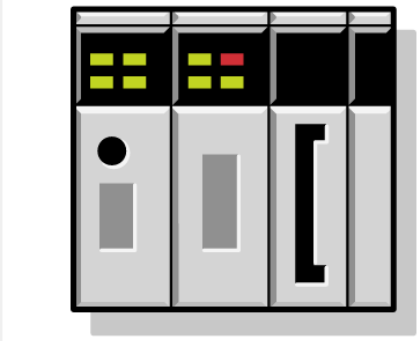
Allen-Bradley

SLC 500™ PROFIBUS DP Slave/Adapter Module

(Cat. No. 1747-APB)



User Manual

Important User Information

Because of the variety of uses for the products described in this publication, those responsible for the application and use of this control equipment must satisfy themselves that all necessary steps have been taken to assure that each application and use meets all performance and safety requirements, including any applicable laws, regulations, codes, and standards.

The illustrations, charts, sample programs and layout examples shown in this guide are intended solely for purposes of example. Since there are many variables and requirements associated with any particular installation, Allen-Bradley does not assume responsibility or liability (to include intellectual property liability) for actual use based on the examples shown in this publication.

Allen-Bradley publication SGI-1.1, Safety Guidelines for the Application, Installation, and Maintenance of Solid-State Control (available from your local Allen-Bradley office), describes some important differences between solid-state equipment and electromechanical devices that should be taken into consideration when applying products such as those described in this publication.

Throughout this manual, we use notes to make you aware of safety considerations:

ATTENTION: Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss.

Attention statements help you to:

- identify a hazard
- avoid the hazard
- recognize the consequences

Important: Identifies information that is critical for successful application and understanding of the product.

Shading is 25% black. Font is Helvetica Narrow 14 (or equivalent). Each tab is 2.0” long. The PROFIBUS DP Network tab should start 2.50” down from top of page. Thus, the SLC System tab will be 2.50” up from bottom of page.

The tabs shown below illustrate how the finished tabs should look.

Chapters 2, 3, and 4.

Chapters 5, 6, 7, 8, and 9.

Chapters 10 and 11.

Table of Contents

Preface

Read this preface to familiarize yourself with the rest of the manual. This preface covers the following topics:

- who should use this manual
- the purpose of this manual
- conventions used in this manual
- Allen-Bradley support

Who Should Use this Manual

Use this manual if you are responsible for designing, installing, programming, or troubleshooting control systems that use programmable controllers on a PROFIBUS DP system.

You should have a basic understanding of programmable controller products. You should also have some knowledge of the PROFIBUS DP Standards (DIN 19245 Part 1, Issue 1991, and Draft DIN 19245 Part 3, Issue 1993). If you do not, contact your local Allen-Bradley representative for information on available training courses before using this product.

Purpose of this Manual

This manual is a learning and reference guide for the 1747-APB adapter module. It describes the procedures you use to install and operate the 1747-APB module, and provides the configuration information you need for your DP master.

Contents of this Manual

Tab	Chapter	Title	Contents
		Preface	Describes the purpose, background, and scope of this manual. Also specifies the audience for whom this manual is intended.
	1	Quick Start for Experienced Users	Serves as a fast installation and start-up guide for users who are familiar with PROFIBUS DP network operation.
PROFIBUS DP Network	2	Profibus DP Overview	Gives an overview of PROFIBUS DP operation, and lists other PROFIBUS products offered by Allen-Bradley.
	3	Connecting to the PROFIBUS DP Network	Contains network wiring information.
	4	Configuring the PROFIBUS DP Master	Provides the configuration and parameter data needed for the PROFIBUS DP master.
1747-APB Module	5	1747-APB Module Overview	Provides an overview of the 1747-APB module, and covers the compatible devices for the SLC chassis and the features of the 1747-APB module.
	6	Installing the 1747-APB Module	Explains setting the DIP switch and station number switch, and provides installation procedures and wiring guidelines.
	7	Start-Up and Operation	Explains powerup and initialization sequences, normal operation, and remote expansion chassis power loss.
	8	Troubleshooting	Shows how to interpret and correct problems with your 1747-APB module.
	9	Specifications	Gives 1747-APB module and PROFIBUS DP network specifications.
SLC System	10	Understanding Your SLC 500 Control System	Provides a chassis overview, power supply specifications, and recommendations for safely installing and mounting the control system.
	11	Installing and Wiring I/O Modules	Explains installation procedures and wiring guidelines for I/O modules.
	Appendix A	Throughput	Shows how to calculate the contribution the 1747-APB module adds to the PROFIBUS system throughput.
	Appendix B	Device Data Base File	Provides an example Device Data Base file for the 1747-APB module.
		Glossary	Contains definitions for terms and abbreviations that are specific to this product.

Related Documentation

The following documents contain additional information concerning Allen-Bradley SLC™ products. To obtain a copy, contact your local Allen-Bradley office or distributor.

For	Read this Document	Document Number
An overview of the SLC 500 family of products	SLC 500 System Overview	1747-2.30
Information regarding the use of analog modules with the SLC 500 system	SLC 500 Analog I/O Modules User Manual	1746-6.4
A detailed overview of Allen-Bradley PROFIBUS products	Allen-Bradley PROFIBUS System Overview	1785-2.39
Information on how to install and use the PLC-5® PROFIBUS Coprocessor	PLC-5 PROFIBUS Coprocessor User Manual	1785-6.5.15
Instructions on installing and using the PROFIBUS Manager software	PROFIBUS Manager Software User Manual	1785-6.5.20
Instructions on installing and using the PROFIBUS Local Station Manager software	PROFIBUS Local Station Manager Software User Manual	1785-6.5.21
Information on how to install and use the PROFIBUS Flex I/O adapter	1794-APB Flex I/O PROFIBUS Adapter User Manual	1794-6.5.6
In-depth information on grounding and wiring Allen-Bradley programmable controllers	Allen-Bradley Programmable Controller Grounding and Wiring Guidelines	1770-4.1
A description of important differences between solid-state programmable controller products and hard-wired electromechanical devices	Application Considerations for Solid-State Controls	SGI-1.1
A complete listing of current Allen-Bradley documentation, including ordering instructions. Also indicates whether the documents are available on CD-ROM or in multi-languages.	Allen-Bradley Publication Index	SD499
A glossary of industrial automation terms and abbreviations	Allen-Bradley Industrial Automation Glossary	AG-7.1

Common Techniques Used in this Manual

The following conventions are used throughout this manual:

- Bulleted lists such as this one provide information, not procedural steps.
- Numbered lists provide sequential steps or hierarchical information.
- *Italic* type is used for emphasis.

We also use this convention to call attention to helpful information.

Allen-Bradley Support

Allen-Bradley offers support services worldwide, with over 75 Sales/Support Offices, 512 authorized Distributors and 260 authorized Systems Integrators located throughout the United States alone, plus Allen-Bradley representatives in every major country in the world.

Local Product Support

Contact your local Allen-Bradley representative for:

- sales and order support
- product technical training
- warranty support
- support service agreements

Technical Product Assistance

If you need to contact Allen-Bradley for technical assistance, please review the information in the *Troubleshooting* chapter first. Then call your local Allen-Bradley representative.

Quick Start for Experienced Users

This chapter helps you to get started using the 1747-APB module; a DP slave (adapter) that can be used with any PROFIBUS DP master.

We base the procedures here on the assumption that you understand the PROFIBUS network and DP protocol. You also must have a basic understanding of programmable controller products.

Because it is a start-up guide for experienced users, this chapter *does not* contain detailed explanations about the procedures listed. It does, however, reference other chapters in this book where you can get more information.

If you have any questions, or are unfamiliar with the terms used or concepts presented in the procedural steps, *always read the referenced chapters* before trying to apply the information.

This chapter:

- tells you what tools and equipment you need
- lists preliminary considerations
- describes how to configure the 1747-APB module
- explains how to install and wire the 1747-APB and I/O modules
- describes connection of the PROFIBUS DP network
- lists the information needed for configuring the DP master for communication with the 1747-APB module
- discusses system power-up procedures

Required Tools and Equipment

You must supply the following equipment to connect your 1747-APB module to a PROFIBUS DP network (see chapter 3 for more information):

- a 9 pin D-sub connector
- network connection equipment

  For Line Type A (baud rates up to 1.5M bit/s): shielded twisted pair cable (We recommend Belden PROFIBUS cable, 3079A.)

  For Line Type B (baud rates up to 500k bit/s): drop cables, T-junction connectors, and bus segment cables (We recommend Sprecher + Schuh equipment.)
- termination blocks, if the devices on the end of the network do not have built-in terminating resistors (We recommend Sprecher + Schuh, Catalog Number PCE-0, Part Number 87.890.284-01.)

Important: We assume you are familiar with the connection equipment of the PROFIBUS network. Refer to the installation instructions shipped with this equipment for installation and precautionary information.

Procedures

1.	Check the contents of shipping box.	Reference

Unpack the shipping box making sure that the contents include:

- SLC 500 PROFIBUS adapter module (Catalog Number 1747-APB)
- user manual (Publication 1747-6.14)
- Device Database File diskette (GSD file)

If the contents are incomplete, call your local Allen-Bradley/Sprecher+Schuh representative for assistance.

2.	Ensure your chassis supports placement of the 1747-APB module.	Reference

Check to see that your 1746 chassis supports placement of the adapter module by:

- reviewing the power requirements of your system (The adapter consumes 0.6A @ 5 Volts.)
- calculating the total load on the 1746 system power supply using the worksheet provided on page 10–6.

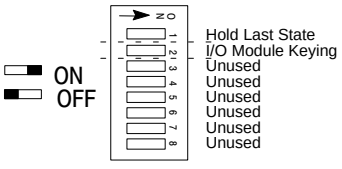
Chapter 9 *(Specifications)*

Chapter 10 *(Understanding Your SLC 500 Control System)*

3.	Configure the module using the DIP switch.	Reference

Set the DIP switch (located on the printed circuit board) to the desired setting.

Chapter 6 *(Installing the 1747-APB Module)*



1. Hold Last State

   ON = Hold Last State

   OFF = Do Not Hold Last State (default)

2. I/O Module Keying

   ON = Save Mode (default)

   OFF = Check Mode

Switches 3–8 are not used and should remain in their default positions (OFF) to ensure proper operation of the module.

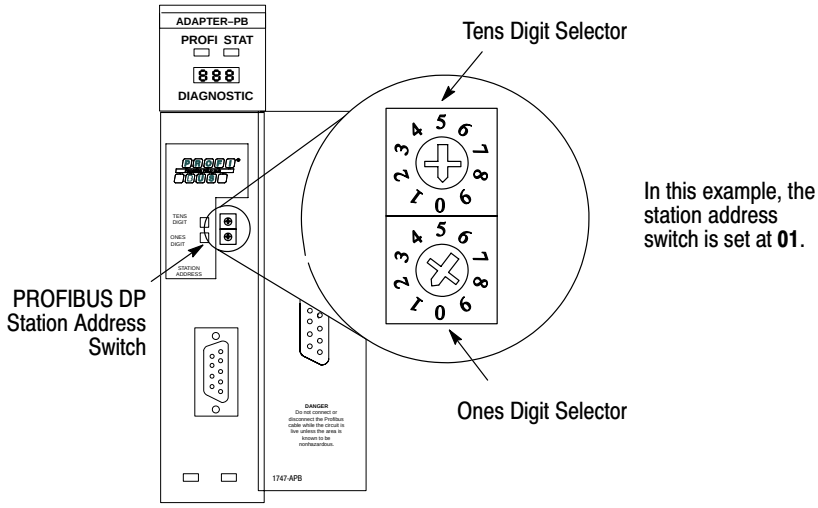
4. Set the station address switch.

Reference

To change the station address to a new setting, use a screwdriver to turn each of the selector switches. Allowable settings range from 01 to 99. The switches can be turned either clockwise or counterclockwise.

Chapter 6 *(Installing the 1747-APB Module)*

Important: The PROFIBUS DP protocol mechanisms do not provide the ability to detect and report a duplicate station address between a DP master and a DP slave device, or between two DP slaves (only between two DP masters).



5. Install the 1747-APB and I/O modules in the 1746 chassis.

Reference

Chapter 6 *(Installing the 1747-APB Module)*

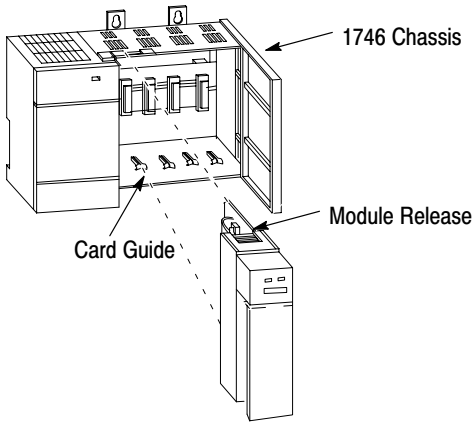
> **ATTENTION:** Never insert, remove, or wire modules with power applied to the chassis or devices wired to the module.

Follow the steps below:

Chapter 11 *(Installing and Wiring I/O Modules)*

1. Make sure system power is off; then insert the modules into the 1746 chassis.

   Important: The 1747-APB module must be inserted into the left slot (slot 0), as shown below. Do not install the 1747-APB module in a 1746 expansion chassis.



2. Cover any unused slots with card slot fillers (Catalog Number 1746-N2) to keep the chassis free from debris and dust.
3. Write the appropriate slot, chassis, and module type on the removable terminal block labels supplied with the 1746 I/O modules.
4. Wire the I/O devices.

6. Attach the octal labels, if applicable.

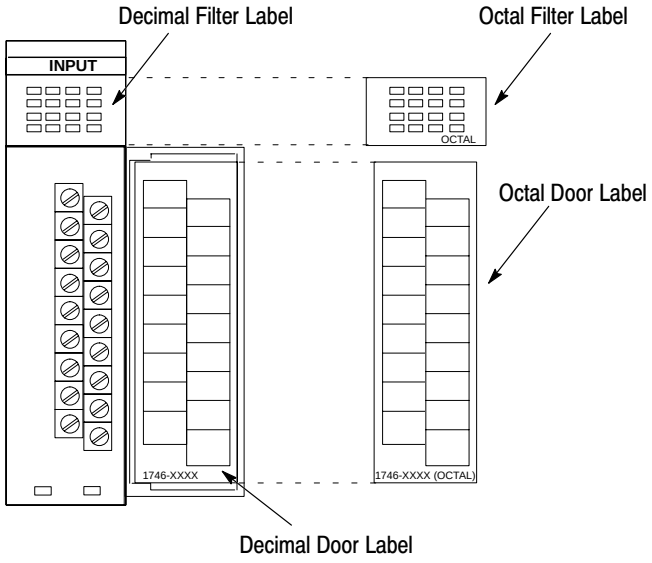
Reference

Chapter 11 *(Installing and Wiring I/O Modules)*

Important: This step only applies if the DP master uses octal bit addressing.

A list of I/O modules that include an octal label kit can be found on page 11–10.

Adhere the octal labels over the existing decimal labels, as shown below.



7. Connect all devices on the PROFIBUS DP network.

Reference

Chapter 3 *(Connecting to the PROFIBUS DP Network)*

Ensure that you:

- Select the appropriate line type (A or B) for your requirements.
- *For line type A (up to 1.5M bit/s):* Daisy chain each network device.
  For line type B (up to 500k bit/s): Use drop cables, T-junctions, and bus segments to connect the PROFIBUS media.
- Connect the appropriate termination resistors or blocks on each end of the network.
- Attach the bus connector to the socket 9 pin D-sub connector on the front of the 1747-APB module for connection to the network.

8. Configure the DP master for communication with the adapter module.

Reference

Use your DP master's configuration software to define the configuration and parameter data in the PROFIBUS DP master.

In addition, bus parameters and the location of I/O data within the DP master data tables must be defined. See your DP master's user manual for details.

Chapter 4 *(Configuring the PROFIBUS DP Master)*

your DP master's user manual

9. Go through the system start-up procedure.

Reference

Chapter 7 *(Start-Up and Operation)*

> **ATTENTION:** Never insert, remove, or wire modules with power applied to the chassis or devices wired to the module.

Follow the steps below:

1. Cycle power in save mode (I/O Keying DIP switch ON).
2. Remove power from the system.
3. Remove the 1747-APB module and put it in check mode (I/O Keying DIP switch OFF).
4. Replace the 1747-APB module in slot 0.
5. Apply power to your system.

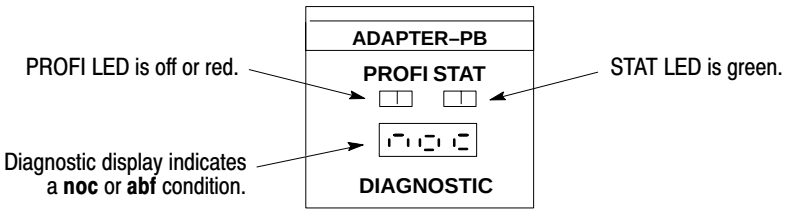
10. Check that the module is operating correctly.

Reference

During normal operation, when not connected to a PROFIBUS line or not yet initialized, the 1747-APB module appears as shown below:

Chapter 7 *(Start-Up and Operation)*

Chapter 8 *(Troubleshooting)*

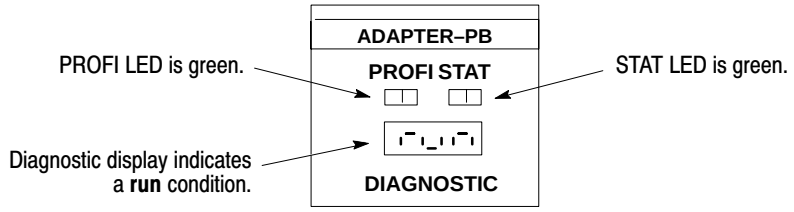


11. Initialize master/slave communication.

Reference

Once communication is established with the master, the 1747-APB module appears as shown below:

your DP master's user manual



PROFIBUS DP Overview

Read this chapter for an overview of PROFIBUS DP. Topics include:

- introduction to PROFIBUS DP
- communication between DP masters and DP slaves
- PROFIBUS DP products available from Allen-Bradley

Introduction to PROFIBUS DP

PROFIBUS DP is the performance-optimized version of PROFIBUS. It is a remote I/O protocol designed for high-speed data transmission between automation systems and distributed peripherals, such as remote I/O chassis or operator interface panels. PROFIBUS DP is most useful for time-critical communication.

There are two main devices on the PROFIBUS DP network: the DP master(s) and DP slave(s). The DP master acts as a requester of data from the DP slaves. A DP master of controller type (Class 1) may also act as a responder to requests made from a DP master of management type (Class 2).

The DP slaves act only as responders to a DP master, implementing a defined set of functions. These functions are:

- data exchange
- check configuration
- set parameters
- read diagnostics
- get configuration
- global control①
- read output
- read input
- set slave address②

① Only Clear Data is supported by the 1747-APB module.

② Not supported by the 1747-APB module.

Communication Between DP Masters and DP Slaves

The PROFIBUS DP network uses the polling principle for communication, in which the DP master sends and requests information, and the DP slave sends back a response. This is a cyclic exchange of information that occurs independently from the actual update of the database by the DP master and DP slave application.

Before data exchange begins, each device on the network must have a unique station number assigned to it. (See chapter 6 for information on setting the 1747-APB module's station number.)

How Data is Exchanged on the Network

To exchange I/O data with the DP slaves on the network, the DP master must have sets of parameter and configuration data for each DP slave. This data contains all the information necessary to define the DP slave. In addition, the DP master's parameter data includes bus parameters and an address assignment table.

Data is exchanged over predefined Source and Destination Service Access Points (SSAPs and DSAPs). The maximum size of data that can be exchanged is 244 bytes.

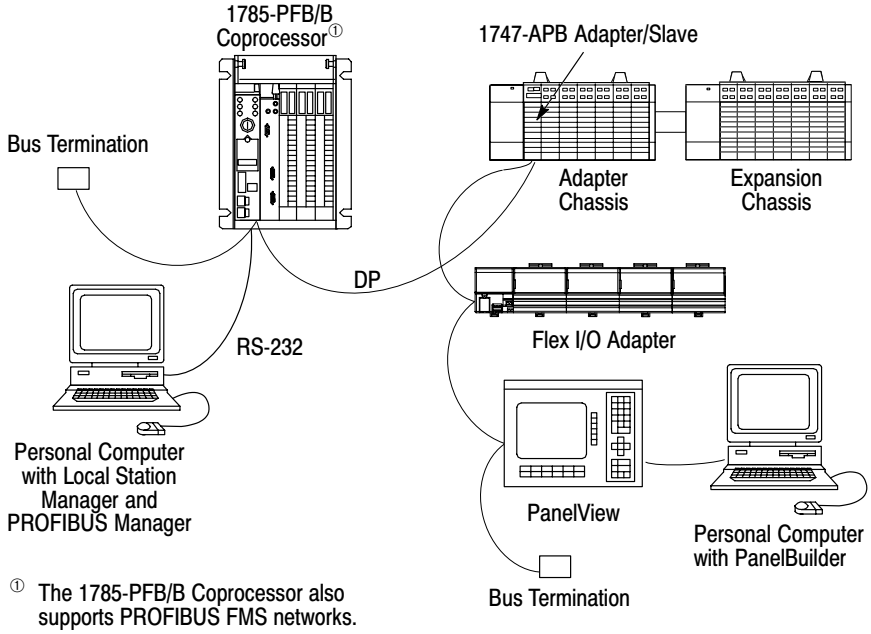
Defining the DP Slave Data

The structure of the DP slave configuration data can be divided into a maximum of 64 *logical modules,* (however, the 1747-APB module supports *30* due to physical slot limitations), each with as many as 16 words of input and or output data. The configuration also specifies whether the data is sent in bytes or words.

When communication begins, the DP master sends the DP slave parameter data and information on what it expects is the DP slave's configuration data. Upon receipt, the DP slave compares this information to its actual configuration. If the master's information does not exactly match the slave's actual configuration, a fault occurs. (See chapter 4 for specific information on defining data for the 1747-APB module.)

PROFIBUS DP Products Available from Allen-Bradley

The illustration below shows the Allen-Bradley PROFIBUS DP products and how they fit into an example network configuration.



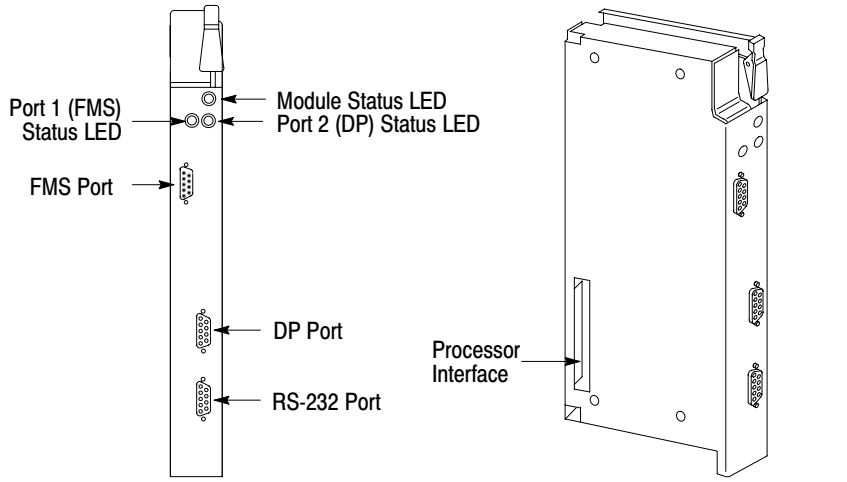
① The 1785-PFB/B Coprocessor also supports PROFIBUS FMS networks.

For more information

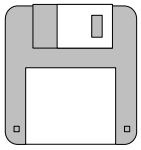
Descriptions of each of these products can be found on the pages that follow. If you need more information, contact your local Allen-Bradley integrator or sales office for assistance.

The 1785-PFB/B Coprocessor

The coprocessor is a communication module that enables a PLC-5 processor to connect and operate as a master/scanner in the PROFIBUS DP (and FMS) network. Through the coprocessor, the PLC-5 processor communicates and controls adapter/slave devices contained in the network.



Local Station Manager Software



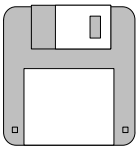
Local Station Manager Software

The Local Station Manager is a PC program that runs under Microsoft® Windows™ version 3.1, and transfers data between your personal computer and the coprocessor over an RS-232 interface.

This software provides management features that enable you to:

- debug and maintain the network
- monitor the network (WHO)
- monitor events
- reset the coprocessor
- change master/slave modes
- monitor diagnostics
- set-up basic communication parameters (i.e., address, maximum address, baud rate)
- download into the coprocessor configuration data defined using the PROFIBUS Manager software

Detailed requirements, installation procedure, management features for troubleshooting and user instructions are explained in the Local Station Manager Software User Manual (publication number 1785-6.5.21) that ships with the 1785-PFB/B coprocessor.



PROFIBUS Manager Software
Catalog Number 1785-PFBMGR

PROFIBUS Manager Software

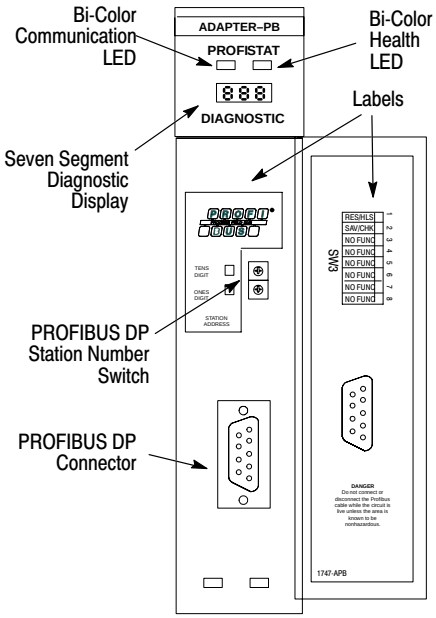
The PROFIBUS Manager is also an Allen-Bradley PC program that runs under Microsoft Windows version 3.1. The software contains all of the functionalities of the Local Station Manager. In addition, this program allows you to create, download and monitor network configurations on your personal computer through an RS-232 interface to your coprocessor.

Use the PROFIBUS Manager to:

- manage projects
- create FMS projects
- create DP projects
- monitor applications
- import and export configurations
- set up communication parameters for your applications:
  - Fieldbus Data Link (FDL)
  - Communication Relationship List (CRL)
  - Object Dictionary (OD)
  - polling cycle timings
  - slave configuration/parameter database

To purchase the PROFIBUS Manager (cat. no. 1785-PFBMGR), contact your local Allen-Bradley representative.

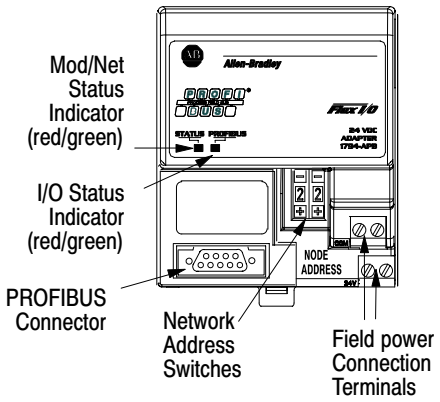
The 1747-APB Module



The 1747-APB module is an SLC 500 single-slot module that interacts with the SLC 500 backplane and any DP master/scanner controller on a PROFIBUS DP network. It occupies the first slot (slot 0) of a 1746 chassis.

This module acts as a DP adapter/slave device to the DP master/scanner controller, and acts as the master of the 1746 chassis in which it is installed. (The module also supports up to two optional expansion chassis.) See chapter 5, *1747-APB Module Overview*, for more information.

The 1794-APB Flex I/O Adapter



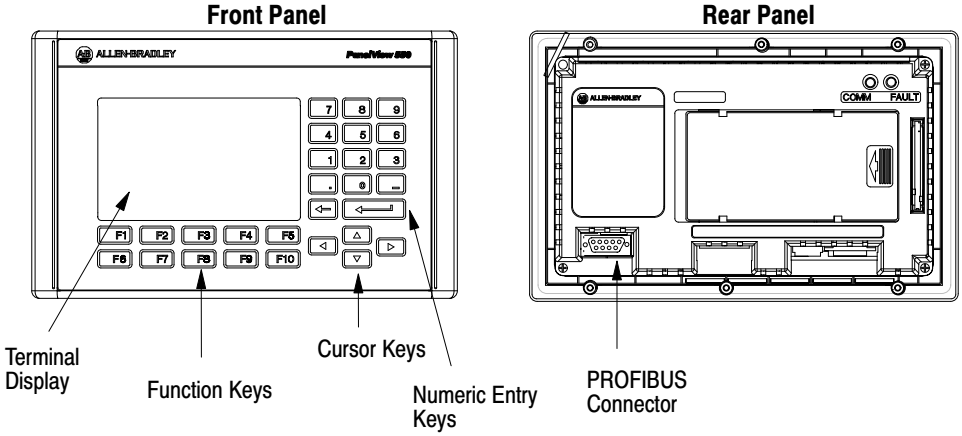
The 1794-APB is a Flex I/O adapter that interacts with the Flex I/O backplane and any PROFIBUS DP master/scanner controller on a PROFIBUS DP network.

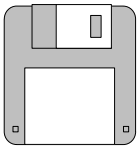
The 1794-APB module acts as an adapter, or slave device, to the DP master/scanner, and acts as the master controller of the Flex I/O system it is installed in.

The I/O data exchange occurs as follows: Output data is sent from the DP master/scanner controller across the PROFIBUS DP network to the 1794-APB adapter. The adapter then automatically transfers the data across the Flex I/O backplane to the output modules. Inputs from the input modules are collected by the Flex I/O adapter via the backplane and sent across the PROFIBUS DP network to the DP master/scanner controller.

PanelView™ Operator Terminal

The PanelView Operator Terminal serves as an operator interface to either the PROFIBUS DP master or an SLC 500 adapter. PanelView offers Keypad or Combination Keypad and Touch Screen terminals for operator input.





PanelBuilder Software
Catalog Number 2711ND2

PanelBuilder™ Software

PanelBuilder is a Microsoft Windows graphic interface that you install on a personal computer. PanelBuilder allows you to create, archive, upload, and download application files to the PanelView terminal.

Connecting to the PROFIBUS DP Network

This chapter presents:

- selecting the line type you should use
- connecting to the network using line type A
- connecting to the network using line type B

Selecting the Line Type You Should Use

The PROFIBUS network media is a balanced transmission line corresponding to the standard EIA RS-485, terminated at both ends. For PROFIBUS DP, you can use line type A and/or line type B, depending on your system requirements. (See the table that follows.)

▶ We recommend using line type A since it is capable of better performance at greater distances, and it supports a baud rate of 1.5M bits/s.

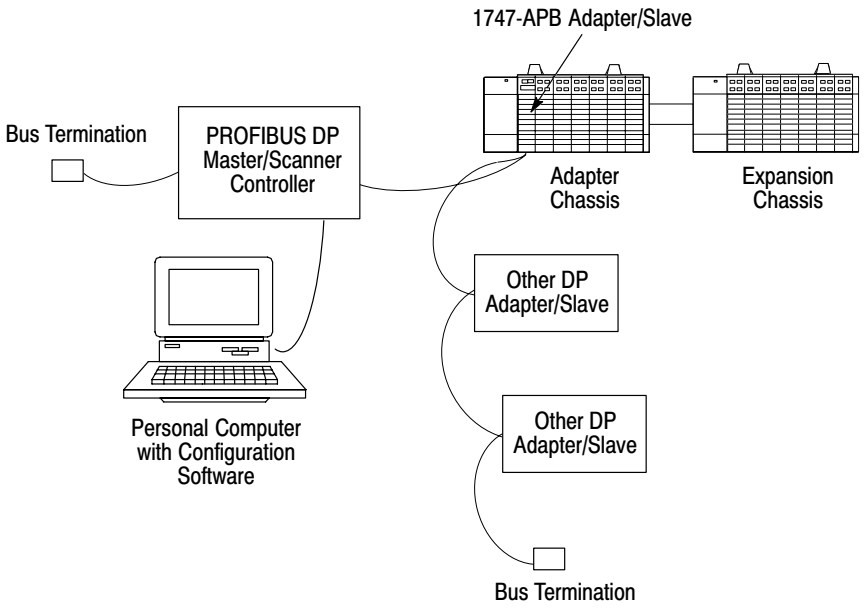
Characteristic		Line Type A Requirements	Line Type B Requirements
Impedance		135–165 Ω (3–20 MHz)	100–130 Ω (f > 100 kHz)
Capacity		< 30 pF/m	< 60 pF/m
Resistance		< 110 Ω/km	–
Wire Gauge		> 0.64 mm	> 0.53 mm
Conductor Area		> 0.34 mm^2	> 0.22 mm^2
Maximum Length① with a Baud Rate of:	≤ 93.75k bit/s	1200 m	1200 m
	187.5k bit/s	1000 m	600 m
	500k bit/s	400 m	200 m
	1.5M bit/s	200 m	NA

NA = Not Applicable

① This is the sum of all bus segment and drop cable lengths. If using a combination of both line types, divide the lengths shown by two.

Connecting to the Network Using Line Type A

For line type A connections, daisy chain each of the network devices together and terminate the line at both ends. (Drop cables are also allowed for line type A; however, we do not recommend using that cabling scheme.) The maximum number of stations on the same network segment is 32 (126 with repeaters).



Important: For detailed information on the topology and cabling for line type A, see the PROFIBUS DP Standard (Draft DIN 19245 Part 3, Issue 1993).

Equipment Needed for Line Type A

Cables

You must use a shielded twisted pair cable for your connections. Off-the-shelf cables can be used to connect your adapter to a PROFIBUS DP network; however, we recommend using Belden PROFIBUS cable, 3079A (for baud rates up to1.5M bits/s).

Termination Blocks

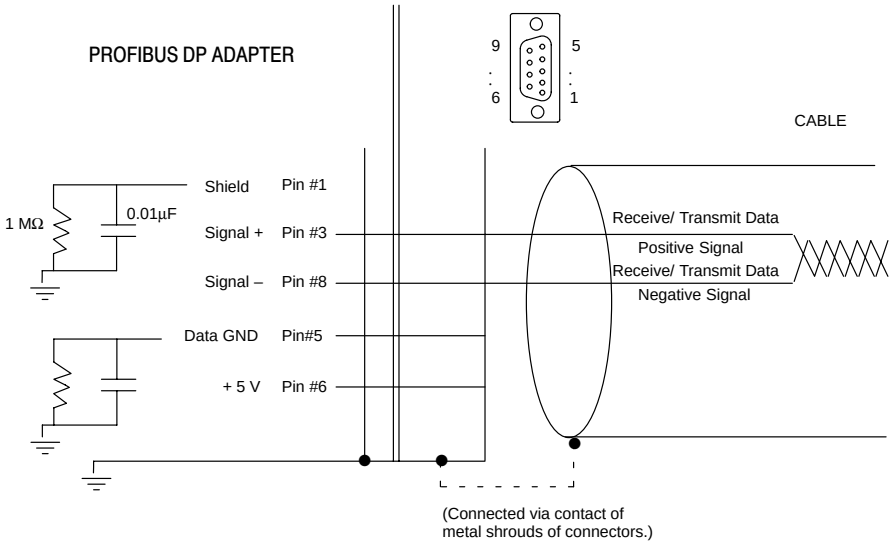
Termination blocks are only needed if the devices or connectors on the end of the network do not have built-in terminating resistors.

Connector

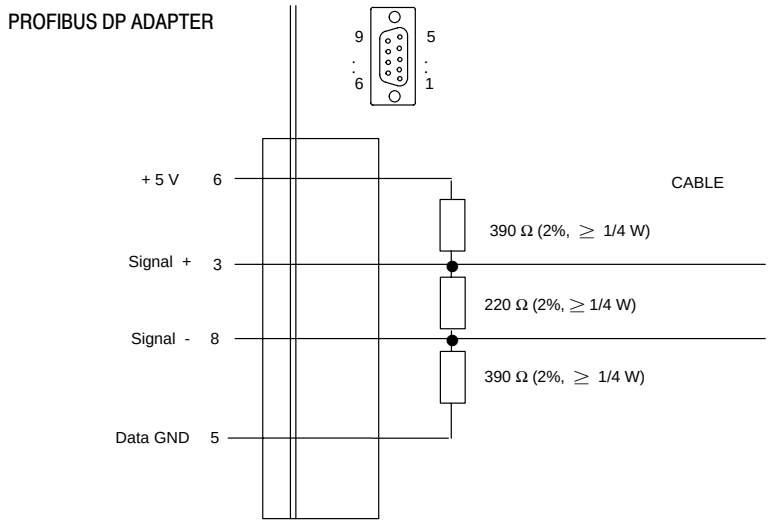
Connect your adapter to the PROFIBUS DP network by attaching a bus connector to the socket 9 pin D-Sub connector on the front of the module. We recommend using any of the following Siemens connectors: Catalog Numbers 6ES7 972-0BA00-0XA0, 6ES5 762-2AA12, or 6ES7 193-9AA00-0XA0.

Connecting Line Type A Cabling

Connect your cabling as shown in the following figure.

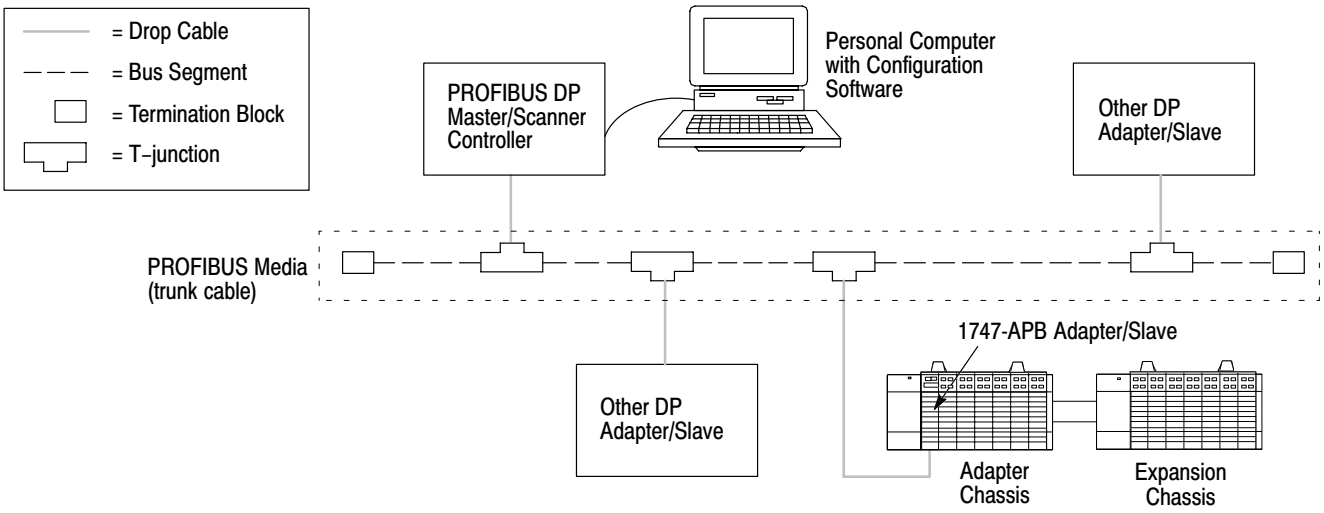


1. Connect the cable shield to the metal shroud of the pin type connector. The shield is connected to the 1746 I/O chassis ground.
2. Connect data signal pins on both ends (Signal+, Pin #3 and Signal–, Pin #8).
3. Terminate the PROFIBUS cable at both ends of the network. If your adapter is located at one of the ends, you must terminate at the PROFIBUS DP connector. Connectors are available that have built-in terminating resistors (such as the Siemens connectors mentioned on page 3–2). If you are not using a connector with built-in resistors, terminate the cable as shown in the following figure.



Connecting to the Network Using Line Type B

When using line type B, T-junctions are used to disconnect or replace a station without breaking the network. The maximum number of stations on the same network segment is 32 (126 with repeaters).



Important: For detailed information on the topology and cabling for line type B, see the PROFIBUS Standard (DIN 19245 Part 1, Issue 1991).

Equipment Needed for Line Type B

You can use off-the-shelf drop-cables, T-junctions, bus segments, and termination blocks to connect your adapter to a PROFIBUS DP network. However, we recommend the following Sprecher + Schuh equipment:

Sprecher + Schuh Equipment	Catalog Number	Part Number
Drop cable ①	PTL-02 PTL-04 PDC-10	87.890.280-02 87.890.280-04 87.890.282-10
T-junction connector	PTS-0	87.890.276-01
Bus segment cable	none	299.257.001
Termination Block	PCE-0	87.890.284-01

① We strongly recommend using shorter drop cables (i.e., PTL-02 or PTL-04).

If you use other equipment, make sure that the bus segment cable contains at least one:

- shielded twisted pair of wires for the data lines
- cable braid shield (to connect drain wire to pin 1 and metal shroud of connector)
- wire for data ground *(optional)*

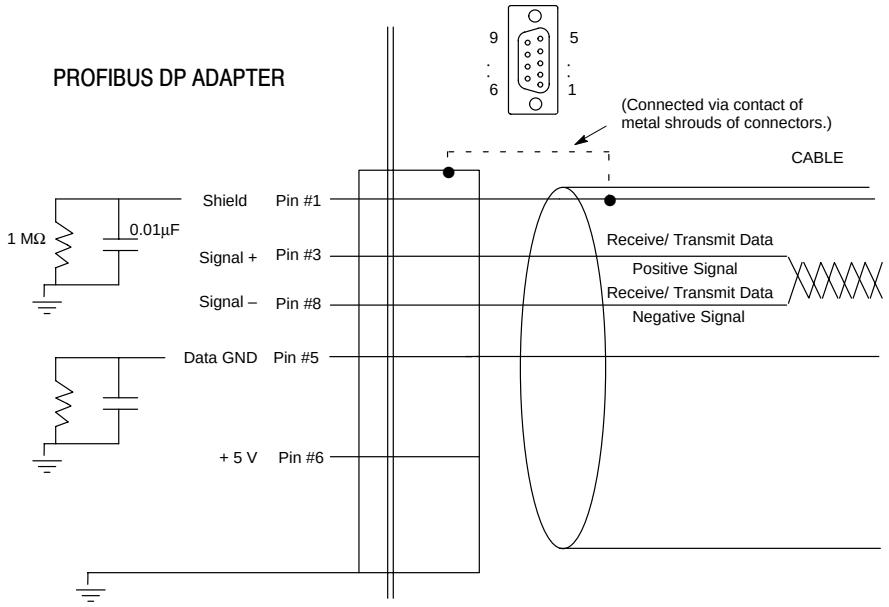
Guidelines for Drop Cables

Per the standard, the recommended drop cable length is 0.3 m (1 ft).

At a baud rate of:	the total capacitance of all drop cables is:	and the total length (cable type B) is:
≤ 19.2k bit/s	15 nanofarads	250 meters
93.75k bit/s	3 nanofarads	50 meters
187.5k bit/s	1 nanofarads	16.6 meters
500k bit/s	0.6 nanofarads	10 meters

Connecting Line Type B Cabling

Connect your cabling as shown in the figure below. The maximum number of stations on the same network segment is 32 (126 with repeaters).

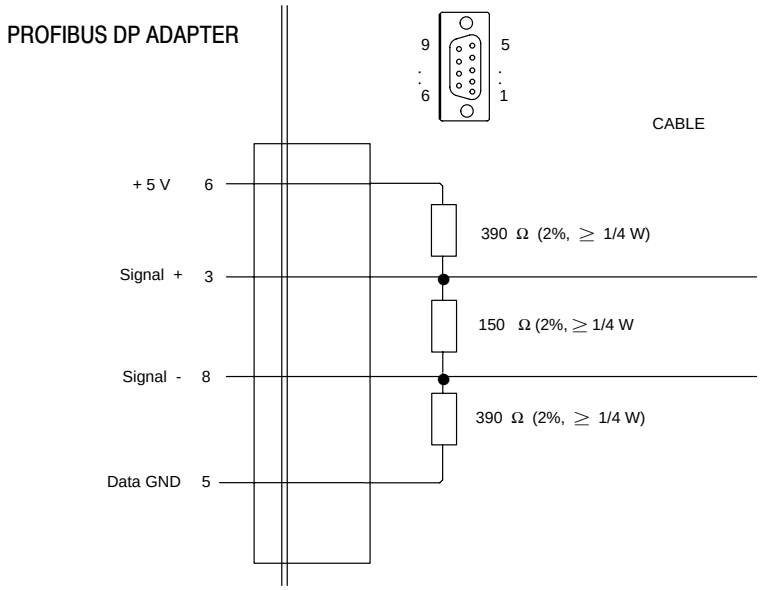


1. Connect the cable shield to pin 1 on both sides. The shield pin (Pin 1 of the PROFIBUS DP connector) is connected by an R/C filter to 1746 I/O chassis ground.
2. Connect data signal pins on both ends (Signal+, Pin #3 and Signal–, Pin #8).
3. Connect data ground pins on both sides. The data ground pin (Pin 5 of the PROFIBUS DP connector) is also connected by an R/C filter to 1746 I/O chassis ground.

4. The cable connector hood is connected to chassis ground directly through the adapter cover. For compliance with the European Electromagnetic Compatibility (EMC) directives, also connect the cable shield to metal shroud of connectors on both sides: this will connect the cable shield directly to local chassis ground at all points on the PROFIBUS DP network, thus bypassing the adapter R/C filter.

   Important: For improved noise immunity in networks featuring long distances, an alternate wiring may be preferred to avoid dc and low frequency ground loops. In such cases, connect the cable shield directly to local chassis ground (via the cable connector hood) at only *one* point on the PROFIBUS DP network.

5. Terminate the PROFIBUS cable at both ends of the network. If your adapter is located at one of the ends, you must terminate at the PROFIBUS DP connector or T-junction. If you are not using Sprecher+Schuh termination blocks, terminate the cable as shown in the following figure.



Configuring the PROFIBUS DP Master

Configuration and parameter information is sent by the master to the 1747-APB module when communication with the module begins. This chapter explains the information required. The following topics are presented:

- entering DP slave data using the device data base
- entering configuration data
- entering parameter data

For information on defining the bus parameters and the location of I/O data within the DP master data tables, see your DP master's user manual.

Entering Slave Data Using the Device Data Base

For ease of configuring your master, a disk containing an electronic device data base is shipped with each 1747-APB module. If your PROFIBUS master's configuration software has the capability to read this `*.gsd` file (DP standard Device Data Base file), the software will automatically extract from this file all the configuration and parameter bytes needed to configure your master for the 1747-APB module. Otherwise you will probably need to manually enter this information into the software. (See your configuration software's user manual for more information.) See appendix B for an example Device Data Base file.

Entering Configuration Data

Upon communication startup, the master's I/O configuration data is sent to the 1747-APB module, for the module to compare with its own I/O configuration data. It contains the range of input and output areas as well as information on data consistency.

On a PROFIBUS DP network, the I/O data exchanged between the PROFIBUS DP master and a DP slave is encapsulated into *logical modules*. One logical module can contain up to 16 words maximum of inputs, outputs, or combined inputs/outputs. The total I/O data exchanged between a PROFIBUS DP master and a DP slave device comprises a set of logical modules, described in configuration data.

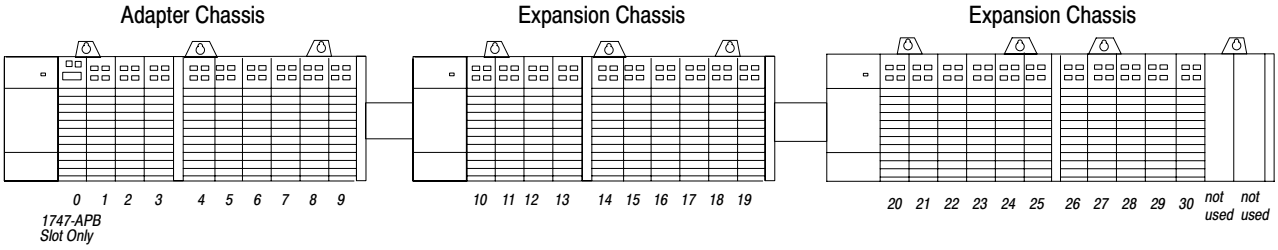
For the 1747-APB module, each slot of the adapter chassis or expansion chassis corresponds to one logical module. An understanding of the physical layout of the chassis will help you define the logical modules.

Understanding Slot Numbering

The 1747-APB module is capable of controlling 1 to 30 physical I/O modules (within the restraints of the PROFIBUS data limits), each of which resides in a chassis slot. When expansion chassis are used, the 1747-APB module treats all of the I/O modules as if they are installed in a single chassis. (For more information on adapter chassis and expansion chassis, see chapter 10.)

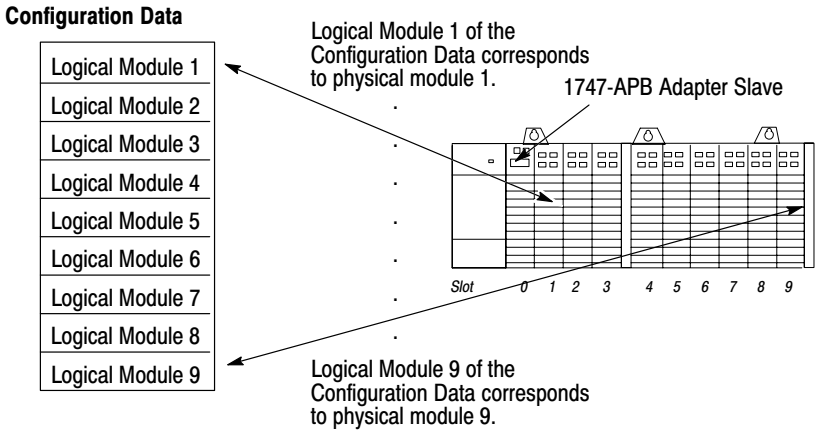
The adapter chassis and expansion chassis slots are numbered from 0–30. Slots numbered 31 and above cannot be used. The 1747-APB module *must* reside in slot 0, as shown below.

Important: Installing modules in slots 31 and above causes a 1747-APB module error.



Mapping Between Logical Modules and Physical Modules

The figure below illustrates the mapping process.



Important: With the 1747-APB, you *cannot* assign more than one physical module to a logical module, and vice versa. If attempted, a 1747-APB configuration error occurs.

Creating the Configuration Data

Important: The configuration data in the master must exactly match the physical configuration of the adapter chassis; otherwise the initialization process of the adapter module will fault, and no I/O communication will occur.

Each logical module is described with a *DP identifier byte*, containing information on the type and point size of the physical module residing in a slot.

Important: If a slot is empty, a corresponding logical module must still be included as part of the configuration data. (See page 4–5 for an example.)

The following table lists the physical modules that the 1747-APB module supports, along with the corresponding DP identifier bytes that describe the logical modules. The table also provides the I/O type, number of words, and data consistency for each module in case your master's configuration software requires you to manually enter this information.

If the Slot Contains:		Its DP Identifier Byte is:	I/O Type is:	Number of Words is:	and Data Consistency is:
nothing (that is, the slot is empty)		00	NA	NA	NA
1746-BAS	BASIC Language Module (used in SLC 5/01 mode only)	77	Input/Output	8 words	word
1746-FIO4I	(2) High-Speed Analog Inputs, Selectable, Current or Voltage, (2) Analog Current Outputs	71	Input/Output	2 words	word
1746-FIO4V	(2) High-Speed Analog Inputs, Selectable, Current or Voltage, (2) Analog Voltage Outputs	71	Input/Output	2 words	word
1746-HS	IMC™ 110 Servo Positioning Module	73	Input/Output	4 words	word
1746-HSTP1	Stepper Controller Module	77	Input/Output	8 words	word
1746-IA4	AC Input Module (4) Inputs — 100/120V ac	50	Input	1 word	word
1746-IA8	AC Input Module (8) Inputs — 100/120V ac	50	Input	1 word	word
1746-IA16	AC Input Module (16) Inputs — 100/120V ac	50	Input	1 word	word
1746-IB8	DC Input Module (8) Inputs — Sink 24V dc	50	Input	1 word	word
1746-IB16	DC Input Module (16) Inputs — Sink 24V dc	50	Input	1 word	word
1746-IB32	DC Input Module (32) Inputs — Sink 24V dc	51	Input	2 words	word
1746-IC16	DC Input Module (16) Inputs — Sink 48V dc	50	Input	1 word	word
1746-IG16	TTL Input Module (16) Inputs — 5V dc	50	Input	1 word	word
1746-IH16	DC Input Module (16) Inputs — 125V dc	50	Input	1 word	word
1746-IM4	AC Input Module (4) Inputs — 200/240V ac	50	Input	1 word	word
1746-IM8	AC Input Module (8) Inputs — 200/240V ac	50	Input	1 word	word
1746-IM16	AC Input Module (16) Inputs — 200/240V ac	50	Input	1 word	word
1746-IN16	Input Module (16) Inputs — 24V ac/dc	50	Input	1 word	word
1746-IO4	Combination Module (2) Inputs — 100/120V ac & (2) Outputs relay	70	Input	1 word	word
1746-IO8	Combination Module (4) Inputs — 100/120V ac & (4) Outputs relay	70	Input	1 word	word
1746-IO12	Combination Module (6) Inputs — 100/120V ac & (6) Outputs relay	70	Input	1 word	word
1746-ITB16	Fast DC Input Module (16) Inputs — Sink 24V dc	50	Input	1 word	word
1746-ITV16	Fast DC Input Module (16) Inputs — Source 24V dc	50	Input	1 word	word
1746-IV8	DC Input Module (8) Inputs — Source 24V dc	50	Input	1 word	word
1746-IV16	DC Input Module (16) Inputs — Source 24V dc	50	Input	1 word	word
1746-IV32	DC Input Module (32) Inputs — Source 24V dc	51	Input	2 words	word
1746-NI4	(4) High Resolution Analog Inputs, Each Selectable to Accept Either Current or Voltage	53	Input	4 words	word
1746-NIO4I	(2) High Resolution Analog Inputs, Selectable, Current or Voltage, (2) Analog Current Outputs	71	Input/Output	2 words	word
1746-NIO4V	(2) High Resolution Analog Inputs, Selectable, Current or Voltage, (2) Analog Voltage Outputs	71	Input/Output	2 words	word
1746-NO4I	Analog Module (4) Current Outputs — 0 to 20 mA	63	Output	4 words	word
1746-NO4V	Analog Module (4) Voltage Outputs — 10V dc to +10V ac	63	Output	4 words	word
1746-NR4	RTD/Resistance Input Module	77	Input/Output	8 words	word
1746-NT4	Thermocouple/mV Module	77	Input/Output	8 words	word
1746-OA8	AC Output Module (8) Triac — 120/240V ac	60	Output	1 word	word
1746-OA16	AC Output Module (16) Triac — 120/240V ac	60	Output	1 word	word
1746-OAP12	AC Output Module (12) Triac — 120/240V ac	60	Output	1 word	word
1746-OB8	DC Output module (8) Transistor Source — 10–50V dc	60	Output	1 word	word
1746-OB16	DC Output module (16) Transistor Source — 10–50V dc	60	Output	1 word	word

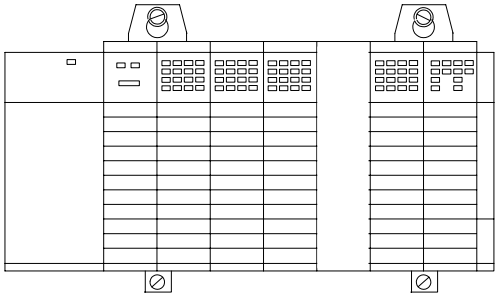
NA (Not Applicable)

Continued on the next page.

If the Slot Contains:		Its DP Identifier Byte is:	I/O Type is:	Number of Words is:	and Data Consistency is:
1746-OB32	DC Output module (32) Transistor Source — 10–50V dc	61	Output	2 words	word
1746-OBP8	High Current DC Output Module (8) Current Source — 24V dc	60	Output	1 word	word
1746-OBP16	High Current DC Output Module (16) Current Source — 24V dc	60	Output	1 word	word
1746-OG16	TTL Output Module (16) Outputs — 5V dc	60	Output	1 word	word
1746-OV8	DC Output Module (8) Transistor Sink — 10–50V dc	60	Output	1 word	word
1746-OV16	DC Output Module (16) Transistor Sink — 10–50V dc	60	Output	1 word	word
1746-OV32	DC Output Module (32) Transistor Sink — 5–50V dc	61	Output	2 words	word
1746-OVP16	High Current DC Output Module (16). Current Sink — 24V dc	60	Output	1 word	word
1746-OW4	Relay Output Module (4) Outputs — 10–250V ac / 10–125V dc	60	Output	1 word	word
1746-OW8	Relay Output Module (8) Outputs — 10–250V ac / 10–125V dc	60	Output	1 word	word
1746-OW16	Relay Output Module (16) Outputs — 10–250V ac / 10–125V dc	60	Output	1 word	word
1746-OX8	Isolated Relay Output (8 Point) Module	60	Output	1 word	word
1747-KE	DH-485/RS-232C Interface Module	77	Input/Output	8 words	word

Configuration Data Example

For this example, assume a 7-slot chassis is configured.



If the chassis contains these modules:			Then the configuration data that should be entered is:	
Slot Number	Physical Module	Catalog Number	Logical Module	DP Identifier Byte
0	PROFIBUS DP Adapter	1747-APB	NA	NA
1	Input Module	1746-IA16	1	50
2	Input Module	1746-IA16	2	50
3	32 pt. Output Module	1746-OB32	3	61
4	Empty Slot	NA	4	00
5	32 pt. Output Module	1746-OB32	5	61
6	12 pt. Combination Module	1746-IO12	6	70

NA (Not Applicable)

Entering Parameter Data

Upon communication startup, parameter data is delivered from the DP master to the 1747-APB module. The module does not require any specific user parameter data besides generic standard parameter data. Your master's configuration software will automatically build this generic parameter data, based on information provided in the *.gsd file (or entered manually if your software does not support this file format), and on specified watchdog options.

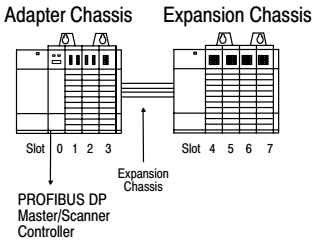
1747-APB Module Overview

Read this chapter for information on the following topics:

- 1747-APB module
- compatible modules
- 1747-APB module features

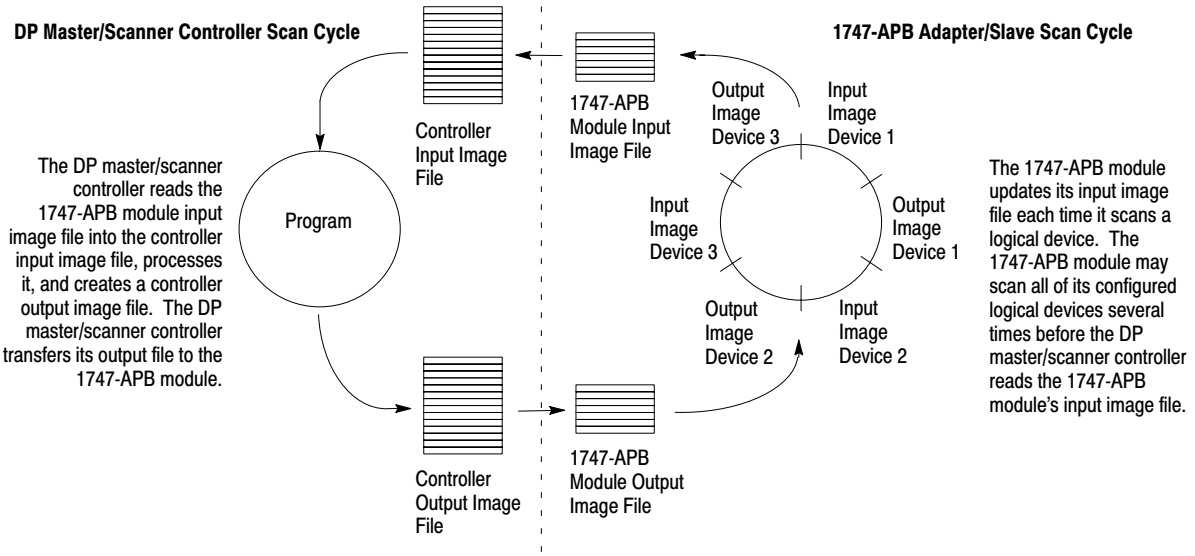
1747-APB Module

The 1747-APB module is an SLC 500 single-slot module that interacts with the SLC 500 backplane and any DP master/scanner controller on a PROFIBUS DP network. It occupies the first slot (slot 0) of a 1746 chassis.



This module acts as a DP adapter/slave device to the DP master/scanner controller, and acts as the master of the 1746 chassis in which it is installed. (The module also supports up to two optional expansion chassis.)

The I/O data exchange occurs as follows: Output data is sent from the DP master/scanner controller across the PROFIBUS DP network to the 1747-APB module. The module then automatically transfers the data across the chassis backplane to the output modules. Inputs from the input modules are collected by the 1747-APB module via the backplane and sent across the PROFIBUS DP network to the DP master/scanner controller. See the following figure.



Important: The outputs of the 1747-APB module are updated *after* the end of the first DP master/scanner controller scan.

Compatible Modules

The following table lists the SLC modules that can be placed in the adapter chassis and expansion chassis. The 1747-APB module supports any SLC I/O module that uses 8 or less I/O words.

Catalog Number	Description
1746-BAS	BASIC Language Module (used in SLC 5/01 mode only)
1746-FIO4I	(2) High-Speed Analog Inputs, Selectable, Current or Voltage, (2) Analog Current Outputs
1746-FIO4V	(2) High-Speed Analog Inputs, Selectable, Current or Voltage, (2) Analog Voltage Outputs
1746-HS	IMC™ 110 Servo Positioning Module
1746-HSTP1	Stepper Controller Module
1746-IA4	AC Input Module (4) Inputs — 100/120V ac
1746-IA4	AC Input Module (4) Inputs — 100/120V ac
1746-IA8	AC Input Module (8) Inputs — 100/120V ac
1746-IA16	AC Input Module (16) Inputs — 100/120V ac
1746-IB8	DC Input Module (8) Inputs — Sink 24V dc
1746-IB16	DC Input Module (16) Inputs — Sink 24V dc
1746-IB32	DC Input Module (32) Inputs — Sink 24V dc
1746-IC16	DC Input Module (16) Inputs — Sink 48V dc
1746-IG16	TTL Input Module (16) Inputs — 5V dc
1746-IH16	DC Input Module (16) Inputs — Sink 125V dc
1746-IM4	AC Input Module (4) Inputs — 200/240V ac
1746-IM8	AC Input Module (8) Inputs — 200/240V ac
1746-IM16	AC Input Module (16) Inputs — 200/240V ac
1746-IN16	Input Module (16) Inputs — 24V ac/dc
1746-IO4	Combination Module (2) Inputs — 100/120V ac & (2) Outputs relay
1746-IO8	Combination Module (4) Inputs — 100/120V ac & (4) Outputs relay
1746-IO12	Combination Module (6) Inputs — 100/120V ac & (6) Outputs relay
1746-ITB16	Fast DC Input Module (16) Inputs — Sink 24V dc
1746-ITV16	Fast DC Input Module (16) Inputs — Source 24V dc
1746-IV8	DC Input Module (8) Inputs — Source 24V dc
1746-IV16	DC Input Module (16) Inputs — Source 24V dc
1746-IV32	DC Input Module (32) Inputs — Source 24V dc
1746-NI4	(4) High Resolution Analog Inputs, Each Selectable to Accept Either Current or Voltage
1746-NIO4I	(2) High Resolution Analog Inputs, Selectable, Current or Voltage, (2) Analog Current Outputs
1746-NIO4V	(2) High Resolution Analog Inputs, Selectable, Current or Voltage, (2) Analog Voltage Outputs
1746-NO4I	Analog Module (4) Current Outputs — 0 to 20 mA
1746-NO4V	Analog Module (4) Voltage Outputs — 10V dc to +10V ac
1746-NR4	RTD/Resistance Input Module
1746-NT4	Thermocouple/mV Module
1746-OA8	AC Output Module (8) Triac — 120/240V ac
1746-OA16	AC Output Module (16) Triac — 120/240V ac
1746-OAP12	AC Output Module (12) Triac — 120/240V ac
1746-OB8	DC Output module (8) Transistor Source — 10-–50V dc

Continued on the next page.

Catalog Number	Description
1746-OB16	DC Output module (16) Transistor Source — 10–50V dc
1746-OB32	DC Output module (32) Transistor Source — 10–50V dc
1746-OBP8	High Current DC Output Module (8) Current Source — 24V dc
1746-OBP16	High Current DC Output Module (16) Current Source — 24V dc
1746-OG16	TTL Output Module (16) Outputs — 5V dc
1746-OV8	DC Output Module (8) Transistor Sink — 10–50V dc
1746-OV16	DC Output Module (16) Transistor Sink — 10–50V dc
1746-OV32	DC Output Module (32) Transistor Sink — 5–50V dc
1746-OVP16	High Current DC Output Module (16). Current Sink — 24V dc
1746-OW4	Relay Output Module (4) Outputs — 10–250V ac / 10–125V dc
1746-OW8	Relay Output Module (8) Outputs — 10–250V ac / 10–125V dc
1746-OW16	Relay Output Module (16) Outputs — 10–250V ac / 10–125V dc
1746-OX8	Isolated Relay Output (8 Point) Module
1747-KE	DH-485/RS-232C Interface Module

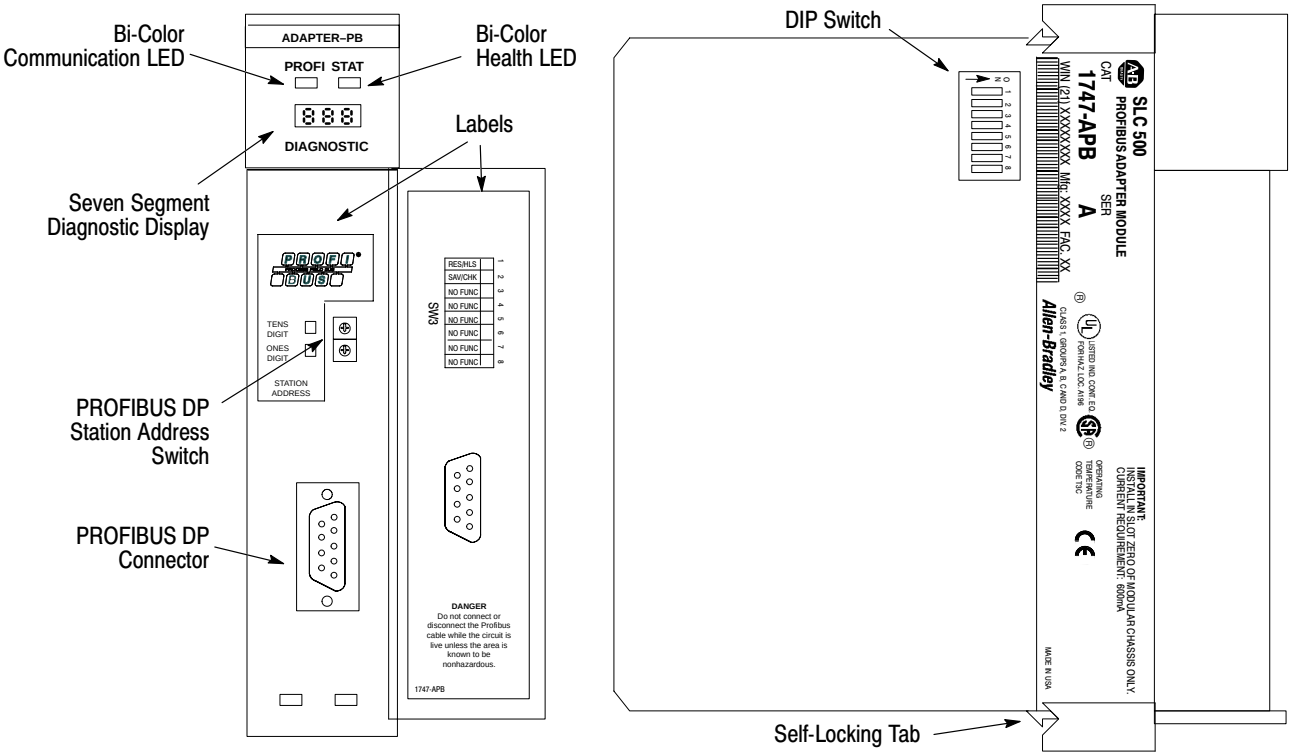
1747-APB Module Features

The 1747-APB module:

- communicates I/O data up to a maximum line length of between 200 and 1200 meters (656 and 3937 feet), depending on the baud rate
- supports all baud rates up to 1.5M bits/s on the PROFIBUS DP network
- automatically recognizes the current operating baud rate by listening to the link (auto-baud feature)
- supports any mix of 1746 discrete or specialty (e.g., analog) I/O
- controls up to 30 physical I/O modules using a maximum of two expansion chassis
- supports the transfer of up to 244 bytes of I/O data
- incorporates enhanced operating status and troubleshooting capability using a three digit 7-segment display
- provides non-volatile memory; no back-up battery required
- provides discrete output module hold last state selection
- complies with DIN 19245 Part 1, Issue 1991, and Draft DIN 19245 Part 3, Issue 1993
- is certified by the PNO (PNO ident number 1100 [hex])

Hardware Features

The 1747-APB module's hardware features are highlighted in the figure that follows. Detailed installation, operation, and troubleshooting information is contained in chapters 6, 7, and 8.



Diagnostic Display and LEDs

The diagnostic display provides alphanumeric status of the 1747-APB module. When combined with the PROFI and STAT LEDs, they are effective troubleshooting tools.

DIP Switch

The 1747-APB module's DIP switch allows you to configure the following:

- **Hold Last State (HLS) –** determines whether the discrete output modules are held in their last state when communication with the DP master is lost (PROFIBUS watchdog timeout), or when the slave is abruptly released by the DP master.

  The default position is the OFF (reset) position.

- **I/O Module Keying (KEY) –** determines if the 1747-APB module saves its current I/O module and DIP switch configuration to its non-volatile memory, or if the 1747-APB module compares the current I/O module and DIP switch configuration to the one saved in its non-volatile memory.

  The default position is the ON (save) position. It should be in this position at initial power-up.

The remaining switches are unused and should remain in their default positions (OFF) to ensure proper operation of the module.

PROFIBUS DP Station Address Switch

A two-digit decimal switch used to set the station address to values between 01 and 99. (The value 00 is reserved.)

Labels

The front and door labels give connector information and provide areas to record the adapter's DIP switch and station address settings.

PROFIBUS DP Connector

A 9 pin socket connector that is compliant with Draft DIN 19245 Part 3, Issue 1993.

Self-Locking Tabs

Self-locking tabs secure the module in the chassis. No tools are necessary to install or remove a module.

Installing the 1747-APB Module

This chapter presents:

- European Union Directive compliance
- setting the DIP switch
- setting the station address switch
- installing the 1747-APB module

European Union Directive Compliance

If this product is installed within the European Union or EEA regions, the following regulations apply.

EMC Directive

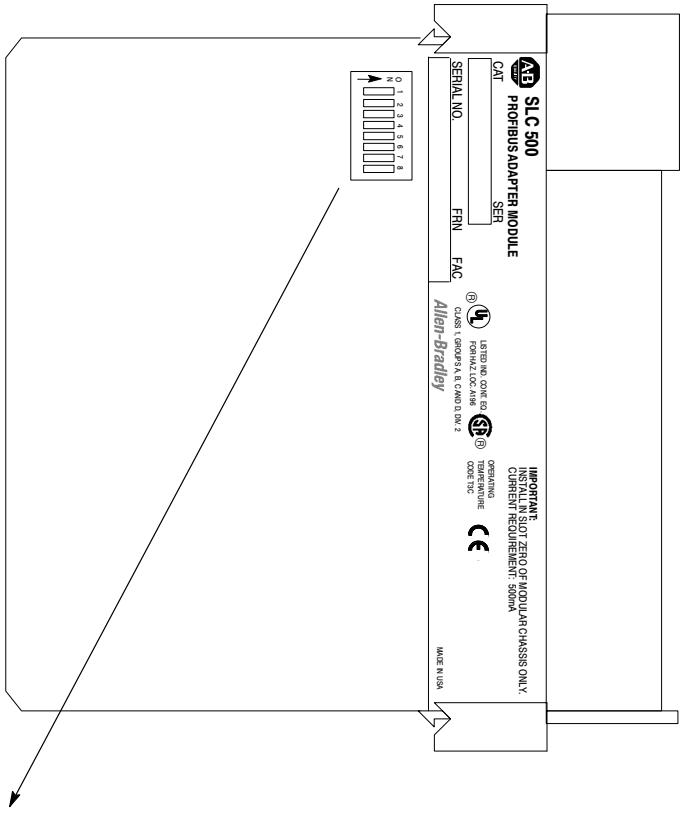
This apparatus is tested to meet Council Directive 89/336 Electromagnetic Compatibility (EMC) using a technical construction file and the following standards, in whole or in part:

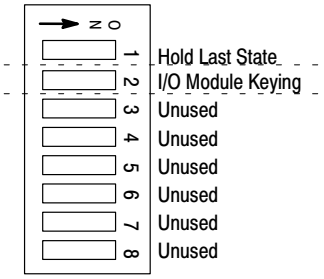
- EN 50081-2 EMC – Generic Emission Standard, Part 2 – Industrial Environment
- EN 50082-2 EMC – Generic Immunity Standard, Part 2 – Industrial Environment

The product described in this manual is intended for use in an industrial environment.

Setting the DIP Switch

The 1747-APB module parameters are configured by a DIP switch, shown below.





Switch Setting Summary

1. Hold Last State

- ON = Hold Last State
- OFF = Do Not Hold Last State (default)

2. I/O Module Keying

- ON = Save Mode (default)
- OFF = Check Mode

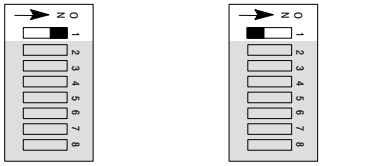
Switches 3–8 are not used and should remain in their default positions (OFF) to ensure proper operation of the module.

Hold Last State

Use the Hold Last State switch to hold discrete outputs in their last state when certain, but not all, system faults occur.

ATTENTION: If switch 1 is set to the ON position, outputs belonging to this adapter remain in their last state when communication is lost to the DP master, and machine motion may continue after fault detection. For this reason we recommend that you set switch 1 to the OFF position to de-energize outputs belonging to this adapter when a fault is detected.

Hold Last State DIP Switch Settings



Hold Last State Do Not Hold Last State

If the switch is in this position:	then all digital outputs:
ON (Hold Last State)	remain in their current position when communication with the DP master is lost
OFF (Do Not Hold Last State)	are reset (switched off) when communication to the DP master is lost

Your system must be designed so it is in a safe state when all discrete outputs are off, or cleared.

ATTENTION: When hold last state is selected and specialty I/O modules are used, the operation of the specialty I/O modules must be considered when the discrete outputs are held in their last state. (i.e., specialty inputs are still read by the adapter, but output data does not change.)

The 1747-APB module is shipped from the factory with the Hold Last State switch in the OFF (do not hold last state) position.

I/O Module Keying

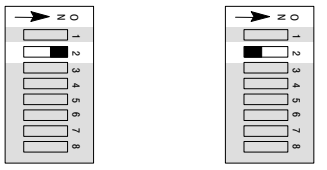
Use this switch to provide I/O module keying. It prevents you from operating the 1747-APB module when the module's DIP switch configuration, station address setting, or the I/O module configuration differs from the last time you saved it. There are two modes, save and check.

Important: Use *save mode* during setup and debug. After debugging is complete, power up in save mode one last time. Remove power and place the 1747-APB module in check mode prior to normal operation.

When power is applied in *save* mode and the DIP switch, station address, and I/O module configurations are valid, the 1747-APB module saves the DIP switch, station address, and I/O module configurations in non-volatile memory, regardless of its content.

When power is applied in *check* mode, the 1747-APB module compares the stored 1747-APB module DIP switch, station address, and I/O module configurations to the current DIP switch, station address, and I/O module configuration. If the configurations do not match, a 1747-APB module error occurs. (The 1747-APBs diagnostic LED provides information on the cause of the configuration mismatch.)

I/O Module Keying DIP Switch Settings



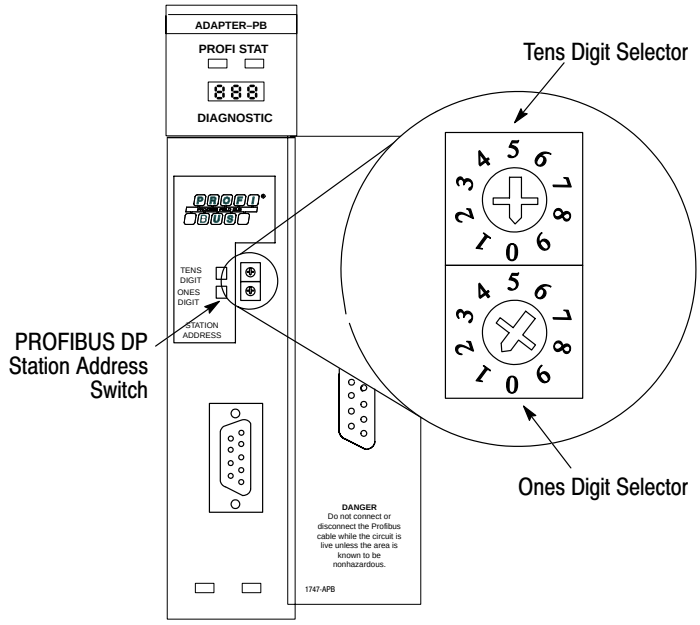
Save Mode Check Mode

The 1747-APB module is shipped from the factory with the I/O module keying switch in the ON (save mode) position.

Setting the Station Address Switch

The 1747-APB module supports station addresses 01 to 99. An example of the station address set for 01 is shown below. Notice that the arrow head on each selector switch points to the selected digit.

Important: The station address 00 is reserved.



Important: The PROFIBUS DP protocol mechanisms do not provide the ability to detect and report a duplicate station address between a DP master and a DP slave device, or between two DP slaves (only between two DP masters).

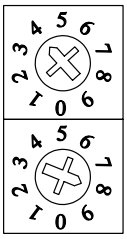
To change the station address to a new setting, follow these steps:

1. Remove power.
2. Use a screwdriver to turn each of the selector switches. The switches can be turned either clockwise or counterclockwise.
3. Reapply power.

Important: A change made to the station address switch does not take affect until power to the 1747–APB module is cycled. If you attempt to change the station address while power is applied, a minor fault occurs and an error message is displayed. (See chapter 8.) However, the module continues normal operation with the original station address.

Station Address Setting Example

If you choose station address 48, set the selector switches as follows:



Installing the 1747-APB Module

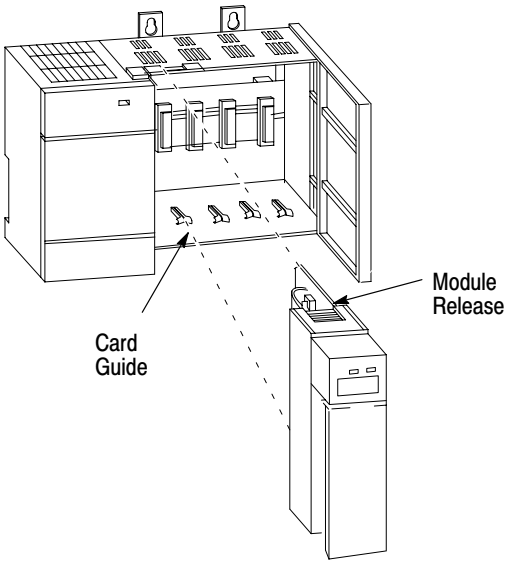
ATTENTION: Disconnect power before attempting to install, remove, or wire modules.

Important: Before installation, make sure your SLC power supply has adequate reserve current capacity. The 1747-APB module requires 0.5A @ 5 Volts.

Inserting the 1747-APB Module

Important: Make sure you have set the DIP switches properly before inserting the 1747-APB module.

Refer to the illustration below to identify the chassis and module components listed in the procedures that follow.



1. Disconnect power.
2. Install the module into the left slot of the chassis, slot 0, by aligning the circuit board with the chassis card guide.

   The 1747-APB module must only be installed in slot 0 of the chassis. Do not install the 1747-APB module in the expansion chassis.
3. Slide the module into the chassis until the top and bottom tabs lock into place.
4. Cover all unused slots with the Card Slot Filler, Catalog Number 1746-N2, to keep the chassis free from dust and debris.

Removing the 1747-APB Module

1. Disconnect power.
2. Press and hold the module release located on each self-locking tab and slide the module out of the chassis slot.

Start-Up and Operation

This chapter guides you through:

- system setup
- powerup and initialization sequences
- normal operation
- remote expansion chassis power loss

System Setup

Make sure the I/O Module Keying DIP switch is ON (save mode) while you setup and debug your system. When you have completed debugging your system:

1. Cycle the power in save mode (I/O Module Keying DIP switch ON).
2. Remove power from the system.
3. Remove the 1747-APB module and put it in check mode (I/O Module Keying DIP switch OFF).
4. Replace the 1747-APB module in slot 0.
5. Apply power to your system.

As long as the 1747-APB module is in check mode, any future changes to the 1747-APB module's DIP switch or I/O module configuration results in an 1747-APB module error.

Powerup and Initialization Sequences

The powerup and initialization sequence depends on whether the 1747-APB module is in the save or check mode. PROFIBUS network communications do not begin until a powerup and initialization sequence is complete.

Power must be applied to all of the chassis and expansion chassis controlled by the 1747-APB module before this sequence can be completed. If the expansion chassis are not powered, a 1747-APB module error occurs.

Save Mode

When power is applied in *save mode*, the 1747-APB module:

1. performs power up diagnostics
2. reads and verifies the actual I/O module and DIP switch configuration
3. saves the I/O module and DIP switch configuration
4. waits for PROFIBUS network communications from the DP master

Check Mode

When power is applied in *check mode*, the 1747-APB module:

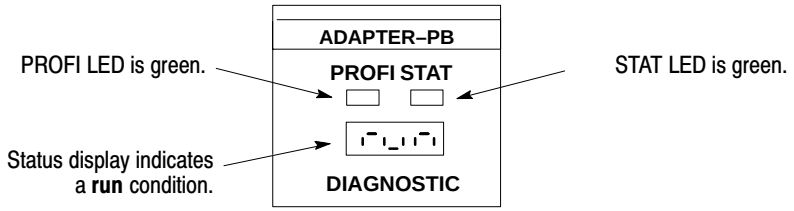
1. performs power up diagnostics
2. verifies the stored configuration integrity
3. compares the actual I/O module, DIP switch, and chassis configurations to the stored configurations
4. verifies that the configurations match, then waits for PROFIBUS network communications from the DP master

1747-APB module errors found during powerup and initialization are noted in chapter 8.

Normal Operation

After successfully completing a powerup sequence, the 1747-APB module waits to be initialized by its DP master. Once initialized, the 1747-APB module begins normal operation (i.e., I/O data exchange).

During normal operation (DP master in operate mode), the 1747-APB module appears as shown below:



The following table shows how the 1747-APB module's inputs and outputs operate in relation to the mode of the PROFIBUS master.

If the PROFIBUS Master is in:	the 1747-APB Module's I/O Operate as Follows:
Operate Mode (i.e., normal operation)	Input status is read. Outputs are updated per the program.
Stop Mode	Module is released. Outputs are set to 0 (off).
Clear Mode	Input status is read. Outputs are set to 0 (off).
Offline Mode	Network manager communication only. No I/O operation.
Leave Master Mode	If HLS is selected, outputs are in HLS. If Reset is selected, outputs are off.

Expansion Chassis Power Loss

If power to any 1746 expansion chassis is lost, a 1747-APB module error occurs. When power to the expansion chassis is restored, the 1747-APB module acts as if its own chassis power was cycled and resets itself. The master must resend configuration and parameters to the 1747-APB before RUN can resume.

Troubleshooting

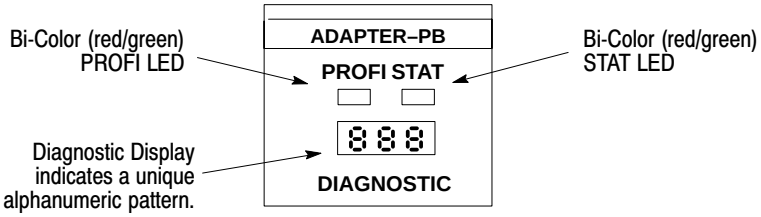
You can read status and fault codes in either of two ways:

- from the 1747-APBs display (See the section that follows.)
- with the master's monitoring software (See page 8–6.)

This chapter explains both of these methods, and also discusses detecting duplicate station addresses and contacting Allen-Bradley for assistance.

Viewing Status and Fault Codes from the 1747-APB Module's Display

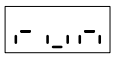
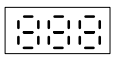
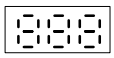
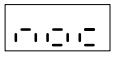
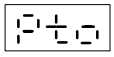
The 1747-APB module has two LEDs and a diagnostic display. They are used to indicate operating status and fault conditions while the module is operating.



This section shows you how to interpret the LEDs and diagnostic display on the front of the 1747-APB module.

Status Codes

When under normal operating conditions, the 1747-APB module displays one of the following status codes.

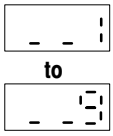
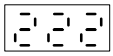
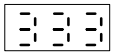
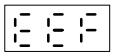
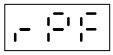
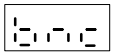
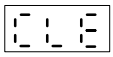
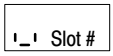
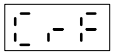
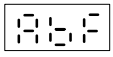
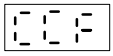
PROFI LED	STAT LED	Diagnostic Display	Operating Condition	Corrective Action
green	green		(run)① The 1747-APB is operating normally.	No corrective action required.
alternating red and green	alternating red and green		(888) Lamp test. (Occurs for several seconds after power is applied.)	No corrective action required.
off	off		(888) The flash sector is being erased prior to writing the new configuration to the flash PROM.	No corrective action required.
off	flashing green		(noc)① The 1747-APB is part of a working PROFIBUS system, but no communication is occurring yet. (The 1747-APB has not been addressed by the DP master.)	Configure the system.
flashing red	green		(Pto) A PROFIBUS watchdog timeout has occurred. The backplane firmware remains active and either resets the outputs or keeps them in their last state, depending on the position of the Hold Last State switch. The Pto display remains for about one second, and then the PROFIBUS communication restarts.	Check the configuration of the DP master and then restart the DP master.

① These diagnostics can be read from the DP master's monitoring software.

Fault Codes

Under fault conditions, the 1747-APB module displays a fault code. This diagnostic display shows either a single *primary* display, or two *alternating* displays. The primary displays are shown in the table that follows. For alternating displays, see the table on page 8–4.

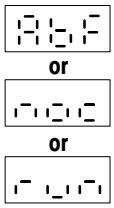
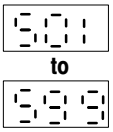
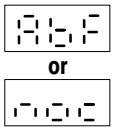
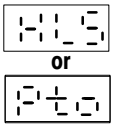
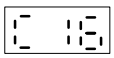
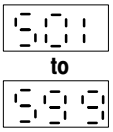
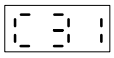
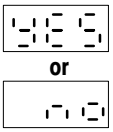
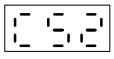
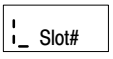
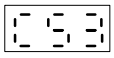
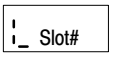
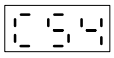
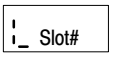
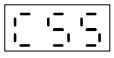
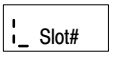
Primary Diagnostic Display

PROFI LED	STAT LED	Diagnostic Display	Fault Condition	Corrective Action
off	off	off	The 1747-APB module is not powered.	Cycle power to reset the 1747-APB module. If the problem persists, replace the 1747-APB module.
off	red	 to	(_1 to _9) A fault occurred during the powerup self test. No operation of the backplane or PROFIBUS communication can occur.	
off	red		(222) A runtime RAM fault has occurred. The module resets all outputs and stops exchanging I/O data.	
off	red		(333) An adapter hardware watchdog reset has been detected. The module resets all outputs and stops exchanging I/O data.	
off	red		(EEF)① The flash memory is not being written correctly when powering up in Save mode (I/O Module Keying DIP switch ON). The PROFIBUS communication is started, but does not start exchanging I/O data.	
off	flashing red		(rPF)① The expansion chassis is powered down (remote power fail). The module resets all outputs and stops exchanging I/O data.	Apply power to all expansion chassis.
off	flashing red		(bnc)① The number of chassis exceeds the allowable number of 3. (There is a maximum of 2 expansion chassis.) The PROFIBUS communication starts, but does not start exchanging I/O data. Also, the backplane firmware does not. operate.	Reconfigure/remove the extra chassis.
off	flashing red		(CLE)① The number of input or output bytes installed exceeds the allowable limit (244 bytes).	Reduce the number of inputs or outputs installed in the chassis.
off	flashing red	 Slot #	(u slot#)① An unsupported I/O Module is installed in the slot number shown on the diagnostic display. The PROFIBUS communication starts, but does not start exchanging I/O data. Also, the backplane operation is stopped.	Remove the unsupported I/O module from displayed slot number.②
off	flashing red		(CrF)① The configuration stored in flash memory is not valid when powering up in Check mode. The PROFIBUS communication starts, but does not start exchanging I/O data. Also, the backplane operation is stopped.	Change to Save mode (I/O Module Keying DIP switch ON) and restore power.
flashing red	green		(AbF) The adapter's auto-baud process could not be completed.	Re-initialize the system.
flashing red	green		(CCF)① The PROFIBUS configuration data sent by the DP master was rejected by the 1747-APB module.	Correct the configuration of the DP master for the 1747-APB module.

① These diagnostics can be read from the DP master's monitoring software.

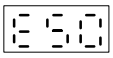
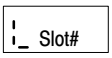
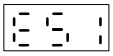
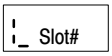
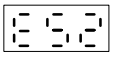
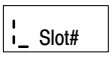
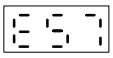
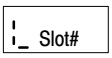
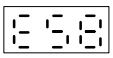
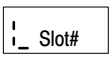
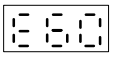
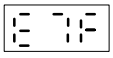
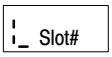
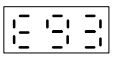
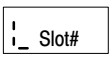
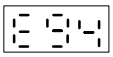
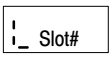
② The slot # is a 2-digit decimal number between 1 and 31. 31 indicates the offending slot could not be detected.

Alternating Diagnostic Display

PROFI LED	STAT LED	Alternating Diagnostic Display		Fault Condition	Corrective Action
off	green			(abf, or noc①, or run①; and S01 to S99①) The station address was changed after the 1747-APB module reached its normal operating state, causing a minor fault. The module continues to operate as before, with its original station address; however, if the station address is not returned to the saved address, a C16 fault occurs when power is cycled. The saved station address is displayed (S01 to S99).	Either change the incorrect station address switch setting, or change to Save mode (I/O Module Keying DIP switch ON).
off	flashing green			(abf or noc①; and HLS or Pto) Communication to the DP master has been lost. If HLS is displayed, the module's Hold Last State switch is ON; therefore, all outputs are in the last state. If Pto is displayed, the module's Hold Last State switch is OFF; therefore, all outputs are reset.	Restart the DP master.
off	flashing red			(C16 and S01 to S99) According to the saved configuration, there is a station address configuration mismatch The saved value is displayed (S01 to S99).	Either change the incorrect station address switch setting, or change to Save mode (I/O Module Keying DIP switch ON).
off	flashing red			(C31 and yES or no)① According to the saved configuration, there is a Hold Last State (HLS) configuration mismatch. Yes or no indicates if the HLS was (yes) or was not (no) the previously saved selection.	Either change the incorrect DIP switch setting, or change to Save mode (I/O Module Keying DIP switch ON).
off	flashing red			(C52 and L slot#)① According to the saved configuration, an I/O module is missing. The PROFIBUS communication starts, but does not start exchanging I/O data. Also, the backplane operation is stopped.	Either check the I/O module in the displayed slot number② and either correct the configuration problem or change to the Save mode (I/O Module Keying DIP switch ON).
off	flashing red			(C53 and L slot#)① According to the saved configuration, an I/O module is detected in a previously unused slot. The PROFIBUS communication starts, but does not start exchanging I/O data. Also, the backplane operation is stopped.	
off	flashing red			(C54 and L slot#)① The I/O Module in the slot indicated is of a different electrical interface type than the saved configuration. (e.g., A dc output module is in an AC output slot.) The PROFIBUS communication starts, but does not start exchanging I/O data. Also, the backplane operation is stopped.	
off	flashing red			(C55 and L slot#)① The I/O Module in the slot indicated is of a different module mix or class type than the saved configuration. (e.g., A dc 16 point input module is in an 8 point dc input slot.) The PROFIBUS communication starts, but does not start exchanging I/O data. Also, the backplane firmware does not. operate.	

① These diagnostics can be read from the DP master's monitoring software.

② The slot # is a 2-digit decimal number between 1 and 31. 31 indicates the offending slot could not be detected.

PROFI LED	STAT LED	Alternating Diagnostic Display		Fault Condition	Corrective Action
off	flashing red			(E50 and L slot#)① An I/O parity fault occurred. The module resets all outputs and stops exchanging I/O data.	Check the I/O module in the displayed slot number.② Cycle power to the 1747-APB module and the I/O module. If the condition persists, replace the I/O module.
off	flashing red			(E51 and L slot#)① Either an I/O parity fault has occurred, or an I/O module was removed and installed under power. The module resets all outputs and stops exchanging I/O data.	
off	flashing red			(E52 and L slot#)① An I/O module was removed under power. The module resets all outputs and stops exchanging I/O data.	
off	flashing red			(E57 and L slot#)① A file access grant timeout occurred. (Applies to specialty I/O modules only.) The module resets all outputs and stops exchanging I/O data.	
off	flashing red			(E58 and L slot#)① An I/O module fault occurred (generic). The module resets all outputs and stops exchanging I/O data.	
off	flashing red	 to 		(E60 to E7F and L slot#)① An I/O module reported a fault code. The module resets all outputs and stops exchanging I/O data.	
off	flashing red			(E93 and L slot#)① An I/O module reported an unknown fault code. The module resets all outputs and stops exchanging I/O data.	
off	flashing red			(E94 and L slot#)① An I/O Module has been inserted under power. The module resets all outputs and stops exchanging I/O data.	

① These diagnostics can be read from the DP master's monitoring software.

② The slot # is a 2-digit decimal number between 1 and 31. 31 indicates the offending slot could not be detected.

Viewing Status and Fault Codes from the Master's Monitoring Software

You can interpret slave faults from the DP master's monitoring software using the Read Diagnostics. The table below shows how the information is stored.

Read Diagnostic Data Format

Bit / Byte	7	6	5	4	3	2	1	0
1	Master_Lock	Prm_Fault	Invalid_Slave_ Response	Not_Supported	Ext_Diag	Cfg_Fault	Station_Not_ Ready	Station_Non_ Existent
2	Deactivated	Reserved	Sync_Mode	Freeze_Mode	WD_On	1	Stat_Diag①	Prm_Req①
3	Ext_Diag_ Overflow	Reserved						
4	Master_Add							
5	Ident_Number							
6	Ident_Number							
7	Device Related Diagnostics Header							
8	Revision							
9	Adapter and LED Status							
10–12	Primary Diagnostic Display information							
13–15	Alternating Diagnostic Display information							

= 1747-APB module specific diagnostic data.

① If bit 1 and bit 0 of byte two are set, bit 0 has the higher priority.

Determining the Module's Condition

You can determine the 1747-APB module's condition (normal or fault) by viewing byte 9 for the adapter and LED status, and bytes 10 through 15 for the primary and alternating display information.

Adapter and LED Status (Byte 9)

The adapter and LED status byte indicates the condition of the 1747-APB module, as described below.

Adapter Status Bits (0–1)

Bit 0 provides *minor fault* status information. A minor fault is a condition that is either transitional as part of normal operating sequence, or a condition that still allows the 1747-APB to operate as intended.

Bit 1 provides *major fault* status information. A major fault is a condition that interrupts the normal operation of the 1747-APB. You need to manually clear this fault.

The following coding applies to both bits:

0 = Adapter does not have a fault

1 = Adapter has a fault

LED Status Bits (2–7)

Bits 2–4 provide the PROFI LED status information.

Bits 5–7 provide the STAT LED status information.

The following coding applies to both bit groups:

000 = off

001 = solid green

010 = solid red

011 = blinking off/green

100 = blinking off/red

101 = blinking green/red

110 = blinking green/off/red/off

Primary and Alternating Displays (Bytes 10–15)

From your DP master's monitoring software, the status and fault codes appear as Hex characters. To aid you in interpreting these, a Hex character conversion table is provided below.

Hex Character Conversion Table

Hex Character	7-Segment Display	Hex Character	7-Segment Display	Hex Character	7-Segment Display
30	0	39	9	59	Y
31	1	41	A	62	b
32	2	43	C	63	c
33	3	45	E	64	d
34	4	46	F	6E	n
35	5	48	H	6F	o
36	6	4C	L	72	r
37	7	50	P	74	t
38	8	53	S	75	u

Detecting Duplicate Station Addresses

The PROFIBUS DP protocol mechanisms do not provide the ability to detect and report a duplicate station address between a DP master and a DP slave device, or between two DP slaves (only between two DP masters).

Contacting Allen-Bradley

If you need to contact Allen-Bradley for assistance, please have the following information available when you call:

- Module's series letter and firmware (FRN) number. (See side label.)
- LED status and fault codes
- hardware types in the system, including I/O modules and chassis

Specifications

This chapter provides adapter and system specifications. Topics include:

- adapter operating specifications
- network specifications

Adapter Operating Specifications

Description	Specification
Module Location	SLC 500 chassis, slot 0
Power Requirement	0.6A @ 5V dc
Operational Temperature	32° F to 140° F (0° C to 60° C)
Storage Temperature	–40° F to +185° F (–40° C to +85° C)
Relative Humidity	5% to 95% noncondensing

Network Specifications

Description	Specification
Communication Standard	PROFIBUS – DIN 19245 Part 1, Issue 1991 and Draft DIN 19245 Part 3, Issue 1993
PROFIBUS Supported Baud Rates	9.6, 19.2, 93.75, 187.5, 500k bits/s, and 1.5M bits/s
SLC Supported Devices	Class 0 and Class 1 SLC modules (See list on page 5–2.)

Station Delay Response Times (Tsdr)

Baud Rate	Minimum T_{sdr}	Maximum T_{sdr}
9.6k bit/s, 19.2k bit/s, 93.7k bit/s, 187.5k bit/s	11 bit times	60 bit times
500k bit/s	11 bit times	100 bit times
1.5M bit/s	11 bit times	150 bit times

Supported DP Data Sizes

Data Type	Highest Maximum Data Size (bytes)
Input Data	244
Output Data	244
Extended Diagnostic Data	9
User Operational Parameters	Not Used
Maximum Module Size	32
Maximum Required Consistency	32

Supported DP Features

Freeze_Mode	Not Supported
Sync_Mode	Not Supported
Auto_Baud	Supported
Set_Slave_Add	Not Supported

Understanding Your SLC 500 Control System

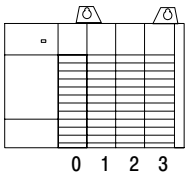
This chapter provides information on using SLC 500 control systems. Topics include:

- chassis overview
- selecting your 1746 control power supply
- system installation recommendations
- mounting your control system
- calculating heat dissipation for your control system

Chassis Overview

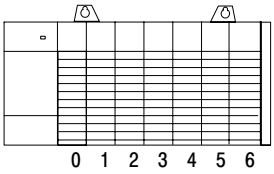
The 1747-APB module controls 1 adapter chassis and up to 2 expansion chassis, for a maximum of 30 I/O module slots. Currently, there are four different types of chassis available.

4-Slot



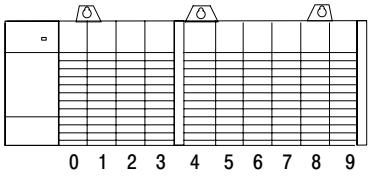
Catalog Number 1746-A4

7-Slot



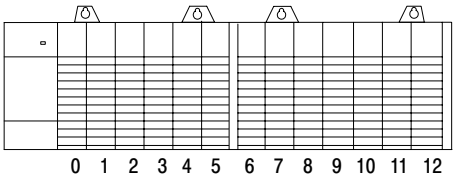
Catalog Number 1746-A7

10-Slot



Catalog Number 1746-A10

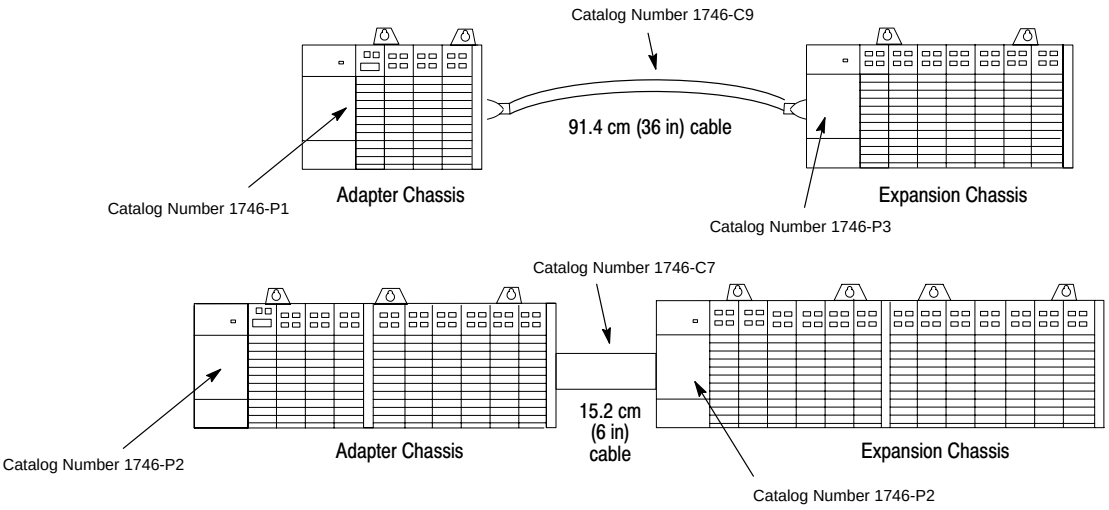
13-Slot



Catalog Number 1746-A13

Connect the expansion chassis to the adapter chassis using either of the following cables:

- 15.2 cm (6 in) cable, Catalog Number 1746-C7
- 91.4 cm (36 in) cable, Catalog Number 1746-C9



Each adapter chassis and expansion chassis requires its own power supply (Catalog Number 1746-P1, -P2, -P3, or -P4).

Important: A 1747-APB module fault occurs if the expansion chassis are not powered.

Selecting Your 1746 Control Power Supply

When configuring a modular system, you must have an individual power supply for each chassis. Careful system configuration will result in the best performance. Excessive loading of the power supply outputs can cause a power supply shutdown or premature failure. All power supplies are protected by a replaceable fuse except for the 1746-P4.

There are three different ac power supplies and one dc power supply. For ac power supplies, the 120/240V selection is made by a jumper. Place the jumper to match the input voltage. The power supply has an LED that illuminates when the power supply is functioning properly. Following are the general specifications for the power supplies.

Power Supply Specifications

Description	1746-P1	1746-P2	1746-P3	1746-P4
Line Voltage	85–132/170–265V ac 47–63 Hz	85–132/170–265V ac 47–63 Hz	19.2–28.8V dc	85–132/170–265V ac 47–63 Hz
Typical Line Power Requirement①	135 VA	180 VA	90 VA	240 VA
Maximum Inrush Current	20A	20A	20A	45A
Internal Current Capacity	2A at 5V dc 0.46A at 24V dc	5A at 5V dc 0.96A at 24V dc	3.6A at 5V dc 0.87A at 24V dc	10.0A at 5V dc 2.88A at 24V dc②
Fuse Protection③	1746-F1 or equivalent: 250V–3A Fuse Nagasawa ULCS-61ML-3 or BUSSMANN AGC 3	1746-F2 or equivalent: 250V–3A Fuse SANO SOC SD4 or BUSSMANN AGC 3	1746-F3 or equivalent: 125V–5A Fuse Nagasawa ULCS-61ML-5 or BUSSMAN AGC 5	Non-replaceable fuse is soldered in place.
24V dc User Power Current Capacity	200 mA	200 mA	NA	1A③
24V dc User Power Voltage Range	18–30V dc	18–30V dc	NA	20.4–27.6V dc
Ambient Operating Temperature Rating	0° C to 60° C (32° F to 140° F) (Current capacity derated 5% above 55° C)			0° C to 60° C (32° F to 140° F) no derating
Storage Temperature	–40° C to 85° C (–40° F to 185° F)			
Humidity Rating	5–95% (non-condensing)			
Wiring	two 2mm^2 cross section (#14 AWG) wires per terminal (maximum)			
Agency Certification (when product or packaging is marked)	• CSA certified • CSA Class I, Division 2 Groups A, B, C, D certified • UL listed • CE marked for all applicable directives			
Hazardous Environment Certification	Class I Division 2	Class I Division 2	Class I Division 2	Pending

NA (Not Applicable)

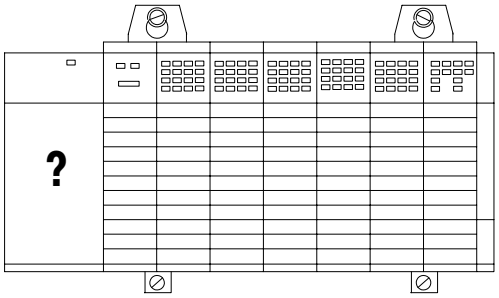
① Refer to page 10–22 to determine line power requirements for your configuration.

② The combination of all output power (5V backplane, 24V backplane, and 24V user source) cannot exceed 70W.

③ Power supply fuse is intended to guard against fire hazard due to short circuit conditions and may not protect the supply from damage under overload conditions.

Example for Selecting a 1746 Power Supply

Select a power supply for the adapter chassis shown below. (The worksheets for this example start on page 10–5.)



The Adapter Chassis Contains:

Slot Number	Description	Catalog Number	Power Supply at 5V dc (Amps)	Power Supply at 24V dc (Amps)
0	PROFIBUS DP Adapter	1747-APB	0.60	NA
1	Input Module	1746-IA16	0.085	NA
2	Input Module	1746-IA16	0.085	NA
3	Output Module	1746-OB32	0.452	NA
4	Output Module	1746-OB32	0.452	NA
5	Output Module	1746-OB32	0.452	NA
6	Combination Module	1746-IO12	0.09	0.07
	Total Current:①		2.216	0.07

NA (Not Applicable)

① Power Supply 1746-P2 is sufficient for the adapter chassis. The “Internal Current Capacity” for this power supply is 5A at 5V dc, 0.96A at 24V dc.

Example — Worksheet for Selecting a 1746 Power Supply

If you have a multiple chassis system, make copies of the *Worksheet for Selecting a Power Supply* found on page 10–6. For a detailed list of device load currents, refer to the *SLC 500 Modular Chassis and Power Supplies Product Data*, Publication Number 1746-2.38.

Procedure

1. For each slot of the chassis that contains a module, list the slot number, the catalog number of the module, and its 5V and 24V maximum currents.

Chassis Number: *1*

	Catalog Number	Maximum Currents 5V	24V
slot *0*	*APB*	*0.600*	–
slot *1*	*IA16*	*0.085*	–
slot *2*	*IA16*	*0.085*	–
slot *3*	*OB32*	*0.452*	–
slot *4*	*OB32*	*0.452*	–
slot *5*	*OB32*	*0.452*	–
slot *6*	*IO12*	*0.090*	*0.070*
slot			

2. Add the power supply loading currents of all the system devices (at 5V and 24V).

Total Current: *2.216* *0.070*

When using the 1746-P4 power supply, use the formula below to calculate total power consumption of all the system devices (at 5V and 24V). Note that the 1746-P4 total power supply loading currents cannot exceed 70 Watts. If you are not using a 1746-P4 power supply, proceed to step 3.

The user current @ 24V listed below is for example only. The current required depends on the application.

Total current @ 5V *Total current @ 24V* *User Current @ 24V* *Total Power*

[ ] x5V) + [ ] x24V) + [ ] x 24V) = [ ] W

Chassis Number: _____

	Catalog Number	Maximum Currents 5V	24V
slot			
slot			
slot			
slot			
slot			
slot			
slot			
slot			

Total Current: _____

Total current @ 5V *Total current @ 24V* *User Current @ 24V* *Total Power*

[ ] x 5V) + ([ ] x 24V) + [ ] x 24V) = [ ] W

3. Compare the Total Current required for the chassis with the Internal Current Capacity of the power supplies.
To select the proper power supply for your chassis, make sure that the power supply loading current for the chassis is *less than* the internal current capacity for the power supply, for both 5V and 24V loads.

	Internal Current Capacity 5V	24V	
Catalog Number 1746-P1	2.0A	0.46A	
Catalog Number 1746-P2	5.0A	0.96A	
Catalog Number 1746-P3	3.6A	0.87A	
Catalog Number 1746-P4	10.0A	2.88A	(70W maximum)

Required Power Supply for this Chassis: 1746- *P2*

Required Power Supply for this Chassis: 1746- [ ]

Consider future system expansion when selecting a power supply.

Worksheet for Selecting a 1746 Power Supply

Make copies of this worksheet as needed. For a detailed list of device load currents, refer to the SLC 500 price sheet, product instruction sheet, or appropriate product data.

Procedure

1. For each slot of the chassis that contains a module, list the slot number, the catalog number of the module, and its 5V and 24V maximum currents.

Chassis Number: _____

	Catalog Number	Maximum Currents 5V	24V
slot _____			
slot _____			
slot _____			
slot _____			
slot _____			
slot _____			
slot _____			
slot _____			

2. Add the power supply loading currents of all the system devices (at 5V and 24V).

Total Current: _____

When using the 1746-P4 power supply, use the formula below to calculate total power consumption of all the system devices (at 5V and 24V). Note that the 1746-P4 total power supply loading currents cannot exceed 70 Watts. If you are not using a 1746-P4 power supply, proceed to step 3.

Total current @ 5V *Total current @ 24V* *User Current @ 24V* *Total Power*

(____ x 5V) + (____ x 24V) + (____ x 24V) = ____ W

3. Compare the Total Current required for the chassis with the Internal Current Capacity of the power supplies.
To select the proper power supply for your chassis, make sure that the power supply loading current for the chassis is *less than* the internal current capacity for the power supply, for both 5V and 24V loads.

	Internal Current Capacity 5V	24V	
Catalog Number 1746-P1	2.0A	0.46A	
Catalog Number 1746-P2	5.0A	0.96A	
Catalog Number 1746-P3	3.6A	0.87A	
Catalog Number 1746-P4	10.0A	2.88A	(70W maximum)

Required Power Supply for this Chassis: 1746- ____

Chassis Number: _____

	Catalog Number	Maximum Currents 5V	24V
slot _____			
slot _____			
slot _____			
slot _____			
slot _____			
slot _____			
slot _____			
slot _____			

Total Current: _____

Total current @ 5V *Total current @ 24V* *User Current @ 24V* *Total Power*

(____ x 5V) + (____ x 24V) + (____ x 24V) = ____ W

Required Power Supply for this Chassis: 1746- ____

Consider future system expansion when selecting a power supply.

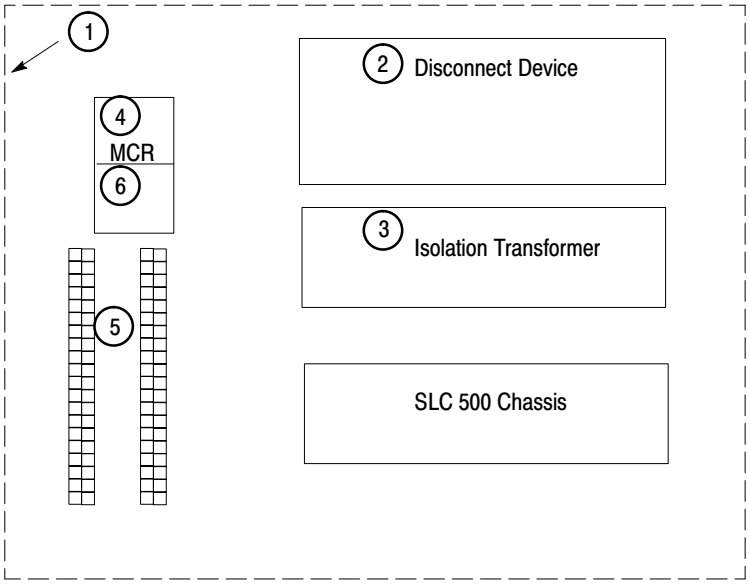
SLC 500 System Installation Recommendations

This section provides specific recommendations to help you install your SLC 500 components. For general installation guidelines, also refer to the requirements specific to your region.

- *Europe:* Reference the standards found in EN 60204 and your national regulations.
- *United States:* Refer to article 70E of the National Fire Protection Association (NFPA). It describes electrical safety requirements for employee workplaces.

Typical Installation

The figure below consists of some components that make up a typical installation.



1. An IEC- or NEMA-rated enclosure suitable for your application and environment that shields your adapter from electrical noise and airborne contaminants
2. Disconnect device that allows you to remove power from the system
3. Fused isolation transformer or a constant voltage transformer, as your application requires
4. Master control relay/emergency-stop circuit
5. Terminal blocks or wiring ducts
6. Suppression devices for limiting electromagnetic interference (EMI) generation

Selecting an Enclosure

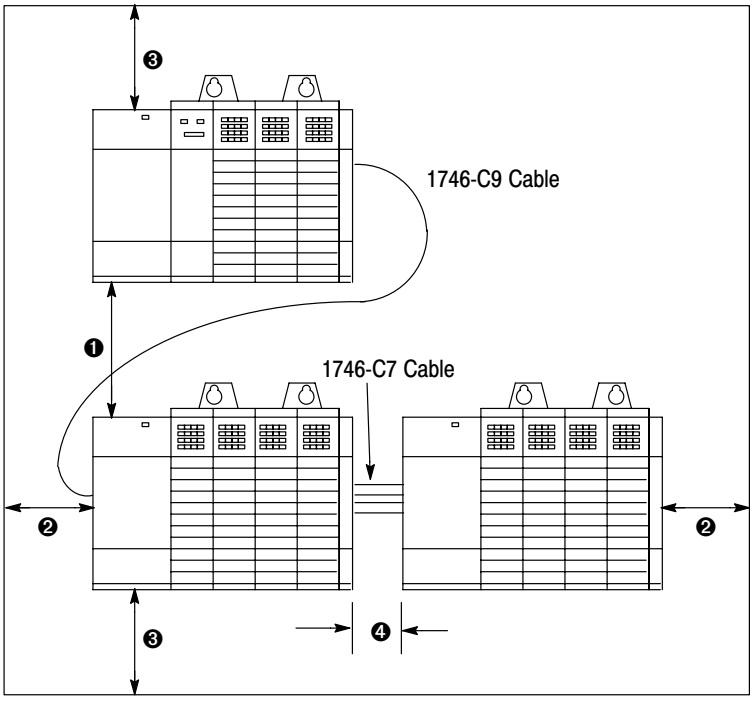
The enclosure protects the equipment from atmospheric contamination. Standards established by the International Electrotechnical Commission (IEC) and National Electrical Manufacturer's Association (NEMA) define enclosure types based on the degree of protection an enclosure will provide. Select an IEC- or NEMA-rated enclosure that suits your application and environment.

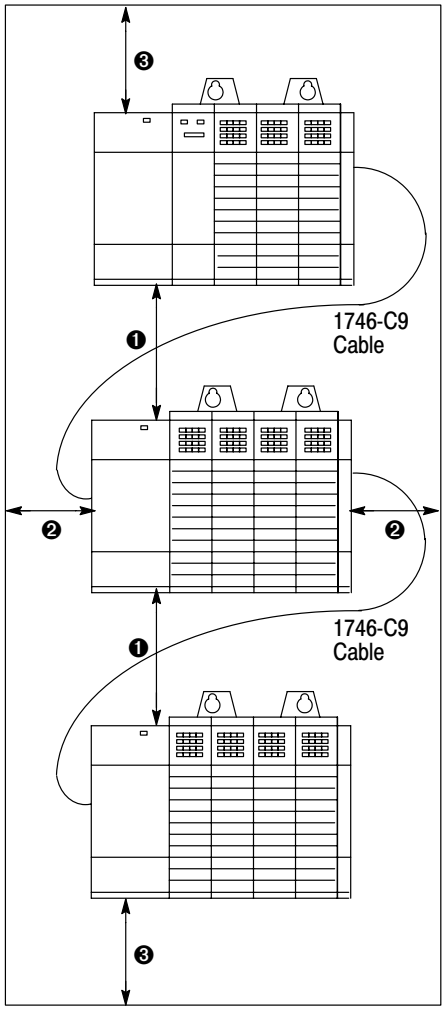
The enclosure should be equipped with a disconnect device. To calculate the heat dissipation of your controller, refer to *Calculating Heat Dissipation* on page 10–22.

Spacing Considerations

Up to three chassis can be connected (for a maximum of 30 I/O slots). Follow the recommended *minimum* spacing shown below to allow for convection cooling within the enclosure.

Important: Be careful of metal chips when drilling mounting holes for the chassis. Do not drill holes above a mounted control system.





Recommended Spacing

❶ 15.3 to 20 cm (6 to 8 inches) when using the 1746-C9 cable

Important: When making a vertical connection between two A13 chassis with a 1746-C9 cable, you must limit the space to 15.3 cm (6 inches) for the C-9 cable to reach from chassis to chassis.

❷ Greater than 10.2 cm (4 inches)

❸ Greater than 15.3 cm (6 inches)

❹ 7.7 to 10.2 cm (3 to 4 inches) when using the 1746-C7 cable

Preventing Excessive Heat

For most applications, normal convection cooling will keep the adapter components within the specified operating range of 0° to +60° C (+32° to +140° F). Proper spacing of components within the enclosure is usually sufficient for heat dissipation.

In some applications, a substantial amount of heat is produced by other equipment inside or outside the enclosure. In this case, place blower fans inside the enclosure to assist in air circulation and to reduce “hot spots” near the adapter.

Additional cooling provisions might be necessary when high ambient temperatures are encountered.

Important: Do not bring in unfiltered outside air. It may introduce harmful contaminants of dirt that could cause improper operation or damage to components. In extreme cases, you may need to use air conditioning to protect against heat build-up within the enclosure.

Wiring Layout

Careful wire routing within the enclosure helps to cut down electrical noise between I/O lines. Follow these rules for routing your wires:

- Route incoming power to the power supply by a separate path from wiring to I/O devices. Where paths must cross, their intersection should be perpendicular.

  Important: Do not run signal or communications wiring and power wiring in the same conduit.

- If wiring ducts are used, allow for at least 5 cm (2 in) between I/O wiring ducts and the adapter. If the terminal strips are used for I/O wiring, allow for at least 5 cm (2 in) between the terminal strips and the adapter.
- Limit the cable length for the TTL input module to 15 m (50 ft) per point and 3 m (10 ft) per point for the TTL output module. Use low power dc I/O wiring even though it is less tolerant to electrical noise.

ATTENTION: Handle the TTL module by its ends, not metallic surfaces. Electrostatic discharges can damage the module. Do not expose the TTL module to electrostatic charges.

- Segregate I/O wiring by signal type. Bundle wiring with similar electrical characteristics together.

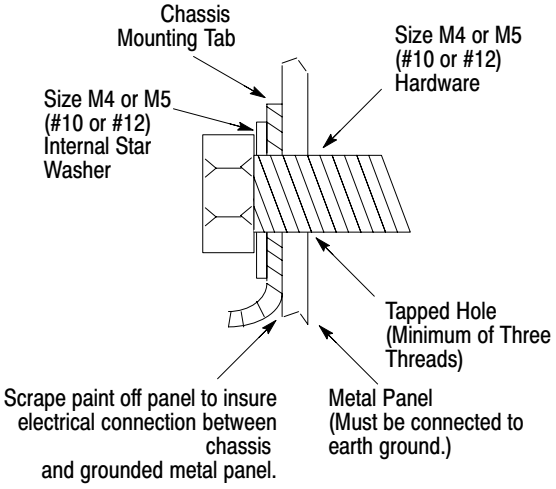
Wires with different signal characteristics should be routed into the enclosure by separate paths. Refer to *Allen-Bradley Programmable Controller Grounding and Wiring Guidelines*, Publication Number 1770-4.1.

ATTENTION: *United States Only:* If the adapter is being installed within a potentially hazardous environment (i.e., Class I, Division 2), all wiring must comply with the requirements stated in the National Electrical Code 501-4 (b).

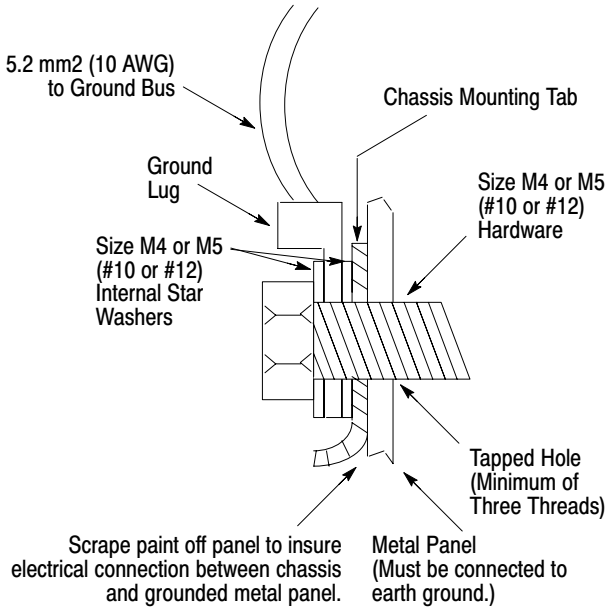
Grounding Guidelines

In solid-state control systems, grounding helps limit the effects of electrical noise due to electromagnetic interference (EMI). The ground path for the adapter and its enclosure is provided by the equipment grounding conductor.

Normal Electrical Noise Conditions



Severe Electrical Noise Conditions



ATTENTION: The 1746 chassis, the enclosure, and other control devices must be properly grounded. All applicable codes and ordinances must be observed when wiring the adapter system.

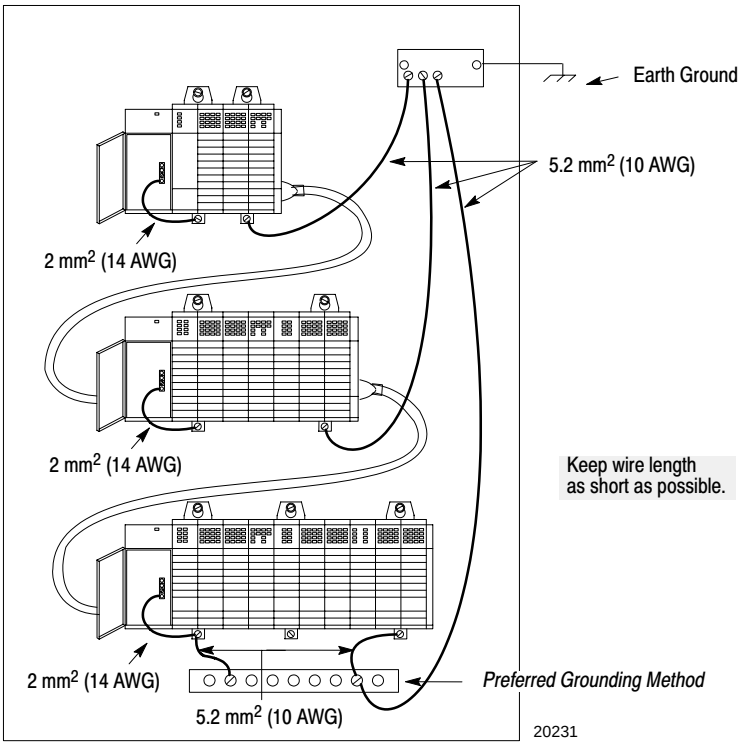
Ground connections should run from the chassis and power supply of each chassis and expansion unit to the ground bus. Exact connections will differ between applications.

Europe: Reference EN 60204 for safety information on grounding. Also, refer to *Allen-Bradley Programmable Controller Grounding and Wiring Guidelines*, Publication Number 1770-4.1.

United States: An authoritative source on grounding requirements for most installations is the National Electrical Code. Also, refer to *Allen-Bradley Programmable Controller Grounding and Wiring Guidelines*, Publication Number 1770-4.1.

In addition to the grounding required for the adapter and its enclosure, you must also provide proper grounding for all controlled devices in your application. Care must be taken to provide each device with an acceptable grounding path.

This figure shows you how to run ground connections from the chassis to the ground bus. Two acceptable grounding methods are shown; we recommend using a ground bus because it reduces the electrical resistance at the connection.



Master Control Relay

A hard-wired master control relay (supplied by user) provides a convenient means for emergency shutdown. Since the master control relay allows the placement of several Emergency-Stop switches in different locations, its installation is important from a safety standpoint. Overtravel limit switches or mushroom head push buttons are wired in series so that when any of them opens, the master control relay is de-energized. This removes power to input and output device circuits.

ATTENTION: Never alter these circuits to defeat their function, since serious injury and/or machine damage could result.

Important: If you are using a dc power supply, interrupt the dc side rather than the ac side to avoid the additional delay of power supply turn-on and turn-off. The dc power supply should receive its power directly from the fused secondary of the transformer. Connect the power to the dc input and output circuits through a set of master control relay contacts.

Place the main power disconnect switch where operators and maintenance personnel have quick and easy access to it. If you mount a disconnect switch inside the system enclosure, place the switch operating handle on the outside of the enclosure, so that you can disconnect power without opening the enclosure.

Whenever any of the emergency-stop switches are opened, power to input and output devices is stopped.

When you use the master control relay to remove power from the external I/O circuits, power continues to be provided to the system's power supply so that diagnostic indicators on the processor can still be observed.

The master control relay is not a substitute for a disconnect to the DP master. It is intended for any situation where the operator must quickly de-energize I/O devices only. When inspecting or installing terminal connections, replacing output fuses, or working on equipment within the enclosure, use the disconnect to shut off power to the rest of the system.

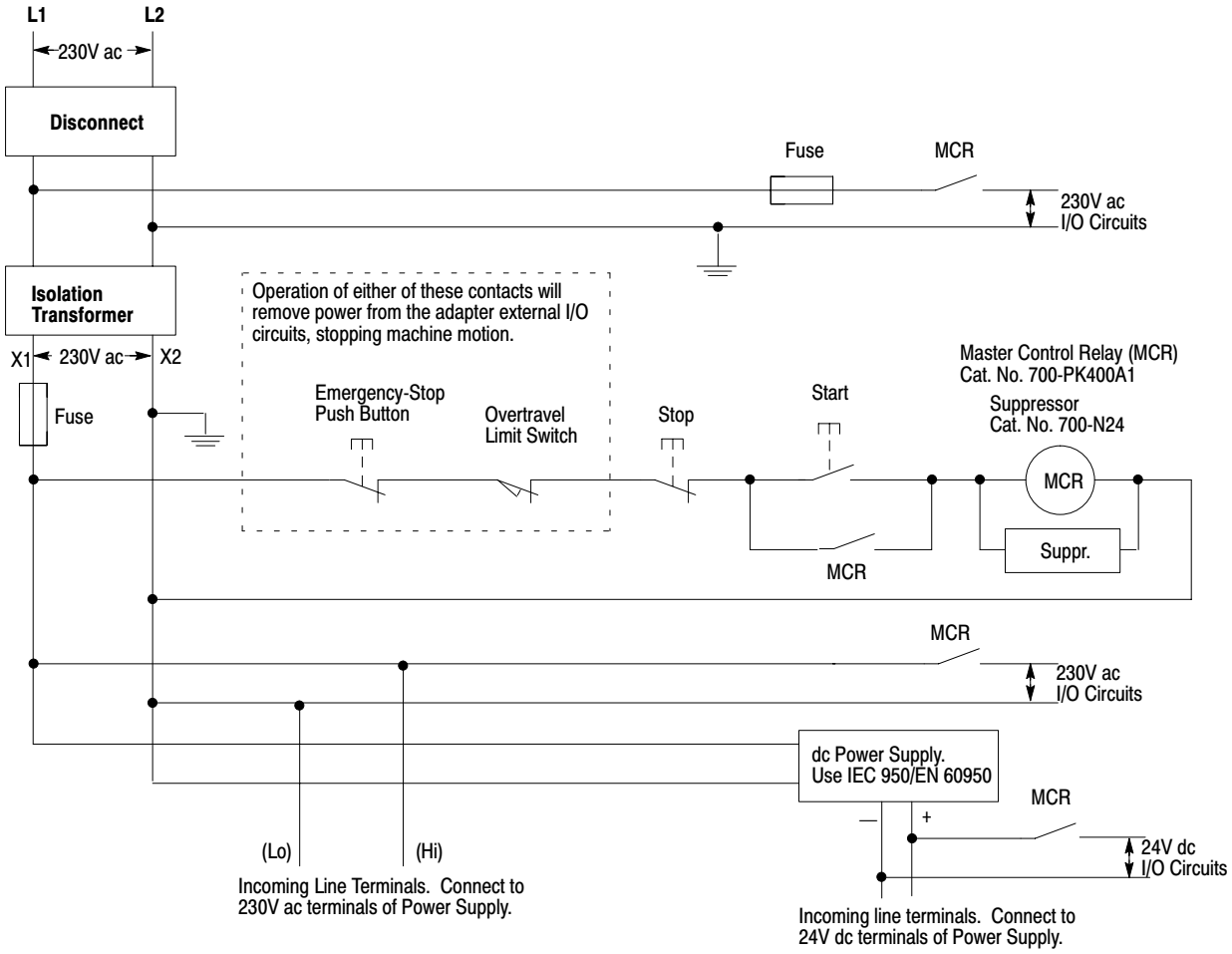
Important: The operator must not control the master control relay with the processor. Provide the operator with the safety of a direct connection between an emergency stop switch and the master control relay.

Emergency-Stop Switches

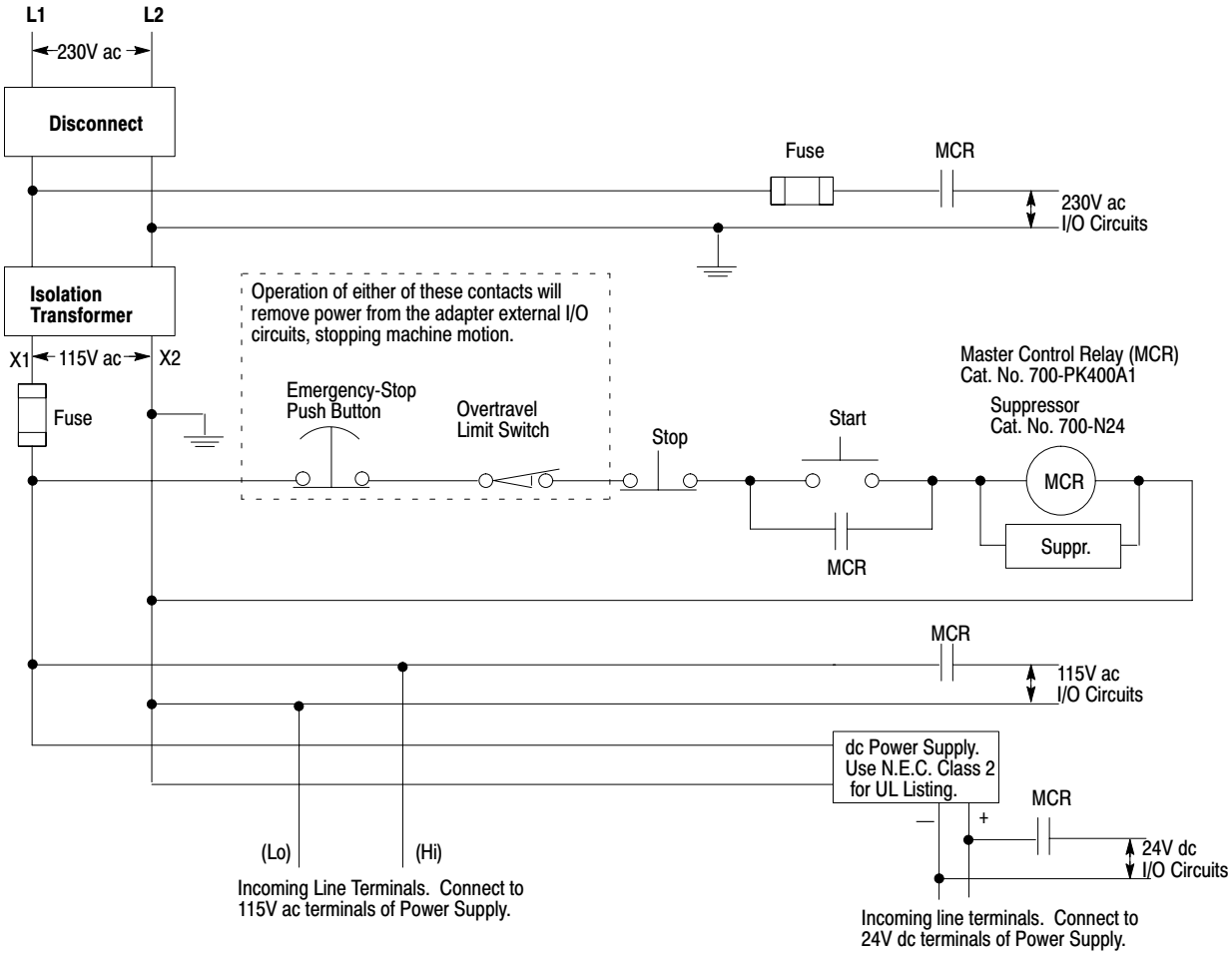
Adhere to the following points concerning Emergency-Stop switches:

- Do not program Emergency-Stop switches in the program. Any Emergency Stop switch should turn off all machine power by turning off the master control relay.
- Observe all applicable local codes concerning the placement and labeling of Emergency-Stop switches.
- Install Emergency-Stop switches and the master control relay in your system. Make certain that relay contacts have a sufficient rating for your application. Emergency-Stop switches must be easy to reach. See the following schematics.

Schematic (Using IEC Symbols)



Schematic (Using ANSI/CSA Symbols)



Common Power Source

We strongly recommend that all chassis power supplies have the same power source as the input and output devices. This helps reduce the chance of electrical interference due to multiple sources and grounds, as well as helps maintain system integrity if power is interrupted.

If you do not use a common power source, you need to apply power to the expansion chassis *before* you apply power to the chassis containing the adapter to avoid an unwanted fault. That is, if the adapter detects the absence of power to any chassis in the system, the STAT LED turns on and all adapter outputs are de-energized.

Loss of Power Source

The chassis power supplies are designed to withstand brief power losses without affecting the operation of the system. The time the system is operational during power loss is called “Scan Hold-up time after Loss of Power.” The duration of the power supply hold-up time depends on the number, type and state of the I/O modules, but is typically between 20 ms and 3 s. When the duration of power loss reaches this limit, the power supply signals can no longer provide adequate dc power to the system. This is referred to as a power supply shutdown. The power supply LED is turned off.

In multi-chassis systems, power outages of 20 to 300 ms in duration can cause a power fail error to occur. You can clear this error by cycling power to your system.

Input States on Power Down

The power supply hold-up time as described above is generally longer than the turn-on and turn-off times of the input modules. Because of this, the input state change from “On” to “Off” that occurs when power is removed may be recorded by the 1747-APB and sent to the DP master/scanner controller before the power supply shuts down the system. Understanding this concept is important. The user program should be written to take this effect into account. For example, hard wire power to one spare input. In the user program, check to be sure that one input is On; otherwise, jump to the end of the program and avoid scanning the logic. Use of a common power source as recommended in the previous section is assumed.

Other Types of Line Conditions

Occasionally the power source to the system can be temporarily interrupted. It is also possible that the voltage level drops substantially below the normal line voltage range for a period of time. Both of these conditions are considered to be a loss of power for the system.

Power Conditioning Considerations

There are two types of power conditioning considerations: isolation and suppression.

Isolation

If there is high frequency conducted noise in or around your distribution equipment, we recommend the use of an isolation transformer in the ac line to the power supply. This type of transformer provides isolation from your power distribution system and is often used as a “step down” transformer to reduce line voltage. Any transformer used with the adapter must have a sufficient power rating for its load. This power rating is generally expressed in volt-amperes (VA).

To select an appropriate isolation transformer, you must calculate the power required by the chassis power supply (or supplies if the system has expansion chassis) and any input circuits and output loads that are connected through this transformer.

The power requirement for the input circuits is determined by the number of inputs, the operating voltage, and the nominal input current. The power requirement for output loads is determined by the number of outputs, the load voltage, and load current.

For example, if you have a 1746-P1 power supply, 1746-IV16 16-point dc input module (0.012A at 24V dc) and a 1746-OV16 16-point dc transistor sink output module (0.5A at 24V dc), the power consumed would be:

230 VA + (16)(24V)(0.012A) + (16)(24V)(0.5A) = 426.6 VA

Important: In this case, 0.5A is the maximum rating of the transistor sink output (at 30° C). If your load draws less than 0.5A, this figure may be reduced accordingly. The output portion of the VA calculation should reflect the current requirements of your loads.

In general, we recommend that the transformer is oversized to provide some margin for line voltage variations and other factors. Typically a transformer that is 25% larger than the calculated VA is sufficient.

Suppression

Most industrial environments are susceptible to power transients or spikes. To help insure fault-free operation and protection of equipment, we recommend suppression devices on power to the equipment in addition to the isolation equipment.

Special Considerations

The recommendations given previously will provide favorable operating conditions for most adapter installations. Your application may involve one or more of the following adverse conditions. Additional measures can be taken to minimize the effect of these conditions.

Excessive Line Voltage Variations

The best solution for excessive line voltage variation is to correct any feeder problems in your distribution system. Where this does not solve the line variation problem, or in certain critical applications, use a constant voltage transformer. If you require a constant voltage transformer, connect it to the power supply *and* all input devices connected to the 1747-APB chassis.

Connect output devices on the same power line, but their connection along the power line is normally made before the constant voltage transformer. A constant voltage transformer must have a sufficient power rating for its load.

Excessive Noise

When you operate the 1747–APB module in a “noise polluted” industrial environment, special consideration should be given to possible electrical interference.

The following reduces the effect of electrical interference:

- 1747–APB design features
- proper mounting of adapter within an enclosure
- proper equipment grounding
- proper routing of wiring
- proper suppression added to noise generating devices

Inductive loads, such as relays, solenoids, and motor starters, when operated by “hard contacts” like push buttons or selector switches, generate surges on the ac line. Suppression may be necessary when such loads are connected as output devices or when connected to the same supply line that powers the adapter.

Lack of surge suppression on inductive loads may contribute to faults and sporadic operation, RAM can be corrupted (lost), and I/O modules may appear to be faulty or reset themselves.

If you connect a 1746 triac output module to control an inductive load, we recommend that you use varistors for surge suppression. Choose a varistor that is appropriate for the application. The surge suppressors we recommend for triac outputs when switching 120V ac inductive loads are a Harris MOV, part number V220 MA2A, or an Allen-Bradley MOV, Catalog Number 599-K04 or 599-KA04, Series C or later.

Consult the varistor manufacturer's data sheet when selecting a varistor for your application.

ATTENTION: Do not use suppressors having RC networks, since damage to triacs could occur. Allen-Bradley ac surge suppressors *not recommended* for use with triacs include Catalog Numbers 199-FSMA1, 199-FSMA2, 1401-N10, and 700-N24.

Applications such as high frequency welding equipment and large ac motors generate excessively high levels of electrical noise. In these applications, all possible sources of noise should be suppressed. Achieve best results when the noise suppressors are connected as closely as possible to the surge generating device. (See table below.)

Device	Coil Voltage	Suppressor Catalog Number
Bulletin 509 Motor Starter Bulletin 509 Motor Starter	120V ac 240V ac	599-K04① 599-KA04①
Bulletin 100 Contactor Bulletin 100 Contactor	120V ac 240V ac	199-FSMA1② 199-F5MA2②
Bulletin 709 Motor Starter	120V ac	1401-N10②
Bulletin 700 Type R, RM Relays	ac coil	None Required
Bulletin 700 Type R Relay Bulletin 700 Type RM Relay	12V dc 12V dc	700-N22 700-N28
Bulletin 700 Type R Relay Bulletin 700 Type RM Relay	24V dc 24V dc	700-N10 700-N13
Bulletin 700 Type R Relay Bulletin 700 Type RM Relay	48V dc 48V dc	700-N16 700-N17
Bulletin 700 Type R Relay Bulletin 700 Type RM Relay	115–125V dc 115–125V dc	700-N11 700-N14
Bulletin 700 Type R Relay Bulletin 700 Type RM Relay	230–250V dc 230–250V dc	700-N12 700-N15
Bulletin 700 Type N, P, or PK Relay	150V max, ac or dc	700-N24②
Miscellaneous electromagnetic devices limited to 35 sealed VA	150V max, ac or dc	700-N24②

① Series C or later of these catalog numbers do not contain capacitors. They are recommended for use with SLC 500 triac outputs.

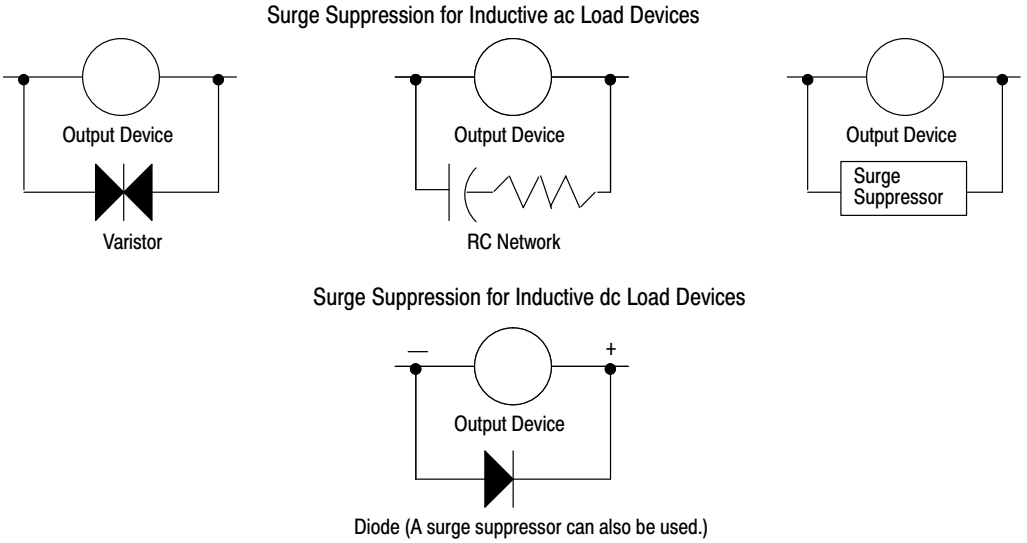
② Not recommended for use with triac outputs.

Class I, Division 2 Applications *(United States Only)*

Important: When installing peripheral devices (for example, push buttons, lamps) into a hazardous environment, ensure that they are Class I, Division 2 certified, or determined to be safe for the environment.

Output Contact Protection

Inductive load devices such as motor starters and solenoids may require the use of some type of surge suppression to protect the controller output contacts. Switching inductive loads without Surge Suppression can *significantly* reduce lifetime or relay contacts. The figure below details the use of surge suppression devices.



Contact protection methods for inductive ac and dc output devices.

These surge suppression circuits connect directly across the load device. This reduces arcing of the output contacts. (High transient can cause arcing that occurs when switching off an inductive device.) Suitable surge suppression methods for inductive ac load devices include a varistor, an RC network, or an Allen-Bradley surge suppressor. These components must be appropriately rated to suppress the switching transient characteristic of the particular inductive device.

For inductive dc load devices, a diode is suitable. A 1N4004 diode is acceptable for most applications.

We recommend that you locate the suppression device as close as possible to the load device.

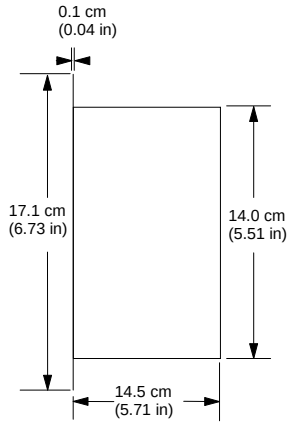
Mounting Your Control System

This section assists you in mounting your modular style unit. It consists of the dimensions of the four modular hardware styles and link coupler. For more information, see the *SLC 500 Modular Chassis Installation Instructions*, Publication Number 1746-5.8.

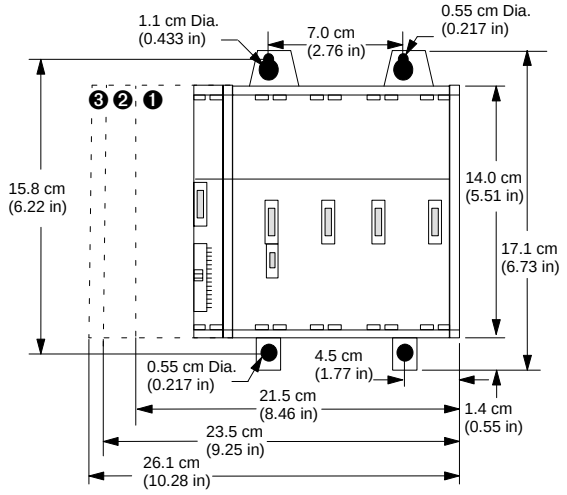
Mounting Modular Hardware Style Units

You can mount the modular hardware style units directly to the back panel of your enclosure using the mounting tabs and M4 or M5 (#10 or #12) screws. The torque requirement is 3.4 N-m (30 in-lbs) maximum.

Left-side View (all chassis)

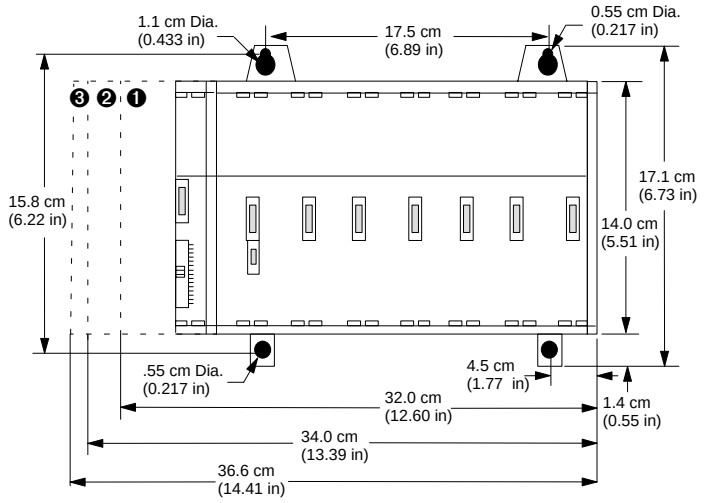


1746-A4

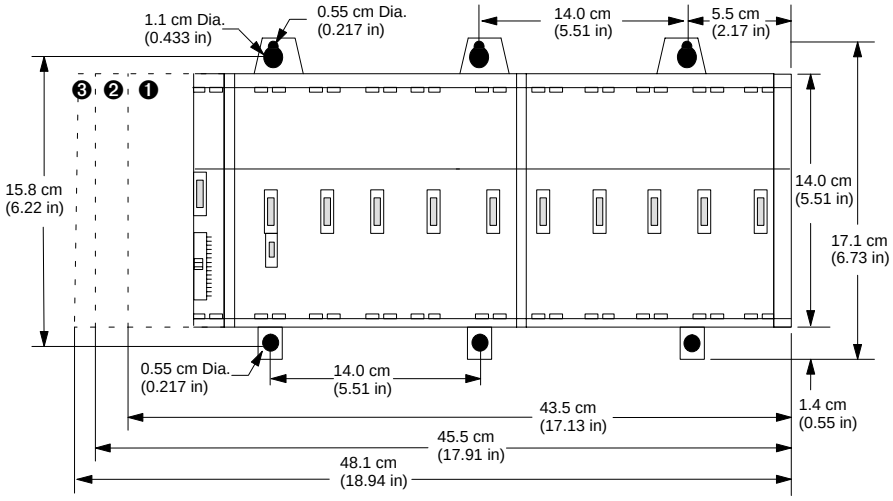


❶ Dimensions with 1746-P1 power supply.
❷ Dimensions with 1746-P2 or 1746-P3 power supply.
❸ Dimensions with 1746-P4 power supply.

1746-A7

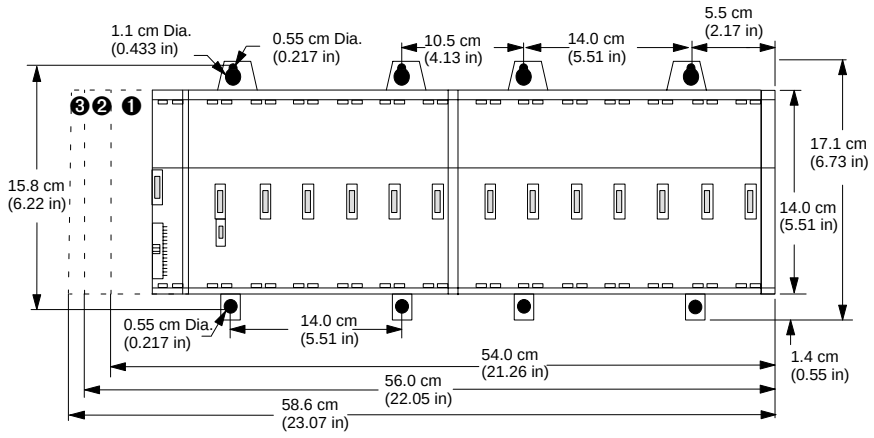


1746-A10



❶ Dimensions with 1746-P1 power supply.
❷ Dimensions with 1746-P2 or 1746-P3 power supply.
❸ Dimensions with 1746-P4 power supply.

1746-A13



❶ Dimensions with 1746-P1 power supply.
❷ Dimensions with 1746-P2 or 1746-P3 power supply.
❸ Dimensions with 1746-P4 power supply.

Calculating Heat Dissipation for Your Control System

The following terms are used throughout this section. Familiarize yourself with them before proceeding further into the section.

Watts per point — maximum heat dissipation that can occur in each field wiring point when energized.

Minimum watts — amount of heat dissipation that can occur when there is no field power present.

Maximum watts — maximum amount of heat that the module generates with field power present.

Module Heat Dissipation: Calculated Watts vs. Maximum Watts

There are two ways that you can calculate heat dissipation.

Calculated Watts — if you want to determine the amount of heat generated by the points energized on your module, use the formula below for calculating the heat dissipation of each module. Then use these values for calculating the *power supply loading* for each chassis — this is done using the worksheet.

(number of points energized x watts per point) + minimum watts = heat dissipation of module

Maximum watts — maximum amount of heat that the module generates with field power present. Use maximum watts especially if you are not sure how many points on a module will be energized at any time.

Once you have determined which way you will calculate the heat dissipation of your modules, see the Example Worksheet for Calculating Heat Dissipation on page 10–27. This worksheet shows you how to calculate the heat dissipation for the example 1747-APB system on page 10–26. Once you feel comfortable with the layout of the worksheet, go to the worksheet on page 10–28 and fill it out for your control system.

Calculating the Power Supply Loading

Use the table below to calculate the power supply loading for each chassis that you have (step 1 of the worksheet).

Hardware Component	Catalog Numbers	Watts per Point	Minimum Watts	Maximum Watts
Adapter Modules	1747-APB	NA	3.000	3.000
Specialty Modules	1746-BAS	NA	3.750	3.800
	1746-FIO4I	NA	3.760	3.800
	1746-FIO4V	NA	3.040	3.100
	1746-HS	NA	consult factory	
	1746-HSTP1	NA	consult factory	
	1746-NI4	NA	2.170	2.200
	1746-NIO4I	NA	3.760	3.800
	1746-NIO4V	NA	3.040	3.100
	1746-NO4I	NA	4.960	5.000
	1746-NO4V	NA	3.780	3.800
	1746-NR4	NA	consult factory	
	1746-NT4	NA	consult factory	
	1747-KE	NA	3.750	3.800
Input & Output Modules	1746-IO4	0.270 — per input pt. 0.133 — per output pt.	0.750	1.600
	1746-IO8	0.270 — per input pt. 0.133 — per output pt.	1.380	3.000
	1746-IO12	0.270 — per input pt. 0.133 — per output pt.	2.130	4.600

NA (Not Applicable)

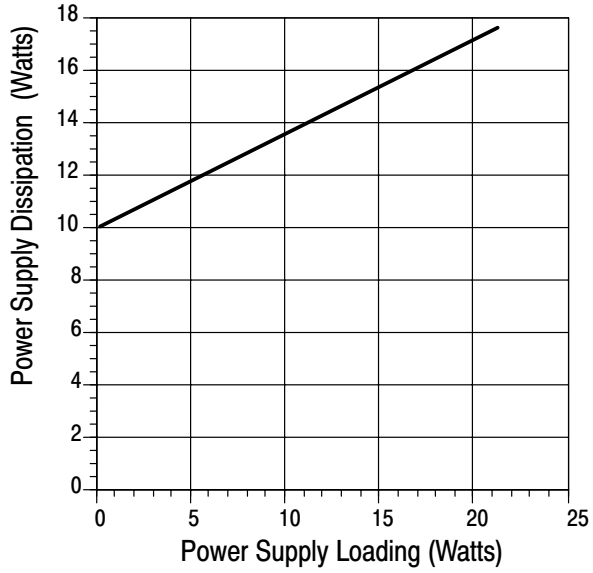
Continued on the next page.

Hardware Component	Catalog Numbers	Watts per Point	Minimum Watts	Maximum Watts
Input Modules	1746-IA4	0.270	0.175	1.300
	1746-IA8	0.270	0.250	2.400
	1746-IA16	0.270	0.425	4.800
	1746-IB8	0.200	0.250	1.900
	1746-IB16	0.200	0.425	3.600
	1746-IB32	0.200	0.530	6.900
	1746-IC16	0.220	0.425	3.950
	1746-IG16	0.020	0.700	1.000
	1746-IH16	consult factory		
	1746-IM4	0.350	0.175	1.600
	1746-IM8	0.350	0.250	3.100
	1746-IM16	0.350	0.425	6.000
	1746-IN16	0.350	0.425	6.000
	1746-ITB16	0.200	0.425	3.600
	1746-ITV16	0.200	0.425	3.600
	1746-IV8	0.200	0.250	1.900
	1746-IV16	0.200	0.425	3.600
	1746-IV32	0.200	0.530	6.900
Output Modules	1746-OA8	1.000	0.925	9.000
	1746-OA16	0.462	1.850	9.300
	1746-OAP12	1.000	1.850	10.850
	1746-OB8	0.775	0.675	6.900
	1746-OB16	0.338	1.400	7.600
	1746-OB32	0.078	2.260	4.800
	1746-OBP8	0.300	0.675	3.080
	1746-OBP16	0.310	1.250	6.260
	1746-OG16	0.033	0.900	1.500
	1746-OV8	0.775	0.675	6.900
	1746-OV16	0.388	1.400	7.600
	1746-OV32	0.078	2.260	4.800
	1746-OVP16	0.310	1.250	6.260
	1746-OW4	0.133	1.310	1.900
	1746-OW8	0.138	2.590	3.700
	1746-OW16	0.033	5.170	5.700
	1746-OX8	0.825	2.590	8.600

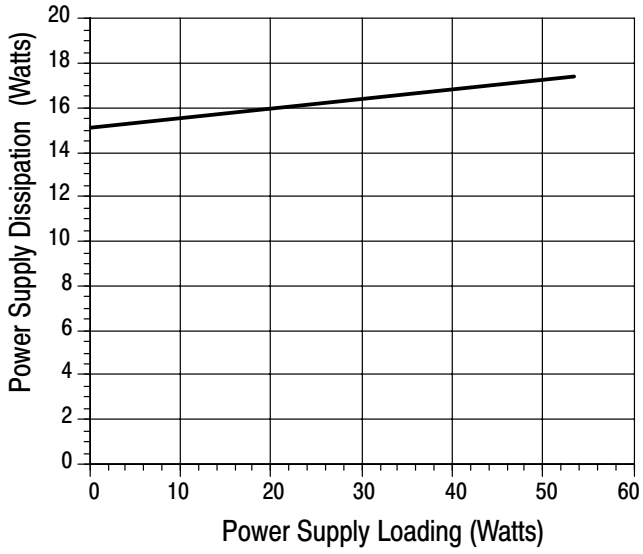
Determining the Power Supply Dissipation

Use the graphs below for determining the power supply dissipation in step 2 of the worksheet.

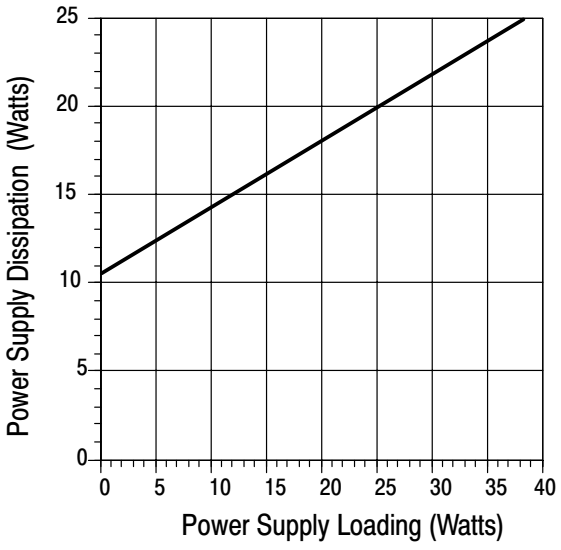
1746-P1 Power Supply Change in Power Dissipation due to Output Loading



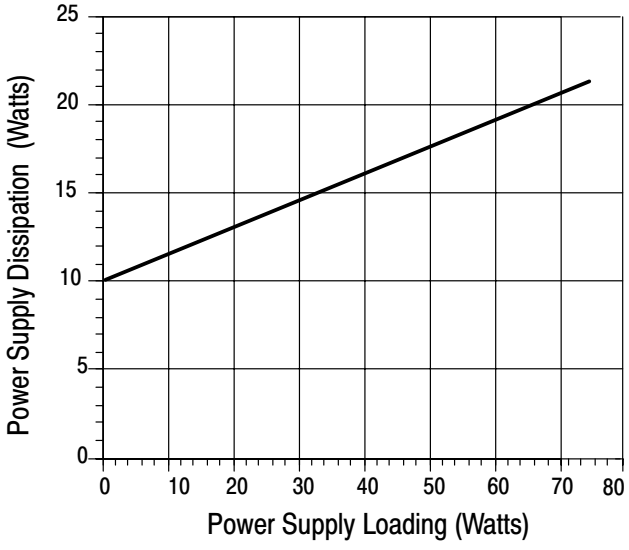
1746-P2 Power Supply Change in Power Dissipation due to Output Loading



1746-P3 Power Supply Change in Power Dissipation due to Output Loading

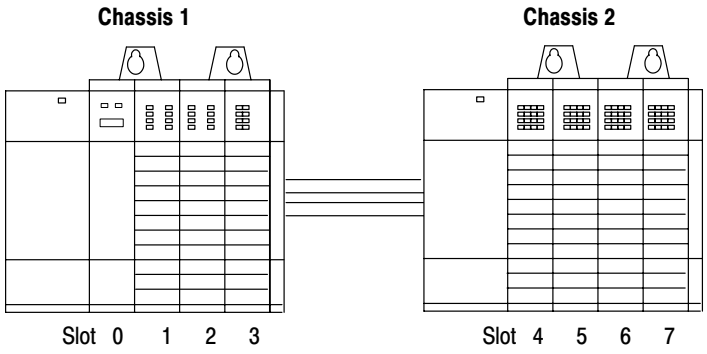


1746-P4 Power Supply Change in Power Dissipation due to Output Loading



Example Heat Dissipation Calculation

If your chassis consisted of the following hardware components, you would calculate heat dissipation as shown in the worksheet on page 10–27.



The following table details the total watts dissipated by the modules in the above chassis.

Chassis 1				Chassis 2			
Slot Number	Catalog Number	Min. Watts	Max. Watts	Slot Number	Catalog Number	Min. Watts	Max. Watts
0	1747-APB	3.000	3.000	4	1746-IA16	0.425	4.800
1	1746-IA8	0.250	2.400	5	1746-IA16	0.425	4.800
2	1746-IA8	0.250	2.400	6	1746-OW16	5.170	5.500①
3	1746-OV8	0.675	6.900	7	1746-OW16	5.170	5.700

① This output card uses 5.50 watts because only 10 points are on at any one time. Using the calculated watts formula — (number of points energized x watts per point) + minimum watts = heat dissipation of module — the calculated watts for the 1746-OW16 module is 5.500W: (10 points X 0.033) + 5.170 = 5.500W.

Example – Worksheet for Calculating Heat Dissipation

Procedure:	Chassis 1	Chassis 2	Chassis 3	Heat Dissipation
1. Calculate the heat dissipation for each chassis without the power supply.				
A. Write in the watts (calculated watts or maximum watts, see page 10–22) dissipated by the adapter, I/O and specialty modules, and any peripheral devices attached to the adapter. Then, for each chassis, add these values together.				
B. Place the heat dissipation for each chassis into the appropriate columns.	14.700	20.800	—	
2. Calculate the heat dissipation for each power supply.				
A. Calculate the power supply loading for each chassis: write in the minimum watts for each device (see page 10–23) and then, for each chassis, add these values together. **Important:** If you have a device connected to user power, multiply 24V by the current used. Include user power in the total power supply loading.				
B. Use the power supply loading for each chassis and the graphs on page 10–25 to determine the power supply dissipation. Place the power supply dissipations into the appropriate columns.	11.500	14.000	—	
3. Add the chassis dissipation to the power supply dissipation.	26.200 +	34.800 +	— =	61.000 W①
4. Add across the columns for the total heat dissipation of the PROFIBUS adapter.				

Chassis 1

Cat. No.	Ht. Dis.
APB	3.000
IA8	2.400
IA8	2.400
OV8	6.900
Total:	14.700

Chassis 2

Cat. No.	Ht. Dis.
IA16	4.800
IA16	4.800
OW16	5.500
OW16	5.700
	20.800

Chassis 3

Cat. No.	Ht. Dis.

Chassis 1

Cat. No.	Min. Ht. Dis.
APB	3.000
IA8	0.250
IA8	0.250
OV8	0.675
Total:	4.175

Chassis 2

Cat. No.	Min. Ht. Dis.
IA16	0.425
IA16	0.425
OW16	5.170
OW16	5.170
	11.190

Chassis 3

Cat. No.	Min. Ht. Dis.

① *United States:* To convert to BTUs/hr., multiply the total heat dissipation by 3.414.

Worksheet for Calculating Heat Dissipation

Make copies of this worksheet as needed.

Procedure:	Chassis 1	Chassis 2	Chassis 3	Heat Dissipation
1. Calculate the *heat dissipation* for each chassis without the power supply.				
A. Write in the watts (calculated watts or maximum watts, see page 10–22) dissipated by the adapter, I/O and specialty modules, and any peripheral devices attached to the adapter. Then, for each chassis, add these values together.				
Chassis 1 Cat. No. / Ht. Dis. — Chassis 2 Cat. No. / Ht. Dis. — Chassis 3 Cat. No. / Ht. Dis.				
Total:	_____	_____	_____	
B. Place the heat dissipation for each chassis into the appropriate columns.	_____	_____	_____	
2. Calculate the heat dissipation for each power supply.				
A. Calculate the power supply loading for each chassis: write in the minimum watts for each device (see page 10–23) and then, for each chassis, add these values together. **Important**: If you have a device connected to user power, multiply 24V by the current used. Include user power in the total power supply loading.				
Chassis 1 Cat. No. / Min. Ht. Dis. — Chassis 2 Cat. No. / Min. Ht. Dis. — Chassis 3 Cat. No. / Min. Ht. Dis.				
Total:	_____	_____	_____	
B. Use the power supply loading for each chassis and the graphs on page 10–25 to determine the power supply dissipation. Place the power supply dissipations into the appropriate columns.	_____	_____	_____	
3. Add the chassis dissipation to the power supply dissipation.				
4. Add across the columns for the total heat dissipation of your PROFIBUS adapter.	_____ +	_____ +	_____ =	_____ W①

① *United States:* To convert to BTUs/hr., multiply the total heat dissipation by 3.414.

Installing and Wiring I/O Modules

Read this chapter for information on:

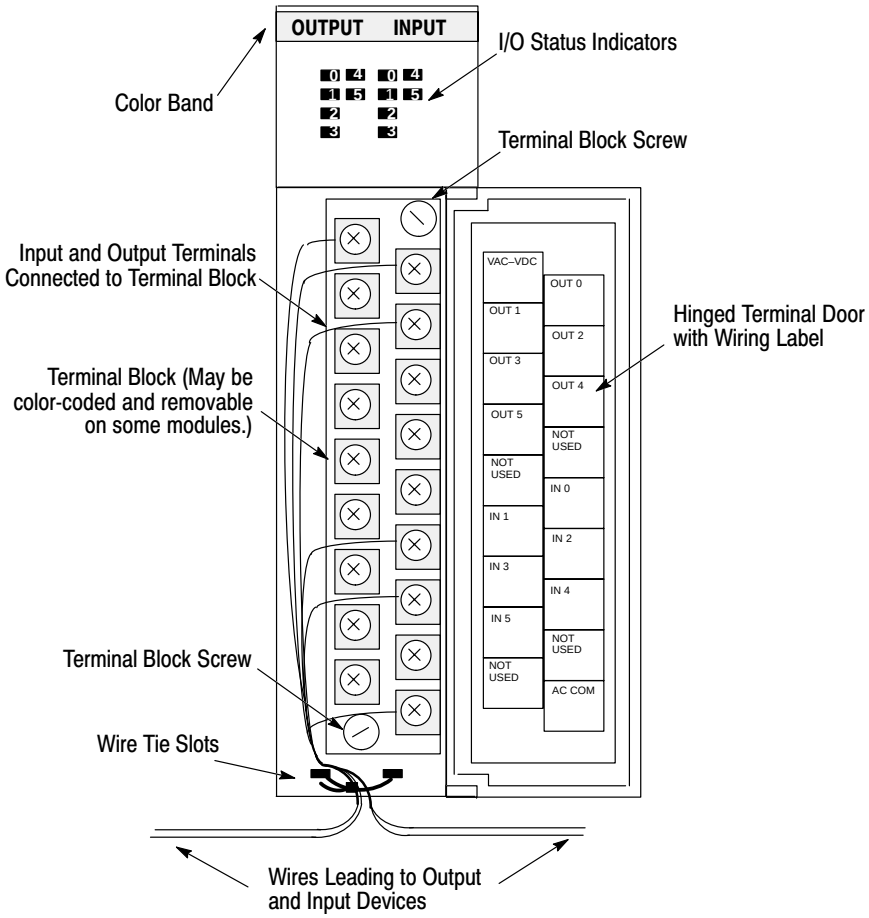
- installing your I/O modules
- wiring the I/O modules

Installing Your I/O Modules

This section describes the features of an I/O module, defines sinking and sourcing, and provides installation instructions for an I/O module.

Features of an SLC 500 I/O Module

Below is an example of a combination I/O module.



Definition of Sinking and Sourcing

Sinking and sourcing are terms used to describe a current signal flow relationship between field input and output devices in a control system and their power supply.

- Field devices connected to the positive side (+V) of the field power supply are sourcing field devices.
- Field devices connected to the negative side (DC Common) of the field power supply are called sinking field devices.

To maintain electrical compatibility between field devices and the programmable controller system, this definition is extended to the input/output circuits on the discrete I/O modules.

- Sourcing I/O circuits supply (source) current to sinking field devices.
- Sinking I/O circuits receive (sink) current from sourcing field devices.

Europe: DC sinking input and sourcing output module circuits are the commonly used options.

Contact Output Circuits – AC or DC

Relays can be used for either AC or DC output circuits and accommodate either sinking or sourcing field devices. These capabilities are a result of the output switch being a mechanical contact closure, not sensitive to current flow direction and capable of accommodating a broad range of voltages.

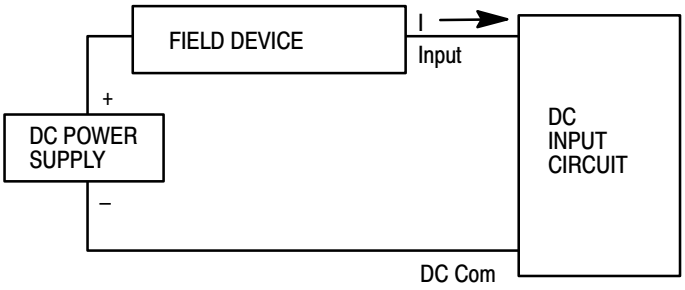
This high degree of application flexibility makes contact output modules very popular and useful in control environments with a broad mix of electrical I/O circuit requirements.

Solid State DC I/O Circuits

The design of DC field devices typically requires that they be used in a specific sinking or sourcing circuit depending on the internal circuitry of the device. DC input and output field circuits are commonly used with field devices that have some form of internal solid state circuitry that need a DC signal voltage to function.

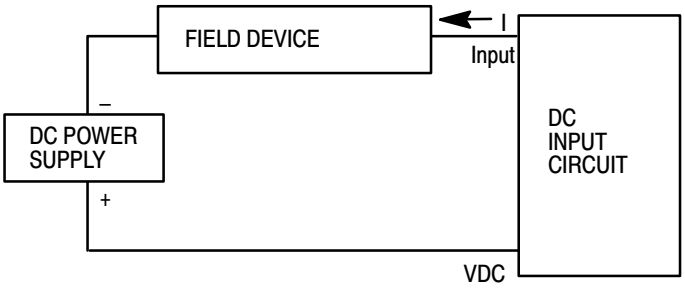
Sourcing Device with Sinking Input Module Circuit

The field device is on the positive side of the power supply between the supply and the input terminal. When the field device is activated, it sources current to the input circuit.



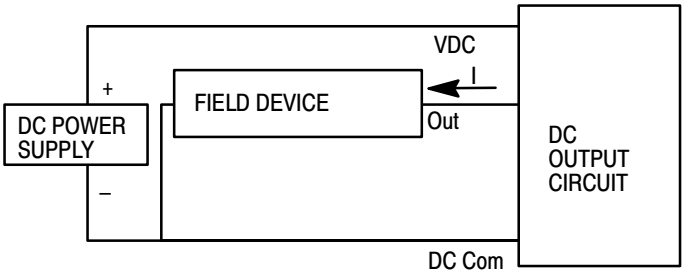
Sinking Device with Sourcing Input Module Circuit

The field device is on the negative side of the power supply between the supply and the input terminal. When the field device is activated, it sinks current from the input circuit.



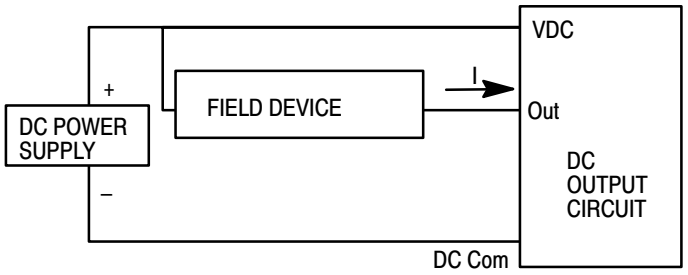
Sinking Device with Sourcing Output Module Circuit

The field device is on the negative side of the power supply between the supply and the output terminal. When the output is activated, it sources current to the field device.



Sourcing Device with Sinking Output Module Circuit

The field device is on the positive side of the power supply between the supply and the output terminal. When the output is activated, it sinks current from the field device.

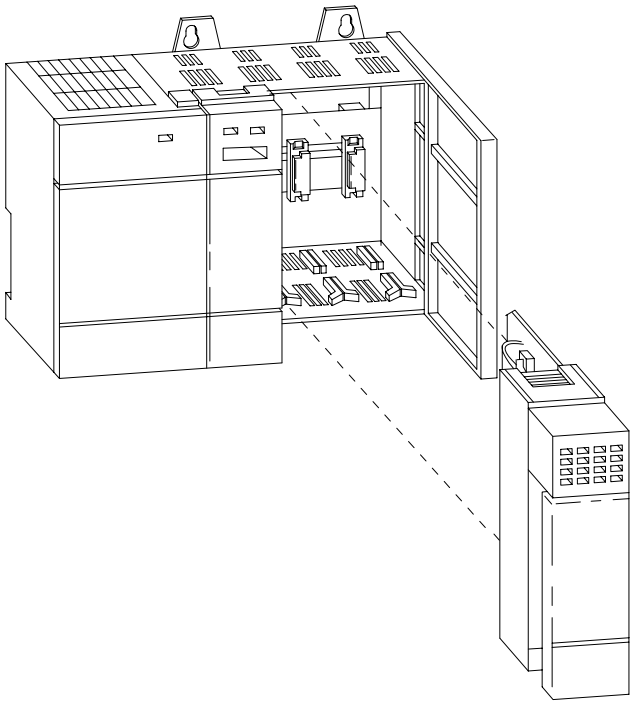


Inserting I/O Modules

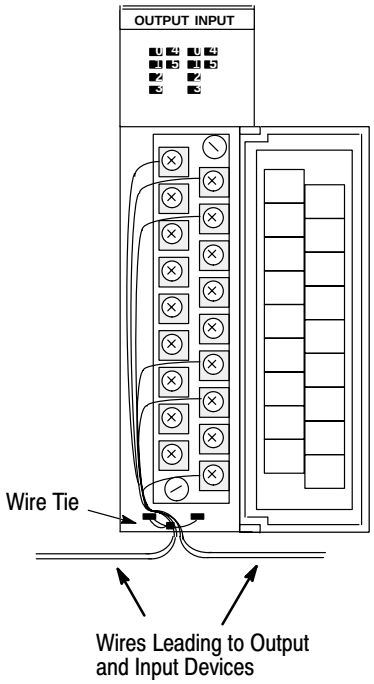
The procedure for installing I/O modules is similar to the procedure for installing the 1747-APB module. Follow the steps below.

ATTENTION: Disconnect power before attempting to install, remove, or wire modules.

1. Disconnect power.
2. Align circuit board of the module with the chassis card guide.



3. Slide the module into the chassis until the top and bottom tabs lock into place.
4. Insert the wire tie in the slots.
5. Route the wires down and away from the module, securing them with the wire tie.



6. Cover all unused slots with the Card Slot Filler, Catalog Number 1746-N2, to keep the chassis free from dust and debris.

Removing I/O Modules

ATTENTION: Disconnect power before attempting to install, remove, or wire modules.

1. Disconnect power.
2. Press and hold the module release located on each self-locking tab and slide the module out of the chassis slot.
3. Cover all unused slots with the Card Slot Filler, Catalog Number 1746-N2, to keep the chassis free from dust and debris.

Wiring the I/O Modules

The following are general recommendations for wiring I/O devices.

ATTENTION: Before you install and wire I/O devices, disconnect power from the controller and any other source to the I/O devices.

Use acceptable wire gauge — The I/O wiring terminals are designed to accept two wires per terminal (maximum) of the following size wire:

- *Europe:* $2mm^2$ cross section or smaller
- *United States:* 14 AWG or smaller stranded wires

Label wires — Label wiring to I/O devices, power sources, and ground. Use tape, shrink-tubing, or other dependable means for labeling purposes. In addition to labeling, use colored insulation to identify wiring based on signal characteristics. For example, you may use blue for DC I/O wiring and red for AC I/O wiring.

Secure wires — Route the wires down and away from the module, securing them with the cable tie.

Bundle wires — Bundle wiring for each similar I/O device together. If you use ducts, allow at least 5 cm (2 in.) between the ducts and the controller so there is sufficient room to wire the devices.

Identify terminals — Terminal cover plates have a write-on area for each terminal. Use this area to identify your I/O devices. Label the removable terminal block if you have not already.

ATTENTION: Calculate the maximum possible current in each power and common wire. Observe all local electrical codes dictating the maximum current allowable for each wire size. Current above the maximum ratings may cause wiring to overheat, which can cause damage.

Capacitors on input modules have a stored charge that can cause a non-lethal shock. Avoid mounting the controller in a position where installation or service personnel would be in danger from startle reaction.

Using Removable Terminal Blocks

The Removable Terminal Block (RTB) is provided on all 12-point and 16-point discrete I/O modules and analog modules. They allow for faster and more convenient wiring of the I/O modules. The RTBs and modules are color-coded as follows:

If the color is:	Then the RTB is for:
red	AC inputs/outputs
blue	DC inputs/outputs
orange	relay outputs
green	specialty modules
black	These I/O wiring terminal blocks are not removable.

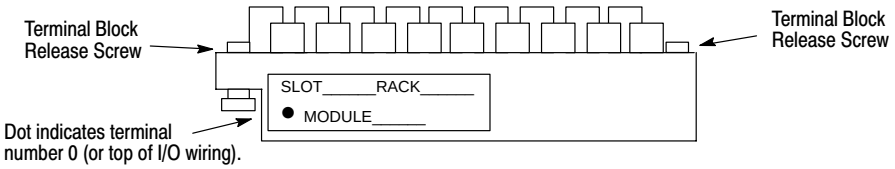
Replacement terminal blocks are available if they are lost or damaged.

Removing the RTB

Below are guidelines for removing the RTB.

ATTENTION: Disconnect power before attempting to install or remove I/O modules or their terminal blocks.

1. If the I/O module is already installed in the chassis, disconnect power.
2. Unscrew the upper right and lower left terminal block release screws.
3. Grasp the RTB with your thumb and forefinger and pull straight out.
4. Write the appropriate slot, chassis, and module type on the RTB label.



Installing the RTB

Below are guidelines for installing the RTB.

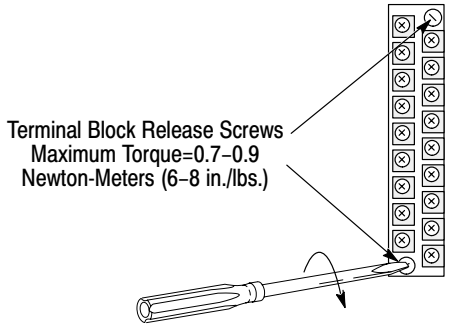
1. Be sure the color of the RTB matches the color band on the module.

ATTENTION: Inserting a wired RTB on an incorrect module can damage the module circuitry when power is applied.

2. Write the appropriate slot, chassis, and module type on the RTB label.

ATTENTION: Disconnect power before attempting to install or remove I/O modules or their terminal blocks.

3. Disconnect power.
4. Align the terminal block release screws with the mating connector in the module.
5. Press the RTB firmly onto the connector contacts.
6. Tighten the terminal block release screws. To avoid cracking the terminal block, alternate the tightening of the screws.



Octal Label Kit Installation (For DP Master's that Use Octal Bit Addresses Only)

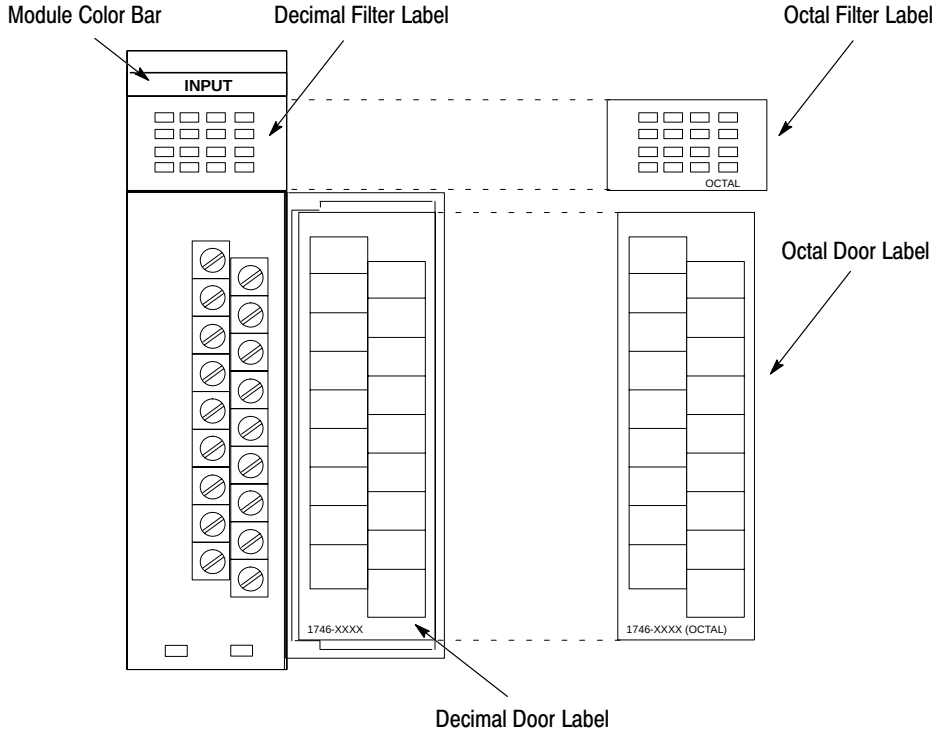
The octal label kit consists of an octal filter label and a door label. Use these octal labels to replace the decimal labels that are attached to the I/O modules. An octal label kit is included with the I/O modules listed in the table on the following page. The kits can also be obtained through your Allen-Bradley distributor.

Applying the Octal Filter Label

1. Remove the octal filter label from its paper carrier.
2. Align the octal filter label numbers horizontally to the module color bar and over the decimal filter numbers, as shown in the illustration below.
3. Apply the octal label to the filter.
4. Press firmly to ensure proper adhesion of the label.

Applying the Octal Door Label

1. Remove the octal door label from its paper carrier.
2. Align it over the decimal door label on the inside of the door.
3. Press firmly to ensure proper adhesion of the label.



Octal Kit and I/O Module Information

Octal Kit Catalog Number 1746-	Applies to I/O Module 1746-①
RL40	IA16
RL41	IB16
RL42	IG16
RL43	IM16
RL44	IN16
RL45	IV16
RL46	ITB16
RL47	ITV16
RL50	OA16
RL51	OB16
RL52	OG16
RL53	OV16
RL54	OW16
RL55	OBP16
RL56	OVP16
RL57	OAP12
RL60	IB32
RL61	IV32
RL70	OB32
RL71	OV32

① Kit available with series C I/O modules.

Throughput

This appendix provides information on calculating the contribution the 1747-APB module adds to the PROFIBUS system throughput.

Calculating PROFIBUS System Throughput

The Profibus system throughput is determined by more than the 1747-APB module itself. The I/O module input and output delays, PROFIBUS DP master scan time, and programmable controller scan time contribute to system throughput as well.

An example formula to calculate the maximum PROFIBUS system throughput is:

$$T_{max} = 2T_{ps} + T_{DPm} + T_{id} + T_{od} + 2T_{PB} + 2T_{bp}$$

Where T_{max} = the maximum PROFIBUS system throughput in milliseconds (ms).

To calculate throughput, substitute values for the variables in the formula above. Locate these values in the following documents:

Variable	Variable Description	Location of Variable
T_{ps}	The total processor scan time (ms)	your programmable controller's user manual
T_{DPm}	The DP master delay time (ms) (only if master is a separate module, otherwise value is typically 0)	your DP master's user manual
T_{id}	The input module input delay time (ms)	SLC I/O product data and I/O instruction sheets
T_{od}	The output module output delay time (ms)	SLC I/O product data and I/O instruction sheets
T_{PBT}	The total PROFIBUS station delay time (ms)	your DP master's user manual
T_{bp}	1747-APB module backplane scan time (ms)	the section that follows

1747-APB Module Backplane Time (T_{bp})

The 1747-APB module backplane time is determined by the type of I/O modules and I/O chassis size used in the 1747-APB PROFIBUS slave system. To calculate the 1747-APB module backplane time (T_{bp}), use the following equation.

$$T_{bp} = T_{chassis1} + (T_{I/O\ MOD1} \ldots + T_{I/O\ MODn}) + T_{chassis2} + (T_{I/O\ MOD1} \ldots + T_{I/O\ MODn}) + T_{chassis3} + (T_{I/O\ MOD1} \ldots + T_{I/O\ MODn})$$

Where T_{bp} = the base backplane scan time in milliseconds (ms).

Locate the appropriate chassis and I/O module backplane times in the following tables to solve the equation.

Chassis: 1746-		Backplane Time (ms)
A4	4-Slot	0.06
A7	7-Slot	0.10
A10	10-Slot	0.14
A13	13-Slot	0.18

I/O Module	Backplane Time (ms)
8 point input	0.14
16 point input	0.19
32 point input	0.33
2 word specialty input	0.27
4 word specialty input	1.14
8 word specialty input	2.08
8 point output	0.11
16 point output	0.15
32 point output	0.24
2 word specialty output	0.27
4 word specialty output	1.03

Device Data Base File

For ease of configuring your master, a disk containing an electronic device data base is shipped with each 1747-APB module. If your PROFIBUS master's configuration software has the capability to read this `*.gsd` file (DP standard Device Data Base file), the software will automatically extract from this file all the configuration and parameter bytes needed to configure your master for the 1747-APB module. Otherwise you will probably need to manually enter this information into the software. (See your configuration software's user manual for more information.)

Starting on the next page is a *sample* of the Device Data Base File for the 1747-APB module.

Important: You will find the most current device data base file information on the disk. The information in this appendix is provided for reference only.

```
;=======================================================
; Profibus Device Database of :
;  Allen–Bradley DP slave
;  Model : 1747–APB    Revision Series A FRN1.0
;  Description : SLC 500 Profibus Slave Adapter
; Language : English
; Date : 15 February 1996
; Author : Allen–Bradley
;=======================================================

AB_GSD_Revision  = “1.0”

#Profibus_DP

; Device identification
Vendor_Name      = “Allen–Bradley”
Model_Name       = “1747–APB”
Revision         = “Series A FRN1.0”
Ident_Number     = “0x1100”
Protocol_Ident   = 0          ; DP protocol
Station_Type     = 0          ; Slave device
FMS_supp         = 0          ; FMS not supported
Hardware_Release = “Series A”
Software_Release = “FRN1.0”

; Supported baudrates
9.6_supp     = 1
19.2_supp    = 1
93.75_supp   = 1
187.5_supp   = 1
500_supp     = 1
1.5M_supp    = 1
3M_supp      = 0
6M_supp      = 0
12M_supp     = 0

; Maximum responder time for supported baudrates
MaxTsdr_9.6      = 60
MaxTsdr_19.2     = 60
MaxTsdr_93.75    = 60
MaxTsdr_187.5    = 60
MaxTsdr_500      = 100
MaxTsdr_1.5M     = 150

; Supported hardware features
Redundancy       = 0          ; not supported
Repeater_Ctrl_Sig = 0         ; not connected
24V_Pins         = 0          ; not connected
```

```
; Supported DP features
Freeze_Mode_supp        = 0
Sync_Mode_supp          = 0
Auto_Baud_supp          = 1     ; supported
Set_Slave_Add_supp      = 0

; Maximum Length of User Parameter
User_Prm_Data_Len = 0

; Maximum polling frequency
Min_Slave_Interval = 10         ; 10*100 microsecond => 1 millisecond

; Maximum supported sizes
Modular_Station         = 1     ; modular
Max_Module              = 30    ; physical modules = slots
Max_Input_Len           = 244
Max_Output_Len          = 244
Max_Data_Len            = 488

; Meaning of ”device diagnostic” field

;Firmware revisions of device
Unit_Diag_Area = 0–7
Value (16) = “Firmware Rev. : 1.0”
Unit_Diag_Area_End

Unit_Diag_Bit (8)    = “Module Has Minor Fault”          ; Adapter Status
Unit_Diag_Bit (9)    = “Module Has Major Fault”          ; Adapter Status

;LED states
Unit_Diag_Area       = 10–12                    ; Communication LED
Value (0)       = “PROFI LED is Off”
Value (1)       = “PROFI LED is Solid Green”
Value (2)       = “PROFI LED is Solid Red”
Value (3)       = “PROFI LED is Blinking Off/Green”
Value (4)       = “PROFI LED is Blinking Off/Red”
Value (5)       = “PROFI LED is Blinking Red/Green”
Value (6)       = “PROFI LED is Blinking Off/Red/Off/Green”
Unit_Diag_Area_End

Unit_Diag_Area       = 13–15                    ; Health LED
Value (0)       = “STAT LED is Off”
Value (1)       = “STAT LED is Solid Green”
Value (2)       = “STAT LED is Solid Red”
Value (3)       = “STAT LED is Blinking Off/Green”
Value (4)       = “STAT LED is Blinking Off/Red”
Value (5)       = “STAT LED is Blinking Red/Green”
Value (6)       = “STAT LED is Blinking Off/Red/Off/Green”
Unit_Diag_Area_End

;The remaining 6 bytes contains the ASCII codes corresponding to Primary
;and Alternating Display, as shown on the adapter front panel.
;Please look at the user manual (section “Troubleshooting”) for a detailed
;explanation about the meaning of these bytes.
```

```
; Definition of compatible SLC modules
; Contact your Local Allen–Bradley representative, for new products
; that may be compatible with the 1747–APB Slave Adapter, but is not on this gsd file.

; Empty slot
Module = “SLC empty slot”                                   0x00
EndModule

; “Any binary module with 16 or less input points.
Module = “1746– 16, 8, 4, or 2 Point Input”                  0x50
“EndModule

; Any binary module with 32 input points.
Module = “1746 – 32 Point Input”                            0x51
EndModule

; Any binary module with 32 output points.
Module = “1746 – 32 Point Output”                           0x61
EndModule

; Any binary module with 16 or less output points.
Module = “1746– 16, 8, 4, or 2 Point Output”                 0x60
EndModule

; Combination  binary input (2, 4, 8) /  outputs  (2, 4, 8)
Module = “1746–  8 in / 8 out, binary”                      0x70
EndModule

; Combination, (2) Input words & (2) Output words, module
Module       = “1746– (2  Input / 2 Output) words”          0x71
EndModule

; Combination, (4) Input words & (4) Output words, module
Module       = “1746– (4  Input / 4 Output) words”          0x73
EndModule

; Combination, (8) Input words & (8) Output words, module
Module       = “1746– (8 Input / 8 Output) words”           0x77
EndModule

; Any Four (4) Input  words module
Module       = “1746– (4) Input  words”                     0x53
EndModule

; Any Eight (8 ) Input  words module
Module       = “1746– (8) Input  words”                     0x57
EndModule

; Any Four (4) Output  words module
Module       = “1746– (4) Output  words”                    0x63
EndModule

; Any Eight (8) Output words module
Module       = “1746– (8) Output  words”                    0x67
EndModule
```

Module = “BAS – BASIC Module (501 mode)” 0x77
EndModule

Module = “FIO4I (2 IN , 2 OUT) Fast Analog” 0x71
EndModule

Module = ”FIO4V (2 IN , 2 OUT) Fast Analog” 0x71
EndModule

Module = ”HS – IMC 110 Servo Controller” 0x73
EndModule

Module = ”HSTP1 – SLC Stepper Motor Module” 0x77
EndModule

Module = “IA16 (16 IN) – 100/120 VAC” 0x50
EndModule

Module = “IA4 (4 IN) – 100/120 VAC” 0x50
EndModule

Module = “IA8 (8 IN) – 100/120 VAC” 0x50
EndModule

Module = “IB16 (16 IN) – Sink 24 VDC” 0x50
EndModule

Module = “IB32 (32 IN) – Sink 24 VDC” 0x51
EndModule

Module = “IB8 (8 IN) – Sink 24 VDC” 0x50
EndModule

Module = “IC16 (16IN) 48VDC” 0x50
EndModule

Module = “IG16 (16 IN) – 5 VDC TTL” 0x50
EndModule

Module = “IM16 (16 IN) – 200/240 VAC” 0x50
EndModule

Module = “IM4 (4 IN) – 200/240 VAC” 0x50
EndModule

Module = “IM8 (8 IN) – 200/240 VAC” 0x50
EndModule

Module = “IN16 (16 IN) – 24V AC/DC” 0x50
EndModule

Module = “IO12 (6/6 I/O) – 100/120 VAC” 0x70
EndModule

Module = “IO4 (2/2 I/O) – 100/120 VAC” 0x70
EndModule

Module = “IO8 (4/4 I/O) – 100/120 VAC” 0x70
EndModule

Module = “ITB16 (16 IN) Fast, Sink 24VDC” 0x50
EndModule

Module = “ITV16 (16 IN) Fast, Source 24VDC” 0x50
EndModule

Module = “IV16 (16 IN) Source 24 VDC” 0x50
EndModule

Module = “IV32 (32 IN) Source 24 VDC” 0x51
EndModule

Module = “IV8 (8 IN) Source 24 VDC” 0x50
EndModule

Module = “KE – DH485/RS232C Interface” 0x77
EndModule

Module = “NR4 – RTD/Resistance Input Mod” 0x77
EndModule

Module = “NT4 – Thermocouple/mV Input Mod” 0x77
EndModule

Module = “NI4 (4 IN) Analog, I or V” 0x53
EndModule

Module = “NIO4I (2 IN, 2 OUT) Analog” 0x71
EndModule

Module = “NIO4V (2 IN, 2 OUT) Analog” 0x71
EndModule

Module = “NO4I (4 OUT) 0 to 20 mA Analog” 0x63
EndModule

Module = “NO4V (4 OUT) – 10 VDC to +10 VAC” 0x63
EndModule

Module = “OA16 (16 OUT) Triac – 120/240VAC” 0x60
EndModule

Module = “OA8 (8 OUT) Triac – 120/240VAC” 0x60
EndModule

Module = “OAP12 (12 OUT) Triac– 120/240VAC” 0x60
EndModule

Module = “OB16 (16 OUT) Trans Src 10–50VDC” 0x60
EndModule

Module = “OB32 (32 OUT) Trans Src 10–50VDC” 0x61
EndModule

Module = “OB8 (8 OUT) Trans Src 10–50 VDC” 0x60
EndModule

Module = “OBP8 (8 OUT) High Current DC” 0x60
EndModule

```
Module      = “OBP16 (16 OUT) Trans Src 24 VDC”          0x60
EndModule

Module      = “OG16 (16 OUT) – 5VDC TTL”                 0x60
EndModule

Module      = “OV16 (16 OUT) TransSink 10–50VDC”         0x60
EndModule

Module      = “OV32 (32 OUT) Trans Sink 5–50 VDC”        0x61
EndModule

Module      = “OV8 (8 OUT) Trans Sink 10–50 VDC”         0x60
EndModule

Module      = “OVP16 (16 OUT) Trans Sink 24 VDC”         0x60
EndModule

Module      = “OW16 (16 OUT) Relay”                      0x60
EndModule

Module      = “OW4 (4 OUT) Relay”                        0x60
EndModule

Module      = “OW8 (8 OUT) Relay”                        0x60
EndModule

Module      = “OX8 (8 OUT) Isolated Relay”               0x60
EndModule


; Profibus Manager specific parameters

AB_Icon_File = “res\SLCAPB_A.Ico”              ; SLC, Series A, FRN 1.0
AB_Bitmap_File = “res\SLCAPB_A.bmp”            ; SLC, Series A, FRN 1.0
AB_Attach_Offset = 32
AB_Description = “Allen–Bradley SLC 500 Profibus Adapter”

;=============================================================
```

Glossary

The following terms are used throughout this manual.

Adapter – Any physical device that is a slave on the PROFIBUS DP network. The 1747-APB module is an adapter.

Baud Rate – The speed of communication between devices on a network. All devices must communicate at the same baud rate.

Calculated Watts – The amount of heat generated by those points energized on an I/O module.

Chassis – A hardware assembly that houses the 1747-APB module, a power supply, and I/O modules.

Discrete I/O Module – An I/O module used to sense or control two-state (ON/OFF) devices.

CSA – Canadian Standards Agency.

DIN – German Normalization Agency.

DP – Decentralized Periphery. A German/European standard (DIN 19245, Part 3) that specifies a simplified user interface with PROFIBUS link layer services and protocol, for use with decentralized peripherals.

Expansion Chassis – A hardware assembly that connects to a chassis using a 1747-C9 (91.4 cm [36 in]) or 1747-C7 (15.2 cm [6 in]) cable. It houses a power supply and I/O modules.

Input Device – A device, such as a push button or a switch, that supplies signals through input circuits to a programmable controller.

I/O – Inputs and Outputs

I/O Module – Any 1746 or 1747 I/O module that is supported by the 1747-APB module.

LED – Light-emitting Diode.

Logical Module – Features up to 16 words maximum of inputs, outputs, or combined inputs/outputs. The I/O data exchanged between a PROFIBUS DP master and a slave device comprises a set of logical modules.

Maximum Watts – The maximum amount of heat that the module generates with field power present.

Minimum Load Current – The lowest amount of current at which the output is designed to operate. Operating at or below this value is not reliable.

Minimum Watts – The amount of heat dissipation that can occur when there is no field power present.

Module Slot – Also called slot. A location in a chassis or expansion chassis for installing a module. Each module slides into a module slot that lines up with a backplane connector.

Network – A series of stations (nodes) connected by some type of communication medium. A network may be made up of a single link or multiple links.

Node – Also called station. An address or software location on the network.

Nominal Input Current – The current at nominal input voltage.

Off-State Current – For input circuits, the maximum amount of leakage current allowed from an input device in its Off-state.

Off-State Leakage – For output circuits, the maximum amount of (leakage) current that may flow when the output circuit is in its Off-state.

Off-State Voltage (max) – The maximum input voltage level detected as an Off condition by the input module.

On-State Voltage Drop – The voltage developed across the output driver circuit during the On state at maximum load current.

Operating Voltage – For inputs, the voltage range needed for the input to be in the On state. For outputs, the allowable range of user-supplied voltage.

Output Device – A device, such as a pilot light or a motor starter coil, that is energized by the programmable controller.

Physical Module – Any 1746 or 1747 I/O module that is supported by the 1747-APB module.

Points per Common – The number of input or output points connected to a single return (common) or supply (vcc).

PROFIBUS – PROcess FIeld BUS. A German standard (DIN 19245/Part 1, 2, and 3) that specifies a fieldbus for communications at the process level.

Protocol – The “language” or packaging of information that is transmitted across a network.

RTB – Removable Terminal Block.

Signal Delay – For inputs, the response time required to transmit the circuit status from the field wiring to the digital logic. For outputs, the time required to transmit the circuit status from digital logic to the output wiring.

Sinking – A term used to describe current flow between an I/O device and SLC I/O circuit — typically, a sinking device or circuit provides a path to ground, low, or negative side of power supply.

Sinking/Sourcing – Describes a current signal flow relationship between field input and output devices in a control system and their power supply. Sourcing I/O modules supply (or source) current to sinking field devices. Sinking I/O modules receive (or sink) current from sourcing field devices.

Slot – Also called module slot. A location in a chassis or expansion chassis for installing a module. Each module slides into a slot that lines up with a backplane connector.

Sourcing – A term used to describe current flow between an I/O device and SLC I/O circuit — typically, a sourcing device or circuit provides a path to the source, high, or positive side of power supply.

Specialty I/O Module – An I/O module other than a discrete I/O module (e.g., an analog module). See page 10–23 for a list of specialty I/O modules supported by the 1747-APB module.

Station – Also called node. An address or software location on the network.

Surge Current Per Point – The maximum amplitude and duration (pulse) of current allowed for a given period of time and temperature.

Surge Suppressor – A device used to absorb voltage transients created by energizing an inductive load to reduce electrical noise or to protect the output circuit. For example, an R-C network, MOV (metal oxide varistor) or diode.

Watts Per Point – The maximum heat dissipation that can occur in each field wiring point when energized.

Numbers

A

B

C

D

E

F

G

H

I

L

M

N

O

P

Q

R

S

T

U

W

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