Installation and Setup

2

In This Chapter. . . .

— Installing the H2–PBC
— The Profibus Network
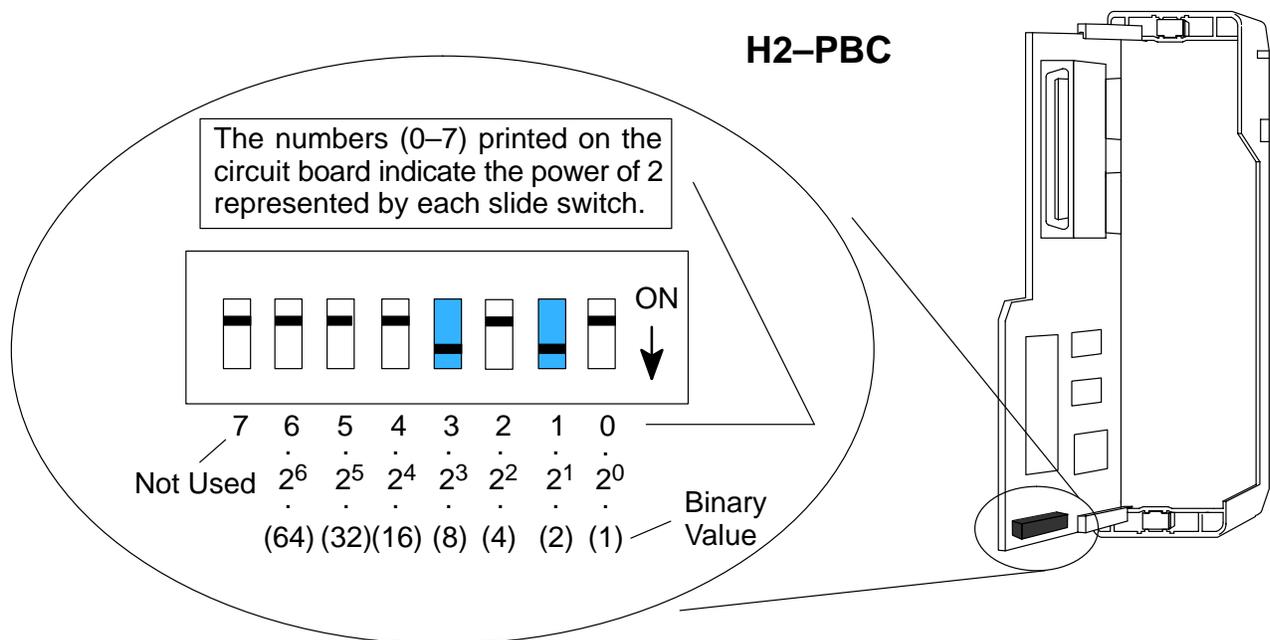— Configuring the Controller

Installing the H2–PBC

Setting the Node Address

Setting the Node Address

Profibus DP is usually a mono master system. Since Profibus is based on a token principle, more than one active station (masters) is allowed. The overall controlling master of the network should be node address "1". The master should be placed at the beginning of the network. Network address "0" should be reserved for monitoring and diagnostic devices.

It is recommended that slave devices begin with address "3". The slave devices need to be addressed in consecutive order by bus location moving away from the master.

Locate the DIP switch on the module and set the Node Address to an available Node Address, from 3 – 125 for the H2–PBC. Node Address 0 is normally reserved for the Profibus network master. Note that each DIP switch position is numbered on the printed circuit board, beginning from the right, 0 (zero) through 7. Each DIP switch position represent the power of 2. Refer to the figure below.

H2–PBC

The numbers (0–7) printed on the circuit board indicate the power of 2 represented by each slide switch.

ON

| 7	6	5	4	3	2	1	0
Not Used	2^6	2^5	2^4	2^3	2^2	2^1	2^0
	(64)	(32)	(16)	(8)	(4)	(2)	(1)

Binary Value

The Node Address equals the *sum* of the binary values of the slide switches set in the ON position. For example, if you set slide switches 1 and 3 to the ON position, the Node Address will be 10. This is found by adding 8+2=10. The maximum value you can set on the DIP switch is 32+16+8+4+2+1=63. This is achieved by setting switches 0 through 5 to the ON position.

Inserting the H2–PBC into the Base

The H2–PBC plugs into the CPU slot of any DL205 base.

- Locate the grooves on the inside top and bottom of the DL205 base.
- Align the module with the grooves and slide the module into the slot until the face of the module is flush with the power supply.
- Push in the retaining clips to secure the module.
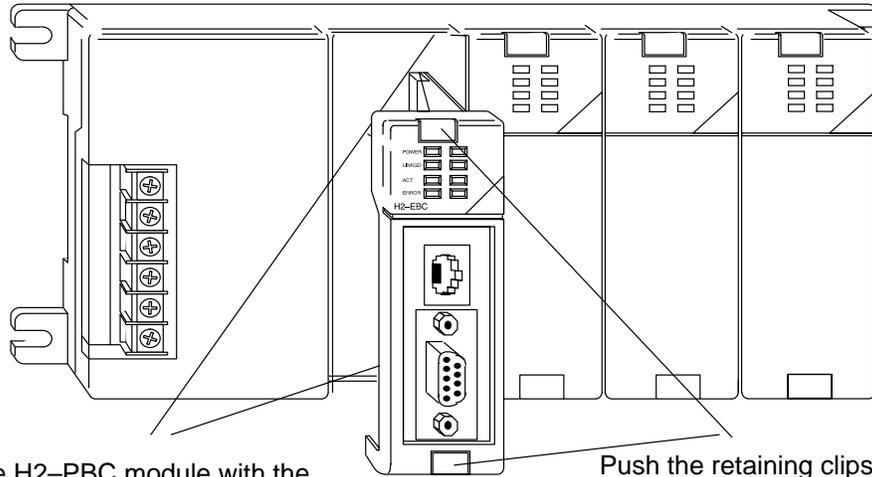
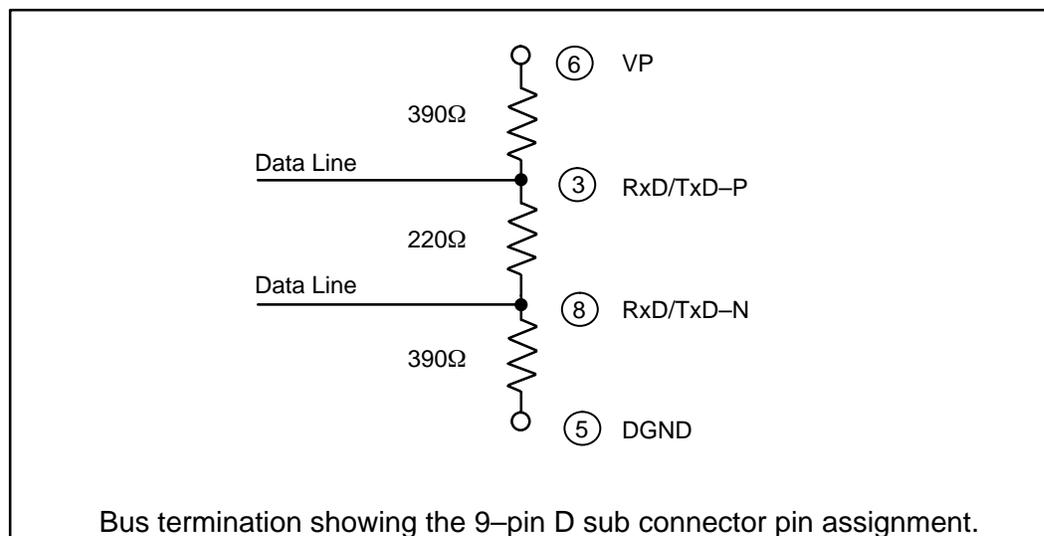Align the H2–PBC module with the grooves in the base and slide it in.

Push the retaining clips in to secure the module in the DL205 base.

Installation and Setup

The Profibus Network

RS–485 serial communication is most frequently used by Profibus. Twisted pair shielded copper cable with one conductor pair is the most common cable used for the Profibus network. Installation of this cable does not require expert knowledge. The bus structure permits addition and removal of stations or step–by–step commissioning of the system without interfering with the other stations. Later expansions will not effect the stations which are already in operation. It is important to follow the RS–485 installation guidelines, for 90% of the problems which occur with Profibus networks can be attributed to incorrect wiring and installation.

Wiring the Controller to a PROFIBUS Network

All devices are connected in a bus structure (line) in a Profibus network. It can be built in several segments with a segment consisting of the maximum number of stations (32) and/or the maximum length of the network. A repeater must be added if there is a need to have more than 32 stations (126 maximum). The bus is terminated by an active bus terminator at the beginning and end of each segment. See the diagram of the termination network below. Both bus terminators should be powered at all times to insure error–free operation. The bus terminator can usually be switched at the device or in the bus terminator connections.

Bus termination showing the 9–pin D sub connector pin assignment.

Communication speeds between 9.6 kbps and 12 Mbps are available. One unique baud rate is selected for all devices on the bus when the system is commissioned. The baud rate selected will depend upon the cable length.

The following table shows the maximum network cable lengths for the available baud rates that can be obtained with copper wire.

Baud Rate (bits per second)	Max. Segment Length	Max. Expansion
9.6k	1,000m / 3,278 feet	10,000m / 32,786 feet
19.2k	1,000m / 3,278 feet	10,000m / 32,786 feet
93.75k	1,000m / 3,278 feet	10,000m / 32,786 feet
187.5k	1,000m / 3,278 feet	10,000m / 32,786 feet
500.0k	400m / 1,311 feet	4,000m / 13,114 feet
1,500.0k	200m / 655 feet	2,000m / 6,557 feet
3,000.0k	100m / 327 feet	1,000m / 3,270 feet
6,000.0k	100m / 327 feet	1,000m / 3,270 feet
12,000.0k	100m / 327 feet	1,000m / 3,270 feet

To use baud rates greater than 1.5 Mbps, special connectors are required. The connectors have built in inductors in order to run with higher baud rates (refer to the diagram on page 2–9). Branch lines are not permitted when using baud rates greater than 1.5 Mbps. The minimum recommended cable length between two stations is 1m/3 feet.

The standard EN 50170 specifies the cable for use with Profibus. The following table specifications must be met for Profibus cables.

Cable Specification – Profibus DP	
Impedance	135 to 165Ω / 3 to 20 MHz
Capacitance	< 30 pf / m
Resistance	< 110 Ω / km
Wire gauge	> 0.64 mm
Conductor area	> 0.34 mm^2

There are several types of Profibus cable available. The most common cable used has solid conductors for the Profibus line. Some recommended cables are: two with solid conductors, Belden Profibus 3079A and Siemens 6XV1 830 0AH10, one with flexible conductors, Bosch Comnet DP #913 548.

The Profibus network is generally connected with a shielded, twisted pair, cable. The shield must to be connected to the protective housing of the connector which is then brought to ground through the connection on the device. Care must be taken when connecting the wires to the connectors that the shield and wires are properly installed.

In many automation control systems, the I/O bus cables are the most important connections between individual components in the system. Damage to the cable or improper cable installation can lead to problems and often to a breakdown of the entire control system.

To avoid damage to the Profibus cables, install them where they will be clearly visible and separate from all other cables. This will improve EMC characteristics. Install the cables in their own cable trays or conduit separate from all A/C power wiring.

The standard Profibus cable is intended for permanent installation in buildings or in an environment which is protected form the climate. The cable should only be used in applications where there is a minimum of cable flexing and where it will not be exposed to a wet environment.

A 9–pin D–sub connector is required for connecting to Profibus networks using RS–485 for communication. The connector pin assignment and the wiring is shown in the following diagram.
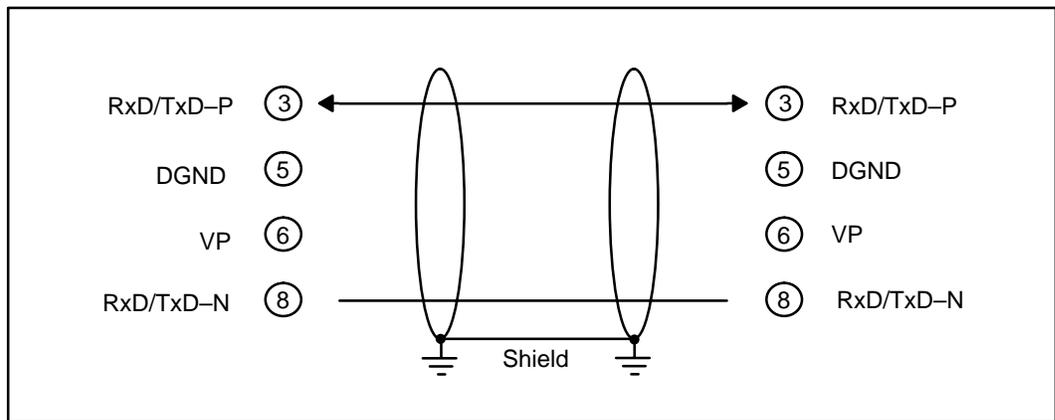
The two wires are usually color coded. Typically red and green are used. Red is used for the **B** Transmit/Receive line and Green for the **A** transmit/receive line. It is important to keep A and B line consistent throughout the network to avoid improper operation. ***This is the most common connection mistake in the field.***

It is recommended that a IP20 protective connector, such as, the Vertical Termination shown in the diagram on the next page, be used for making all terminations for the Profibus network. This is the best way for a quick and easy solution to terminating each end of your Profibus network. AutomationDirect offers two certified connectors for the Profibus Base Controller, one for a standard termination and one for a node termination.
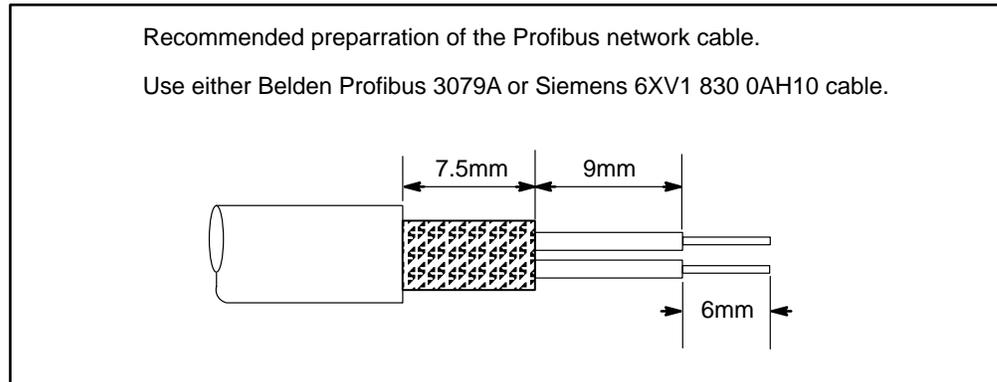
Reverse vertical termination
AutomationDirect Part No. 104322.
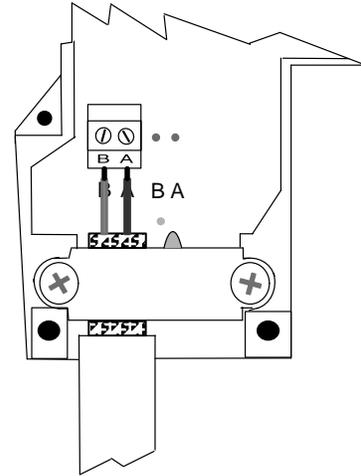
Termination showing the cable connection to
points A (Red) and B (Green).

Note: The insulation has been removed
exposing the shield. It is connected to ground by
the metal clamp holding the cable in place.

Proper preparation of the cable is important for good Profibus network installation.
When removing the cable insulation cover, make sure that the braided cable shield is
not damaged. Strip the ends of the cable conductors as shown below.

Recommended preparrration of the Profibus network cable.

Use either Belden Profibus 3079A or Siemens 6XV1 830 0AH10 cable.

7.5mm   9mm

6mm

After preparing the cable, insert the green and the red conductors in the appropriate
screw terminals of the bus connector.
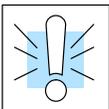
WARNING: The cable shield is not always connected to protective ground within all
Profibus devices; therefore, make sure the cable shield is connected to ground
before it enters the enclosure.

One important point when setting up a Profibus network is where and how to place the termination. Each Profibus peer–to–peer network, or last segment, needs to be terminated at the beginning and end of a segment (must be at the last device). The termination is usually built into the connector. Power must be supplied to the terminating resistors at the device. This means the last device needs to be powered at all times. If you have to replace the last device, the whole network could become unstable. It is preferred that the master device be installed at the beginning of the network and as a termination point.

Each segment is allowed to have a maximum of 32 stations, and a maximum of 9 segments is possible.

For installation applications where there is electromagnetic interference or to cover longer distances, fiber optic cable can be used for the Profibus field bus networks. Refer to Profibus guideline 2.022 for the specification of the Profibus fiber optic transmission method. For an overview of the fiber optic components available for Profibus, refer to a current Profibus Product Guide which can be found at the Profibus website, www.profibus.com.

Status Indicators

The H2–PBC Profibus Slave Base Controller has four Status Indicators: (Module) Status, (Link) Active, (Holding) Token and Error.

STATUS
ACTIVE
TOKEN
ERROR

H2–PBC
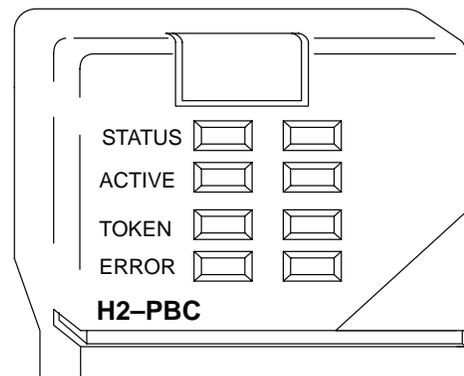
Indicator	Action	Status
STATUS	ON	Powerup check passed
	OFF	Powerup check failed
ACTIVE	ON	Connected to network
	OFF	Not connected to network or incorrect configuration
TOKEN	ON	Correct configuration and running
	OFF	Incorrect configuration and running
ERROR	ON	Watchdog timer timeout

Installation and Setup

Configuring the Controller

Use the Profibus configuration tool (this should come with the master unit) to configure the master and the H2–PBC for your network. ***Refer to the software Help file and/or the manual for assistance with the configuration***.

GSD File The actual configuration of the H2–PBC takes place whenever the Profibus master is configured. The characteristic communication features of the H2–PBC are defined in the form of an electronic device data sheet, GSD file. The defined file format permits the configuration system to simply read in the GSD files of the H2–PBC and automatically use this information when configuring the bus system. The GSD file is installed in the Profibus master during the configuration of the master.

H2–PBC Configuration The configuration tool made available with the master controller will allow you to achieve a simple Plug and Play configuration for your Profibus network. Based on the GSD files, the network can be set up with devices from different manufacturers.

1. **Set the Controller Node Address:**
   Make sure that the H2–PBC Base Controller node address is set to an available node number on the Profibus network (from 3 to 125).

2. **Configure the Profibus master:**
   Configure the Profibus master with the Profibus Configuration Tool that was supplied with the master controller to configure the H2–PBC and the DL205 I/O.

3. **Add the GSD file:**
   When configuring the Profibus master, add the H2–PBC slave GSD file from the disk which came with this manual or from our web site **www.automationdirect.com**.

4. **Commission the Node:**
   Use the Profibus Configuration Tool used to configure the master to put the system on line.

5. **Scan the I/O:**
   Use the monitor utility that comes with the configuration tool to scan the DL205 I/O.

6. **View Indicators on the H2–PBC module:**
   Refer to the Status Indicators when connecting to the network.

H2–PBC Memory Map The Profibus DP slave memory map specification per station will allow up to 244 bytes of input data and 244 bytes of output data to be transmitted. This is well within the range for the DL205 I/O modules. The H2–CTRIO module will be limited to no more than four modules per H2–PBC station due to the power budget restraints.

Installation and Setup

Calculating the Power Budget for the DL205 with H2–PBC

Managing your Power Resource

When determining which I/O modules you will be using in the H2–PBC system, it is important to remember that there is a limited amount of power available from the power supply. A table has been provided here showing the power available from the various DL205 base power supplies and a table showing the maximum power consumed by the H2–PBC and each of the I/O modules supported by the H2–PBC. Following these two tables is an example of a completed power budgeting worksheet and then a blank worksheet you can use for your own calculations.

If the I/O modules you choose exceed the maximum power available from the smaller DL205 base power supplies, you will need to use a D2–09B 9-slot base. This base supplies more power than the other bases, as you can see in the table below.

WARNING: It is *extremely* important to calculate the power budget. If you exceed the power budget, the system may operate in an unpredictable manner which may result in a risk of personal injury or equipment damage.

PBC Power Specifications

The following table shows the amount of electrical current available at the two voltages supplied from the DL205 base. Use these values when calculating the power budget for you system.

The Auxiliary 24V power source mentioned in the table is available at the base terminal strip. You can connect to external devices or DL205 I/O modules that require 24VDC, but be sure not to exceed the maximum current supplied.

Bases	5V Current Supplied	Auxiliary 24VDC Current Supplied
D2–03B–1	2600 mA	300 mA
D2–04B–1	2600 mA	300 mA
D2–06B–1	2600 mA	300 mA
D2–09B–1	2600 mA	300 mA
D2–03B1–1	2600 mA	None
D2–04B1–1	2600 mA	None
D2–06B1–1	2600 mA	None
D2–09B1–1	2600 mA	None
D2–03BDC–2	1550 mA	200 mA
D2–04BDC–2	1550 mA	200 mA
D2–06B2–1	2600 mA	300 mA
D2–09B2–1	2600 mA	300 mA

Module Power Requirements

The chart on the next page shows the maximum amount of electrical current required to power each of the DL205 PBC or I/O modules. Use these values when calculating the power budget for your system.

Installation and Setup

Power Consumption Chart (DL205 Modules)

Module	5V Power Required (mA)	External Power Source Required
PBC Module		
H2–PBC	530	None
DC Input Modules		
D2–08ND3	50	None
D2–16ND3–2	100	None
D2–32ND3/–2	25	None
AC Input Modules		
D2–08NA–1	50	None
D2–08NA–2	100	None
D2–16NA	100	None
DC Output Modules		
D2–04TD1	60	20
D2–08TD1/2	100	None
D2–16TD1–2	200	24 VDC @ 80 mA max
D2–16TD2–2	200	0
D2–32TD1/2	350	0
AC Output Modules		
D2–08TA	250	None
D2–12TA	350	None
Relay Output Modules		
D2–04TRS	350	None
D2–08TR	250	None
D2–12TR	450	None
F2–08TR	670	None
F2–08TRS	670	None
Combination Modules		
D2–08CDR	200	0
Analog		
F2–04AD–1(L)	50	18–30 VDC @ 80 mA max; (–L) 10–15VDC @ 90mA
F2–04AD–2(L)	60	18–26.4 VDC @ 80 mA max; (–L) 10–15VDC @ 90mA
F2–08AD–1	50	18–26.4 VDC @ 80 mA max
F2–08AD–2	60	18–26.4 VDC @ 80 mA max
F2–02DA–1(L)	40	18–30VDC @ 60mA; (L) 10–15VDC @ 70mA (add 20mA / loop)
F2–02DA–2(L)	40	18–30 VDC @ 60 mA max; (–L) 10–15VDC @ 70mA
F2–02DAS–1	100	18–32VDC @ 50mA per channel
F2–02DAS–2	60	21.6–26.4 VDC @ 60 mA per channel
F2–08DA–2	60	18–30 VDC @ 80 mA max
F2–04AD2DA	110	18–26.4VDC @ 80mA; add 20mA / loop
F2–04RTD	90	0
F2–04THM	110	18–26.4 VDC @ 60 mA max
Specialty Modules		
D2–CTRINT	50	5 VDC @ 60 mA max (required for outputs only)
H2–CTRO	400	5 VDC Maximum of 6 watts (All I/O in ON state at max. voltage/current).

Installation and Setup

Power Budget Calculation Example

The following example shows how to calculate the power budget for the H2–PBC system.

Base # ____1____	Module Type	5 VDC (mA)	Auxiliary Power Source 24 VDC Output (mA)
Available Base Power	D2–09B	2600	300
PBC	H2–PBC	+ 530	+ 0
Slot 0	D2–16ND3–2	+ 100	+ 0
Slot 1	D2–16NA	+ 100	+ 0
Slot 2	D2–16NA	+ 100	+ 0
Slot 3	F2–04AD–1	+ 50	+ 80
Slot 4	F2–02DA–1	+ 40	+ 100
Slot 5	D2–08TA	+ 250	+ 0
Slot 6	D2–08TD1	+ 100	+ 0
Slot 7	D2–08TR	+ 250	+ 0
Other			
Maximum Power Required		1520	180
Remaining Power Available		2600–1520= **1080**	300 – 170 = **120**

1. Using the table on the previous page, fill in the information for the base power supply, the H2–PBC, I/O modules, and any other devices that will use system power including devices that use the 24 VDC output.

2. Add the current columns starting with the row for Slot 0 and working your way down to the "**Other**" category. Put the total in the row labeled "**Maximum power required**"**.**

3. Subtract the row labeled "**Maximum power required**" from the row labeled "**Available Base Power**". Place the difference in the row labeled **"**Remaining Power Available".

4. If **"Maximum Power Required"** is greater than "**Available Base Power**" in either of the two columns, the power budget will be exceeded. It will be unsafe to use this configuration, and you will need to restructure your I/O.

Installation and Setup

Power Budget Calculation Worksheet

This blank chart is provided for you to copy and use in your power budget calculations.

Base # 0	Module Type	5 VDC (mA)	Auxiliary Power Source 24 VDC Output (mA)
Available Base Power			
CPU Slot			
Slot 0			
Slot 1			
Slot 2			
Slot 3			
Slot 4			
Slot 5			
Slot 6			
Slot 7			
Other			
Total Power Required			
Remaining Power Available			

1. Using the table on the previous page, fill in the information for the base power supply, the H2–PBC, I/O modules, and any other devices that will use system power including devices that use the 24 VDC output.

2. Add the current columns starting with the row for Slot 0 and working your way down to the **"Other"** category. Put the total in the row labeled "**Maximum power required**"**.**

3. Subtract the row labeled "**Maximum power required**" from the row labeled "**Available Base Power**". Place the difference in the row labeled **"Remaining Power Available"**.

4. If **"Maximum Power Required"** is greater than "**Available Base Power**" in either of the two columns, the power budget will be exceeded. It will be unsafe to use this configuration, and you will need to restructure your I/O.