



Pow-R-Command™ 1000 System Overview

Instruction Leaflet IL01412008E



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Notes and Warnings

Warning

DO NOT RUN THE LOW VOLTAGE WIRES FOR I/O IN THE SAME PIPE OR TROUGH AS THE HIGH VOLTAGE WIRES.

- Read this guide completely and carefully prior to any installation. Failure to follow the instructions or the prescribed procedures may cause severe injury or death and/or damage to the equipment.
- Qualified personnel or service technicians must perform all installation and service. Keep this guide available for those responsible for installation, programming, operation and maintenance of the system.
- All installation and wiring information contained herein is based on industry-accepted standards and practices. This information is not intended to conflict with or overrule any applicable codes or ordinances. If conflicts exist, please contact your Eaton sales office before proceeding with the installation.
- Use extreme caution when operating the system. Dangerous voltages may exist inside the units. Failure to follow any or all warnings and instructions contained herein may cause severe injury or death and/or damage to the equipment.
- Some Pow-R-Command panelboards may be shipped from the factory with the electronic boards installed and tested. Many of the electronic components may be sensitive to static electricity. Do not handle electronic parts without proper electrostatic protection.
- Document all wiring, device termination and locations. This information will be required for system startup and programming.
- Under no circumstances should any of the procedures described herein be performed on a panelboard that is powered up. Qualified personnel should perform power-up, programming, and system configuration during the system startup.
- The instructions and prescribed procedures in this Installation Guide do not purport to cover all possible contingencies that may arise during installation, nor does it cover all details and variations of the system. If further information is desired regarding the particular installation of the system, please contact your Eaton sales office.
- The scope of this document is limited to the use of the Pow-R-Command components and software only. For OEM applications, also refer to the OEM operating and configuration instructions.

I. Introduction

Eaton offers a full line of chassis styles and configurations for Pow-R-Command applications. Each Pow-R-Command application is designed to suit a specific need at a reasonable cost/performance ratio. This document describes the installation and configuration of the Pow-R-Command 1000 System as applied to the Pow-R-Line C 1a and 2a style panelboards, including the column-style panelboard. For information regarding standard configurations, physical characteristics, and electrical capacities, refer to the Eaton sales and specification literatures for the specific panelboard style of interest.

The Pow-R-Command 1000 (PRC1000) for the Pow-R-Line 1a/2a panelboards offers a departure from the conventions established in previous Pow-R-Command 100 (PRC100) products. Pow-R-Command 100 designs employed a smart controller with integral breaker drivers. The signals and current necessary to control the GHBS, GHQRSP or BABRSP breakers were distributed by means of a passive Breaker Termination Board (BTB). While this provided a neat, self-contained, package it was not optimal for retrofit or partial implementations. The Pow-R-Command 1000 implementation incorporates a smart controller that handles all the intelligent automation functions such as input, output, schedules and control scenarios and then communicates the resulting commands to turn the BABRSP or GHQRSP breakers on or off through a serial link to a Breaker Control Bus (BCB) module. The BCB has a microprocessor, which communicates not only the breaker presence, but also the breaker status to the PRC1000 controller. This design provides even further flexibility and cost saving by allowing the PRC1000 to communicate with up to eight BCB

modules, allowing one PRC1000 to control four fully loaded (42 controllable circuit) panelboards. Standard configuration is a 42-circuit smart-panelboard, but optional configurations of 30-circuit, and even 18-circuit sizes are available to order.

Pow-R-Command 1000 Panelboard

Pow-R-Command 1000 Systems are provided in two basic configurations:

- Pow-R-Command 1000 panelboard with external controller 1000 provides control to GHQRSP and BABRSP circuit breakers. The breakers are mounted in the panelboard with the Breaker Control Bus (BCB) modules and are installed ready for simple cable hookup to an external PRC1000 Control Cabinet.

Panelboards with mounted Breaker Control Bus modules, but no PRC1000 control chassis, are referred to as PRC EP panelboards. The PRC1000 Control Cabinet contains the controller, the power supply, and termination points for field wiring. It is to be mounted near the panelboard(s) to be controlled (see **Figure 1**).

- Pow-R-Command 1000 panelboard with integrated controller provides control to GHQRSP and BABRSP circuit breakers. The breakers are mounted in the panelboard with the Breaker Control Bus (BCB) modules and are installed ready for simple cable stand-alone intelligent control.

Panelboards with mounted Breaker Control Bus modules, and internally mounted control chassis, are referred to as PRC1000 panelboards. A PRC1000 panelboard is a smart panelboard, self contained, or able to control itself and up to three other fully loaded Pow-R-Command (PRC EP) panelboards (see **Figure 2**).

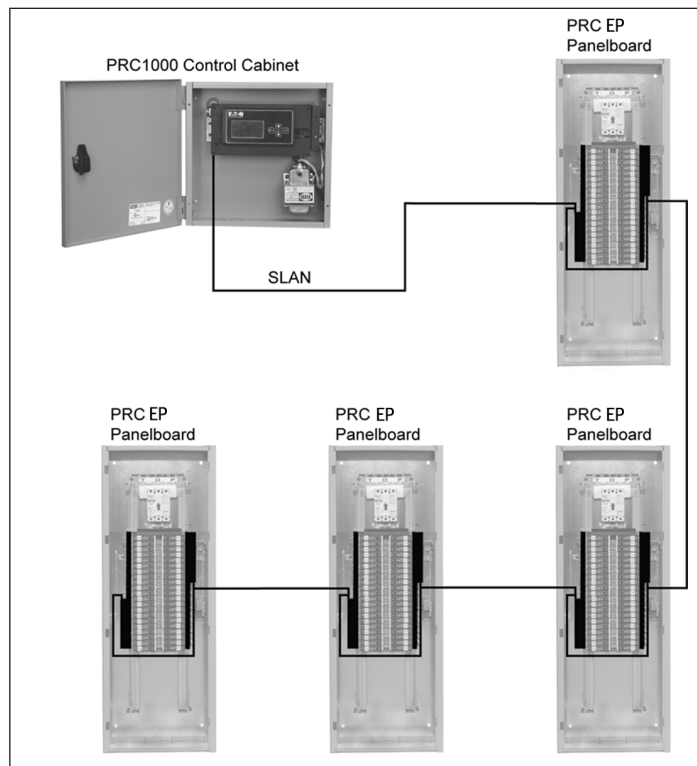


FIGURE 1. EXTERNAL CONTROL BOX WIRED TO FOUR FULL PRC EP PANELBOARDS

As shown in **Figure 1**, only one externally mounted PRC1000 controller is required for eight BCB modules. The illustration shows four fully loaded PRC EP panelboards (a total of 42 x 4 for 168 circuits). The system is limited to eight BCB modules per PRC1000. If the Pow-R-Command 1000 panelboard requires controllable breakers on only one side of the panelboard, then the second BCB is available to be placed in another panelboard. In other words; four fully loaded panelboards utilize eight BCB devices while eight panelboards with controllable breakers on only one side (odd or even) will still require only eight BCBs.

Note also the orientation of the rails within each type of panelboard. The same part is used for the left and right sides of a panelboard and the top and bottom of a column panelboard. Placement of the BCB within the panelboard and the associated circuit numbers is described in the "Configuring the PRC1000 Subpanels" topic later in this document. It is important to observe proper orientation to facilitate both physical placement and logical performance.

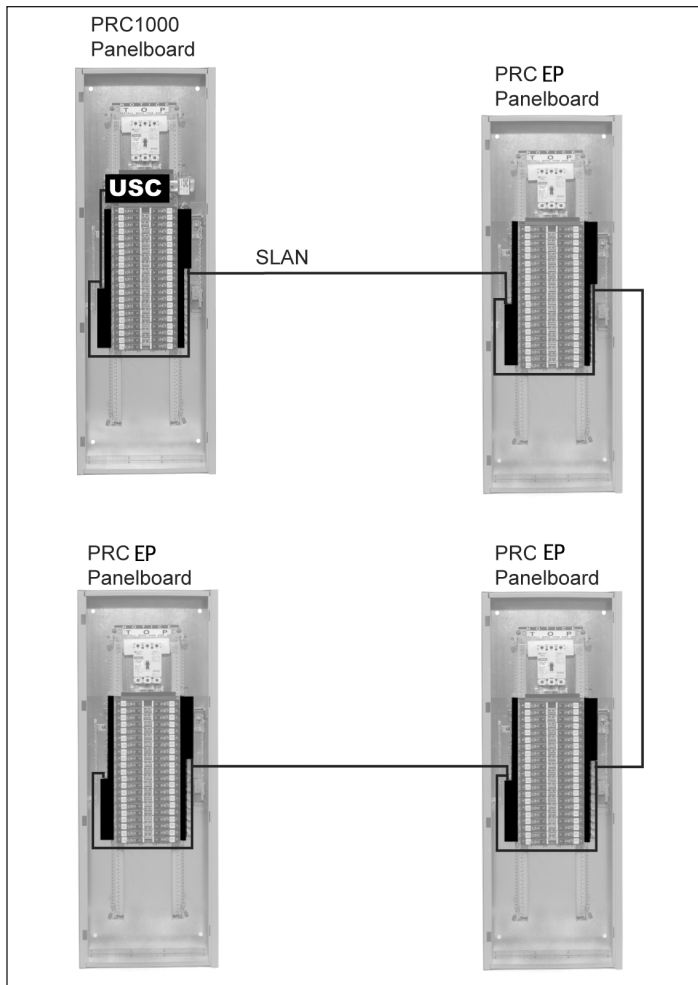


FIGURE 2. SMART PANELBOARD HAVING BOTH THE USC AND RAILS INSTALLED

The smart PRC1000 panelboard consists of a PRC EP panelboard with integral controller. This panelboard configuration allows one panelboard to act as the "master" controlling breakers in external, or "slave," panelboards. The PRC1000 panelboard incorporates the controller, power supply, network, and field wiring inputs. It's capable of controlling three additional, fully loaded PRC EP "slave" panelboards.

The two figures above represent the Pow-R-Command 1000 panelboards in a stand-alone, self-contained, environment. The function of these panelboards is expanded through the incorporation of low-voltage controls that are wired directly to the controller. These controls can consist of programmable analog and digital inputs and outputs.

The interface capabilities of the PRC1000 are discussed in Low voltage wiring applications later in this document. Once we have the Pow-R-Command 1000 system installed as described above, there may be need for larger scale applications. To accommodate larger requirements the Pow-R-Command 1000 panelboard systems can be networked together to a maximum of 120 PRC1000 controllers. It is easiest to think of the systems in the Pow-R-Command 1000 panelboard and Control Cabinet as "islands of control." Each island may consist of an entire electrical closet and there can be up to 120 electrical closets. Networking these "islands" is discussed in Network Termination later in this document.

PRC1000 External Controller Cabinet in a Retrofit Application

A PRC1000 Control Cabinet is mounted externally, but in close proximity, to one or more PRC EP panelboards containing the BCB assemblies and either GHQRSP or BABRSP circuit breakers. In these configurations, the PRC1000 Control Cabinet is linked to the PRC EP panelboards using the serial bus (SLAN).

Figure 2 shows the layout of the interior of the cabinet. The PRC1000 Control Cabinet must be physically mounted on a wall or structure that it is near the PRC EP panelboards to be controlled. Appropriate AC Voltage to the enclosed transformer must be provided. The enclosure provides knockouts in popular sizes where fittings can be added for routing the power and signal cables.



FIGURE 3. PRC1000 CONTROL CABINET WITH OPTIONAL LCD PANELBOARD

Field wiring connections are discussed in the "Field Wiring Termination" topic of this document. Field wiring termination discusses connection of power, communications, and control wiring. Additional application information can be found in low voltage wiring application examples later in this document.

Breaker Control Bus (BCB) Installation

The BCB is designed to fit easily into the Cutler-Hammer PRL1a and PRL2a panelboard models. The standard 1a/2a application can be converted to a PRC EP panelboard by installing one or two BCB modules. A factory-manufactured PRC EP panelboard should contain one or two pre-installed BCB modules. If this was not a factory ordered option, it will be necessary to install the BCB into the Pow-R-Line 1a/2a panelboard containing BABRSP or GHQRSP circuit breakers.

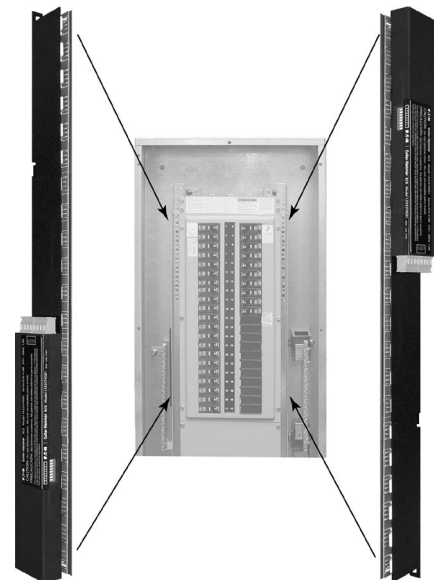


FIGURE 4. BCB INSTALLATION

Warning

DISCONNECT THE MAIN POWER FROM THE PANELBOARD. THE FOLLOWING PROCEDURES REQUIRE REMOVAL OF PROTECTIVE COVERS AND SHIELDS RESULTING IN POSSIBLE EXPOSURE TO DANGEROUS AND/OR DEADLY VOLTAGES!

The BCB is designed to fit either side of a Pow-R-Line 1a or 2a panelboard. The Lighting Optimization Software or optional LCD tool is used to configure the BCB for proper association with circuits in the panelboard. Refer to the software documentation for assistance with configuring and orienting the BCB. Configure BCB using the Web-page optional LCD, or optional LO software.

Step 1: Remove the trim piece.

Different designs and options have different trim pieces. It is beyond the scope of this document to describe each possibility. Please refer to the Instruction Leaflet provided with the panelboard.

Step 2: Remove the deadfront cover.

Remove the four screws holding the perforated frame to the panelboard chassis. **Figure 5** shows a typical detail of the top-left screw to be removed. There should be an identical screw at, or near, each corner of the deadfront cover.

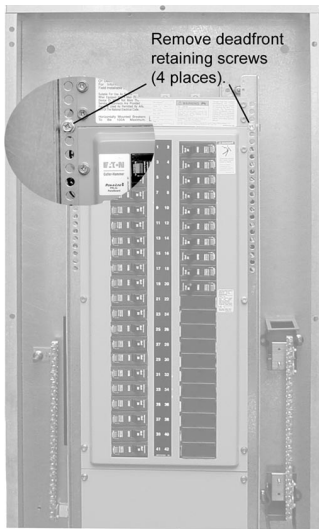


FIGURE 5. DEADFRONT COVER REMOVAL

The following steps describe installation of a left-side (odd breakers) BCB into the 1a or 2a panelboard. It is essential that the positioning and orientation in the chassis be precisely as described herein. Improper location of the BCB will cause problems when trying to connect the breaker pigtails to the BCB and improper orientation will cause configuration difficulties.

Step 3: BCB upper mount.

Figure 6 shows the proper installation point for the topmost rail mounting screw. Notice the small arrow pointing to the hole. This hole is located just below the buss support bracket and left of the number-one breaker position. It may prove helpful to mark the hole with a piece of tape or a marking pen.

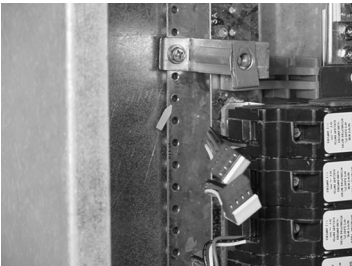


FIGURE 6. LOCATING THE BCB UPPER MOUNTING HOLE

Take care to obey the BCB orientation shown on the cover of this document; use one of the supplied screws to hold the BCB in place loosely. The general rule is that the control box extends into the wire gutter of the panelboard.

Step 4: BCB lower mount.

The BCB is fastened to the “C” channel by two screws (provided). Let the BCB hang freely down the channel to locate the bottom-mounting hole.



FIGURE 7. LOCATING THE BCB LOWER MOUNTING HOLE

Notice

DEPENDING ON THE DATE OF MANUFACTURE OF THE PANELBOARD, THERE MAY NOT BE A HOLE FOR THE BOTTOM MOUNTING SCREW. IF THE HOLE IS PRESENT THEN IT WILL BE IN THE VICINITY OF THE SMALL ARROW SHOWN IN Figure 7. IF THE HOLE IS NOT PRESENT, IT WILL BE NECESSARY TO USE THE BCB AS A GUIDE TO LOCATE THE HOLE. THIS CAN BE ACCOMPLISHED BY LOOSELY SCREWING THE BCB INTO THE TOP HOLE AND THEN USE THE RAIL ASSEMBLY ITSELF TO LOCATE THE HOLE. IT MAY BE EASIER TO APPLY MASKING TAPE TO THE CHASSIS TO MAKE YOUR MARK MORE VISIBLE. ONCE THE LOCATION IS DETERMINED, REMOVE THE BCB FROM THE PANELBOARD AND DRILL THE HOLE USING A #29 DRILL BIT.

Step 5: Finishing up.

To complete the mechanical fastening of the BCB to the Pow-R-Line panelboard, make sure all breaker pigtails are clear from any pinching or jamming. Tighten the top and bottom mounting screws. Finally, verify that any branch circuit wiring is clear of the newly installed component.

Step 6: Plug on the breakers.

The last step is to connect each breaker pigtail to the appropriate branch breaker. This is done here as a means of verifying proper placement of the BCB in the panelboard. If any breaker pigtails do not reach the matching BCB circuit position, then it will be necessary to relocate the BCB up or down to accommodate all controllable breakers. The first eight, odd breakers can be seen plugged on to the BCB in **Figure 8**.



FIGURE 8. BREAKERS CONNECTED TO BCB

To install the right-side BCB, follow Steps 3 to 6 using **Figure 6** through **Figure 8** for reference to locate the holes in the right side “C” channel.

⚠ Notice

THE VIEW IN Figure 8 SHOWS ALL BREAKERS PLUGGED ONTO THE BCB. IF THERE ARE SPACES LEFT BY BLANK POSITIONS OR UNCONTROLLED BREAKERS, PLACE ONE OF THE INCLUDED DUMMY-PLUGS OVER THE UNUSED BREAKER TERMINATION POSITIONS.

Step 7: Replace the deadfront cover.

Reverse the procedure described in Step 2 to replace the deadfront cover over the breakers. **Important:** Do not replace the trim, as additional connections to the BCB are required as described in the “Wiring” section of this document.

II. Field Wiring Termination

The following topics discuss the necessary and optional wiring connections between the PRC1000 and BCB devices, as well as termination of the field devices, which can consist of switches and sensors. The following discussion breaks the wiring into logical topics such as power, breaker control, and field devices.

Power Supply

The PRC1000 enclosure uses 24 V AC power. From this 24 V AC supply, all needed control voltages are generated internally. The internal and external enclosures include a step-down transformer capable of accepting a variety of supply voltage. The connection to the controller transformer depends on the type of enclosure and is discussed separately below.

Panelboard Control Chassis

The Pow-R-Command 1000 PRC1000 panelboard is shipped with an integral controller, which is pre-wired to the correct supply voltage for the panelboard rating. There is no need for the personnel installing the panelboard to supply connections to the power supply of the integral Controller Chassis. Please verify that the panelboard’s supply voltage matches the voltages specified on the label of the panelboard.

PRC1000 Control Cabinet

The personnel installing the PRC1000 Control Cabinet are responsible for providing and terminating the power wires to these panelboards. Standard configurations accommodate either 120 or 277 V AC supply voltage. Be certain the supplied voltage matched the stated voltage of the control cabinet. **Table 1** cross-references the standard transformer lead colors with the supply voltage.

TABLE 1. TRANSFORMER LEAD COLORS/SUPPLY VOLTAGE — CROSS REFERENCE

PRIMARY	COLOR	SECONDARY	COLOR
Transformer Model: TR75VA005			
COM	Black	24 V AC	Yellow
120 V	White	COM	Yellow-White
208 V	Red		
240 V	Orange		
480 V	Grey		
Transformer Model: TR75VA003			
COM	Black	24 V AC	Yellow
277 V	Brown	COM	Yellow-White

The secondary leads are pre-wired to the 24 V AC supply terminals on the PRC1000 enclosure. The Yellow-White secondary lead is also connected to chassis ground.

Low Voltage Device Termination

All open areas inside the PRC1000 enclosure are considered low voltage/class-2 termination areas. No voltages above 28 V AC are permitted in this area.

No external voltages should be applied to the low voltage terminal blocks. The panelboard provides all necessary power.

Low-voltage devices should be terminated using a minimum #22 AWG twisted-pair wire. Shielding is generally not required. Low voltage device cables should not be located in the same conduit with the high voltage load wires. Be sure the wire type you use is rated properly, especially for plenum or hazardous applications.

⚠ Notice

WHEN WIRING TO THE PRC1000 AND BCBS MOUNTED INSIDE THE PANELBOARD, IT IS NECESSARY TO OBSERVE THE 600 V RATING OF ANY CLASS-2 WIRING IN THE PANELBOARD GUTTER. IF THE WIRING IS NOT RATED AT 600 V, THEN ANY WIRING PASSING THROUGH THE GUTTER WILL NEED TO BE ENCLOSED IN CONDUIT OR OTHER RECOGNIZED MATERIAL.

Breaker Control Bus (BCB) Wiring

Each BCB has two four-pin combination power/data connectors. These connectors are shown in **Figure 9** labeled as “LAN / Power Connectors.” Also shown in **Figure 9** are the “Breaker Terminations” for plugging up to twenty-one BABRSP or GHQRSP circuit breakers and the “LAN Address Switches” used to set the relative position. Additionally the BCB contains three recessed LEDs to indicate the status or condition of the BCB. These latter mentioned components will be discussed individually.

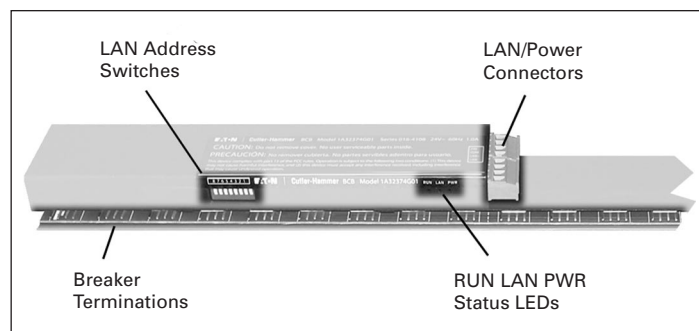


FIGURE 9. BCB CONTROL MODULE HIGHLIGHTS

It is recommended to use 16 AWG, 4-conductor cable with 600 V isolation jacket (e.g., Alpha 1064) for interconnecting BCB modules. Use of this cable will allow for a total SLAN wire-length of 150 feet. If the BCB modules are mounted in closer proximity such that the total SLAN length is 50 feet, or less, then 18 AWG conductors may be substituted. For installations requiring distances greater than 150 feet, please contact your local application engineer, local Satellite or Pow-R-Command technical support.

The relationship between the BCB and controller can best be seen in **Figure 10**. This diagram shows a simple daisy-chain connection between the PRC1000 Control Cabinet and the BCB modules installed in a Pow-R-Command panelboard. For PRC1000 panelboards with integral PRC1000 controller, the controller would be wired internally in the first panelboard (BCB 1,2) and then to the three remaining PRC EP panelboards.

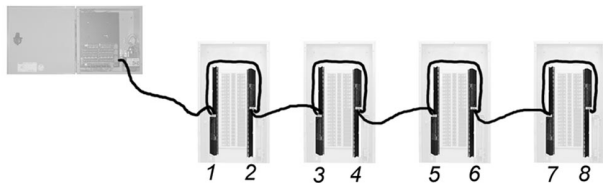


FIGURE 10. EXTERNAL PRC1000 CONTROLLER AND PRC EP PANELBOARDS

Notice the alternating orientation of the BCB modules in the panelboards. The first (left) BCB has the control module down while the right module is up (see **Figures 4** and **10** of this manual.) This orientation is critical to proper operation of the “smart” breaker panelboard.

Warning

FAILURE TO OBSERVE THE PROPER ORIENTATION OF THE BCB IN THE PANELBOARD WILL CREATE DIFFICULTY ASSOCIATING THE SOFTWARE CIRCUIT NUMBERS WITH THE ACTUAL BREAKER POSITION.

The following steps will guide you through proper wiring of the Pow-R-Command 1000 Breaker Control Bus modules and the PRC1000 Control Cabinet.

The same cable is used between the PRC1000 Control Cabinet and the first BCB as is used between BCB modules. Once the cable is routed it can be trimmed and terminated with the supplied four-pin connector.

Step 1: BCB SLAN/power termination.

For external controller applications, feed a free end of the recommended cable through a conduit from the Control Cabinet into the PRC EP panelboard. Route the cable to the BCB nearest the panelboard entry point. Route the cable through the wiring gutters at the top, bottom, and sides of the panelboard. It is not required to use conduit for internal BCB interconnects as the cable used has a 600 V isolation rating. It is, however, recommended that the wire connection between the BCB modules inside a PRC1000 or PRC EP panelboard be dressed and tied to prevent chaffing and minimize interference with load wires in the gutter.

Notice

WHILE Figure 10 SHOWS THE RECOMMENDED LAYOUT, IT IS NOT NECESSARY TO FOLLOW THE SHOWN ORDER. IT IS NECESSARY TO CONNECT TO THE PRC1000 CONTROLLER FROM EITHER END OF THE CHAIN. THIS IS BECAUSE THE PRC1000 CONTROLLER TERMINAL BOARD HAS A SINGLE SLAN CONNECTOR AND HAS AN INTEGRAL END-OF-LINE (EOL) RESISTOR.

Cut the cable to length allowing for some excess to facilitate plugging and unplugging the cable for service purposes.

Step 2: Stripping and terminating the cable.

Locate one of the four-pin plugs, either inserted into the BCB or in the parts bag. Strip the jacket back to a maximum of 1-1/4 inches. Be careful not to nick or cut the insulation of the individual conductors. Strip each conductor to expose no more than 1/4 inch of bare wire.

Using **Figure 11** for reference, insert each colored conductor in the proper position on the four-pin plug.



FIGURE 11. BCB COMMUNICATIONS AND POWER CONNECTOR DETAIL

Tip

Both connectors shown in **Figure 11** have the same wire-out relationship. If there is any doubt about the color positions, plug one terminated end into the BCB and wire the newly installed cable to match.

Step 3: UL® consideration.

For UL approved isolation of the LAN/power connection from the high voltage section of the panelboard, the connector screw terminals must be covered.



FIGURE 12. BCB UL CONSIDERATIONS

In the panelboard parts bag, there should be a length of heat-shrink tubing approximately 6-inches long. Cut this tubing in half and slip one length over the plug and cable prior to plugging it into the BCB. Then slip the tubing over the cable and plug so the green connector and screws are completely covered. DO NOT apply heat to shrink the tubing around the connector, as this will make subsequent servicing difficult. **Figure 12** shows two views of the BCB. The left view shows the wires terminated into the four-pin plug and the 3-inch heat-shrink ready to be dressed over the connection. The right view of **Figure 12** shows the completed cable termination. If this is the last BCB in the chain, place the remaining 3-inch piece of heat-shrink over the remaining plug. Given the inversion of the right-side BCB (invert **Figure 12**) it may be necessary to place a few wraps of electrical tape around the insulation tubing and the wire to prevent the insulation from slipping off the green connectors. If only one cable is terminated to the BCB, use the tubing to insulate the free connector as well.

Step 4: Connecting BCB modules.

Repeat Steps 1 through 4 to connect the remaining BCB modules together. Use the second connector on the BCB to continue to chain the BCB modules as illustrated in **Figure 11**.

Step 5: Control cabinet termination.

The first (or last) BCB has to be connected to the controller to get power and data. Locate one of the four-pin plugs, either inserted into the BCB or in the parts bag. Strip the jacket back to a maximum of 1-1/4 inches. Be careful not to nick or cut the insulation of the individual conductors. Strip each conductor to expose no more than 1/4 inch of bare wire.

Using **Figure 11** for reference, insert each colored conductor in the proper position on the four-pin plug.

Plug the pre-terminated end of the SLAN/power cable into the terminal labeled “24V~ COM S+ S-” on the PRC1000 enclosure. This connector is found in the left side of the PRC1000 as shown in **Figure 13**.



FIGURE 13. LAN AND BCB SLAN/POWER TERMINALS

⚠ Notice

WHEN THE PRC1000 CONTROLLER AND BCB ARE WIRED AS ILLUSTRATED IN Figure 10, IT IS IMPORTANT NOT TO EXCEED 150 FEET TOTAL LENGTH WHEN USING THE RECOMMENDED 16 AWG CABLE. IT IS ALSO STRONGLY RECOMMENDED THAT ALL PANELBOARDS CONNECTED TO A CONTROLLER BE CONFINED TO THE SAME ELECTRICAL ROOM OR STRUCTURE. SUBSTITUTING 18 AWG CABLE DECREASES THE LENGTH MAXIMUM TO 50 FEET. FAILURE TO OBSERVE THESE RECOMMENDATIONS MAY ADVERSELY AFFECT THE PERFORMANCE OR RELIABILITY OF THE BREAKER CONTROLS.

BCB Startup and Troubleshooting

After the BCB modules are installed and wired, each BCB can be configured to communicate with the PRC1000 controller.

Step 1: Addressing the BCB.

Each BCB needs a unique address assigned before the controller can reliably communicate. **Figure 14** shows the recommended address scheme; each BCD requires a unique address from 1 to 8 and is numbered in ascending order away from the PRC1000.

The SLAN Address is set using the SLAN Address Switches 1 through 4. Refer to **Figure 9** to locate the SLAN Address Switches and reference **Figure 14** for positioning of the individual switches to achieve the required value. Be careful to observe the switch number as labeled so as to avoid reversing the values due to top and bottom module location.

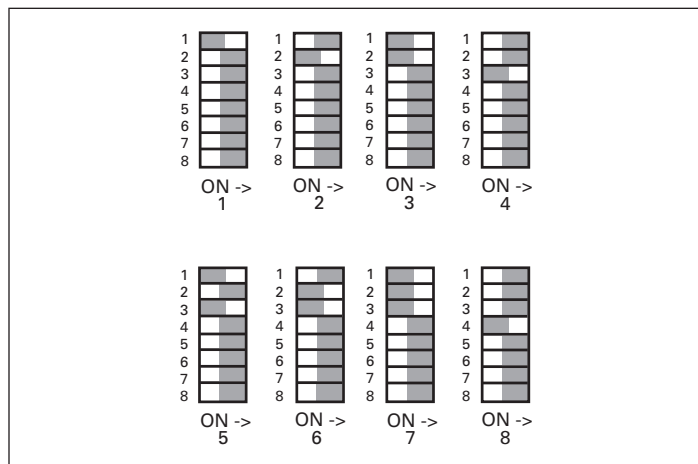


FIGURE 14. SLAN ADDRESS SWITCH SETTINGS

⚠ Notice

SWITCHES 5 THROUGH 8 ARE NOT USED FOR THE PRC1000 APPLICATION AND SHOULD BE LEFT IN THE OFF POSITION. PRC1000 PANELBOARDS HAVING TWO BCBs WILL BE PRE-ADDRESSED WITH THE LEFT SIDE ADDRESS 1 AND THE RIGHT SIDE ADDRESS 2.

Step 2: Power on and verification.

Apply power to the PRC1000 Control Cabinet and verify that power is routed to each connected BCB. Observe the "PWR" (Power) LED on each BCB and confirm that it is glowing red.

If the power LED does not light on each BCB, check proper wiring terminations and power to the PRC1000 controller. Also verify that all four-pin connectors are wired correctly.

The following is a brief discussion of the three status LEDs used to indicate activity and operation of the BCB.

PWR:

This LED will glow whenever the BCB has sufficient power to operate. If this LED is off, then the others will not light either. Check the circuit breaker and wiring to ensure that power is delivered to the BCB in question.

LAN:

The LAN LED will blink whenever data is being sent to the BCB via the SLAN. This LED simply implies that SLAN traffic is present. SLAN traffic, along with internal hardware integrity, is required to keep the RUN LED blinking at regular intervals.

If the LAN LED is not blinking, make sure the PWR LED is lit, and then check the SLAN wiring for crossed or shorted connections.

RUN:

The RUN LED will blink on and off at regular 1 second intervals when the BCB is properly wired and communicating with the controller. If the RUN LED blinks twice in succession and is then off for three seconds, has not been discovered, or there is a problem with the BCB communication, then refer to discover breakers.

The SLAN between the PRC1000 and BCBs uses the RS-485 Communications Specification. Strict adherence to this specification dictates that a 120 Ω End-Of-Line Resistor be installed into the free connector of the last BCB. This may not be required for most application as the lengths are typically short. If communications between the components seems hindered, or the run is at the 150-foot limit of cable length; then an EOL resistor is strongly recommended.

PRC1000 Controller Wiring

The PRC1000 handles the communication of direct breaker command and status through the onboard SLAN port. In addition to controlling breakers, the PRC1000 has low voltage inputs and outputs, which can be used for switches, pilot lamps, photocells, dimmer ballasts, or other external devices.

⚠ Warning

DO NOT RUN THE LOW VOLTAGE WIRES FOR I/O IN THE SAME PIPE OR TROUGH AS THE HIGH VOLTAGE WIRES.

To access the low voltage control wiring terminals, remove the front access cover or LCD (optional) from the PRC1000 enclosure. The cover is held by one screw that can be seen easily inside the high-lighted circle in **Figure 15**. Loosen this captive screw until the cover swings free and slide the cover slightly to the right to release the retaining tabs on the left end of the cover. If necessary, turn the power switch off (shown right-center in **Figure 15**) and unplug the ribbon connector from the PRC1000 controller terminal board. It is strongly advised that the ribbon be disconnected from the PRC1000 controller rather than the back of the LCD, as the LCD connector is not keyed and improper re-connection can damage the unit. If the connector is disconnected from the LCD, when reconnecting, the red stripe on the ribbon cable should be oriented with the red dot beside the connector on the LCD.

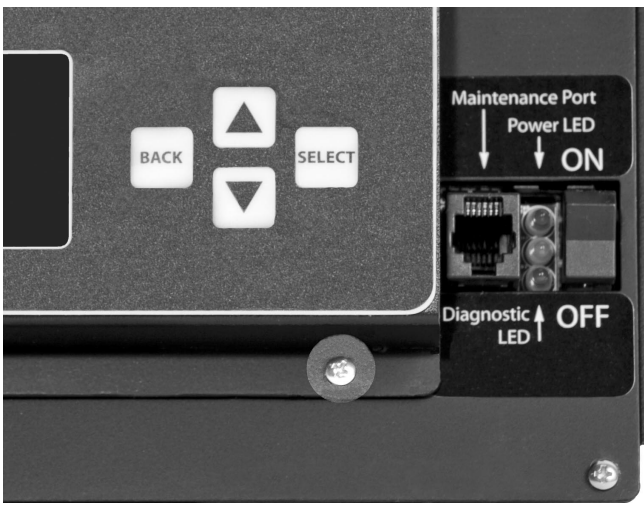


FIGURE 15. LOW VOLTAGE TERMINAL ACCESS SCREW

With the cover removed the terminal board is exposed. There are three rows of screw-terminal connector strips. These rows are combined into logical blocks as illustrated in **Figure 16**.

Note: **Figure 16** shows more detail than will be visible through the access cover. Components not exposed by removal of the access cover are not relevant to this topic and will be ignored.

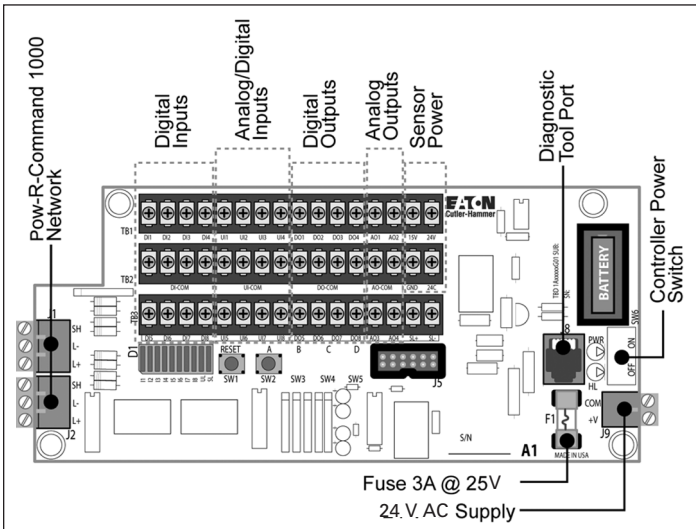
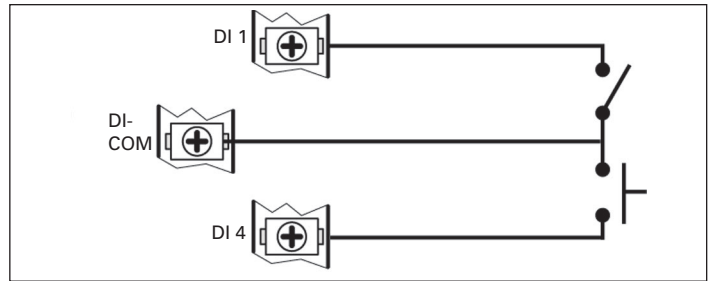


FIGURE 16. USC1000 TERMINATION BOARD

Low Voltage Inputs and Outputs

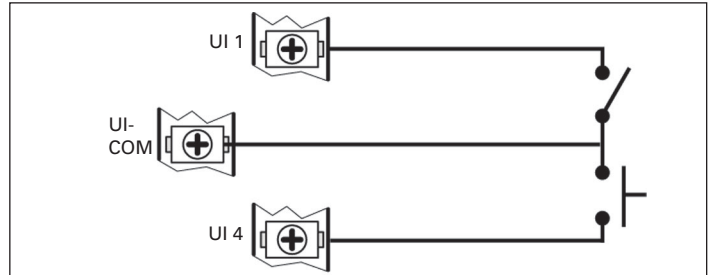
Each PRC1000 has a number of low voltage input and output points. These general purpose points can be used for a variety of applications involving override switches with pilot lamps, dimming ballast control, photocell, photo-sensors for daylight harvesting, rheostats, occupancy sensors, temperature sensors, relative humidity sensors, water meters, counters, relay or contactor control, and for interfacing with other control systems like security or building control. In addition to the input and output points, the controllers also provide an auxiliary 15 V DC (100 mA) and 24 V AC (100 mA) power sources for powering external devices. Each group of input, output, and power points is labeled across the top of **Figure 16** and each group is discussed separately below. Also, be aware that this topic is purposely kept generic and that more explicit examples can be found in the “Low Voltage Wiring Application” examples section on **Page 9**.

1. Digital inputs — these inputs are always used as digital input points. A dry contact is placed between the input point and the common on the connector. (The wetting voltage is approximately 24 V DC.) The input can be defined at startup in a variety of maintained and momentary contact configurations. The configuration is dependant upon the type of closure wired to the input.

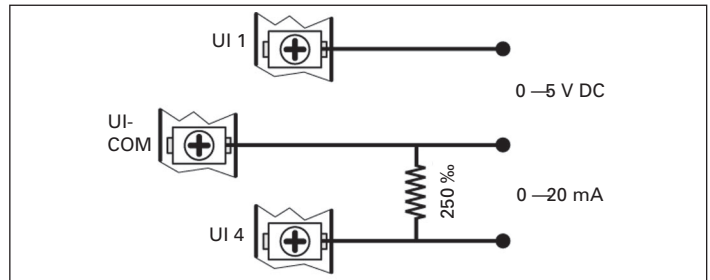


The above is a schematic illustration showing two types of dry-contact inputs. Notice there is no control voltage, merely a simple switch closure

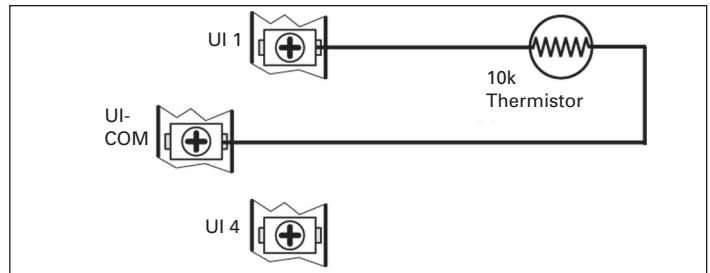
2. Universal inputs — these input points can be defined as digital input points or as analog input points. If used as a digital input point, a dry contact should be placed between the input point and the common point on the connector. (The wetting voltage is 5 V DC.) The input can be defined at start up in a variety of maintained and momentary contact configurations. If used as an analog input point, the input is a 0 – 5 V DC input. With a resistor between the point and ground, the input could be 0 – 20 mA or 0 – 10 V DC. The input can also be connected directly to a 10k temperature thermistor. The input is defined at startup for the desired function and conversion to engineering units.



The above schematic clearly demonstrates the similarity of the Universal Input (when using the digital component) to its cousin the Digital Input. Logically these inputs have the same operation, but physically the wetting voltage is significantly less for the UI and thus may not be the best choice in electrically noisy or long-wire-run applications.

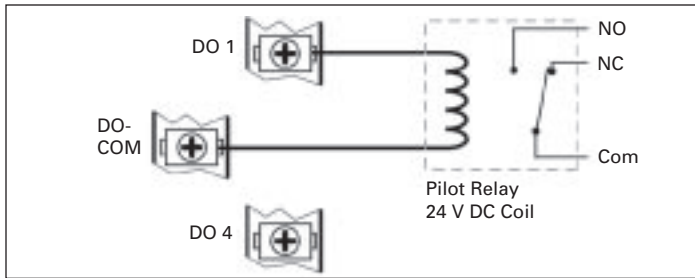
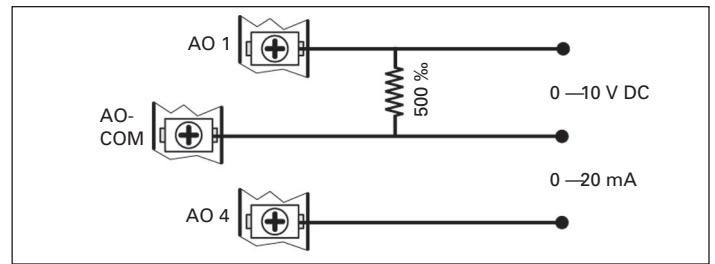


Analog inputs are natively 0 – 5 V DC. Some control equipment operates on a 4 – 20 mA current-loop. These signals can be accommodated by simply tying a 250 Ω resistor across the input. This changes the 0 – 20 mA through the resistor to 0 – 5 V DC across the resistor.

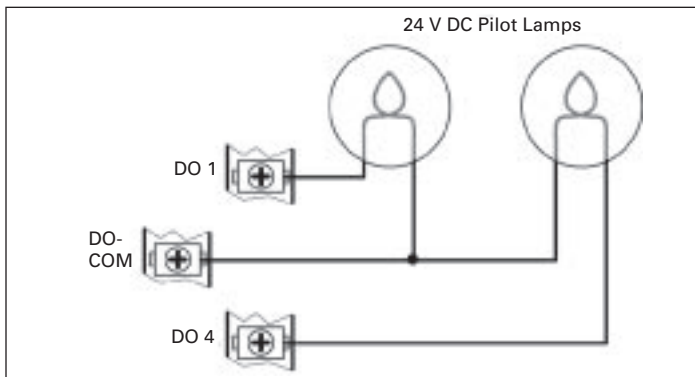


For simple temperature control, a 10k Thermistor can be connected directly to the analog input. It is important to choose the appropriate thermistor value for the temperature range, but beyond that it's a simple connection.

3. Digital outputs — these points provide for low-voltage digital control for external relays or pilot lamps. The Digital Outputs operate by connecting half-wave rectified 24 V AC for each terminal to the Common terminal. Turning a Digital Output "ON" will cause the USC to present voltage across the DO # and Com terminals.



Here a Digital Output is wired to control a pilot relay, which could control a load or contactor. The pilot relay is necessary to protect the PRC from sourcing too much current through the Digital Output. The use of the interposing relay in this example also provides a fairly robust means of protecting the USC from errant current surges and voltage spikes that the load equipment may experience or generate.



As seen here, the simple act of connecting a 24 V DC Pilot Lamp across a Digital Output can be used to provide visual feedback, or night-light functions.

⚠ Notice

THE DIGITAL OUTPUTS ARE CURRENT LIMITED BY A COMMON PROTECTION CIRCUIT. THE RECOMMENDED PER-CHANNEL LIMIT IS 20 MA. IT IS IMPORTANT TO KEEP THIS LIMIT IN MIND WHEN CONNECTING MULTIPLE DEVICES, AS THE CIRCUIT WILL PROTECT TO THE SUM OF ALL OUTPUTS.

4. Analog outputs — these points can be used for either digital or analog control. The output is a 0 – 20 mA source to the common on the connector. A resistor between the output and the common converts the output to 0 – 5 V DC (250 Ω) or 0 – 10 V DC (500 Ω). When used as a digital output, the output switches between 0 and 20 mA. The digital output could be used for a pilot lamp or LED. With an external sensitive pilot relay (12 V DC coil at less than 20 mA), the digital output could be used to drive a control relay or contactor. The output is defined at startup for the desired function and conversion to engineering units.

III. Low Voltage Wiring Application Examples

The following application examples represent connection of real equipment to the PRC1000 controller. References to manufacturers and their part numbers are for reference only and in no way imply sole usage. Use these examples as guides for design, layout and specifying components. Examples as shown, require corresponding parameters be entered into the respective controller's database before operation can be realized.

Note: The devices referenced in the following figures are for illustration purposes only. Refer to each manufacturer's installation literature for proper field wiring.

It is absolutely imperative that the connected equipment parameters (e.g., Signal type, signal range, terminal connections) be provided to the startup engineer. This information along with the desired operation strategy is imperative for reliable and predictable function.

Some of the examples have tables of data adjacent to the switch or sensor. This information represents the minimum information to enter into the Control Table of the PRC1000 to make the example work as described. For information on programming the controls, please refer to the Pow-R-Command Lighting Optimization Software manual, document # EH01412001E for detailed descriptions.

Field Terminating Devices Directly to the PRC1000 Controller

The following examples show how typical switches can be connected directly to the PRC1000 controller. This is often desirable when fewer than 16 switch inputs are required or when universal and digital inputs are available on the controller. Wiring switches directly to the PRC1000 provides added performance by eliminating network latency when using remote controllers such as the Switch Override Controller (SOC).

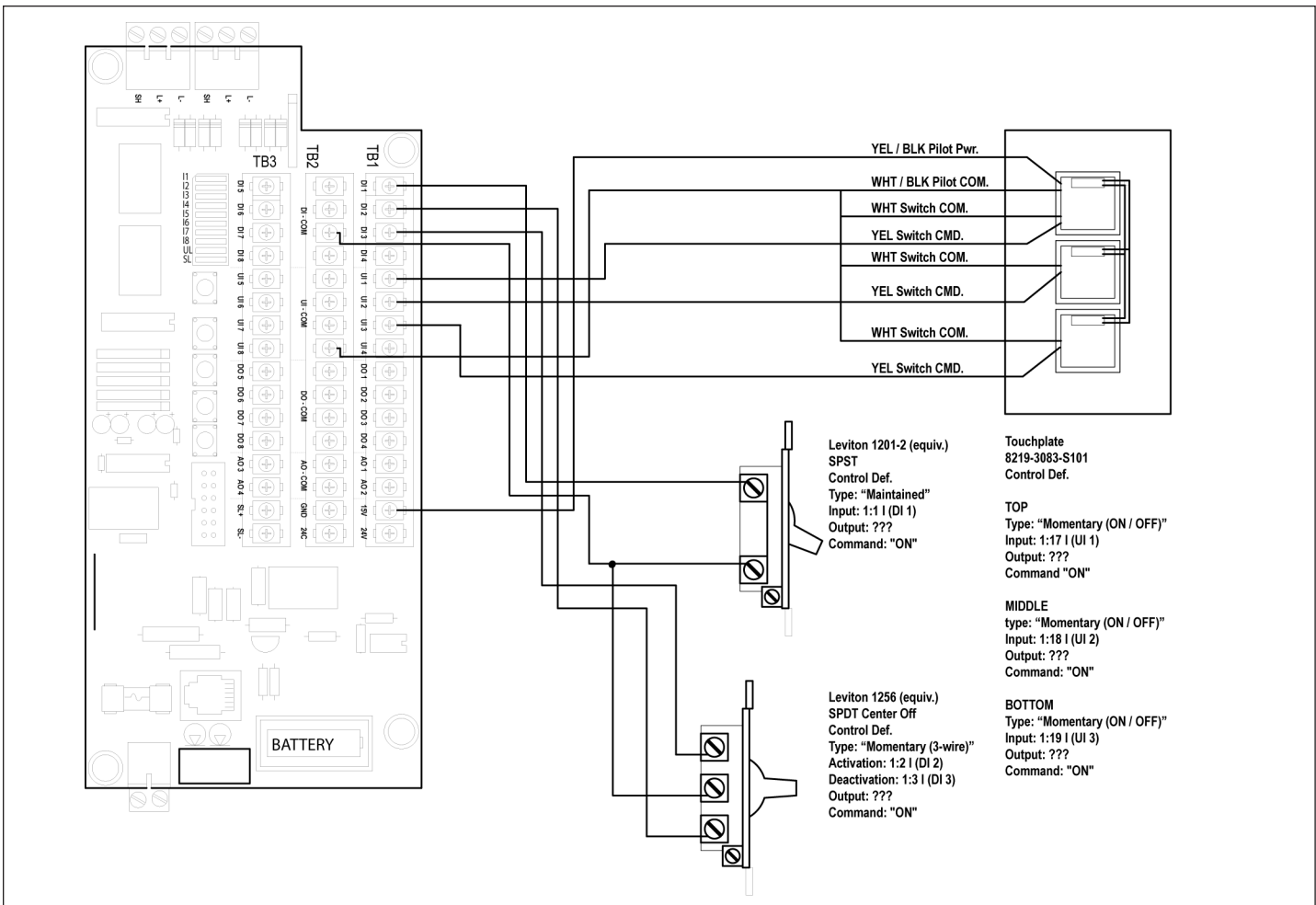


FIGURE 17. SWITCH INPUT EXAMPLE — THREE-POSITION PUSHBUTTON SWITCH

The three-position pushbutton switch, in this example, contains pilot lamps in each position. As wired (directly across the 15 V DC supply) the pilot lamps will always be on. The dotted lines imply that the pilot lights are wired together inside the wall-box. As shown, there are no current limiting resistors because the specified switch has internal current limiting. Also of interest is that all the pilots and switches share a single common. These can be combined in the wall-box to reduce the number of conductors pulled.

Touchplate Switch Application Notes

The preceding illustration shows the Switch Pilots sharing a common connection to power and common. In this wiring scheme, the three pilots will be continuously illuminated without regard to switch or load state. If the pilot lamp is to be an "active" component of the control system, one pilot (LED) could be wired to one Digital Output. Setting the Digital Output to ON would cause the LED to illuminate while setting to OFF would extinguish the LED.

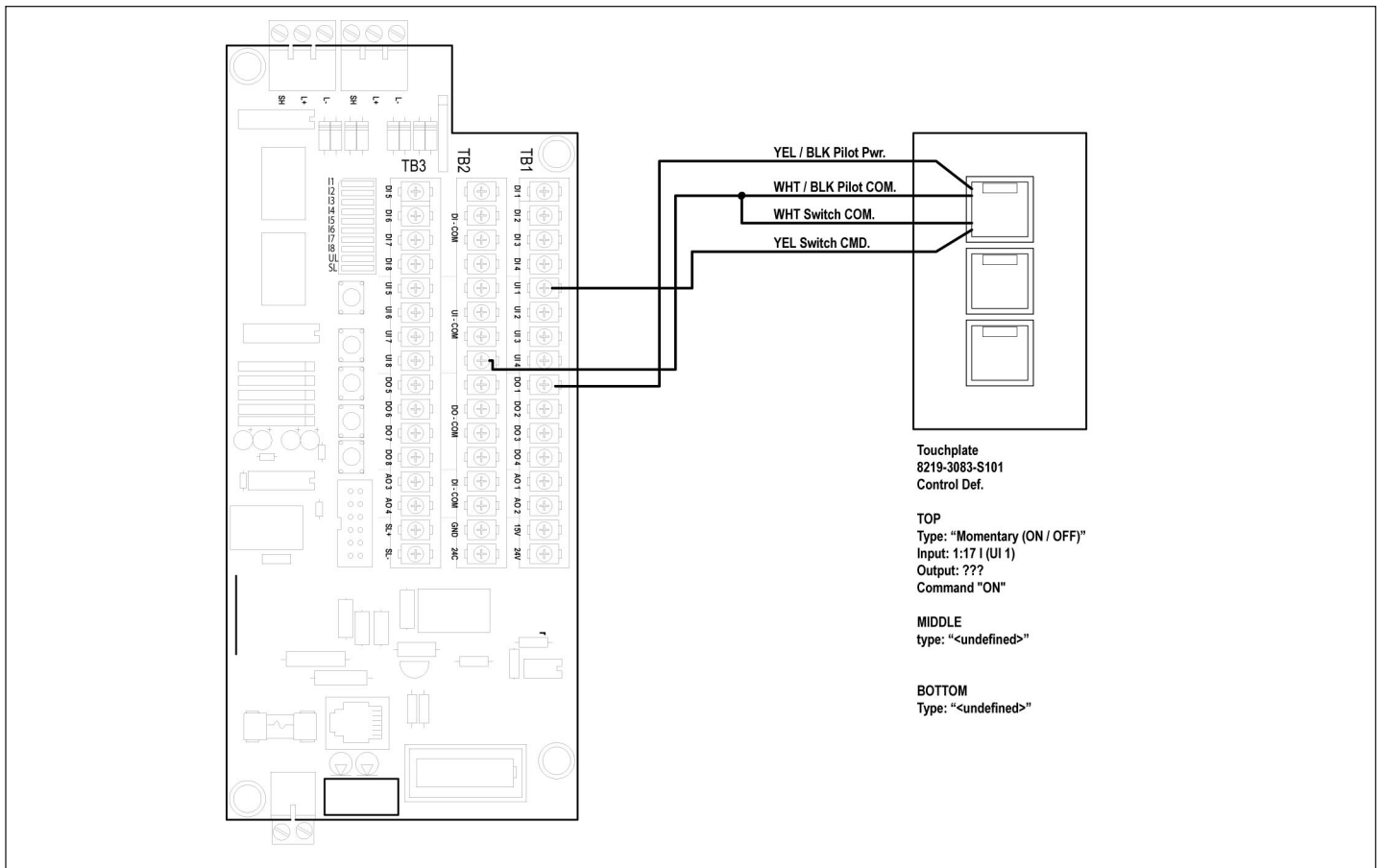


FIGURE 18. SWITCH INPUT EXAMPLE

Wiring the lamps as described in this note allows for two modes of operation. The lamp can give visual feedback that shows the state of a remote load. In other words, when the load is switched ON the lamp is illuminated and when the load is OFF, the lamp is off.

Optionally this could be inverted so that when the room lights are OFF the pilot lamp is ON, and when the room lights are ON the pilot lamp is OFF. This is helpful in locating the switch in a darkened room.

Connecting Environmental Sensors Directly to the PRC1000 Controller

Environmental sensors can be used by the PRC1000 system to provide limited security, health, and comfort control. By utilizing temperature and humidity sensors, equipment can be protected from environmental extremes. Additionally a CO₂ Sensor can be used to monitor unsafe CO₂ levels and, in turn, control ventilators. Fire, security, and other dry contact devices may also be used.

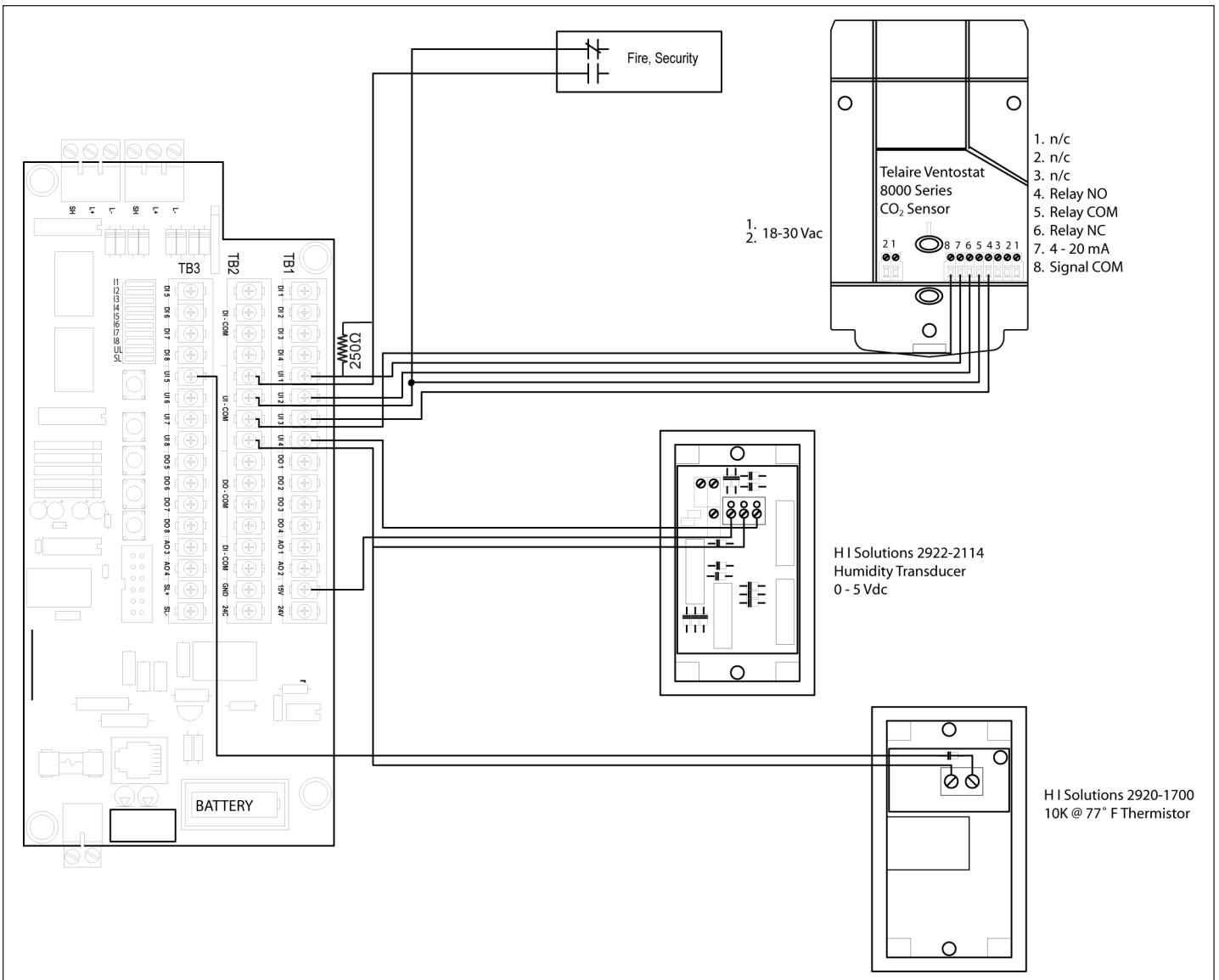


FIGURE 19. SWITCH INPUT EXAMPLE — CO₂ SENSOR

The CO₂ Sensor example shows all modes connected. This sensor provides direct analog input (through the 250 Ω resistor) and can also provide closures determined by an on-board threshold adjustment. While it is not necessary to make all connections they are shown here for example. Additional parameters are required for all three sensors to condition the inputs to usable values (type conversion). It is absolutely necessary to provide the sensor's output characteristics to the Eaton Cutler-Hammer Engineer prior to startup of these devices. Refer to the Pow-R-Command Lighting Optimization Software manual, document # EH01412001E for detailed descriptions.

Dimming Sensors, Controls, and Ballasts

All the PRC1000 Controllers have similar capabilities for input, output and application functions. The following examples demonstrate connections for both manual and automatic dimming of fluorescent fixtures.

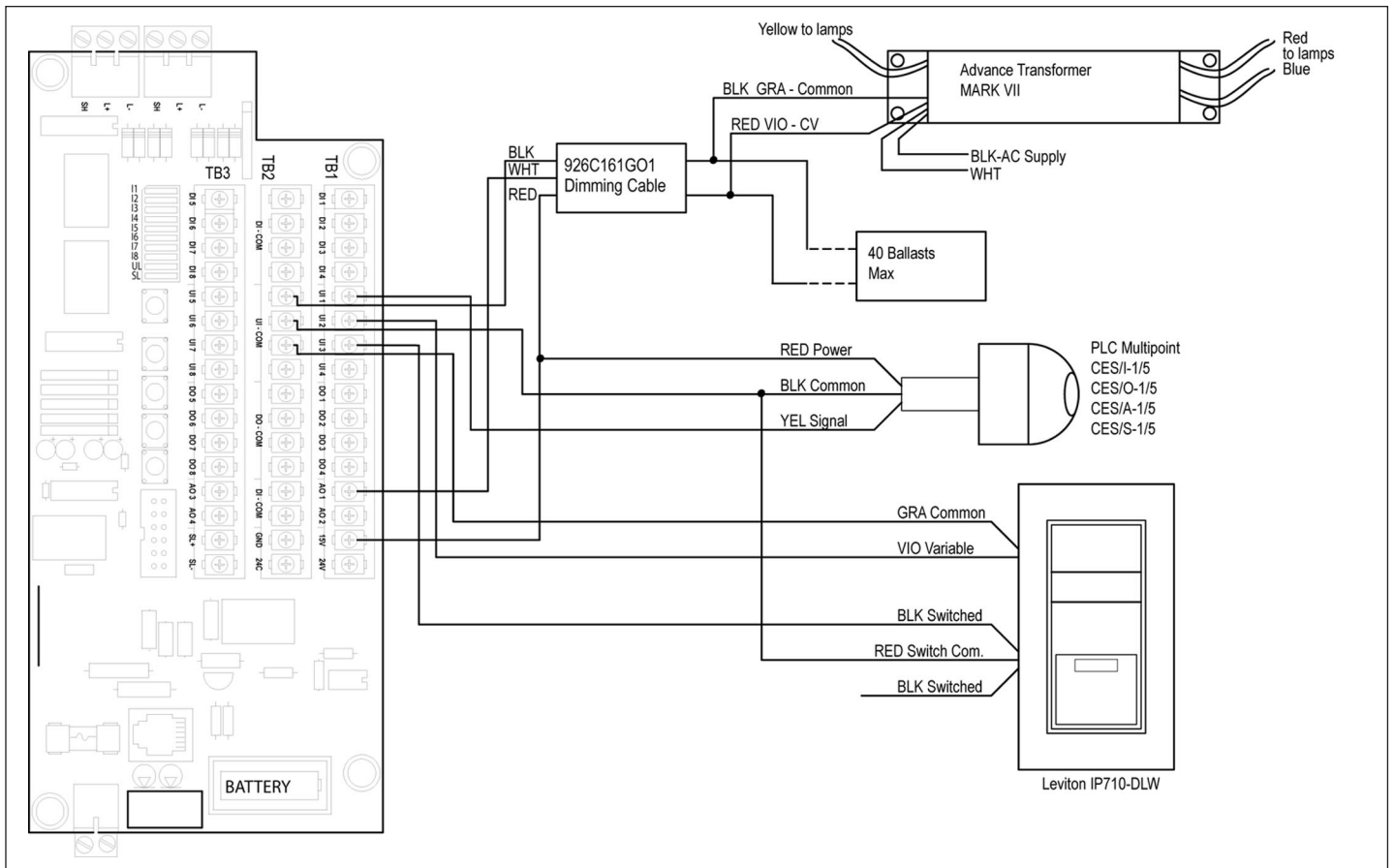


FIGURE 20. SWITCH INPUT EXAMPLE — MANUAL AND AUTOMATIC DIMMING CONTROL

The major components required for manual and automatic dimming control are represented in **Figure 20**. Certain parameters must be entered into the system to compensate for the different characteristics of the devices. For example, the PLC Multipoint® photo sensors listed in **Figure 20** have different footcandle (FC) ranges but all have 1 – 5 V DC signals. The conversion to percent or units would be determined at the time of startup. Using the connections shown here, control strategies such as lumen maintenance, daylight harvesting, manual control, and manual control to a variable set point can be accomplished through programming the controller database.

It is imperative that the sensor type associated with each input be provided to the Eaton engineer for proper startup and operation of the dimming controls. It is recommended that the total length of the ballast control voltage cable be under the maximum 1,000 feet.

PLC Multipoint® Sensor Notes

The CES series of sensors have different input ranges, but are normalized to a 1 – 5 V DC output. While these relationships are adjustable at the sensor, it is probably better to make any adjustments through the controller’s built-in type definitions. The CES Series sensors are supplied from the factory with the following calibrated ranges:

- CES/I 0 to 100 FC = 1 to 5 V DC
- CES/O 0 to 250 FC = 1 to 5 V DC
- CES/A 2 to 1000 FC = 1 to 5 V DC
- CES/S 10 to 2000 FC = 1 to 5 V DC

The adjustable maximums for these sensors are:

- CES/I 5 to 750 FC
- CES/O5 to 750 FC
- CES/A200 to 2500 FC
- CES/S1000 to 7500 FC

LEVITON® IP710-DLW

The LED provided in this switch is hard-wired internally as a night-light. This switch is intended for connection to a 120 V AC circuit and uses a small amount of leakage to illuminate the LED when the lights are off. Connecting this device to any of the DIGITAL INPUTS (DI 1 through 8) will cause improper operation of the input due to this leakage. The Digital Inputs provide enough wetting voltage to cause the LED to conduct and thus, the circuit will never open.

For this reason the Leviton switch will only function when connected to the Universal Inputs (Analog Inputs 1 – 8). In any event, the LED is not usable in this application because it will never illuminate.

Sensor Switch CM Series Occupancy Sensor and Manual Dimming

This schematic presents two additional lighting control applications. The Occupancy Sensor (OS) is intended to provide automatic on/off control while the pushbutton-pair allows for manual dimming.

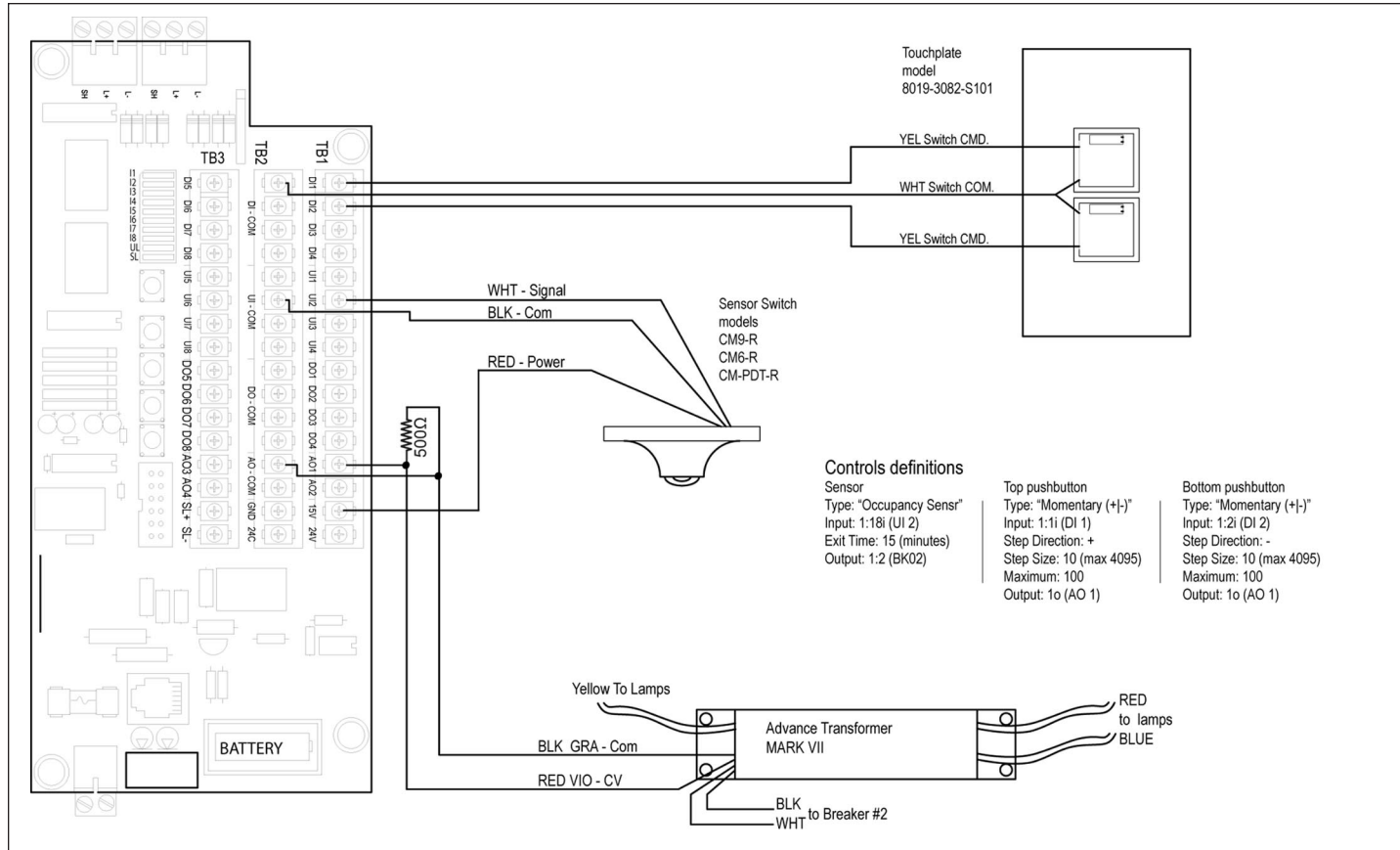


FIGURE 21. OCCUPANCY SENSOR SCHEMATIC

Each press of the upper pushbutton will increase the light level by 10%. Similarly, pressing the lower pushbutton will decrease the level. The occupancy sensor uses the load controlling the 120 V AC to the light fixtures as its control output. So the switches control dimming and the sensor controls on/off.

There are many alternatives to this scheme. For example, on/off control can be handled by another control, eliminating the OS. Also, the acceptable lighting limit can be lowered and an "analog compare" control can monitor the output and automatically turn the lights off when dimmed below a certain level.

Of additional interest: This example forgoes the use of the Dimming Cable (HIS 016-4092). The Analog Output of the controller has sufficient drive for up to two (2) Electronic Dimming Ballasts. If it is necessary to attach more than two ballasts to one output, use of a Dimming Cable is highly recommended.

Note: It is necessary to place a 500 Ω resistor across the Gray and Violet ballast wires to change the controller output from 0 – 20 mA to 0 – 10 V DC.

Occupancy Sensors

Occupancy sensors are a convenient means of obtaining automatic control of the lights based on the presence of personnel within "visible" proximity of the sensor. The sensors are capable of detecting people using a variety of technologies including: infrared, ultrasonic, and microphonic detectors, or combinations of these detectors. Excepting the sensing technology, these detectors operate similarly.

When the detector senses presence, it closes a relay inside the power pack. Typically, this relay is wired to a light fixture, which gives the sensor direct control of the light fixture. In the case of Pow-R-Command, greater flexibility can be achieved by connecting the relay contacts to a PRC1000 USC input. Through the PRC1000, additional interactivity and control can be achieved in coordinating switches and time schedules to enable and disable devices. For example, you may wish to have the lights always on during occupied hours and use the sensors for after-hours safety lighting only.

Occupancy Sensor Use Guidelines

Note: Many occupancy sensors, including some SensorSwitch™ models, do not have dry contacts integral to the sensor unit. These devices typically use a remote power pack with integral relay and timer and are intended for direct control of load voltages. These sensors can still be used with the PRC1000 by wiring the load relay contacts to switch inputs as shown in the following schematic.

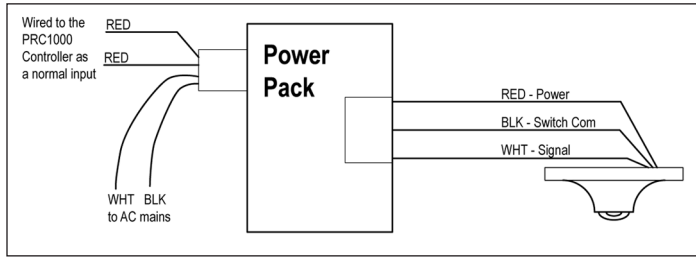


FIGURE 22. SELF-TIMED SENSOR CONNECTION

Nearly all occupancy sensors have integral delay timers. These timers delay (keep the lights on) for an adjustable period of time after sensing no activity. It is recommended that the integral timer be set to minimum and any delay be programmed into the PRC1000 controller. Use the Occupancy Sensor control-type when a self-timed sensor is connected to the controller, as shown in **Figure 22**. This will minimize the chance of a lights-off lockout, which can happen if the lights are turned off by other means while the sensor is detecting.

Of special note: If occupancy sensors and time schedules are controlling the same load or group of lights, it is strongly recommended that the two functions NOT point to the same output point to avoid operational conflicts. Instead combine the two outputs to control the load or group.

Note: This can be done with additional controls or by using one to ENABLE the other, depending on precedence.

IV. Network Installation

The Pow-R-Command Network provides global communication between the panelboards in the system. Each panelboard is connected to the network in a daisy-chain. Two connectors are provided in the panelboard to facilitate the in-and-out nature of a daisy-chain. The Pow-R-Command 1000 Network is based on the RS-485 two-wire, half-duplex specification. The network is implemented using a proprietary protocol over the RS-485 standard media. This section of the document restricts discussion to the proper installation and termination of the media, to provide reliable inter-device communication.

Following are some general guidelines for installing the Pow-R-Command network:

- Only BELDEN 3105A or equivalent cable should be used for network connections.
- Maximum overall length of the network should not exceed 4,000 feet. If this limit is exceeded, a repeater may be required.
- Uniform polarity is important when connecting RS-485 network wiring.
- All panelboards in the system should be connected in a daisy-chain; loops, stars and stubs are to be avoided.
- The ends of the network should be terminated with the End-of-Line Resistors. A 120 Ω resistor must be placed on the furthest two panelboards on the network.
- One end of the shield of the network cable must be connected to the ground. It is not important if it is in the first or last panelboard on the network. Note that the shield should only be connected to ground at one location in the network to prevent a ground loop.
- Avoid running network cable through electrically noisy environments. This includes light fixtures with magnetic or electronic ballasts, large motors, and cable-tray with power distribution wires.

- Keep cable splices to a minimum. The network is a low-power application and splices degrade over time and can be detrimental to the performance and reliability of the network.
- All Pow-R-Command devices (PRC100 and 1000) share the same protocol and thus can intercommunicate. This sharing allows easy integration of newer technologies into existing installations.

It is considered the installer's responsibility to locate and provide the end-of-line termination of the completed network installation.

Network Termination

The Pow-R-Command 1000 USC is encapsulated in a small (3X) chassis enclosure. This same enclosure can be mounted into a PRC1000 panelboard or a separate utility box called the PRC1000 External Control Cabinet. No matter how, or where, the USC Module (3X-Controller Chassis) is located, the network wiring is the same. The network is terminated to one, or both, of the three-position connectors located on the left end of the 3X-Controller Chassis. A Pow-R-Command Network connector is typically marked as follows:

- "L+" (top pin on the connector)-BLUE wire of the network cable
- "L-" (middle pin on the connector)-WHITE wire of the network cable
- "SH" (bottom pin on the connector)-SHIELD of the network cable

Note: The shield (SH) terminals of the 3X-Controller Chassis are tied together, but not grounded in the controller. At some point on the network it will be necessary to add a drain-wire to bond the shield terminal to earth.

Warning

DO NOT CONFUSE THE FOUR-POSITION SLAN CONNECTOR FOR THE NETWORK CONNECTORS DISCUSSED HERE. THIS CONNECTOR HAS VOLTAGE PRESENT AND ACCIDENTAL CONNECTION (TERMINATION) WILL DISRUPT SYSTEM OPERATION AND POSSIBLY DAMAGE COMPONENTS. FOR INFORMATION REGARDING THIS CONNECTOR, SEE THE PREVIOUS TOPIC BREAKER CONTROL BUS (BCB) WIRING.

Note: As mentioned previously, uniform polarity is important when connecting RS-485 network wiring. The colors in the example above are provided for BELDEN 3105A cable. If equivalent cable is used, the colors might be different. For clarity of the installation, keep the termination consistent, using - the same color wires on the same pins in all the panelboards.

Remove a plug from the socket on the 3X-Controller Chassis (see **Figure 23**). Terminate the wires into the plugs and push them firmly back into the sockets on the board. If the panelboard is in the middle of the network, use the top connector for the previous panelboard cable and the bottom connector for the next panelboard cable. Remember to install 120 Ω end-of-line resistors and to ground the shield at one end of the network.



FIGURE 23. 3X-CONTROLLER CHASSIS, PRC1000 NETWORK (L+, L-, SH) TERMINALS

When the 3X-Control Chassis is mounted in a PRC1000 panelboard, it is necessary to cover the connectors with a short piece of heat-shrink tubing or a wrap of electrical tape. This is to prevent contact with high-voltage branch wiring during installation and maintenance.

Two terminals are provided for PRC1000 network wiring to facilitate easy in-out relationships for network cabling. A good convention, for trouble-shooting purposes, is to terminate the cable from the previous (lower address) panelboard into the bottom connector and the cable out to the next (higher address) panelboard into the top connector. This is a purely voluntary practice and failure to observe this tip will not adversely affect performance.

When the network is wired as recommended (straight-line daisy-chain with no "star" or "tee" connections), it is easy to determine where the end-of-line resistor should go. The EOL resistor should be placed in the panelboards that have only one connector with LAN wires terminated. Use the open connector to install a 120Ω resistor between the LAN+ and LAN- terminals. If the recommended topology is not observed, then more than two panelboards can have open plugs. It is important that only two (2) EOL resistors be installed onto any one segment of a RS-485 network.

RPTR — Network Repeater

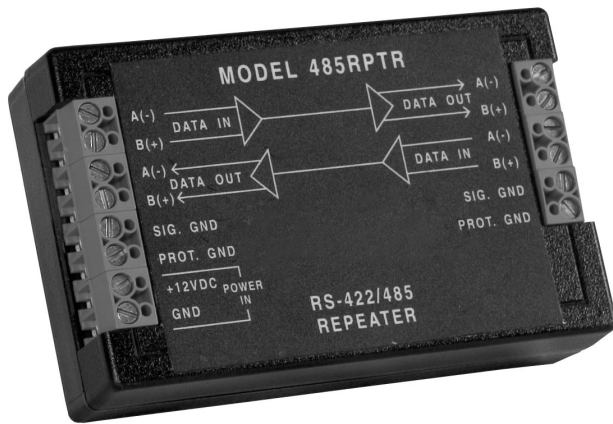


FIGURE 24. NETWORK REPEATER

The RS-485 specification states that whenever a network exceeds 4,000 feet or 32 transceivers, a repeater may be required to segment the network. A repeater serves to regenerate signals that may be degraded by the extremes of the network. A repeater is likely installed at the end of one segment and the beginning of another. For this reason, the 485RPTR will have 120 Ω terminating resistors across the "+" and "-" network wires on each side of the repeater. It is also quite likely that a LAN Bias Plug will be required for the side of the repeater away from the NIB. The NIB provides sufficient bias voltage for general applications; the repeater provides no such bias and thus it must be added when required.

The 485RPTR is ideally suited for single sub-station, and single building applications. If the network is of sufficient length (total of all segments) that the connected equipment is powered from different sub-stations (e.g. large distribution centers or stadiums), then the 485OP optically isolated repeater should be used. This will protect connected equipment from large common and differential mode interference and alleviate any potential differences between panelboard grounds.

The 485OP can also be used when connecting two buildings. Overhead lines are especially susceptible to storms and other phenomena that can introduce noise and voltage to the network cabling. An optically isolated repeater installed at the entry point to each building offers protection against such interference.

While the above text is intended as a guideline for the use of repeaters, it is in no way all-inclusive. Because of the nature of the PRC1000, strict adherence to RS-485 standards may not be necessary. For example, the below rated BAUD rate and advanced transceivers can actually extend the published limits. Under ideal circumstances, cable lengths of more than 4,000 feet are possible, as well as more than 32 devices.

The repeater is implemented on a per-job, as needed, basis. Over-use of repeaters (more than 3 in series) could have detrimental effects on network performance due to delays in signal propagation.

Important: The repeater requires external dc power. This can be acquired from either the USC (15 V DC) or a power supply (12 V DC). Loss of power to the repeater will cause a "break" in the network.

Location: The repeater cannot be located within the panelboard (e.g., in the gutter of the panelboard). The repeater should be located away from the panelboard "mains" to avoid 60-cycle noise from coupling into the repeater. The proper location for a repeater is in a small utility box adjacent to the panelboard. This location provides adherence to safety standards and affords the greatest operational efficiency.

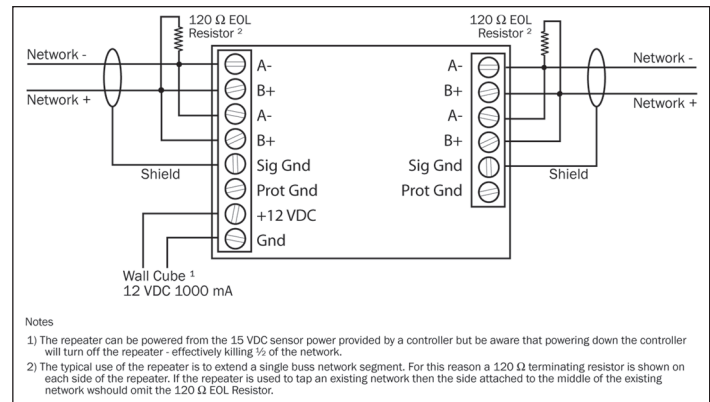


FIGURE 25. NETWORK REPEATER WIRING EXAMPLE

Notice in **Figure 25** that each side of the repeater has an EOL resistor installed. This is because the repeater actually serves to break the network into two distinct RS-485 segments. Each RS-485 segment should be terminated at both ends — in this case there will be four EOL resistors on the network.

V. Personal Computer Termination

Typically, the PC is located in an office remote from the panelboards. A Network Interface Box (NIB) is installed near the PC and translates the RS-232 protocol used by the PC to the RS-485 protocol of the system controller cards.

The NIB should be located on either end of the system's network to extend the daisy-chain configuration. The personnel installing the system are responsible for providing and terminating the network to the NIB. The NIB is powered by a 15 V DC power cube, which can be plugged into a 120 V AC wall receptacle.

Since the NIB is normally located at one end of the network, it will have a 120 Ω network termination resistor. When a good chassis ground is available at the NIB location, the Shield (S) on the NIB is the preferred ground location for the shield. If not, the preferred ground location for the shield is the closest network panelboard to the NIB.

When connecting the network wires to the NIB network connector, the network blue wire is connected to the "+" terminal and the network white wire is connected to the "-" terminal. The shield is connected to the "S" terminal. If the NIB is located at the end of the network, a 120 Ω termination resistor should be connected between the "+" and "-" terminals.

NIB to PC Connection

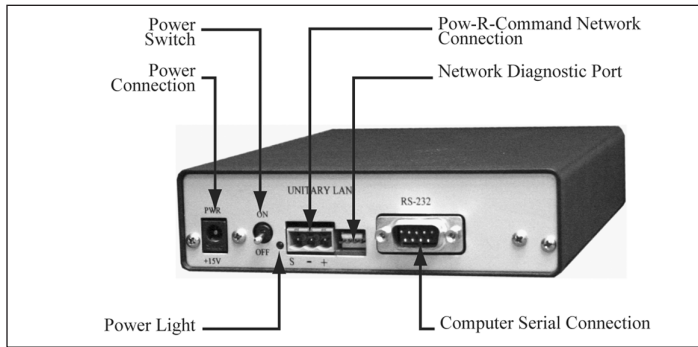


FIGURE 26. NETWORK INTERFACE BOX

The PC is connected to the NIB through the DB9 serial communication connector. A standard serial modem cable is used to connect the NIB to an available serial communication port on the PC. The length of the communication cable between the PC and the NIB cannot exceed 25 feet.

Ethernet Server to PC Ethernet Connection

In some cases, it is preferable to use a facility's existing Ethernet connection for system communication. The Ethernet Server is the preferred interface for this type of protocol. A standard CAT5 cable is used to connect the server to the Ethernet network.

The Ethernet Server should be physically located near the Ethernet hub or repeater, but the PC can be located anywhere on the Ethernet network. The server will communicate at 10Base-T and must have a fixed IP address assignment on the Ethernet network.

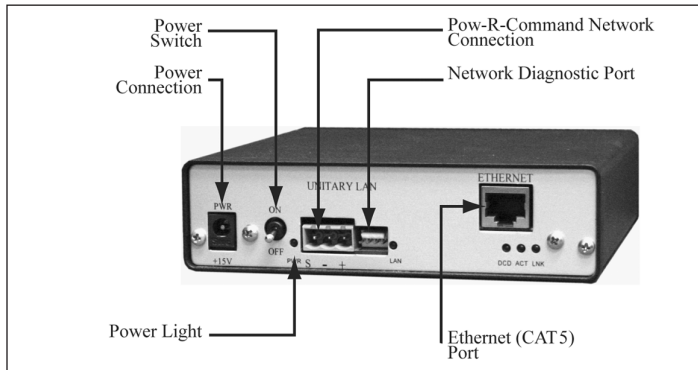


FIGURE 27. NETWORK INTERFACE BOX — ETHERNET

NIB to Modem Connection

In some cases, it may be necessary to access the network via modem. A remote PC can connect to the network by dialing the phone number associated with the modem. The NIB is equipped with an RJ11 phone jack to connect a phone line from the wall to the NIB. The phone line can be either a direct phone line or a PBX extension.

The cable connecting the NIB to the modem is a standard PC to modem cable. The modem must use the AT command set and is, typically, a standard Hayes compatible modem.

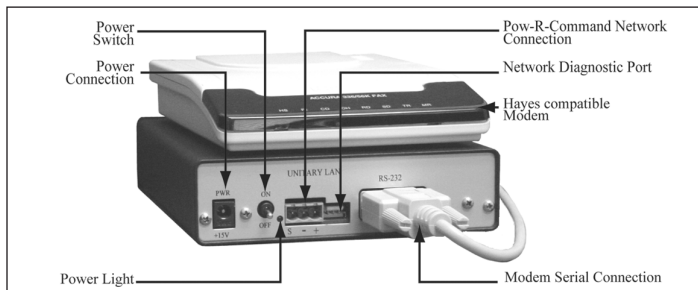


FIGURE 28. NETWORK INTERFACE BOX WITH MODEM

Ethernet Server to Ethernet with Modem Backup

In some cases, the user may wish to access the network via Ethernet, but also have the option of accessing via modem. In this case the Ethernet Server need not be physically located near the PC, but rather, near the Ethernet hub or repeater and the phone jack to be used. The PC can be located anywhere on the Ethernet network. The phone line could be either a direct analog phone line or a PBX analog extension.

A standard CAT5 cable connects the Ethernet Server to the network. The Ethernet Server will communicate at 10Base-T and must have a fixed IP address assignment on the Ethernet network. The cable connecting the Ethernet Server to the modem is a standard PC modem cable and the port is located on the back of the server. The modem must use the AT command set and is, typically, a standard Hayes compatible modem.

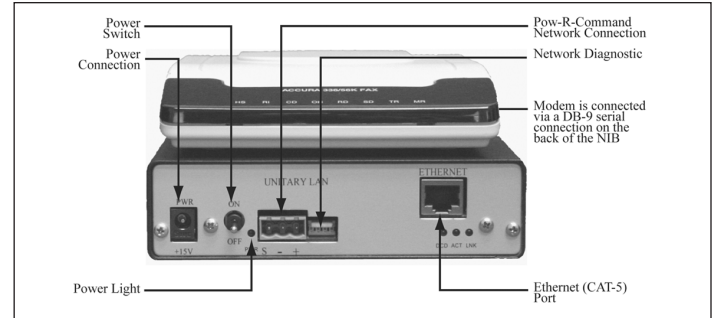


FIGURE 29. NETWORK INTERFACE BOX — ETHERNET AND BACKUP MODEM

VI. Controller Addressing

After all system components have been physically wired to the network (as described in Section 5), the controller cards must be addressed. The following topics describe the procedures for assigning a unique network address to each controller. Remember that optimum performance is attained when addresses are assigned sequentially from low to high (1 to 120). Take care not to assign two controllers the same address.

The following steps assume familiarity with the Windows® Operating System and general computer skills.

Addressing Using a PC

To use the PC to assign controller addresses, it is first necessary to install the Lighting Optimization Software onto the PC.

Secondly, the NIB or Ethernet Server must be connected between the PC and network as per **Section 5**.

Next, ensure that each device is programmed to a unique address so the computer (and operator) can determine which controller is being queried or programmed.

Note: For addressing using optional LCD, see LCD programming guide.

⚠ Notice

IF THE CONTROLLERS ARE ALREADY INSTALLED INTO THEIR RESPECTIVE PANELBOARDS, THE FOLLOWING PROCEDURE WILL REQUIRE TWO PEOPLE AND THEY MUST BE ABLE TO COMMUNICATE WITH EACH OTHER (RADIO, TELEPHONE, ETC.).

It is otherwise possible for one person to perform this by pre-addressing all cards at one panelboard. This would require a temporary connection of the NIB to a panelboard and a PC connected to the NIB. Each card is then "added" to the network and removed from this panelboard and placed in the appropriate panelboard. Alternately, a NIB can be used with a Laptop PC and a short network cable to connect to each panelboard. This way the Laptop and NIB could be moved from panelboard to panelboard.

Begin by launching the Lighting Optimization Software and log in to the system as user admin and password admin.

⚠ Notice

THE LOGIN SEQUENCE MUST BE ENTERED IN LOWER CASE CHARACTERS. THE ADMIN USER NAME AND PASSWORD WORK ONLY IF ANOTHER ADMINISTRATOR DID NOT CHANGE THEM.

Double-click the ICON representing this network or system. Once the site view is displayed, locate the devices ICON and double-click to view all defined devices on the network.



In the top-left corner of the Device List display, double-click the New Controller ICON.



The above actions will launch the Add Controller Wizard (**Figure 30**). Following is a brief synopsis of the steps needed to add a controller to the network.



FIGURE 30. ADD CONTROLLER WIZARD

Enter the desired address in the text field when prompted (8 in this example). Press the Next button to continue.

The software will query the network to ensure you are requesting a valid and unique address. If the address you requested already exists on the network you will be alerted and a different address must be entered.



FIGURE 31. ADD CONTROLLER WIZARD

The next step requires that the RESET button on the controller being added (see **Figure 31** Step 3) be physically pressed. If you need help identifying the controller type or the location of the RESET button, please refer to **Section 4**.

Once the RESET button is pressed on the controller, the “Finish” button on the PC will need to be clicked within 15 seconds of controller reset. This is why it is necessary to have two persons with radios when addressing pre-assembled panelboards.

If the “Finish” button is clicked before the “RESET” button is pressed on the controller, there will be a time-out counter displayed right-of-center at the top of the window (beneath the text “Step 4 of 5”). This time-out will count down from 30 seconds and then explain that the RESET button must be pressed before clicking the Finish button.

The computer screen will now display Steps 4 and 5, which describe the status and progress of the operation. If completed successfully, the user will be prompted to download a database to the added controller. It is beyond the scope of this document to describe programming features so just click “No”. Double-click the “<New Controller>” ICON and repeat the above procedure for additional controllers.

⚠ Notice

THE ABOVE PROCEDURE CAN ALSO BE USED TO CHANGE THE ADDRESS OF AN EXISTING CONTROLLER. WHILE THERE ARE OTHER METHODS DESCRIBED IN THE SOFTWARE MANUAL, THIS METHOD WILL WORK AND HAS THE ADDED BENEFIT OF ENSURING UNIQUE ADDRESS ASSIGNMENTS.

VII. Configuring the PRC1000 Subpanels

To properly identify panelboards and circuits, it is necessary to associate each BCB with its panelboard assignment. For example, a lighting panelboard may be named LVLP1. Within that panelboard there are a number of controllable breakers activating various branch circuits. Some circuits may be on the left, or odd, and some may be on the right, or even, side of the panelboard. The PRC1000 must be told which BCB controls which circuit in the associated panelboard. This is accomplished through association of the BCB address with the panelboard name. This is why it is important to have accurate records of the BCB address as they are installed into the panelboards. It is necessary to add the controller to the network, using one of the tools and procedures outlined in the previous section, BEFORE the subpanels can be configured. The following steps assume the controller is on the network and open in the Lighting Optimization Software.

Subpanels Dialog

A single BCB can serve as a left or right side device in a panelboard or as the top or bottom device in a column panelboard. This means one part can be configured to serve any one of four functions. This assignment is accomplished through the Lighting Optimization software subpanel configuration screens.

The BCB is installed with the control-module down on the left side of a panelboard and up on the right side. Circuit 1 is at the farthest end from the module while circuit 2 is closest. It is therefore necessary to configure the BCB modules to associate an output with the lowest circuit number.

The following steps outline the procedure for relating subpanels with panelboards.

From the Tools menu select the Configure Subpanels... option. This will open the Subpanels dialog box, showing the 8 BCB positions available to the USC.

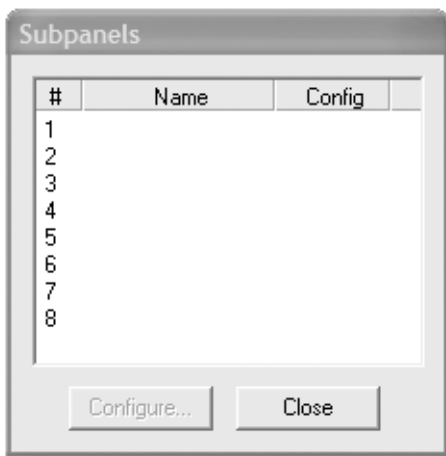


FIGURE 32. SUBPANELS DIALOG

Subpanels “Configure” Dialog

From the Subpanels List Dialog shown in **Figure 32**, highlight the entry having the same number as the address of the BCB you wish to configure and then click the Configure button.

Note: You can also just double-click an entry to go directly to the Configure Dialog.

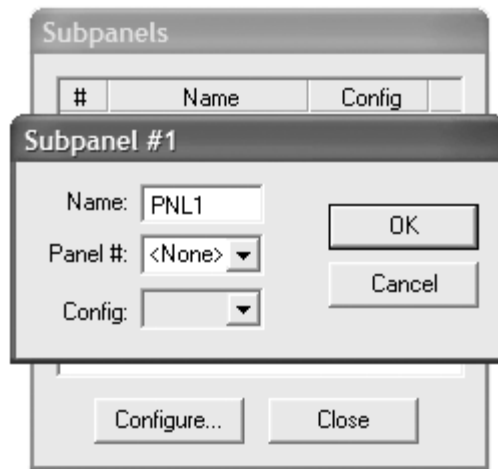


FIGURE 34. SUBPANEL NAME

It should be noted that the Name is a totally arbitrary four-character name given to each BCB. It is good practice to give each pair related names, but a single panelboard containing two BCBs may have totally unrelated names like “ODD” and “EVEN”. This is not recommended, but is a legitimate option.

Associate Subpanel Numbers

A single Pow-R-Command 1000 panelboard can consist of one or two BCBs, so it is necessary to associate the BCB address with the host panelboard. The BCB address is the number of the row clicked in the Subpanels dialog (**Figure 32**). The panelboard #: entry here finalizes the association. Upon selection of the panelboard number, the BCB is installed into the BCB SLAN Address and is associated with the physical panelboard.

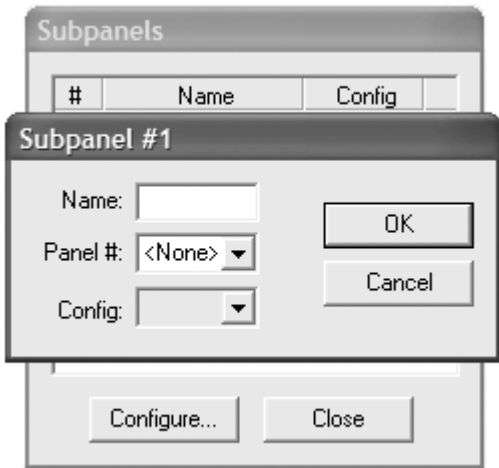


FIGURE 33. SUBPANEL CONFIGURATION SCREEN

Subpanel Name

The first field of the Configuration Dialog is the Name: entry. This is a four-character (maximum) name given to each BCB. To use the example panelboard-name from before “LVLP1”, an abbreviated name such as “LP1” could be entered here. To help clarify this discussion, the name “PNL1” is shown in **Figure 34** to denote a generic panelboard name and remain consistent with previous Figures.

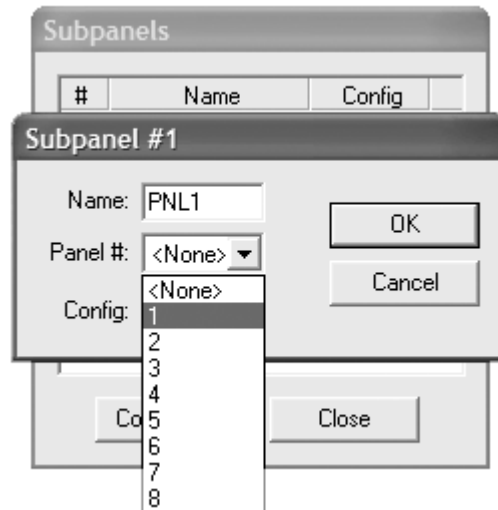


FIGURE 35. PANELBOARD NUMBER ASSOCIATION

The panelboard number chosen has no physical relationship to an actual panelboard, but the chosen value is important in linking the BCBs to one logical PRC1000 or PRC EP panelboard. There are eight choices available. If a PRC1000 is connected to BCBs only, with no knowledge of a panelboard, there could theoretically be eight single-BCB panelboards (8 panelboards with one BCB each), or four double-BCB panelboards (4 panelboards with two BCBS each), or any combination thereof. The PRC1000 is limited to a maximum of eight BCBs on the SLAN.

Associate Subpanel Types

As previously mentioned in the BCB installation, the left-side BCB is mounted with the control-module near the bottom of the panelboard while the right side is mounted near to the top. This inversion causes the lowest numbered breaker to change from end to end. The left-side BCB has circuit one at the far end while the right-side BCB has circuit two at the near end (see **Figure 17**). This relationship is further complicated by the fact that there are 18, 30 and 42 circuit panelboard configurations. There are also the cases for the 18, 30 and 42 circuit column-panelboards. For these configuration differences, the USC is told what type of panelboard the BCB is mounted in and where to look for the lowest numbered circuit. The Config: list presents the exceptions necessary to distinguish from the BCB positions available.

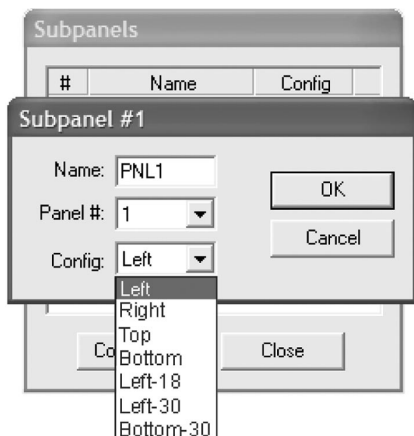


FIGURE 36. SUBPANEL TYPES

There are actually more combinations than are presented in the list in **Figure 36**, but those shown are the only variables needing definition to distinguish every combination. Each type is discussed briefly below.

Left — This BCB is mounted on the left (or odd) side of a standard panelboard. Circuit number 1 is located at the end opposite the control-module of the BCB. It is a full panelboard having 21 odd circuits (1/2 of 42).

Right — This BCB is mounted on the right (or even) side of the standard panelboard. Circuit number 2 is located at the end nearest the control-module of the BCB. It is a full panelboard having 9, 15, or 21 even circuits (1/2 of 18, 30 and 42 respectively).

Note: The right-side BCB will be cut short for a 30-circuit panelboard and shorter yet for the 18-circuit panelboard. Because the natural first breaker for a BCB is nearest the control-module, the number of circuits in the panelboard has no bearing on the first position.

Top — This BCB is mounted at the top of a column-type panelboard. Circuit number 1 is located at the end opposite the control-module of the BCB. This is a column panelboard having 30 or 42 circuits. (This BCB type always has 21 circuits.)

Bottom — This BCB is mounted at the bottom of a column-type panelboard. Circuit number 22 is located at the end opposite the control-module of the BCB. This is a column panelboard having 42 circuits (21 top plus 21 bottom).

Left-18 — This BCB is mounted on the left (or odd) side of a standard panelboard. Circuit number 1 is located at the end opposite the control-module of the BCB. It is a panelboard having 9 odd circuits (1/2 of 18).

Left-30 — This BCB is mounted on the left (or odd) side of a standard panelboard. Circuit number 1 is located at the end opposite the control-module of the BCB. It is a panelboard having 15 odd circuits (1/2 of 30).

Bottom-30 — This BCB is mounted at the bottom of a column-type panelboard. Circuit number 22 is located at the end opposite the control-module of the BCB. This is a column panelboard having 30 circuits (21 top plus 9 bottom).

Subpanels Configuration Summary

The previous discussion lead to one BCB configured as a left side for panelboard number one. Selecting the row that corresponded to the BCB SLAN Address and then clicking the Configure button accomplished this. This opened another window where the pertinent information was entered to associate the BCB with a physical panelboard, configure the BCB for proper orientation and number of circuits, and to name the BCB. **Figure 37** shows a possible list after configuring multiple panelboards of different types.

The image shows a software window titled "Subpanels" containing a table with three columns: "#", "Name", and "Config". The table is populated with 8 rows of data. Below the table are buttons for "Configure..." and "Close".

#	Name	Config
1	PNL1	1L
2	PNL1	1R
3	PNL2	2L
4	PNL2	2R
5	PNL4	4B
6	PNL3	3R
7	PNL4	4T
8		

FIGURE 37. A POPULATED SUBPANELS LIST

Referring to **Figure 37**, we can see that this PRC1000 currently has seven BCB connected to the SLAN. These BCBs are addressed sequentially from 1 to 7 and there are four physical panelboards connected. Following is a discussion of the anatomy of the list.

Row 1 in the above figure from left to right:

#: "1" — is the address of a BCB on the SLAN.

Name: "PNL1" — the arbitrary four-character name given the BCB. Usually, this will be paired with another BCB and is an abbreviation derived from a real panelboard name.

Config: "1L" — logical panelboard 1, left side BCB.

From **Figure 37**, we can determine that BCB #1 is in a panelboard named "PNL1" and it is associated as panelboard #1 Left (1L). Row 2 shows the configuration for the BCB at SLAN Address 2. This is named the same as panelboard 1 because it is logically associated as the right side of panelboard 1 (1R). Similarly panelboard #2 (PNL2) uses BCB #'s 3 and 4 as the left and right modules, respectively.

Note: It is not necessary (though recommended) to have adjacent BCB numbers in the panelboard. Notice that BCB #5 is a Column panelboard (PNL4) bottom (4B) and BCB #6 is associated as a right side in PNL3 (3R). The top of the column panelboard uses BCB at address 7. Rows 5, 6 and 7 demonstrate that it is not necessary to use adjacent BCB addresses to define a panelboard — though it is generally considered good practice.

Panelboard Status with Subpanels

When viewing the Breaker Status window of a PRC1000 panelboard, the subpanels again become apparent. At the top-center of the Breaker Status window (above the breaker graphics) is an information region displaying the left and right panelboard names (see **Figure 38**). Additionally, above the breaker configuration data columns are the BCB configuration summary data. This display can be handy when troubleshooting a panelboard or system, as this information is readily available.

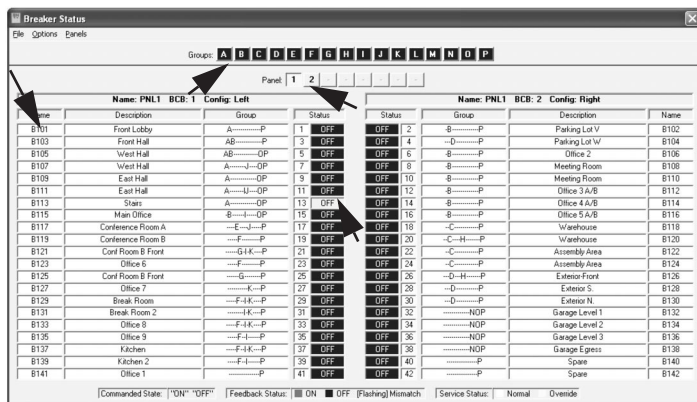


FIGURE 38. BREAKER STATUS DISPLAY

The Breaker Status window of the PRC1000 Panelboard (See **Figure 38**) makes it convenient to view the status of the breakers, edit breaker features, and manually control the breakers of the panelboard and sub-panelboards. The status window is laid out to resemble the panelboard, with the panel name and BCB address at the top of each side of the window. Each breaker can be given a name and a description, and can be added to any group or groups from this window by double-clicking on the corresponding breaker row (1). Any group can be manually controlled by left-clicking the corresponding group letter from the green icons across the top of the page. (2) The breakers can be manually controlled from this screen by double-clicking on the corresponding breaker number or status in the center of the page. (3) Also, the sub-panelboards can be accessed by left-clicking the panelboard number buttons located at the top of the screen below the group buttons. (4)

Appendix A — Troubleshooting Guide / FAQ

General Troubleshooting

Symptom 1: The text on the LCD display is not visible/legible. There is a blue backlight, but the text is washed out.

Cause: The contrast on the LCD needs to be adjusted.

Solution: Press the **BACK** key multiple times to ensure that you are on the very first screen of the LCD. Press the **Select key** one time. Press and hold the **UP** arrow. The contrast should begin to lighten. You can make the contrast darker by pressing and holding the **DOWN** arrow. The contrast can also be adjusted from within the **ADVANCED MENU**. Please reference the PRC750, PRC1000, PRC2000 LCD Quick Start Guide for details.

Document to Reference:

PRC750, PRC1000, PRC2000 Quick Start Guide (IL01412018E, IL01412010E or IL01412021E).

Symptom 2: One or more Smart Breakers are not showing up in CONFIGURE GROUPS.

Causes:

1. Subnetwork wiring from controller to each BCB in master and expansion panelboards is not properly pulled/terminated.
2. BCBs are not properly addressed via DIP switches on each BCB.
3. Smart Breaker has not properly been connected to BCB breaker port.
4. Breakers have not properly been discovered.

Solution:

Step 1: Make sure all subnetwork wiring from controller to each BCB (including expansion panelboards) is properly terminated. (See **Figure 39**.)

Step 2: Ensure that each BCB is properly addressed via the DIP switches on each BCB. (See **Figure 40**.)

Step 3: Make sure that each Smart Breaker is properly terminated onto each BCB Breaker Port. Each Smart Breaker has a 4-pin connector that slides onto each 4-pin breaker port on the BCB. It is very easy to misalign this connection.

Step 4: Discover breakers. Please reference the LCD Quick Start Guide for complete details on how to properly discover all Smart Breakers.

Note: If Smart Breaker(s) still do not show up in configure groups after completing these steps, please call the PRC Technical Support Line at 1-888-252-6286, Option 3.

Documents to Reference:

1. Instruction Leaflet (IL01412012E).
2. PRC750, PRC1000 and PRC2000 Quick Start Guide (IL01412018E, IL01412010E, IL01412021E).

Symptom 3: After completing the above steps, one or more Smart Breakers are not responding to issued commands.

Note: Make sure all the above steps have been completed before proceeding.

Causes:

1. The Smart Breaker(s) has/have been Overridden.
2. The black primary handle to the breaker is in the OFF position.

Definition of Overridden: Breaker is taken "out of service" or taken out of normal operation. This means that the Smart Breaker will not follow any issued commands. The breaker must be restored and put back into service/normal operation to follow issued commands.

Solution:

1. Take a look at the status LEDs on front of the controller. They are located next to the power switch to the controller. There will be three LEDs. The top LED represents the power to the controller. This LED is red and should be constantly ON. The middle LED is the "override" LED. If any one of the Smart Breakers are overridden, this LED will be lit. This LED is green. The bottom LED is the network LED. It will blink RED during normal operation.

If the middle LED is lit/green, this means that the Smart Breaker(s) is/are overridden and need to be restored back into service. From the MAIN MENU of the LCD, scroll down and select **BYPASS LOADS ON/OFF** (this should be the last option on the MAIN MENU). Next, scroll down and select **CLEAR BYPASS**.

2. If it is safe to energize the load connected to each Smart Breaker, ensure that the black primary handle to the breaker is in the ON position. The Smart Breaker will not properly respond to issued commands when the black primary handle is in the OFF position.



FIGURE 39.



FIGURE 40.

Documents to Reference:

PRC750, PRC1000 or PRC2000 LCD Quick Start Guide (IL01412018E, IL01412010E, IL01412021E).

Symptom 4: I have a 30-circuit panelboard, and my Smart Breaker positions on the left side are not numbered correctly from within the LCD.

Cause: The controller needs to be configured to represent the type of panelboard that it is controlling (i.e., 42 circuit, 30 circuit, etc.).

Solution: The controller needs to be configured to represent the type of panelboard that it is controlling. In this case, the controller needs to be configured to control a 30-circuit panelboard. All controllers default to control a 42-circuit panelboard. To adjust this setting, the following steps need to be taken:

1. From the **MAIN MENU**, scroll down and highlight, but don't select, **BYPASS LOADS ON/OFF**. Hold the **BACK** button for about 5 seconds.
2. An **ADVANCED MENU** item will appear. Scroll down and select **ADVANCED MENU**.
3. Scroll down and select **SUBPANEL CONFIGURATION**. Here, you should see a list of BCBs and their addresses. (If nothing shows up on the BCB list, please stop and go through the steps depicted in Symptom 2 above and then continue.)
4. The BCBs should be split into left and right for each panelboard. Highlight the first BCB that needs to be configured for a 30-circuit panelboard. Press **SEL**.
5. Scroll down to **TYPE** and press **SEL**. If this BCB is a left side BCB, then **SEL LEFT-30**. If it is a right side BCB, then **SEL RIGHT-30**.
6. Repeat for the remainder of BCBs that need to be configured for 30-circuit panelboards.

For more details, reference the PRC750, PRC1000 or PRC2000 LCD Quick Start Guide (IL01412018E, IL01412010E or IL01412021E).

Documents to Reference:

PRC750, PRC1000 or PRC2000 LCD Quick Start Guide (IL01412018E, IL01412010E, or IL01412021E).

Indicator Lights/LEDS Troubleshooting

The LEDs on the controller and BCBs can be used to help diagnose an issue with the current setup of the system.

Symptom 1: Power LED not lit on controller when the power switch is toggled on.

Causes:

1. No ac voltage to the controller transformer.
2. Incorrect voltage to the control transformer.
3. No 24 V AC voltage to controller unit.
4. Blown fuse within the controller.

Solutions:

1. Make sure there is ac voltage to the control transformer, and it is the correct amount.
2. Controllers are available in various voltages. Check the transformer label for the correct input voltage.
3. Press the reset on the transformer, there will be a noticeable click if it resets. The transformer may have tripped, if the trip state continues after resets this is a sign of other issues. Make sure no wires are pinched or shorted coming from the controller. If none found, please contact technical support.
4. Check the plug on the right side of the controller for proper connection of the 24 V AC from the transformer. If plugged in, check for 24 V AC at the plug.
5. Check the internal fuse in the unit. It is located behind the faceplate. Four screws must be removed to gain access to the fuse. Check the status of the fuse in the lower right hand corner of the unit. If this fuse is blown, it needs to be replaced.

Symptom 2: Power LED lit on the controller but not lit on BCB when the controller power switch is toggled on.

Causes:

1. No connection from the controller to BCB.
2. Incorrect wiring on the BCB from the controller.
3. Problem with the output voltage from the controllers.

Solutions:

1. Check the plug on the BCB and the controller for proper connection.
2. Check for correct wiring of the BCB; see the side of the controller and BCB for proper connections. Also, the connections are included in the Instruction Manual.
3. Check for 24 V AC from the controller; see the label on the side of the controller for the correct pins of the 4-pin connector. If voltage is not present, please contact PRC Technical Support Line at 1-888-252-6286, Option 3.

Symptom 3: The "POWER" LED and the "LAN" LED are lit, and the "RUN" LED blinks twice every few seconds on the BCB.

Cause: There is a communication failure between the controller and BCB caused by incorrect wiring of the BCB.

Solution: Check wiring (L+ and L- may be crossed or 24V~ and COM may be crossed from the controller to the BCB).

Symptom 4: The "POWER" LED is lit, and the "LAN" LED flickers every so often with the "RUN" LED blinking twice every few seconds on the BCB.

Cause:

1. There is a communication failure between the controller and BCB caused by incorrect wiring of the BCB.
2. Breakers have not been discovered.

Solution:

1. Check wiring; L- may be disconnected.
2. Discover the breakers. (See section 4 of this document "Discover Breakers")

Notes

