



Allen-Bradley

***AIC+ Advanced
Interface
Converter***

(Cat. No. 1761-NET-AIC)

User Manual

Allen-Bradley Parts

Important User Information

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

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

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

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



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

Attention statements help you to:

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

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

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Read this preface to familiarize yourself with the rest of the manual.

This preface covers the following topics:

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

Who Should Use this Manual

Use this manual if you are responsible for designing, installing, programming, or troubleshooting control systems that use Allen–Bradley small logic controllers.

You should have a basic understanding of MicroLogix™ products. You should understand programmable controllers and be able to interpret the ladder logic instructions required to control your application. If you do not, contact your local Allen–Bradley representative for information on available training courses before using this product.

Purpose of this Manual

This manual is a reference guide for the Advanced Interface Converter (AIC+).

This manual:

- gives you an overview of the AIC+ operation
- explains the procedures you need to install and wire the AIC+

Contents of this Manual

Chapter	Title	Contents
	Preface	Describes the purpose, background, and scope of this manual. Also specifies the audience for whom this manual is intended.
1	Product Overview	Explains and illustrates the theory behind the AIC+ operation. Covers hardware and software features.
2	Installation and Wiring	Provides installation procedures and wiring guidelines.
3	Network Connections	Provides guidelines for connecting to a network.
4	Troubleshooting	Explains how to interpret and correct problems with your AIC+.
Appendix A	Specifications	Provides physical, electrical, environmental, and functional specifications for the AIC+.

Related Documentation

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

For	Read this Document	Document Number
Setting up a DH-485 network	SLC 500 Modular Hardware Style Installation and Operation Manual	1747-6.2
	MicroLogix 1000 Programmable Controllers User Manual	1761-6.3
DF1 protocol	SLC 500 Modular Hardware Style Installation and Operation Manual	1747-6.2
	Data Highway/Data Highway Plus™ Station Connector Installation Data	1770-6.2.2
	Data Highway/DH+/DH-485 Communication Protocol and Command Set Reference Manual	1770-6.5.16
MicroLogix 1000 Controllers	MicroLogix 1000 Programmable Controllers User Manual	1761-6.3
SLC 500 Processors	SLC 500 Modular Hardware Style Installation and Operation Manual	1747-6.2
Recommended third party devices	Rockwell Automation Encompass™ Product Directory (The Americas)	6873
Cable wiring techniques	Industrial Automation Wiring and Grounding Guidelines	1770-4.1
A complete listing of current Allen–Bradley documentation, including ordering instructions. Also indicates whether the documents are available on CD-ROM or in multi-languages.	Allen–Bradley Publication Index	SD499
A glossary of industrial automation terms and abbreviations	Allen–Bradley Industrial Automation Glossary	AG-7.1

Common Techniques Used in this Manual

The following conventions are used throughout this manual:

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



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

Allen-Bradley Support

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

Local Product Support

Contact your local Allen-Bradley representative for:

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

Technical Product Assistance

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

Your Questions or Comments on this Manual

If you find a problem with this manual, please notify us of it on the enclosed Publication Problem Report.

If you have any suggestions for how this manual could be made more useful to you, please contact us at the address below:

Allen-Bradley Company, Inc.
Control and Information Group
Technical Communication, Dept. A602V, T122
P.O. Box 2086
Milwaukee, WI 53201-2086

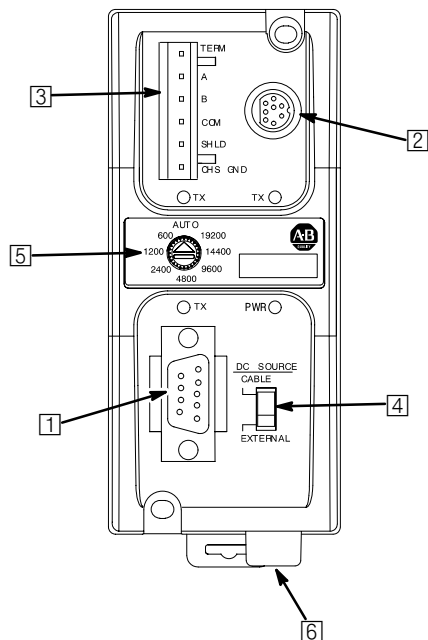
Allen-Bradley Parts

Product Overview

Description

The AIC+ advanced interface converter provides a communication link between various networked devices. Ports 1, 2, and 3 are used for making the communication connections. The AIC+ is compatible with a variety of SLC™ and MicroLogix™ controllers and peripherals.

MicroLogix controllers provide power to the AIC+ via port 2's cable. However, if a MicroLogix controller is not connected to port 2, a 24V dc power supply connected to the converter's external power terminals is required. The DC power source selector switch needs to be set for your particular configuration. See Network Diagrams on pages 3-1 through 3-9 for more details on how to wire and configure the AIC+.



The baud rate selector switch is used to match the baud rate filter of the AIC+ to the network baud rate. This switch *does not* change the network baud rate and is normally left in the AUTO position. In high noise environments, the baud rate selector switch should be taken out of the AUTO mode and set to the same baud rate as the network. See Auto Transmit Delay on page A-2 for more information on baud rates.

Item	Description
1	Port 1 – DB-9 RS-232, DTE
2	Port 2 – mini-DIN 8 RS-232
3	Port 3 – RS-485 Phoenix plug
4	DC Power Source selector switch
5	Baud Rate Filter selector switch
6	Terminals for external 24V dc power supply and chassis ground

Operating Modes

The AIC+ can be used in the following modes:

- point-to-point isolator (see page 3-1)
- RS-232 to RS-485 isolator (see pages 3-2 through 3-8)
- RS-232 to half-duplex “user mode” ASCII isolator (see page 3-8)

Communication is established using hardware handshaking or auto transmit signals. For more information on hardware handshaking, see page A-1. For more information on auto transmitting, see page A-2.

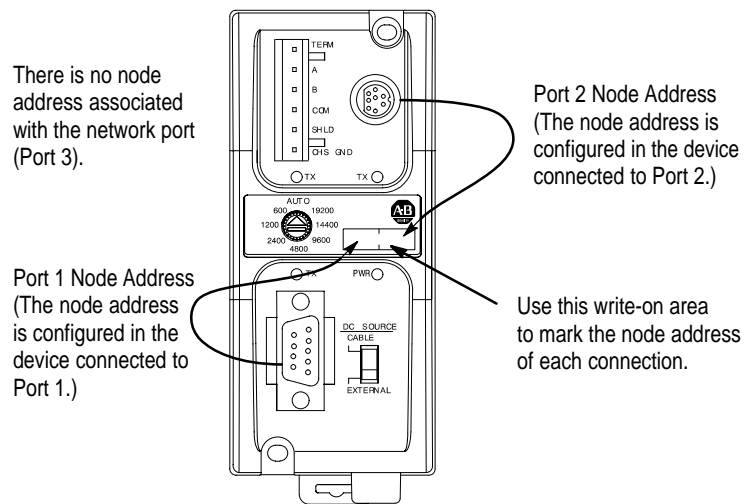
Device Compatibility

The AIC+ can be used to interconnect the following devices:

- SLC 500™, 5/01™, 5/02™, and 5/03™ processors (channel 1)
- SLC 5/03, 5/04™, and 5/05™ processors (channel 0)
- MicroLogix 1000 controllers
- Operator interface devices
- PC serial ports (or any 9-pin DTE serial port)
- Modems

Note: The 1761-HHP-B30 Hand-Held Programmer is not connectable to the AIC+ advanced interface converter.

Node Address Identification



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Installation and Wiring

Compliance to European Union Directives

If this product has the CE mark it is approved for installation within the European Union and EEA regions. It has been designed and tested to meet the following directives.

EMC Directive

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

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

This product is intended for use in an industrial environment.

Low Voltage Directive

This product is tested to meet Council Directive 73/23/EEC Low Voltage, by applying the safety requirements of EN 61131-2 Programmable Controllers, Part 2 – Equipment Requirements and Tests.

For specific information required by EN 61131-2, see the appropriate sections in this publication, as well as the following Allen-Bradley publications:

- Industrial Automation Wiring and Grounding Guidelines For Noise Immunity, publication 1770-4.1
- Guidelines for Handling Lithium Batteries, publication AG-5.4
- Automation Systems Catalog, publication B111

Safety Considerations

This equipment is suitable for use in Class I, Division 2, Groups A, B, C, D, or non-hazardous locations only.



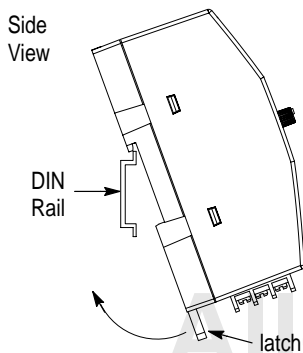
ATTENTION: Explosion Hazard

- Substitution of components may impair suitability for Class I, Division 2.
- Do not replace components or disconnect equipment unless power is switched off and the area is known to be non-hazardous.
- Do not connect or disconnect connectors or operate switches while circuit is live unless the area is known to be non-hazardous.
- This product must be installed in an enclosure. All cables connected to the product must remain in the enclosure or be protected by conduit or other means.
- AIC+ must be operated from an external power source.

Use only the following communication cables and replacement connectors in Class I, Division 2, Hazardous Locations.

Environment Classification	Communication Cables
Class I, Division 2 Hazardous Environment	1761-CBL-PM02 (Series C or later)
	1761-CBL-HM02 (Series C or later)
	1761-CBL-AM00 (Series C or later)
	1761-CBL-AP00 (Series C or later)
	2707-NC8 (Series B)
	2707-NC9 (Series B)
	2707-NC10 (Series B)
	2707-NC11 (Series B)
	1746-RT30 AIC+ Connector

Mounting



The AIC+ can be mounted in the vertical or horizontal position. There are no spacing requirements except as necessary for DIN rail latch movement. See page A-1 for operating temperature specification.

DIN Rail Mounting

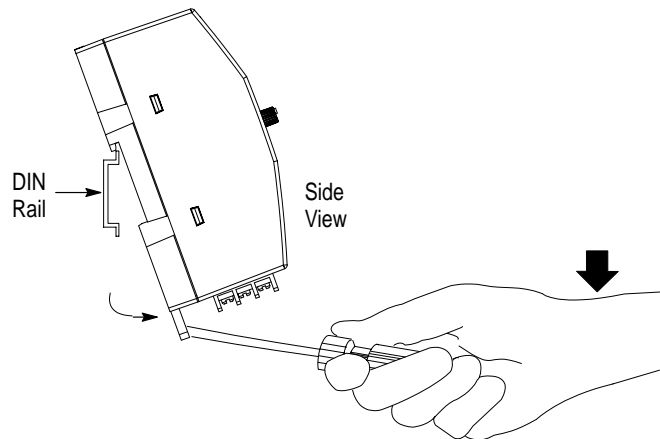
Installation

1. Mount your DIN rail.
2. Snap the DIN rail latch into the closed position.

3. Hook the top slot over the DIN rail.
4. While pressing the AIC+ against the rail, snap the AIC+ into position.

Removal

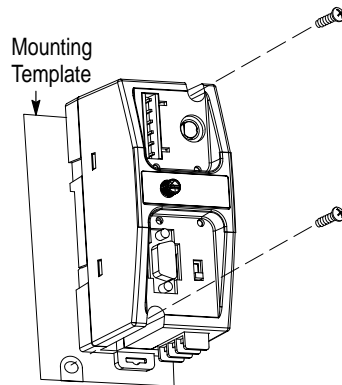
1. Place a screwdriver in the DIN rail latch at the bottom of the AIC+.
2. Holding the AIC+, pry downward on the latch until the AIC+ is released from the DIN rail.



Panel Mounting

Installation

1. Remove the mounting template from page A-3 of this document.
2. Secure the template to the mounting surface.
3. Drill holes through the template.
4. Remove the mounting template.
5. Mount the AIC+.



Wiring

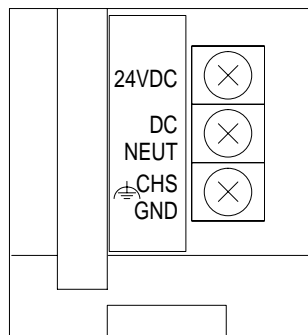
Power Supply Wiring



ATTENTION: EXPLOSION HAZARD - An external power supply must be used in Class I, Division 2 applications and the DC Power Source selector switch must be in the EXTERNAL position before connecting the power supply to the AIC+.

Important: In non-hazardous locations, external power is not required if the AIC+ port 2 is connected to a MicroLogix controller.

Bottom View



- Important:**
- Some devices provide power to the AIC+ via port 2's cable. The DC power source selector switch needs to be set for your particular configuration.
 - If you are using a 1746-P1 or 1746-P2 power supply, the AIC+ is the only device that can be connected to that power supply.
 - Always connect the CHS GND (chassis ground) terminal to the nearest earth ground. This connection must be made whether or not an external 24V dc supply is used.

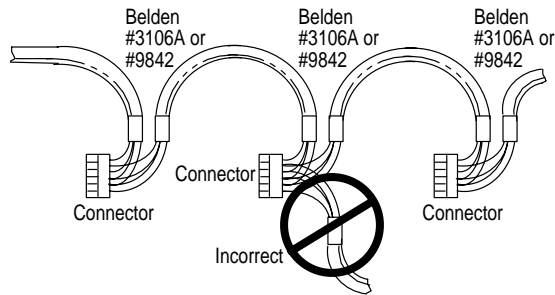
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Network Port Wiring

Use these instructions for wiring Belden™ cable. If you are using standard Allen-Bradley cables, see the Cable Selection Guide on page 2-7.

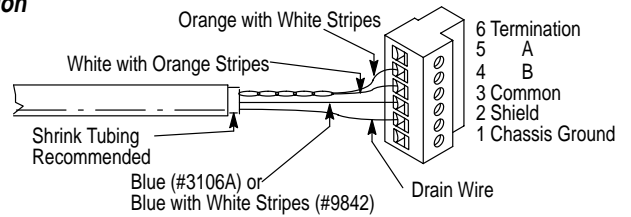
Attaching the RS-485 Connector to the Communication Cable

Important: A daisy-chained network is recommended. We do *not* recommend the following:

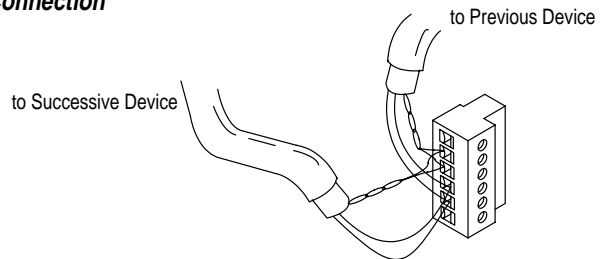


Attach the connector to the Belden #3106A or #9842 cable as shown below.

Single Cable Connection



Multiple Cable Connection



The table below shows connections for Belden #3106A.

For this Wire/Pair	Connect this Wire	To this Terminal
Shield/Drain	Non-jacketed	Terminal 2 – Shield
Blue	Blue	Terminal 3 – (Common)
White/Orange	White with Orange Stripe	Terminal 4 – (Data B)
	Orange with White Stripe	Terminal 5 – (Data A)

The table below shows connections for Belden #9842.

For this Wire/Pair	Connect this Wire	To this Terminal
Shield/Drain	Non-jacketed	Terminal 2 – Shield
Blue/White	White with Blue Stripe	Cut back – no connection ^①
	Blue with White Stripe	Terminal 3 – (Common)
White/Orange	White with Orange Stripe	Terminal 4 – (Data B)
	Orange with White Stripe	Terminal 5 – (Data A)

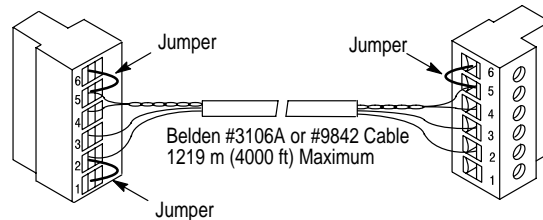
^① To prevent confusion when installing the communication cable, cut back the white with blue stripe wire immediately after the the insulation jacket is removed. This wire is not used by DH-485.

Grounding and Terminating the RS-485 Network

Only one connector at the end of the link must have Terminals 1 and 2 jumpered together. This provides an earth ground connection for the shield of the communication cable.

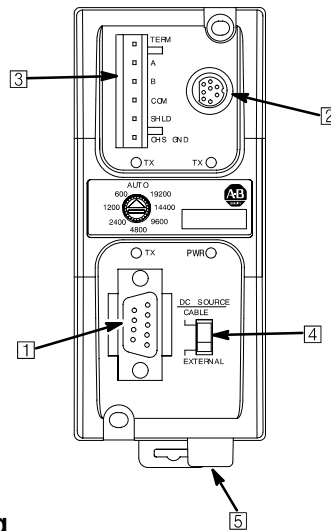
Both ends of the network must have Terminals 5 and 6 jumpered together. This connects the termination impedance (of 120 Ω) that is built into each AIC and AIC+ as required by the RS-485 specification.

End-of-Line Termination



Allen-Bradley Parts

Cable Selection Guide



Reference Drawing

Item	Description
1	Port 1 – Isolated DB-9 RS-232, DTE
2	Port 2 – Isolated Mini-DIN 8 RS-232
3	Port 3 – RS-485 Phoenix plug
4	DC Power Source selector switch (cable = port 2 power source, external = external power source connected to item 5)
5	Terminals for external 24V dc power supply and chassis ground

Selection Guide



Cable	Length	Connections	
		from	to AIC+
1747-CP3	3m (9.8 ft)	SLC 5/03 or SLC 5/04 processor, channel 0	port 1
1761-CBL-AC00	45 cm (17.7 in)	PC COM port	port 1
		PanelView 550 through NULL modem adapter	port 1
		DTAM Plus / DTAM™ Micro ^①	port 1
		Port 1 on another AIC+	port 1

^① Requires a male-to-male gender changer.



Cable	Length	Connections	
		from	to AIC+
1761-CBL-AS03	3m (9.8 ft)	SLC 500 Fixed, SLC 5/01, SLC 5/02, and SLC 5/03 processors	port 3
1761-CBL-AS09	9.9m (29.5 ft)	PanelView 550 RJ45 port	port 3



Cable	Length	Connections		External Power Supply Required	Selection Switch Setting
		from	to AIC+		
1761-CBL-AM00	45 cm (17.7 in)	MicroLogix 1000	port 2	no	cable
1761-CBL-HM02 ^②	2m (6.5 ft)	to port 2 on another AIC+	port 2	yes	external



Cable	Length	Connections		External Power Supply Required	Selection Switch Setting
		from	to AIC+		
1761-CBL-AP00	45 cm (17.7 in)	SLC 5/03 or SLC 5/04 processors, channel 0	port 2	yes	external
1761-CBL-PM02 ^②	2m (6.5 ft)	MicroLogix 1000	port 1	not applicable ^③	
		PanelView 550 through NULL modem adapter	port 2	yes	external
		DTAM Plus / DTAM Micro ^①	port 2	yes	external
		PC COM port	port 2	yes	external



Cable	Length	Connections	
		from	to AIC+
straight 9-25 pin	—	modem or other communication device	port 1

^① Requires a male-to-male gender changer.

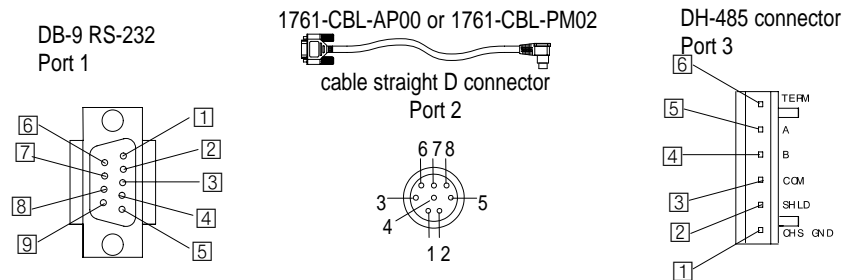
^② Series B cables are required for hardware handshaking.

^③ External power supply is required unless the AIC+ is powered by a MicroLogix controller connected to port 2 with a 1761-CBL-AM00 or 1761-CBL-HM02 or equivalent cable.

Recommended User Supplied Components.E

These components can be purchased from your local electronics supplier.

Component	Recommended Model
external power supply and chassis ground	power supply rated for 20.4–28.8V dc
NULL modem adapter	standard AT
radio modem	model MDS 9310, no hardware handshaking (Refer to Pyramid Integrator Solution Product Directory, publication PSP 5.1)
straight 9–25 pin RS-232 cable	see table below for port information if making own cables



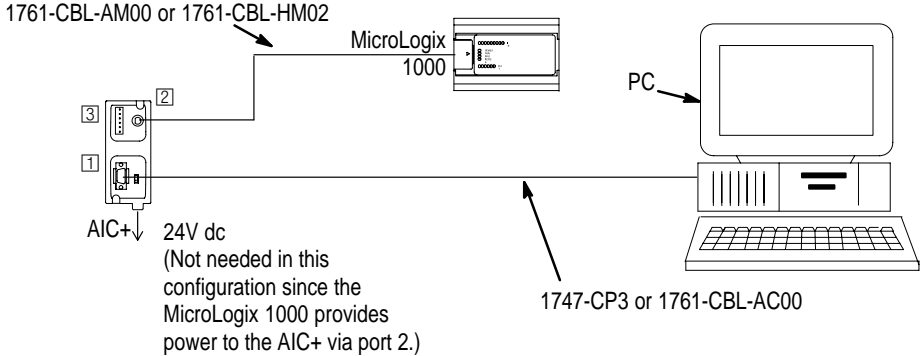
Item	Port 1 DB-9 RS-232	Port 2 ^① (1761-CBL-PM02 cable)	Port 3 DH-485 Connector
①	received line signal detector (DCD)	same state as port 1's DCD signal	chassis ground
②	received data (RxD)	received data (RxD)	cable shield
③	transmitted data (TxD)	transmitted data (TxD)	signal ground
④	DTE ready (DTR)	DTE ready (DTR)	DH-485 data B
⑤	signal common (GRD)	signal common (GRD)	DH-485 data A
⑥	DCE ready (DSR)	DCE ready (DSR)	termination
⑦	request to send (RTS)	request to send (RTS)	not applicable
⑧	clear to send (CTS)	clear to send (CTS)	not applicable
⑨	not applicable	not applicable	not applicable

^① An 8-pin mini DIN connector is used for making connections to port 2. This connector is not commercially available. If you are making a cable to connect to port 2, you must configure your cable to connect to the Allen-Bradley cable shown above.

Network Connections

Network Diagrams.C

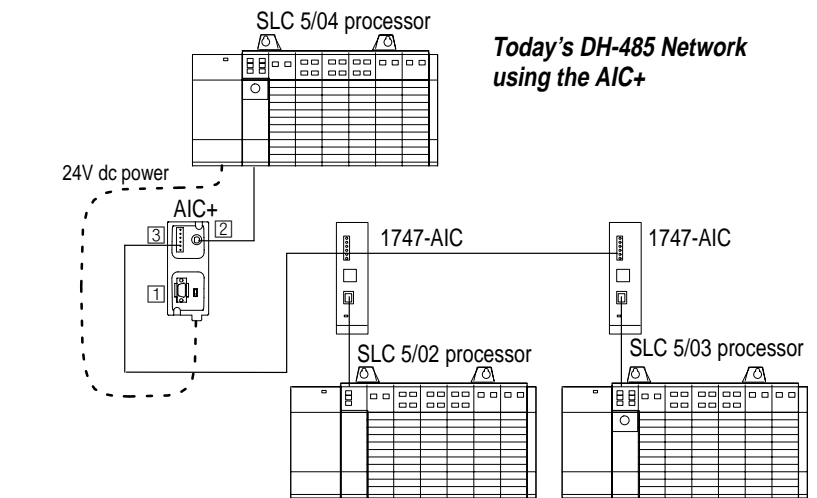
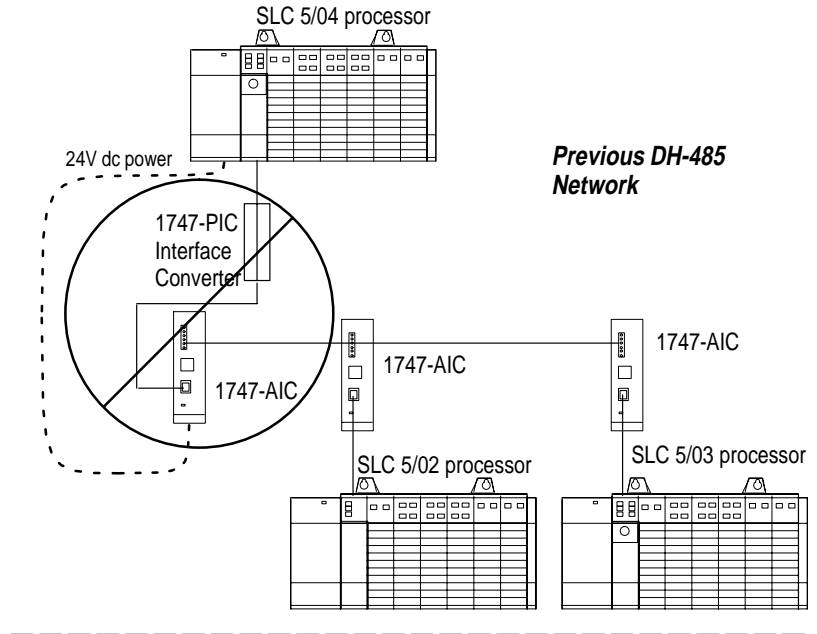
Point-to-Point Isolator.D



- 1 DB-9 RS-232 port
- 2 mini-DIN 8 RS-232 port
- 3 DH-485/DF1 port

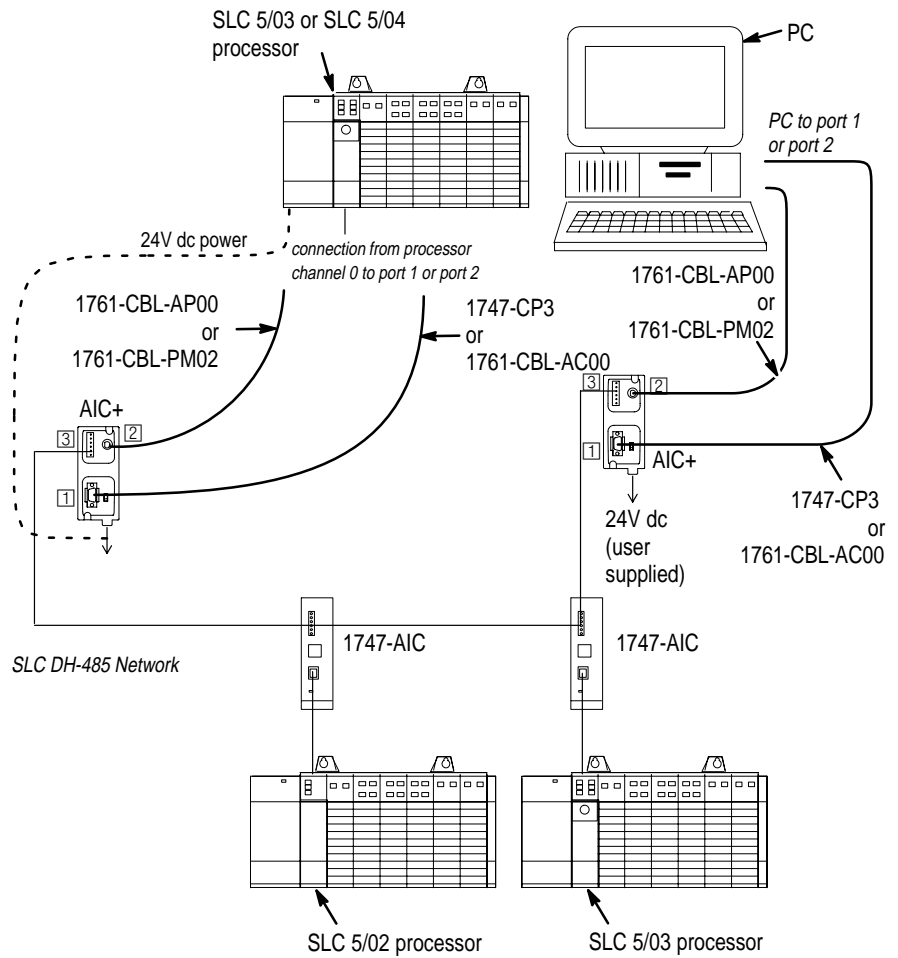
Components Replaced by the AIC+.E

The AIC+ replaces the combination of a 1747-PIC interface converter and 1747-AIC isolated link coupler in most applications.



- 1 DB-9 RS-232 port
- 2 mini-DIN 8 RS-232 port
- 3 DH-485/DF1 port

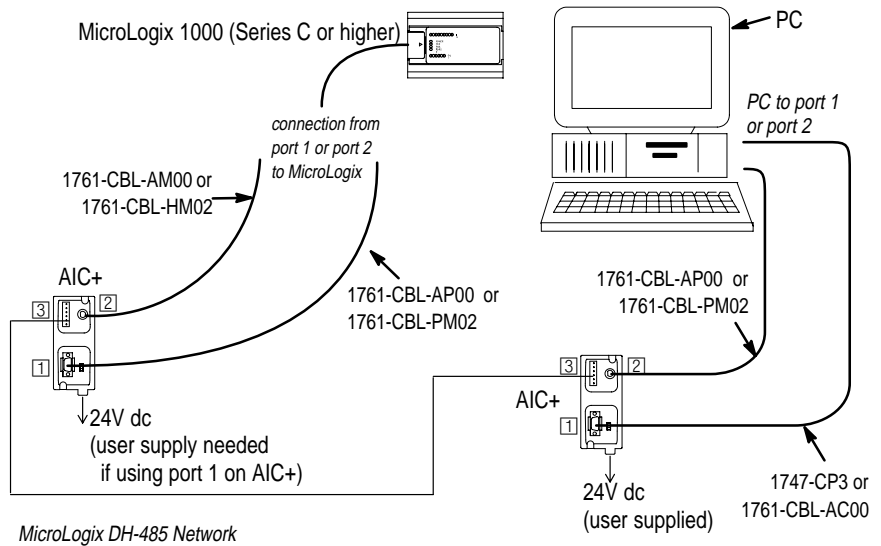
DH-485 Network with SLC 5/03 and SLC 5/04 Processors and a PC



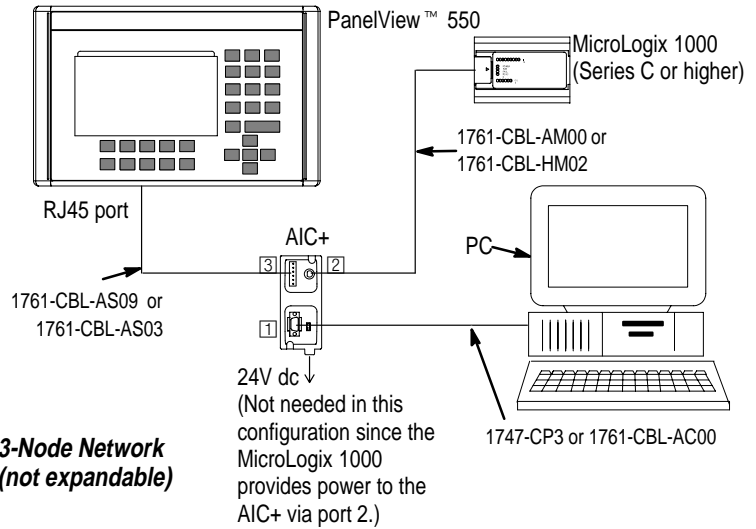
Series B cables are required for hardware handshaking.

- 1 DB-9 RS-232 port
- 2 mini-DIN 8 RS-232 port
- 3 DH-485/DF1 port

DH-485 Network with a MicroLogix 1000 Controller



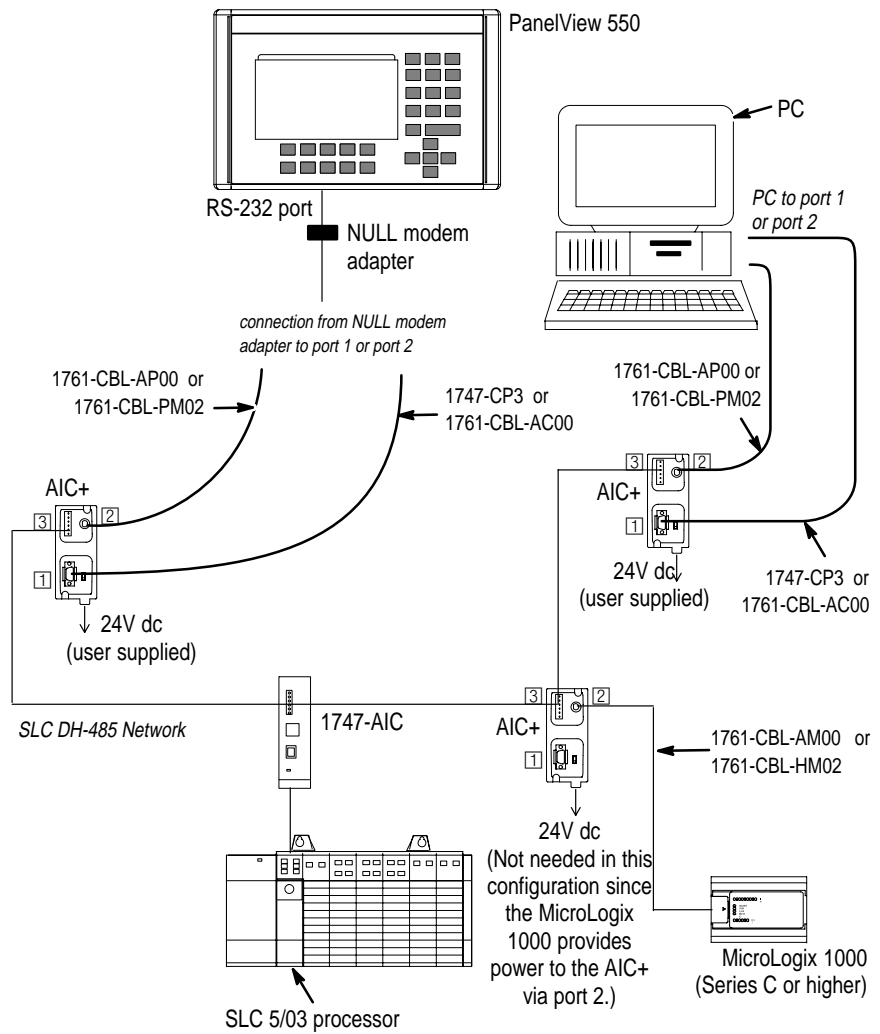
Typical 3-Node OEM Network



Series B cables are required for hardware handshaking.

- 1 DB-9 RS-232 port
- 2 mini-DIN 8 RS-232 port
- 3 DH-485/DF1 port

Networked Operator Interface Device and MicroLogix Controller

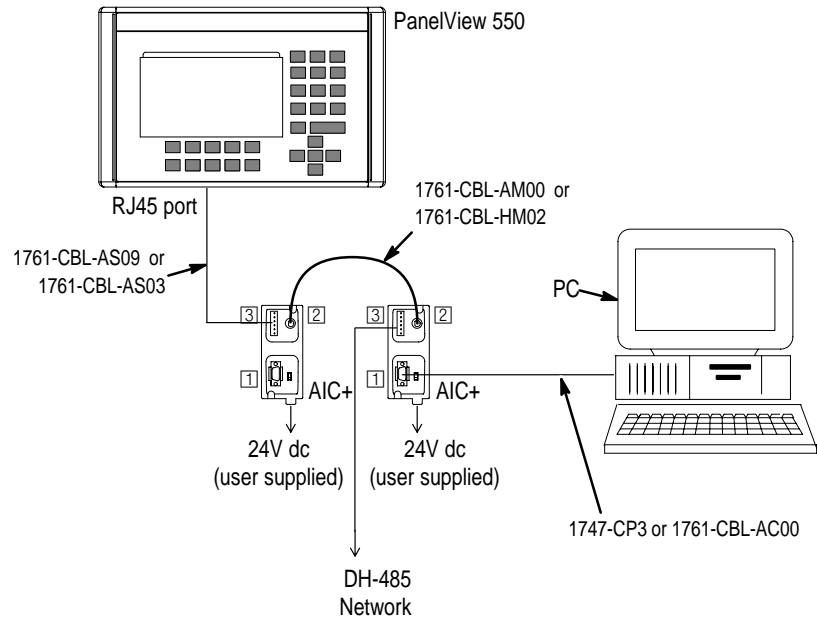


Series B cables are required for hardware handshaking.

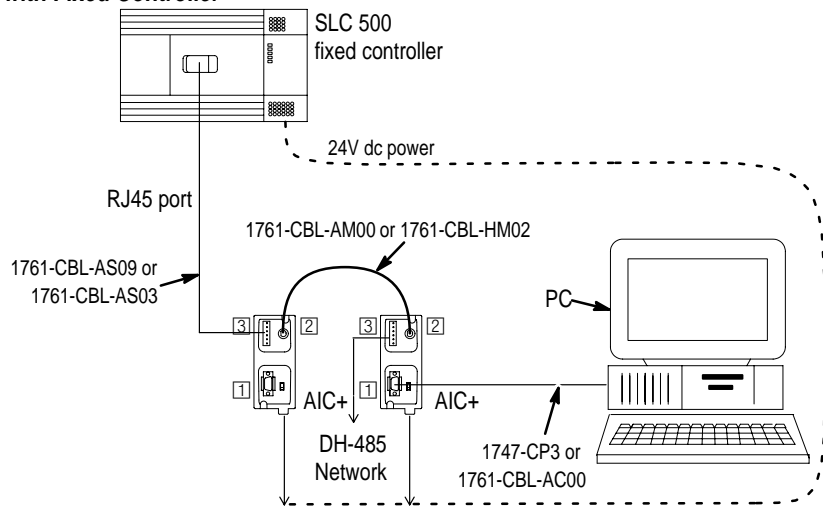
- 1 DB-9 RS-232 port
- 2 mini-DIN 8 RS-232 port
- 3 DH-485/DF1 port

Networks Using “Ganged” Converters

DH-485 Network with PanelView

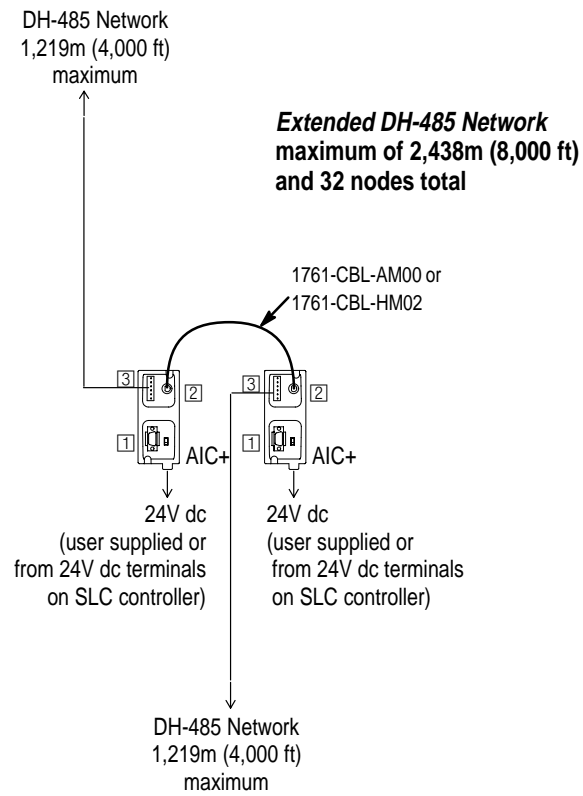


DH-485 Network with Fixed Controller



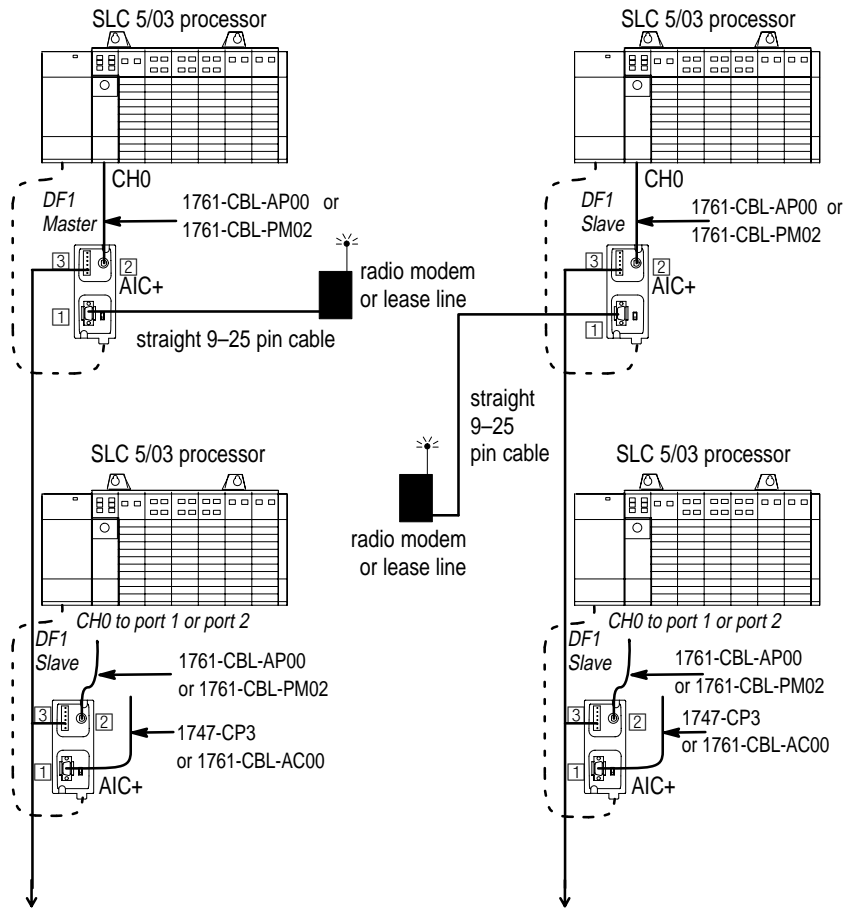
- 1 DB-9 RS-232 port
- 2 mini-DIN 8 RS-232 port
- 3 DH-485/DF1 port

Extending Network to 2,438 Meters (8,000 Feet)



- 1 DB-9 RS-232 port
- 2 mini-DIN 8 RS-232 port
- 3 DH-485/DF1 port

DF1 Master-Slave Network with Modem.F .G

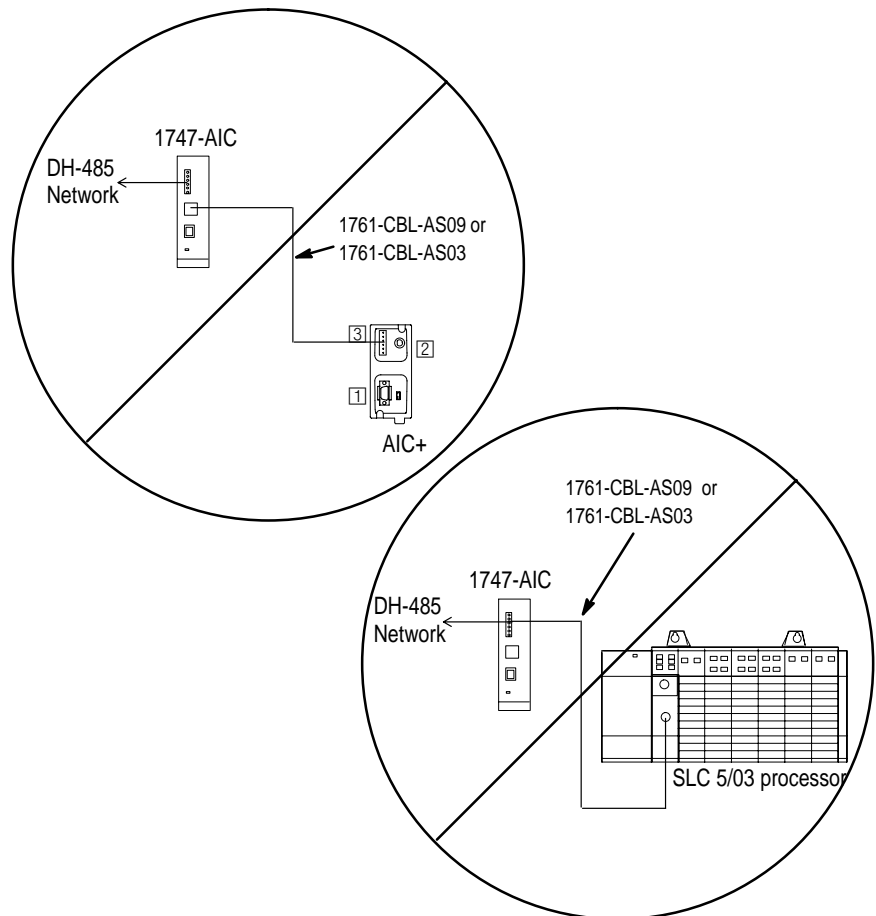


Important: Use this diagram for “user mode” ASCII as well as DF1 master-slave protocol. See page A-1 (in Specifications) for more information on hardware handshaking and communication protocols.

Hardware handshaking requires Series B cables.

- 1 DB-9 RS-232 port
- 2 mini-DIN 8 RS-232 port
- 3 DH-485/DF1 port

Avoid Incorrect Connections.H



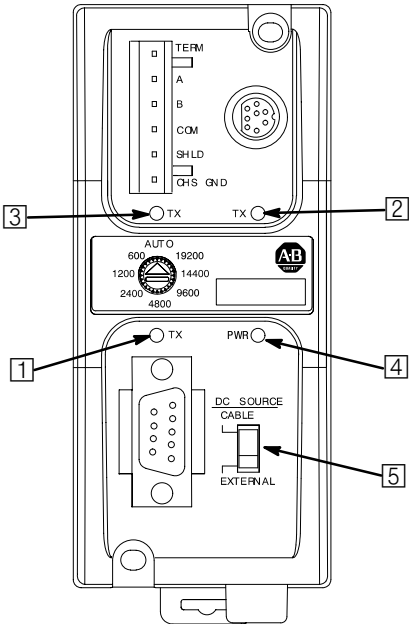
Important: Do not do this— the cable will fit, but will NOT function properly.

- ❶ DB-9 RS-232 port
- ❷ mini-DIN 8 RS-232 port
- ❸ DH-485/DF1 port

Allen-Bradley Parts

Troubleshooting

Diagnostics

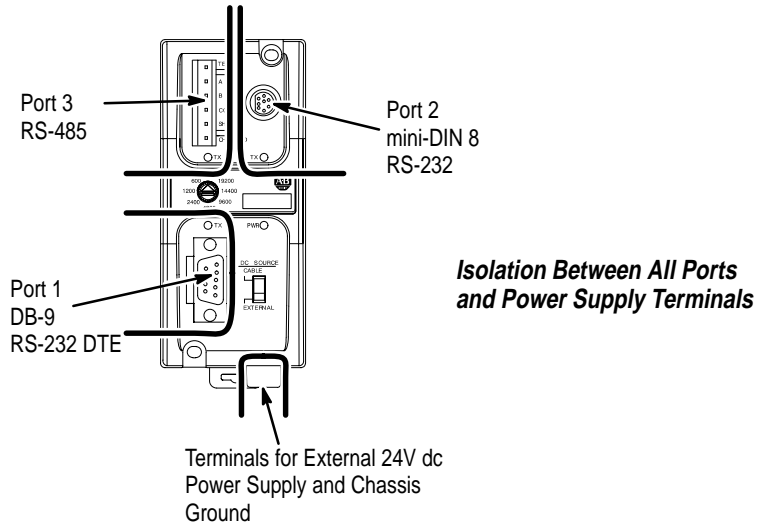


Item	Indicator	Condition	Indicates
1	TX RS-232 9-pin (port 1)	flashing	transmitting
		off	receiving or idle
2	TX RS-232 8-pin (port 2)	flashing	transmitting
		off	receiving or idle
3	TX RS-485 (port 3)	flashing	transmitting
		off	receiving or idle
4	PWR – Power OK	on	power OK
		off	no power to AIC+ or DC source switch set incorrectly
5	Power Source Selection Switch	cable	24V dc power supplied to AIC+ from device connected to port 2
		external	24V dc power supplied to AIC+ from external source (use 24V dc power from SLC or user-supplied 24V dc power supply)

Specifications.I

Physical Specifications

Description	Specification
24V dc Power Source Requirement	20.4 – 28.8V dc
Current Draw	0 – 120 mA 200 mA maximum inrush current
Internal Isolation (see below)	500V dc
Operating Ambient Temperature	–0 to 60°C (32 to 140°F)
Storage Temperature	–40 to 85°C (–40 to 175°F)
Agency Certification	UL 1604 C-UL C22.2 No. 213 Class I Division 2 Groups A, B, C, D CE compliant for all applicable directives
DH-485, DF1, or “user” Network	maximum number of nodes = 32 per multidrop network maximum length = 1,219m (4,000 ft) per multidrop network maximum number of “ganged” multidrop networks = 2



Hardware Handshaking.J

To implement hardware handshaking, use cables that support the following signals.

Signal Definition	Function
RTS active	an input to AIC+ port
CTS active	an output from AIC+ port

When hardware handshaking is used, the auto transmit delay (turnaround time) is zero.

Protocol	AIC+ Support of Hardware Handshaking
DF1 full duplex (point-to-point isolator)	yes
DF1 Master-Slave	no ^①
"user mode" ASCII	yes

① Any communication coming off of the RS-485 line (port 3) will not drive the handshaking lines on ports 1 and 2. Devices on ports 1 and 2 can drive the other RS-232 ports handshaking lines and the RS-485 transmitters.

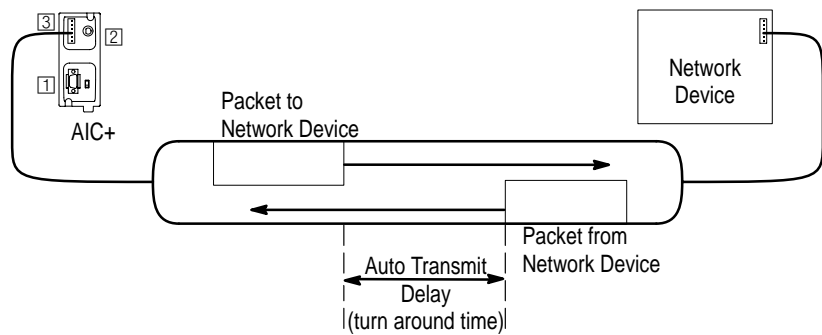
Auto Transmit Delay (turn around time) Per Baud Rate.K

Baud Rate	Minimum Delay	Maximum Delay	Typical Delay	Pre-Send Transmit Delay Setting ^①
600	7.3 ms	15.0 ms	10.8 ms	16 ms
1200	7.3 ms	15.0 ms	10.8 ms	16 ms
2400	5.5 ms	11.2 ms	8.1 ms	12 ms
4800	2.7 ms	5.7 ms	4.0 ms	6 ms
9600	1.3 ms	2.8 ms	2.0 ms	3 ms
14400	0.9 ms	1.9 ms	1.4 ms	2 ms
19200	0.6 ms	1.4 ms	1.0 ms	2 ms
AUTO	0.3 ms	0.7 ms	0.5 ms	②

① The pre-send transmit delay setting is used in your device's (SLC, PLC, etc.) communications configuration.

② Use a pre-send value from above, depending upon the network baud rate being used.

Auto Transmit Delay for AIC+ Using Auto Transmit Detection (no hardware handshaking)

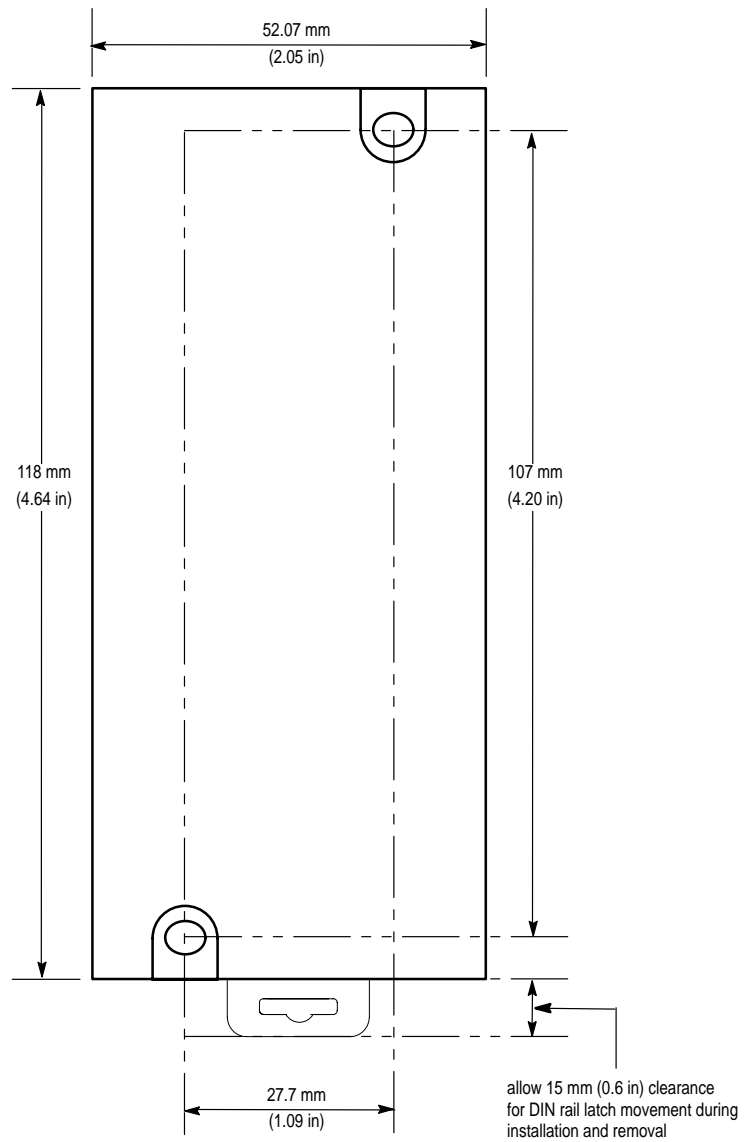


Auto Transmit Delay is measured from the time the AIC+ transmits its last mark out of Port 3, until the delay time (from table above) expires. The AIC+ will not accept Port 3 data during the Auto Transmit Delay time.

① DB-9 RS-232 port

② mini-DIN 8 RS-232 port

③ RS-485 port

Mounting Template.L

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