ OCCUPANCY SENSOR / MULTI-SENSOR ADJUSTMENT SCREWS



STATUS INDICATORS

OUTPUT UNIT STATUS INDICATORS

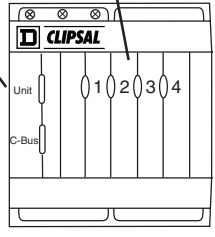
Toggle/Channel Control/Local Override Buttons
- LED: Light lit, channel ON; Light unlit, channel OFF
- Button Press: Manually overrides channel status
- Start Learn Mode to configure a unit

Override Buttons

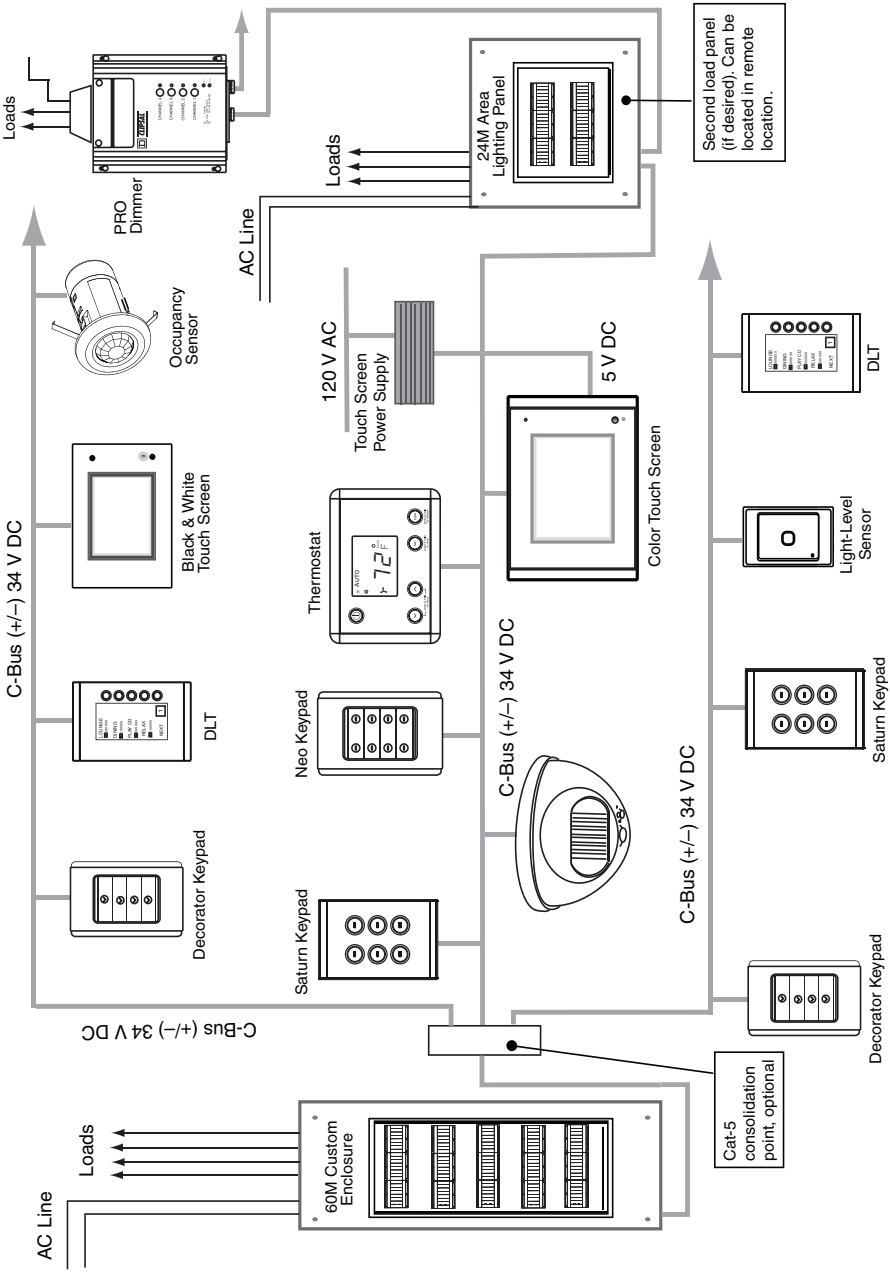
If channel(s)/unit(s) are in Local Override mode:
- Short press: "Toggles" the channel/unit, e.g., OFF to ON
- Double press: Returns control of channel/unit to the C-Bus network
- Long press: Returns control of all channels/units in Local Override mode to the C-Bus network

UNIT: Unit status and power
- ON (lit): Line-level voltage.
- Flashing: Local/Remote Overrides toggled ON/OFF
- OFF (unlit): No line-level voltage

C-BUS: Network status at the unit
- ON (lit): C-Bus Clock, acceptable network power (22–36 V DC)
- Flashing: Marginal network power (15–20 V DC)
- OFF (unlit): No Clock, no C-Bus power



TYPICAL C-BUS NETWORK LAYOUT AND COMPONENTS



PROJECT PLANNING AND EXECUTION

If you are performing installation only, use the instructions in Step 6 below.

1. Study the building floor plans, lighting schedule, and panel schedule. Discuss requirements with customer.
2. Develop a Bill of Materials; order products.
3. C-Bus units must be configured to operate on the C-Bus network. For the units covered in this guide, you will need the C-Bus Toolkit and/or PICED software, available on the Square D Lighting Control website (http://www.squaredlightingcontrol.com/downloadcenter.cfm).
4. Install the software and create a Toolkit project for the installation; pre-configure the units on an off-site mini-network; and prepare to send the units to the site:
   - Create a temporary mini-network from a PC, PC Interface, Power Supply, and hardware Network Burden.
   - Temporarily attach each unit, in turn, to the mini-network and give it a unique Unit Address and Part Name.
   - Perform any other lighting-control configuration planned for the off-site configuration.
   - Save the information to the unit and to the Toolkit project database.
   - Write the Unit Address and Part Name on the unit, its box, and the site plan.
5. Send the units and plan to site for installation.
6. When you install a unit, record its location: remove the self-stick serial number label from the product box and place it on the site plan at the unit's location.
7. Prepare detailed switching and control configurations in the Toolkit project database.
8. When the units have been installed, connect your laptop to the network via a PC Interface (standard or USB) or Ethernet Interface, and download the Toolkit project from the database to the C-Bus network.
9. Test the system's functions and make any changes required.
10. Schedule a visit for about a month following occupation of the building to adjust its configuration.

C-BUS UNITS

Three main types of units: system units, input units, and output units

- System units (e.g., a DIN-Rail Power Supply) enable certain network operations.
- Input units (e.g., a Two-Button Neo Keypad) issue commands.
- Output units (e.g., a Four-Channel Dimmer) execute commands from input units.

C-BUS NETWORK PARAMETERS

Maximum number of units on a network: 100 (@ 18 mA)

When a network contains units that draw more than 18 mA, the maximum number of units will be less than 100.

Maximum total length of Cat-5 UTP cable on a single network: 3281 ft (1 km)

This is approximately three 1000 ft (305 m) boxes of Cat-5 UTP wire.

C-BUS NETWORK PARAMETERS (CONTINUED)

Maximum 34 V DC on the C-Bus cable: 2,000 mA (2 A)

Each DIN Relay and DIN Dimmer with an on-board network Power Supply can supply 200 mA to the Bus. Where more than 10 DIN Relays and/or Dimmers are required on a network, the additional units should be the type without an on-board network Power Supply.

Maximum number of Network Burdens: One (only one)

The PCI, USB, Ethernet Network Interface, and Network Bridge come with a plug-in RJ-45 Hardware Burden. We recommend using the Hardware Burden. A software-enabled Network Burden is available on DIN units and Professional Dimmer units. (Software Burdens are disabled by default.)

Minimum number of active System Clocks: One active, two more enabled

System Clocks are available on any DIN unit or Professional Dimmer unit. Use the Toolkit software to enable a Clock, except on the PC Interface, where it is enabled by default. Recommended maximum three enabled Clocks at any time.

Maximum number of networks than can be linked together: 255

Topologies: Single- and Multi-Network: Star, Daisy Chain, or Star-Daisy Chain combination.

Maximum 6 Network Bridges (7 networks) on a Daisy Chain.

C-BUS DATA CONNECTIONS

C-Bus units can have RJ-45 style ports for any of four types of data:

- C-Bus network
- RS-232 Serial
- USB
- Ethernet

Verify that you are connecting the correct cable at each port. Each cable carries a different type of signal, and incorrect connections could result in damage to the equipment, a computer, and/or the C-Bus network.

CAUTION

HAZARD OF IMPROPER OR UNSTABLE OPERATION

- Verify that all connections to C-Bus units are being made to the correct port.
- Only connect an RS-232 Serial cable to a port labeled RS-232; an Ethernet cable to a port labeled Ethernet; and a C-Bus network cable to a port labeled C-Bus.

Failure to follow these instructions can result in improper C-Bus network operation, damage to the computer or C-Bus network equipment, or both.

Network Connection Types

- C-Bus: The C-Bus network consists of C-Bus units interconnected with Cat-5 UTP cable. C-Bus network connections are typically made to labeled RJ-45 ports at the bottom of the unit or to screw terminals.
- RS-232 Serial: The standard PC Interface (SLC5500PCI) has two labeled RS-232 Serial ports, enabling computerized monitoring and configuration of the network. RS-232 cable is shielded untwisted wire.

Network Connection Types (continued)

- USB: A second PC Interface model (SLC5500PCU) has one USB port for use with newer computers that lack a serial port.

  NOTE: Install USB drivers from the C-Bus Toolkit "File" menu.

- Ethernet: The Ethernet Network Interface (SLC5500CN) has one labeled Ethernet port for connecting a computer to the C-Bus network.

C-BUS CABLE

Types

Unshielded twisted pair Category 5 Local Area Network (Cat-5 UTP LAN) cable, maximum current 2 A. Cat-5E UTP and Cat-6 UTP are also acceptable.

- Solid: typically used for long runs that are infrequently moved
- Stranded: typically used for 'patch leads,' or connections that may be frequently connected/disconnected

Connectors

To Positive and Negative Terminals

- Positive terminal: Blue and orange wires
- Negative terminal: Blue-white and orange-white wires

To terminate each wire pair, use bootlace ferrules or twist bare ends of wires together neatly (no frayed ends). Do not solder ends, it can cause cold flow and result in a bad connection.

To a DIN Unit C-Bus (RJ-45) Port

Use an RJ-45 type connector appropriate for the type of wire being used—solid and stranded Cat-5 have specific types of connectors and connection crimp tools. Proper connections require the correct connector and tool for each type of wire. Using the wrong combination tool/connector can crush the wire, causing a faulty connection that will be hard to diagnose.

Remote Overrides

The green, green-white, brown, and brown-white Cat-5 wires are available for "Remote Override" connections. Remote Overrides provide a manual override of C-Bus operations by locking an output unit's channels ON or OFF. Remote Override wire pairs are connected to C-Bus negative via a mechanical switch.

- Remote Override ON: Green and green-white wires
- Remote Override OFF: Brown and brown-white wires

MAXIMUM NUMBER OF SCENES &/OR GROUPS/KEYPAD

Any one Neo or Saturn unit (including DLT variants) can have one Scene per button (maximum depends on the number of buttons). Each unit can use up to 40 Group Addresses total. Any one Scene can have up to 40 Group Addresses.

Example: An 8-Button Neo Keypad can have 1 Scene with up to 40 Group Addresses, or 2 Scenes with 20 Group Addresses each, or any permutation consistent with the 8 Scene/40 Group Address rule.

C-BUS NETWORK WIRING GUIDELINES

These guidelines are consistent with Best Practices and provide the best immunity to noise.

- Follow national and local electrical codes. Refer to the product's installation bulletin for product-specific information on wiring, wire gauge, and so on.
- In panels and enclosures, securely anchor and sleeve C-Bus network cable and anchor electrical power lines. This helps prevent contact between loose electrical power conductors and the C-Bus network wiring.
- Wherever possible, consolidate multiple C-Bus network Cat-5 cables outside a panel or enclosure so that only one C-Bus cable is brought into the enclosure.
- Insulate any consolidation of multiple C-Bus network cables in panels or enclosures so that there are no loose wires, no exposed terminal screws, etc.
- If C-Bus network cable is run in parallel with electrical power lines (outside an enclosure), there must be at least 6 in. (152 mm) segregation between the two cables at all times.
- If C-Bus network cable will cross an electrical power line, the crossing must be at a 90° angle. Also provide at least 2.5 in. (64 mm) separation between the two cables where they cross.
- Limit the current on a C-Bus network to 2 A or less.
- Limit the total length of Cat-5 cable on a single network to 3281 ft (1 km).

MULTI-POINT SWITCHING/DIMMING/CONTROL

- To control a light from two, four, or more switch locations, give the same Group Address to one or more buttons on each switch and the Relay or Dimmer.
- To control multiple Relay or Dimmer channels from a single switch, give the various Relay and/or Dimmer channels the same Group Address as the switch.

OUTPUT UNIT STATUS INDICATOR ACTIVITY

For a description of the status indicators' activity on other types of units, such as an input unit, see the other side of this guide or the unit's installation bulletin.

NOTE: The Unit and C-Bus indicators on output units only function when output units are connected to 120/277 V AC.

Unit

Indicates the status of the individual unit and whether it is receiving line-level voltage.

- ON (lit): the unit is receiving line-level voltage.
- Flashing: the Local or Remote Overrides have been toggled ON or OFF.
- OFF (unlit): there is no line-level voltage.

C-Bus

Indicates the status of the C-Bus network at the unit:

- ON (lit): there is a C-Bus Clock and an acceptable level of C-Bus network power (recommended range is 22–36 V DC).
- Flashing: the line voltage on the C-Bus network is marginal (15–20 V DC).
- OFF (unlit): no C-Bus System Clock or no C-Bus network power.

Toggle/Local Override/Channel Control Buttons

On output units (e.g., DIN-rail Dimmers and Relays), these buttons operate a unit's output channels and LEDs, as long as the unit is connected to line voltage. Use them to verify that the power lines are installed correctly and that each channel switches the correct load(s). These buttons are multi-functional.

Override Button Functions

The Toggle's Status Indicator LED shows the status (ON or OFF) of each channel on that output unit.

1. Light ON/lit, the channel is ON; light OFF/unlit, the channel is OFF.
2. A press on a Toggle/Local Override/Channel Control button manually overrides the current state of that channel.
3. Local Override/Channel Control buttons can be used to start Learn Mode and configure a unit.

Override Button Operations

When one or more channels or units are in Local Override mode, different button presses have different effects.

- Short press: "Toggles" that channel/unit, e.g., from OFF to ON.
- Double press: Returns control of that channel/unit to the C-Bus network.
- Long press: All channels or units in Local Override mode are returned to control by the C-Bus network.

VERIFYING NETWORK POWER

The amount of current required for a C-Bus network depends on the current drawn by its C-Bus units. Typical C-Bus units draw 18–40 mA, and many networks require less than 2 A. See a unit's illustration or installation bulletin to determine its current requirements. The steps below summarize how to calculate a network's power requirements and verify that only 2 A will be supplied to the network. (The C-Bus Toolkit software will also calculate this for you.)

STEP 1: Add up the current consumed by all the input, system support, and output units **that draw power** from the C-Bus network. Remember that the combined current consumed by all these units must not exceed 2 A.

Unit Type	No. Units	Current Draw	Total Current Draw
USB PC Interface	1	32 mA	32 mA
4-Button Decorator Keypad	12	22 mA	264 mA
6-Button Saturn Keypad	5	22 mA	110 mA
8-Button Neo Keypad	3	22 mA	66 mA
Light-Level Sensor	5	18 mA	90 mA
Color Touch Screen	2	22 mA	44 mA
		Total Drawn	606 mA

STEP 2: Add up the current provided to the network by C-Bus network Power Supplies (stand-alone and on-board) and verify that the amount is less than 2 A.

Unit Type	No. Units	Current Sourced	Total Current Sourced
DIN Relay with on-board Power Supply	2	200 mA	400 mA
Stand-alone Power Supply	1	350 mA	350 mA
		Total Sourced	750 mA (less than 2 A)

STEP 3: Subtract the current required (Step 1) from the current provided (Step 2) to determine if the power will be sufficient for network operations.

750 mA (sourced) – 660 mA (needed) = 44 mA (extra)

CONCLUSIONS: The current drawn and sourced are under 2 A, and there is more sourced than drawn, so no extra Power Supplies are needed.

PIR SENSOR ADJUSTMENT

Let the sensor stabilize for at least two minutes before adjusting it.

Use the sensor-adjustment screw. It has a 270° range-of-motion, with stops at about 7 o'clock and 5 o'clock. At 7 o'clock the light-level threshold is 150 footcandles; at 5 o'clock the light-level threshold is 0 footcandles.

Setting	Action	Adjustment Screw
Load turns on day and night	Turn screw counter-clockwise until notch points to 7	
Load off when ambient light is sufficient	Turn screw clockwise until notch points to 11	
Load turns on at dusk	Turn screw clockwise until notch points to 1	
Load turns on at night	Turn screw clockwise until notch points to 3	

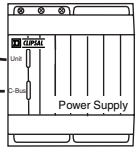
DISCLAIMER

Electrical equipment should be installed, operated, serviced, and maintained only by qualified electrical maintenance personnel. Training provided by the Square D Company, in-person or in a manual, should not be viewed as sufficient instruction for those who are not otherwise qualified to install, operate, service, or maintain the equipment under consideration. Although reasonable care has been taken to provide accurate and authoritative information in presentations and documentation, no responsibility is assumed by Square D Company, its employees, or its agents, for any consequences arising out of the use of this material.

POWER SUPPLY STATUS INDICATORS

UNIT: Unit status and power
- ON (lit): Normal operation
- OFF (unlit): No C-Bus connection

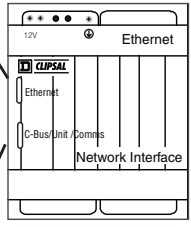
C-BUS: Network status at the unit
- ON (lit): Acceptable network power (22–36 V DC)
- Flashing: Marginal network power (15–20 V DC)
- OFF (unlit): No Clock, no external power



ETHERNET NETWORK INTERFACE STATUS INDICATORS

ETHERNET: Communications status
- RED, solid: Normal, power on
- RED, flashing: No server, no link
- ORANGE, solid: Good link
- ORANGE/GRN, flashing: Active session

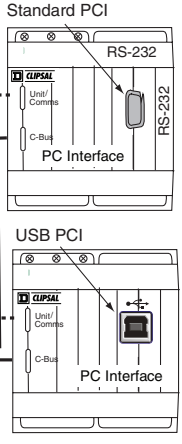
C-BUS/UNIT/COMMS: Network and unit status
- RED, solid: No C-Bus connection
- RED, flashing: No C-Bus connect., no comms to Ethernet side
- RED/ORANGE, flash: Marginal C-Bus power (15–20 V DC)
- ORANGE, solid: Good C-Bus power (22–36 V DC)
- ORANGE/GRN, flashing: Active comms to Ethernet side



STANDARD & USB PC INTERFACE STATUS INDICATORS

UNIT/COMMS: Unit status and power
- ON (lit): Normal, C-Bus power
- Flashing: Data transfer in progress
- OFF (unlit): No C-Bus power

C-BUS: Network status at the unit
- ON (lit): C-Bus Clock, acceptable C-Bus power (22–36 V DC)
- Flashing: Marginal C-Bus power (15–20 V DC).
- OFF (unlit): No Clock, no C-Bus power



Schneider Electric - North American Operating Division

295 Tech Park Drive
La Vergne, TN, 37086
Tel: 1-888-SquareD
www.squaredlightingcontrol.com

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