

CH Breaker Gateway Installation and Operation Manual





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1 Overview

The CH Breaker Gateway is designed to allow CPC's family of site controllers to interface directly with Cutler-Hammer Pow-R-Command PRC100 breaker control panels (equipped with PRC100MOD System Controllers) to activate and deactivate loads.

A Pow-R-Command™ breaker panel features remotely controllable circuit breakers, each of which may be flipped from OFF to ON and from ON to OFF by commanding the PRC100MOD System Controller. The E2, Einstein, and REFLECTS site controllers communicate with the PRC100MOD by use of the CH Breaker Gateway. The Gateway has one MODBUS channel that interconnects up to 4 PRC100MOD System Controllers and one RS485 I/O channel that connects the Gateway to the CPC site controller.

A CH Breaker Gateway controls up to 48 inputs and 48 digital outputs, and to the CPC controller the board appears identical to 8RO (relay output) boards and 16AI (input) boards. The Gateway can emulate up to 3 16AI and 6 8RO boards, depending on the amount of breaker groups used.

1.1. The CH Breaker Gateway System

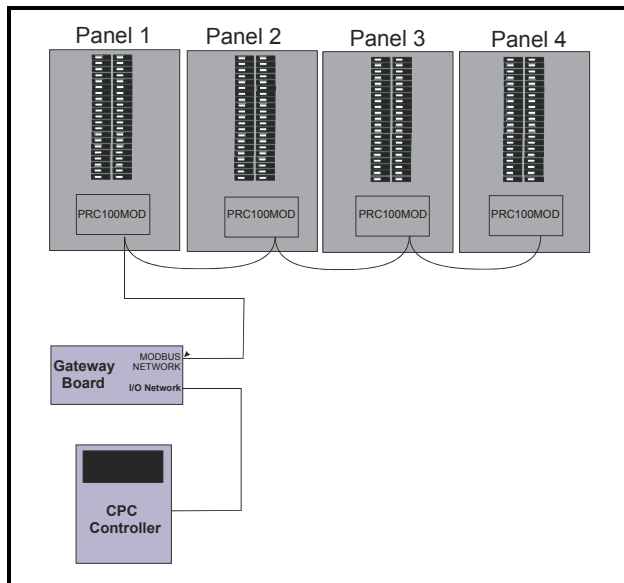


Figure 1-1 - Typical Layout of Panels, Gateway, and Controller

A typical layout of a CPC-controlled PRC100 network configuration is shown in *Figure 1-1*.

1.2. The CH Breaker Gateway

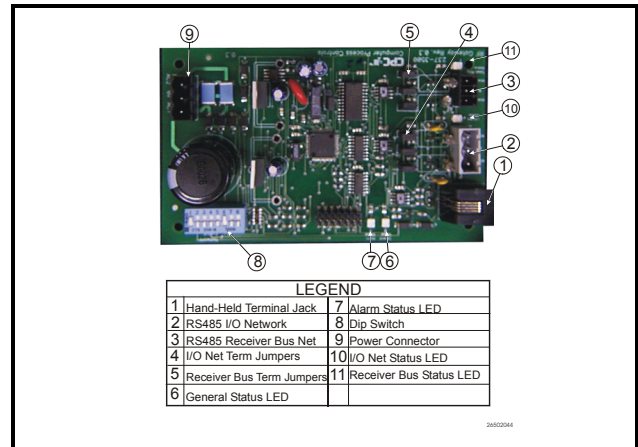


Figure 1-2 - Gateway Board

The CH Breaker Gateway (*Figure 1-2*) allows you to drive multiple breakers from a single virtual I/O point by arranging them into **breaker groups**. Each group represents one output point (driven by a lighting control or schedule application in the CPC site controller) and one input point (which sends a combined proof signal back to the CPC site controller for proof checking).

The Gateway supports control of up to 48 breaker groups, made up of breakers from up to 4 PRC100 panels, each of which may have up to 48 breakers.

2 Mounting

2.1. The CH Breaker Gateway

The Gateway is typically mounted in the same area as the site controller, near the controller's 16AI, 8RO, and other RS485 Network peripherals. The Gateway is designed to fit into a standard 3" snap track (supplied with the board) or may be mounted in a panel or on stand-offs. Follow the dimensions in *Figure 2-1* for panel mounting.

3 Power Wiring

3.1 CH Breaker Gateway Power Wiring

Input Voltage	24VAC, Class 2, 50/60Hz
Power	5VA

Table 3-1 - Gateway Power Requirements

The Gateway requires 24VAC power from a Class 2 center-tapped transformer.

CPC supplies several sizes of center-tapped transformers for powering multiple 16AIs, 8ROs, and other RS485 peripheral boards of the E2, Einstein, and REFLECS systems.

Refer to your controller's user manual for information on how to use the center-tapped transformers listed in *Table 3-1* to power multiple RS485 I/O devices for the US and Canada.

Figure 3-1 shows how to connect the 56VA and 80VA transformers to the Gateway power connector.

	Three-Board	Six-Board
P/N	640-0056	640-0080
Power Rating	56 VA	80 VA

Table 3-1-US and Canada Power Ratings for CPC Transformers

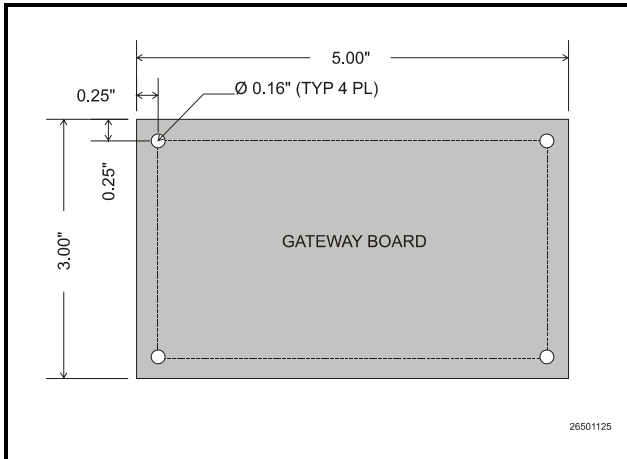


Figure 2-1 - Gateway Board Mounting Dimensions

The Gateway should be mounted in an environment with ambient temperature between -40°F and 150°F, with a non-condensing relative humidity between 5% and 95%.

Gateway boards are not supplied with an enclosure but come with a snap-track for easy installation. The insulation sheet and I/O board must be removed from the track before the track is mounted. The snap-track is mounted using the 0.1875" mounting slots. *Figure 2-2* shows this installation procedure.

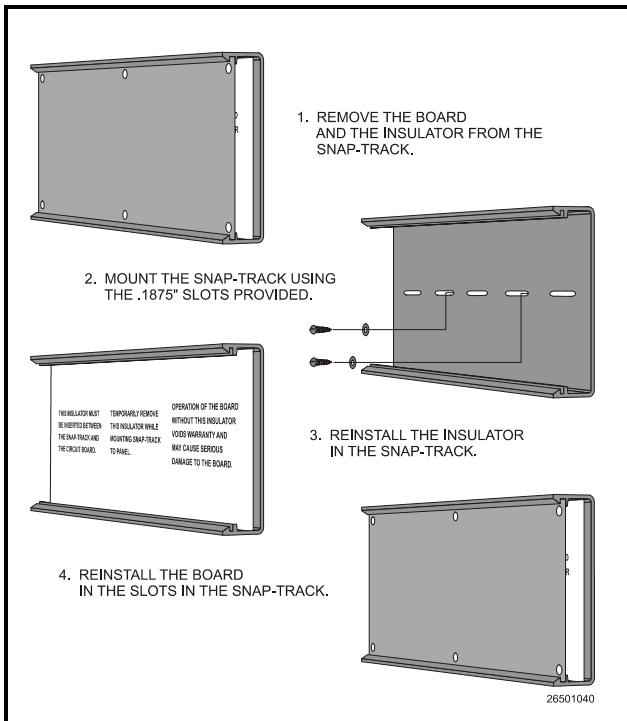


Figure 2-2 - Snap-Track Installation

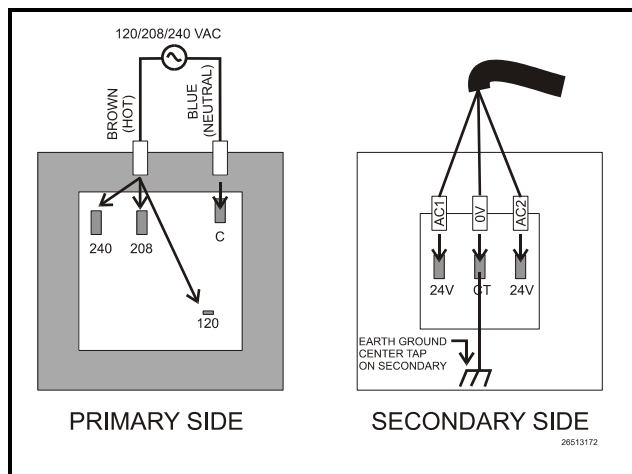


Figure 3-1 - Pinout for the 56VA (640-0056) and 80VA (640-0080) Transformers

4 Networking

4.1. Connecting the CH Breaker Gateway to the Breaker Panels

The Cutler-Hammer breaker panels connect to the Gateway by MODBUS network connection. MODBUS is a two-wire, polarity-sensitive network physically similar to RS485. Using shielded, two-conductor 22AWG wire (Belden #8761 or equivalent), connect all panels in a single daisy-chain network configuration leading from the Gateway to each of the breaker panels in series.

Figure 4-1 shows how to connect the wires to the MODBUS connectors.

IMPORTANT! The polarity of the PRC100MOD connectors is the opposite of the Gateway board's connector. The wire color connected to the positive (+) terminal of the Gateway board should be wired to the negative (-) terminal on the breaker panels, and vice-versa.

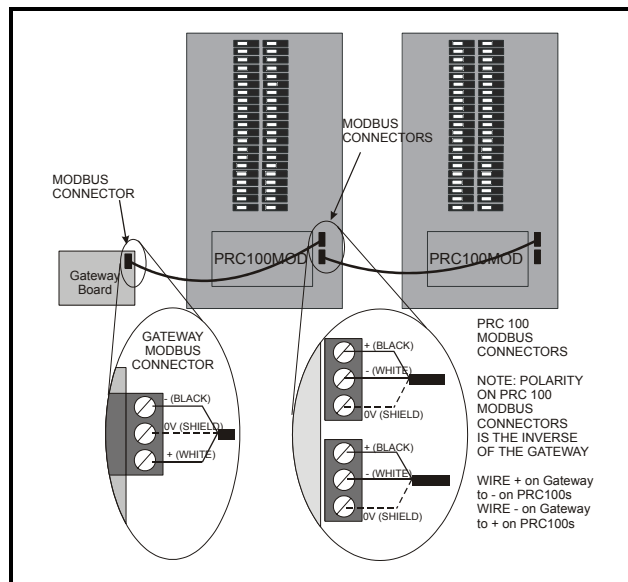


Figure 4-1 - MODBUS Connection Diagram

4.1.1. Terminating the MODBUS Network

The two devices at the ends of the MODBUS network must be terminated. If the Gateway board is one of the end devices, terminate the network using the three termination jumpers located next to the Gateway MODBUS Connector

(**Figure 4-2**). PRC100MOD boards have no on-board termination and must be terminated with a 150-ohm resistor across the + and - terminals (**Figure 4-2**).

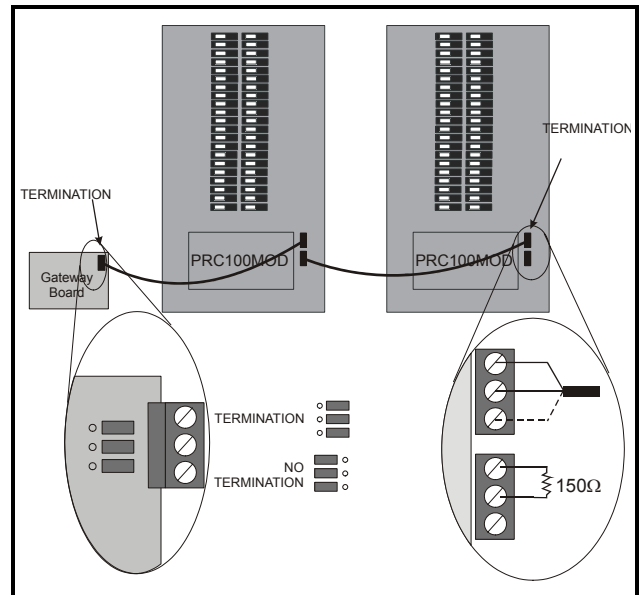


Figure 4-2 - MODBUS Network Termination

4.1.2. Setting the PRC100MOD Address

The PRC100MOD controllers on the Cutler-Hammer breaker panels have a switch used to set the MODBUS address. This switch must be used to give each PRC100MOD a unique address from 1 through 4. **Figure 4-3** shows the switch location and positions for each MODBUS address.

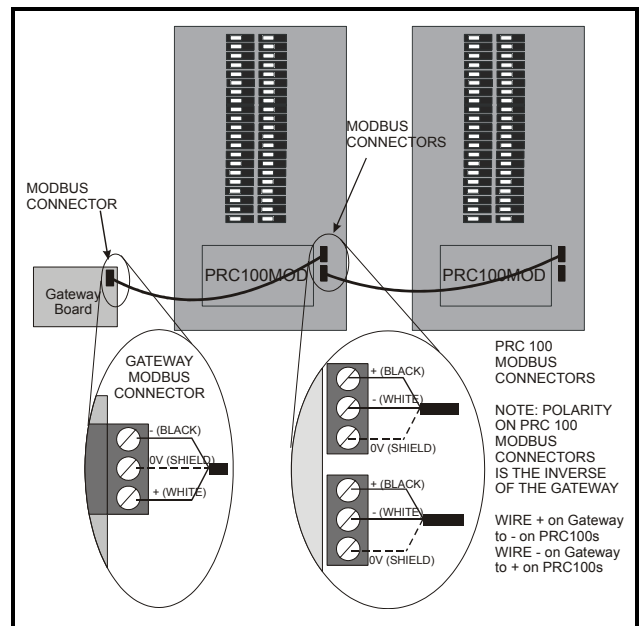


Figure 4-3 - MODBUS Addressing Switch Positions

4.1.3. Setting the NET Switches

The PRC100MOD controller has a pair of switches that, when switched to the OFF position, breaks the MODBUS network connection. Verify that these switches are in the ON position as shown in **Figure 4-4** to enable MODBUS communication.

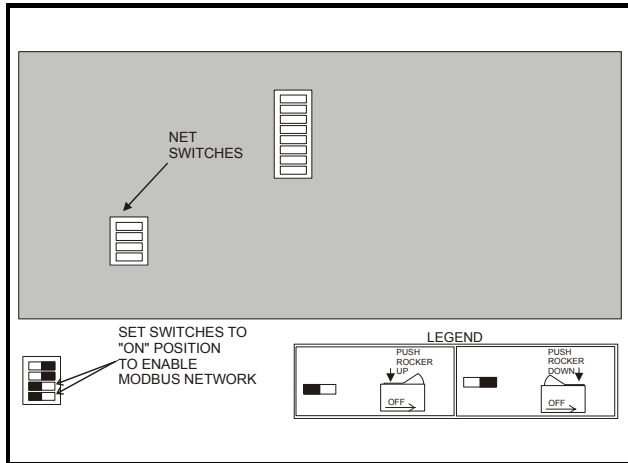


Figure 4-4 - MODBUS Network Enable/Disable Switches

4.2. Connecting the Gateway to the RS485 I/O Network

Using shielded two-conductor network cable (Belden #8761 or equivalent), connect the RS485 I/O Network wire to the three-terminal connector on the Gateway board as shown in **Figure 4-5**. For further information about how RS485 networks are configured, refer to your site controller's user manual.

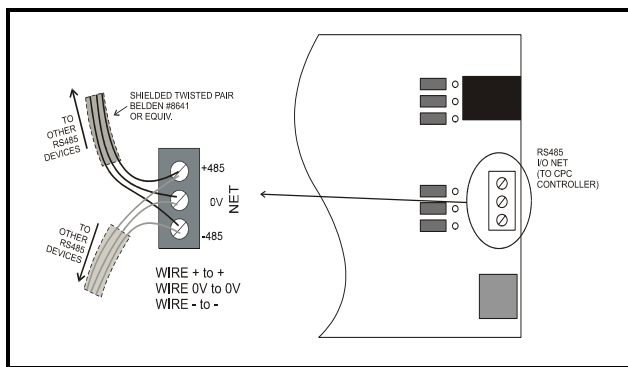


Figure 4-5 - Connecting the Gateway to the RS485 Network

4.2.1. Gateway Board Numbering

The E2, Einstein, or REFLECS controller interprets the Gateway board as one or more 16AI Analog Input boards and one or more 8RO boards numbered in succession. Addressing the “boards” represented by the Gateway is achieved using the HHT.

1. Plug the HHT into the HHT jack.
2. From the opening screen, press the DOWN ARROW key to display the Board Addresses screen (**Figure 4-6**).

# of Brk Grps:	2
ADDR	Start End
16AI	1 - 1
8RO	1 - 1

Figure 4-6 - Starting Board Addresses Screen

3. Press RIGHT ARROW to move the cursor to the # of Brk Grps field. Enter the total number of breaker groups you will be controlling. When finished, press RIGHT ARROW to move the cursor to the 16AI Start field.
4. The end ranges for the 16AI and 8RO boards will adjust based on the number you entered in **step 3**. For every 16 breaker groups, another 16AI board number will be added to the End range up to a maximum of 3. For every 8 breaker groups, another 8RO board number will be added to the End range, up to a maximum of 6.
5. Enter the 16AI board number that will be the lowest in the Gateway's Start-End range. Press RIGHT ARROW. The End range value will change to show the new Start-End range of board numbers.
6. Enter the 8RO board number that will be the lowest in the Gateway's Start-End range. Press RIGHT ARROW. The End range value will change to show the new Start-End range of board numbers.

4.2.2. Setting the Baud Rate Dip Switches

Dip switches 6 and 7 control the baud rate at which the Gateway communicates with the site controller on the RS485 Network. These switches must be set to the same baud rate setting as the E2, Einstein, or REFLECS (usually 9600 baud).

There is no dip switch to set the MODBUS baud rate. Since the PRC100MOD control board is fixed at 9600 baud, the Gateway board also uses a fixed 9600 baud rate for MODBUS.

5 Site Controller Software Setup

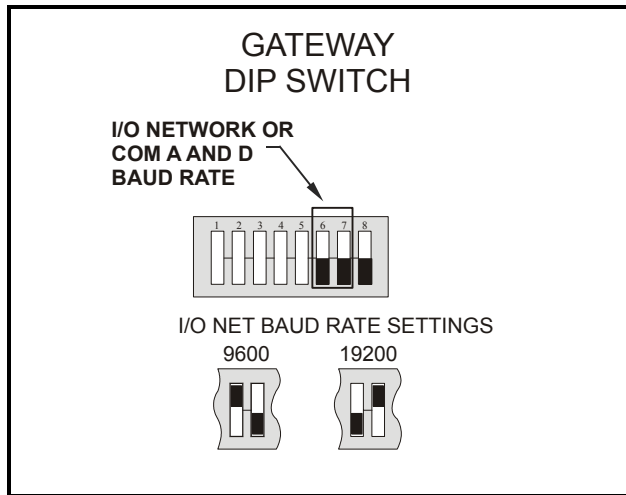


Figure 4-7 - Dip Switch Setting for Numbering Gateway

4.2.3. Setting the RS485 I/O Termination Jumpers

As part of a site controller's RS485 I/O (COM A or COM D) Network, a Gateway must be terminated if it is the end device of a daisy chain. Refer to the controller's user manual for information about daisy chain networks and how they are terminated.

To terminate the Gateway, set the I/O Network Jumpers to the RIGHT position as shown in **Figure 4-8**. To unterminate the Gateway, set the jumpers to the LEFT position.

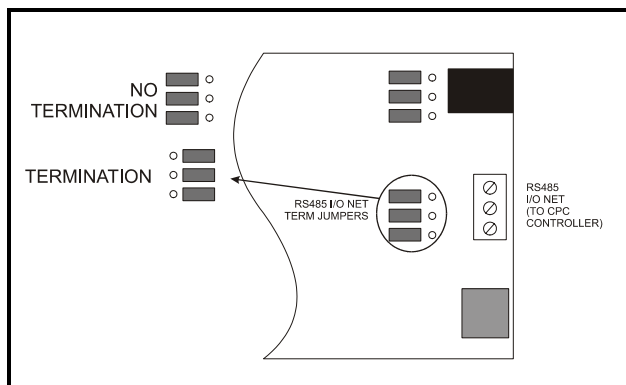


Figure 4-8 - Gateway RS485 I/O Network Termination

5.1. REFLECS

For backwards compatibility with REFLECS, the CH Breaker Gateway behaves on the network identically to 16AI and 8RO boards. These devices should be set up and addressed in the same way I/O boards are set up. Refer to your controller's manual for set up instructions.

5.2. E2 and Einstein

5.2.1. Board and Application Setup

Set up the number of boards on the I/O Network from the Connected I/O screen. Press the **Menu** key to open the Main Menu and press:

1. **& 7** System Configuration
2. **& 7** Network Setup
3. **@ 2** Connected I/O Boards and Controllers

If using an Einstein controller, from the Main Status/Home screen, press **F8** (Actions), **4** Network Status/Setup, and then **2** Connected I/O Boards & Controllers.

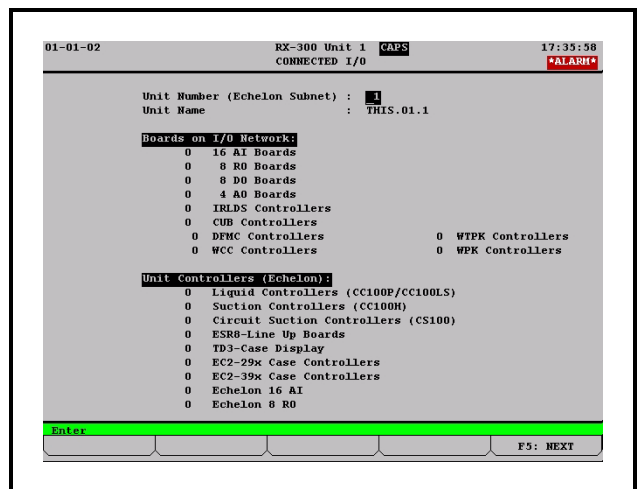


Figure 5-1 - Connected I/O Boards Screen

Add as many 16AIs and 8ROs as is necessary to cover the entire Start-End range chosen in **Section 4.2.1., Gateway Board Numbering**. Press **Menu** to save and exit.

5.2.2. Adding Lighting Schedule Applications

For each group of breakers to be controlled separately, set up a Lighting Schedule application from the Add New Application screen.

1. **6** Add/Delete Application
2. **1** Add New Application
3. **F4** LOOK UP to select **Lighting Control**. Enter the number of desired applications in the **How Many?** field.

If using an Einstein controller, from the Home screen or Enhanced Lighting Status screen, press **F8** (Actions), **XZ** (Control Appl Setup), and then **1** (Add Control Application). Press **F7** (Look Up) to select **Enhanced Lighting**. Press **F9** (Home) to return to the Home screen.



TRY THIS: When creating a name for your Lighting application, incorporate the application's corresponding group number into the name. For example, **PARKLIGHTS01** associates the parking lot breakers with Group 1.

5.2.3. Proof Inputs and Light Outputs Setup

Once the Lighting Schedule applications have been added, set up the proof inputs and light outputs for each Lighting application. The outputs of a Lighting Schedule cell control the breakers on the Cutler-Hammer panels, and the inputs are the combined proofs of all the breakers that are part of the group being controlled by the application.

5.2.3.1. Proof Inputs Setup

Set up 16AI board inputs in Proof Setup. To enable proofing, set **Enable Proofing** to **Yes** for each Lighting application by accessing the Lighting Control Setup screen. From the Main Menu:

1. Press **F3** (Lighting Sched) and select the a Lighting application.
2. **F5** (Setup) to go the Setup screen for that Lighting application.

If using an Einstein controller, from the Home screen or Enhanced Lighting Status screen, press **F8** (Actions), **B** (Setup), and choose the **S1: Setup** tab. (Note that the Proof tab is **S8** and the Outputs tab is **S9**).

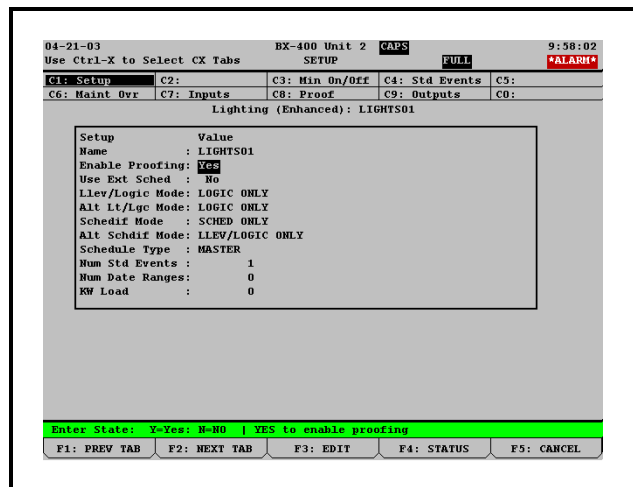


Figure 5-2 - Setup Lighting Control

3. Under the **C1: Setup** tab, set **Enable Proofing** to **Yes**. (**C8: Proof** tab becomes visible once you cursor across the tabs. See *Figure 5-3*.)
4. Press **F2** (Next Tab) or **F1** (Prev Tab) to cursor over to **C8: Proof** tab.

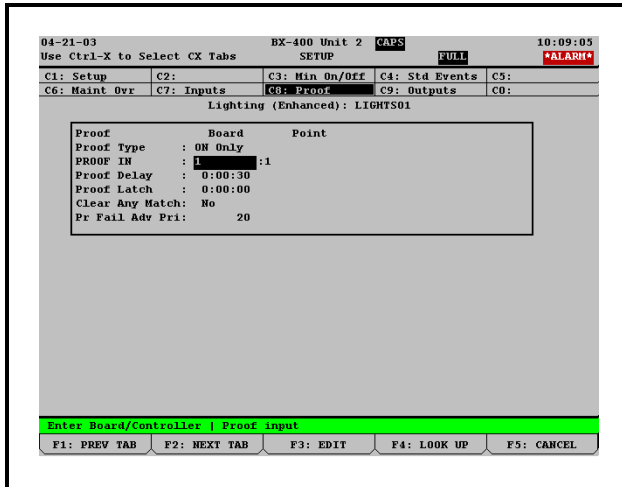


Figure 5-3 - Lighting Proof Setup Screen

5. Set **Proof Type** to **ON Only**. If the light circuit is read as open when it should normally be closed, the 16AI board will send a "fail" input relay to the controller. The Gateway proofs both ON and OFF so that the user can select the desired proof type as **ALL Values**, **ON Only**, or **OFF Only**. If any breaker within a group fails the proof, the entire group will fail the proof.
6. In the **PROOF IN** input, enter the virtual board and point address of the proof input on the gateway for the lighting group.
7. Set **Proof Delay** to a minimum of two minutes. (0:02:00)



NOTE: Cycling power to all 48 breakers can take up to 2 minutes. Choose a Proof Delay that allows time for all breakers in the group to switch ON and OFF.

8. Press **F2** (Next Tab) or **F1** (Prev Tab) to cursor over to **C9: Outputs** tab.



NOTE: If a breaker is assigned to a group that is not set up, a proof failure message will occur.

5.2.3.2. Light Outputs Setup

The Lighting Outputs Setup screen is where you will set up the 8RO board and point numbers for each group for all Lighting applications.

Refer to **Table 7-1** to associate the inputs and outputs with their corresponding group, board and point numbers.

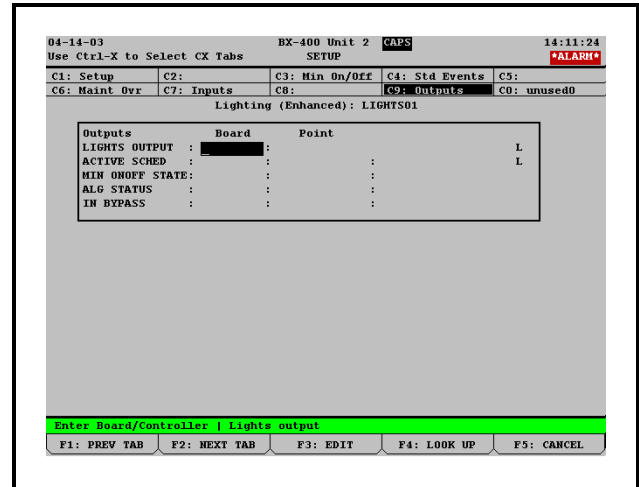


Figure 5-4 - Lighting Outputs Setup Screen

For more information on setting up Lighting Schedules, refer to your CPC site controller's manual.

6 Software Setup

6.1. CH Breaker Gateway (HHT)

Connect the HHT to the Gateway board via the HHT jack (refer to figure **Figure 1-2 #1**). Use the HHT to assign individual breakers to a particular group.

HHT Keys	Function
F1	Home screen key
F2	Quick access to status information
	Left and right arrow keys point to the desired field to be configured
	Up and down arrow keys scroll through all breakers on panel screens
Cancel	Deletes number you have chosen and changes it to zero, and cancels overrides on selected field
Enter	Saves changes (optional - use the down arrow)
-	Toggles between override ON and OFF
.	Toggles between override ON and OFF

Table 6-1 - HHT Key Functions

6.1.1. HHT Screens

The Home screen is the first screen that appears. Press F1 at any time to return to the Home screen.

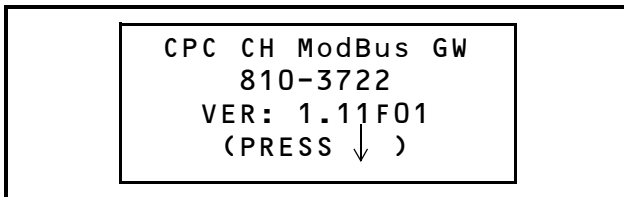


Figure 6-1 - Home Screen

Press the down arrow key to move to the Starting Board Addresses screen.

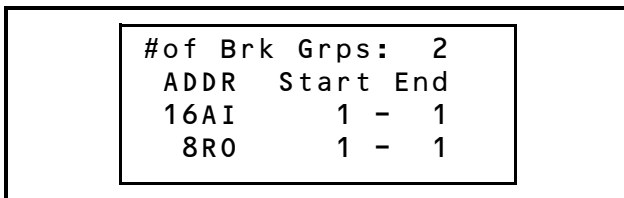


Figure 6-2 - Starting Board Addresses Screen

Next, arrow down to the Option screen.

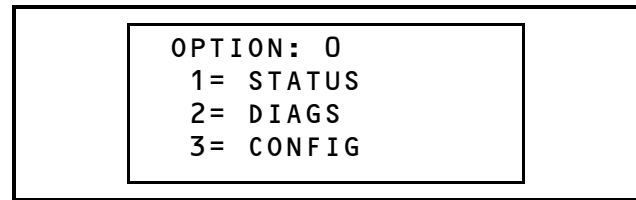


Figure 6-3 - Option Screen

Option No.	Function
1	Status information that can be overridden. (An asterisk "*" signifies a proof failure)
2	Diagnostics for troubleshooting
3	Configuration settings

Table 6-2 - Option Choices Chart

6.1.2. Configuration

Use the left or right arrows to activate the **OPTION:** field and choose **3** to start configuring each Panel's breakers to groups. Press DOWN ARROW to move to the next screen.

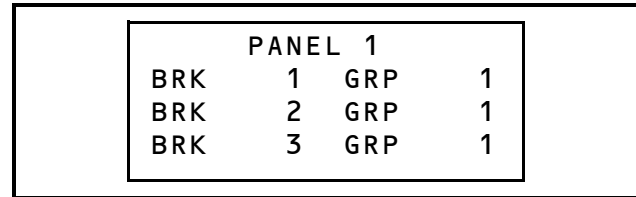


Figure 6-4 - Panel 1 Breakers to Group Screen

From this screen you can begin assigning breakers on panels 1 through 4 to breaker groups. Refer to **Table A-1** for a diagram of the breaker panel and the breaker number to group assignment.

Use the number keys to enter the group number. Change the group number to the group you want to associate the breaker with (a maximum number of 48).

Press DOWN ARROW to scroll through all 48 breakers on each of the four panels and set the group numbers as you scroll through the breakers.



NOTE: If a breaker is assigned to a group that is not set up, a proof failure message will occur.

6.1.3. Status

From the Option screen, select **1** for Status. The Status screen shows the status of the 48 groups and shows the ON or OFF state of each group and any proof failures (a proof failure is indicated by "*" after the ON or OFF state). Press the down arrow key to scroll through the groups. After the groups are displayed, continue pressing the down arrow key to see the ON or OFF state and any proof failures of each of the 48 breakers and all panels.

If a group is not assigned or set to zero, a "-" will appear as the breaker status.

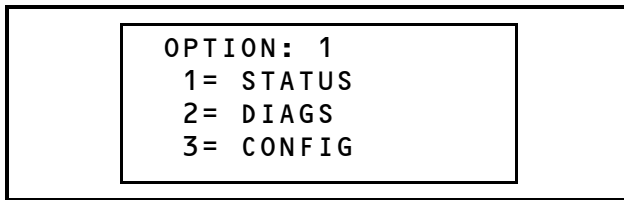


Figure 6-5 - Option Screen

7 Charts/Appendices

7.1. Mapping Breaker Numbers to Board and Points (Bd:Pt)

Up to a maximum of 48 groups can be set up, but there is no limitation to the number of breakers that may belong to a single group.

Y represents the starting 16AI address and *X* represents the starting 8RO address of the Gateway configured in Section 6.1.1., *HHT Screens*.

Light Schedule	Proof In (Bd)	Proof In (Pt)	Lights Output (Bd)	Lights Output (Pt)
Group	16AI Addr	16AI Points	8RO Addr	8RO Points
1	<i>Y</i>	1	<i>X</i>	1
2	<i>Y</i>	2	<i>X</i>	2
3	<i>Y</i>	3	<i>X</i>	3
4	<i>Y</i>	4	<i>X</i>	4
5	<i>Y</i>	5	<i>X</i>	5
6	<i>Y</i>	6	<i>X</i>	6
7	<i>Y</i>	7	<i>X</i>	7
8	<i>Y</i>	8	<i>X</i>	8
9	<i>Y</i>	9	<i>X+1</i>	1
10	<i>Y</i>	10	<i>X+1</i>	2
11	<i>Y</i>	11	<i>X+1</i>	3
12	<i>Y</i>	12	<i>X+1</i>	4
13	<i>Y</i>	13	<i>X+1</i>	5
14	<i>Y</i>	14	<i>X+1</i>	6
15	<i>Y</i>	15	<i>X+1</i>	7
16	<i>Y</i>	16	<i>X+1</i>	8
17	<i>Y+1</i>	1	<i>X+2</i>	1
18	<i>Y+1</i>	2	<i>X+2</i>	2
19	<i>Y+1</i>	3	<i>X+2</i>	3
20	<i>Y+1</i>	4	<i>X+2</i>	4
21	<i>Y+1</i>	5	<i>X+2</i>	5
22	<i>Y+1</i>	6	<i>X+2</i>	6
23	<i>Y+1</i>	7	<i>X+2</i>	7
24	<i>Y+1</i>	8	<i>X+2</i>	8

Table 7-1 - Mapping Group Numbers to Point Numbers

25	Y+1	9	X+3	1
26	Y+1	10	X+3	2
27	Y+1	11	X+3	3
28	Y+1	12	X+3	4
29	Y+1	13	X+3	5
30	Y+1	14	X+3	6
31	Y+1	15	X+3	7
32	Y+1	16	X+3	8
33	Y+2	1	X+4	1
34	Y+2	2	X+4	2
35	Y+2	3	X+4	3
36	Y+2	4	X+4	4
37	Y+2	5	X+4	5
38	Y+2	6	X+4	6
39	Y+2	7	X+4	7
40	Y+2	8	X+4	8
41	Y+2	9	X+5	1
42	Y+2	10	X+5	2
43	Y+2	11	X+5	3
44	Y+2	12	X+5	4
45	Y+2	13	X+5	5
46	Y+2	14	X+5	6
47	Y+2	15	X+5	7
48	Y+2	16	X+5	8

Table 7-1 - Mapping Group Numbers to Point Numbers

7.3. 16AI Mapping Table

Table 7-3 shows how the outputs of the 16AI Board are connected to group numbers.

16AI Board #	16AI Board Inputs	Associated Group Number
1	16 Inputs	1-16
2	16 Inputs	17-32
3	16 Inputs	33-48

Table 7-3 - 16AI Mapping

7.2. 8RO Mapping Table

Table 7-2 shows how the outputs of the 8RO Board are connected to group numbers.

8RO Board #	8RO Board Outputs	Associated Group Number
1	8 Outputs	1-8
2	8 Outputs	9-16
3	8 Outputs	17-24
4	8 Outputs	25-32
5	8 Outputs	33-40
6	8 Outputs	41-48

Table 7-2 - 8RO Mapping

Appendix A: Worksheets

Use the workspace below to assign breakers to groups. Refer to *Table A-2* for group number board and point assignment.

Panel 1 Breakers		Panel 2 Breakers		Panel 3 Breakers		Panel 4 Breakers	
Group#	Group#	Group#	Group#	Group#	Group#	Group#	Group#
1	25	1	25	1	25	1	25
2	26	2	26	2	26	2	26
3	27	3	27	3	27	3	27
4	28	4	28	4	28	4	28
5	29	5	29	5	29	5	29
6	30	6	30	6	30	6	30
7	31	7	31	7	31	7	31
8	32	8	32	8	32	8	32
9	33	9	33	9	33	9	33
10	34	10	34	10	34	10	34
11	35	11	35	11	35	11	35
12	36	12	36	12	36	12	36
13	37	13	37	13	37	13	37
14	38	14	38	14	38	14	38
15	39	15	39	15	39	15	39
16	40	16	40	16	40	16	40
17	41	17	41	17	41	17	41
18	42	18	42	18	42	18	42
19	43	19	43	19	43	19	43
20	44	20	44	20	44	20	44
21	45	21	45	21	45	21	45
22	46	22	46	22	46	22	46
23	47	23	47	23	47	23	47
24	48	24	48	24	48	24	48

Table A-1 - Assigning Breakers to Group Numbers

16AI Address = ____ Fill in the Gateway 16AI board address that you set with the HHT. For groups 17-32, add 1; for groups 33-48, add 2.

8RO Address = ____ Fill in the Gateway 8RO board address that you set with the HHT for Groups 1-8. For Groups 9-16, add 1; for 17-24, add 2; for 25-32, add 3; for 33-40, add 4; for 41-48, add 5.

Light Sched-ule	Proof In (Bd)	Proof In (Pt)	Lights Output (Bd)	Lights Output (Pt)	Group Name
Group	16AI Addr	16AI Points	8RO Addr	8RO Points	
1		1		1	
2		2		2	
3		3		3	
4		4		4	
5		5		5	
6		6		6	
7		7		7	
8		8		8	
9		9		1	
10		10		2	
11		11		3	
12		12		4	
13		13		5	
14		14		6	
15		15		7	
16		16		8	
17		1		1	
18		2		2	
19		3		3	
20		4		4	
21		5		5	
22		6		6	
23		7		7	
24		8		8	
25		9		1	
26		10		2	
27		11		3	
28		12		4	
29		13		5	
30		14		6	
31		15		7	
32		16		8	

Table A-2 - Mapping Group Numbers to Point Numbers

33		1		1	
34		2		2	
35		3		3	
36		4		4	
37		5		5	
38		6		6	
39		7		7	
40		8		8	
41		9		1	
42		10		2	
43		11		3	
44		12		4	
45		13		5	
46		14		6	
47		15		7	
48		16		8	

Table A-2 - Mapping Group Numbers to Point Numbers

Appendix B: Troubleshooting

SYMPTOM	POSSIBLE PROBLEM	SOLUTION
Board Offline	I/O Network Problems	<p>Check wiring polarity. Verify the 485+ uses one color and the 485- uses the other color throughout the network.</p> <p>Check each connector for any loose wires or frayed strands between connectors.</p>
	Termination Jumpers Set Incorrectly	<p>Verify all three jumpers are set in the UP position if the board is at the end of a daisy chain, and that all other boards are not terminated (jumpers in DOWN position).</p>
	Board Not Receiving Power	<p>Refer to Figure 3-1 for the following steps:</p> <ol style="list-style-type: none"> 1. Verify proper transformer wiring. Check that the 28 VAC secondary switch is in the ON position. 2. Verify that the secondary power is 28 VAC and the wires are connected properly. 3. Check Fuses F5 and F6. 4. Verify line voltage is connected to high-line side of the control power transformer.
	Dip Switches Set Incorrectly	<p>Check 8RO address, 16AI address, and baud rate settings. Refer to Section 4.2.1., Gateway Board Numbering and Section 4.2.2., Setting the Baud Rate Dip Switches.</p> <p>Note: after changing dip switch settings, cycle power to board using the 28 VAC secondary power switch (flip to the OFF position and then to the ON position).</p>

SYMPTOM	POSSIBLE PROBLEM	SOLUTION
<p>HHT Home screen displays FAIL: I/O NET.</p> <p>Red Alarm Status LED is blinking once per second.</p> <p>I/O Net Status LED is not blinking.</p>	<p>Communication has been lost between the site controller and the Gateway.</p>	<p>Check I/O Net wiring.</p> <p>Check that 16AI and 8RO addresses are set with the HHT, and boards are defined in the site controller.</p>
<p>HHT Home screen displays FAIL: COMM BUS.</p> <p>The red Alarm Status LED is on solid.</p>	<p>The Gateway is not configured with at least one group. It must be configured before the Gateway will communicate with the PRC100MODs on the MOD-BUS Network.</p> <p>Communication has been lost between the Gateway and the PRC100MOD(s).</p>	<p>If Receiver Bus Status LED is not blinking, assign at least one breaker to a group (1-16). If the Group number is 0 (zero), it is undefined.</p> <p>If Receiver Bus Status LED is blinking rapidly, check MOD-BUS wiring and PRC100MOD addressing.</p>

