2

Installation and Setup

In This Chapter. . . .

- — Installing the T1H–PBC
- — The Profibus Network
- — Configuring the Controller
- — Terminator I/O Backplane Communications

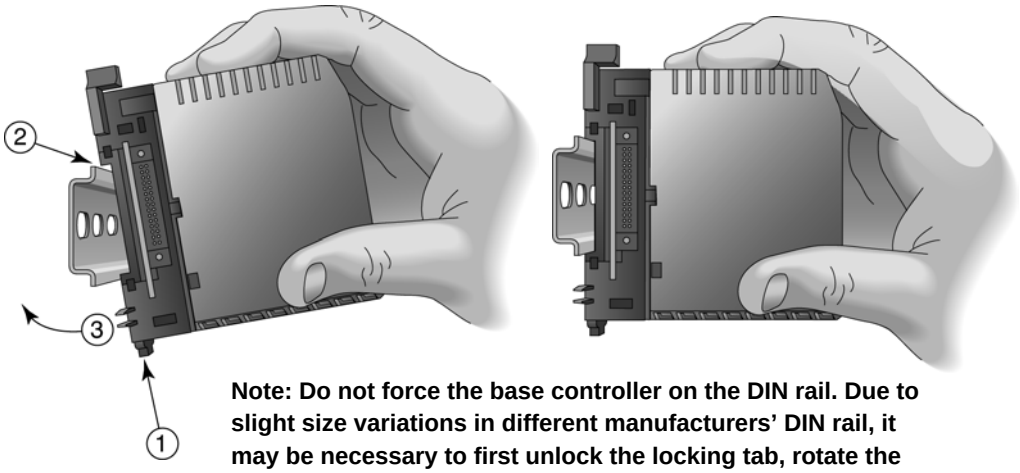
NOTE: T1H-PBC Module is retired as of 08/20. No replacement is available.

Installing the T1H–PBC

Mounting on DIN Rail

The T1H–PBC installs to the *right* of the first power supply. To mount the module on the DIN rail, follow steps 1 through 3 below.

1. Push in the locking tab on the bottom of the module.
2. Hook the upper tab over the upper flange of the DIN rail.
3. Tilt the module toward the DIN rail until it snaps securely into place.

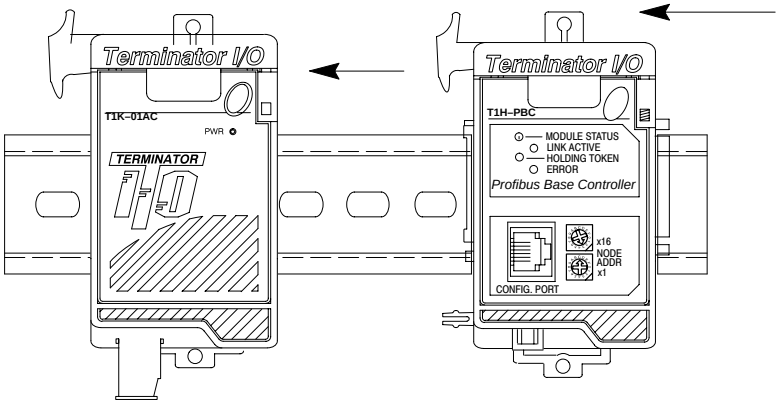


Note: Do not force the base controller on the DIN rail. Due to slight size variations in different manufacturers' DIN rail, it may be necessary to first unlock the locking tab, rotate the module into place, then latch the locking tab.

Assure that power wiring is not connected.

When the module is securely attached to the DIN rail, push the module toward the power supply until the connectors are joined and the release arm of the T1H–PBC has clamped the two modules together.

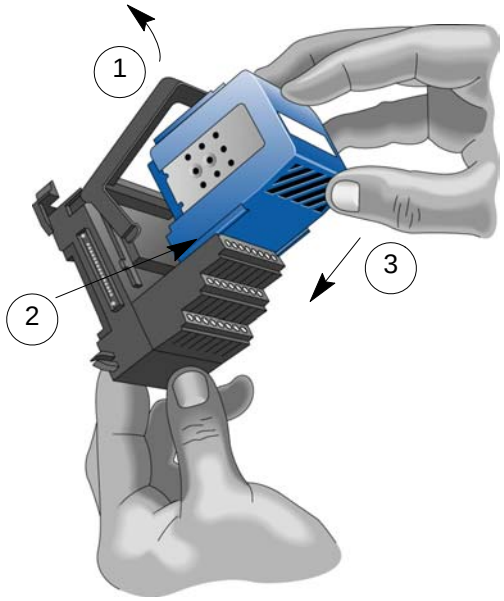
Connecting the Controller to a Power Supply



WARNING: Power to the T1K Power Supply **must** be disconnected before installing or removing the T1H–PBC. Failure to disconnect power could result in serious damage to the module, to the power supply or both.

Continue to add I/O modules to the right of the T1H–PBC as necessary for your application. More information about power wiring and power budgeting is available in the Terminator I/O Installation Manual, T1K–INST–M.

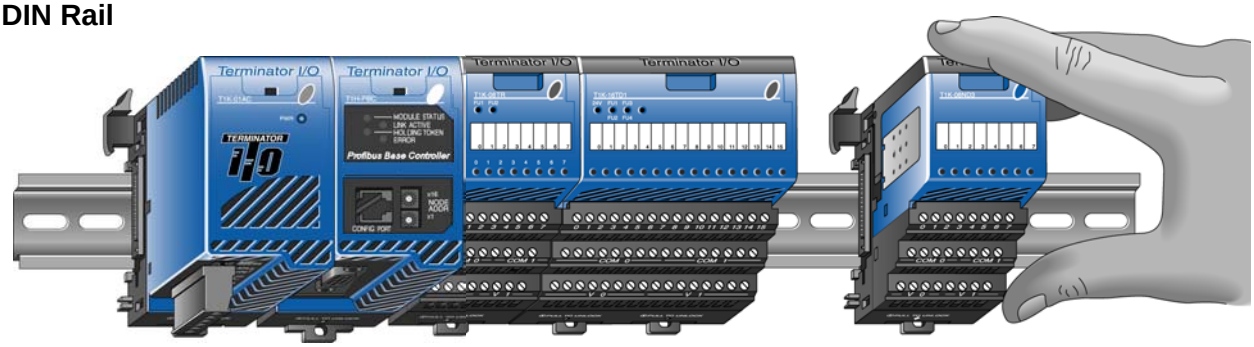
Assembling the I/O Modules and Bases



Insert Module into Base

1. Pull base arm back to allow space for module to enter base
2. Align module slides with base track
3. Press module firmly into base

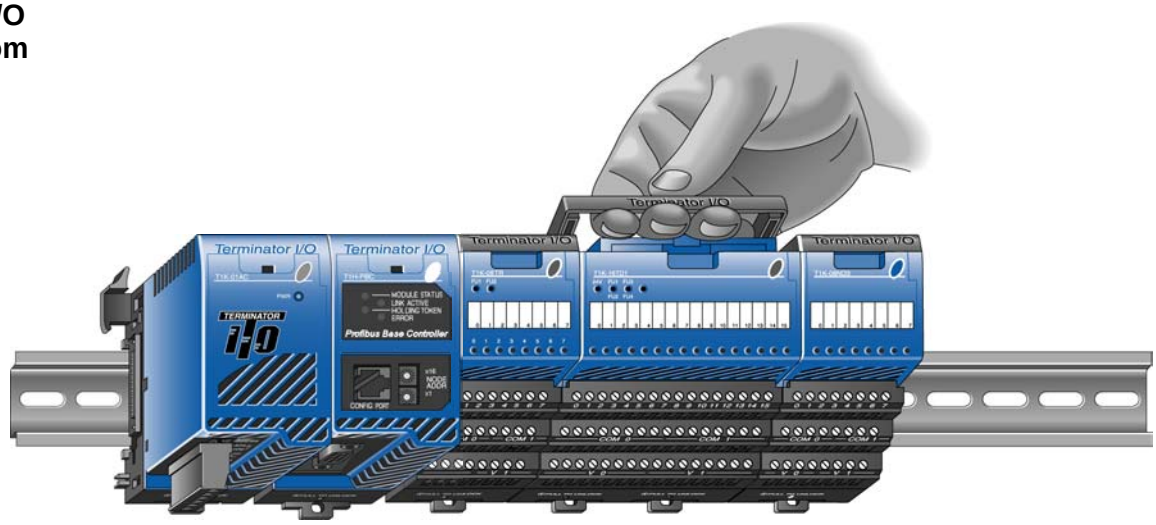
Connecting the Components on the DIN Rail



Slide the module assembly onto the DIN rail until the clip arm attaches securely to the adjacent module.

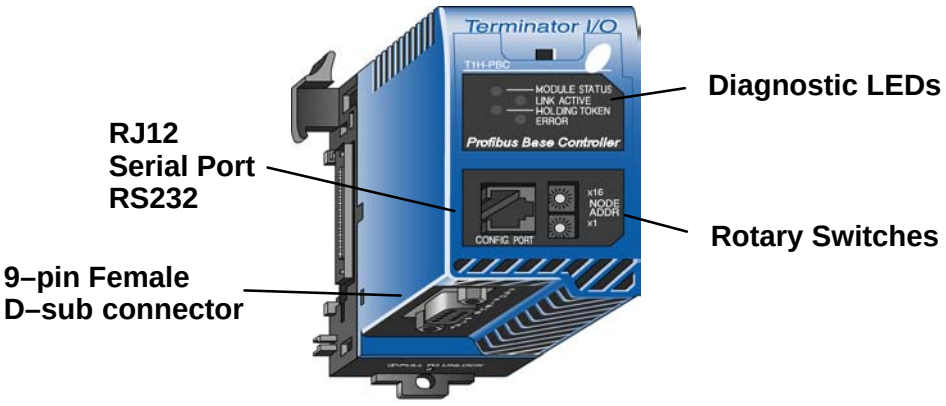
WARNING: Again, be sure that the power to the T1K Power Supply is **disconnected** before installing or removing the module assemby. Failure to disconnect power could result in serious damage to the modules, to the power supply or to the entire assembly.

Removing I/O Modules from the Base



To remove the module from the base, grip the center of the base arm and rotate outward releasing the module.

To remove the module assembly from the DIN rail, lift the clip arm up and slide the module assembly away from the adjacent module. Pull the locking tab down (out) and lift the assembly off the DIN rail. Refer to the “I/O Module Hot Swap Feature”, page 3–17, in the *Terminator I/O Installation and I/O Manual* (**T1K–INST–M**), to remove an I/O module with Terminator I/O system power ON.



Serial Port (RS–232)

The T1H–PBC Serial Port (Config. Port) is only used to update the firmware of the base controller when necessary.

Use AutomationDirect cable part number D2–DSCBL to connect your PC to the RJ12 serial port, or use the following information to make a cable.

Serial Port Pinout	
Pin	**Signal**
1	0V
2	+5V
3	RXD
4	TXD
5	RTS
6	CTS

DIP Switch Settings

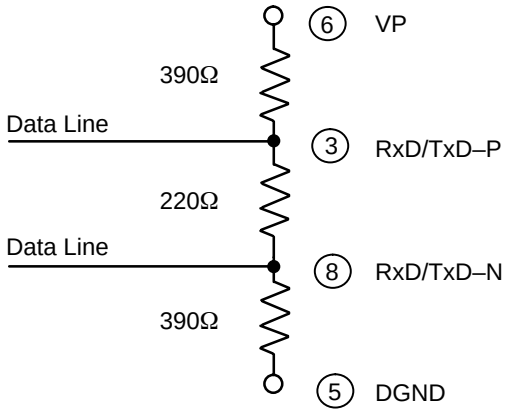
The T1H–PBC base controller has a DIP Switch located on the side of the unit, opposite the power supply. This DIP switch is reserved for future use.

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.

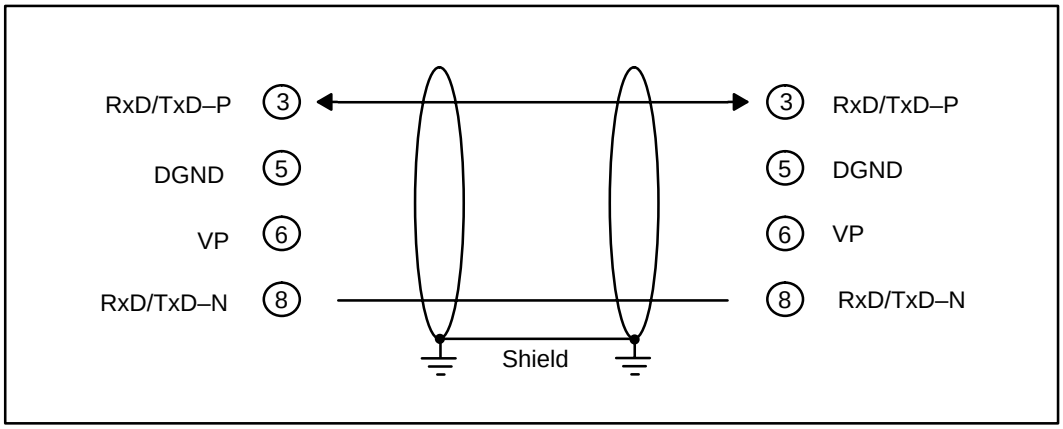
The Profibus network is generally connected with a shielded, twisted pair, cable. The shield must to be connected to the protective housing of the connector which is then brought to ground through the connection on the device. Care must be taken when connecting the wires to the connectors that the shield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

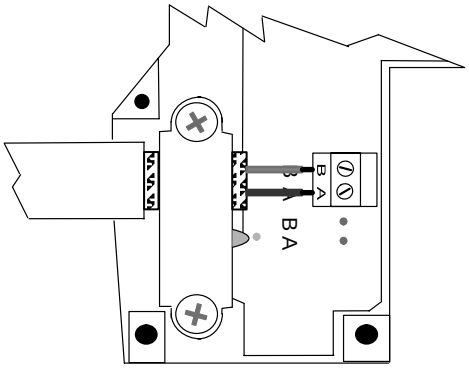
A 9–pin D–sub connector is required for connecting to Profibus networks using RS–485 for communication. The connector pin assignment and the wiring is shown in the following diagram.



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 DP Base Controller, one for a standard termination and one for a node termination.

Standard vertical termination
AutomationDirect Part No. 103659.



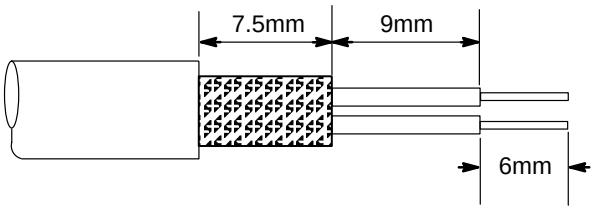
Termination showing the cable connection to points A (Red) and B (Green).

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 preparration of the Profibus network cable.

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



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.

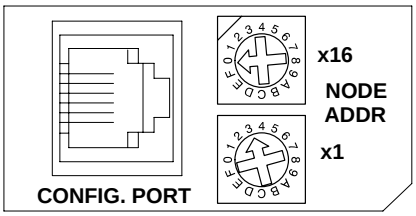
For installation applications where there is electromagnetic interference or to cover longer distances, fiber optic cable can be used for the Profibus field bus networks. Refer to Profibus guideline 2.022 for the specification of the Profibus fiber optic transmission method. For an overview of the fiber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

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.

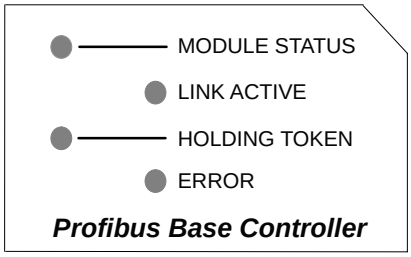
It is recommended that slave devices begin with address “3”. The slave devices need to be addressed in consecutive order by bus location moving away from the master.

Use a small flat screwdriver to set the Node Address to an available Node Address, from 3 – 125. Node Address 0 is normally reserved for the Profibus network master. Note that x16 represents the sixteens place and x1 represents the units place.



Status Indicators

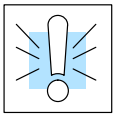
The Controller has four Status Indicators: Module Status, Link Active, Holding Token and Error.



Indicator	Action	Status
MODULE STATUS	ON	Powerup check passed
	OFF	Powerup check failed
	Blinking	I/O in base does not match configuration
LINK ACTIVE	ON	Connected to network
	OFF	Not connected to network or incorrect configuration
HOLDING TOKEN	ON	Correct configuration and running
	OFF	Incorrect configuration
ERROR	ON	Watchdog timer timeout

Hot–Swapping I/O Modules

The Hot–Swap feature allows Terminator I/O modules to be replaced with Terminator I/O system power ON so that the other I/O modules can continue to function. Be careful not to touch the terminals with your hands or any conductive material to avoid the risk of personal injury or equipment damage. ***It is always best to remove power if it is equally convenient to do so***. The T1H–PBC Hot–Swap parameter is configured in the GSD file which is loaded in the master controller. These parameters are set to Automatic I/O reconfiguration by default. If Manual I/O reconfiguration is desired, this can be selected during configuration of the Master.



WARNING: Only authorized personnel fully familiar with all aspects of the application should replace an I/O module with system power ON.

Check External 24VDC Wiring Before Hot–Swapping

Before Hot–Swapping an analog I/O module or a DC output module in a Terminator I/O system, make sure that each of the analog I/O and DC output module's 24VDC and 0VDC base terminals are wired directly to the external power supply individually. If the external 24VDC / 0VDC is jumpered from base to base in a daisy chain fashion, and an analog I/O or DC output module is removed from its base, the risk of disconnecting the external 24VDC to the subsequent I/O modules exists.

Hot–Swap: I/O Module Replacement

The following steps explain how to Hot–Swap an I/O module.

1. Remove the I/O module from the base. If necessary, refer to the***Terminator I/O Installation & I/O Manual*** for steps on removing an I/O module.
2. The T1H–PBC Module Status indicator will begin to blink, and scanning of the other I/O modules will continue to scan.
3. After the new I/O module has been installed, the Module Status indicator will turn ON with Auto I/O reconfiguration Hot–Swap enabled, and scanning of the I/O module will automatically begin. If Manual I/O reconfiguration Hot–Swap was enabled, the Module Status indicator will continue to blink, and the T1H–PBC will need to be manually reset by toggling the first bit in the first output byte within the user program in order to begin scanning the I/O module again (refer to Memory Map, page 2–14).

Note: It is good safe practice to disable outputs before Hot–Swapping modules if the application allows this.

Configuring the Controller

Use the Profibus configuration tool (this should come with the master unit) to configure the master and the T1H–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 T1H–PBC takes place whenever the Profibus master is configured. The characteristic communication features of the T1H–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 T1H–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.

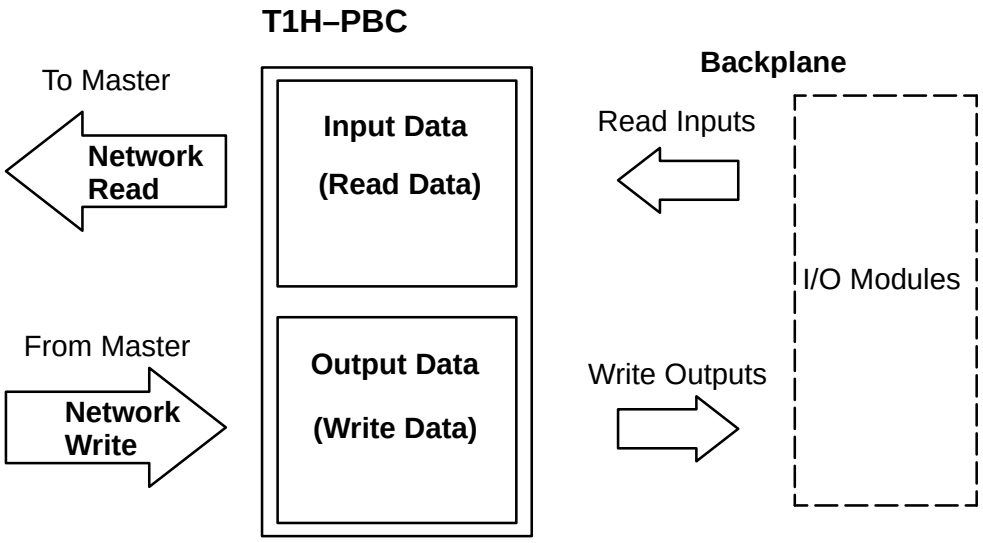
T1H–PBC Configuration

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.

4. **Set the Controller Node Address:**
   Make sure that the T1H–PBC DP Base Controller node address is set to an available node number on the Profibus network (from 3 to 125).
5. **Configure the Profibus master:**
   Configure the Profibus master with the Profibus Configuration Tool that was supplied with the master controller to configure the T1H–PBC and the Terminator I/O.
6. **Add the GSD file:**
   When configuring the Profibus master, add the T1H–PBC slave GSD file from the disk which came with this manual or from our web site **www.automationdirect.com**.
7. **Commission the Node:**
   Use the Profibus Configuration Tool used to configure the master to put the system on line.
8. **Scan the I/O:**
   Use the monitor utility that comes with the configuration tool to scan the Terminator I/O.
9. **View Indicators on the T1H–PBC module:**
   Refer to the Status Indicators when connecting to the network.

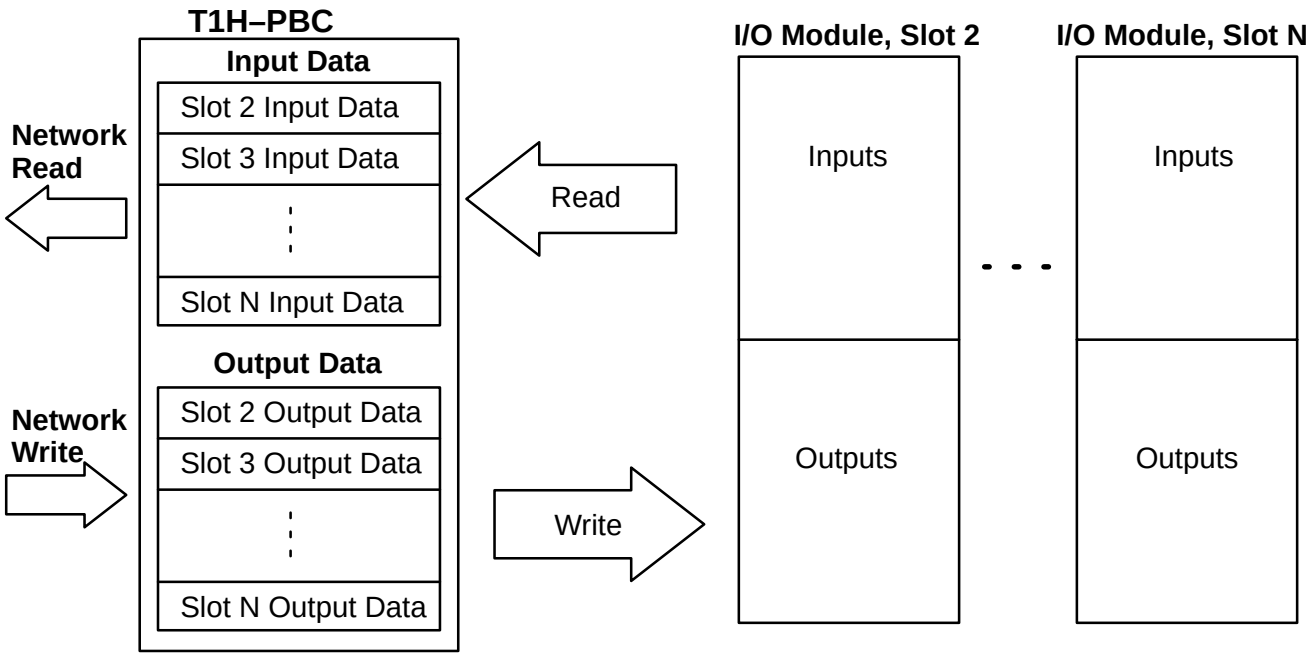
Master/Slave Communications

The T1H–PBC DP base controller (slave) communicates with the DP master by sending Input Data and receiving Output Data. The DP master *reads* Inputs from I/O Modules and *writes* Outputs to I/O Modules.



Terminator I/O Backplane Communications

The Controller communicates with its I/O modules over the backplane. The I/O is mapped in consecutive order as shown.



T1H–PBC Memory Map

T1H–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. The maximum amount of I/O memory per T1H–PBC station is 244 input bytes and 242 output bytes. The maximum 244 output bytes are not available because the first two output bytes are reserved as control bits for system functions. Only one control bit, the first bit in the first output byte, is available while the rest are reserved for future use. The bit that is available is used for manual I/O reconfiguration during Hot–Swap (refer to page 2–11).

Terminator I/O Memory Map

TheTerminator family of I/O modules is available in many types and I/O densities. Discrete I/O modules are available in 8 point and 16 point input and output types. The 8 point modules consume 1 byte of I/O memory, and the 16 point modules consume 2 bytes of I/O memory. Analog I/O modules, when used in a T1H–PBC station, consume 2 bytes per channel and are offered in 8 channel and 16 channel input and output types, as well as combination modules of 8 channel in / 4 channel out. In order to determine if your system is within the maximum I/O that can be used by a single T1H–PBC station (244 input bytes and 242 output bytes), you must calculate the amount of I/O memory consumed by each station.

Calculate I/O Memory Consumption

The following charts will show how a typical Terminator station is configured, and the amount of I/O memory consumed.

Input Type	Bytes/Module	Modules/Station	Total Bytes
8 point discrete	1	1	1
16 point discrete	2	1	2
8 channel analog	16	4	64
16 channel analog	32	4	128
TOTALS		10	195

Output Type	Bytes/Module	Modules/Station	Total Bytes
8 point discrete	1	0	0
16 point discrete	2	2	4
8 channel analog	16	2	32
16 channel analog	32	2	64
TOTALS		6	100

The total amount of input bytes consumed is 195, the total amount of output bytes consumed is 100 and there are a total of 16 I/O modules in the example Terminator station.

Note: It is important to consider the Terminator I/O power budget when configuring your T1H–PBC system. Refer to the ***Terminator I/O Installation Manual* (T1K–INST–M)**.