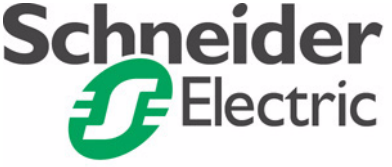
984-A120 Compact PLC's User Guide

890 USE 108 00 Version 4.0



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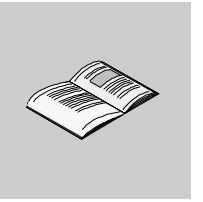
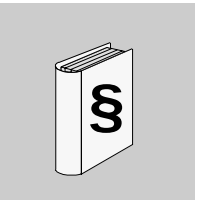


Safety Information



Important Information

NOTICE

Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, or maintain it. The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.


The addition of this symbol to a Danger or Warning safety label indicates that an electrical hazard exists, which will result in personal injury if the instructions are not followed.


This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

 DANGER
DANGER indicates an imminently hazardous situation, which, if not avoided, **will result** in death or serious injury.

 WARNING
WARNING indicates a potentially hazardous situation, which, if not avoided, **can result** in death or serious injury.

CAUTION

CAUTION indicates a potentially hazardous situation, which, if not avoided, **can result** in minor or moderate injury or in property damage.

PLEASE NOTE

Electrical equipment should be serviced only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material. This document is not intended as an instruction manual for untrained persons.

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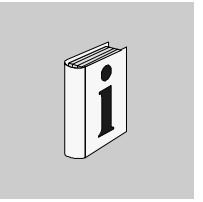
About the Book



At a Glance

Document Scope

This manual presents information about the A & E Series Compact PLC's including: hardware, software support, communication capabilities, planning and installation, wiring and cabling, system specifications, CE requirements, power supplies, getting started, accessories, health status, and trouble shooting and maintenance.

Validity Note

A984-1xx, E984-24x/251/255 require Modsoft panel software. E984-258/265/275/285 require Concept Version 2.1, ProWORX software, or higher panel software.

Related Documents

Title of Documentation	Reference Number
A120 Series I/O Modules User Guide	890USE10900
Modsoft Programmer Software User Guide	890USE11500
ProWORX Nxt 2.10 User Manual	371SPU68001

Product Related Warnings

All pertinent state, regional, and local safety regulations must be observed when installing and using this product. For reasons of safety and to assure compliance with documented system data, repairs to components should be performed only by the manufacturer.

User Comments

We welcome your comments about this document. You can reach us by e-mail at TECHCOMM@modicon.com

Compact Hardware

1

At a Glance

Introduction

The information in this chapter introduces the Compact Controller and describes the common architecture shared by the 984 Controllers. If the Compact Controller is new to you, please refer to *Getting Started, p. 145*).

What's in this Chapter?

This chapter contains the following topics:

The 984 Family of PLCs

Common 984 Controller Architecture

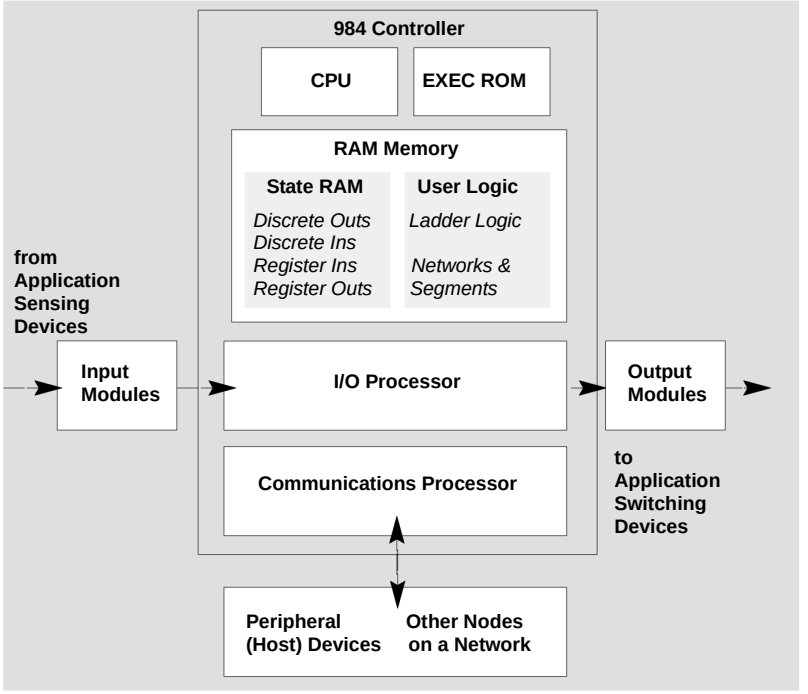
Modicon's Compact Programmable Controllers bring the high performance, application flexibility, and programming compatibility of the 984 family to the small controller market. As a controller in the 984 family, Compacts implement a common instruction set for developing user logic, standard Modbus communication functionality, and optional Modbus Plus communication capabilities.

The Compact Controllers share the following 984 processing architecture features:

- A memory section that stores user logic, state RAM, and system overhead in battery-backed CMOS RAM and holds the system's Executive firmware in nonvolatile PROM or FLASH RAM
- A CPU section that solves the user logic program based on the current input values in state RAM, then updates the output values in state RAM
- An I/O processing section that directs the flow of signals from input modules to state RAM and provides a path over which output signals from the CPU's logic solve are sent to the output modules
- A communications section that provides one or more port interfaces. These interfaces allow the controller to communicate with programming panels, host computers, hand-held diagnostic tools and other master devices, as well as with additional controllers and other nodes on a Modbus (or Modbus Plus) network

This architectural consistency allows the Compact Controllers to achieve machine compatibility with the other controllers in the family. This allows sequences of user logic created on a mid-range or high performance controller, such as a 984B or a 984-685 Controller,-to be relocated to a Compact. It also assures that user logic generated for this small controller is upwardly compatible to larger 984(s). Thus, a Compact can be easily integrated into a multi-controller network.

The following figure shows the 984 PLC architecture.



Programming

The Compact Controllers may be configured, I/O Mapped, and programmed with the following software:

- Concept panel software
- Full-feature Modsoft panel software
- Modsoft Lite depending upon the model
- ProWORX software

Refer to *Software Support, p. 49* for more information.

Special Features of the Compacts

CPU Memory Choices

The Compact Controllers deliver 984 architectural consistency and performance in a small, modular package. Compacts are easy to install, require only a small area for installation, and support the low-cost line of A120 I/O modules. The E984-258/265/275/285 PLCs feature 386 EX processors for increased performance and operate using Concept programming panel software. In addition to these features the E984-275/285 come with a PCMCIA interface for memory backup.
Compact PLCs are available in thirteen CPU models with four different user memory sizes:

- The A984-120 CPU with 1.5K words of user memory, 2K words State RAM, 3.5K words total and one Modbus communication port, 8Mhz CPU operation.
- The A984-130 CPU with 4K words of user memory, 2K words State RAM, 6K words total and one Modbus communication port, 8Mhz CPU operation.
- The A984-131 CPU with 4K words of user memory, 2K words State RAM, 6K words total and two Modbus communication ports, 8Mhz, CPU operation.
- The A984-141 CPU with 8K words of user memory, 2K words State RAM, 10K words total and two Modbus communication ports, 8Mhz, CPU operation.
- The A984-145 CPU with 8K words of user memory, 2K words State RAM, 10K words total, a Modbus port, and a Modbus Plus network interface, 8Mhz CPU operation.
- The E984-241 CPU with 8K words of user memory, 2K words State RAM, 10K words total, two Modbus communication ports and FLASH RAM based system executive, 16Mhz CPU operation.
- The E984-245 CPU with 8K words of user memory, 2K words State RAM, 10K words total, a Modbus port, a Modbus Plus network interface and FLASH RAM based system executive, 16Mhz CPU operation.
- The E984-251 CPU with 16K words of user memory, 2K words State RAM, 18K words total, and two Modbus communication ports, FLASH RAM based system executive, 16Mhz CPU operation, and 24K of (6xxxx) extended data register storage.
- The E984-255 CPU with 16K words of user memory, 2K words State RAM, 18K words total, a Modbus port, a Modbus Plus network interface, FLASH RAM based system executive, 16Mhz CPU operation, and 24K of (6xxxx) extended data register storage.
- The E984-258 CPU with two Modbus communication ports, 1Meg FLASH RAM based system executive, 512K SRAM, 16K words of user memory, 32K words State RAM, 48K words total, 128K words of configurable SDA 6X registers, 25Mhz CPU operation, operating temperature -40 ... +70 degrees C, and the Run, Ready, Communication 1 & 2 LEDs are yellow.
- The E984-265 CPU with two Modbus communication ports and a Modbus Plus network interface, 1 Meg FLASH RAM based system executive, 512K SRAM, 8K words of user memory, 16K words State RAM, 24K words total, 128K words of configurable SDA 6X registers, and 25Mhz CPU operation.

- The E984-275 CPU with two Modbus communication ports and a Modbus Plus network interface, 1 Meg FLASH RAM based system executive, 512K SRAM, 16K words of user memory, 32K words-State RAM, 48K words total, 128K words of configurable SDA 6X registers, 25Mhz CPU operation, and PCMCIA release 2.1 type II socket supported.
- The E984-285 CPU with two Modbus communication ports and a Modbus Plus network interface, 1Meg FLASH RAM based system executive, 1024K SRAM, 32K words of user memory, 64K words-State RAM, 96K words total, 128K words of configurable SDA 6X registers, 25Mhz CPU operation, PCMCIA release 2.1 type II socket supported and operating temperature -40 ... +70 degrees C.

Note: E984-258/265/275/285 models are available with conformal coating. The conformal coating models are E984-258C, E984-265C, E984-275C, and E984-285C.

Note: The E984-258C meets Railway standard EN 50 155 because it has yellow LEDs, extended operating temperature, conformal coating and is capable of operation with no battery in addition to other requirements.

Performance

- Five Compact A984 models (A984-120/130, A984-131/141, and A984-145) solve logic at the rate of 4.25 ... 6 ms/K nodes of standard ladder logic.
- Four Compact E984 models (E984-241/251, E984-245/255) solve logic at the rate of 2.13 ... 3 ms/K nodes of standard ladder logic.
- Four Compact E984 models (E984-258/265/275/285) solve logic at the rate of 0.2 ... 0.6 ms/K for 1K of binary ladder logic.

Memory

- User memory is the amount of memory available for your user logic program (one word comprises 16 bits).
- State RAM memory is used to hold register and discrete inputs and outputs and internal data storage. State RAM is allocated to the four different reference types (0xxxx, 1xxxx, 3xxxx, and 4xxxx). (See *System Capacity, p. 18*).
- Memory Partition Option with Concept 2.1. When using the E984-258/265/275/285 PLC with Concept 2.1 or higher you may partition the total SRAM memory. The five IEC languages in Concept share the same memory space as the 984LL language and 16-bit Loadables. When you enable the IEC usable memory size in Concept, you allocate a specific amount of memory to IEC thus limiting the amount of memory for 984LL and loadables

This is the Allocation Table.

PLC Model	SRAM Size	IEC Minimum Memory Size	IEC Maximum Memory Size
-258/265/275	512K	68 k bytes	220 k bytes
-285	1 Meg	68 k bytes	620 k bytes

Note: Concept language memory is measured in k bytes (8 bits). In contrast, 984LL language memory is measured in K words.

The following is an example using a E984-275 requiring: Modbus master (XMIT Loadable), an AGA gas flow (GD2 Loadable), 984LL memory of 3K words, and IEC Structured Text (ST) program of 20K bytes.

This is the example table.

SRAM Shared memory Space of E984-275	Requirements	Specific Items	Memory Allocations
16K words in 984 Ladder Logic or 204K bytes in IEC	Modbus master	XMIT loadable NSUP loadable	17K bytes 6K bytes
	AGA flow	GD92 Loadable	52K bytes
	IEC	ST	(20K bytes*20%**)=22K bytes
		Subtotal IEC space needed	97K bytes
	984LL	984LL space needed	(3K words*14***)=42K bytes
		Total memory space used	139K bytes
		Memory space remaining	(204K bytes-139K bytes)=65K bytes
		Use of remaining 68K bytes of space	In IEC: (65K bytes-20%)=52K bytes In 984LL: (65K bytes/ 14)=4.6K bytes
We recommend allocating 20% spare RAM space in IEC. ***14 is a constant conversion factor.**When using the GD92 loadable you must use LSUP, not NSUP			

For this example, you should set the IEC memory size to 97. The figures for other PLC models (E984-258/265/285) will vary due to internal reserved memory allocations.

System Capacity The system capacity for the PLCs are described below.
This is the system capacity table.

PLC	Total User Memory	Total State RAM	Max. I/O Capacity per System	Max. 0xxxx type State RAM	Max. 1xxxx type State RAM	Max. 3xxxx type State RAM	Max. 4xxxx type State RAM	Comm Ports/ PCMCIA
120	1.5k	2k	256 max. (any mis) (0x, 1x) discrete I/O points plus register I/O up to a total of 32 words In/ 32words Out (3x,4x)	**0x=2032** 1x=16 3x=16 4x=16	0x=16 **1x=2032** 3x=16 4x=16	0x=16 1x=16 **3x=1904** 4x=16	0x=16 1x=16 3x=16 **4x=1904**	1 Modbus
130	4k	2k						1 Modbus
131	4k	2k						2 Modbus
141	8k	2k						2 Modbus
145	8k	2k						1 Modbus Modbus Plus
241	8k	2k						2 Modbus
245	8k	2k						1 Modbus 1Modbus Plus
251	16k (24K Extended Memory)	2k						2 Modbus
255	16k (24K Extended Memory)	2k						1 Modbus 1Modbus Plus
258	16k (128K configurable SDA 6x**)	32k*	256 In 256 Out (words)	**0x=65504** 1x=16 3x=8893 4x=9968	0x=16 **1x=65504** 3x=8893 4x=9968	0x=16 1x=16 **3x=32224** 4x=1	0x=16 1x=16 3x=16 **4x=28640**	2 Modbus
265	8k (128K configurable SDA 6x**)	16k*	128 In128 Out (words)	**0x=65504** 1x=16 3x=2048 4x=1823	0x=16 **1x=65504** 3x=2048 4x=1823	0x=16 1x=16 **3x=15840** 4x=1	0x=16 1x=16 3x=16 **4x=14076**	2 Modbus 1Modbus Plus
275	16k (128K configurable SDA 6x**)	32k*	256 In256 Out (words)	**0x=65504** 1x=16 3x=8893 4x=9968	0x=16 **1x=65504** 3x=8893 4x=9968	0x=16 1x=16 **3x=32224** 4x=1	0x=16 1x=16 3x=16 **4x=28640**	2 Modbus 1 Modbus Plus PCMCIA
285	32k (128K configurable SDA 6x**)	64k*	512 In512 Out (words)	**0x=65504** 1x=16 3x=23454 4x=26028	0x=16 **1x=65504** 3x=23454 4x=26028	0x=16 1x=16 **3x=64992** 4x=1	0x=16 1x=16 3x=16 **4x=57766**	2 Modbus 1 Modbus Plus PCMCIA

*The available state RAM for the E984-258/265/275/285 models are always 512 words less than these stated values.
**Allocating the SDA (Secured Data Area) reduces your available user memory.

Note: For the A984-120/13x/14x and E984-24x/251/255 models. The listed values (in the table). See *System Capacity, p. 18* for discrete (0xxxx, 1xxxx) and register (3xxxx, 4xxxx) types represent maximum allowable. To maximize one type you minimize the other three types. Other than these limits the allocation between data types is flexible. This type of trade off between reference types does NOT apply to the E984-258/265/275/285 models. Furthermore, due to the large memory size you will not reach the maximum limits.

Note: Maximum I/O module count is 18 for all Compact PLC models.

Space Allocation Formula for Data Types

The maximum of each data type expressed in *System Capacity, p. 18*, or the E984-258/265/275/285 PLCs fit into the total configured memory space according to the following formula: A+B+C+D+E+F <= 65024 words for 64k State RAM or 32256 words for 32k State RAM or 15872 words for 16k State RAM (and the combined mix of configured #0x +#1x <= 65536 or 32768 or 16384) Where: A =Number of (0x/16) * 3 to include History and Disable bits B=Number of (1x/16) * 3 to include History and Disable bits C=0 if starting 3x on a 16 word boundary, otherwise add the required difference D=Number of 3x data types E=0 if starting 4x on a 16 word boundary, otherwise add the required difference F=Number of 4x +(2*((#4x+15(/16)) to include Up/Down counter history

Executive Non-Volatile ROM FLASH Memory and RAM (E984's Only)

The Compact executive firmware has two areas of memory which are referred to in this manual as executive and user memory. The executive is contained in Non-Volatile ROM (flash in the E984s memory that can be updated with new features in the field if required), and the user memory is stored in battery backed RAM which may also be backed up to internal FLASH for the E984-258/265/275/285 models or to the PCMCIA memory card for the E984-275/285 models. (See *Customer Service & Technical Assistance, p. 219* regarding upgrading the NV FLASH Memory in the field).

EEPROM Auxiliary Memory Upload-Download Capabilities (A984-1xx, E984-24x/251/255 Only)

The A984-1xx, and E984-24x/251/255 Compact Controllers contain an auxiliary memory socket for a credit card-sized EEPROM card. You can write the current system configuration and user logic program to an EEPROM card while the controller is in STOP Mode and read the data back to the controller from the EEPROM card as part of the power-up sequence. This utility allows you to record, store, transport and reload applications and configuration with an easily maintainable medium. Thus this EEPROM may be used on similar compact models.

PCMCIA (E984-275/285 Only)

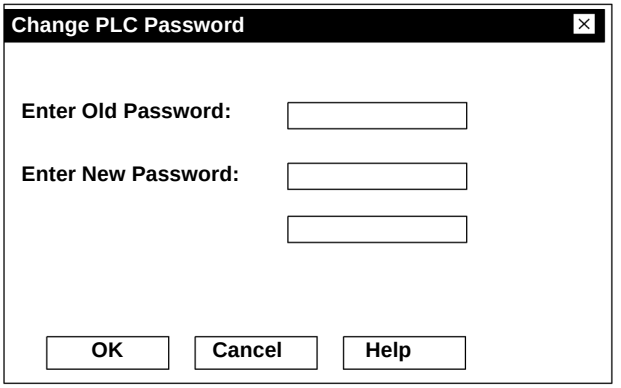
The E984-275/285 CPUs support PCMCIA release 2.1 type II socket. The CPU provides routines for accessing the PCMCIA card. Drivers are included to support additional memory via AMD compatible memory cards. The card may be used to store your application or as dynamic storage for data. You may write and read your applications to either FLASH or PCMCIA card. You may use the PCMCIA card for data logging from the user program via the DLOG instruction. (See *Program Storage using FLASH RAM & PCMCIA (E984-258/265/275/285 Only), p. 44*).

Transferring MEEP Applications to PCMCIA Cards

Applications on earlier models (A984-1xx, E984-24x/251/255) using MEEP cards can not be directly ported to the newer models (E984-275/285). This occurs because the PCMCIA card replaces the MEEP card. In this case, go into the Concept directory and run convert.exe. This converts your Modsoft application files to Concept project files. Then select your PLC type. However, your I/O map is not converted because the E984-258/265/275/285 PLCs I/O drivers are different than the older models. Thus, reenter your I/O map and validate your analog scaling within your application. The PCMCIA card works in a similar manner as the MEEP in earlier models.

PLC Login Password Protection (E984-258/265/275/285 Only)

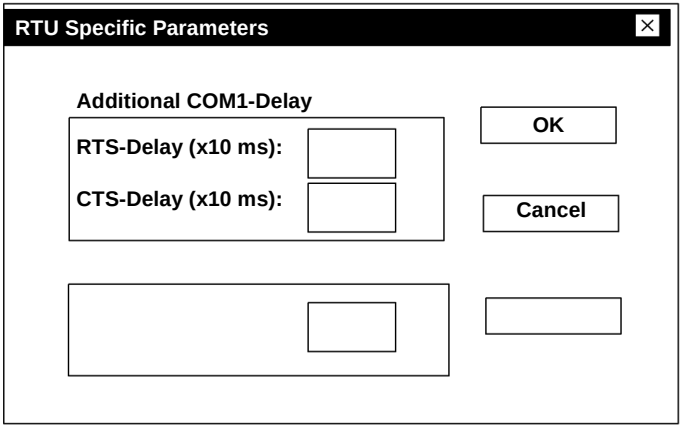
This feature allows you to prevent unauthorized writes to the PLC via Modbus commands. The password must be at least 1 character and may be up to 16 characters long. Valid characters are: a ... z, A ... Z, 0 ... 9. Spaces are NOT allowed and the password is case sensitive. The default is no password. The PLC MUST be stopped before entering a password. Checking the box labeled PLC level password protection enables this option. The password is entered in two steps. First you enter your password into a Concept dialog box to gain access to the PLC. Second, from the main Concept menu select Online, Online Control Panel, then Set PLC-Password... The Change PLC-Password dialog box appears. Enter your password. Then confirm with OK. To deactivate the password feature, enter the old password and press OK. This prompts a confirm to remove.
The following figure shows the Change PLC Login Password screen.



When downloading a new executive to your PLC you MUST disable the PLC password (via Concept) unless the PLC is stopped in a stop with error state. Under this condition the Concept executive loader works. When a login password is lost, you can gain access by using the following procedure: Push the Memory Protection switch up to the Mem Prot position. Remove the Lithium battery from the PLC. Cycle the power to the PLC. This procedure erases the battery-backup RAM without loading the PLCs program from FLASH. Thus, returning the PLC to its initial, unconfigured state with NO login password.

CTS/RTS Communication Delays for Communication Port 1 (E984-258/265/ 275/285 Only)

This feature allows you to set time delays for CTS or RTS independently for Communication port 1 of your Compact PLC. The CTS delay sets the amount of time between when the PLC receives CTS and when a Modbus slave response is transmitted. The RTS delay is the amount of time the PLC waits to drop RTS after a Modbus slave response is transmitted. This feature allows modem communications with radios that require longer time frames. The delay time range is 0... 500ms using 10ms units. From the main Concept menu select Configure, then RTU Extension. The RTU-Specific Parameters dialog box appears. Enter the time delays your require. Then confirm with OK.
This is the CTS/RTS screen.

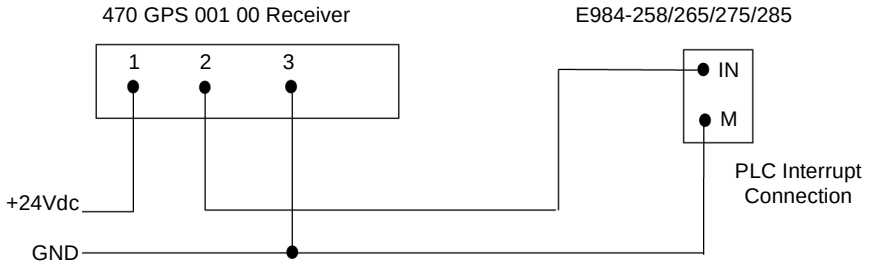


Secured Data Area (SDA) (E984-258/265/ 275/285 Only)

This feature allows you to configure an area in RAM that is secured from being overwritten. Secured Data Area (SDA) is a block of the Compact PLCs RAM that is set aside as 6x data space. The SDA can only be written to by specific functions that require secured data storage (Gas Flow Calculation Audit Trails, etc.). General purpose Modbus commands, built-ins, and loadables can NOT write to the SDA. Modbus Read (function 20) is able to read from the SDA, Modbus Write (function 21) is NOT able to write to the SDA. The SDA size range is 0 ... 128K words using ONLY 1K word blocks. From the main Concept menu, select Configure, then RTU Extension. The RTU-Specific Parameters dialog box appears. Enter the size you require. Then confirm with OK. Refer to the applicable user manual for the specific function for the required SDA size. For example, for Gas Flow, refer to the Starling Associates Gas Flow Loadable Function Block User Guide (890 USE 137 00).

Time Synchronization of the TOD (E984-258/265/ 275/285 Only)

This feature allows you to synchronize your PLCs Time-Of-Day (TOD) clock time signal from GPS (Global Positioning System) satellites. This feature provides accurate time stamping of logged data, and the synchronization of different PLCs because the time synchronization is dependent on the scan of the PLC, the accuracy is +/-10ms. Connect the 470 GPS 001 00 GPS Receiver to the PLCs Interrupt Connections located on the front of your PLC. Refer to the User Information shipped with the GPS module (Part Number 708874.21) and below. To see when the time synchronize is present or not refer to bit 13 of word 1 (CPU-Status) of the STAT Block. (See *Word 182 - Health Status, p. 207*). A 1 indicates you have a valid signal and the TOD has been updated, a 0 indicates you are NOT receiving a time signal. Connecting the GPS module to your PLC is very easy.
This is how to wire up the GPS module.



A120 I/O Support

The Compact Controllers work with Modicon's A120 Series of low-cost I/O modules. A120 modules are available in densities of four, eight, and sixteen discrete I/O points; eight analog input channels; and two, four, and eight analog output channels. In addition, speciality modules for positioning, servo control, simulators and filler modules are available. Each module uses a standardized pair of screw-type terminal blocks that facilitate easy access and easy field wiring; because the terminal blocks are standardized and removable, they allow you to make module changes without disturbing connections. A tool (AS-0TBP-000) to facilitate the removal of terminal blocks is shipped with each Compact Controller.

Detailed descriptions of available A120 modules are found in the A120 Series I/O Modules User Guide (890 USE 109 00 formerly GM-A984-IOS). To be sure that your documentation is up to date, check with Modicon Customer Support or your area distributor for the current revision level of this document.

Power Supplies

The A984s, E984-24x/25x, and the E984-258/265/275/285 CPUs use a +24 Vdc source, and have a built-in power converter to provide 5 Vdc to the bus.

- 2.5 A is available across the I/O bus for all modules in A984s, E984-24x/251/255 systems.
- 2.5 A is available across the I/O bus for all modules in E984-258/285 systems.
- 3.0 A is available across the I/O bus for all modules in E984-265/275 systems.

Five optional power supplies are available: a P120-000 (115/230 Vac input), a P120-125 (125 Vdc input), a P120-250 (240 Vac input), a PRTU-252 (240 Vac input), and a PRTU-258 (240 Vac input) that provide +24 Vdc to the CPU.These external power supplies may be used with any of the Compacts. See *P120-000 Power Supply, p. 178* for detailed specifications.

The A984-120/130 PLCs

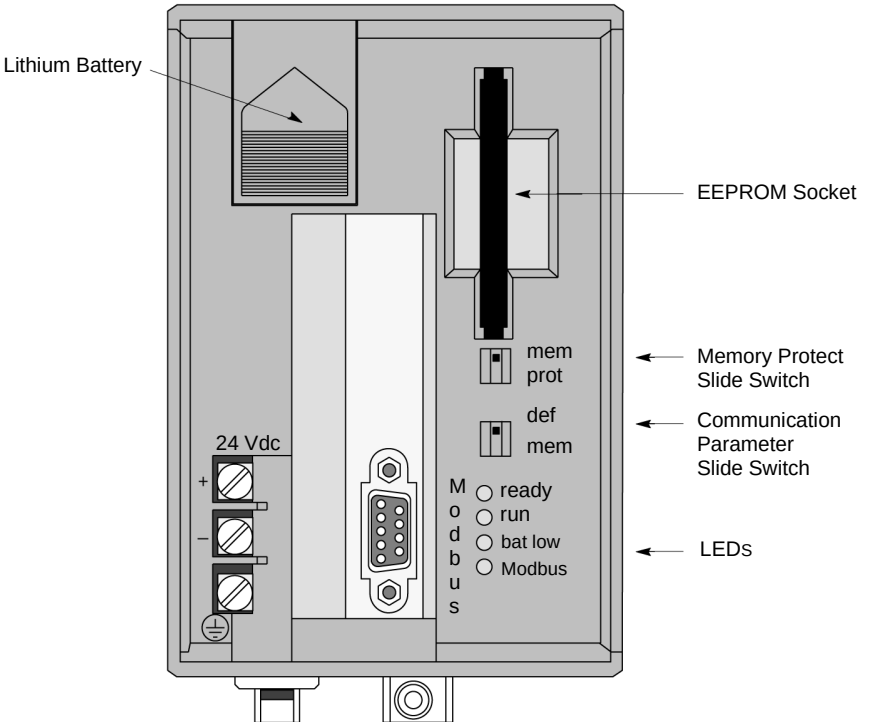
A984-120/130 Front Panel

These two models have identically designed front panels, with one Modbus communications interface, an EEPROM auxiliary memory socket, two slide switches for memory protection and communication parameter selection, four LED indicators, and a terminal strip for 24 Vdc power.

- The A984-120 (Compact Controller comes with 1 Modbus communication port, 2K state RAM, 1.5K words of user memory, 8Mhz CPU, and operating temperature 0 ... 60 degrees C).
- The A984-130 (Compact Controller comes with 1 Modbus communication port, 2K state RAM, 4.0K words of user memory, 8Mhz CPU, and operating temperature 0 ... 60 degrees C).

This is the front panel.

A984-120/130 PLC



Slide Switches

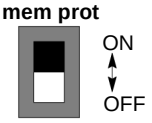
Two slide switches are located on the front panel of the controller directly above LEDs, a memory protect switch and a communication parameter switch.

Memory Protect

The memory protect switch is the top switch; it serves two purposes:

- If on, it prevents a programming panel from overwriting the configuration or user logic
- If off, it allows configuration and user logic changes. It also determines whether or not the controller should read the configuration and user logic from an EEPROM auxiliary memory card inserted in the EEPROM socket. This occurs only at power-up.

This is the mem prot switch.



Communication Parameter

The communication parameter switch-the bottom slide switch-is used to specify whether you want to use the default communication parameters on the Modbus port or specify whether you want to use previously configured and saved communication parameters (See *MODBUS Port Parameters (2-Position Slide Switch), p. 71*.)

LED Indicators

The following table lists the LED indicators and their meaning.

LED Indicator	Meaning
Ready (amber)	Controller has passed power-up diagnostics- LED is ON in unconfigured, stopped, and run states as long as health status is valid; is OFF when error condition detected by diagnostics.
Run (green)	Controller has started and is solving logic. If memory checksum fails this light will blink 3 times for.5 seconds followed by a rest period of 2.5 seconds then the pattern repeats. The controller has detected a STOP ERROR CODE and may require either restarting, reloading of the user logic, or reloading of the executive firmware. If the controller attempts to read the EEPROM card but fails, it terminates the power-up sequence and flashes the RUN LED on the front panel continually until you cycle power. Four flashes per second indicates that a checksum error was detected; one flash per second indicates that the user logic program is larger than the available memory.
Battery Low (red)	Battery needs replacing-14 day hold-up from initial indication
Modbus (green)	Communications are active on the Modbus port

Note: A green power OK LED exists on the power supply board inside the controller. It is located below the top surface of the unit, and is visible when the unit is viewed from the top.

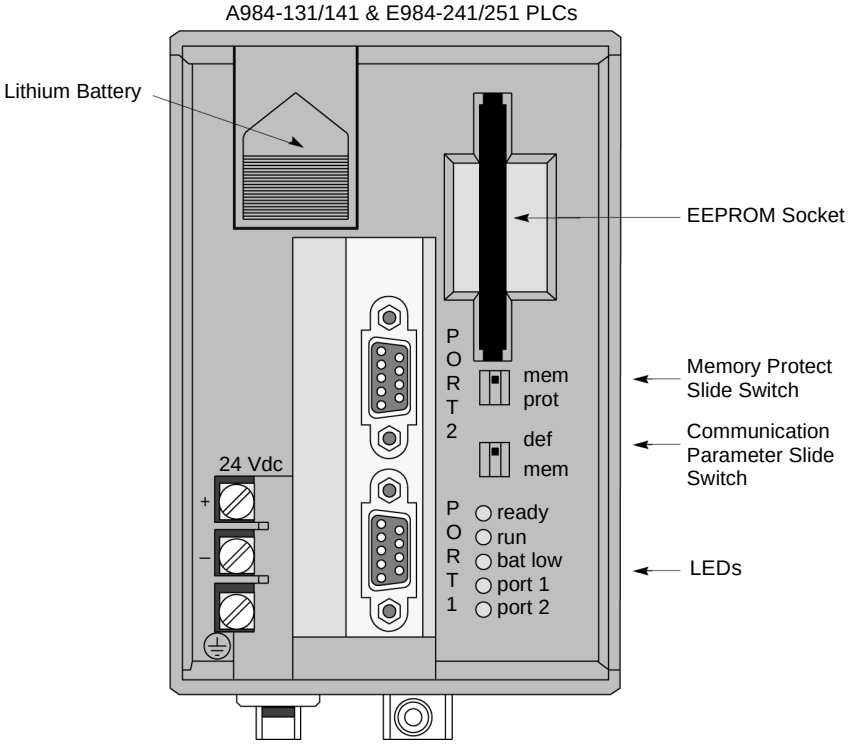
The A984-131/141 & E984-241/251 PLCs

A984-131/141 and E984-241/ 251 PLCs Panels

These four models have identically designed front panels, with two Modbus communications interfaces, an EEPROM auxiliary memory socket, two slide switches for memory protection and communication parameter selection, five LED indicators, and a terminal strip for 24 Vdc power.

- The A984-131 (Compact Controller comes with 2 Modbus communication ports, 4.0K words of user memory, 2K state RAM, 8Mhz CPU, and operating temperature 0 ... 60 degrees C).
- The A984-141 (Compact Controller comes with 2 Modbus communication ports, 8.0K words of user memory, 2K state RAM, 8Mhz CPU, and operating temperature 0 ... 60 degrees C).
- The E984-241 (Compact Controller comes with 2 Modbus communication ports, FLASH RAM based system executive, 8.0K words of user memory, 2K state RAM, 16Mhz CPU, and operating temperature 0 ... 60 degrees C).
- The E984-251 (Compact Controller comes with 2 Modbus communication ports, FLASH RAM based system executive, 16.0K words of user memory, 24K of (6xxxx) extended data register storage, 2K state RAM, 16Mhz CPU, and operating temperature 0 ... 60 degrees C).

This is the panel.



Slide Switches

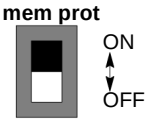
Two slide switches are located on the front panel of the controller directly above LEDs, a memory protect switch, and a communication parameter switch.

Memory Protect

The memory protect switch is the top switch; it serves two purposes:

- If on, it prevents a programming panel from overwriting the configuration or user logic
- If off, it allows configuration and user logic changes. It also determines whether or not the controller should read the configuration and user logic from an EEPROM auxiliary memory card inserted in the EEPROM socket. This occurs only at power-up.

This is the mem prot switch.



Communication Parameter

The communication parameter switch (the bottom slide switch) is used to specify whether you want to use the default communication parameters on Modbus port 1 or the previously configured and saved communication parameters. (See *MODBUS Port Parameters (2-Position Slide Switch), p. 71.*)

LED Indicators

The following table lists the LED indicators and their meaning.

LED Indicators	Meaning
Ready (amber)	Controller has passed power-up diagnostics- LED is ON in unconfigured, stopped, and run states as long as health status is valid; is OFF when error condition detected by diagnostics.
Run (green)	Controller has started and is solving logic. If memory checksum fails this light will blink three times for.five seconds followed by a rest period of 2.5 seconds; then the pattern repeats. The controller has detected a STOP ERROR CODE and may require either restarting, reloading of the user logic, or reloading of the executive firmware. If the controller attempts to read the EEPROM card and fails, it terminates the power-up sequence and flashes the RUN LED on the front panel continually until you cycle power. Four flashes per second indicates that a checksum error was detected; one flash per second indicates that the user logic program is larger than the available memory.
Battery Low (red)	Battery needs replacing-14 day hold-up from initial indication
Port 1 (green)	Communications are active on Modbus Port 1
Port 2 (green)	Communications are active on Modbus Port 2

Note: A green power OK LED exists on the power supply board inside the controller. It is located below the top surface of the unit. It is visible if the unit is viewed from the top.

A984-145, E984-245/255 Controllers

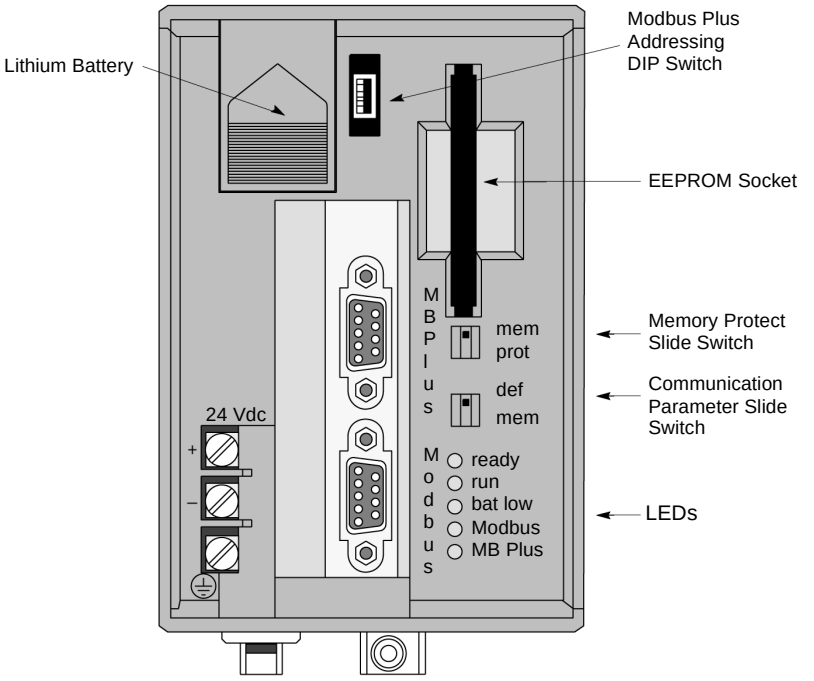
A984-145, E984-245/255 Front Panel

These models have identically designed front panels, with two communications interfaces, an EEPROM auxiliary memory socket, two slide switches for memory protection and communication parameter selection, five LED indicators, and a terminal strip for 24 Vdc power.

- The A984-145 (Compact Controller comes with 1 Modbus communication port, 1 Modbus Plus port, 8.0K words of user memory, 2K state RAM, 8Mhz CPU, and operating temperature 0 ... 60 degrees C).
- The E984-245 (Compact Controller comes with 1 Modbus communication port, 1 Modbus Plus port, FLASH RAM based system executive, 8.0K words of user memory, 2K state RAM, 16Mhz CPU, and operating temperature 0 ... 60 degrees C).
- The E984-255 (Compact Controller comes with 1 Modbus communication port, 1 Modbus Plus port, FLASH RAM based system executive, 16.0K words of user memory, 24K of (6xxxx) extended data register storage, 2K state RAM, 16Mhz CPU, and operating temperature 0 ... 60 degrees C).

This is the front panel.

A984-145 & E984-245/255 PLCs



Slide Switches

The communication parameter slide switch is used to select a bridge mode between a Modbus master device and Modbus Plus. (For a detailed description of bridge mode functionality and other Modbus Plus capabilities provided with the A984-145, E984-245/255 Controller, see *Bridge Mode Between Modbus and Modbus Plus, p. 91*. (See *9-Pin Port/Cable Pin-Outs, p. 70* for 9-pin cable pin-outs.)

Modbus Plus 6-Position DIP Switch

These three models have identical MB Plus DIP Switches. (See *6-Position DIP Switch -Node Addressing, p. 80*.)

Modbus Plus LED

Other than the bottom indicator, LEDs on these three models have the same function as those on the E984-241/251. (Port 1 is labeled Modbus). (See *LED Indicators, p. 30*.) The MB Plus LED is a green indicator that shows the type of communications activity on the Modbus Plus port on A984-145, E984-245/255 Controllers.

A specific flash pattern indicates the nature of the Modbus Plus communication activity. (See *Modbus Plus LEDs A984-145, E984-245/255/265/275/285, p. 216* and *Modbus Plus LEDs, p. 86*.)

The E984-258 Controller

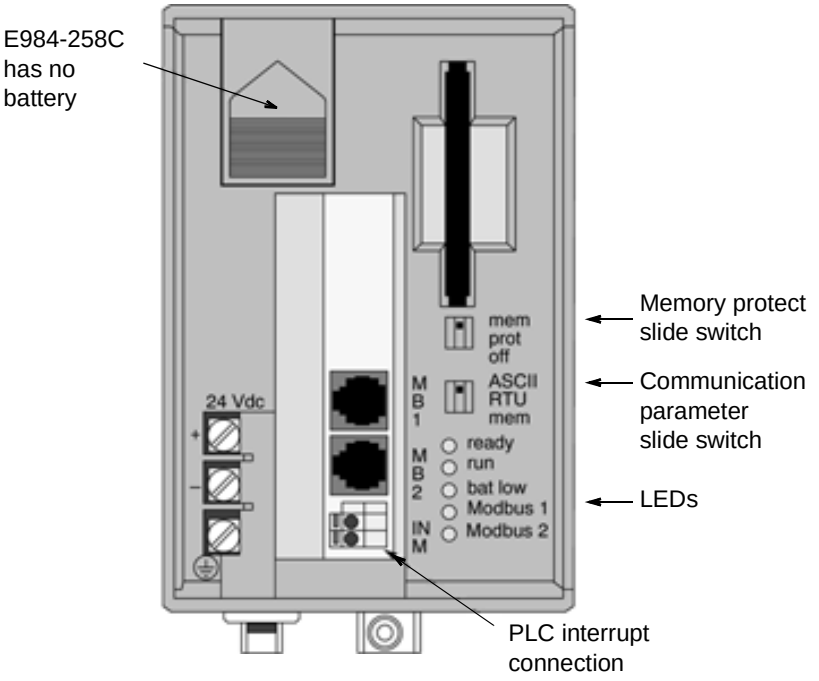
E984-258 Front Panel

This model has two Modbus communications interfaces (RJ45), two three position slide switches for communication parameter selection, five LED indicators, and a terminal strip for 24 Vdc power.

- The E984-258 (TSX Compact Controller comes with 2 Modbus communication ports, 1Meg FLASH RAM based system executive, 512K SRAM, 16K words user memory, 32K words State Ram, 48K words total, 128K words of configurable SDA 6X registers, 25Mhz CPU, and operating temperature -40 ... +70 degrees C) and the Run, Ready, Modbus 1 and Modbus 2 LEDs are yellow.

This is the front panel.

E984-258 PLC



Slide Switches

Two three-position slide switches are located on the front of the CPU. The top switch is used for memory protection when in the top position and no memory protection in the middle and bottom position. The three-position slide switch on the bottom is used to select the communication parameter settings for Modbus (RJ45) port one. Three options are available. (See *MODBUS Port Parameters (3-Position Slide Switch), p. 76*). For RJ45 cable pin-outs, see *Connector Pinouts (RJ45 to 25-Pin, p. 75*).

Note: The E984-258 does not support a PCMCIA card.

PLC Interrupt Connection

One two-position connection is located on the front of the CPU. It is used to connect to the 470 GPS 001 00 Receiver for the time synchronization of the PLCs TOD clock. (See *Time Synchronization of the TOD (E984-258/265/275/285 Only), p. 22*).

LED Indicators

The following table shows LED Indicators on the E984-258 Controllers.

Indicator	Meaning
ready (yellow)	Controller has passed power-up diagnostics- LED is ON in unconfigured, stopped, and start states as long as health status is valid; is OFF when error condition detected by diagnostics.
run (yellow)	Controller has started and is solving logic. (See *LED Error Codes, p. 211*) for the RUN LED error codes
battery low (red)	Battery needs replacing-10 day hold-up from initial indication (258C has no battery)
Modbus 1 (yellow)	Communications are active on the Modbus port 1
Modbus 2 (yellow)	Communications are active on the Modbus port 2

Note: The E984-258C meets Railway standard EN 50 155 because it has yellow LEDs, extended operating temperature, conformal coating and can operate with no battery in addition to other requirements. Since no battery comes with the 258C, the Battery Low LED is always ON. You may purchase and install a battery based upon your needs. Simply replace the battery dummy (part number AS-BDUM-001) with a battery and the Battery Low LED turns OFF.

CAUTION

No battery.

When NO battery is present you MUST save your ladder logic (application) to internal FLASH before power is cycled. If you do not save it to FLASH, your ladder logic (application) will be lost.

Failure to observe this precaution can result in injury or equipment damage.

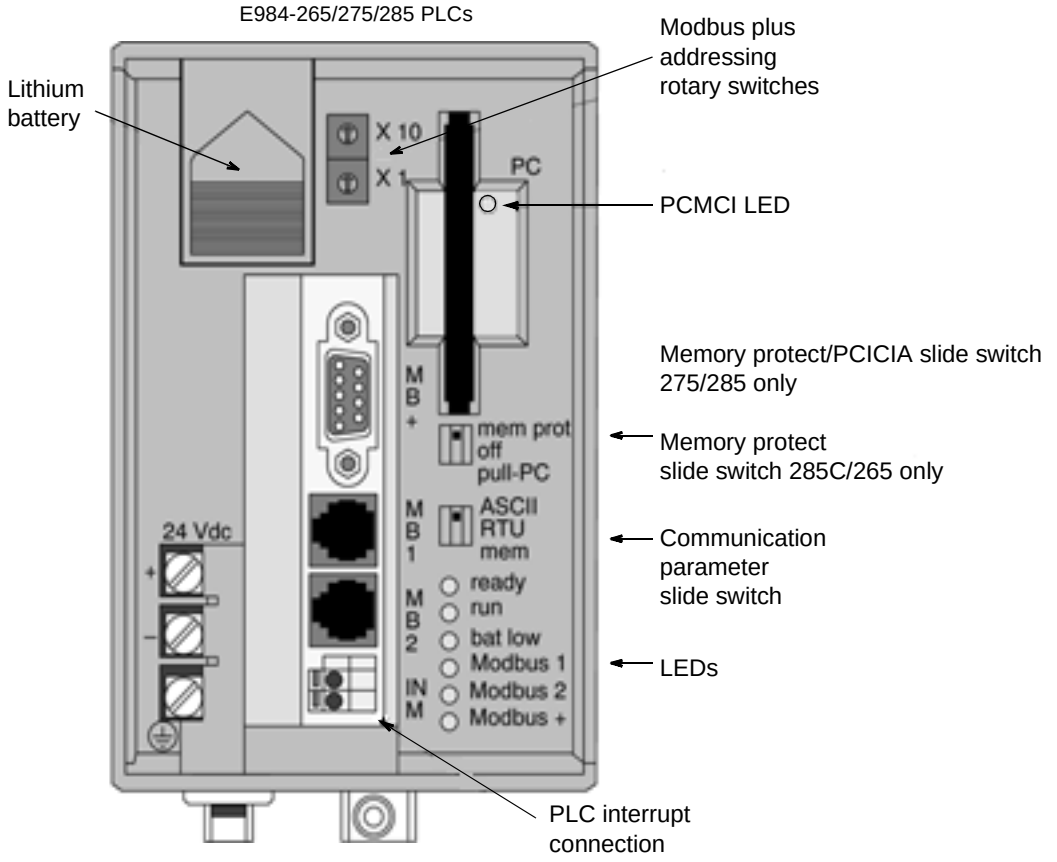
E984-265/275/285 Controllers

E984-265/275/285 Front Panel

These three models have identically designed front panels, with three communications interfaces, two three position slide switches for memory protection, communication parameter selection, seven LED indicators, and a terminal strip for 24 Vdc power.

- The E984-265 (TSX Compact Controller comes with 1Meg FLASH RAM, 256K SRAM, 8K words user memory, 16K words State Ram, 24K words total, 128K words of configurable SDA 6X registers, 2 Modbus ports, and 1 Modbus Plus port).
- The E984-275 (TSX Compact Controller comes with 1Meg FLASH RAM, 512K SRAM, 16K words user memory, 32K words State Ram, 48K words total, 128K words of configurable SDA 6X registers, 2 Modbus ports, 1 Modbus Plus port, and PCMCIA auxiliary memory socket).
- The E984-285 (TSX Compact Controller comes with 1Meg FLASH RAM, 1024K SRAM, 32K words user memory, 64K words State Ram, 96K words total, 128K words of configurable SDA 6X registers, 2 Modbus ports, 1 Modbus Plus port, and PCMCIA auxiliary memory socket).

This is the panel.



Slide Switches

Two three-position slide switches are located on the front of the CPU. The top switch is used as follows: for memory protection if in the top position; for no memory protection in the middle position; and for swapping PCMCIA card (pull-PC 275/285 only) in the bottom position. The three-position slide switch on the bottom is used to select the communication parameter settings for Modbus (RJ45) port 1. Three options are available. See *MODBUS Port Parameters (3-Position Slide Switch), p. 76*. For RJ45 cable pin-outs, (see *RJ45 Port/Cable Pin-Outs, p. 72*.)

Rotary Switches

Two rotary switches are used for setting Modbus Plus node and Modbus port addresses. (See *10-Position Rotary Switches -Node Addressing, p. 84*.)

PLC Interrupt Connection

One two-position connection is located on the front of the CPU. It is used to connect to the 470 GPS 001 00 Receiver for the time synchronization of the PLCs TOD clock.(See *Time Synchronization of the TOD (E984-258/265/275/285 Only), p. 22*.)

LED Indicators

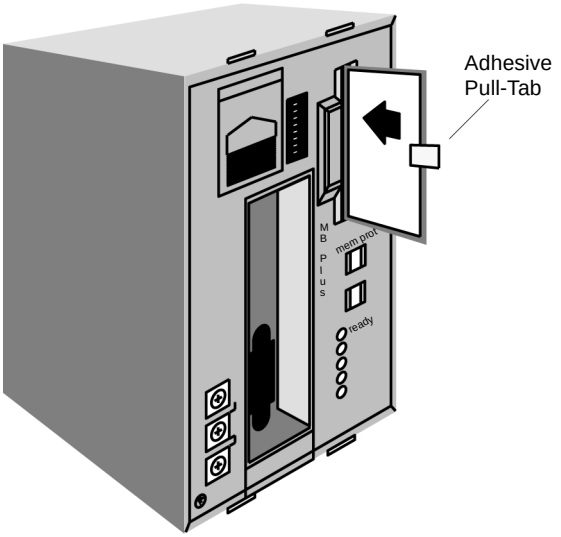
The following table shows the LED indicators and their purpose.

LED Indicator	Meaning
Ready (green)	Controller has passed power-up diagnostics- LED is ON in unconfigured, stopped, and start states as long as health status is valid; is OFF if error condition detected by diagnostics.
Run (green)	Controller has started and is solving logic. (See *LED Error Codes, p. 211* for the RUN LED error codes.)
Battery Low (red)	Battery needs replacing-10 day hold-up from initial indication
Modbus 1 (green)	Communications are active on the Modbus port 1
PC (green)	PCMCIA card can be swapped when on. (See *Program Storage using FLASH RAM & PCMCIA (E984-258/265/275/285 Only), p. 44* for more information about LED status.
Modbus Plus (green)	For details about Modbus Plus LED, see *Modbus Plus LEDs, p. 86* and *LED Error Codes, p. 211*.

EEPROM Auxiliary Memory Capability (A984-1xx/E984-24x/251/255 Only)

Auxiliary Memory Socket

The A984-1xx, E984-24x/251/255 Controllers contain an auxiliary memory socket for a credit card-sized EEPROM card on which system configuration and user logic can be saved. System configuration and user logic data can be written to an EEPROM card and used to back up the program stored in battery-backed RAM. This is the socket location.



An AS-MEEP-000 EEPROM card provides 32K bytes of auxiliary memory, and an AS-MEEP-001 EEPROM card provides 8K bytes of auxiliary memory. (The 8K EEPROM card can be used to store programs that use under 4K words of user memory.) The card should be inserted into the socket with its label side facing the communication ports and with the arrow on the label pointing toward the socket. White MEEP card pull-tabs ship with the MEEP cards for better card extraction.

Note: A 32K MEEP card must be used if you are using either the PC-E984-251 or PC-E984-255.

CAUTION

Do not insert EPROM card if controller is ON.

An EEPROM card must be inserted into or removed from the socket only when the controller is OFF. Insertion or removal while the controller is powered up can damage the EEPROM card.

Failure to observe this precaution can result in injury or equipment damage.

Writing to EEPROM Auxiliary Memory

Using either Modsoft or Modsoft Lite programming software, you may write the configuration and user logic to the EEPROM card. Users of the A984 Compact controller may also predefine controller startup RUN state conditions and save 4X registers. You may write to the EEPROM card while the controller is running and while Modbus activity is occurring. However, no activity that writes to user memory is allowed while writing to EEPROM is occurring.

Note: It is recommended that the Compact be in STOP Mode.
After inserting a blank EEPROM card into the controller, ensure that the memory protect switch is in the ON position before turning power back on. If the switch is in the OFF position, the controller will attempt to read a blank card at power up.
To write to an EEPROM card, you must be ON LINE or in Combine mode in Modsoft. Under PLC OPS menu select Save to FLASH/EEPROM. If earlier software versions are used, after download the controllers will start (or not start) based on the last power-down state; 4X registers are not saved; and state RAM is cleared if the controller powers up from Dim Awareness. If your user logic requires specific information in state RAM, it must be initialized by the user logic.
Using any version of panel software, the 0984 series (ONLY) Compact controllers saves the configuration and user logic but not the 4X register data. State RAM is not cleared, and if your user logic requires specific information in state RAM, it must be initialized by the user logic. Also, after download, the controller will come up in its previous operating mode (RUN or STOPPED).
The write procedure verifies that an EEPROM card is actually present in the socket and that the card has enough memory to store all the system data. It then computes the checksum and verifies that the data has been written successfully. If any errors occur in the writing process, an error message pops up on the screen; if no errors are encountered, a message pops up to inform you that the EEPROM write procedure has been accomplished.

Reading EEPROM System Data

Data are read from an EEPROM card as part of the power-up sequence. If the controller determines that a card is present in the socket, it checks the state of the memory protect slide switch.

- If the switch is OFF, the controller tries to read the data
- If the switch is ON, the controller ignores the presence of the card.

If the controller attempts to read the EEPROM card but fails, it terminates the power-up sequence and flashes the RUN LED on the front panel continually until you cycle power.

- Four flashes per second indicates that a checksum error was detected
- One flash per second indicates that the user logic program is larger than the available memory.

If the controller successfully reads data from the EEPROM card, it sets a flag in system memory that prohibits any further writing to memory locations.
Memory locations may be written to after power is turned off, the EEPROM card removed, and power turned on.
The EEPROM card will bring controllers up in the appropriate operating mode (RUN or STOPPED). In A984-1xx, E984-24x/25x controllers, the mode may be selected at EEPROM Write time. In 0984 controllers without a functioning battery, the EEPROM card will always bring the controller up in STOPPED mode, and you will need a DAP or programming panel to get it into RUN mode.
In both the A984-1xx and 0984, 0X and 1X references are enabled when the controller is set to RUN mode after EEPROM download. 0X's are cleared when the controller goes to RUN mode and 1X's are updated on the first scan. In A984 controllers, 4X references are zeroed if not saved to EEPROM. The document packed with the EEPROM card (GI-MEEP-RMF) contains an illustration of user logic that may be used to zero out the 4X registers in 0984 controllers.

EEPROM Memory Program Migration

Where controller memory limitations are not exceeded, the rules governing EEPROM memory program migration are:

- EEPROM programs from 0984 controllers can be loaded into A984-1xx controllers.
- EEPROM programs from A984-1xx, E984-24x/25x controllers cannot be loaded into 0984 controllers because the 0984 controllers do not acknowledge 4x registers and return an error.
- A984-1xx, and E984-24x/25x controller EEPROM programs may be exchanged.

Note: The only other restriction may be due to the memory size of the individual controller.

Editing Logic Loaded from EEPROM Card (A984-1xx, E984-24x/251/255 Only)

Editing Logic From EEPROM Card

An A984-1xx or an E984-24x/25x Controller loaded from an EEPROM card is brought up in OPTIMIZED mode-i.e.; that is, either in RUN or STOPPED mode (depending on the controller's previous operating state) but not in EDIT mode. EDIT mode is required for programming the controller.
To modify the newly loaded logic, you must move the controller out of OPTIMIZED mode and into the Ladder Logic area. There are two procedures for doing this: one for a controller that has an active battery; and one for a controller with no battery.

Note: Remember that you cannot insert or remove the EEPROM card while the controller is powered ON.

Editing Procedure If Controller Has a Battery

Follow these steps to edit a controller that has an active battery.

Step	Action
1	Insert the EEPROM card with the desired logic into the slot in the controller, then power up the unit. The controller should come up in OPTIMIZED mode with the EEPROM logic and configuration data loaded.
2	Power down the controller.
3	Either remove the EEPROM card or turn ON (=) the memory protect slide switch.
4	Power up the controller again.
5	You must be **ON LINE** when using Modsoft. Choose either **Select Program** or **Direct to PLC**. Check your **Communications Parameters**. Now you should be in the ladder logic area where you can edit the EEPROM-loaded logic.

Editing Procedure If Controller Has No Battery

Follow these steps if the controller has no battery.

Step	Action
1	Insert the EEPROM card with the desired logic into the slot in the controller, then power up the unit. The controller should come up in OPTIMIZED mode with the EEPROM logic and configuration data loaded.
2	Using **Transfer** in your panel software, upload the logic program to the programming panel.
3	Power down the controller.
4	Either remove the EEPROM card or turn ON (=) the memory protect slide switch.
5	Power up the controller again.
6	Using **Transfer**, download the program from the panel back to the controller.
7	You must be **ON LINE** when using Modsoft. Choose either **Select Program** or **Direct to PLC**. Check your **Communications Parameters**. Now you should be in the ladder logic area where you can edit the EEPROM-loaded logic.

Program Storage using FLASH RAM & PCMCIA (E984-258/265/275/285 Only)

Program Storage Overview

The E984-258/265/275/285 PLCs feature 1 megabyte of internal FLASH RAM. 480 kilobytes are available for application storage. The remaining area is reserved for kernel, executive, and special code use. In addition, the E984-275/285 PLCs have a PCMCIA auxiliary memory socket for storage.

The E984-275/285 PLCs supports industry standard memory size PCMCIA cards up to 4 megabytes. You can use this area of memory (PCMCIA/FLASH RAM) to store the controller and I/O configuration, ladder logic programs, and 4x registers. PCMCIA FLASH/FLASH RAM memory cards offer a more permanent means of storage over battery backed storage. They have the added benefit of transporting data onto other PLC platforms.

Two PCMCIA cards are available from Modicon: AS-FLSH-004; (4 megabytes, 150nS, -40 ... +70C, without conformal coating, with pull-tab), and AS-FLSH-004C; (4 megabytes, 150nS, -40 ... +70C, with conformal coating, with pull-tab). These PLCs require AMD commercial PCMCIA cards, (part number AmCOXXCFLKA, 150 nS, 0 ... 60C, XX is the memory size of the card), or its equivalent, provided it uses AMD FLASH chips.

Note: The E984-258/265 does not support the PCMCIA card.

Note: Applications stored on EEPROM using 0984, A984 or E984-24x/251/255 PLCs cannot be transferred into FLASH RAM on the E984-258/265/275/285 PLCs.

Writing to PCMCIA/Internal FLASH RAM Auxiliary Memory

Writing is performed by using the available options in Concept 2.1 or higher programming panel software. Click on Online, Online Control Panel, Stop controller, Yes, Flash program. The Save to Flash screen appears after following this sequence.

Note: The Flash Program option is accessible only if *Connected* and the Concept project and PLC program are equal.

Note: It is recommended that the Compact be in STOP Mode. FLASH is unavailable if the controller is running.

Storing to the PCMCIA or Internal FLASH Card

Save to FLASH stores information to the PCMCIA or internal FLASH card. The following table describes the options that are available from the Save to Flash screen. When the save to FLASH is performed, the configuration, IEC and 984 LL are all stored to the PCMCIA card or internal FLASH depending on your selection.

Option	Description
Internal	Stores, RAM information to the internal on board FLASH of the PLC.PCMCIA stores, RAM information to the PCMCIA card.
Start After Power Up	Automatically starts the PLC after downloading an application from the PCMCIA card
Stop After Power Up	Automatically stops the PLC after downloading an application from the PCMCIA card
Allow Editing After Power Up	Allows edits after download to controller.
Save State RAM	Stores the information in 4x registers to the PCMCIA card
Number of 4x Registers to Save	Determines the number of 4x registers to save to the PCMCIA card
Clear FLASH	erases the information on the PCMCIA card or in internal FLASH

Note: Five PCMCIA card pull-tabs (individual part number 042710748) ship with these PLCs for better card extraction. Additional pull-tabs may be purchased in quantities of fives (part number 042710786). (See *PLC Accessories, p. 194* for recommended PCMCIA cards.)

PCMCIA Operations and PLC Power Up

Reading the PCMCIA/FLASH RAM data is performed automatically.
The following table describes the PLC power up state in relation to PCMCIA loading.

FLASH RAM or PCMCIA Card	PLC	MEM Switch	Concept Dialog	Result
Application present	Not configured	Off	If Dialog box was checked, it starts after download.	Application is loaded from the PCMCIA card to the RAM of the PLC and the PLC starts running automatically.
Application NOT present	Not configured	Off	Not applicable	PLC operates normally
Application NOT present	Not configured	On	Not Applicable	PLC operates normally
Application present	Configured	Off	If Dialog box was checked, it starts after download.	Application is loaded from the PCMCIA card to the RAM of the PLC and the PLC starts running automatically.
Application NOT present	Configured	Off	Not Applicable	PLC operates normally
Application NOT present	Configured	On	Not Applicable	PLC operates normally

Note: If your application is stored in both internal FLASH and the PCMCIA card and the battery backed RAM is lost on power-up, the PLC first checks the internal FLASH, then the PCMCIA card.

PCMCIA LED Error Conditions

If any the error conditions listed in the following table occurs, the loading of an application to the PLCs memory is terminated, and the PC LED (PCMCIA) blinks indicating the specific error detected.

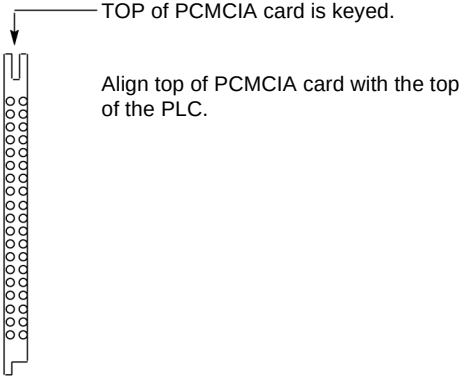
Note: Remember that only the E984-275/285 have a PC LED (PCMCIA).

These are the PC LED (PCMCIA)-Error Conditions (E984-275/285):

# of Flashes PC LED (PCMCIA)	Description of Error Condition
1 Flash	No PCMCIA driver for the inserted card
2 Flashes	Invalid checksum
3 Flashes	Security signature in the PLC does NOT match the PCMCIA card-
4 Flashes	Model mismatch
5 Flashes	PCMCIA driver error

PCMCIA Card Insertion

The PCMCIA cards are keyed. Ensure that the top of the PCMCIA card is aligned with the top of the PLC PCMCIA slot.
The following figure shows the correct PCMCIA alignment.



Software Support

2

At a Glance

Introduction

This chapter describes the software packages that support the Compact family. All of the elements of the Compact PLC instruction set are listed.

What's in this Chapter?

This chapter contains the following topics:

Panel Software Support

Overview

The Compact Controllers may be configured, I/O Mapped, and programmed using Concept panel software, full-feature Modsoft panel software, or Modsoft Lite (depending upon the model).
All of these software packages can be installed on the Modicon P230, an IBM-AT, or a compatible computer. The programming and configuration editors used for Compact are similar to those used for other 984s; special I/O Map screens have been designed for A120 I/O modules.

Concept (E984-258/265/275/285 Only)

Concept may be used with the E984-258/265/275/285 models.
Concept contains Function Block Diagram (FBD) and Sequential Function Chart (SFC) programming languages as well as a subset of data types of the international IEC 1131-3 norm.
Concept includes the following features:

- FBD depicts process data flow for both discrete and continuous control applications.
- SFC provides a graphical representation of the process.
- EFB is a "C" toolkit that allows you to create custom function blocks.
- Structured Text is ideal for implementing complex equations.
- Ladder Diagram (ladder logic) complies with the IEC 1131-3 ladder diagram specification.
- LL984, inside Concept, provides the same tools as Modsoft 984 ladder logic.

Concept operates with Windows 98, Windows NT, or Windows 2000. The E984-258/265/275/285 models are supported by the following two Concept software packages: Concept M (372 SPU 472 01 V25) and Concept XL (372 SPU 474 01 V25).

Note: You must use Concept 2.1 or higher with the E984-258/265/275/285 models; Modsoft does not support these models. For a detailed description of Concept and its operations, see the *Concept User Manual* (840 USE 493 0x).

Modsoft Lite (A984-1xx, E984-24x/251/255 Only)

Modsoft Lite (371SPU921000) is provided on 3.5 inch diskettes. Standard panel software packages include the editors listed in the following table.

Editor	Description
Configurator	Defines controller and communication parameters, allocates memory, accesses controller operations and specials (e.g., battery coil register, timer register, and time-of-day clock)
I/O Map	Links discrete and register reference numbers to modules in the I/O subsystems. Defines I/O data types
Programmer	Generates, edits, monitors ladder logic, and accesses controller
Transfer	Loads programs from disk to controller, records 984 memory to disk, and compares programs on disk and in memory
Print	Generates hard copy of user logic program and prints user comments
Environment	Defines default configurations for the panel software (e.g., printer setup, file locations, and so forth

For a detailed description of Modsoft lite and its operations, see the *Modsoft Lite Programmer User Manual* (GM-MSLT-001).

Modsoft Full-Feature (A984-1xx, E984-24x/ 251/255 Only)

Modsoft full-feature (SW-MSxD-9SA) is an integrated software tool for programming, testing, and documenting application logic for 984 controllers. The full-feature Modsoft package includes all of the Modsoft Lite editor functions as well as enhanced features, such as *sequential function chart* (SFC) and *macros*.

Sequential Function Charting

SFC is especially suitable for sequential processes because it allows you to generate programs that are organized in steps (rather than in linear ladder logic sequence). A sequential function chart can solve multiple networks in a *parallel link* or one in a choice of several networks in a *selective link*. Logic is solved within a block until a specified transition event informs the CPU to move to the next step. SFC allows application software to be created in a format that more closely emulates an actual machining procedure or process flow. It can help improve system throughput by solving only those networks specified by transition events rather than moving linearly through each network in the program on every scan.
Modsoft macros simplify the task of generating and updating large numbers of repetitive network structures. They allow you to create a repetitive structure once only, then specify the node values using macro parameters rather than standard 984 reference numbers. Each macro can contain up to 66 macro parameters by using (*) wild card characters in your naming scheme, you can create thousands of parameters per macro.

Note: If you are using full-feature Modsoft to develop application logic for a Compact system that will use full Modsoft as its permanent programming software, be careful about the use of SFC and macro ladder logic.
You can develop your programs using the /p switch. This switch prevents you from creating SFC logic and does not reserve any registers or coils for SFC us. *Do not use macros in this case.*
Alternatively, you may develop programs with SFC and macros, then use the convert-to-file menu in Modsoft to produce an equivalent program in standard ladder logic that will run with other panel software.

For a detailed description of full-feature Modsoft and its operations, see the *Modsoft Programmer User Manual* (890 USE 115 00).

The Compact Instruction Set

Overview

The Compact instruction set is dependent on the Compact model:

- The A984-1xx, E984-24x/251/255 supports 984 ladder logic only. In contrast, the E984-258/265/275/285 supports 984 ladder logic and IEC 1131-3.
- The specific instructions listed below are available for the A984-1xx, E984-24x/251/255, and E984-258/265/275/285 models as noted.

984 Ladder Logic (A984-1xx, E984-24x/251/255 Only)

Resident in the executive firmware of the Compact Controller is a set of six ladder logic programming elements and several ladder logic programming instructions that depend on the controller model.

MSTR and CKSM are never available together. All compacts (A984-145, E984-245/255) that use Modbus Plus use MSTR. All others use CKSM. Compact models E984-251/255 use XMRD and XMWT. Therefore, all compacts except E984-245/255 have 36 functions and the E984-245/255 Compacts have 38 functions.

984 Ladder Logic & IEC 1131-3 (E984-258/265/275/285 Only)

Resident in executive firmware of the E984-258/265/275/285 Controller is a set of six ladder logic programming elements and more than 80 ladder logic programming instructions.

The following table lists the standard ladder logic programming elements.

Symbol	Meaning
-| |-	A normally open contact
-||-	A normally closed contact
-|=|-	A positive transitional contact
-|O|-	A negative transitional contact
-( )-	A normal coil
-(L)-	A latched or memory-retentive coil

For more information about these instructions, see the *Modicon Ladder Logic Block Library User Guide* (840 USE 101 00).

984 Ladder Logic Instruction Set

The three tables that follow list, in detail, all of the ladder logic programming instructions used by Compact.
The following table describes the Counters, Timers, (Two Nodes); Calculations, and Other Math (Three Nodes) instructions in the **Compact Instruction set.**

Instruction		Description
Counters and Timers (Two-Nodes)	UCTR	Counts up from 0 to a preset value
	DCTR	Counts down from a preset value to 0
	T1.0	Timer that measures in seconds
	T0.1	Timer that measures in tenths of a second
	T.01	Timer that measures in hundredths of a second
	T1MS	A timer that increments in milliseconds **E984-258/265/275/285 only**
Calculations (Three-Nodes)	ADD	Adds top node value to middle node value
	SUB	Subtracts middle node value from top node value
	MUL	Multiplies top node value by middle node value
	DIV	Divides top node value by middle node value
Other Math (Three-Nodes)	AD16	Signed/unsigned 16-bit addition **E984-258/265/275/285 only**
	SU16	Signed/unsigned 16-bit subtraction **E984-258/265/275/285 only**
	MU16	Signed/unsigned 16-bit multiplication **E984-258/265/275/285 only**
	DV16	Signed/unsigned 16-bit division **E984-258/265/275/285 only**
	ITOF	Signed/unsigned integer-to-floating point conversion **E984-258/265/275/285 only**
	FTOI	Floating point-to-signed/unsigned integer conversion **E984-258/265/275/285 only**
	BCD	Converts binary values to BCD values and BCD values to binary values **E984-258/265/275/285 only**

The following table describes the DX Moves (Three Nodes), DX Matrix (Three Nodes), and Skip Node (One Node) instructions in the **Compact Instruction set.**

Instruction		**Description**
DX Moves (Three-Nodes)	R"T	Moves register values to a table
	T"R	Moves table values to only one register.
	T"T	Moves a specified set of values from one table to another table
	BLKM	Moves a specified block of data
	TBLK	Moves a block of data from a table to another specified block area
	BLKT	Moves a block of registers to specified locations in a table
	FIN	First-in operation to a queue
	FOUT	First-out operation from a queue
	SRCH	Performs a table search
	IBKR	Accesses data in non-contiguous registers and reads the data into a contiguous block of registers. **E984-258/265/275/285 only**
	IBKW	Accesses data in a contiguous block of registers and writes the data into several non-contiguous registers. **E984-258/265/275/285 only**
	TEST	Compares signed or unsigned values between two 16-bit registers and outputs the results based upon the relationship **E984-258/265/275/285 only**
	STAT	Displays status registers from status table in system memory
	XMWT	Allows you to write to the 24K words of extended registers (6xxxx)
	XMRD	Allows you to read the 24K words of extended registers (6xxxx)
	DIOH	Retrieves health data from a specified group of drops on a distributed I/O network

Instruction		Description
DX Matrix (Three-Nodes)	AND	Logically ANDs two matrices
	OR	Does logical inclusive OR of two matrices
	XOR	Does logical exclusive OR of two matrices
	COMP	Performs the logical complement of values in a matrix
	CMPR	Logically compares the values in two matrices
	NOBT	Senses the logic state of a bit in a register. The bit represents an N.O. contact. **E984-258/265/275/285 only**
	NCBT	Senses the logic state of a bit in a register. The bit represents an N.C. contact. **E984-258/265/275/285 only**
	SBIT	Sets the state of a specified bit to ON. **E984-258/265/275/285 only**
	RBIT	Clears a latched-ON bit. **E984-258/265/275/285 only**
	NBIT	Controls the state of a bit in a register. **E984-258/265/275/285 onl**y
	MBIT	Logical bit modify
	SENS	Logical bit modify
	BROT	Logical bit rotate
	CKSM	Performs one of four possible checksum operations (Built-in for E984-241/251, no MSTR function supported)
	SCIF	Provides tenor drum sequencer functionality and the ability to do input comparisons within the application program **E984-258/265/275/285 only**
	IMIO	Permits access of specified I/O modules from within ladder logic. **E984-258/265/275/285 only**
Skip-Node (One-Node)	SKIP	Skips to a specified network
	SKPC	(Skip constant) Skips a specified number of networks
	SKPR	(Skip register) Skips a specified number of networks using a value stored in a 3x or 4x register

The following table describes Process Control Function Library (PCFL) (Three-Nodes) and the Ladder Logic Subroutine Instructions in the **Compact Instruction set.**

Instruction		Description
Process Control Function Library (PCFL) (Three-Nodes)	AIN	Scales raw analog input into engineering units for calculations. **E984-258/265/275/285 only**
	AOUT	Calculates signals for analog output modules. **E984-258/265/275/285 only**
	ALARM	Handles alarm limits on process variables. **E984-258/265/275/285 only**
	AVER	Calculates the average of up to four weighted inputs. **E984-258/265/275/285 only**
	CALC	Calculates a preset formula with up to four inputs. **E984-258/265/275/285 only**
	EQN	A formatted equation calculator used for equations that have four or fewer variables but does not fit into the CALC format. E984-258/265/275/285 only
	DELAY	Builds a series of readings for time-delay compensation in the logic. **E984-258/265/275/285 only**
	INTEG	Integrates over a specified time interval. **E984-258/265/275/285 only**
	LIMIT	Limits the input to a range between a specified high and low value. **E984-258/265/275/285 only**
	LLAG	Provides dynamic compensation for a known disturbance. **E984-258/265/275/285 only**
	MODE	Sets up a manual or automatic station for enabling and disabling data transfers to the next block. **E984-258/265/275/285 only**
	ONOFF	Controls the output signal between fully ON and fully OFF conditions so that you can manually force the output ON or OFF. **E984-258/265/275/285 only**
	PID	Performs closed loop control. **E984-258/265/275/285 only**
	RAMP	Ramps up linearly to a target set point at a specified approach rate. **E984-258/265/275/285 only**
	RATE	Calculates the rate of change over the last two input values. **E984-258/265/275/285 only**
	SEL	Compares up to four inputs and makes a selection based upon either the highest, lowest, or average value. **E984-258/265/275/285 only**
	PI	Performs simple PID. **E984-258/265/275/285 only**
	KPID	Offers a superset of the functionality of the PID function. **E984-258/265/275/285 only**
	RATIO	Provides a four-station ratio controller. **E984-258/265/275/285 only**
	TOTAL	Provides a material totalizer for batch processing reagents. **E984-258/265/275/285 only**
Ladder Logic Subroutine Instructions (Two-Nodes)	JSR	Jumps from scheduled logic scan to a ladder logic subroutine

Instruction		Description
(Two-Nodes) (One-Node)	LAB	Labels the entry point of a ladder logic subroutine
	RET	Returns from the subroutine to scheduled logic
PID Instruction (Three-Nodes)	PID2	Performs a specified proportional-integral-derivative function
Enhanced Math (Three-Nodes)	EMTH	Performs 38 math operations, including floating point math operations and extra integer math operations such as square root
Ladder Logic Interrupt Instructions (Two-Nodes)	ITMR	Defines an interval timer that generates interrupts into the ladder logic scan. **E984-258/265/275/285 only**
(One-Node)	ID	Protects data in both the normal (scheduled) ladder logic and the (unscheduled) interrupt handling subroutine logic. **E984-258/265/275/285 only**
(One-Node)	IMIO	Permits access of specified I/O modules from within ladder logic that differs from the normal I/O processing procedure. **E984-258/265/275/285 only**
(One-Node)	IE	Protects data in both the normal (scheduled) ladder logic and the (unscheduled) interrupt handling subroutine logic. **E984-258/265/275/285 only**
(Three-Nodes)	BMDI	Protects data in both the normal (scheduled) ladder logic and the (unscheduled) interrupt handling subroutine logic. **E984-258/265/275/285 only**
Modbus Plus Networking Instruction (Three-Nodes)	MSTR	Specifies a function from a menu of networking operations (This function is available only on the A984-145, E984-245/255, and E984-265/275/285 Controllers that support Modbus Plus communications. No CKSM supported for E984-245/255)
Application Specific (Three-Nodes)	SAVE	Saves a block of 4x registers to state RAM where they are protected from unauthorized modification. **E984-258/265/275/285 only**
	LOAD	Loads a block of 4x registers (previously SAVEd) from state RAM where they are protected from unauthorized modification. **E984-258/265/275/285 only**

Compact Loadable Software Instructions

You can add loadable instructions to the resident instruction set.
The following table describes the **loadable software instructions** that are available for Compact.

Three-Nodes	FNxx	Allows you to develop your own custom loadable function blocks. Modicon part number SW-AP98-GDA.
	DRUM and ICMP	Simplifies implementation of sequential step-oriented logic. Modicon part number SW-AP98-SxA.
	EARS	Supports an event/alarm recording system by tracking and reporting time-stamped messages. Modicon part number SW-AP9D-EDA.
	HLTH	Detects changes in the I/O system and reports problems on an exception-only basis. Modicon part number SW-HLTH-D8L.
	Gxxx	Measures gas flow using several industry standards. Modicon part number 309 ULD 455 00. E984-251/255, E984-258/265/275/285 supports all gas functions. A984-141/145, E984-241/245 supports GD92 and G392 only.
	XMIT	Transmit for sending Modbus messages from master PLC to multiple slave PLCs or to ASCII printers. Modicon part number 309 COM 455 00. **E984-241/245/251/255 only**

For more information about these instructions, see the *Modicon Ladder Logic Block Library User Guide* (840 USE 101 00) or the manual that describes the respective loadable.

Note: For every 10 bytes of.EXE that are loaded, you lose one node of ladder logic if you are using an A984-1xx, E984-24x/251/255 PLC model, or an E984-258/265/275/285 PLC model.

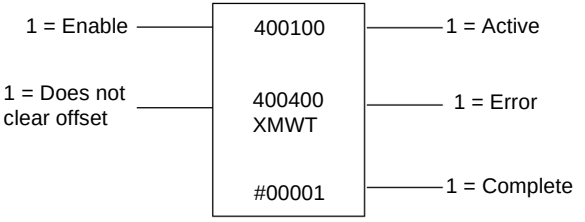
XMWT AND XMRD Function Blocks (E984-251/255 Only)

The Extended Memory function blocks XMWT and XMRD function as described in the *Modicon Ladder Logic Block Library User Guide* (840 USE 101 00) with two exceptions, as noted below. The functions are available from the panel DX selection when E984-251/255 is configured

- The bottom input is ignored because the E984-251/255 can not detect memory errors as it reads or writes to the extended memory.
- The status word bits 14 and 15 are not used because the memory does not have parity and the extended memory is not separated from the remainder of the Controller memory.

  XMWT Block: The top node refers to the address of the first reference to get for transfer to the 6X area. The middle node and Reference Data shows the 6X register control block associated with Extended Memory transfers.

The following figure shows the XMWT block.



Reference Data:

400100 Source_add	0 Dec
400401 Status	1 Dec
400402 File_Number	9999 Dec (Max 9999)
400403 Start 6X	9999 Dec (Max 9999)
400404 Count	0 Dec (Keeps running total of
400405 Nmbr_done	transfers
400406 Max_reg	9999 Dec (Max 9999)

The extended memory Modbus read and write functions are described in the *Modbus Protocol Reference Guide* (PI-MBUS-300) as Read/Write General Reference function codes 20 and 21. The only difference in the E984-251/255 extra register implementation is the size of the extended memory, which changes the number of files and the number of registers.
The following table show the E984-251/255 extra register implementation.

Type	**E984-251**	**E984-255**
State RAM	2K words	2K words
Extended Memory	24K words	24K words
Number of Files	3 files	3 files
Registers in last File	4K words	4K words

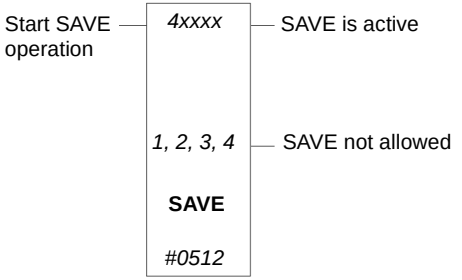
Note: Incrementing the pointer beyond 9999 results in an error. However, if the count is larger, the function block accesses the next file.

SAVE Instruction Block (E984-258/265/275/285 Only)

The SAVE block saves a block of 4x registers to state RAM. State RAM protects the registers from unauthorized modification.

- The size is three nodes
- The PLC compatibility is PC-E984-258, PC-E984-265, PC-E984-275, and PC-E984-285.
- The opcode is 54 hex

The following figure shows the block structure of the SAVE block.



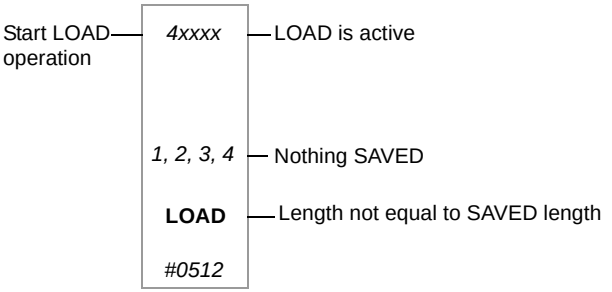
- Inputs
  SAVE has one control input that starts the operation and it should remain ON until the operation has completed successfully or an error has occurred.
- Outputs
  SAVE may produce two possible outputs. The outputs from the top node goes ON while a SAVE operation is in progress. The output from the middle node goes ON when previously saved data has not been accessed using the LOAD instruction. This prevents inadvertent overwriting of data in the SAVE buffer.
- Top Node Content
  The top node specifies a block of 4x registers to be saved to state RAM. The 4x register entered here defines the beginning register of the block.
- Middle Node Content
  The middle node defines the specific buffer, within state RAM, where the block of data is to be saved. Four 512 word buffers are allowed. Each buffer is defined by placing its corresponding value in the middle node, that is, the value 1 represents the first buffer, value 2 represents the second buffer and so on. The legal values are 1, 2, 3, and 4. When the PLC is started all four buffers are zeroed. Therefore, you may not SAVE data to the same buffer without first transferring data in the buffer to 4x registers by using the LOAD instruction. When this is attempted the middle output goes ON. In other words, once a buffer is used, it may not be used again until the data has been removed.
- Bottom Node Content
  The bottom node contains the number of holding registers to be saved. The range is 1 ... 512.

LOAD Instruction Block (E984-258/265/ 275/285 Only)

The LOAD block loads a block of 4x registers (previously saved) from state RAM where they are protected from unauthorized modification.

- The size is three nodes high
- The PLC compatibility is PC-E984-258, PC-E984-265, PC-E984-275, and PC-E984-285.
- The opcode is 55 hex

The following figure shows the block structure of the LOAD block.



- Inputs
  LOAD has one control input that starts the operation and it should remain ON until the operation has completed successfully or an error has occurred.
- Outputs
  LOAD may produce three possible outputs. The outputs from the top node goes ON while a LOAD operation is in progress. The output from the middle node goes ON when a LOAD is requested from a buffer where no data has been saved. Therefore, no LOAD is allowed. This prevents inadvertent overwriting of data in state RAM. The output from the bottom node goes ON when a LOAD request is not equal to the registers that were saved.
- Top Node Content
  The top node specifies a block of 4x registers to be loaded from state RAM. The 4x register entered here defines the beginning register of the block.
- Middle Node Content
  The middle node defines the specific buffer where the block of data is to be loaded. Four 512 word buffers are allowed. Each buffer is defines by placing its corresponding value in the middle node, that is, the value 1 represents the first buffer, value 2 represents the second buffer and so on. The legal values are 1, 2, 3, and 4. When the PLC is started all four buffers are zeroed. Therefore, you may not LOAD data from the same buffer without first saving it. When this is attempted the middle output goes ON. In other words, once a buffer is used, it may not be used again until the data has been removed.
- Bottom Node Content
  The bottom node contains the number of words to be loaded. The range is 1... 512.

Description of the DLOG Instruction Block (E984-275/285 Only)

The DLOG (data logging) block allows state RAM data to be recorded into the memory of a PCMCIA card using ladder logic.

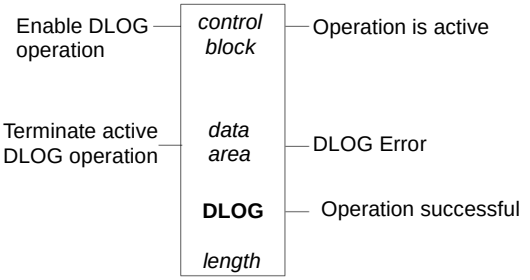
Note: Each segment in the PCMCIA card MUST be erased before any locations, in the segment, are written, this is necessary because the PCMCIA driver does not allow 0 bits in the card to be changed to 1 bits via a write command. Only an erase can make this change.

The DLOG (data logging) block has the following characteristics:

- The size is three nodes high
- The PLC compatibility is PC-E984-275, and PC-E984-285.
- The opcode is 56 hex

Representation

The following information describes the representation of the DLOG instruction block.
The following figure represents the block structure.



The following list provides detailed information about inputs to, outputs from, sand the node content of DLOG.

- **Inputs**
  DLOG has two possible control inputs:
  - The top input should remain ON until the operation has completed successfully or an error occurs.
  - The middle input stops the active operation of the instruction block.

  Note that data format and its frequency of writing is determined by your application. Note also that the DLOG block operates only with AMD flash cards. For information about Compact Accessories for PCMCIA cards, refer to *Compact Accessories, p. 193*.
- **Outputs**
  DLOG can produce three possible outputs:
  - The outputs from the top node goes ON while a DLOG operation is in progress.
  - The output from the middle node goes ON if DLOG detects an error during a DLOG operation.
  - The output from the bottom node goes ON if DLOG operation is successfully completed.
- **Top Node Content**

The following table defines the 4x registers in the DLOG control block.

Register	Function	Description	Content
4x	Error Status	This register displays DLOG errors in Hex.	1=The count parameter > the DLOG block length during a WRITE operation (01) or read operation (02),2=PCMCIA card operation failed when initial started (write/ read/erase), 3=PCMCIA card operation failed during execution (write/read/erase)
4x+1	DLOG Function	This register specifics which DLOG function to perform.	1=Write to PCMCIA Card,2=Read from PCMCIA Card,3=Erase One Block in the PCMCIA Card,4=Erase the Entire PCMCIA Card Content
4x+2	PCMCIA Card Block Identifier	This register identifies a particular block located on the PCMCIA card (1 block=65535 words)	0 ... 31 Max. for a 4Meg PCMCIA card. (The number of blocks are dependent on the memory size of the PCMCIA card)
4x+3	PCMCIA Card Byte Address within the Block Identified	This register identifies a starting range of words located within a particular block on the PCMCIA card.	0 ... 65,535 words*
4x+4	4x Register Counter	This register specifies the number of 4x registers to be written to or read from the PCMCIA card within the limits length set in the button node.	1 ... 100*
*__Note:__ No Read or Write can be > 65,536 words. Therefore, your PCMCIA Card Address within the Block Identified (4x+3) plus your 4x Register Counter (4x+4) MUST NOT exceed 65,536 words.			

- Middle Node Content
  The *data area* comprises a group of contiguous holding registers. The 4x register entered in the middle node is the first holding register in the group.
  - For the Write operation, the *data area* is the source of the data.
  - For the Read operation, the *data area* is the destination of the data.
- Bottom Node Content
  The bottom node contains the *length* (the number of 4x registers) of the data area. The range is 1 ... 100.

Note: The PCMCIA card does not allow a Write command to change 0 bits (in the card) to 1 bits. Therefore, each segment in a PCMCIA card must be erased before you can write to any location in the segment. Only an Erase command can make this change.

Relocating Logic from One 984 to Another

The only constraints on logic relocation are that the program in the source controller must generate logic that implements only instruction and/or function blocks acceptable to the target controller. Also, the size of the source logic program must not exceed the memory limits of the target controller.
For a detailed description of relocating 984 logic and its operations, see the *Modsoft Programmer User Manual* (890 USE 115 00).

Communication Capabilities

3

At a Glance

Introduction

The following information describes the communication features of the Compact family.

Note: (See *Compact Specifications, p. 159*) for complete controller specifications.

What's in this Chapter?

This chapter contains the following topics:

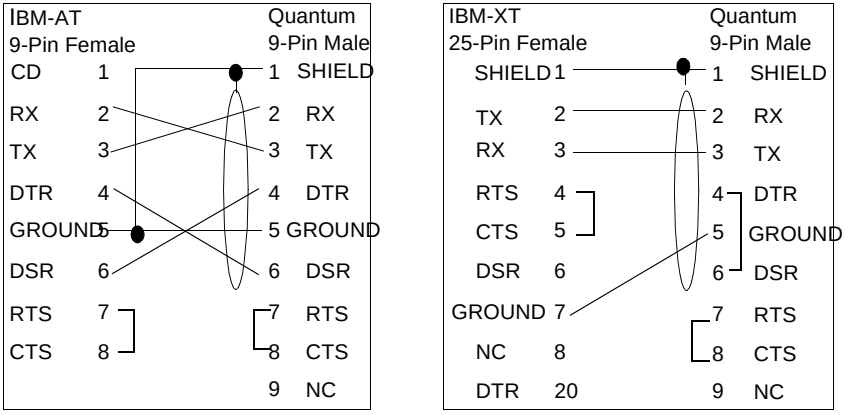
Modbus Communications A984 & E984-241/251

9-Pin Port/Cable Pin-Outs

The A984-1xx and E984-241/251 CPUs are equipped with a nine-pin RS-232C connector that supports Modicon's proprietary Modbus communication protocol.

- For connection to a 25-pin XT-type panel, use a Modicon W951 (null modem) cable or the cable shown in the figure that follows.
- For connection to a 9-pin AT-type panel, use a Modicon AS-W952-01 2 cable. The W952 cable is 12 ft long.

The following figure shows the Modbus port pinouts (**Controller to 9-Pin and 25-Pin Panel Connections**)



Modbus Protocol Features

The Modbus protocol can be used for programming or for data transfer; the controller responds to transactions initiated by a host device connected to the controller's communication processor at a Modbus port. Modbus facilitates communication with host devices, such as a programming panel or a P965 Data Access Panel, and it also supports a multi-controller (master-slave) communications networking strategy. The P965 does not support the E984-258/265/275/285 PLCs.

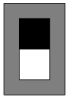
MODBUS Port Parameters (2-Position Slide Switch)

Use the communication parameter slide switch on the front panel of the controller to specify Modbus port parameters as follows.

- In the default position (=), port one automatically adopts these parameters: 9600 baud, EVEN parity, RTU mode.
- In the mem position (O) the port assumes the parameters that you have specified in the configurator editor in panel software.
- Use of this switch in the context of Modbus Plus communications is discussed in *Modbus Plus Communications E984-265/275/285, p. 84*

The first time that you connect a programming panel to start the controller, your panel device must use the following Modbus port parameters: 9600 baud, EVEN parity, RTU mode, 1 stop bit, Modbus port address 1.

The following figure shows the Modbus port switch.



9600 Baud, EVEN Parity, RTU Mode
(1 Stop Bit, 8 Data Bits)
Modbus Port Address 1

Port 1 - 50, 75, 110, 150, 300, 600, 1200, 2400, 4800, 9600, or 19200 Baud
EVEN/ODD/NO Parity (1/2 Stop Bits)
RTU (8 Data Bits) or ASCII (7 Data Bits) Mode

Port 2 - 300, 600, 1200, 2400, 4800, 9600, or 19200 Baud
EVEN/ODD/NO Parity (1/2 Stop Bits)
RTU (8 Data Bits) or ASCII (7 Data Bits) Mode

Note: Port 2 of the A984-1xx, and E984-24x/251/255 models does not support the following Modbus port parameters.

- ASCII 7 data bits - 1 stop - no parity= 9 bits (illegal)
- RTU 8 data bits - 2 stop - parity = 12 bits (illegal)

Modbus Communications E984-258/265/275/285

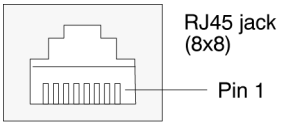
RJ45 Port/Cable Pin-Outs

The E984-258/265/275/285 CPUs are equipped with two RS-232 ports using eight-pin RJ45 (phone jack-type) connectors that support Modicon's proprietary Modbus communication protocol.

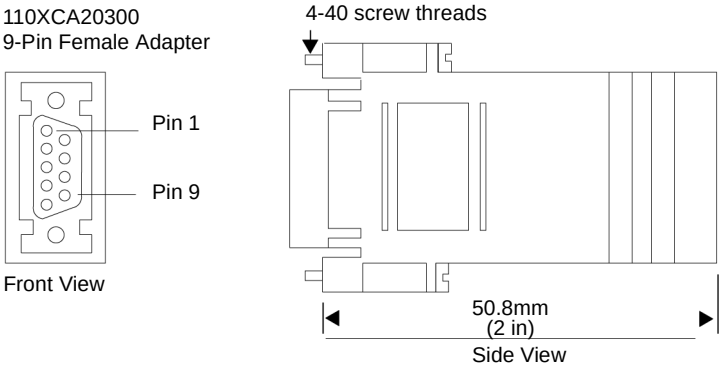
- For connection to a 9-pin AT-type panel, use a Modicon 110XCA20300 adapter.
- For connection to a 25-pin XT-type panel, use a Modicon 110XCA20400 adapter.

Physical Connector (RJ45 to 9-Pin)

The following figure shows the RJ45 to 9-pin connector.



The following figure shows the physical layout of the RJ45 to 9-pin connector.



Connector Pinouts (RJ45 to 9-Pin)

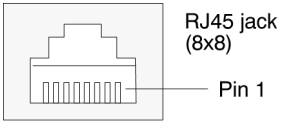
The following table describes the **connector pinouts** of the **RJ45 to 9-pin** connector.

Signal Name	Pinout	Pinout Connected To ...	Pinout	Signal Name
+5VDC (150ma Limit)	1		1	DCD
TXD	3	Yes	2	RXD
RXD	4	Yes	3	TXD
DSR	2	Yes	4	DTR
GND	5	Yes	5	GND
			6 Connected to Pins 2 and 4	DSR
*CTS	7 Jumpered		7 Jumpered	RTS
*RTS	6 Jumpered		8 Jumpered	CTS
			9	RI
Chassis Ground	8	Yes	Case of the Connector	

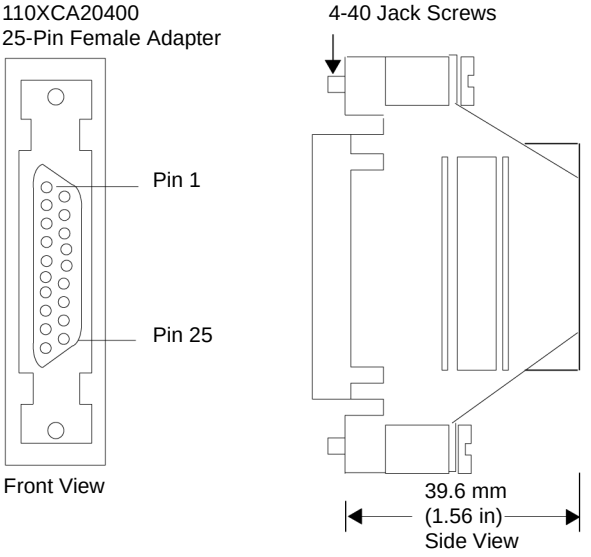
Note: *The Modbus 2 port supports neither CTS nor RTS.

Physical Connector (RJ45 to 25-Pin)

The following figure shows the RJ45 to 25-pin connector.



The following figure shows the physical layout of the RJ45 to 25-pin connector pinouts.



Connector Pinouts (RJ45 to 25-Pin)

The following table describes the **connector pinouts** of the **RJ45 to 25-pin**.

Signal Name	Pinout	Pinout Connected To ...	Pinout	Signal Name
+5VDC (150ma Limit)	1		1	
RXD	4	Yes	2	TXD
TXD	3	Yes	3	RXD
*CTS	7 Jumpered		4 Jumpered	DTS
*RTS	6 Jumpered		5 Jumpered	CTS
			6 Connected to pins 2 and 20	DSR
GND	5	Yes	7	GND
			8	DCD
DSR	2	Yes	20	DTR
Chassis Ground	8	Yes	1	Chassis Ground

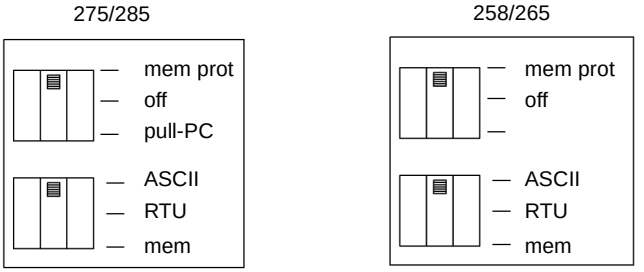
Note: *The Modbus 2 port supports neither CTS nor RTS.

Note: If Pin 1 of either Modbus port 1 or port 2 of the E984-258 or -258C PLC is shorted to GND, excessive current draw above 150 ma can cause the power supply and PLC to shut down.

MODBUS Port Parameters (3-Position Slide Switch)

Two three-position slide switches are located on the front of the E984-258/265/275/285 PLCs. The three-position slide switch on the bottom is used to select the communication parameter settings for Modbus (RJ45) port one. The top switch is used for memory protection in the top position, no memory protection in the middle position, and swapping PCMCIA card (pull-PC 275/285 only) in the bottom position. When you connect a programming panel to start the controller for the first time, your panel device must use the following Modbus port parameters: 9600 baud, EVEN parity, RTU mode, Modbus port address 1.

The following figure shows the switch positions for the various 275/285 and 258/265 models.



Note: The E984-258/265 does not support a PCMCIA card.

3-Position Slide Switch Setting Options

The following information provides detailed descriptions of the settings and functionality enabled by the top, middle, and bottom slide switch settings.
Setting the slide switch to the top position assigns ASCII functionality to the ports; the following communication parameters are set and cannot be changed.
The following table shows the values of the communication port parameters if the slide switch is set to the top position (**ASCII functionality**).

Parameter	Value
Baud	2,400
Parity	Even
Data Bits	7
Stop Bits	1
Device Address	Front panel rotary switch setting for Modbus port 1 only

Setting the slide switch to the middle position assigns remote terminal unit (RTU) functionality to port 1.
The following table shows the values of the communication port parameters if the slide switch is set to the middle position (**RTU functionality**). The values are fixed; you cannot change them.

Parameter	Fixed Value
Baud	9,600
Parity	Even
Data Bits	8
Stop Bits	1
Device Address	Front panel rotary switch setting for Modbus port 1 only

Setting the slide switch to the bottom position enables you to use software to configure the values of the communication port parameters.
The following table lists the communication port parameters that you can configure if the slide switch is set to the bottom position (using **software**). The table includes the valid values for the parameters.

Parameter	**Range of Valid Values**	
Baud	19,200	1,200
	9,600	600
	7,200	300
	4,800	150
	3,600	134.5
	2,400	110
	2,000	75
	1,800	50
Parity	Enable/Disable Odd/Even	
Data Bits	7/8	
Stop Bits	1/2	
Device Address	1 ... 247	

CTS/RTS Communication Delays for Communication Port 1

Your application may require the use of time delays. (For more information, see *CTS/RTS Communication Delays for Communication Port 1 (E984-258/265/275/285 Only), p. 21*).

Generic Modbus Communication Functions

Modbus Communication Modes

Modbus can operate in two communication modes: ASCII (the ANSI standard for inter-device communications) and RTU.

How to Specify Modbus Port Parameters

For the A984 and E984-241/251, refer to *MODBUS Port Parameters (2-Position Slide Switch), p. 71*. For the E984-258/265/275/285, refer to *MODBUS Port Parameters (3-Position Slide Switch), p. 76*. Use of this switch in the context of Modbus Plus communications is discussed in *Communication Parameters Slide Switch -Bridge Mode, p. 83*.

Setting Up a Communications Network Over Modbus

Modbus also provides a cost-effective method for handling remote programming and data transfer over a master-slave nodal network. Modbus allows you to link Compact Controllers and other Modicon Programmable Controllers with computer terminals or programming panels for data acquisition, supervisory control, and programming functions.
Up to 247 slave nodes can be linked on a Modbus network, and communications can occur at data rates of up to 19,200 baud over twisted pair cable, common carrier phone lines, or microwave transmitters.

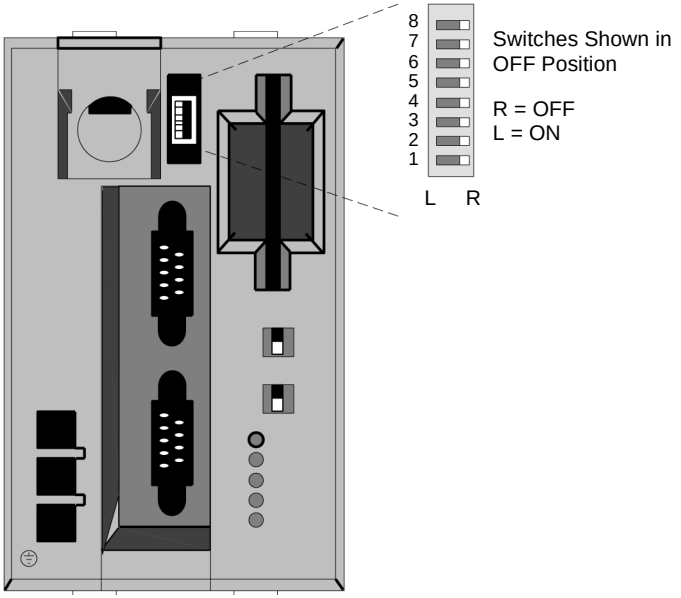
Modbus Plus Communications A984-145, E984-245/255

Modbus Plus Addressing

Each node on a Modbus Plus network must be assigned a unique address in the range 1 ... 64 using switches 1 ... 6 on the addressing DIP switch on the top front of the A984-145, E984-245/255 bezel.

6-Position DIP Switch-Node Addressing

This is location of the DIP switch.



The following table shows the actual **Modbus Plus Node Address Settings** for the A984-145, E984-245/255 PLC switches.

Address	**Switch Positions**							
	1	2	3	4	5	6	7	8

Address	Switch Positions							
1	R	R	R	R	R	R		
2	L	R	R	R	R	R		
3	R	L	R	R	R	R		
4	L	L	R	R	R	R		
5	R	R	L	R	R	R		
6	L	R	L	R	R	R		
7	R	L	L	R	R	R		
8	L	L	L	R	R	R		
9	R	R	R	L	R	R		
10	L	L	R	L	R	R		
11	R	L	R	L	R	R		
12	L	L	R	L	R	R		
13	R	R	L	L	R	R		
14	L	R	L	L	R	R		
15	R	L	L	L	R	R		
16	L	L	L	L	R	R		
17	R	R	R	R	L	R		
18	L	R	R	R	L	R		
19	R	L	R	R	L	R		
20	L	L	R	R	L	R		
21	R	R	L	R	L	R		
22	L	R	L	R	L	R		
23	R	L	L	R	L	R		
24	L	L	L	R	L	R		
25	R	R	R	L	L	R		
26	L	R	R	L	L	R		
27	R	L	R	L	L	R		
28	L	L	R	L	L	R		
29	R	R	L	L	L	R		
30	L	R	L	L	L	R		
31	R	L	L	L	L	R		
32	L	L	L	L	L	R		
33	R	R	R	R	R	L		
34	L	R	R	R	R	L		

Address	Switch Positions							
35	R	L	R	R	R	L		
36	L	L	R	R	R	L		
37	R	R	L	R	R	L		
38	L	R	L	R	R	L		
39	R	L	L	R	R	L		
40	L	L	L	R	R	L		
41	R	R	R	L	R	L		
42	L	R	R	L	R	L		
43	R	L	R	L	R	L		
44	L	L	R	L	R	L		
45	R	R	L	L	R	L		
46	L	R	L	L	R	L		
47	R	L	L	L	R	L		
48	L	L	L	L	R	L		
49	R	R	R	R	L	L		
50	L	R	R	R	L	L		
51	R	L	R	R	L	L		
52	L	L	R	R	L	L		
53	R	R	L	R	L	L		
54	L	R	L	R	L	L		
55	R	L	L	R	L	L		
56	L	L	L	R	L	L		
57	R	R	R	L	L	L		
58	L	R	R	L	L	L		
59	R	L	R	L	L	L		
60	L	L	R	L	L	L		
61	R	R	L	L	L	L		
62	L	R	L	L	L	L		
63	R	L	L	L	L	L		
64	L	L	L	L	L	L		

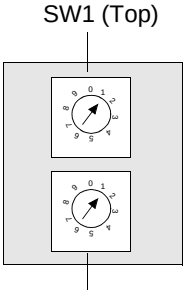
Communication Parameters Slide Switch-Bridge Mode

Bridge mode allows you to access nodes on a Modbus Plus network from a Modbus master device (connected to the standard Modbus port). To set the Modbus Plus bridge mode for port 1 of the A984-145, and E984-245/255 Controllers, set the slide switch to default position, the controller's bridge mode is automatically enabled. When in the memory position (MEM), bridge mode can be enabled or disabled in the Modbus port parameter settings of the controllers configuration table. When bridge mode is enabled the port always uses the Modbus Plus address setting.

Modbus Plus Communications E984-265/275/285

10-Position Rotary Switches-Node Addressing

Each node on a Modbus Plus network must have a unique address from 1-64 using the two rotary switches on the front of the E984-265/275/285 bezel.
Two rotary switches are used for setting Modbus Plus node and Modbus port 1 addresses. SW1 (the top switch) sets the upper digit (tens) of the address; SW2 (the bottom switch) sets the lower digit (ones) of the address.
The following figure shows the correct setting for example address 11.



The following table lists the SW1 and SW2 address settings.

Node Address	SW1 X10	SW2 X1
1 ... 9	0	1 ... 9
10 ... 19	1	0 ... 9
20 ... 29	2	0 ... 9
30 ... 39	3	0 ... 9
40 ... 49	4	0 ... 9
50 ... 59	5	0 ... 9
60 ... 64	6	0 ... 4

Note: If "0" or an address greater than 64 is selected, the Modbus Plus LED remains on steady to indicate that an invalid address was selected.

Communication Parameters Slide Switch-Bridge Mode

Bridge mode allows you to access nodes on a Modbus Plus network from a Modbus master device (connected to the standard Modbus port). To set the Modbus Plus bridge mode for port 1 of the E984-265/275/285 Controllers, set the slide switch to either the ASCII or RTU position.

In the memory position (MEM), bridge mode is enabled (or disabled) by the Modbus port parameter setting in the Controller configuration table. If bridge mode is enabled, the port always uses the Modbus Plus address.

Modbus Plus LEDs

Flash Pattern Details

The MB Plus LED is a green indicator that shows the type of communications activity on the Modbus Plus port on A984-145, E984-245/255/265/275/285 Controllers. A specific flash pattern indicates the nature of the Modbus Plus communication activity:
The following table lists the LEDs flash patterns and their meanings.

LED Flash Patters	Description
Six flashes per second	The normal operating state for a Modbus Plus node. The node is successfully receiving and passing the token. All nodes on the network should be flashing this pattern.
One flash per second	The node is offline after just being powered up, or after hearing a message from another node with the same address (duplicate addresses are not allowed). In this state, the node monitors the network and builds a table of active nodes and token-holding nodes. It remains in this state for five seconds, then attempts to go to its normal operating state.
Two flashes, then OFF for two seconds	The node is hearing the token being passed among other nodes, but is never receiving the token. Check the network link for an open or short circuit, or defective termination.
Three flashes, then OFF for 1.7 seconds	The node is not hearing any other nodes. It is periodically claiming the token, but finding no other node to which to pass it. Check the network link for an open or short circuit, or for a defective termination.
Four flashes, then OFF for 1.4 seconds	The node has heard a valid message from another node that is using the same address as this node. The node remains offline in this state as long as it continues to hear the duplicate address. If the duplicate address is not heard for five seconds, the node then changes to the pattern of one flash every second.
On steady	The address switch setting is set to an invalid Modbus Plus address (i.e.: 0 or > 64).

Generic Modbus Plus Communications

Modbus Plus Communication Protocol Reference

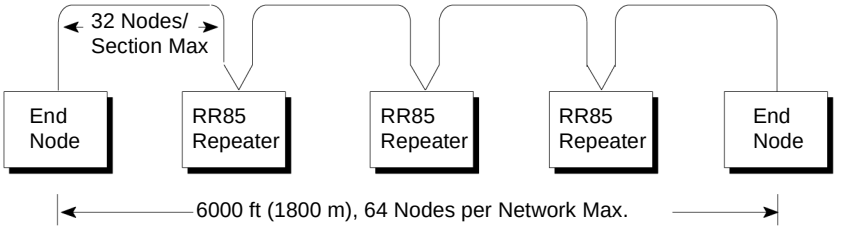
The A984-145, E984-245/255/265/275/285 Compact-E984 Controllers are equipped with a nine-pin D-Sub connector that supports Modicon's proprietary Modbus Plus communication protocol. Refer to *Schneider Automation's Modbus Plus Network Planning and Installation Guide* (890 USE 100 00).

Modbus Plus Capabilities for Compact

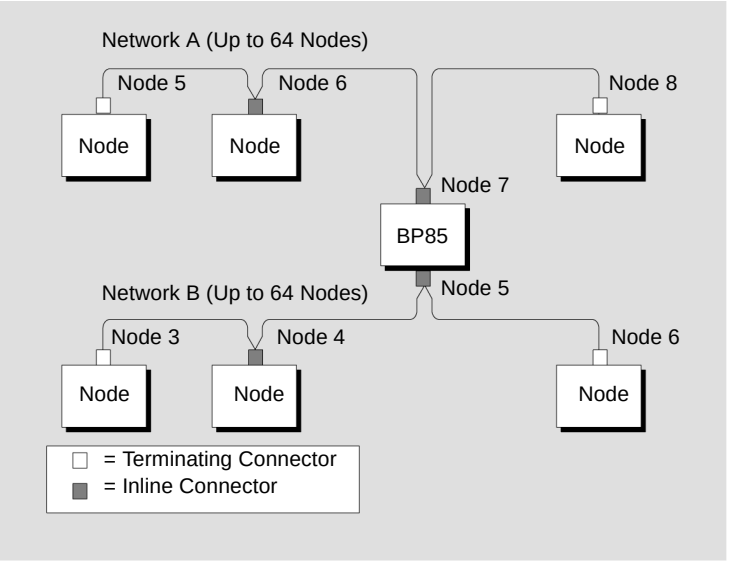
Overview of Modbus Plus

Modbus Plus is a local area network designed for industrial control applications. It enables the A984-145, E984-245/255/265/275/285 Controllers to become a node on the network and to communicate with other 984 controllers, host computers, and special bridge and multiplexer devices. A network may comprise one or more communication sections. One section can support up to 32 nodes. Up to 64 nodes can exist on a network.

The following figure shows the maximum linear configuration.



Multiple Modbus Plus networks can be interconnected using a BP85 Bridge Plus device.
The following figure shows multiple networks linked by Bridge Plus.



Each node within a network must have a unique address number in the range 1 ... 64. The node address of a 984 chassis mount controller is specified using a set of DIP switches provided on the top front of the A984-145, E984-245/255 models. The E984-265/275/285 uses the rotary switches.
Modbus Plus uses a proprietary protocol that delivers high performance intercommunication capabilities at a data transfer rate of 1 Mbit/s. The network medium is twisted-pair shielded cable, laid out in a sequential multidrop path directly between successive nodes.

Modbus Plus Token Rotation

Each node on a Modbus Plus network functions as a peer on a logical ring, gaining access to the network upon receipt of a token frame. The token is a bit grouping that is passed in a rotating address sequence from one node to the next. While an individual node holds the token, it may initiate data read/write and statistical transactions with other nodes; when the node passes its token, it may write to a global database that is maintained by all nodes on the network. Use of this global database allows rapid updating of alarms, setpoints, and other data.

How the A984-145, E984-245/255/265/275/285 Initiates Modbus Plus Transactions

A984-145 (or any programmable controller with Modbus Plus capability) may initiate network communication using a ladder logic function called MSTR. MSTR allows you to specify the type of communications transaction you want to carry out and to define the routing path over which you wish the transaction to take place.
The MSTR block is part of the standard A984-145, E984-245/255/265/275/285 instruction set, contained in the system executive. Modbus Plus transactions can be accessed from the FFB communication library in the IEC program sections of Concept for the E984-258/265/275/285.

Note: To have a good understanding of the Modbus Plus theory of operations, to be able to plan the layout of the total network, and to meet all the requirements of the network cable installation, refer to the Modicon Modbus Plus Network Planning and Installation Guide (890 USE 100 00). Also, you may wish to refer to Modbus Protocol Reference Guide (PI-MBUS-300). For a full description of the MSTR function block, refer to the *Modicon Ladder Logic Block Library User Guide* (840 USE 101 00).

How the A984-145, E984-245/255/265/275/285 Initiates Peer Cop Transactions

Point to point data can be transacted while a node holds the token and during its token pass with Modbus Plus Peer Cop. Up to 500 words (16bits each) can be directed to specific data references in node devices prior to release of the token frame, and up to 32 words can be globally broadcast to all nodes as part of the token frame.

Note: In order to thoroughly understand Peer Cop theory of operations, to be able to plan the layout of the total network, and to meet all the requirements of the network cable installation, refer to the *Modicon Modbus Plus Network Planning and Installation Guide* (890 USE 100 00).

Bridge Mode Between Modbus and Modbus Plus

Selecting Standard or Bridge Communications

The standard Modbus port on the A984-145, E984-245/255/265/275/285 Controllers can be used in either of these two ways:

- as a slave port to a Modbus master device
- as a *bridge* between a Modbus master device and the Modbus Plus network nodes

Make the above selection by setting the communication parameter slide switch as follows:

- setting the communication parameter slide switch (the bottom slide switch) on the A984-145, E984-45/255 Controllers
- setting the communication parameter slide switch (the bottom slide switch) on the E984-265/275/285 Controllers

Settings for Modbus Mode

For Modbus mode, set the switch to the **mem** position for the A984-145, E984-245/255, and E984-/265/275/285 Controllers, and use the configuration editor to assign the values for the Modbus port parameters.

Note: The Modbus Plus hardware address is always used in bridge mode. If a software setting is used to enable bridge mode, all of the memory port parameter settings are set by software except for the address parameter.

Settings for Bridge Mode

Bridge mode allows you to access nodes on a Modbus Plus network from a Modbus master device (connected to the Modbus port).

Set Modbus Plus bridge mode, as follows:

- For the E984-245/255 and A984-145 Controllers, set the slide switch to **default** position, the controller's bridge mode is automatically enabled.
- For the E984-265/275/285 Controllers, set the slide switch to either **ASCII** or **RTU** position, the controller's bridge mode is automatically enabled. (See *MODBUS Port Parameters (3-Position Slide Switch), p. 76* for information about configuring port parameters.)

Modbus Port Parameter Settings

The Modbus port parameters are set to 9600 baud, RTU mode (8 data bits and 1 stop bit), and even parity, the same **default** conditions as the -120 and -130 Controllers.

Unique to the A984-145, E984-245/255, E984-265/275/285, however, is the default port address. Instead of defaulting to Modbus port address 1, it defaults to the Modbus Plus port address set by the DIP switch at the top of the (A984-145, E984-245/255 PLCs) or by the rotary switches at the top of the (E984-265/275/285 PLCs).

Modbus Master Device Connections

If a Modbus master device is connected to the Modbus port while the A984-145, E984-245/255/265/275/285 is in bridge mode, the master device can be attached to the local controller or to any other node on Modbus Plus.

- If you attach to the local controller, messages from the Modbus master are sent directly to the local A984-145, E984-245/255/265/275/285 without being routed over a Modbus Plus communication path.
- If you attach to any other node on the network, the message is routed through the Modbus Plus port to the destination device.

If you are connecting a Modbus master device to a node on Modbus Plus, always use the Modbus Plus address of the target node.

- If you are attaching to the local Compact PLC in bridge mode, the master automatically attaches to the Modbus Plus node address, which can only be set by hardware -- either with the DIP switch (A984-145, E984-245/255) or with the rotary switches (E984-265/275/285) on the local controller.
- If you want to attach to any other Modbus Plus node, the Modbus master device must specify that node by Modbus Plus address.

CAUTION

Failure to enter correct Modbus Plus address for controller.

If you are accustomed to using Modbus master devices (such as programming panels) with Modicon programmable controllers in un-networked environments, you may be used to attaching to the local controller by addressing it as device #1-the default device address in the configurator editor. Be aware that in a Modbus Plus network environment you must know the Modbus Plus address of the controller (or any other nodal device) with which you want to communicate, and you must specify that address correctly in the attach procedure. If you want to attach to a node on Modbus Plus but do not know its network address, get this information from your network supervisor before proceeding.

Failure to observe this precaution can result in injury or equipment damage.

Note: When a Modbus port is used in bridge mode, it must be connected to a single Modbus master device. That is, the bridge cannot be used as a connection for a Modbus Slave device network.

Addressing Ranges on Modbus Plus

A single Modbus Plus network can have up to 64 addressable nodes, each with a unique address in the range 1 ... 64. (See *Modbus Plus Communications A984-145, E984-245/255, p. 80* for more information about address settings). The Modbus master device connected to the Modbus port can attach to any node using *direct attach address* routing, simply by specifying the correct address in the range 1 ... 64. Multiple networks can be joined via BP85 Bridge Plus devices, and nodes across multiple networks can be addressed. An addressing capability outside the 1 ... 64 range is required.

In Modbus Plus, an *explicit* and an *implicit* attach address routing strategy are available for this purpose. These routing techniques are described in *Modbus Plus Address Routing Schemes, p. 94*.

Modbus Plus Address Routing Schemes

Address Schemes Between Modbus and Modbus Plus

Modbus devices use addresses of one byte in the range 1 ... 255. Modbus Plus devices are addressed in the range 1 ... 64, with five consecutive routing bytes contained in each message. When a Modbus message is received at the Modbus port on the A984-145, E984-245/255/265/275/285 Controllers, the single-byte address contained in the message is converted into a five-byte routing path for Modbus Plus. The five bytes of routing are imbedded in a Modbus Plus message frame as it is sent from the originating node.

Destination Device Requirements

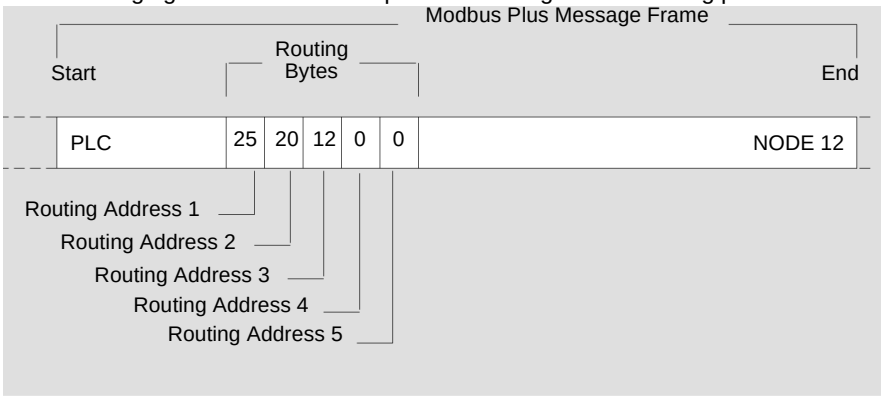
The structure of the Modbus Plus routing address is determined by the type of device at the destination node:

- If you are initiating a transaction with another 984 controller, the last (rightmost) nonzero byte in the routing scheme is the destination node address
- If you are initiating a transaction with a network adapter in a non-controller node-e.g., an SA85-the next to the last nonzero byte is the destination node address, and the last nonzero byte is the task # (range: 1 ... 8)
- If you are initiating a transaction with a single slave on a Bridge MUX port, the next to the last nonzero byte is the Bridge MUX node address, and the last nonzero byte is the desired MUX port # (range: 1 ... 4)
- If you are initiating a transaction with a slave device on a Modbus network connected to a Bridge MUX, the second from the last nonzero byte is the node address of the MUX, the next to the last nonzero byte is the desired MUX port # (range: 1 ... 4), and the last nonzero byte is the desired Modbus slave address (range: 1 ... 247)

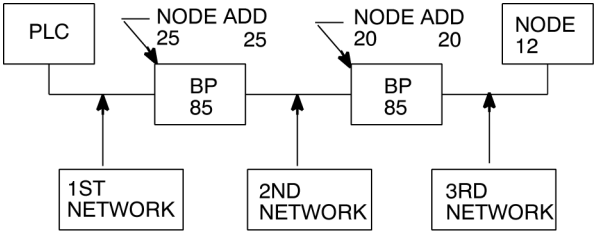
  Any leading nonzero bytes ahead of the address bytes described above are Bridge Plus node addresses.

  Assume, for example, that your routing path is to a controller two networks removed from the originating 984. The message is routed first to a BP85 Bridge Plus at node address 25. The bridge forwards the message to node 20, a BP85 Bridge Plus device on the second network. Node 20 forwards the message to the destination controller node address 12 on the third network. The zero-content bytes in the fourth and fifth routing bytes specify that no further routing is required beyond the third byte:

The following figure shows an example of a message frame routing path.



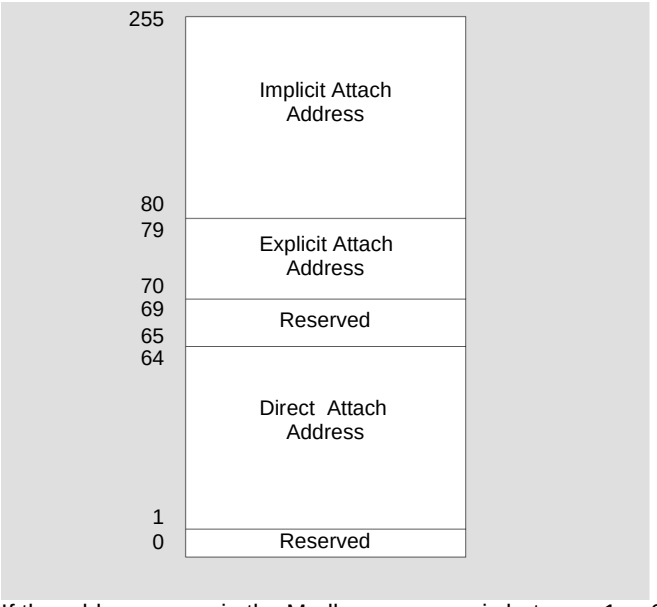
Note: The routing address scheme must be developed as part of an overall network planning process-for details, see the Modbus Plus Network Planning and Installation Guide (840 USE 101 00).
The following figure shows an example of a routing address scheme.



Direct, Explicit, and Implicit Attaches

Modbus to Modbus Plus Address Conversion

The manner in which Modbus Plus converts a Modbus message using bridge mode is determined by the range of the Modbus address (1 ... 255):
This shows the address location and the various attach states.



If the address range in the Modbus message is between 1 ... 64, the message is routed to the corresponding Modbus Plus node address on the local network. This routing procedure is called direct attach address. Direct attach address routing implies that a nonzero value exists in only routing address 1 in the Modbus Plus message frame; it does not allow you to send the incoming Modbus message beyond the local network.

Note: After the controller's Modbus Plus node address is entered while in bridge mode, then you will be attached to that controller.
If the address range in the Modbus message is between 70 ... 79, the controller initiates an explicit attach address procedure which compares the Modbus address to an address table stored in the controller, immediately following the configured 4xxxx real time clock. Up to 10 addresses in the range 70 ... 79 become pointers to the table, which contains up to 10 stored routing paths for Modbus Plus. Each routing path is five bytes in length. The routing path pointed to by each address is applied to the corresponding message.
Explicit attach address routing implies that nonzero values may exist in any or all routing addresses in the Modbus Plus message frame; it allows you to send incoming Modbus messages through as many as four BP85 Bridge Plus devices across as many as five Modbus Plus networks.
If the address range in the Modbus message is between 80 ... 255, the controller initiates an implicit attach address procedure which divides the address by 10 and uses the quotient and remainder as the first and second bytes, respectively, in a routing path. Implicit attach address routing implies that there may be nonzero values in routing addresses 1 and 2 in the Modbus Plus message frame; it allows you to send incoming Modbus messages through one BP85 Bridge Plus device across up to two Modbus Plus networks.

Modbus Plus Communication Paths

Modbus Plus Message Processing

With multiple devices processing messages asynchronously on a Modbus Plus network, an individual device can have several concurrent transactions in process. The A984-145, E984-245/255/265/275/285 Controllers open a communication path when a transaction begins, keep it open during the transaction, and close it when the transaction terminates. After the path is closed, it is available for another transaction.

Four Types of Communication Paths

A984-145, E984-245/255/265/275/285 Controllers maintains four types of communication paths

- *Data master paths*-For read and write data or get and clear remote statistics operations originated by a MSTR block in the A984-145, E984-245/255/265/275/285 Controllers going to a destination device on the network. A 984-145, E984-245/255/265/275/285 supports up to five data master paths-paths DM01... DM04 for processing up to four concurrent MSTR blocks, and path DM05 that may be used for data master transactions via the Modbus port. Design your application to use a maximum of four MSTR data master paths at any one time.
- *Data slave paths*-For data reads and writes received over the network. The A984-145 supports up to four data slave (DS) paths handling up to four concurrent network transactions.
- *Program master paths*-For sending programming commands from the local controller to the Modbus Plus network. Program master paths can handle all Modbus commands-i.e., function codes. If a Modbus master is connected to the Modbus port on the A984-145, E984-245/255/265/275/285, it may be used for either programming or monitoring functions. A984-145, E984-245/255/265/285 supports one program master (PM) path.
- *Program slave paths*-For accepting programming commands received over the network. A984-145, E984-245/255/265/275/285 supports one program slave (PS) path.

  Both the originating and destination devices open paths and maintain them until the transaction completes. If the transaction passes through one or more Bridge Plus devices to access a destination across multiple networks, each bridge opens and maintains a path at each of its two network ports. Thus, a logical path is maintained between the originating and destination devices until the transaction is finished.

  All paths are independent of one another, and activity on one path does not affect the performance of the other paths.

Hardware Planning

4

At a Glance

Introduction

Use the information in this chapter to correctly plan your compact system hardware layout.

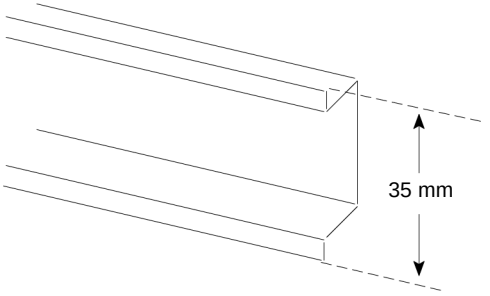
What's in this Chapter?

This chapter contains the following topics:

DIN Carrier Rails

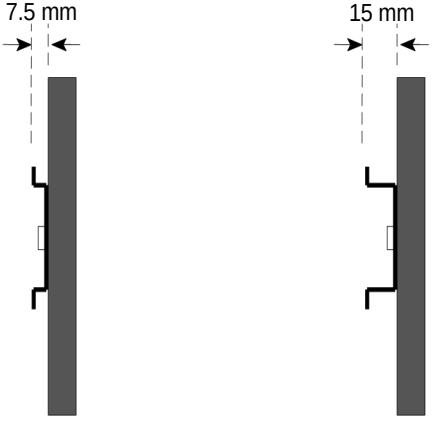
Overview of DIN Carrier Rails

Compact Controllers and their associated A120 I/O modules reside in backplane housings that are installed on DIN EN 50 022 carrier rails. A DIN rail can be attached to a flat mounting surface or hung on an EIA rack or in NEMA cabinet.
The DIN rail also provides the functional ground point for the Compact system.
This is a DIN EN 50 022 Carrier Rail.



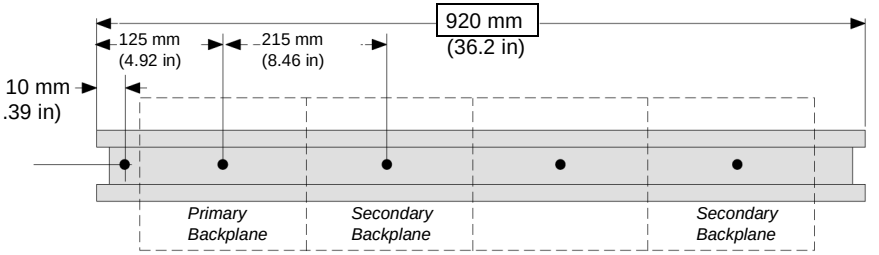
Two Sizes of DIN Rails

The backplanes can be mounted on a DIN rail with either a 7.5 mm or 15 mm clearance from its mounting surface:
The following figure shows the differences in the DIN rail clearance sizes.

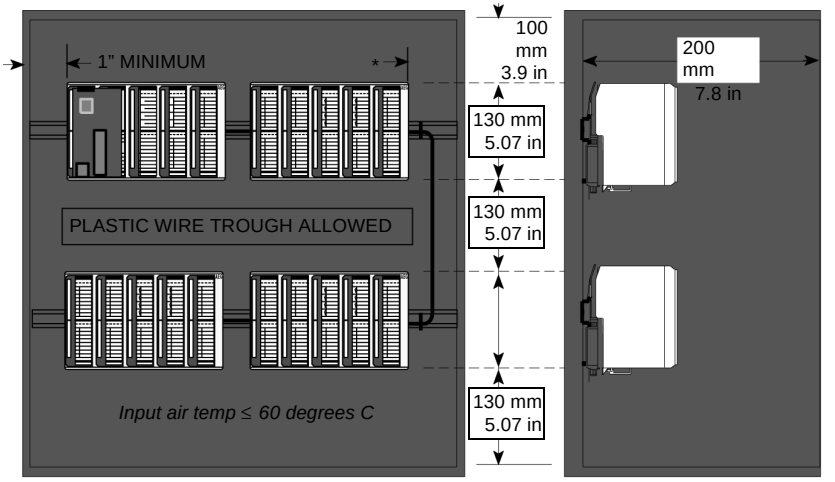


Space Requirements for Mounting DIN Rail

A DIN rail mounting surface must be at least 225 mm (8.86 in) long for a single backplane; four full-length backplanes require a 920 mm (36.2 in) DIN rail. The following figure shows the minimum and maximum width requirements for installation



A DIN rail may be installed in an enclosed cabinet built to the following dimensions: This shows the depth requirements.



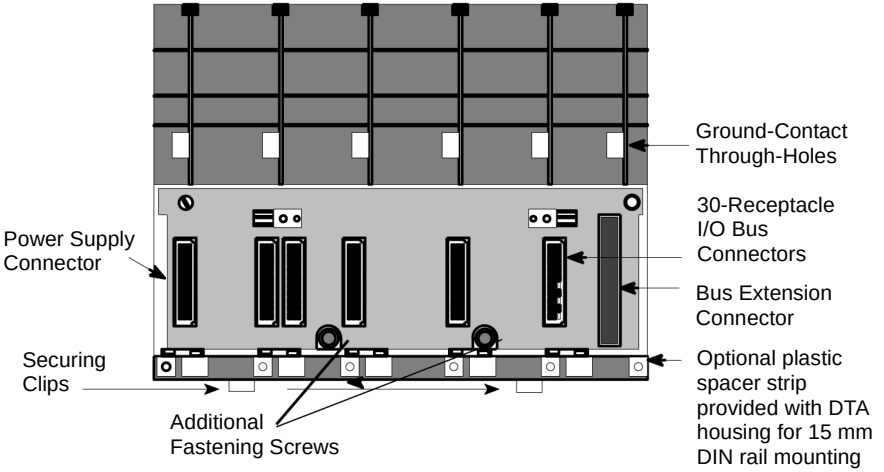
Choosing DTA Backplanes

Overview of DTA Backplanes

A Compact Controller and its associated A120 I/O modules are installed in DTA backplanes which mount on the DIN rail. Three backplanes are available: the primary DTA 200, and two optional secondary DTA 201 and DTA 202 backplanes.

The DTA 200 Primary Backplane

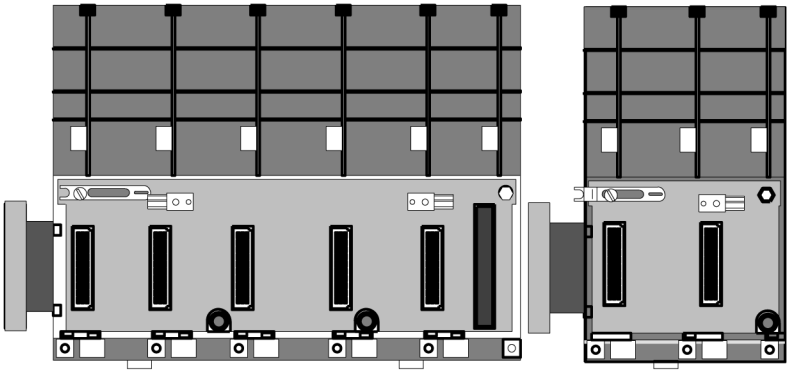
At a minimum, your drop must have a DTA 200 primary backplane. The Compact Controller will reside in the two leftmost slots in the DTA 200 backplane, it plugs into a 30-pin power supply connector and two 30-receptacle connectors. Three additional 30-receptacle slots available for A120 I/O modules or option modules such as the P120 ac-to-dc Power Supply or A120 simulator modules. Only one DTA 200 backplane is used in a drop.
This shows the DTA 200 primary backplane.



The DTA 200 is 213.4 mm wide x 142 mm high x 31 mm deep, and drops onto a DIN EN 50 022 carrier rail, two clips at the bottom of the backplane secure the unit to the DIN rail. On the right side of the DTA 200 backplane is a 30-pin I/O bus extension connector that allows you to connect a secondary (DTA 201 or DTA 202) backplane. Six through-holes provide spaces through which mounted units may make contact with functional ground on the DIN rail.

Two-Slot and Five-Slot Secondary Backplanes

Up to three secondary backplanes may be used in a drop (a drop maximum of four, one primary and three secondary). Secondary (or extension) backplanes may be mounted to the right of the DTA 200 primary backplane on a common DIN rail or beneath the DTA 200 on one other DIN rail. The secondary backplanes contain either two (the DTA 202) or five (the DTA 201) 30-receptacle connectors for I/O module insertion. Secondary backplanes contain a bus extension ribbon cable with a 30-receptacle connector on it, allowing backplanes to be interlocked along a common DIN rail via a ground extension strap.
This shows the DTA 201 and 202 secondary backplanes.



The DTA 201 five-slot backplane is 213.4 mm wide x 142 mm high x 31 mm deep. It has a 30-pin bus extension connector on its right side, allowing you to add another extension backplane to the drop. As many as three DTA 201 backplanes may be used in a drop, and they may be used in either a linear drop layout (along one common DIN rail) or in a stacked drop layout (two DIN rails, one over the other).
The DTA 202 two-slot backplane 91.5 mm wide x 142 mm high x 31 mm deep. Its backplane does not have a bus extension connector on its right side, and, if it is used, it must be the last backplane in the drop. If you plan to use a DTA 202 backplane, remember that only one may be used in the drop, and it may be used only in a linear drop layout.(That is, not in a stacked drop layout.)

Planning a Linear Drop Layout

Overview of Linear Drop Layouts

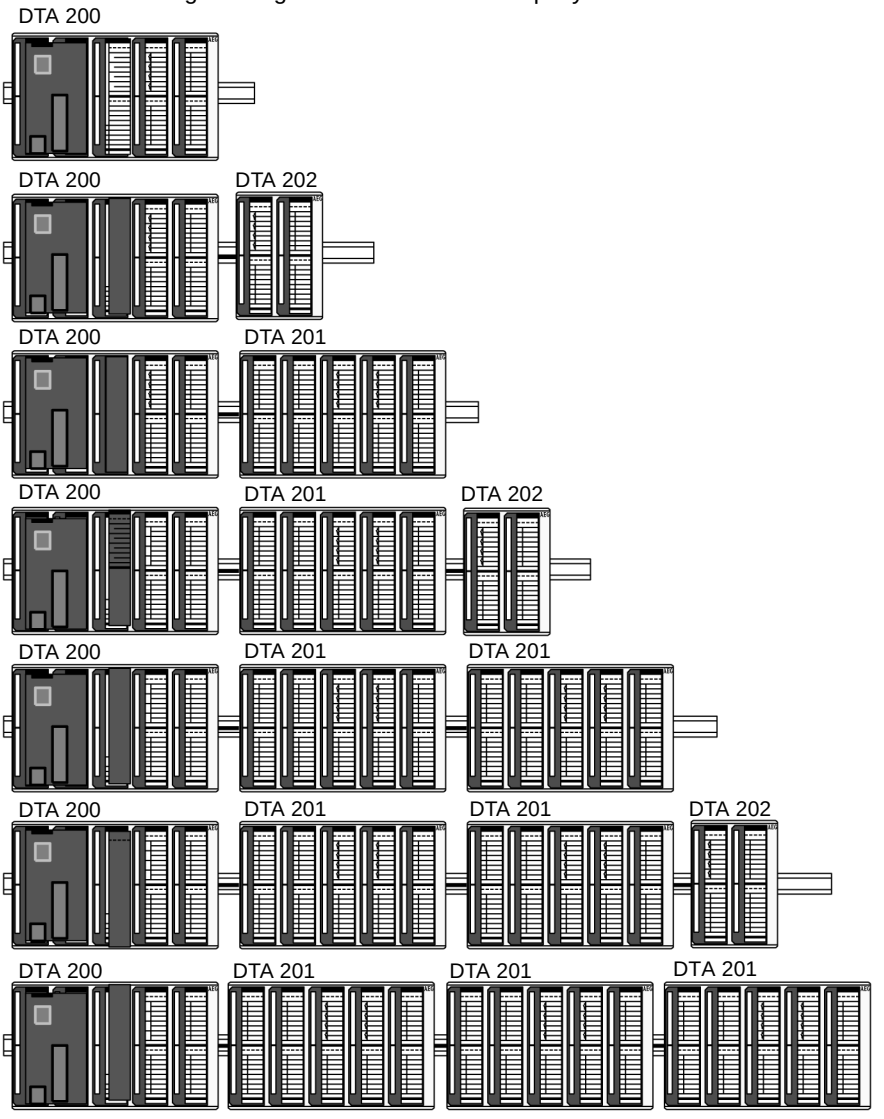
A DTA 200 primary backplane and up to three secondary backplanes may be mounted in a drop. The four backplanes may be mounted in a linear layout along one common DIN rail, or they may be stacked in two rows on two DIN rails and connected via a BXT 201 bus extension cable.

Linear Layouts

The leftmost backplane on the DIN rail must be the DTA 200 primary backplane. Up to three secondary backplanes may be interconnected to the right of the primary backplane. You may use:

- One DTA 202 secondary backplane with the DTA 200
- As many as three DTA 201 secondary backplanes together with the DTA 200
- One or two DTA 201 secondary backplanes together with one DTA 202 secondary backplane with the DTA 200
  If you use a DTA 202 backplane in your drop, it must be the last (rightmost) backplane in the drop.

This shows the legal configurations for a linear drop layout



Planning a Stacked Drop Layout

Overview of Stacked Drop Layout

Backplanes in a drop may also be stacked on two DIN rails and connected by a BXT 201 (30-pin female-to-female connectors) bus extension cable, or a BXT 203 (30-pin female-to-male connectors) bus extension cable. There may be either one or two racks on each DIN rail. (See *Using a BXT 201 Cable (30-Pin Female-to-Female Connectors), p. 108* if using a BXT 201 cable; see *Using a BXT 203 Cable (30-Pin Female-to-Male Connectors), p. 111* if using a BXT 203 cable.)

Using a BXT 201 Cable (30-Pin Female-to-Female Connectors)

A DTA 200 primary backplane and up to three secondary backplanes may be mounted in a drop. The four backplanes can be stacked in two rows on two DIN rails and connected via a BXT 201 bus extension cable.
Note that there can be only one BXT 201 cable per system.

CAUTION

Case 1 and Case 2 are the ONLY legal configurations

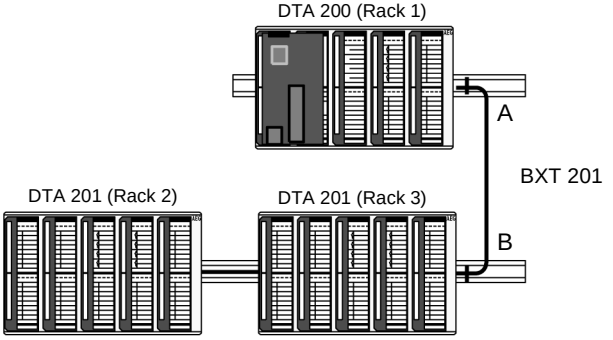
Due to the I/O module addressing method used, the stacked drop layouts shown in Case 1 and Case 2 are the ONLY legal configurations!

Failure to observe this precaution can result in injury or equipment damage.

Note: The BXT 201 cable connectors are polarized and must be connected properly-the A connector must be attached to the top backplane, and the B connector must be attached to the bottom backplane.

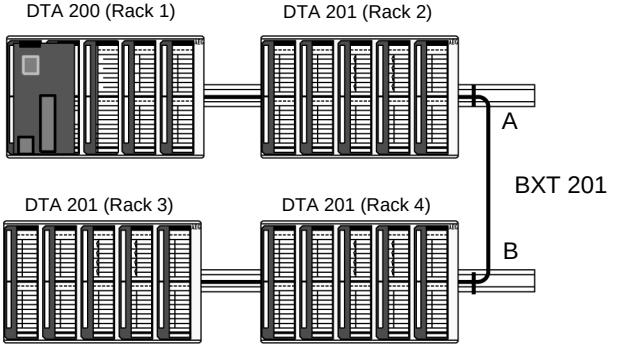
- CASE 1: A single DTA 200 backplane over two DTA 201 backplanes; the BXT 201 runs from rack 1 to rack 3.

Case 1.



- CASE 2: A DTA 200 backplane and one DTA 201 backplane over two DTA 201 backplanes; the BXT 201 runs from rack 2 to rack 4.

Case 2.



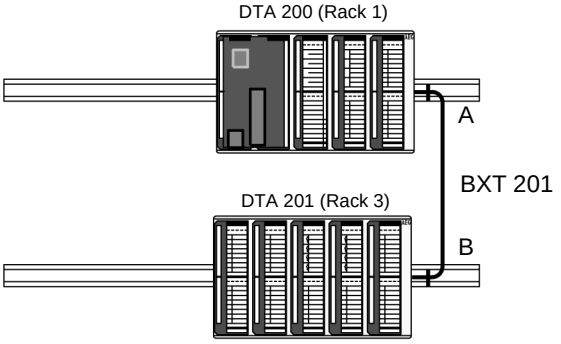
In case 1, the drop is traffic copped as three consecutive racks (rack 1 ... rack 3); in case 2, the drop is traffic copped as four consecutive racks (rack 1 ... rack 4).

Variations on the Stacked Drop Layouts

You can vary the two stack topologies to accommodate a one-over-one or two-over-one layout:

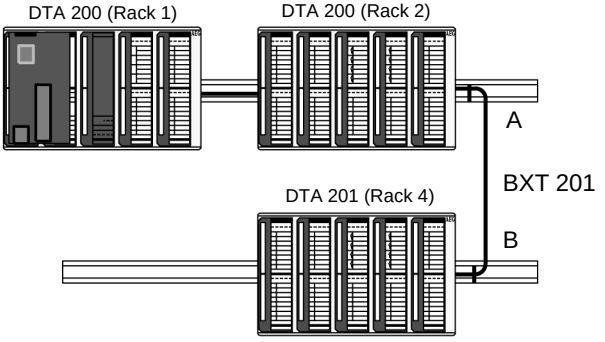
- Variation on Case 1: A single DTA 200 backplane over one DTA 201 backplane, in this case, the traffic cop skips rack 2 and defines modules in racks 1 and 3.

Variation on case 1.



- Variation on Case 2: A DTA 200 backplane and one DTA 201 backplane over one DTA 201 backplane, in this case, the traffic cop skips rack 3 and defines modules in racks 1, 2, and 4.

Variation on case 2.



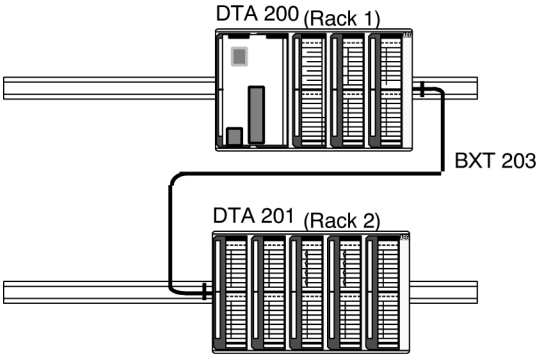
Using a BXT 203 Cable (30-Pin Female-to-Male Connectors)

A DTA 200 primary backplane and up to two secondary backplanes may be mounted in a drop. The three backplanes may be stacked in two rows on two DIN rails and connected via a BXT 203 bus extension cable. Only one BXT 203 cable is allowed per system.

Note: The BXT 203 cable allows stacked configuration that leaves the last 30-pin A120 I/O expansion receptacle available for applications requiring an Enabler Key. For example, the Gas Flow Enabler Key 130 HEK 301 0x.

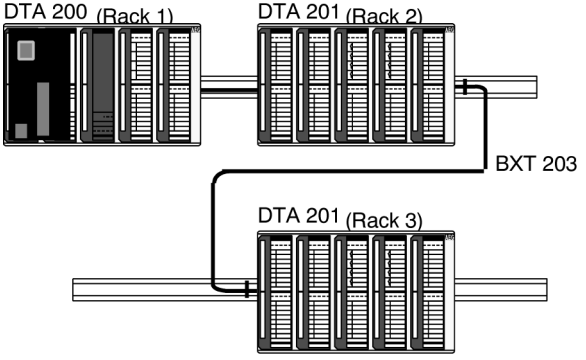
- Case 1: A single DTA 200 backplane over one DTA 201 backplane, in this case, the traffic cop defines modules in racks 1 and 2.A single DTA 200 backplane over one DTA 201 backplane, in this case, the traffic cop defines modules in racks 1 and 2.

This shows case 1.



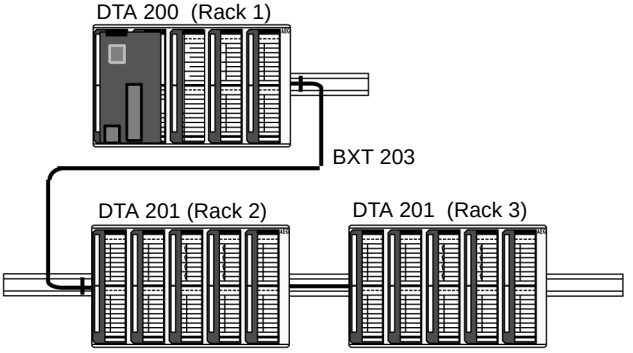
- Case 2: A DTA 200 backplane and one DTA 201 backplane over one DTA 201 backplane, in this case, the traffic cop defines modules in racks 1, 2, and 3.

This shows case 2.



- Case 3: A DTA 200 backplane over one DTA 201 backplane, in this case, the traffic cop defines modules in racks 1, 2, and 3.

This shows case 3.



Hardware Installation

5

At a Glance

Introduction

The following information describes how to install your Compact hardware.

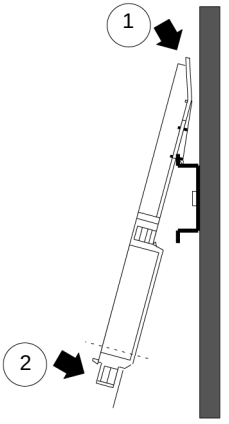
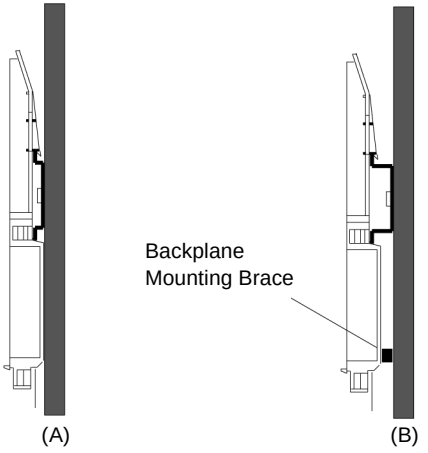
What's in this Chapter?

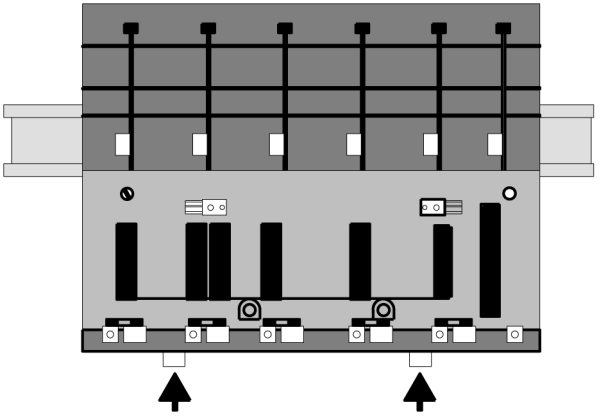
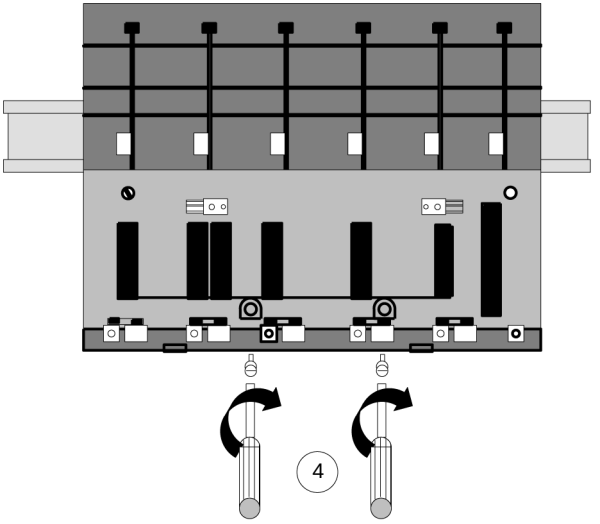
This chapter contains the following topics:

Installing DTA Backplanes

Procedure for Installing DTA Backplanes

These are the DTA installation steps.

Step	Action
1	Place the top clip on the back of the DTA backplane over the top of the DIN carrier rail and drop the unit into place. Refer to the following graphic. 
2	If the DIN rail is mounted on a wall, the backplane will fall flush against the mounting surface, as shown in (A) below. If you are using a 15 mm DIN rail, remember to insert the mounting brace on the lower backside of the backplane before mounting it, as shown in (B) below. Refer to the following graphic. 

Step	Action
3	Push up the securing clips on the bottom of the backplane to clamp the unit onto the DIN rail. Refer to the following graphic. 
4	For increased vibration protection in a wall-mount installation, secure the backplane with two mounting screws (4 mm diameter). Use 20 mm long screws with a 7.5 mm DIN rail; use 25 mm long screws with a 15 mm DIN rail. Refer to the following graphic. 

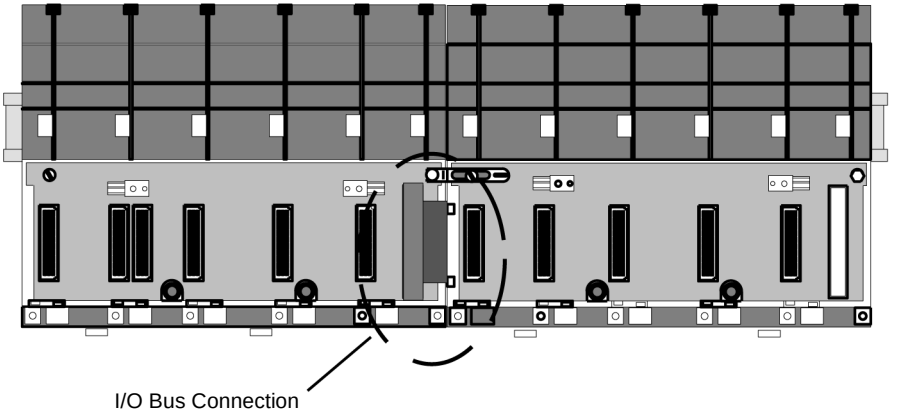
Interlocking Adjacent Backplanes

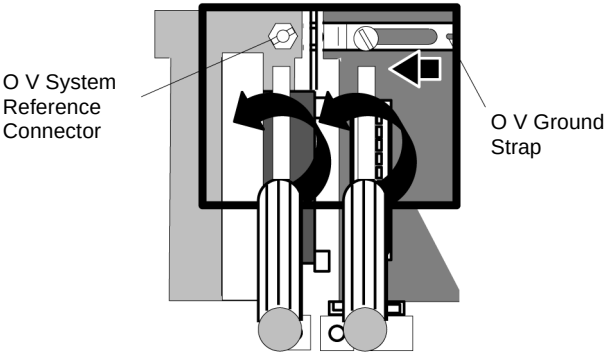
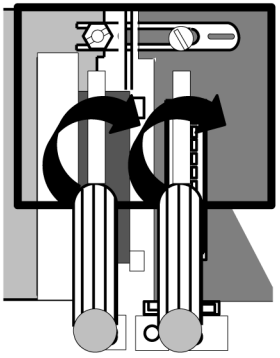
Overview of Interlocking Backplanes

The DTA 200 primary backplane must be rack 1 (the leftmost rack) on the DIN rail. One and only one DTA 200 must be used in each Compact Controller installation. Up to three secondary backplanes may be mounted to the right of the DTA 200 primary backplane on a common DIN rail.

Interlocking Adjacent Backplanes

These are the steps.

Procedure for Interlocking Adjacent Backplanes	
Step	**Action**
1	Mount a secondary backplane flush against the DTA 200 primary backplane on the DIN rail.
2	Release the two 30-pin bus connector latches on the primary backplane, and remove the protective cover.
3	Plug the 30-receptacle bus cable connector on the secondary backplane into the 30-pin bus connector on the primary backplane. Refer to the following graphic. DTA 200 DTA 201 

Procedure for Interlocking Adjacent Backplanes	
Step	**Action**
4	Loosen the screws that secure the ground strap on the secondary backplane and the 0 V system reference connector on the primary backplane: Refer to the following graphic. 
5	Slide the ground strap left, then secure the ground connection across the backplanes by tightening the two screws: Refer to the following graphic. 
6	One or two more (a maximum total of three) secondary housings can be grounded together side by side in this manner.

WARNING

Connector warning

If you use a DTA 202 secondary backplane which does not have a 30-pin bus connector on it, it must be the last (rightmost) backplane in the linear drop layout. A DTA 202 cannot be used in a stacked drop layout.

Failure to observe this precaution can result in severe injury or equipment damage.

Installing a BXT 201 Cable in a Stacked Drop Layout

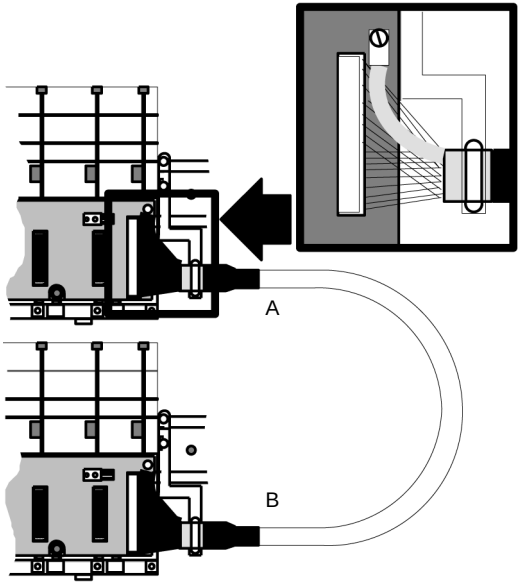
Using a BXT201 Cable in a Stacked Drop

If you are installing a stacked configuration (two rows of backplanes installed one over the other on two parallel DIN rails), you may connect the last (rightmost) backplane in the top row to the last (rightmost) backplane in the bottom row using a BXT 201 bu

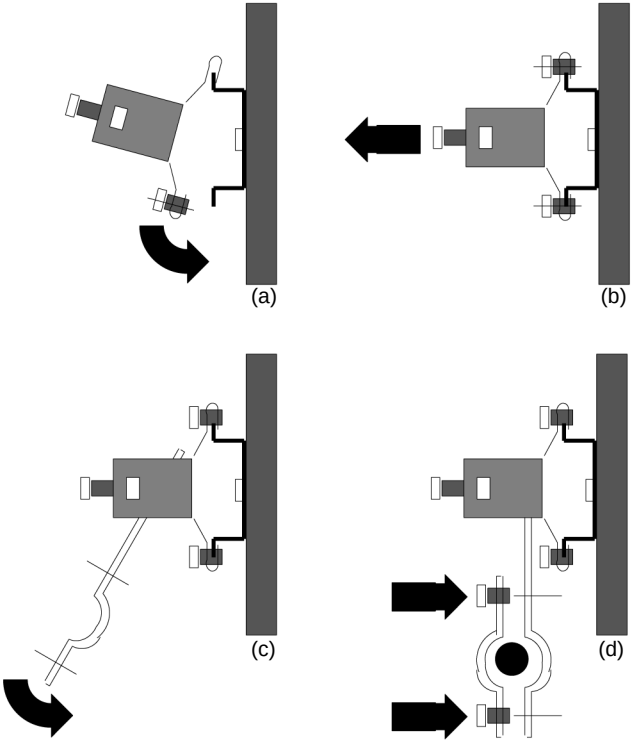
The BXT 201 bus extension cable is 500 mm (19.7 in) long; it may be run either from rack 1 in the top row to rack 3 in the bottom row or from rack 2 in the top row to rack 4 in the bottom row. (See *Planning a Stacked Drop Layout , p. 108*.) A stacked installation may use DTA 201 secondary backplanes in conjunction with a DTA 200 primary backplane; DTA 202 secondary backplanes cannot be used.

Both ends of the BXT 201 cable are 30-receptacle bus connectors that mate with the 30-pin connectors on the right sides of the two backplanes. A ground strap on each end of the cable should also be connected to the system reference connectors on the two backplanes.

The following figure shows the connection for the BXT 201 cable.



Note: The BXT 201 cable connectors are polarized and must be connected properly to the backplanes-the only visible distinction between the two connectors are the labels **A** and **B**. The A connector must be attached to the top backplane, and the B connector must be attached to the bottom backplane.
Two strain relief cleats are provided with the BXT 201 cable. They can be attached to the top and bottom DIN rails in the following manner:
The following figure shows how to install the strain relief cleats.



Installing a BXT 203 Cable in a Stacked Drop Layout

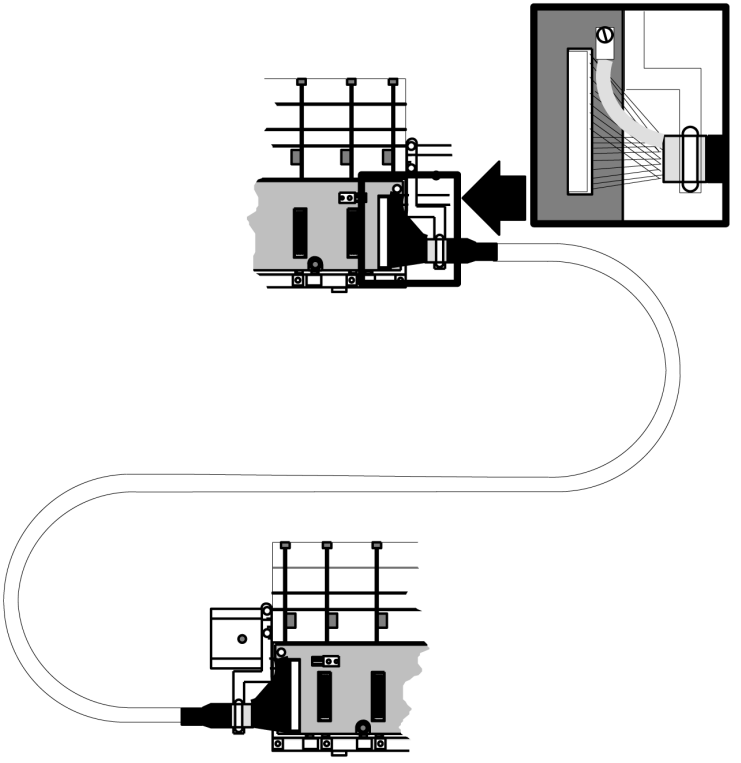
Overview of the BXT 203 Cable

If you are installing a stacked configuration, two rows of backplanes installed one over the other on two parallel DIN rails, you may connect the last (rightmost) backplane in the top row to the first (leftmost) backplane in the bottom row using a BXT 203 bus

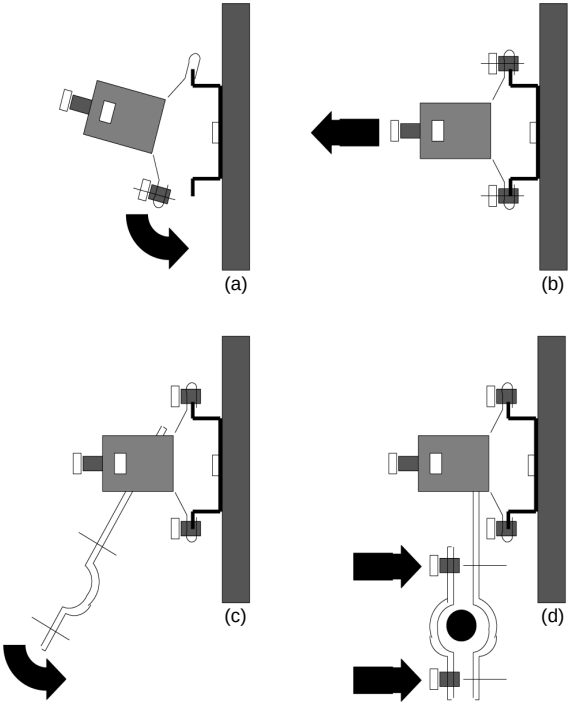
This cable is 700 mm (27.5 in) long; it may be run either from rack 1 in the top row to rack 2 in the bottom row or from rack 2 in the top row to rack 3 in the bottom row or from rack 1 in the top row to rack 2 in the bottom row. (See *Using a BXT 203 Cable (30-Pin Female-to-Male Connectors), p. 111*.) A stacked installation may use DTA 201 secondary backplanes in conjunction with a DTA 200 primary backplane; DTA 202 secondary backplanes cannot be used.

Both ends of the BXT 203 cable are 30-receptacle bus connectors that mate with the 30-pin connectors on the right side of one backplane to the left side of the other backplane. A ground strap on each end of the cable should also be connected to the system reference connectors on the two backplanes.

This shows the ground strap connection.



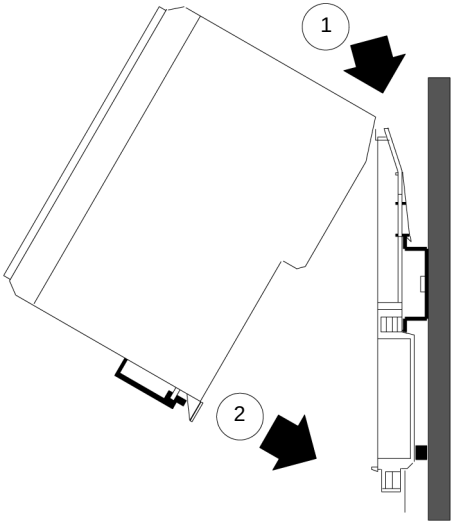
Note: The BXT 203 cable can be installed only one way, because it consists of one 30-pin female connector and one 30-pin male connector.
Two strain relief cleats are provided with the BXT 203 cable. They can be attached to the top and bottom DIN rails as shown in the following figure.



Inserting Modules in the Backplane(s)

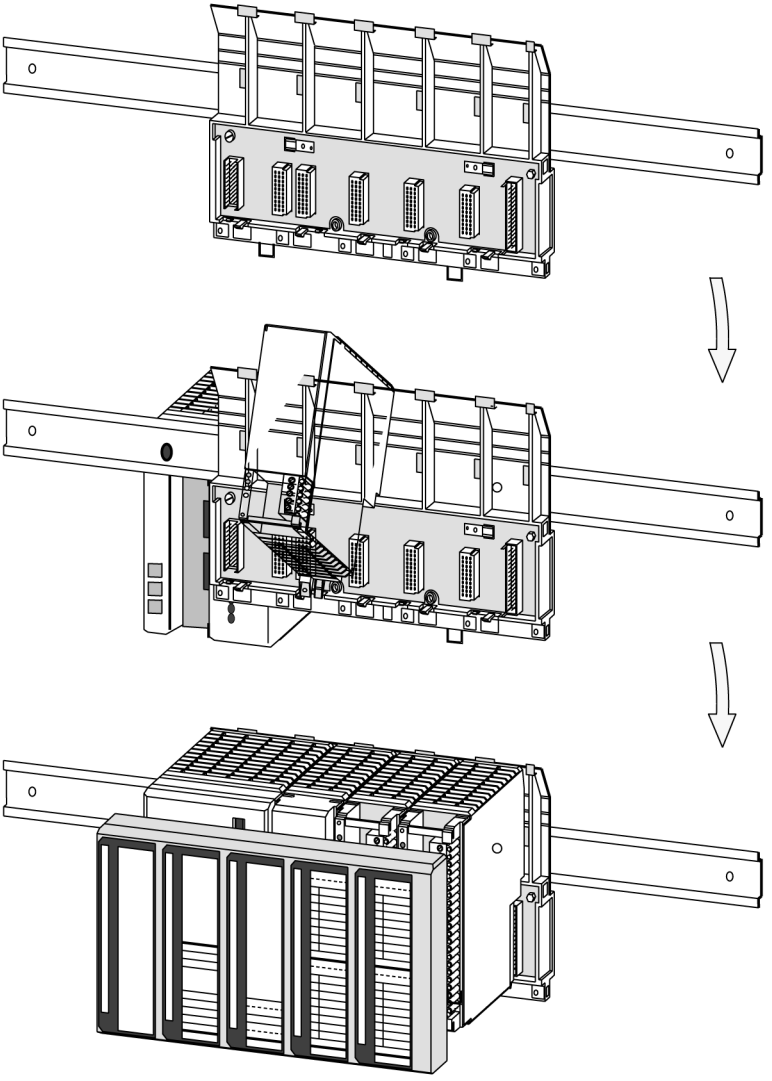
Module Placement in Backplanes

The Compact Controllers and the A120 I/O modules are designed for easy installation. The controller is installed in the first slot in a primary backplane, and I/O modules may be installed in any other slots in a primary or secondary backplane. Attach the module to a hook at the top of the DTA backplane and drop it into the housing. The 20-pin bus connector on the back of the module mates with the 20-receptacle connector on the backplane, and the metal spring-loaded wire on the back of the module passes through a hole in the backplane to make ground contact with the DIN rail. Tighten the screw at the bottom of the module to fasten it to the backplane.
This shows the two connection points.



	**CAUTION**
	We recommend that you use solid wire for all terminal connections. Neat and proper workmanship methods by qualified personnel must be employed when making connections to all system modules. Take extra precautions if you are using stranded wire, ensure that loose or projecting strands do not short circuit or ground other terminals. **Failure to observe this precaution can result in injury or equipment damage.**

If all of the modules are installed in the backplane and the module connections are appropriately wired, place the cover over the assembly.
The cover provides a clear pocket over each I/O slot where you can insert the label that comes with each module (as shown in the following figure). The LEDs on the modules remain clearly visible.

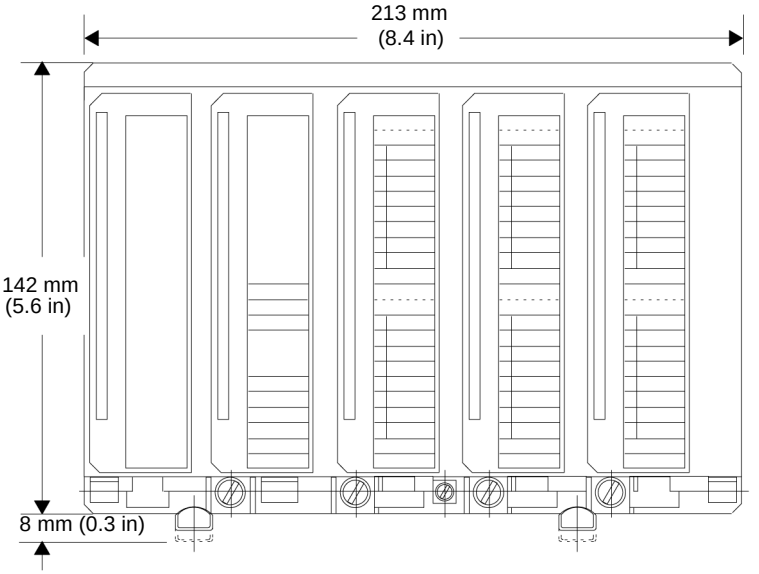


Compact Installation Dimension Drawings

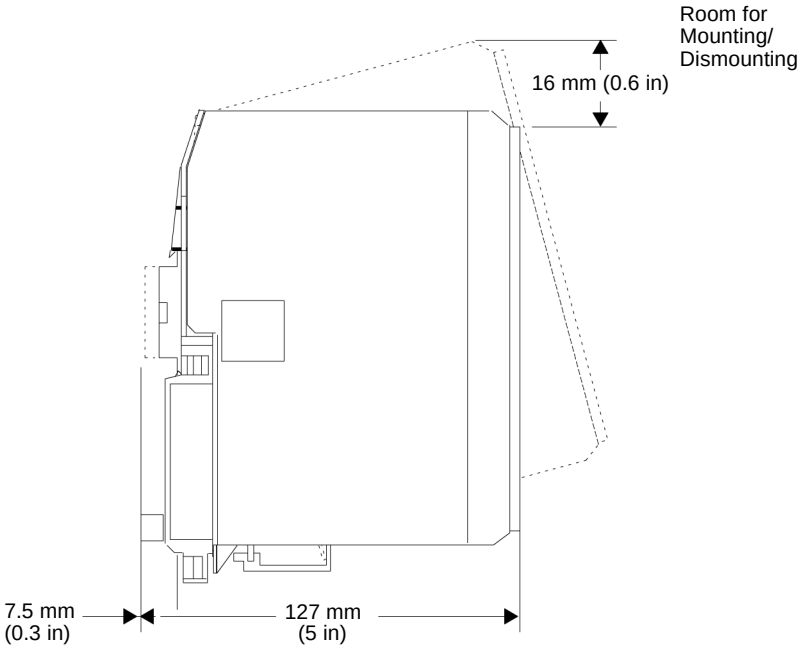
Front and Side Dimensions used to Install the Rack

A front and profile view of a Compact rack installation are shown in the following figures.

This shows the front view of the Compact rack installation.



This shows the side view of the Compact rack installation.



System Power Requirements

External Power Supplies

The Compact Controllers and some of the A120 I/O modules require an external power source.

Power Requirements for a Compact

All the Compact Controllers require a 24 Vdc power source to operate. (Detailed information appears in the note in this block.) Modicon offers the optional P120-000, P120-125, P120-250, PRTU-252, and PRTU-258 Power Supplies. These are designed in the A120 I/O module form factor, so that they can be inserted into any available slot in a DTA backplane. (For details about the P120s, see Appendix *A120 Power Supplies, p. 177*.)

Note: It is not recommended that a single power supply be used to power the Compact and its I/O. A separate supply is recommended to reduce the risk of field noise affecting the controller's operation. This is also beneficial in cases of single-supply configurations, since a field point failure could cause the controller to shut down.

The power requirement for the various PLC models is:

- A984-1xx/E984-24x/251/255 PLCs is 24 Vdc -15% +20% maximum steady state input current 1 A and 2 A peak.
- E984-258/285 PLCs is 24 Vdc -30% +25% maximum steady state input current 1 A @24Vdc.
- E984-265/275 PLCs is 24 Vdc -20% +25% maximum steady state input current 1.1 A @24Vdc.

Power Requirements for the A120 I/O Modules

Some A120 I/O modules require a separate external AC or DC power source. If the CPU is powered from its 24 Vdc source, its built-in 5 Vdc power supply provides power across the I/O system bus to all modules in the drop.
This table lists the values for both internal and external power draws.

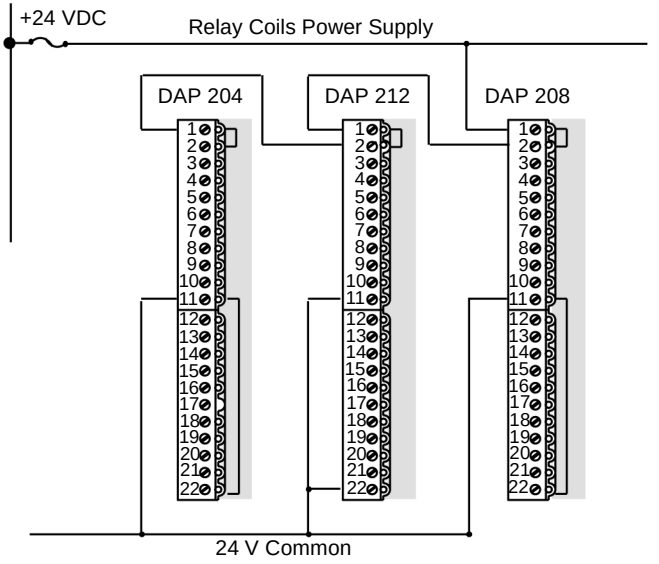
A120 I/O Module	Internal Power Draw mA @ 5V	External Power Draw mA @ Module Voltage
AS-BADU-204 (+500 mV)	<50	
AS-BADU-205 (+10 V, +20 mA)	<50	
AS-BADU-206 (+10 V, +4 ... 20 mA)	<100	<100
AS-BADU-210 (+5V, +10V, +20mA)	<90	
AS-BADU-211 (RTD, TC, +10 V, +4 ... 20 mA)	<1	<170
AS-BADU-214 (+10 V, +5 ... 20 mA)	<100	<150
AS-BADU-216 (TC, 0-72.8mV)	<100	
AS-BADU-257 (TC, RTD, Vdc)	<120	
AS-BDAO-216 (24 Vdc)	<30	<5
AS-BDAP-204 (2 A Relay)	<25	<150
AS-BDAP-208 (2 A Relay)	<60	<150
AS-BDAP-209 (115 Vac, 1 A)	<55	
AS-BDAP-210 (24-230 Vac)	<70	
AS-BDAP-211 (115 Vac)	<30	
AS-BDAP-212 (24 Vdc in/ Relay out)	<25	<150
AS-BDAP-216 (24 Vdc, .5 A)	<50	
AS-BDAP-217 (24 Vdc, .5 A)	<60	
AS-BDAP-218 (24-240 Vac)	<175	
AS-BDAP-220 (24 Vdc)	<60	
AS-BDAP-252 (24 Vdc)	<15	<150
AS-BDAP-253 (110 Vdc; 24 Vdc)	<15	<70
AS-BDAP-292 (60 Vdc; 24 Vdc)	<25	<150
AS-BDEO-216 (24 Vdc	<15	<150
AS-BDEP-208 (230 Vac)	<30	
AS-BDEP-209 (115 Vac)	<30	
AS-BDEP-210 (115 Vac)	<35	
AS-BDEP-211 (115 Vac)	<35	
AS-BDEP-214 (60Vdc)	<22	
AS-BDEP-215 (24Vdc)	<35	

A120 I/O Module	Internal Power Draw mA @ 5V	External Power Draw mA @ Module Voltage
AS-BDEP-217 (24Vdc)	<25	
AS-BDEP-216 (24 Vdc)	<25	<150
AS-BDEP-218 (115 Vac)	<15	
AS-BDEP-220 (24 Vdc)	<50	<150
AS-BDEP-257 (110Vdc)	<25	<40
AS-BDEP-296 (60 Vdc)	<25	<125 @60Vdc
AS-BDEP-297 (48 Vdc)	<25	<125@ 48Vdc
AS-BDAU-202 (+10 V, +20 mA)	<60	<150
AS-BDAU-204 (4 ... 20mA or 0 ... 20mA, +1,5, or 10V, 0 ... 1V,0 ... 5V, or 0 ... 10V)	<1	<250 @24Vdc
AS-BDAU-208 (+10 V)	<30	<120
AS-BVIC-2xx (5, 12, 24Vdc, .025...36Vac)	<1	<70
AS-BVRC-2xx (Variable Reluctance Counter .025...36Vac)	<275	
AS-BCTR-2xx (Counter 5, 12, 24Vdc)	<275	
AS-BFRQ-204 (Frequency & Speed)	<100	
AS-BMOT-201 (Encoder Motion)	<300	
AS-BMOT-202 (Encoder & Resolver Motion)	<600	
AS-BBKF-201 (Interbus S Master)	<250	
AS-BBKF-202 (Interbus S Slave)	<300	
AS-BDEA-202 (Interbus S Interface for A120 I/O)	*	
AS-BDEA-203 (Profibus DP Slave for A120 I/O)	*	
AS-BZAE-201 (2 A Relay)	<100	<30
AS-BZAE-204 (Rapid Counter)	<100	<55
*Both the BDEA-202 and BDEA-203 comes with a built-in power supply that provides 1600 MA (maximum) to the 5V I/O bus.		

Note: For more detail specifications, please refer to the A120 Series I/O Modules User Guide (890 USE 109 00 formerly GM-A984-IOS).

Daisy Chaining Groups of Similar I/O Modules

You can daisy chain groups of similar modules within a drop that requires voltages from external power sources. Each group, however, should have dedicated wires to the external power supplies. Typical groups include 24 Vdc input/output modules, 120 Vac input/output modules, 230 Vac modules, or analog modules.
The following figure is an example of how a group of relay modules can be daisy chained.



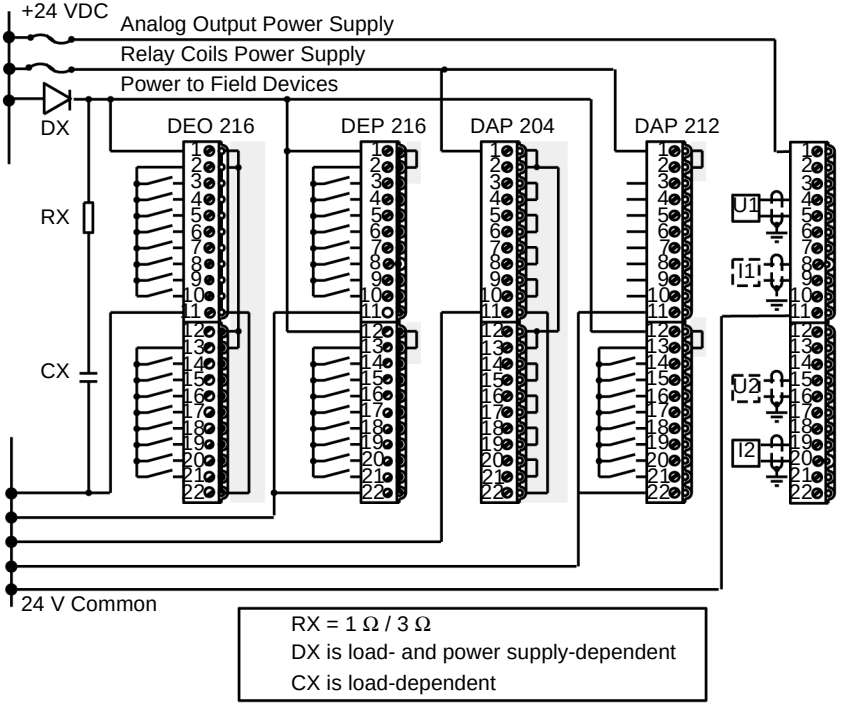
Note: The common connections should not be daisy chained.

Note: The shaded areas denote the internal jumpers on the module's printed circuit boards.

Distributing Field Power to A120 I/O

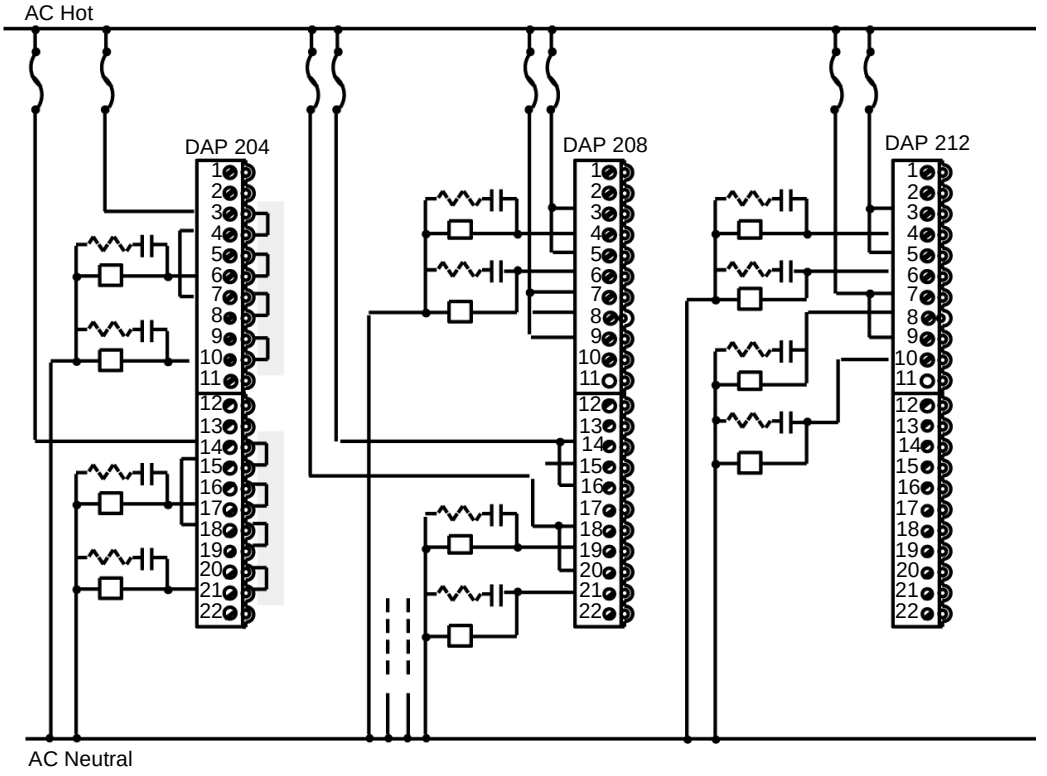
Field Power Distributed to A120 Modules

The following figure is an example of the recommended external 24 Vdc power supply wiring and fusing scheme for discrete, relay, and analog input modules. The 24 Vdc power supply ground is connected to the common functional ground (building ground). A separate circuit is recommended for external loads (outputs), and that circuit should have its ground connected to the common functional ground.



Fuse values are determined by the modules and field devices used. DX, RX, and CX are not required but are recommended in the event field devices are causing noise spikes on the power line which may affect operation. For a 24 Vdc supply, DX may be rated at 30 V minimum. Power rating is load-dependent. CX may be a 0.1 microfarad disk but results should be verified with an oscilloscope and the value adjusted accordingly.

The following figure is an example of the recommended field wiring and fusing scheme for some ac output modules. Fuses and RC suppression component values must be selected according to load requirements. Loads are shown as boxes. Four of a possible eight loads are shown connected to the DAP 208 module, and all ac input power wiring is shown.



Note: The shaded areas denote internal jumpers on the modules' printed circuit boards.

Wiring and Cabling

6

At a Glance

Introduction

The following information describes the wiring and cabling of your Compact system.

What's in this Chapter?

This chapter contains the following topics:

System Bonding and Grounding

Overview

As part of your installation procedure, provide the Compact system with equipotential bonding of all inactive metal parts, protective grounding, functional grounding, and system reference grounding.

Equipotential Bonding

A conductive connection, or equipotential bond, must be made between the inactive metal parts of all electronic equipment. Equipotential bonding provides protection from electric shock, which can result from system faults or from dissimilar chassis potentials due to site wiring. Bonding also prevents ground loops and conducted noise from affecting the system. Building structural metal is normally used, but for the best bonding quality, a separate and dedicated bonding path should be established. Solid metal stock makes the best path, and metal braid installed with minimum loops or bends is a second choice. Stranded heavy-gauge wire is not a good choice because its reactive components present a high impedance at noise frequencies. A dedicated bonding path or any bonding path other than structural metal should be connected to the building metal at one point.

If a dedicated bonding path is not practical at your installation site, you may establish the path using building structural metal or electrical wiring conduit. Lighting circuits, vending machines, and other factory electrical equipment-such as variable frequency drives-can generate interference that may be coupled to your system equipment via building structural members. Equipment should be mounted as far as possible away from these noise sources. Use toothed lockwashers at each connection point to ensure good bare metal connections. Choose connection points that are free from grease, oil, or dirt.

Protective Grounding

To establish protective ground for a Compact Controller, connect ac source ground wires (green or green/yellow) to the DIN rail on which the DTA 200 primary backplane is mounted. This ground connection protects the operator from harmful potentials that might be generated externally or from internal system faults through contact with an exposed, noncircuit, metal surface. If your installation includes the optional AS-P120-000 Power Supply, connect the ac source ground wire to the middle terminal connector on that unit's input power terminal strip (See *A120 Power Supplies, p. 177*).

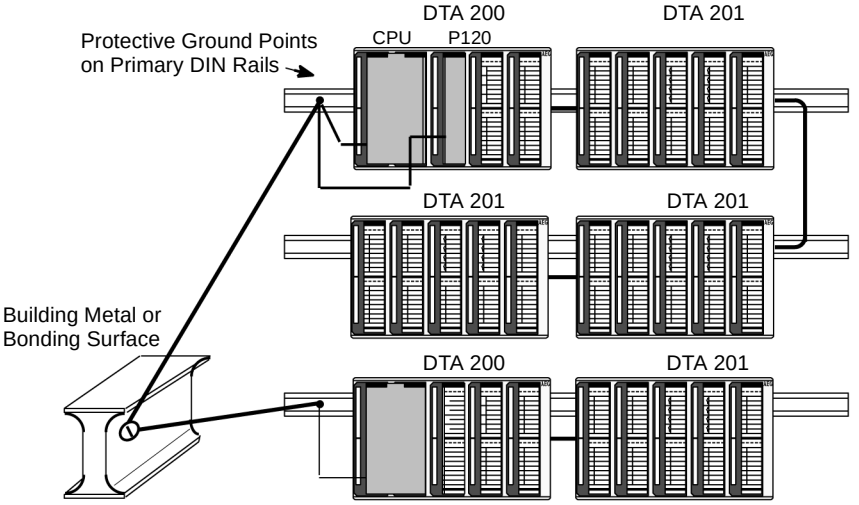
Functional Grounding

Functional grounding diverts and neutralizes extraneous electrical signals that interfere with orderly controller logic voltage levels and clock pulses. Extraneous noise can be generated by electrical motors, variable frequency drives, solenoids, etc., and can radiate through the air as well as be conducted through chassis metal and wiring.

The indicated point on the DIN rail that supports the primary DTA 200 backplane is the control system's functional ground point. This location indicated on the DIN rail is also the collection point for bonding, system reference, and system RFI/EMI shielding.

If you are mounting multiple Compact Controllers on separate DIN rails and you are not mounting them on a plate in a metal cabinet or on a 19 in EIA rack, connect the primary rails to a common bonding point with braid or heavy gauge solid conductor wire. Always avoid daisy chaining ground wiring.

Tying multiple PLCs to a common functional ground is shown in the following figure.

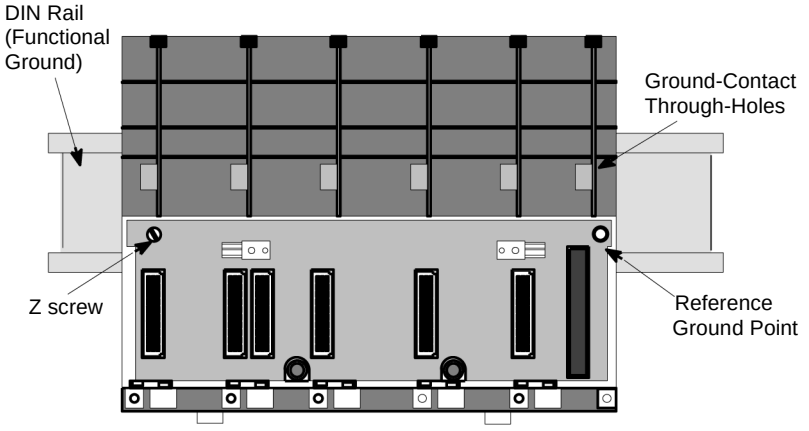


If you are not using a dedicated equipotential bonding path, you should tie the primary DIN rail to the building's structural metal via mounting hardware, metal conductor, or metal braid installed without bends or loops.

System Reference Grounding

System Grounding Overview

The masked copper grid on the primary DTA 200 housing's circuit board is the system reference ground. If the DTA 200 housing is mounted on the DIN rail, the functional ground and system reference ground are connected together (only with the Z screw installed with the fiber washer on top and the metal washer on the bottom against the housing). This creates a closed circuit whereby the system reference ground is established. All DTA 200 housing's are shipped from the factory with the circuit closed. This is accomplished by the Z screw and washers, which makes physical connection between the system reference ground and the spring clips that complete the connection to functional ground.
The following figure shows the ground connections on a DTA 200 primary backplane.



Only the DTA 200 primary backplane can provide the Z screw connection to the system functional ground on the DIN rail. The DTA 201 and DTA 202 secondary backplanes do not have Z screws.

Note: If local environmental conditions warrant, you can, optionally, remove the Z screw to provide isolation between the reference and functional grounds. Reference and functional grounds are routed through an RC filter rather than directly coupled either when the Z screw is installed (only with the Z screw installed with the metal washer on top and the fiber washer on the bottom against the housing), or if both the Z screw and both washers are removed. Either way an open circuit is created.

I/O Module to DIN Rail Grounding Requirements

Under certain conditions (painted, coated, or corrosive DIN rails) and with certain I/O modules, the DIN rail ground may NOT be adequate. The DIN rail resistance should not exceed 0.1 Ohms.

To check this specification just measure the voltage drop as described and then calculate the resistance. A constant current of 30A for at least 2 minutes should be applied between the earthing terminal or contact and each accessible metal part intended to be earthed. The current should be maintained or adjusted accordingly during this test to 30A. Any convenient low voltage not exceeding 12V may be used. The voltage drop should be measured between the points of current flow. Ensure that the contact resistance between the tip of the measuring probe and the metal part underneath does not influence the test results.

If the calculated resistance is greater than 0.1 Ohms, we recommend using Tinn DIN rail models.

The following I/O modules are more sensitive to this type of ground issue: MOT 201/202, ADU 204, ADU 211/212, VRC 200, and CTR 205/212/224.

WARNING

Some DIN rails ship with a protective coating that must be removed to ensure proper grounding.

Failure to observe this precaution can result in severe injury or equipment damage.

Other Ground Contact Points on the DTA Backplanes

All DTA backplanes (the DTA 201 and 202 secondary backplanes as well as the DTA 200) provide a reference ground point on the right side of the backplane. This connection point may be used as the reference ground for test equipment and for the BXT 201 cable ground wire in a stacked drop layout.

All DTA backplanes have ground-contact through-holes, so that I/O modules with ground contact pins can make contact with the DIN rail.

Guarding Against EMI/RFI

Overview of EMI/ RFI Protection

As part of your installation procedure, take care to protect the Compact Controller from extraneous electrical noise interference caused by system wiring. The single best precaution that can be taken against radiated electrical noise is mounting the system inside a metal cabinet that is grounded to the building's structural metal. Even office environments can benefit from this precaution.

General Precautions Against EMI/RFI

In all installations, the following precautions should be taken:

- Tighten backplane and module mounting screws securely
- Run ac, dc, and analog wiring in separate cable trays or conduit
- Always shield analog RTD or Thermocouple wiring

Cabinet Installations

The following precautions should be taken when installing a Compact in a NEMA cabinet:

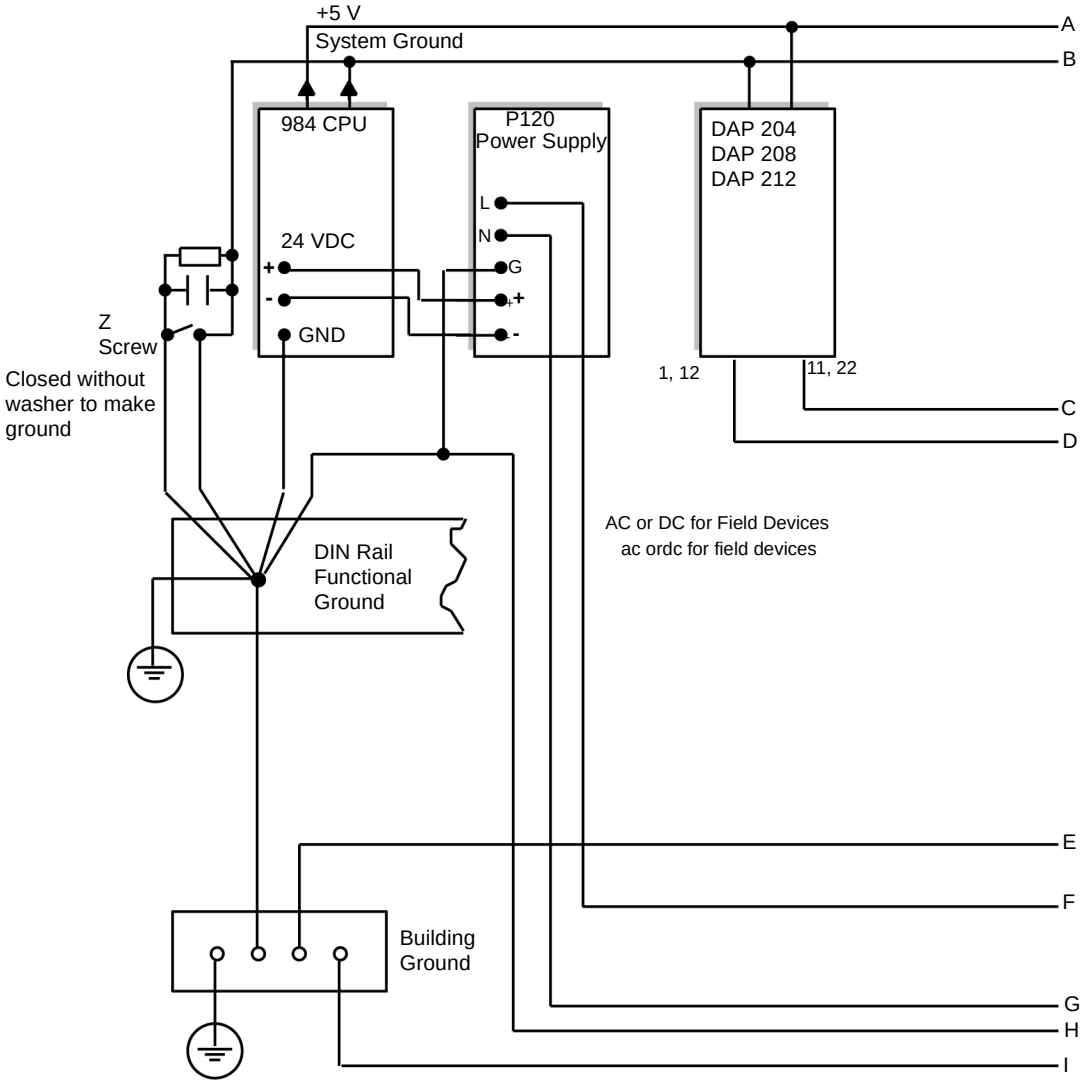
- Do not mix ac power and signal-level wiring in a cable trays or conduit
- Run ac and dc supply wiring separately, preferably in channels on opposite sides of the cabinet; if cables must cross each other, cross them at right angles
- Shield all analog field wiring, particularly if it is run in the same cable or channel as 24 Vdc field wiring
- Place suppression devices-i.e., diodes, capacitors, resistors-across relays, solenoids, and other magnetic-field generating components
- Shield magnetic-field generating components from the controller and I/O modules with a metal plate-a bare metal contact between the plate and the cabinet is required
- Ideally, magnetic-field generating components should be mounted in separate cabinets
- Fluorescent lights generate electrical noise-do not use them inside a working cabinet

Grounding and Power Distribution Overview

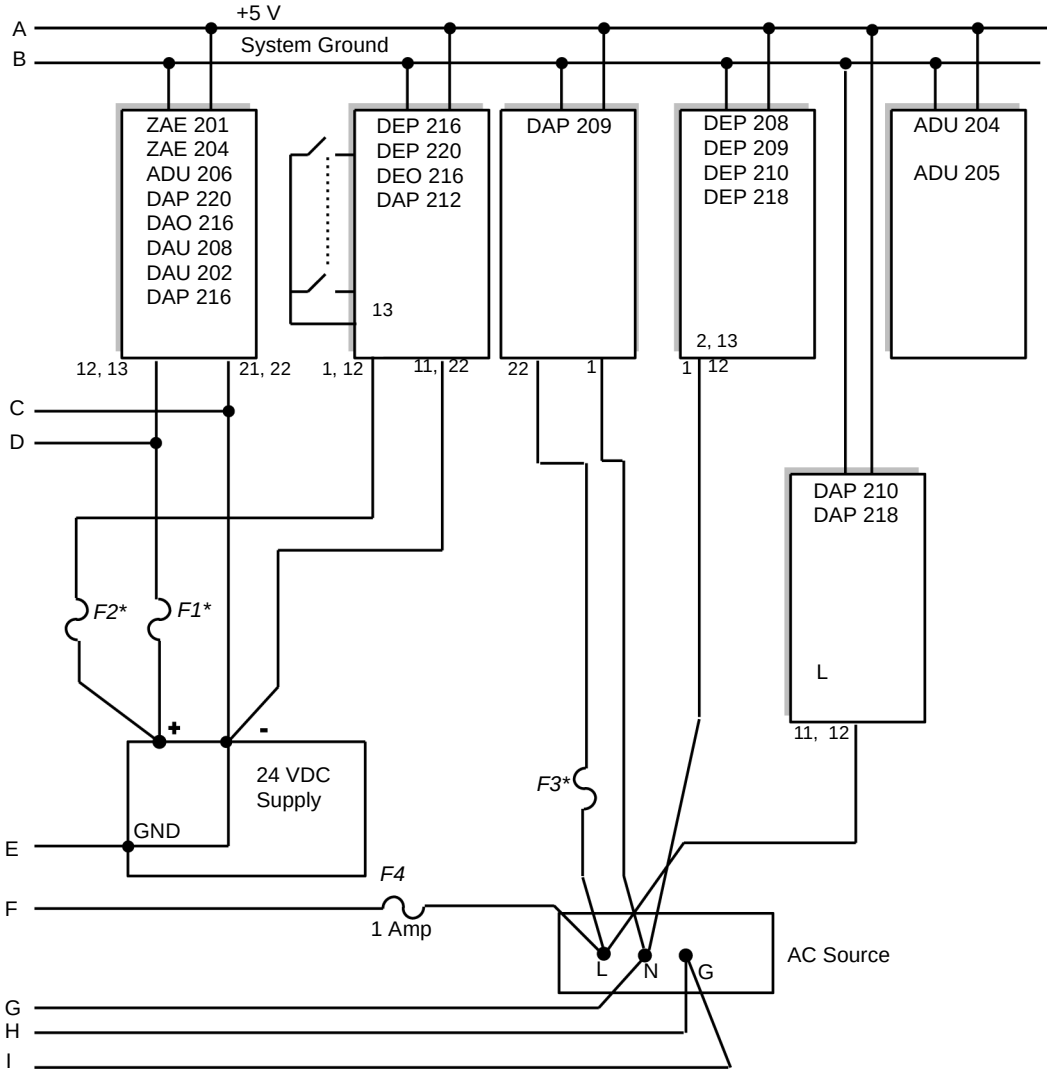
Grounding and Power Distribution Example

The two illustrations that follow provide an example of a Compact system layout for grounding and power distribution. Because of the size, this example is divided into two parts.

The following figure comprises part 1 of a Compact system layout for grounding and power distribution.



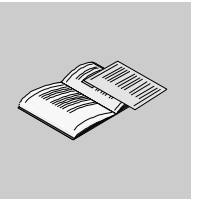
The following figure comprises part 2 of a Compact system layout for grounding and power distribution.



* *SIZED AS REQUIRED*

F1	24 VDC	Relay Coil and Internal Supply
F2	24 VDC	Field Connectors
F3	115 VAC	Field Supply
F4	115 VAC	P120 Supply

Appendices



At a Glance

Introduction

The appendix presents information on Technical References.

What's in this Appendix?

The appendix contains the following chapters:

Getting Started

A

At a Glance

Introduction

Certain Compact PLC models are supported by Modsoft panel software while other Compact PLC models are supported by Concept panel software. The following information provides multistep procedure used to get your Compact PLC up and running with either Modsoft or Concept.

What's in this Chapter?

This chapter contains the following topics:

Using Your Compact with Modsoft

Overview of Using Compact with Modsoft

The purpose of this section is to help a new user become familiar with the Compact PLC. The following steps walk you through removing the Compact PLC from the box to forcing on a coil using Modsoft.

Note: You may use Modsoft with the following Compact PLCs: A984-120/13x/14x, and E984-24x/251/255.

Start-Up Procedure Using Modsoft with Your Compact Stage 1

This procedure takes a Compact from the box to forcing on a coil using Modsoft in 4 stages. The following table includes the steps the first stage.

Step	Action
1	Remove Compact PLC from the box.
2	Install DIN rail.
3	Install backplane DTA200.
4	Install Compact PLC into slots 1 and 2.
5	Install P120-000 power supply into slot 3.
6	Install DEP216 into slot 4.
7	Install DAP216 into slot 5. For wiring diagrams for the two I/O modules, see the Modicon A120 Series I/O Modules User Guide (890 USE 109 00).
8	Connect power to P120-000 power supply.
9	Connect power from P120-000 power supply to Compact PLC. Depending on your Compact model refer to a detailed description of full-feature Modsoft and its operations, see the Modicon Modsoft Programmer User Manual (890 USE 115 00).

Start-Up Procedure Using Modsoft with Your Compact Stage 2

This stage of the procedure includes the configuration steps.

Step	Action
1	Start Modsoft from Offline (F2) selection on the Main Menu.
2	Select New Programs (F2) from the menu.
3	Enter file name Test.
4	Use default path.
5	Select **Address** (**F6**) from the menu.
6	Use default Modbus 1 communication parameters.
7	Select **Config Menu** (**F5**).
8	Select **Overview Menu** (**F3**).
9	Select **PLC Type**.
10	Select **Compact**.
11	Select **E255**.
12	Use default configuration settings.
13	Select I/O Map, (**F4**) this places you at rack 1, slot position 101... 105. Leave slot 103 blank because the P120-000 power supply resides in this slot.
14	Move cursor to slot 104.
15	Hit **Shift?**, this gives you a list of possible I/O modules.
16	Select **DEP21**6.
17	Enter your input reference **10001**.
18	Select **DAP216**.
19	Enter your output reference **1**.
20	Hit **Quit** (**F9**).
21	Hit **Escape** to back out to Modsoft's main menu.

Start-Up Procedure Using Modsoft with Your Compact Stage 3

This stage of the procedure ends with forcing on a coil.

Step	Action
1	Prior to downloading the program. Connect your W952/110XCA20xxx or equivalent cable between COM1 of your PC to Modbus port on the PLC. (if you have a A984 or E984-241/251 PLC).
2	Ensure the MEM/DEF toggle switch is set to DEF. (if you have an A984 or E984-241/251 PLC).
3	Select **Transfer** (**F5**).
4	Select **File to PLC**.
5	Press **ENTER**, and select your programTest.
6	Press **ENTER**. This will download your program to the Compact PLC.
7	A message appears and asks you if you want to start the PLC, type **Y**.
8	Hit **Escape** to back out to Modsoft's main menu.
9	Select **On Line (F3)**.
10	Select **Direct to PLC**.
11	Select the default communication parameters.
12	A message appears and asks you if you want to create a new network, type **Y**.
13	Press **ENTER**.
14	Press the **TAB** key once, this places the cursor in the network.
15	Select **Elements** (**F3**).
16	Select **Relays** (**F1**).
17	Select the open contact symbol **-| |-** (**F1**).
18	Enter reference number **100001**, and press **ENTER**.
19	Select **Elements** (**F3**).
20	Select **Relays** (**F1**).
21	Select the coil symbol **-( )-** (**F5**).
22	Enter reference number 1, and press **ENTER**.

Start-Up Procedure Using Modsoft with Your Compact Stage 4: Simulating Turning on the Input

Use this procedure to simulate turning on the input.

1	Hit **ALT F2** to move the cursor into the reference data area.
2	Enter **100001**.
3	Move cursor to enable field, and enter **D** to disable.
4	Move cursor to bit field, and enter **1**. This turns on output 1. Do not forget to enable the bit before processing further. Move cursor to enable field, and enter **E** to enable.
Note:Do not forget to enable the hit before processing further. Move the cursor to the enable field, and enter E to enable.	

Using Your Compact with Concept

Overview of Using Compact with Concept

This section provides a brief description of how to create a project, for a connection layout between programming unit and PLC, for the downloading of a user program into the PLC, as well as on project documentation.

Note: You must use Concept with the following Compact PLCs: E984-258, E984-265, E984-275, and E984-285.

Creating a Project Stage 1

Use the following the procedure to creating a project. in Concept. Note that the procedure is organized into four stages. Following is stage 1.

Step	Action	Result
1	Start Concept.	
2	Create a new project using the menu command **File**->**New project**.	A project window without a name (untitled) appears.
3	Open the PLC configurator with the menu command **Project** -> **Configurator.**	The configurator window appears.
4	Select your PLC and the applicable memory using the menu command **Configure** -> **PLC type...**	
5	Confirm this selection with the **OK** button.	The PLC type is displayed in the PLC selection window.
6	Open the I/O map with the menu command **Configure** -> **I/O map** ...	The I/O map dialog window appears.
7	Open the **Local/Remote, Compact I/O** dialog with the **Edit** button. Leave slot 1 & 2 blank because the CPU resides in slot 1+2. If the power supply (e.g. P120-000) reside in this slot 3, leave slot 3 blank also.	The Local/Remote, Compact I/O dialog appears.
8	Select an I/O module by using the column **Module** in line 1-4.	The selection dialog of all available I/O Modules appears.
9	Select the **I/O Module DEP 2x6/2x7** (DEP 216) in column Discrete Input.	
10	Confirm this selection with the **OK** button.	The DEP 2x6/2x7 type is displayed in the Local Compact Drop dialog.
11	Enter your first input reference **100001** (Bit input) in column In Ref. Use the Params ... button to configure the various parameters associated with the various modules.	The last input reference of the module is displayed automatically in the column In End.

Creating a Project Stage 2

Perform the following steps as Stage 2 of creating a project.

1	Select an I/O module by using the column Module in line 1-5.	The selection dialog of all available I/O Modules appears.
2	Select the I/O **Module DAP-216-00** in column **Discrete Output**.	
3	Confirm this selection with the **OK** button.	The DAP-216 type is displayed in the Local Compact Drop dialog.
4	Enter your first output reference 000001 (Bit output) in column **Out Ref.**	The last output reference of the module is displayed automatically in the column Out End.
5	Confirm the **Local Compact Drop** dialog (**OK**) and the I/O Map dialog (**OK**).	
6	Save the project which includes the configuration and assign a name to the project at the same time with the menu command **File** -> **Save** project.	
7	Type **Test.prj** at the file name text box and confirm with **OK**.	
8	Close the configurator window with the control-menu box.	
9	Create a new section using the menu command **File**->**New section...**	The New Program window appears.
10	Select option button **LD**.	
11	Type **example** at the **Selection name** and confirm with **OK**	The new section appears.
12	Select the normally closed contact icon at the icon bar (**-| /|-**	The cursor symbol changes to the small contact.
13	Place the cursor near the power rail, and click with the left mouse button in upper left block area.	The contact will be inserted.

Creating a Project Stage 3

Perform the following steps as Stage 3 of creating a project.

1	Open the **FFBs** from Library xxx dialog using **objects** -> **FFB selection**.	
2	Use the button **Library** ... to select a Library.	
3	Select the Library System and confirm with **OK**.	
4	Select the **SYSCLOCK** function at **EFB** type.	
5	Leave the dialog button **close**.	The cursor symbol changes to a small EFB.
6	Insert the EFB at the left side of the contact.	
7	Use **Object** -> **Link** to activate the connect mode.	
8	Place the cursor cross at the left side of the contact (till you get the checkmark symbol).	
9	Click with the left mouse button.	
10	Place the cursor cross at the EFB input (till you get the checkmark symbol).	
11	Click with the left mouse button.	
12	Select the coil icon at the icon bar (-O-).	The cursor symbol changes to the small coil.
13	Place the cursor cross at the **CLK1** output and click with the left mouse button.	
14	Place the cursor cross at the **CLK5** output and click with the left mouse button.	
15	Use **Object** -> **Select** to activate the select mode.	
16	Double click at the normally closed input contact.	The properties dialog appears.
17	Select the **Direct** address option button.	
18	Enter 100001 at the **Address** text box and confirm with **OK**.	The address is displayed on top of the contact.
19	Double click on the first coil.	
20	Enter 000001 at the **Address** text box and confirm with **OK**.	
21	Double click on the second coil.	
22	Enter 000002 at the **Address** text box and confirm with **OK**.	
23	Save the project with **File**-> Save project (or use **CTRL+S**).	

Creating a Project Stage 4 Using the Concept PLC Simulator

Stage 4 of creating a project shows how use the Concept PLC Simulator..

1	Leave Concept with **File** -> **Exi**t.	
2	Start **Concept** -> **SIM**.	
3	Activate simulation with **File**-> **Simulation ON**.	
4	Leave Concept SIM with **File**-> **Exit**.	
5	Start Concept again.	
6	Open your project with **File** -> **Open ...** -> **Test.prjj** -> **OK**.	Your project opens.
7	Open the **Connect to PLC** dialog using **Online** " **Connect ...** .	
8	Select **Modbus Plus** at Protocol type.	IEC simulator is shown and selected.
9	Confirm with **OK**.	Version mismatch Program "Test" appears.
10	Confirm with **OK**.	
11	Open the Download Controller dialog using **Online** -> **Download ...**	
12	Press button **Download** to load transfer.	Program is transferred to the simulated PLC.
13	Start Controller by pressing **yes**.	The status RUNNING and EQUAL are displayed at the status bar.
14	Start the animation with **Online**-> **Animate** booleans.	The current signal state of the contact and coils are displayed (green=1, red=0).
15	To leave Concept use **File** -> **Exit**.	

Building the Connection

Below is the procedure for building the connection.

CAUTION

Disconnect Concept and

Before connecting via Modbus Plus or Modbus make sure you disconnect to leave Concept and then turn the simulator off.

Failure to observe this precaution can result in injury or equipment damage.

Step	Action	Result
1	Using Modbus Plus Use the menu command **Online**-> **Connect**... to open the dialog box for the connection layout.	
2	Select the port of the Modbus Plus adapter.	
3	Select the respective PLC from the network list.	
4	Select the access level privilege Change configuration.	
5	Confirm this with **OK**.	The connection will be built and the display NOT CONNECTED will change to NOT EQUAL.
6	Using Modbus Use the menu command **Online** -> **Connect...** to open the dialog box for the connection layout.	
7	Select the access level privilege Change configuration.	
8	According to the switch setting on your CPU, select RTU or ASCII mode.	
9	Check if the settings 9600 baud, Even parity, 8 bits, and 1 stop bit are specified at the selected interface. (See display above the command button: 9600, e [for "Even"], 8,1).	
10	Enter the node address set for your CPU.	
11	Confirm this with **OK**.	The connection will be established and the display NOT CONNECTED will change to NOT EQUAL.

Downloading the User program

The following is the procedure for downloading the user program.

Step	Action	Result
1	Open Project.	
2	Use the menu command **Online**-> **Download...** to open the download dialog.	
3	If the PLC is in RUN mode, a prompt will ask if you want to stop the PLC. Confirm this query with **Yes**.	
4	Activate the check box Configurator (if not yet selected) to download the configuration.	
5	Activate the check box user Program to download the user program.	
6	If you want to load initial values as well, also activate the check box State RAM.	
7	Click at **Download** to load into the PLC.	The user program and, if necessary, the initial values are downloaded to the PLC and the display in the footer changes to EQUAL.
8	In response to the query whether to start the PLC, enter **Yes**.	The PLC will start.

Forcing an Input

The following is the procedure for forcing an input.

Step	Action	Result
1	Use the menu command **Online**-> **Reference Data Editor ...** to open the RDE template screen.	
2	Click on an address box and type **10001**.	
3	Click on the disable button in the same row.	
4	Click on the value field and type **1** <**ENTER**> to force the input on, **0** <**ENTER**> to force the input off.	Forces the input On or Off dependent on the value used (1or 0).

CAUTION

You must enable the input before performing further processing.

Do not forget to enable the input before processing further.

Failure to observe this precaution can result in injury or equipment damage.

System Specifications

B

Compact Specifications

Compact PLC System Specifications

The following information describes the technical specifications for the Compact PLC system.

The technical specifications are organized as five tables.

The following table is table 1 of the technical specifications.

Models	PC-A984-120	With one Modbus communication port standard, and a slot for an 8 or 32 byte EEPROM; User logic size: 1.5K words, 8Mhz.
	PC-A984-130	With one Modbus communication port standard, and a slot for an 8 or 32 byte EEPROM; User logic size: 4.0K words, 8Mhz.
	PC-A984-145	With one Modbus communication port and one Modbus Plus peer-to-peer network communication port standard, and a slot for an 8 or 32 byte EEPROM; User logic size: 8.0K words, 8Mhz.
	PC-A984-131	With two Modbus communication ports standard, and a slot for an 8 or 32 byte EEPROM; User logic size: 4.0K words, 8Mhz.
	PC-A984-141	With two Modbus communication ports standard, and a slot for an 8 or 32 byte EEPROM; User logic size: 8.0K words, 8Mhz.
	PC-E984-241	With two Modbus communication ports standard, and a slot for an 8 or 32 byte EEPROM; User logic size: 8.0K words, FLASH RAM (exec only), 16Mhz.
	PC-E984-245	With one Modbus communication port and one Modbus Plus peer-to-peer network communication port standard, and a slot for an 8 or 32 byte EEPROM; User logic size: 8.0K words, FLASH RAM (exec only), 16Mhz.
	PC-E984-251	With two Modbus communication ports standard, and a slot for an 8 or 32 byte EEPROM; User logic size:16.0K Words FLASH RAM (exec only), 16Mhz, 24K of extended registers.
	PC-E984-255	With one Modbus communication port and one Modbus Plus peer-to-peer network communication port standard, and a slot for an 8 or 32 byte EEPROM; User logic size: 16.0K words, FLASH RAM exec only), 16Mhz, 24K of extended registers.
	PC-E984-258	With two Modbus communication ports standard; User logic size: 16.0K words, State RAM size: 32K words, Total size: 48K words, 128K words of configurable SDA 6X registers, FLASH RAM (exec plus user program storage), 25Mhz, operating temperature -40 ... +70C, the Run, Ready, Modbus 1 and Modbus 2 LEDs are yellow. TOD sync with GPS input terminals.
	PC-E984-265	With two Modbus communication ports and one Modbus Plus peer-to-peer network communication port standard; User logic size: 8.0K words, State RAM size: 16K words, Total size: 24K words, 128K words of configurable SDA 6X registers, FLASH RAM (exec plus user program storage), 25Mhz. TOD sync with GPS input terminals.
	PC-E984-275	With two Modbus communication ports and one Modbus Plus peer-to-peer network communication port standard; User logic size: 16.0K words, State RAM size: 32K words, Total size: 48K words, 128K words of configurable SDA 6X registers, FLASH RAM (exec plus user program storage), 25Mhz, and one PCMCIA slot. TOD sync with GPS input terminals.
	PC-E984-285	With two Modbus communication ports and one Modbus Plus peer-to-peer network communication port standard; User logic size: 32.0K words, State RAM size: 64K words, Total size: 96K words, 128K words of configurable SDA 6X registers, FLASH RAM (exec plus user program storage), 25Mhz, operating temperature -40 ... +70C and one PCMCIA card slot. TOD sync with GPS input terminals.

The following table is table 2 of the technical specifications.

State RAM	A984 & E984-24x/251/2 55	2k
	E984-258/275	32k
	E984-265	16k
	E984-285	64k
	Word size	16 bit
	Technology	CMOS with lithium battery backup
	Battery	100 days minimum backup retention period 5 year replacement period to assure backup capacity
I/O Capabilities	I/O type supported	A120 Series
	Local I/O support	One, I/O Mapped as drop #1
	I/O racks/drop	Four (maximum) one primary rack and up to three secondary expansion racks
	I/O modules/drop	18 (maximum) three in the primary rack and five in each expansion rack
	Power for I/O racks	From the Controller power supply NOTE: Logic side only. User must provide field side power if needed.
	Remote I/O support	None
I/O Capacity (Maximum)	A984-1xx&E984-24x/251/255	256 maximum Discrete I/O points, any mix (0x, 1x) 64 words Register I/O (32 in/32 out) (3x, 4x)
E984-258& E984-265	128 In/128 Out words Total I/O capacity 256 words	
	E984-275	256 In/256 Out words Total I/O capacity 512 words
	E984-285	512 In/512 Out words Total I/O capacity 1024 words
PLC Power	A984 & E984-24x/251/255	24 Vdc -15% +20% maximum steady state input current 1 A @ 24 Vdc
	E984-258/285	24 Vdc -30% +25% maximum steady state input current 1.0A @24 Vdc
	E984-265/275	24 Vdc -20% +25% maximum steady state input current 1.1A @24 Vdc
I/O Bus Power	A984 & E984-24x/251/255	5 Vdc @ 2.5 A
	E984-265/275	5 Vdc @ 3.0 A
	E984-258/285	5 Vdc @ 2.5 A
PCMCIA (E984-275/ 285)	Current Rating	110 ma @ 5V for -40 ... +855C for AS-FLSH-004C
	Compliance Standard	PCMCIA standard 2.1, type II socket type supported

The following table is table 3 of the technical specifications.

Logic Solve Time	0984/A984 PICs	4.25 ms ... 6 ms/K nodes standard ladder logic (not including end-of-scan diagnostics, I/O processing, or Modbus command handling)
	E984-24x/25x	2.13 ms ... 3 ms/K nodes standard ladder logic (not including end-of-scan diagnostics, I/O processing, or Modbus command handling)
	E984-258/265/ 275/285	0.2ms/k minimum, average for 1K (binary logic) 0.6ms/k maximum average for 1K (binary logic)
Throughput	0984/A984 PLCs	8 ms ... 11 ms for 64 I/O points and 1K of logic
	E984-24x/25x PLCs Only	4 ms ... 5.5 ms for 64 I/O points and 1K of logic
	E984-258/265/ 275/285 PLCs Only	6.7 ms average for 6.1K logic 6.2ms average for 4.2K logic 6.1 ms average for 2.5K logic 6.0 ms average for 1.6K logic
Timers (A984, E984-241/25 1/255)	Watch Dog Timer	250 ms, with nominal +10%, selectable time-out
	Time of Day Clock	Variation @ 255 C = < + 30 seconds/month Max. Variation @ 605 C = + 4 minutes/month
Timers (E984-258/265/275/285	Watch Dog Timer	250 ms (S/W adjustable)
	Time of Day Clock	+ 8.0 seconds/day @ 0 ... 605 C
CPU Diagnostic Procedures	Schedule	Continuous, commencing at power up
	Tests	Available memory for both RAM and ROM, Internal processor resources; Communication with peripheral and/or networked devices; I/O bus during I/O activity
	Normal CPU failure response	Orderly termination of the process and logging of the error condition
	Error code accessibility	From programming panel or DAP, except for catastrophic CPU failure
	Catastrophic failure response	READY LED goes OFF and system fails to respond
	Executive failures (E984's)	If memory checksum fails the RUN LED will blink 3 times for.5 seconds followed by a rest period of 2.5 seconds then the pattern repeats. The controller has detected a STOP ERROR CODE and may require either restarting, reloading of the user logic, or reloading of the executive firmware.

Table 4 of the technical specifications describes physical and agency specifications.

Weight	PC-A984-145	540 g (1.19 lb)
	PC-A984-130	455 g (1.00 lb)
	PC-A984-120	455 g (1.00 lb)
	PC-A984-131	540 g (1.19 lb)
	PC-A984-141	540 g (1.19 lb)
	PC-E984-241	540 g (1.19 lb)
	PC-E984-245	540 g (1.19 lb)
	PC-E984-251	540 g (1.19 lb)
	PC-E984-255	540 g (1.19 lb)
	PC-E984-258	550 g (1.21 lb)
	PC-E984-265	540 g (1.25 lb)
	PC-E984-275	580 g (1.27 lb)
	PC-E984-285	580 g (1.27 lb)
	AS-HTDA-200	330 g (0.73 lb), with cover
	AS-HTDA-201	330 g (0.73 lb), with cover
	AS-HTDA-202	150 g (0.33 lb), with cover
Agency Approvals	A984-120/131/141	VDE 0160; UL 508; CSA 22.2 No.142 and FM Class I, Div 2 Standards
	A984-145, E984-241/251/2 55	UL 508; CSA 22.2 No.142, FM Class I, Div 2 and Europeans Directive on EMC 89/336/EEC Standards
	E984-258/265/275/285	UL 508; CSA 22.2 No.142, European Directive on EMC 89/336/EEC, and Low Voltage Directive 79/23/EEC Standards. FM Class I, Div 2 is pending.
	E984-258C/265 C/275C/285C	UL 508; CSA 22.2 No.142, and European Directive on EMC 89/336/EEC, and Low Voltage Directive 79/23/EEC Standards. FM Class I, Div 2 is pending. In addition, E984-258C meets EN 50 155 Railway standard.

Note: E984-258/265/275/285 models are available with conformal coating. The conformal coating models are E984-258C, E984-265C, E984-275C, and E984-285C.

Note: E984-258C meets Railway standard EN 50 155 because it has yellow LEDs, extended operating temperature, conformal coating, and can be operated with no battery in addition to other requirements.

Table 5 describes specifications related to programming the Compact PLCs.

Programming	Language	Standard 984 ladder logic instruction set with optional loadables (Custom Loadables, DX Loadables Drum Sequencer)	
	Panel Software	SW-MSxD-9SA	Full-feature Modsoft
		372SPU44001	Concept
		371SPU921000	Modsoft Lite
		SW-MSLA-W9F	Modicon State Language*
		371SPU68001	ProWORX
	Loadable Support Software	SW-AP98-GDA	Custom Loadable Kit
		SW-AP98-SDA	DRUM/ ICMP Function Blocks
		SW-SASI-001	Drum Sequencer Interface
		SW-AP9D-EDA	Event Alarm Recording System (EARS) Loadable
		SW-EUCA-D8L	Engineering Unit Conversion and Alarming (EUCA) Loadable
		SW-HLTH-D8L	984 Health Status (HLTH) Loadable
		309 ULD 455 00	Gas Load able E984-258C/ 265/ 275/285 Only
		309 COM 455 00	XMIT Load able E984-258C/ 265/ 275/285 Only
		SW-IODR-001	Required driver for some I/O modules (See the NOTE be low)
* Only applies to A984-130/145, E984-241/245, and E984-251/255 controllers.			
NOTE: PCFL (Process Control Function Library) panel software is not supported.			

Note: Some A120 I/O modules (DEP 211/214/215/217, DAP217/211, ADU211/ 214/216, DAU204, VIC2xx, and MOT20x) require a loadable (SW-IODR-001) for proper operation when using certain PLCs (A984-1xx, E984-24x/251/255) with Modsoft. In contrast, these separate loadables are not needed when using other PLCs (E984-258/265/275/285). Refer to the *A120 Series I/O Modules User Guide* (890 USE 109 00 formerly GM-A984-IOS).

Environmental System Specifications

All Compact 984 PLCs and all power supplies are designed to the following environmental standards.
The environmental system specifications are provided in the following table.

Operating Conditions	Temperature	0 ... 60C (32 ... 140F) -40 ... +705C E984-258/285 Only	
	Relative Humidity	0 ... 93% noncondensing @ 60C	
	Chemical Interactions	Enclosures and bezels are made with Lexan, a polycarbon that can be damaged by strong alkaline solutions.	
	Altitude	15,000 ft (4500 m)	
	Vibration	10 ... 57 Hz, 0.075 mmDA	
	Free Fall	3 ft (1 m)	
Storage Conditions	Temperature	-40 ... +85C (-40 ... +185F)	
	Relative Humidity	0 ... 93% noncondensing @ 60C	
	Shock	30 g for 11 ms, 3 shocks/axis and direction	
Electromagnetic Susceptibility	Radiated	27 ... 1000 MHz, 10 V/m	
	Surge Withstand	Transients	2 kV on power sup ply and I/O
		Ringwave	2.5 kV on power sup ply and I/O
	Fast Transients	+/- 2 kV for power supply, +/- 1 kV for I/O	
	Electro static Dis charge	+/- 8 kV Air, ten discharges +/- 4 kV Contact, ten discharges	
Power Supply Requirements	P120-000	230Vac, See Appendix D	
	P120-125	125Vdc, See Appendix D	
	P120-250	240 Vac, See Appendix D	
	PRTU-252	240Vac, See Appendix D	
	PRTU-258	240 Vac, See Appendix D	

Note: The E984-258/258C/285/285C PLCs and the related extended temperature I/O modules (ADU254/254C, ADU256/256C, DAP258/258C, DAP252/252C, DAP250/250C, DAP253, DAU252/252C, DEP254/254C, DEP256/256C, DEP257/257C, and FRQ254) can operate at ambient temperatures as low as -40 degrees centigrade under the condition that the system is housed in an enclosure that retains some of the heat dissipated by the system components. A typical system tested required 14 watts heat dissipation to maintain the internal enclosure temperature sufficient for proper operation. In no case can the cold start temperature be lower than -25 degrees centigrade.

CE Requirements

C

Requirements for CE Compliance

Overview

The Compact 984 component you have determines to which information you should refer for your EMC requirements.

Note: The E984-258/265/275/285 PLCs meet EMC requirements by design. Therefore, none of the following information applies to these four PLC models.

Installation Requirements for Certain Compact Family Products

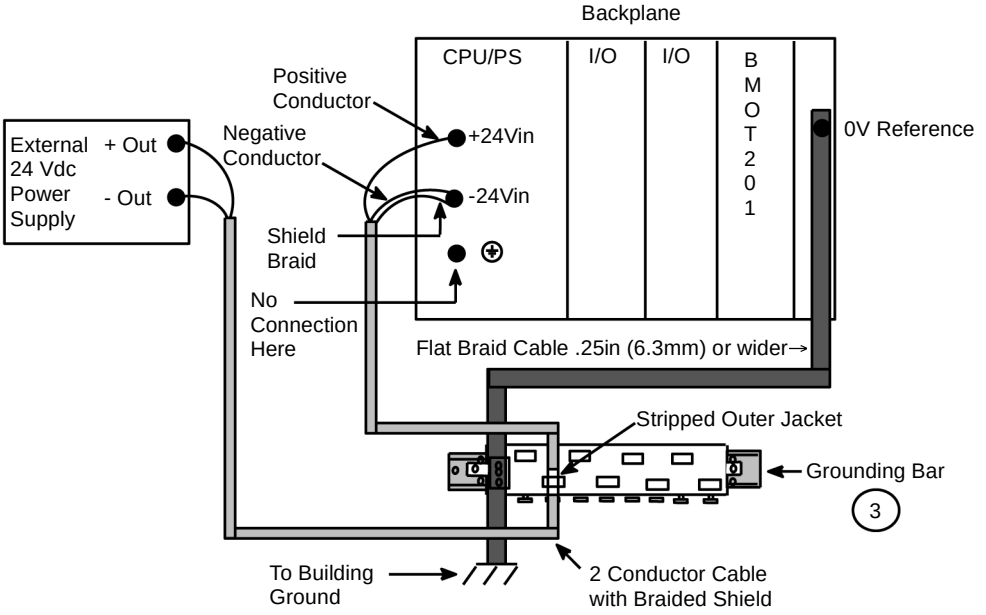
The following information describes the installation requirements necessary to maintain compliance with the European Directive for EMC 89/336/EEC for certain (PC-A984-145, PC-E984-241, PC-E984-245, PC-E984-251, PC-E984-255, AS-BDAP-210, AS-BDAP-218, AS-BVIC-200, AS-BVIC-205, AS-BVIC-212, AS-BVIC-224, AS-BVRC-200, AS-BCTR-205, AS-BCTR-212, AS-BCTR-224, AS-BADU-211, AS-BADU-212, AS-BADU-204, and AS-BMOT-201) Compact 984 components.

Note: For information about specific I/O modules, please refer to the *A120 Series I/O Modules User Guide* (890 USE 109 00 formerly GM-A984-IOS).

Use the following requirements for installations complying with the CE marking:

- Use Braided Shielded Cable on all power supply, communications, and I/O lines. Either the Modicon Grounding Bar (Modicon part number 043509693) or a compatible device may be used. The cable should have at least 80% shield coverage. If you are using the Grounding Bar, the Outer Diameter of the shield should be in the range of 0.189 ... 0.240 in (4.8 ... 6.0 mm).
- All cable shields must be grounded using the clips on the Grounding Bar. Alternatively, you can supply an equivalent low impedance RF ground clamp.
- CPU/PS ground terminal (Ground) must be left open as shown.
- Install braided earth ground from building earth ground to grounding clip (or clips as required) and to backplane 0 Volt reference.
- Use the plastic faceplate supplied with the backplane to cover the front of modules.
- If using a BMOT-201 module, all cables (Motor I/O Cable, Encoder Cable and I/O Cable) exiting the BMOT-201 module must pass through a large Ferrite Bead (Steward part number 28 B2400-000).

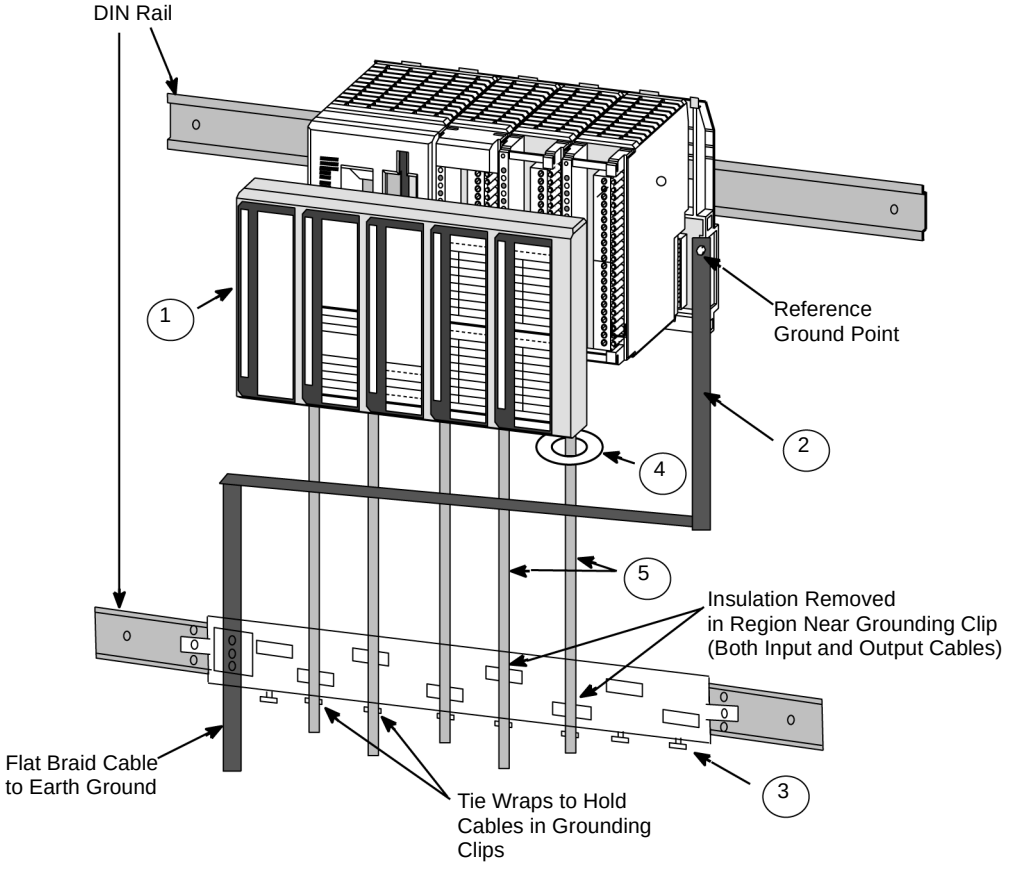
The following figure shows how the configuration would look.



This table shows the **Parts List for Callouts for Above and Below**.

Callout	Vendor (or equivalent)	Part Number	Description	Instruction
1	Modicon	Shipped with backplane	Plastic Cover	Installation is Required.
2			Flat Braid Cable.25in (6.3mm) or wider	
3	Modicon	043509693	Grounding Bar	All cable shields must be grounded.
4	Steward (Outside the United States call Livingston, Scotland at (0044) 1-506-414-200)	28 B2400-000	Ferrite Bead 1.37in(34.8mm) I.D.; 2.5in (63.5mm) O.D.; .44in (11.2mm) Thick	For a BMOT-201 ONLY: All cables (Motor, I/O, Encoder and I/O cables) must pass through this large ferrite bead. Secure it with a tie wrap or equivalent.
5			Braided Shielded Cable. 80% shield coverage, #of conductor and gauge per user requirements.	

The following figure shows how the configuration looks using the parts in this table.



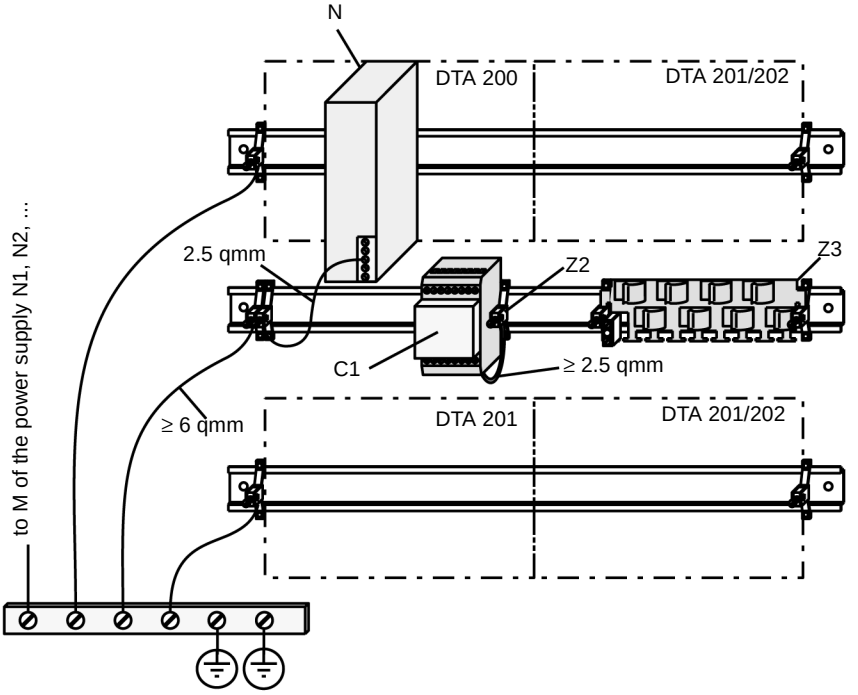
Installation Requirements for Certain Compact Family Products

Follow these requirements for installations that must comply with the CE marking:

- Install equipment following approved EMC practices, i.e. protective earthing and functional earthing, connections with good conductivity, and grounding cables of sufficient cross section
- Avoid all sources of electrical disturbance in proximity of the equipment, encapsulation with metallic walls
- Use manufacturer approved cabling
- Use EMC compliant grounding of cable shielding (proper mechanical connection, connection surface, clamps)
- Separate data and signal cable routing, which emit disturbances (e.g. power cables with switching transients)
- Use the prescribed suppression filters and their competent installation

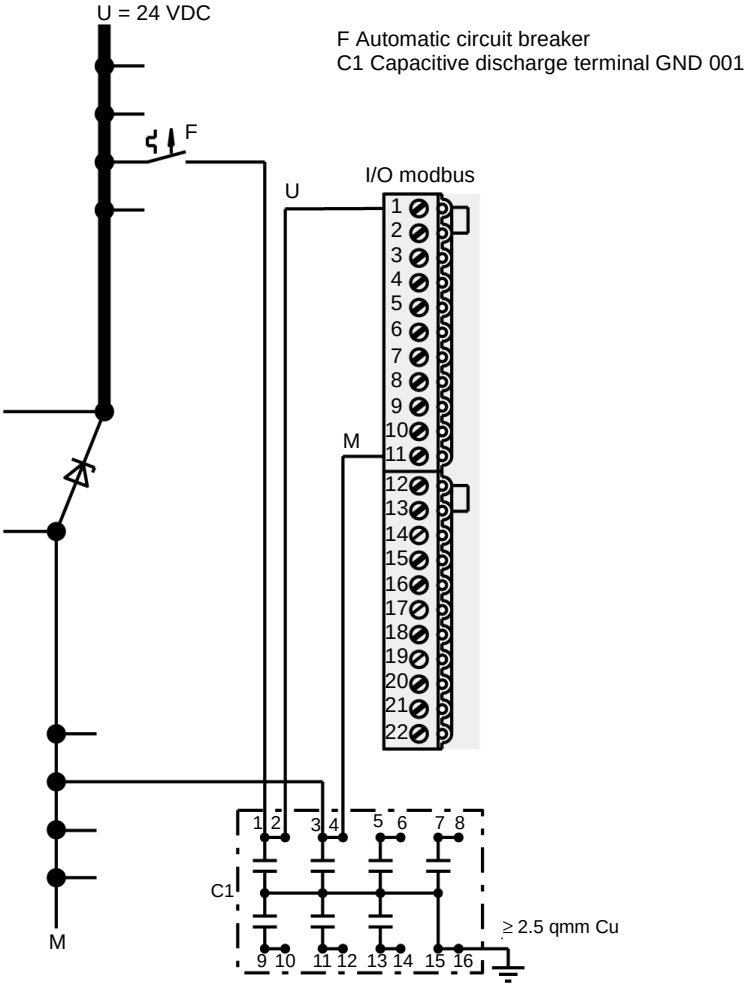
To improve EMC stability on the modules it is recommended that the U (voltage) and M (common) connections used here have a capacitive discharge that is as short as possible from the terminal towards the functional earth. This is the purpose of the capacitive discharge terminal (GND 001), refer to the following figure. In an environment that has a high interference level, an increase of the capacity on the C1 from 2.2 nF to 22 nF is recommended.

The following figure shows the capacitive discharge terminal.



C1 Capacitive discharge terminal GND 001
N Power supply modules CPU / DEA / ASP / P120
Z2 Earthing cleat EDS 000
Z3 Cable earthing bar CER 001

The following figure also shows the capacitive discharge terminal.



Note: Earthing system of the 0V on the rack is already preset when delivered.

For earthing systems of the shielded cable lines, the following table provides an overview of recommended shielded cables.

Types	Features	Use
KAB-2277-LI	shielded, 3 x 0.14 qmm	DCF 77E to KOS
KAB-2205-LI	shielded, twisted-pair, 2 x 2 x 0.5 qmm	System field bus to DEA 201; inputs, outputs for ADU and DAU; counting input for ZAE 204; pulse counter for ZAE 201
KAB-0505-LI	shielded, 5 x 0.5 qmm	Output unit on TXT 201
KAB-0875-LI	shielded, 8 x 0.75 qmm	Sensors and drives for POS 202
KAB-1005-LI	shielded, twisted-pair, 5 x 2 x 0.5 qmm	Group line to ZAE 204; position sensing for ZAE 201; sensors and drives for POS 202
KAB-1014-LI	shielded, 10 x 0.14 qmm	Sensor for POS 202
KAB PROFIB	shielded, inflexible, 2 x 0.64 qmm	PROFIBUS to DEA 203

A120 Power Supplies

D

At a Glance

Introduction

The following information describes the two optional power supplies that are currently available for the Compact PLC system.

What's in this Chapter?

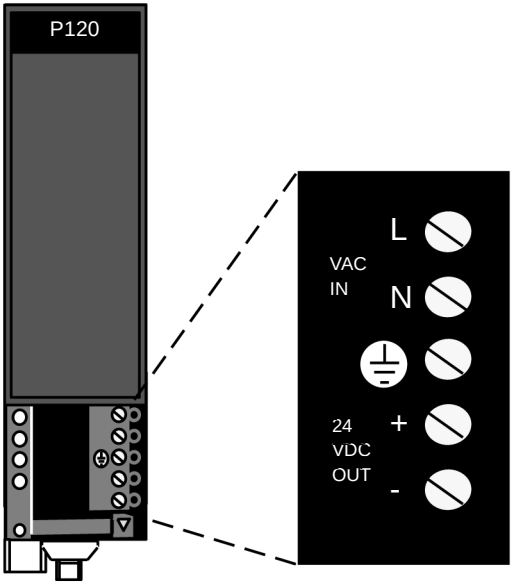
This chapter contains the following topics:

P120-000 Power Supply

Overview of the P120-000 Power Supply

The P120-000 is an isolated power supply for a Compact CPU installed in an environment with 115/230 Vac available. The unit accepts inputs voltages from a 115 V or 230 V (+15%) ac source and outputs a 24 Vdc supply to the CPU at 1 A continuous current.

The following figure shows the front view of the P120 Power Supply.



	**CAUTION**
	Remove power before making any connections. Neat and proper workmanship methods by qualified personnel must be employed when making connections to this module. Take extra precautions if you are using stranded wire. Ensure that loose or projecting strands do not short circuit or ground the other terminals. We recommend that you use solid wire. **Failure to observe this precaution can result in injury or equipment damage.**

The P120 module is designed to be inserted in any available I/O slot in the DTA 200 backplane just like a standard A120 I/O module, but it does not make any connections to the backplane. No jumper changes or switch setting changes are required when changing from 115 Vac to 230 Vac power input, or when changing from 230 Vac to 115 Vac input.

Overload and Overvoltage Protection

The P120 has internal overvoltage protection, preventing the output voltage from exceeding 35 V should the supply lose regulation. If an overvoltage condition is sensed, the P120 shuts down and will not restart until the ac input power source has been turned OFF for a minimum of 5 min. The P120 also has internal overload protection which permits the unit to safely transition into a short circuit for a period no greater than 5 min.

LED Indicator

The P120 has one green LED indicating when ON that the unit is supplying DC power within regulation (+5%). Marginal regulation-line voltage provided but below the required 5% minimum-causes the LED to glow dimly. The LED goes OFF upon loss of regulation.

Note: It is **not recommended** that a single P120 power supply be used to power the Compact 984 and its I/O.
A separate supply, which may be a P120, is recommended to reduce the risk of field noise affecting the controller's operation. This is also beneficial in cases of single-supply configurations, where a field point failure could cause the controller to shut down

P120-000 Specifications

Specifications for the P120-000 Power Supply

The P120-000 Power Supply technical specifications are described herein. Refer to the following table for the detail specifications for the P120-000 Power Supply.

Input Ratings	Input Voltage Range	95 ... 253 Vac
	Frequency Range	47Hz ... 63 Hz
	Ground Leakage	< 1.5 mA @ 265 Vac
	Input Current	0.6 A @ 115 Vac nominal
		0.3 A @ 220 Vac nominal
	Inrush current	6 A typical @ 115 Vac
Output Ratings	Output Voltage	24 Vdc (+5%)
	Current	0 ... 1 A continuous
	Ripple/Noise	100 mV peak to peak
	Holdup	Operates in regulation for periods > 12 ms with half-cycle dropout in nominal ac input voltage
	Transient Load Performance	20% change in load, linear ramp over 200 ms
	Power-up Stability	From AC power application to regulation within 5 s; will not overshoot regulation tolerance during power-up
Reliability	Service Life	5 yr
	MTBF	50,000 hr (minimum) at 30C, assuming fixed ground and component stress within maximum specifications
Dimensions	WxHxD	40.3 x 145 x 117.5 mm (1.6 x 5.6 x 4.5 in)
	Weight	220 g (.5 lb)
Agency Approvals	Designed to meet	VDE 0160, UL 508, Factory Mutual Class I, Division 2 and CSA 142 Standards

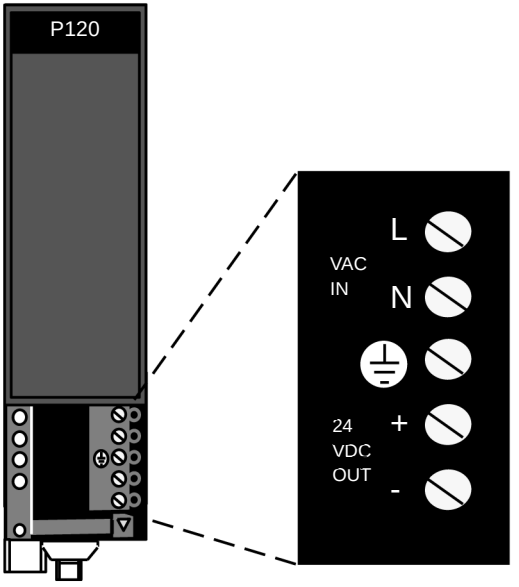
P120-125 Power Supply

About P120-125 Power Supply

The P120-125 is an isolated power supply for a Compact 984 CPU installed in a dc environment

The unit accepts inputs voltages from 105 to 150 Vdc source and outputs 24 Vdc to the CPU up to 1.5 A continuous current. The P120-125 module is designed to be inserted in any available I/O slot in the backplane just like a standard A120 I/O module, but it does not make any connections in the backplane.

The following figure shows the front view of the P120-125 power supply.



	CAUTION
	Remove power before making any connections. Neat and proper workmanship methods by qualified personnel must be employed when making connections to this module. Take extra precautions if you are using stranded wire. Ensure that loose or projecting strands do not short-circuit or ground the other terminals. We recommend that you use solid wire. **Failure to observe this precaution can result in injury or equipment damage.**

Overload and Overvoltage Protection

The P120-125 has internal overvoltage protection, preventing the output voltage from exceeding 36 V should the supply lose regulation. The P120-125 also has internal overload protection which permits the unit to safely transition into a short circuit for a period no greater than 5 min.

LED Indicator

The P120-125 has one green LED indicating, when ON, that the unit is supplying dc power within regulation (+5%). Marginal regulation-line voltage provided but below the required 5% minimum-causes the LED to glow dimly. The LED goes OFF upon loss of regulation.

Note: It is **not recommended** that a single P120-125 power supply be used to power the Compact 984 and its I/O.
A separate supply, which may be a P120-125, is recommended to reduce the risk of field noise affecting the controller's operation. This is also beneficial in cases of single-supply configurations, where a field point failure could cause the controller to shut down.

P120-125 Specifications

P120-125 Power Supply Specifications

The following table lists the technical specifications of the P120-125 power supply.

Input Ratings	Input Voltage Range	105 ... 150 Vdc
	Input Current	0.5 A @ 125 Vdc nominal
	Inrush current	1 A typical @ 125 Vdc
Output Ratings	Output Voltage	24 Vdc (+5%)
	Current	.1A ... 1.5 A continuous
	Ripple/Noise	650 mV peak to peak
	Holdup	Operates in regulation after removal of power (maximum 10 ms)
	Power-up Stability	From dc power application to regulation within 10s; will not overshoot regulation tolerance during power-up
Reliability	Service Life	5 yr
	MTBF	51,800 hr @ 30C, assuming fixed ground and component stress within maximum specifications
Dimensions	WxHxD	40.3 x 145 x 117.5 mm (1.6 x 5.6 x 4.5 in)
	Weight	220 g (.5 lb)
Agency Approvals	Designed to meet	UL 508, CSA 142 Standards

P120-250(C) Power Supply Module

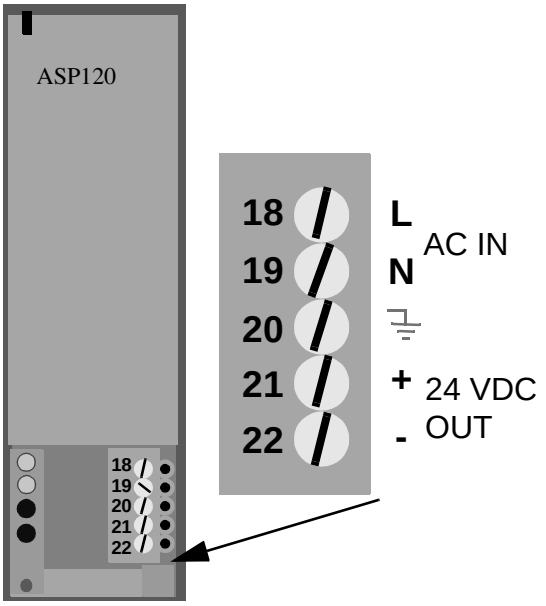
About the P120-250 Power Supply

The P120-250 is an AC input isolated power supply module for a Compact 984 CPU installed in a DC environment. It is also suitable for use with the A120 I/O. A conformal coated version, the P120-250**C**, is also available.

The P120-250(C) accepts input voltages from 90 to 264 VAC, and supplies 24 VDC to the CPU at 2.0 A continuous current.

This supply is designed to be inserted in any available I/O slot in the backplane just like the standard A120 I/O module, but connections are not made through the backplane. Connections are made to the appropriate terminals located on the front of the Power supply.

The following figure shows the front view of the P120-250(C) power supply.



DANGER

Hazard of Electric Shock, Burn, or Explosion

This equipment must be installed and serviced only by qualified electrical personnel.

- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors, and covers before turning on power to this equipment.
- Take extra precautions if you are using stranded wire. Ensure that loose or projecting strands do not short-circuit ground or other terminals. We recommend that you use solid wire.

Failure to observe this precaution will result in death or serious injury.

Overload and Overvoltage Protection

Should the supply lose regulation it has an internal over voltage protection that prevents the output from exceeding 35 V. If an over voltage condition is sensed the the module will shut down and will not restart until the AC input source has been turned off for a minimum of 5 minutes.

LED Indicator

This power supply has one green LED indicating, when on, that the unit is supplying DC power within regulation (+/- 0.5 VDC). The LED goes off upon loss of regulation.

Note: It is **not recommended** that the same power supply be used to power the Compact 984 and its I/O.
Separate supplies are recommended to reduce the risk of field noise affecting the controller's operation. In cases of single supply configurations a field point failure could cause the power supply, and so the controller, to shut down.

The P120-250(C) Specifications

Technical Specifications

The following table details the technical specifications for the P120-250 power supply module.

Input Ratings	AC Input voltage range	90 to 264 VAC, 47 to 63 Hz
	Ground leakage current	0.7mA @ 264 VAC
	Input current	0.9A @ 90 VAC
	Inrush current	5 A typical @ 240 VAC
Output rating	Output voltage	24 VDC (+/- 0.5)
	Output Current	12mA to 2A continuous
	Ripple/noise	+/- 250 mV peak to peak
	Load regulation	Maximum +/- 0.2 % from 1 A to 2 A
	Holdup	Operates in regulation for period > 10 ms after removal of power.
	Output regulation	+/- 0.2% from 90 to 264 VAC
	Transient load performance	A 20% change in load, performed as a linear ramp over a minumum of 200 m seconds, will not cause the power supplies to exceed their specified regulation band.
Reliability	Service life	5 years
Physical Characteristics	Format	One slot **Note**: A two slot passive mounting frame for panel or rail is available from Schneider Automation. Part # 42702282
	Dimensions (WxHxD)	40.3 x 145 x 117.5 mm (1.6 x 5.6 x 4.5 in)
	Weight	328 g (.7 lb)
Agency Approvals	UL508, UL1210, UL1950, CSA 950, TUV 950, and CE requirements	
Environmental Rating	Conducted and radiated noise	Meets FCC docket 20780 Class A (Industrial)
	Temperature	-40°C to +70°C (to +85°C non operating)
Isolation	Input to output (SELV Construction)	2500 VRMS
	Input to chassis ground	1500 VRMS

PRTU252(C) and PRTU258(C) Power Supply Modules

About the Power Supplies

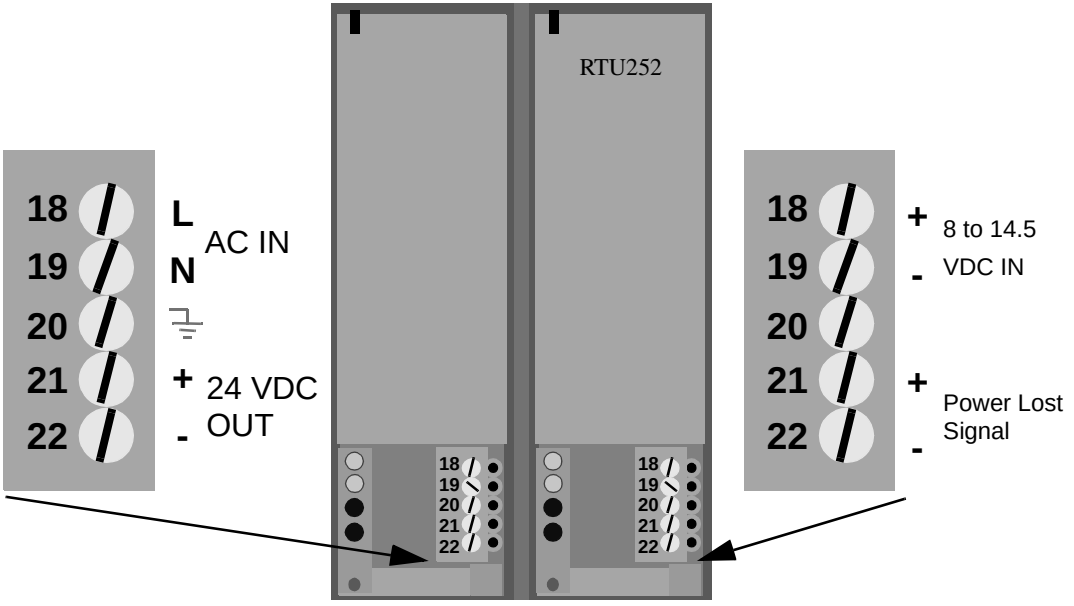
These modules are AC input isolated power supplies with user supplied battery backup for a Compact 984 CPU installed in a DC environment. They are also suitable for use with the A120 I/O. Conformal coated versions, the PRTU252**C** and PRTU258**C**, are available.

The PRTU**252**(C) accepts input voltages from 90 to 264 VAC or 8 to 14.5 VDC. It supplies 24 VDC to the CPU at 2.0A continuous current.

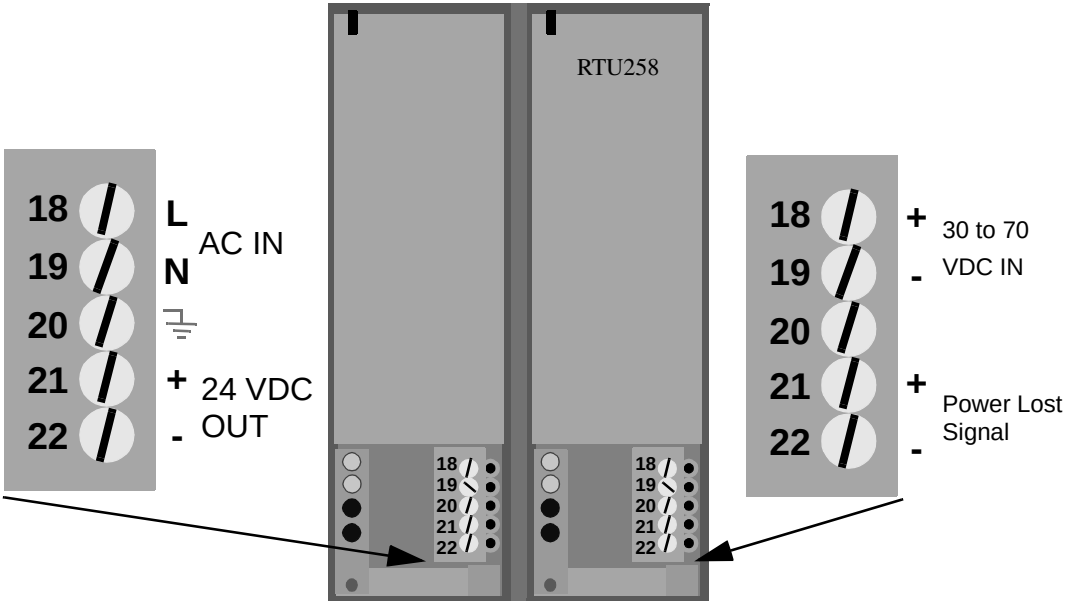
The PRTU**258**(C) accepts input voltages from 90 to 264 VAC or 30 to 70 VDC. It supplies 24 VDC to the CPU at 2.0A continuous current.

These supplies may be inserted in any available I/O slot in the backplane just like a standard A120 I/O module, but connections are not made through the backplane. Connections are made to the appropriate terminals located on the front of the Power supply.

The following figure shows the front view of the PRTU252(C) power supply.



This figure shows the front view of the PRTU258(C) power supply.



	DANGER
	Hazard of Electric Shock, Burn, or Explosion This equipment must be installed and serviced only by qualified electrical personnel. • Turn off all power supplying this equipment before working on or inside equipment. • Always use a properly rated voltage sensing device to confirm power is off. • Replace all devices, doors, and covers before turning on power to this equipment. • Take extra precautions if you are using stranded wire. Ensure that loose or projecting strands do not short-circuit ground or other terminals. We recommend that you use solid wire. **Failure to observe this precaution will result in death or serious injury.**

Overload and Overvoltage Protection

Should the supplies lose regulation they have internal over voltage protection that prevents the output from exceeding 35 V. If an over voltage condition is sensed the modules will shut down and will not restart until the AC or DC input source has been turned off for a minimum of 5 minutes.

LED Indicators

These power supplies have two indicator LEDs, one green and one red. The green LED is located on the AC line source side and, when on, indicates that the power supply is running properly with AC line input present. The red LED, located on the DC battery power input side indicates, when on, that the supply is running on the user supplied DC source (battery), and that the AC line input is not present. The indicator LEDs will not be on at the same time.

Note: It is **not recommended** that the same power supply be used to power both the Compact 984 and its I/O.
Separate supplies are recommended to reduce the risk of field noise affecting the controller's operation. In cases of single supply configurations a field point failure could cause the power supply, and so the controller, to shut down.

Battery Backup

In the event of a primary power outage the Compact system continues to operate on the user supplied battery backup and a 24VDC (12mA max.) **power lost signal** is generated. This power lost signal may be monitored using a discrete input module or other method per the user requirement. Battery support time is dependent upon the Compact system power requirement and the capacity of the user supplied battery.

PRTU252(C) and PRTU258(C) Specifications

Technical Specifications

The following table details the technical specifications for the PRTU252(C) and the PRTU258(C) power supply modules. All specifications are for both modules except where indicated.

Input Ratings	AC Input voltage range	90 to 264 VAC, 47 to 63 Hz		
	DC Input voltage range	PRTU 252(C)	8.5 to 13.8 VDC	
		PRTU 258(C)	30 to 70 VDC	
	Ground leakage current	0.7mA @ 264 VAC		
	Input current	0.9A @ 90 VAC	PRTU 252(C)	5.0 A @ 12 VDC
			PRTU 258(C)	1.8 A @ 30 VDC
	Inrush current	5 A typical @ 240 VAC	8 A typical @ 12 VDC 5 A typical @ 48 VDC	
Output Ratings	Output voltage	24 VDC (+/- 0.5 VDC)		
	Output Current	12mA to 2A continuous		
	Ripple/noise	+/- 250 mV peak to peak		
	Load regulation	Maximum +/- 0.2 % from 1 A to 2 A		
	Holdup	Operates in regulation for period > 10 ms after removal of power.		
	Output regulation	PRTU 252	+/- 0.2% from 90 to 264 VAC or 8.5 to 13.8 VDC	
		PRTU 258	+/- 0.2% from 90 to 264 VAC or 30 to 70 VDC	
	Transient load performance	A 20% change in load, performed as a linear ramp over a minumum of 200 m seconds, will not cause the power supplies to exceed their specified regulation band.		
Power Lost Signal	Voltage	24 VDC		
	Current	12 mA Maximum		
Reliability	Service life	5 years		
Physical Characteristics	Format	Two slots **Note**: A two slot passive mounting frame for panel or rail is available from Schneider Automation. Part # 42702282		
	Dimensions (WxHxD)	81.3 x 145 x 117.5 mm (3.3 x 5.6 x 4.5 in)		
	Weight	588 g (1.3 lb)		

Agency Approvals	UL508, UL1210, UL1950, CSA 950, TUV 950, and CE requirements	
Environmental Rating	Conducted and radiated noise	Meets FCC docket 20780 Class A (Industrial)
	Temperature	-40°C to +70°C (to +85°C non operating)
Isolation	Input to output (SELV Construction)	2500 VRMS
	Input to chassis ground	1500 VRMS

Compact Accessories

E

At a Glance

Introduction

This appendix describes the Compact accessories.

What's in this Chapter?

This chapter contains the following topics:

PLC Accessories

Listing of PLC Accessories

The information in the following table describes the PLC Accessories for Compact.

Controller Accessories	8K byte EEPROM auxiliary memory card (stores up to 4K words user logic)	AS-MEEP-001
	32K byte EEPROM auxiliary memory card (stores 16K words)	AS-MEEP-000
	4 Meg PCMCIA auxiliary memory card (-40 ... +70C, 150nS, without conformal coating, with pull-tab)	AS-FLSH-004
	4 Meg PCMCIA auxiliary memory card (-40 ... +70C, 150nS, with conformal coat ing, with pull-tab)	AS-FLSH-004C
	5 PCMCIA card pull-tabs	042710786
	120 Vac to 24 Vdc Power Converter	AS-P120-000
	125 Vdc to 24 Vdc Power Converter	AS-P120-125
	240 Vac to 24 Vdc Power Converter	AS-P120-250
	240 Vac to 24 Vdc Power Converter	AS-PRTU-252
	240 Vac to 24 Vdc Power Converter	AS-PRTU-258
	1.0 gram tube of Nyogel contact lubricant for conformally coated products	99-C759-000
	2.0 ounce tube of Nyogel contact lubricant for conformally coated products	99-C759-100
Housing	Primary, with 2 slots for Controller and 3 I/O slots	AS-HDTA-200
	Secondary with 5 I/O slots	AS-HDTA-201
	Secondary with 2 I/O slots	AS-HDTA-202
	Primary, with 2 slots for Controller and 3 I/O slots with conformal coating	AS-HDTA-200C
	Secondary with 5 I/O slots with conformal coating	AS-HDTA-201C
	Secondary with 2 I/O slots with conformal coating	AS-HDTA-202C
	3.5 in Diskette Storage Box	AS-HBOX-201

Cables (A984, E984-24x/25x)	RS-232C cable with 25-pin IBM-XT panel connection	AS-W951-012
	RS-232C cable with 9-pin IBM-AT panel connection	AS-W952-012
Cables (E984-258/265/275/285)	RJ45 adapter connector pre made for PC-ATs (9-pin)	110XCA20300
	RJ45 adapter connector wire-it-yourself (male) for PC-ATs (9-pin)	110XCA20301
	RJ45 adapter connector wire-it-yourself (female) for PC-ATs (9-pin)	110XCA20302
	RJ45 adapter connector pre made for PC-XTs (25-pin)	110XCA20400
	RJ45 adapter connector wire-it-yourself (male) for PC-XT (25-pin)	110XCA20401
	RJ45 adapter connector wire-it-yourself (female) for PC-XT (25-pin)	110XCA20402
	RS-232 communication cable assemblies (with RJ45 connectors on both ends)	110XCA28201 3ft (1m)110XCA28202 10ft (3m)110XCA28203 20ft (6m)
Front Covers	I/O module cover - 2 slot	043507936
	I/O module cover - 5 slot	043507935
Cables for Backplanes	I/O Bus Extension Cable (30-pin female-to-female connectors)	AS-WBXT-201
	I/O Bus Extension Cable (30-pin female-to-male connectors)	AS-WBXT-203
Batteries*	Eternacell	60-0576-000
	Maxell	60-0576-100
	Saft	60-0576-100
	Battery dummy	AS-BDUM-001
*Due to size differences, Eternacell batteries must be replaced with other Eternacells. Maxell and Saft batteries are interchangeable.		
Other Accessories	Terminal Block Removal Tool (included with Controller)	AS-0TBP-000
	8 Toggle Switch Simulator for 24 VDC Input Modules	AS-0SIM-011

A120 I/O Modules

A120 I/O Modules

The following information describes the A120 I/O modules that are available with the Compact PLC family.
Some A120 I/O modules (DEP 211/214/215/217, DAP211/217, ADU204/211/214/216, DAU204, VIC2xx, and MOT20x) require loadables (SW-IODR-001) for proper operation if used with Modsoft and certain PLCs, such as the A984-1xx or the E984-24x/251/255. However, separate loadables are not needed if used with Concept and other PLCs, such as the E984-258/265/275/285. For more information, refer to the *A120 Series I/O Modules User Guide* (890 USE 109 00, formerly GM-A984-IOS).
The following table describes the available A120 I/O modules.

Discrete Input Modules	8 point 230 Vac	AS-BDEP-208
	8 point 115 Vac	AS-BDEP-209
	8 point 115 Vac	AS-BDEP-210*
	8 point 115 Vac	AS-BDEP-211*
	16 point 10 ... 60 Vdc	AS-BDEP-214*/254/254C
	16 point 5Vdc	AS-BDEP-215*
	16 point 24 Vdc (isolated)	AS-BDEP-216/256/256C
	16 point 24 Vdc	AS-BDEP-217
	16 point 155Vac	AS-BDEP-218*
	16 point 24 Vdc (non-isolated)	AS-BDEO-216
	16 point 24 Vdc Fast Response	AS-BDEP-220
	16 point 110 Vdc	AS-BDEP-257*/257C
	16 point 60 Vdc	AS-BDEP-296
	16 point 48 Vdc	AS-BDEP-297
Discrete Output Modules	4 point Relay	AS-BDAP-204
	8 point Relay	AS-BDAP-208/258/258C
	8 point 115 Vac	AS-BDAP-209
	8 point 24-230 Vac	AS-BDAP-210*
	16 point 24 Vdc (isolated)	AS-BDAP-216N
	16 point 5-24 Vdc	AS-BDAP-217*
	16 point 24-240Vac	AS-BDAP-218*
	16 point 24 Vdc	AS-BDAO-216*

Discrete Combination Modules	4 point 120 Vac in / 4 point 120 Vac out	AS-BDAP-211*
	8 point 24 Vdc in / 4 point Relay out	AS-BDAP-212/252/252C
	8 point 24 Vdc in / 8 point 24 VDC/2 A out	AS-BDAP-220/250/250C
	8 point 24 Vdc in / 4 point relay 24 Vdc out	AS-BDAP-252
	8 point 110 Vdc in / 4 point relay 110 Vdc out	AS-BDAP-253/253C
	8 point 60 Vdc in / 4 point relay 60 Vdc out	AS-BDAP-292
Analog Input Modules	4 channel +500 me, RTD	AS-BADU-204/254/254C
	4 channel +10 V/+20 mA	AS-BADU-205
	4 channel 12 bit	AS-BADU-206*/256/256C
	4 channel 13 ... 15 bit, +5V, +10V, 0 ... 10V, 2 ... 10V, 0 ... 5V, 1 ... 5V +20mA, 0 ... 20mA, 4 ... 20mA,	**AS-BADU-210*
	8 channel 12 bit, RTD, TC, Vdc, mA	**AS-BADU-211*
	8 channel 12 bit, RTD, TC, Vdc, mA	**AS-BADU-212*
	8 channel 12 bit, RTD, Vdc, mA	**AS-BADU-214*
	8 channel 15 bit, TC, Vdc	AS-BADU-216*
	8/4 channel 16 bit, TC, RTD, +/- 100mV, 0 ... 4000Ohms	AS-BADU-257/257C*
Analog Output Modules	2 channel +1 V, +10 V, +20 mA	AS-BDAU-202/252/252C
	4 channel, 12 bit, RTD, TC, Vdc, mA	AS-BDAU-204*
	8 channel, 12 bit	AS-BDAU-208*
Intelligent Modules	1 channel High Speed Counter/ Positioning Module	AS-BZAE-201*
	4 channel, 50 kHz High Speed Counter Module	**AS-BZAE-204*
	Encoder or Resolver/Encoder Motion Module	AS-MOT-20X*
	4- point High Speed Input Module	**AS-VIC-2XX*,**AS-VRC-2XX*, **AS-CTR-2XX*
	4- point Frequency and Speed Measurement Input Module, 1 kHz	AS-FRQ-204
	4- point Frequency and Speed Measurement Input Module, 1 kHz with Extended Temperature	AS-FRQ-254

Communication Interfaces	Interbus S Master	AS-BBKF-201
	Interbus S Slave	AS-BBKF-202
	Interbus S Interface for A120 I/O	AS-BDEA-202
	Profibus DP Slave for A120 I/O	AS-BDEA-203/253/253C
Special Modules	Empty module with terminals for prewiring a slot	AS-BNUL-200
	Connection multiplexer for <50 V, <6 A	AS-BNUL-202
	2 potentiometer, 1 meter ana log simulator	AS-BSIM-203
	16 point input simulator for DEP 216 Module	AS-BSIM-216
**Modules not supported in Concept 2.1 or higher. *Modules not supported by the PC-0984-1XX PLCs.		

Health Status

F

At a Glance

Introduction

The following information comprises a detailed description of the health status of the Compact PLCs.

What's in this Chapter?

This chapter contains the following topics:

Checking System's Health Status

System Health Status

The Compact Controllers maintain a table in memory that contains vital system diagnostic information regarding the CPU, I/O, and communications. The following information explains how Its contents are structured.
The following table lists the vital system diagnostic information that is kept in memory.

Status Word	Content of Status Register
1 ... 11	Controller status information
12 ... 15	Health of A120 I/O modules
16 ... 181	Not used
182 ... 184	Global health and communications retry status

Each status word is 16 bits long, and the status information is conveyed by the sense of the bits in each word. The illustrations in this map show how the status information is presented in the status table.
The words in the status table can be accessed in ladder logic using the STAT instruction. The STAT block displays the bit patterns of the status words in a table of contiguous 4x registers, the values of which can then be seen in the panel software.

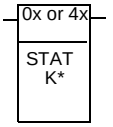
Note: Although you can specify either a 0*x* or 4*x* register in the top node, we recommend that you specify a 4*x* because of the excessive number of 0*x* registers that would be required to manage the status information.

The register that you specify in the top node of the block is loaded with the current *word 1* bit values, and the number of registers that you specify in the bottom node are loaded with bit values from the corresponding words in the status table.
For example, if you are interested only in accessing controller status information, you could specify a register address of 40701 in the top node of the block and a value of 11 in the bottom node; the bit values of the first 11 words in the status table are loaded into registers 40701 ... 40711, respectively.
To load the whole status table, specify 184 in the bottom node of the instruction. If you are not using expanded I/O, you need to specify only 40 in the bottom node to receive all relevant status information.

Note: You do not have to use the whole status table (184 words).

STAT Block Depiction

STAT is a two-high node instruction as the following conceptual depiction shows.

Instruction	Structure	Inputs	Nodes	Outputs	Function
Check CPU/ I/O Status	This is the block. 	Top: ON accesses the status table	Top: First word in the system status table Bottom: Size of the status table	Top: Operation completed	Gets status data from the status table in system memory and displays it in user registers
*K is an integer constant in the range of 1 ... 184					

Mainframe Status

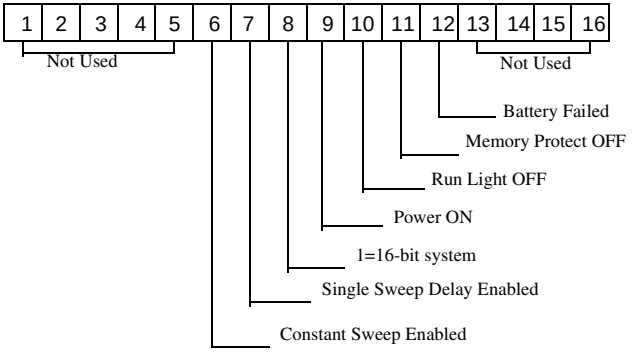
Mainframe Status Table of Registers

The first 11 words of the table of registers contains mainframe status information.

Note: Bits are mapped 1 ... 16. In all cases, Bit 1 represents the most significant bit (MSB) in a word.

Word 1 CPU Status

If the bit is set to "1", the condition is TRUE.



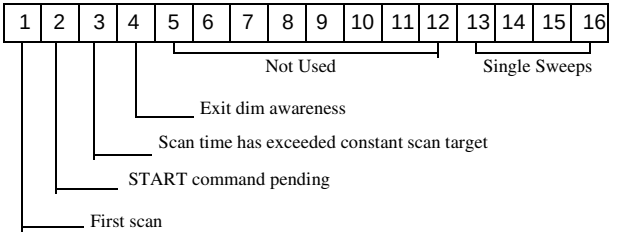
This table describes each bit.

Bit 6	**Constant Sweep Enabled**	**1=Constant sweep, 0=not constant sweep**
Bit 7	Single Sweep	1=Single sweep, 0=not single sweep, subject to other conditions, i.e. no stop states
Bit 8	Small/Large nodes	1=small, 0=large
Bit 9	Power OK	1=on, 0=off
Bit 10	Run Light	1=off, 0=on
Bit 11	Memory Protect	1=off, 0=on
Bit 12	Battery OK	1=not OK, 0=OK

Word 2 Not Used

Word 3
Controller Status

If the bit is set to "1", the condition is TRUE.



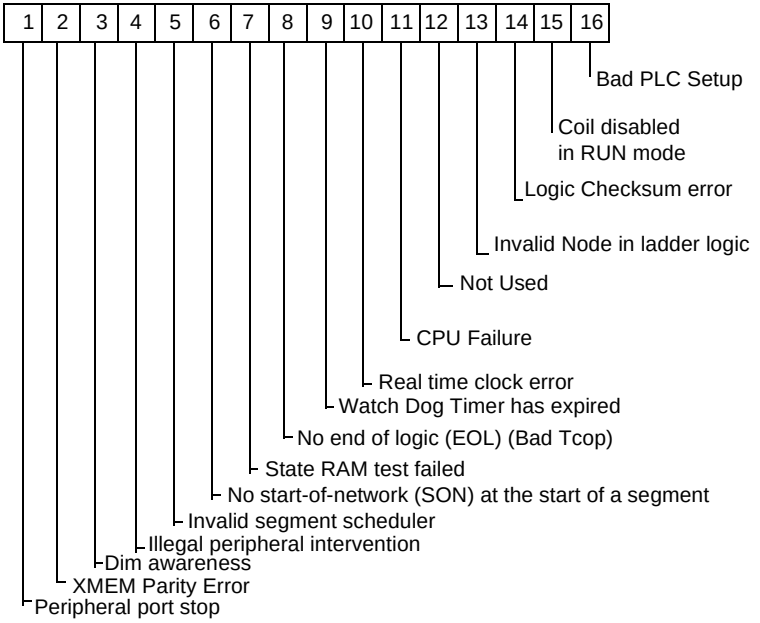
This table describes the word 3 bit states.

Bit 1	First Scan	1=First scan happening, 0=not first scan
Bit 2	Start Command Pending	Used by peripheral port and power up routine
Bit 3	Constant Sweep Exceeded	This bit is set when constant sweep is enabled, 1=sweep time exceeded constant sweep target, 0=sweep time was less, so executive waited
Bit 4	Exiting Dim Awareness	1=Condition is true, 0=Condition is false
Bit 13-16	Single Sweep Trigger	When these bits are not 0 and single sweep is enabled, execute a sweep. Allows bursts of up to 15 sweeps. These bits decrement at the end of the sweep until 0.

Word 4
Not Used

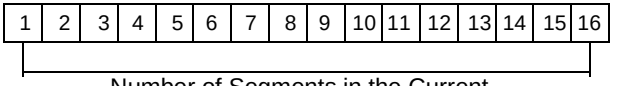
Word 5
CPU Stop State Conditions

If the bit is set to "1", the condition is TRUE.



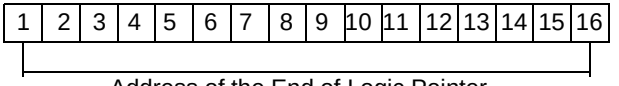
Word 6
Number of Segments in Program

Number of segments in current system. This word is confirmed during power up to be the number of EOS (DOIO) nodes plus 1 (for the end of logic nodes), if untrue, a stop code is set, causing the run light to be off.



Word 7
Address of the End of Logic Pointer

The EOL pointer in page F. This EOL pointer gives the word offset into page 0 where the user logic ends. To find this pointer examine word 7. Word 7 gives the word offset into page F where the EOL pointer may be found. The EOL pointer may be displayed in hexadecimal, decimal or binary using Modsoft. Most applications use hexadecimal.



Word 8
Memory Sizing

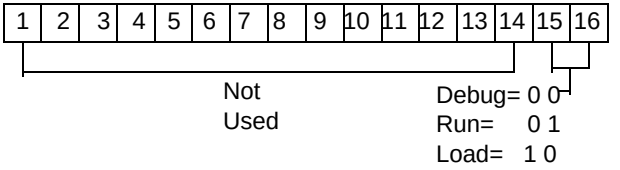
This word is used only with the A984-141/145, E984-241/245, and E984-251/255. It provides user logic re-size value after optimization (this is the actual length of available user logic). For all other models this word is zero (no optimization).

Note: This is not the RI/O time out constant as shown in the Modsoft status screen.

Word 9
Not Used

Word 10
Run/Load/Debug
Status

This word is used to speed up the performance of the controller.



This table describes the Word 10 bit states.

Bit 15-16	Debug Mode	Coils may be disabled and power flow may be requested
	Run Mode	Disable status of coils are ignored and no power flow request allowed
	Load Mode	Set during loading and set back to 0 or 1 when load is completed. This enables skipping of plotting of SON table during loading and thus speeds up the load process.

Word 11
Not Used

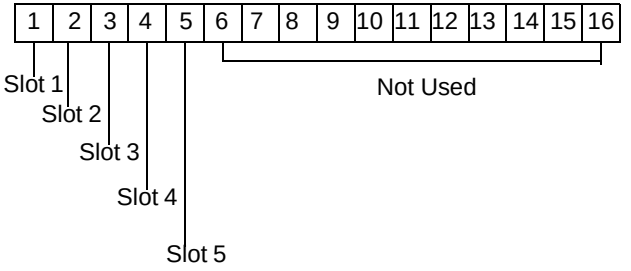
I/O Module Health Status

Overview of the I/O Module Health Status

Words 12 ... 15 display the health of the A120 I/O modules in the four racks. The following table shows the layout..

Word No.	Rack No.
Word 12	Rack 1
Word 13	Rack 2
Word 14	Rack 3
Word 15	Rack 4

Each word contains the health status of up to five A120 I/O modules. The most significant (left-most) bit represents the health of the module in Slot 1 of the rack: If the bit is set to "1", the condition is TRUE.



If a module is I/O Mapped and Active, the bit has a value of "1". If a modules is inactive or not I/O Mapped, the bit has a value of "0".

Note: Slots 1 and 2 in Rack 1 (Word 12) are not used because they are reserved for use by the controller itself.

Status Information

Structure of Status Information

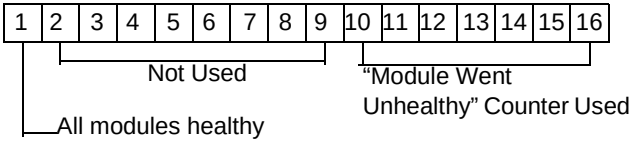
Three words contain health and communication information on the installed I/O modules.
If monitored with the Stat block, they are found in Words 182 through 184. This means that, at a minimum, the length of the Stat block must be 184.

Words 16 ... 181 Not Used

Words 16 through 181 are not used.

Word 182 Health Status

Word 182 increments each time a module becomes bad. After a module becomes bad, this counter does not increment again until the module becomes good and then bad again.
If the bit is ‘1", then this condition is true or ON.
The following figure shows Word 182.



Bit 1 is set if all modules are healthy. Bits 9 ... 16 are a counter that increments if a module is unhealthy. It will roll over at a count of 255.

Word 183 I/O Error Counter

This error counter is similar to that for a good/bad module. This word, however, increments every scan that a module remains in the bad state.

Word 184 PAB Bus Retry Counter

Diagnostics are performed on the communications through the bus. This word should normally be all zeros. If after 5 retires, a bus error is still detected, the controller will stop and error code 10 will be displayed. An error rolls over while running. If the retires are less than 5, no bus error is detected.

Troubleshooting and Maintenance

G

At a Glance

Introduction

The following information relates to troubleshooting and maintenance of the Compact PLCs.

What's in this Chapter?

This chapter contains the following topics:

PLC Codes

PLC Error Codes

A 984 PLC, the Compact contains a set of 17 error codes. If the PLC stops, the error code(s) are displayed on your panel screen.
This table provides information about the seventeen **Stopped PLC Error Codes** of the Compact Controller.

Stop Bits	Mnemonic	Description
0x7FFF	PCSICK	Controller unhealthy
0x8000	PCSTOPPED	Controller stopped
0x4000	BADTCOP	Bad I/O traffic cop table
0x2000	DIMAWAR	Controller in DIM AWARENESS state
0x1000	PORTIVENT	Bad port intervention
0x0800	BADSEGSCH	Bad segment scheduler
0x0400	SONNOTIST	Start of network (SON) did not start segment
0x0200	PDCHEKSUM	Bad power-down checksum
0x0100	NOEOLDOIO	No EOL detected; Bad Network
0x0080	WDTEXPIRE	Watchdog timer has expired
0x0040	RTCFAILED	Real time clock failure
0x0020	BADOXUSED	Bad coil used table
0x0010	PABCOMMERR	CPU to I/O Communication Failure
0x0008	NODETYPE	Illegal node type used
0x0004	ULCSUMERR	User logic checksum error
0x0002	DSCRDISAB	Discrete disable error
0x0001	BADCONFIG	Bad configuration table

Stopped error states of various controller nodes may be sent over the Modbus Plus network using Modbus function 11 hex. Refer to the *Modbus Plus Network Planning and Installation Guide* (890USE10000).

Note: Some errors may appear together, i.e. 8200. Refer to status word for exact bit structure of stop code.

LED Error Codes

Flashing RUN LED Error Codes E984-258/265/275/285

The following tables show the number of times that the Run LED program flashes for each error type and the crash code for the error. (All codes are in hex).

Note: Crash codes are accessible while the exec is flashing.

This table lists the number of flashes indicating each specific Run LED error, the code for the error, and a description of the error.

Number of Flashes	Code	Requested Kernel Mode
Continuous	0000	modbus cmd-buffer overflow
2	0201	modbus cmd-length is zero
	0202	modbus abort command error
	0203	run output active failed
	0204	bad mbp response opcode
	0205	mbp out of synchronization
	0206	mbp invalid path
	0207	page 0 not paragraph aligned
	0208	bad receive communication state
	0209	bad transmit communication state
	020A	bad communication state trn_asc
	020B	bad communication state trn_rtu
	020C	bad communication state rcv_rtu
	020D	bad communication state rcv_asc
	020E	bad modbus state tmr0_evt
	020F	bad modbus state trn-int
	0210	bad modbus state rcv-int
	0211	stack error in MB cmd hndlr
	0212	host ifc opcode unknown
	0213	host ifc diagnostic failed
	0214	host addr xlat error
	0215	bus grant not received

Number of Flashes	Code	Requested Kernel Mode
3	0301	not master asic on cpu
	0302	master config write bad
	0303	lms bus DPM write failure
	0304	plc asic loopback test asic/dpm
	0305	plc asic BAD_DATA
	0306	P.O.S.T BAD MPU ERROR
4	0401	BAD INTERRUPT
	0402	ram error during sizing
	0405	mbp bus interface error
	0406	timeout waiting for mbp
	0407	bad external uart hardware
	0408	bad external uart interrupt
5	0501	bad RTC hardware
6	0601	ram address test error
7	0701	ram data test error

Number of Flashes	Code	Requested Kernel Mode
8	8001	bad executive checksum
	8002	kernel prom checksum error
	8003	flash prog /erase error
	8004	unexpected executive return
	8014	unexpected int1
	8024	divide error
	8034	debug exception
	8044	breakpoint
	8054	overflow
	8064	bounds fault
	8074	invalid opcode
	8084	device not available
	8094	double fault
	80a4	invalid tss
	80b4	segment not present
	80c4	stack fault
	80d4	general protection fault
	80d4	page fault
	80e4	floating point error
	80f4	alignment fault

	0202	modbus cmd-length is zero
	0203	modbus abort command error
	0204	run output active failed
	0205	bad mbp response opcode
	0206	mbp out of synchronization
	0207	mbp invalid path
	0208	page 0 not paragraph aligned
	0209	bad receive communication state
	020A	bad transmit communication state
	020B	bad communication state trn_asc
	020C	bad communication state trn_rtu
	020D	bad communication state rcv_rtu
	020E	bad communication state rcv_asc
	020F	bad modbus state tmr0_evt
	0210	bad modbus state trn-int
	0211	bad modbus state rcv-int
	0212	stack error in MB cmd hndlr
	0213	host ifc opcode unknown
	0214	host ifc diagnostic failed
	0215	host addr xlat error
3	0301	bus grant not received
	0302	not master asic on cpu
	0303	master config write bad
	0304	lms bus DPM write failure
	0305	plc asic loopback test asic/dpm
	0306	plc asic BAD_DATA
4	0401	P.O.S.T BAD MPU ERROR
	0402	BAD INTERRUPT
	0403	ram error during sizing
	0402	mbp bus interface error
	0405	timeout waiting for mbp
	0406	bad external uart hardware
	0407	bad external uart interrupt
	0408	bad RTC hardware

5	0501	ram address test error
6	0601	ram data test error
7	0701	bad executive checksum
8	8001	kernel prom checksum error
	8002	flash prog /erase error
	8003	unexpected executive return
	8004	unexpected int1
	8014	divide error
	8024	debug exception
	8034	breakpoint
	8044	overflow
	8054	bounds fault
	8064	invalid opcode
	8074	device not available
	8084	double fault
	8094	invalid tss
	80a4	segment not present
	80b4	stack fault
	80c4	general protection fault
	80d4	page fault
	80e4	floating point error
	80f4	alignment fault

Modbus Plus LEDs A984-145, E984-245/255/265/275/285

The MB Plus LED is a green indicator that shows the type of communication activity on the Modbus Plus port of the controller. A specific flash pattern indicates the nature of the current Modbus Plus communication activity:
The following table explains the flash patterns for the **Modbus Plus LEDs**.

LED Flash Pattern	Description
Six flashes per second	The normal operating state for a Modbus Plus node. The node is successfully receiving and passing the token. All nodes on the network should be flashing this pattern.
One flash per second	The node is offline immediately after power up, or after hearing a message from a node with the same address. (Duplicate addressing is not allowed.) In this state, the node monitors the network and builds a table of active nodes and token-holding nodes. It remains in this state for five seconds; then it attempts to go to its normal operating state.
Two flashes, then OFF for two seconds	The node is hearing the token being passed among other nodes, but it never receives the token. Check the network link for an open or short circuit, or for a defective termination.
Three flashes, then OFF for 1.7 seconds	The node is not hearing other nodes. It periodically claims the token, but it finds no other node to which to pass it. Check the network link for an open or short circuit, or for a defective termination.
Four flashes, then OFF for 1.4 seconds	The node heard a valid message from another node, using the same address as this node. The node remains offline in this state as long as it continues to hear the duplicate address. If the duplicate address is not heard for five seconds, the node changes to the pattern of one flash every second.

Battery Maintenance

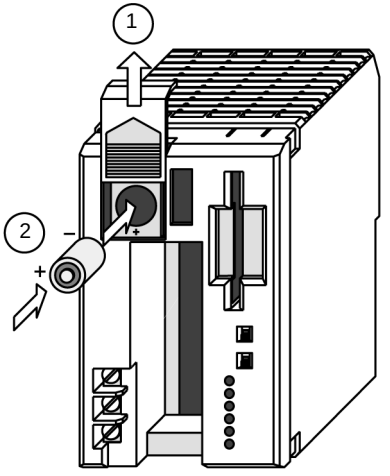
Battery Maintenance

The batteries are used to back up the RAM and to provide power to the clock. You can access the batteries from the front of the Compact PLCs after you remove the front panel of the DTA 200.
A new battery is needed when the battery low LED (red) comes ON. The LED indicates the battery needs to be replaced but it has: a 14 day hold-up for A984-1xx, E984-24x/251/255 PLCs, or a 10 day hold-up for E984-258/265/275/285 PLCs from the initial indication. The minimum backup retention period is one-hundred days. You should replace the battery every five years to assure its backup capacity. Ensure the supply voltage is switched ON. Remove the DTA 200 front panel, battery compartment cover, and the battery. Then insert the new battery (+ pole towards you) and note the date.

CAUTION

Used batteries are hazardous refuse

Please properly dispose of used batteries. Never disassemble, short-circuit or recharge Lithium batteries. There is the possibility of supercharge (voltage reversal) if a battery is overheated by external heat sources.
The following figure shows the proper placement of the battery.



Failure to observe this precaution can result in injury or equipment damage.

Conformally Coated Maintenance

Maintaining Conformally Coated Products

Use the following information to perform periodic maintenance on any Modicon conformally coated product. A 2 gram container of Nyogel ships with the conformal coated PLCs.

- All electrical contacts (such as PCB gold edge contacts, field wiring connector contacts, backplane connectors, and grounding pins), should receive a light application of Nyogel 759G Contact Lubricant. A typical contact pair should have an amount applied no greater in size than a sphere 1/16 inch in diameter.
- If a conformally coated product requires cleaning, the following products are recommended:
  de-ionized water, with or without mild detergent; MicroCare ProClean MCC-PRO; or MicroCare MultiClean MCC-MLC;
- Nyogel can be ordered from Schneider Automation:
  in a 1.0 gram tube (P/N 99-C759-000), or in a 2.0 ounce tube (P/N 99-C759-100)
- MicroCare ProClean is available from suppliers in a 12 ounce aerosol spray can (P/N MCC-PRO); MicroCare MultiClean is available in a 10 ounce aerosol spray can (P/N MCC-MLC).

Customer Service & Technical Assistance

Customer Service Information

Schneider Automation telephone numbers are as follows:

- To call us from anywhere in North America except from within the state of Massachusetts: 1-(800)-468-5342
- To call us from within Massachusetts or from outside North America: 1-(978)-975-5001
- To call us in Seligenstadt, Germany: (49) 6182 81 2900, or fax us at (49) 6182 81 2492

  Customer Service- When calling the Schneider Automation telephone number, ask for service from the list below.

  When calling the 800 number, you will get a recording asking you to enter a one digit code for the type of service you want (listed below). However, this only works with a "touch tone" phone. If using a dial phone, hang on and the operator will intercept after a short pause.

  The service categories- and *extra digit* code responses for push-button phones are: 1-Technical support, 2-Service order administration, 3 -Modfax, 4 -Training/ information, 5 -General information other than above.

Note: MODFAX: For available hardware data sheets, application notes, and software information. Recommended catalogue MC-FAX-DIR which is the master of all available catalogues (only twelve pages) lists all catalogues available on the MODFAX system.

Note: BBS (Schneider Automation's Customer Service Bulletin Board): For Modsoft updates, conversion utilities, hardware and software help, field service bulletins, Modbus and Modbus Plus help, software revision levels, FLASH EXEC updates for 984E controllers, and more. Parameters are up to 14.4k baud, no parity, 8 data, 1 stop, phone 1-(978)-975-9779.

Refer to the table for the correct bin files for your E984 Compact controller.

Model	Exec ID	Bin #
PC-E984-241	843	CPU_11.bin
PC-E984-245	84D	CPU_12.bin
PC-E984-251	844	CPU_31.bin
PC-E984-255	84C	CPU_32.bin
PC-E984-258	845	ctsxv200.bin
PC-E984-265	845	ctsxv200.bin
PC-E984-275	845	ctsxv200.bin
PC-E984-285	845	ctsxv200.bin

Note: Internet access to modfax documentation and .bin file flash exec updates, as well as other Schneider Automation services and information may be found at our Web site at *www.modicon.com*.

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