Alspa C80–35 PLC
I/O Module Specifications

ALS 52118 c–en

First issue: 05–95
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Meaning of terms that may be used in this document / Notice to readers

WARNING

Warning notices are used to emphasize that hazardous voltages, currents, temperatures, or other conditions that could cause personal injury exist or may be associated with use of a particular equipment.

In situations where inattention could cause either personal injury or damage to equipment, a Warning notice is used.

Caution

Caution notices are used where there is a risk of damage to equipment for example.

Note

Notes merely call attention to information that is especially significant to understanding and operating the equipment.

Index letter	Date	Nature of revision
b	07–96	Adding: • Load ratings, temperature and mounting position (§ 3.3.1. of chapter 1), • Baseplate adapter braket (§ 3.3.2. of chapter 1), • High capacity power supply (§ 3.9. of chapter 1), • CPU serial port connector on power supply (§ 3.10.1. of chapter 1), • Appendix B: Product certification, standards and general specification. Other changes of details.
c	06–99	Adding: • Appendix B: Data sheets for I/O cables, • Appendix C: Terminal Block Quick Connect Assembly, • High capacity 24 VDC input power supply (§ 4.4. of chapter 1), • VDC Pos/Neg Logic Input CF693MDL101/102/103 (§ 3.10., 3.11., 3.12. of chapter 2), • Safety Isolated Relay Output CF693MDL150 (§ 3.28. of chapter 2), • References to programming and configuration using Alspa P80 where applicable.

Revisions

Note

This manual, which describes the discrete and analog I/O Modules for the Alspa C80–35 PLC, was created on separation of the *ALS 52101 Alspa C80–35 PLC Installation Manual* into 2 documents, the other being the *ALS 52117 Alspa C80–35 PLC Installation Manual*. Both resulting manuals have been updated to incorporate new modules.

This manual provides specifications and wiring information for each of the currently available discrete and analog I/O modules for the Alspa C80–35 Programmable Logic Controller (PLC). Descriptions and specifications for available option modules can be found in individual manuals for each of those modules. A list of these manuals can be found under *Related Publications* in this Preface.

Note

The I/O modules described in this manual can be controlled two ways:

1. With an Alspa C80–35 Programmable Logic Controller.
2. By a Personal Computer (PC) that has a Personal Computer Interface card (PCIF-35), catalog number CE693PIF301, installed in the PC. This allows a PC to control and monitor Alspa C80–35 I/O using computer language.

If you are using the Alspa C80–35 PLC to control Alspa C80–35 I/O, you should also refer to *ALS 52117 Alspa C80–35 PLC Installation Manual*, which describes the hardware components and provides installation instructions for the Alspa C80–35 PLC.

If you are using a Personal Computer to control the Alspa C80–35 I/O, refer to the documentation for the Personal Computer Interface card and the documentation for your Personal Computer.

1. CONTENT OF THIS MANUAL

This manual contains three chapters and two appendices.

Chapter 1. Introduction to Alspa C80–35 I/O Modules: This chapter provides general information about Alspa C80–35 I/O modules and describes multiple ways that the Alspa C80–35 I/O can be controlled.

Chapter 2. Discrete I/O Module Specifications: This chapter provides specifications for discrete Input and Output modules for the Alspa C80–35 I/O system. The information provided for each module includes a description of the module, module specifications and field wiring information.

Chapter 3. Analog I/O Module Specifications: This chapter provides specifications for analog Input and Output modules for the Alspa C80–35 I/O system. The first part of the chapter is a general discussion of analog modules as used with the Alspa C80–35 PLC. The information provided for each module includes a description of the module, module specifications and field wiring information.

Appendix A. Product Certification, Standards and General Specifications: This appendix describes the product certification, standards and general specifications for the Alspa 8000 products.

Appendix B. Data Sheets for I/O Cables: This appendix provides data sheets describing each of the Alspa C80–35 cable types that can be used in an I/O system.

Appendix C. Terminal Block Quick Connect Assembly: This appendix describes the Terminal Block Quick Connect system, which consists of an interposing terminal block, I/O faceplate and cable. This assembly allows faster wiring of applicable discrete I/O modules.

Glossary: explains some general terms relating to measurements at analog I/O terminals.

2. RELATED PUBLICATIONS

For more information, refer to these publications:

ALS 52102 Alspa C80–35, C80–25 and C80–05 PLCs Reference Manual

ALS 52109 MegaBasic Language for PCM Reference Manual and Programmer's Guide

ALS 52117 Alspa C80–35 PLC Installation Manual

ALS 52201 Alspa P8–25/35/05 Programming Software for Alspa C80–35, C80–25 and C80–05 PLCs User's Manual

ALS 52202 Hand–Held Programmer for Alspa C80–35, C80–25 and C80–05 PLCs User's Manual

ALS 52203 PCM Development Software (PCOP) for Alspa 8000 PLCs User's Manual

ALS 52205 Axis Positioning Module (APM) for Alspa 8000 PLCs Programming Manual

ALS 52309 Alspa C80–35 I/O Processor Module User's Manual

ALS 52313 Alspa CE80–35 Remote I/O Scanner User's Manual

ALS 52401 High Speed Counter for Alspa C80–35 PLC User's Manual

ALS 52402 Programmable Coprocessor Module (PCM) and Support Software for Alspa 8000 PLCs User's Manual

ALS 52403 Axis Positioning Module (APM) for Alspa C80–35 PLC Standard Mode User's Manual

ALS 52501 N80 Communications Module (NCM) for Alspa C80–35 PLC User's Manual

ALS 52502 N80 Enhanced Communications Module (NCM+) for Alspa C80–35 PLC User's Manual

ALS 52506 Serial communication modules for Alspa 8000 PLCs User's Manual

ALS 52511 Alspa C80–35 PLC Bus Controller for Alspa N80 Network (NBC) User's Manual

ALS 52512 Alspa C80–35 TCP/IP Ethernet Communication User's Manual

ALS 52522 TCP/IP Ethernet Communications for the Alspa 8000 PLC Station Manager Manual

ALS 52604 Alphanumeric Display System User's Manual

ALS 52605 Alphanumeric Display System Reference Manual

ALS 52607 Axis Positioning Module (APM) for Alspa C80–35 PLC – Follower Mode User's Manual

ALS 52612 Installation Requirements for Conformance to Standards

3. MANUAL NUMBERS

In some cases, Alspa 8000 manuals may be issued with numbers that differ from the one given under ”Related Publications” in the Preface of other manuals, or in Important Product Information or data sheets.

The contents are similar.

The table below shows the correspondence between ”ALS” and equivalent numbers for the manuals concerned:

ALS Number	***Other Number***	***ALS Number***	***Other Number***
ALS 52113	*GFK–0600*	*ALS 52503*	*GFK–0585*
ALS 52126	*GEK–1527*	*ALS 52507*	*GFK–0074*
ALS 52302	*GEK–90486–2*	*ALS 52508*	*GFK–0868*
ALS 52303	*GFZ–0043*	*ALS 52514*	*GFK–0870*
ALS 52314	*GEK–1171*	*ALS 52515*	*GFK–1026*
ALS 52404	*GFK–0415*	*ALS 52523*	*GFK–1063*
ALS 52405	*GFK–0819*	*ALS 52603*	*GFK–0450*

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Chapter 1 Introduction to Alspa C80–35 I/O System

Note

The Alspa C80–35 I/O modules described in this manual can be controlled two ways:

1. *With an Alspa C80–35 Programmable Logic Controller (PLC)* using either the embedded CPU or the single-slot CPU module (depending on model of CPU) as the controller.
2. *With a Personal Computer (PC)* that has a Personal Computer Interface card (PCIF–35), catalog number CE693PIF301, (or similar interface) installed in the PC. This allows software on a PC to control and monitor Alspa C80–35 I/O.

If you are using an Alspa C80–35 PLC to control Alspa C80–35 I/O, you should refer to *ALS 52117 Alspa C80–35 PLC Installation Manual*, for more information.

If you are using a Personal Computer to control the Alspa C80–35 I/O, refer to the documentation for the PCIF–35 (or similar interface) and your Personal Computer and your application software for more information.

1. ALSPA C80–35 I/O SYSTEM

The Alspa C80–35 I/O system provides the interface between the Alspa C80–35 PLC (or Personal Computer) and user supplied input and output devices. The I/O system supports Alspa C80–35 I/O. In addition to Alspa C80–35 I/O modules, the I/O system, *when controlled by an Alspa C80–35 PLC,* supports Global N80 I/O and PCMs. N80 Communications Modules allow an Alspa C80–35 PLC to communicate on an N80 I/O communications bus. I/O modules are installed in baseplates.

An Alspa C80–35 PLC system can consist of:

- *Model 311, 313 or 323*: a single baseplate with embedded CPU.
- *Model 331, 341 local I/O system:* a CPU baseplate and up to 4 expansion baseplates in a local I/O system with the last expansion baseplate located up to 15 meters (50 feet) from the CPU baseplate.
- *Model 331, 341 remote I/O system*: a CPU baseplate and up to 4 expansion baseplates (up to 15 meters (50 feet) from CPU) and/or remote baseplates (up to 213 meters (700 feet) from CPU) in a remote I/O system.
- *Model 351 or 352 local and remote I/O system:* a system with a model 351 *or 352* CPU can have up to 7 expansion baseplates.

An Alspa C80–35 I/O system controlled by a Personal Computer can consist of:

- A PC with a PCIF–35 card installed and up to 4 expansion baseplates in a local I/O system with the last expansion baseplate located up to 15 meters (50 feet) from the PC.
- A PC with a PCIF–35 card installed and up to 4 expansion baseplates (up to 15 meters (50 feet) from the PC) and/or remote baseplates (up to 213 meters (700 feet) from the PC) in a remote I/O system.

The rack-type I/O system for the Alspa C80–35 PLC is the Alspa C80–35 I/O, referred to as ***Alspa C80–35 I/O***. These modules plug directly into the Alspa C80–35 baseplates. Alspa C80–35 I/O modules can be installed in any available slot in the CPU baseplate (PLC Models 311/313/331/341/351/352), or into any slot in any of the expansion or remote baseplates (PLC Models 331/341/351/352 or in a PC system). The Alspa C80–35 PLC with a Model 331 or 341 CPU supports up to 49 I/O modules (Model 351 or 352 CPUs support up to 79 I/O modules). The Alspa C80–35 PLC Model 311 and Model 313 5-slot baseplates support five I/O modules and the Model 323 10-slot baseplate supports ten I/O modules. An Alspa C80–35 I/O system controlled by a PC with a PCIF–35 card supports up to 40 I/O modules.

Third party I/O modules are also available which can be included in an Alspa C80–35 PLC system. For information on Third party I/O modules, consult your authorized ALSTOM PLC distributor or your local ALSTOM sales office.

I/O modules are retained in their slots by molded latches that easily snap onto the upper and lower edges of the baseplate when the module is fully inserted into its slot to prevent accidental loosening or disengagement of the modules.

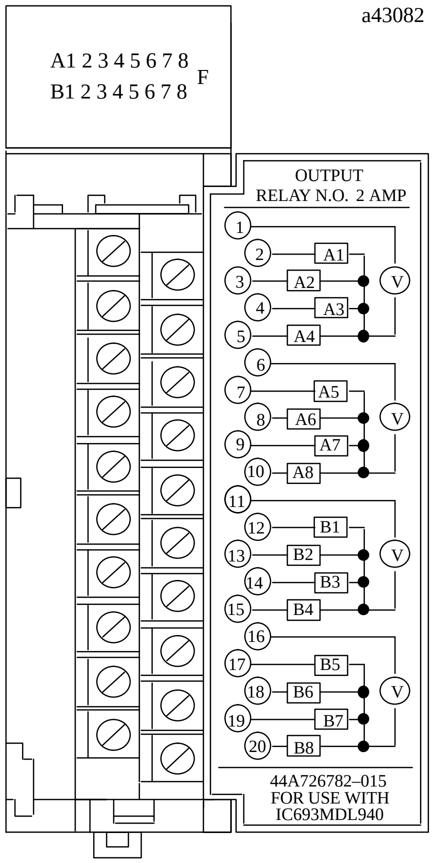


Figure 1.1 – Example of an Alspa C80–35 I/O Module

1.1. Alspa C80–35 I/O Module Types

Alspa C80–35 I/O modules are available as five types: discrete inputs, discrete outputs, analog inputs, analog outputs and option modules, which can be used with all models of PLCs. Additionally, there are specialized option modules which can only be used with PLC Models 331, 341, 351 and 352. Discrete input modules have either 8, 16, or 32 points; discrete output modules have from 5 to 32 points, depending on type. Analog input modules are available with 4 or 16 channels; available analog output modules have 2 or 8 channels and an analog combination module has 4 input channels and 2 output channels.

Option modules include a FIP Bus Controller, a FIP Remote I/O Scanner, a High Speed Counter, an N80 Communications Module, an Enhanced N80 Communications Module (NCM+), an N80 Bus Controller and Axis Positioning Modules (one and two axis), I/O Processor module and Ethernet Interface module. Specialized option modules are the Programmable Coprocessor Modules, Communications Control module and the Alphanumeric Display Coprocessor module. *These specialized option modules are currently NOT supported by the PCIF–35 in a PC system.*

The Circuit status of each I/O point on discrete modules is indicated by a green LED mounted at the top of the module and viewable through a clear plastic lens. There are two horizontal rows of LEDs with eight LEDs in each row. Each LED is identified by a letter and number identification which is illuminated when the applicable LED turns on. These letters and numbers clearly identify each LED to assist in program monitoring and trouble shooting. The top row is labeled A1 through 8 and the bottom row is labeled B1 through 8.

Additionally, a blown fuse status for fused output modules is provided by an LED labeled F on the LED cover (note that the F is labeled on all discrete I/O modules, although it is only relevant to fused output modules).

Each module has an insert that goes between the inside and outside surface of the hinged door. The surface towards the inside of the module (when the hinged door is closed) has circuit wiring information for that module type and the outside surface has space to record circuit identification information. The outside left edge of the insert is color coded so that you can quickly identify the module as a high voltage (red), low voltage (blue), or signal level (grey) type.

For current information on availability of Alspa C80–35 I/O modules, consult your authorized ALSTOM PLC distributor or your local ALSTOM sales office.

1.2. Universal Terminal Boards

Alspa C80–35 I/O modules with up to 16 points have, as a standard feature, detachable terminal boards for field wiring connections to and from user supplied input or output devices. This feature makes it easy to prewire field wiring to user supplied input and output devices and to replace modules in the field without disturbing existing field wiring. I/O connectors on these terminal boards have 20 terminals and will accept up to one 2.1 mm^2 (AWG No. 14) wire or two 1.12 mm^2 (AWG No. 16) wires using ring or lug type terminals. Two terminals on the connector are provided for connection to a +24 volt DC supply for input modules requiring a 24 volt DC power source. Wires to and from field devices are routed out the bottom of the terminal board cavity.

1.3. Terminal Block Quick Connect Assembly

Terminal block assemblies are available for Alspa C80–35 discrete I/O modules. This terminal block assembly is referred to as Terminal Block Quick Connect or simply TBQC. This system allows 16-point discrete modules to be quickly connected to interposing terminal blocks. Installing a 16 point module typically takes 2 1/2 hours to wire from a PLC to interposing terminal blocks. With the TBQC, you simply snap in the interposing terminal block, remove the I/O module's terminal assembly, snap in the I/O faceplate and connect the cable. This reduces wiring time to about two minutes and no additional wiring is required, thereby reducing wiring costs and errors. Complete assemblies consist of a terminal block, an I/O Face Plate and a cable. See Appendix C for more information.

1.4. Connections to High Density I/O Modules

High Density I/O modules (32 Inputs or 32 Outputs) are connected to field devices through a cable, or cables, connected to pin connectors on the front of the I/O module. As mentioned above, High Density I/O modules have two 24-pin connectors. For detailed information on High Density I/O modules, refer to "High Density I/O Modules" beginning on § 4., Chapter 2.

1.5. Horner Electric Modules

Alspa C80–35 compatible modules are available from Horner Electric, Inc. which may be used in an Alspa C80–35 PLC system or in a Personal Computer I/O system with a Personal Computer Interface card installed. Some of these modules are listed below; there are many more.

Catalog Number	Description
HE693ASCxxx	ASCII BASIC Module
HE693ADCxxx	Isolated Analog Input Modules
HE693DACxxx	Isolated Analog Output modules
HE693APGxxx	IQ^2 Remote I/O Interface Modules
HE693PIDxxx	PID modules
HE693STPxxx	Stepper Motor Modules
HE693ADCxxx	Strain Gauge Modules
HE693RTDxxx	RTD Modules
HE693THMxxx	Thermocouple Modules
HE693PIDNETE	PID Network Modules
HE693DRVNETA	Variable Frequency Drive Network Modules

2. PERSONAL COMPUTER INTERFACE CARD

The Personal Computer Interface card (PCIF–35) for Alspa C80–35 I/O provides an alternative method of controlling Alspa C80–35 I/O. The PCIF–35 is an ISA compatible card that can be installed in any PC/AT/ISA bus, 8-bit, half-size slot, connecting a personal computer with up to four Alspa C80–35 Expansion or Remote I/O baseplates. Up to 1280 bytes of I/O data may be monitored and controlled by the personal computer using computer language (for example, C) or third party control software.

Remote baseplates can be located up to 213 meters (700 feet) from the personal computer (local expansion baseplates up to 15 meters (50 feet)) connected through standard ALSTOM expansion cables. The PCIF–35 card connects to the Alspa C80–35 baseplates (four maximum) through a 25-pin connector on the front of the card. The PCIF card also has a 3-pin removable terminal strip which provides connections to a watchdog supervised RUN output signal and relay.

Prewired I/O expansion cables which can be used with expansion and remote baseplates are available from ALSTOM. Catalog numbers and lengths of these cables are listed in Table 1.3, page 1–16. Note that the 1 and 2 meter cables are ”Y” (also referred to as T cables) cables.

The PCIF–35 interfaces to all Alspa C80–35 discrete and analog I/O modules (except 16 channel analog modules which are not currently supported). A variety of smart modules from Horner Electric, Inc. are also supported. A manual describing the PCIF–35 is available from Horner Electric, Inc. An Important Product Information notice (GFK-0889), which is included with the PCIF–35 card provides basic information about the card, including software installation procedures. *More smart modules will be supported in the future, see your local ALSTOM PLC distributor or ALSTOM sales office for details.*

The Personal Computer Interface card when ordered by catalog number CE693PIF301 includes the PCIF–35 card and two software interfaces. One of the interfaces is for a direct interface to I/O modules based on rack and slot address and a second one has a PLC type reference table interface with override capability.

A C Language Interface available from Horner Electric works with both Borland Turbo C and Microsoft C. The source code for this interface is available from Horner Electric (catalog number HE693SRC844).

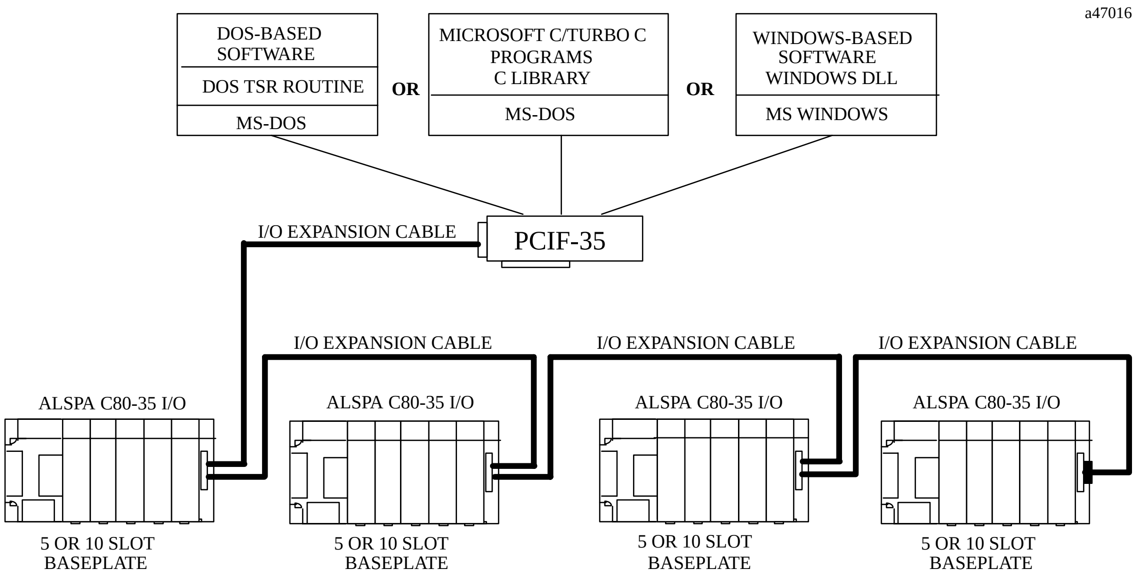


Figure 1.2 – Example of PCIF–35 Interface to Alspa C80–35 I/O System

Supply Power:	
Voltage	4.75 to 5.25 VDC
Current	230 mA maximum
Watchdog Relay	
Initial Resistance	0.05 ohms
Maximum Switching Power	60 Watts, 62.5 VA
Maximum Switching Voltage	220 VDC, 250 VAC
Maximum Switching Current	2 Amps
Maximum Carrying Current	3 Amps
UL/CSA Ratings	125 VAC at 0.3 Amps
	110 VDC at 0.3 Amps
	30 VDC at 1.0 Amp
Minimum Operations (Mechanical)	100 000 000
Minimum Operations (Electrical)	500 000 (30 VDC at 1.0A, resistive)
	100 000 (30 VDC at 2.0A, resistive)
Environmental	
Operating Temperature	0 to 60° C (32 to 140° F)
Storage Temperature	–40 to +85° C (–40 to +185° F)
Humidity	5 to 95% non-condensing

Table 1.1 – Specifications for Personal Computer Interface Card

3. ALSPA C80–35 BASEPLATES AND POWER SUPPLIES

The following is a list of Alspa C80–35 baseplates and power supplies that can be used in an Alspa C80–35 I/O system controlled by a Personal Computer.

Catalog Number	Description
IC693CHS392	Baseplate, 10-slot, expansion
IC693CHS398	Baseplate, 5-slot, expansion
IC693CHS393	Baseplate, 10-slot, remote
IC693CHS399	Baseplate, 5-slot, remote
IC693PWR324	Standard Power Supply, 120/240 VAC or 125 VDC, 30 watts
IC693PWR325	Power Supply, 24/48 VDC, 30 watts
CE693PWR330	High Capacity Power Supply, 120/240 VAC or 125 VDC
CE693PWR331	High Capacity Power Supply, 24 VDC Input

Table 1.2 – Alspa C80–35 Baseplates and Power Supplies

3.1. Expansion Baseplates

Alspa C80–35 expansion baseplates are available in two versions; a 5-slot (IC693CHS398) and a 10-slot (IC693CHS392). Expansion baseplates have either 5 or 10 slots for modules and a power supply slot. The maximum distance from the CPU baseplate that the last expansion baseplate in a local I/O system can be located is 15 meters (50 feet).

There can be **no more** than a total of 15 meters of cable connecting all expansion baseplates in a local expansion system and **all** expansion baseplates must be connected to a common ground. Each expansion baseplate has a 25-pin female D-type connector mounted at the far right of the baseplate for connection to another baseplate in an expansion system.

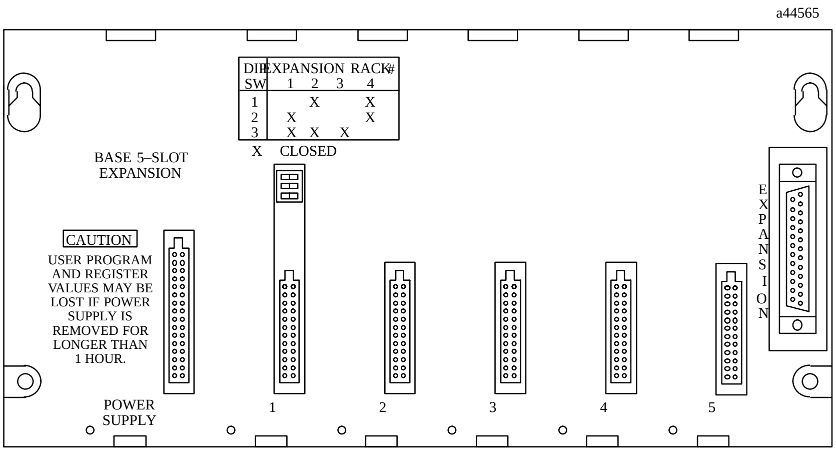


Figure 1.3 – Example of an Alspa C80–35 Expansion Baseplate (5-slot shown)

3.2. Remote Baseplates

Remote baseplates provide an extended expansion capability for the Alspa C80–35 I/O system. Remote baseplates are available in two versions; a 5-slot (IC693CHS399) and a 10-slot (IC693CHS393). Remote baseplates provide the same functionality as the expansion baseplates with the added feature that they can be used at distances up to 213 meters (700 feet). The remote baseplates are the same physical size, are rack addressable, use the same power supply and support the same I/O and option modules as the expansion baseplates. The remote baseplates are identified with the word **Remote** on the plastic cover and the word **Remote** is also visible on the backplane board through the plastic cover immediately above the connector for slot 1.

Remote capability is achieved by providing isolation between the +5 volt logic supply used by the I/O modules installed in the baseplate and the supply for the interface circuit associated with the I/O Interface. Isolation helps prevent problems associated with unbalanced ground conditions. These conditions usually occur when systems are located long distances from each other and do not share the same ground system. However, distance is not always the problem; systems in close proximity should be verified for proper grounding prior to installation.

The use of the remote capability also requires some special considerations; one of which is scan time. In order to operate at long distances, the I/O clock speed must be lowered when communicating with remote racks. This will have an impact on performance. The impact will be relatively small for discrete I/O and slightly more for other modules. The increase in time needed to communicate with modules in a remote baseplate will usually be small with respect to the overall scan time.

Note

The lower clock rate is only used when communicating with remote baseplates; the PC continues to communicate with expansion baseplates at the faster rate.

Another important consideration is the cable used for communicating at longer distances. Propagation of data must be minimized to ensure proper system timing and margins. Any deviation in cable type may result in erratic or improper system operation. Suggested cable types are specified in Table 1.4, page 1–17.

Expansion and remote baseplates can be mixed in the same expansion system as long as certain requirements are followed. These requirements are that the last expansion baseplate must not exceed the 15 meter (50 foot) specification from the CPU to the last expansion baseplate and the cable recommended for use with the remote baseplate must be used throughout the system. The exception to the cabling is that the prewired 1 meter (3 foot) cable, IC693CBL300, can be used as a ”Y” adapter to simplify the custom cable assembly associated with the daisy chain concept.

Information on building cables for use with the remote baseplates is provided later in this chapter. Two types of cables are required in a remote expansion system: point-to-point cables and ”Y” cables (”Y” cables are also referred to as T cables). The point to point cables have a male connector on one end and a female connector on the other end. The ”Y” cables have a single male connector on one end and a dual connector (one male, one female) on the other end. If a ”Y” cable longer than the prewired 1 meter cable is required, you can build one that is the required length.

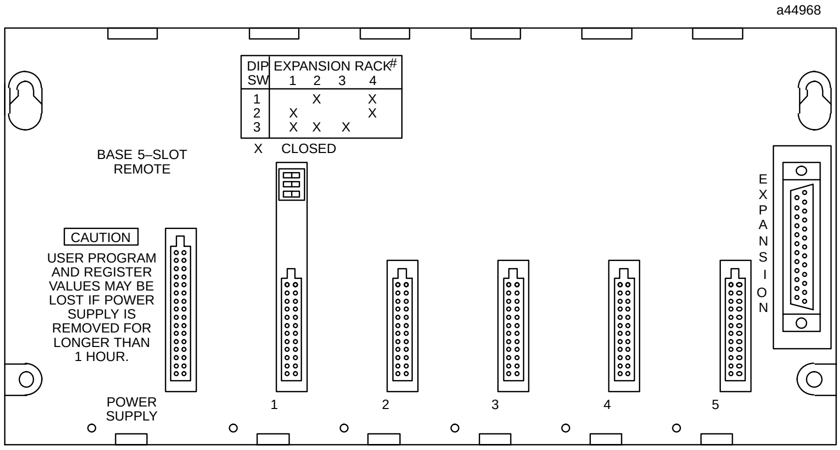


Figure 1.4 – Example of an Alspa C80–35 Remote Baseplate (5-slot shown)

3.3. Baseplate Installation

Alspa C80–35 baseplates must be panel mounted. Each baseplate has standard attachment flanges for mounting on an electrical panel. Baseplate dimensions and proper spacing requirements for installation purposes for both the 5 and 10-slot baseplates are shown in the following figure.

Note

All 5-slot baseplates have the same mounting dimensions and all 10-slot baseplates have the same mounting dimensions. Also, *baseplates must be mounted in the orientation as shown to maintain proper air flow.* (See *Load Ratings, Temperature and Mounting Position* on § 3.3.1.).

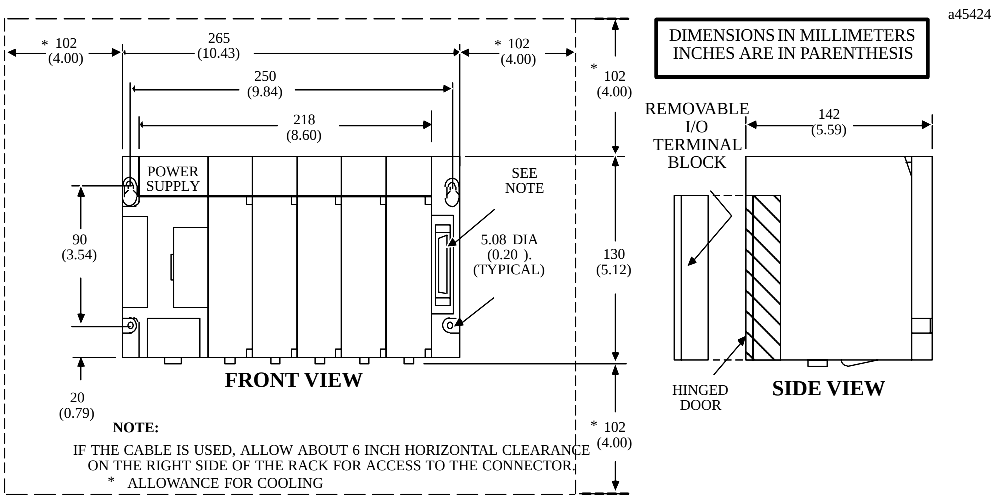


Figure 1.5 – 5-Slot Baseplate Mounting Dimensions and Spacing Requirements

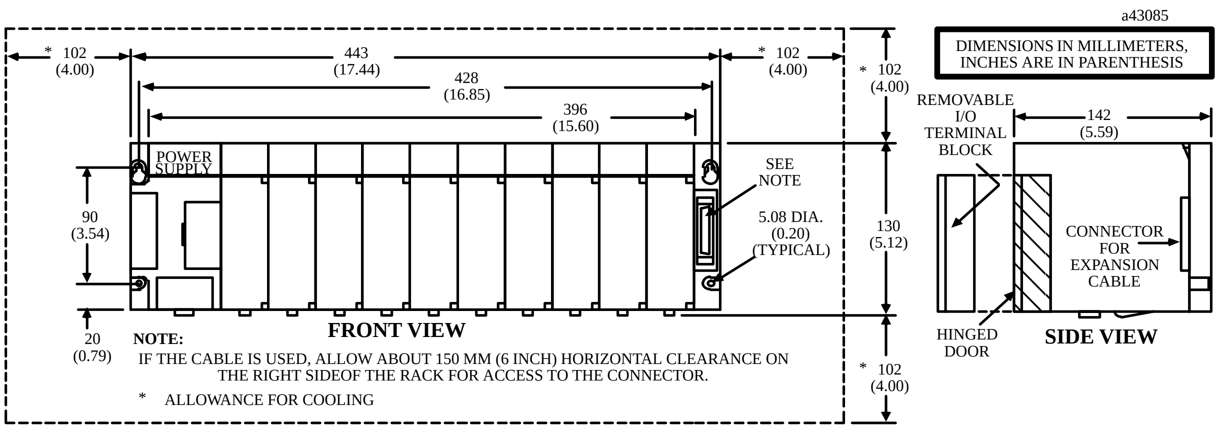


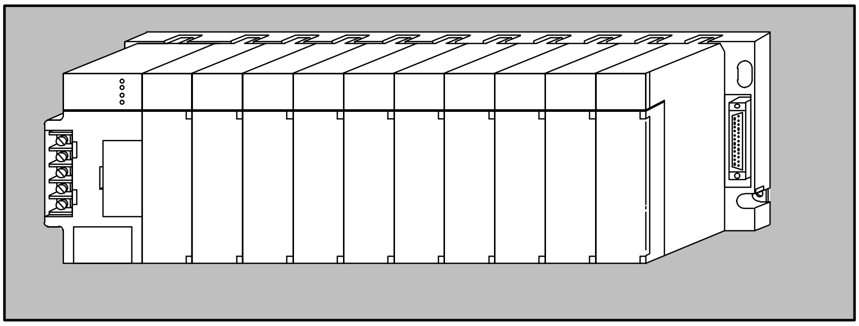
Figure 1.6 – 10-Slot Baseplate Mounting Dimensions and Spacing Requirements

3.3.1. Load Ratings, Temperature and Mounting Position

The power supply load rating depends on the mounting position of the baseplate and the ambient temperature.

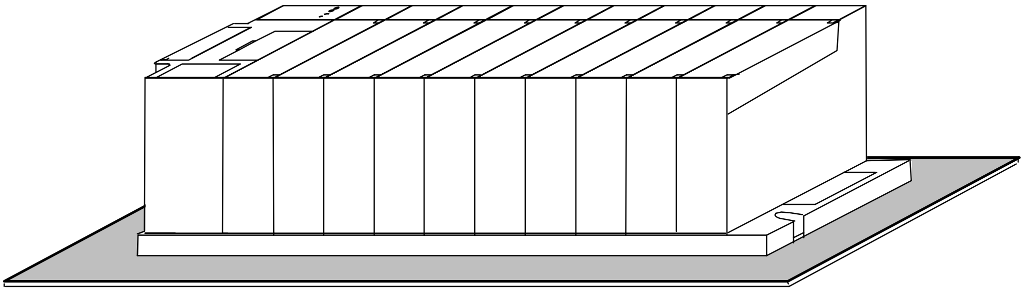
The load rating with the baseplate mounted upright on a panel is:

- 100% at 60°C (140°F).



Power supply load ratings with the baseplate mounted horizontally are:

- temperature at 25°C (77°F) - full load,
- temperature at 60°C (140°F) - 50% of full load.



3.3.2. Baseplate Adapter Bracket

An optional Baseplate Adapter Bracket (catalog number IC693ACC308) allows a 10-slot baseplate to be mounted in a 19 inch rack. Each baseplate installation requires only one of the adapter brackets. Install the adapter bracket by inserting the tabs at the top and bottom of the adapter bracket into the corresponding slots at the top and bottom of the baseplate as shown in the following figure. When the bracket is in place, insert and tighten the two screws (as described in the illustration) included with the bracket into the holes in the bracket and baseplate.

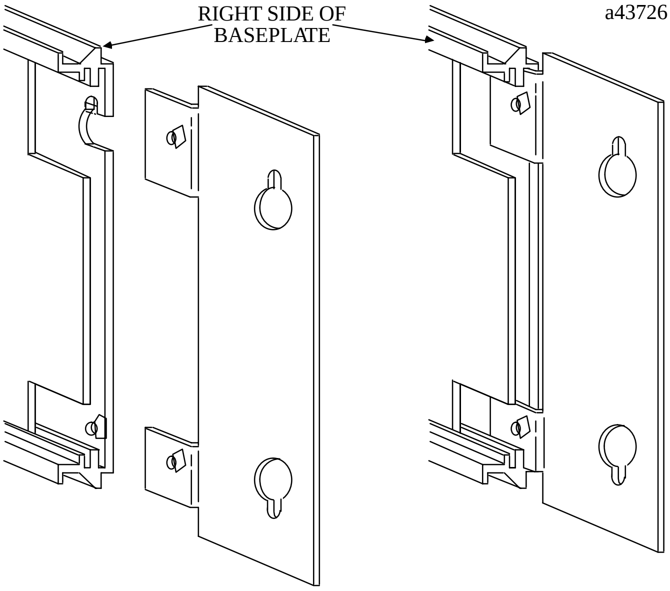
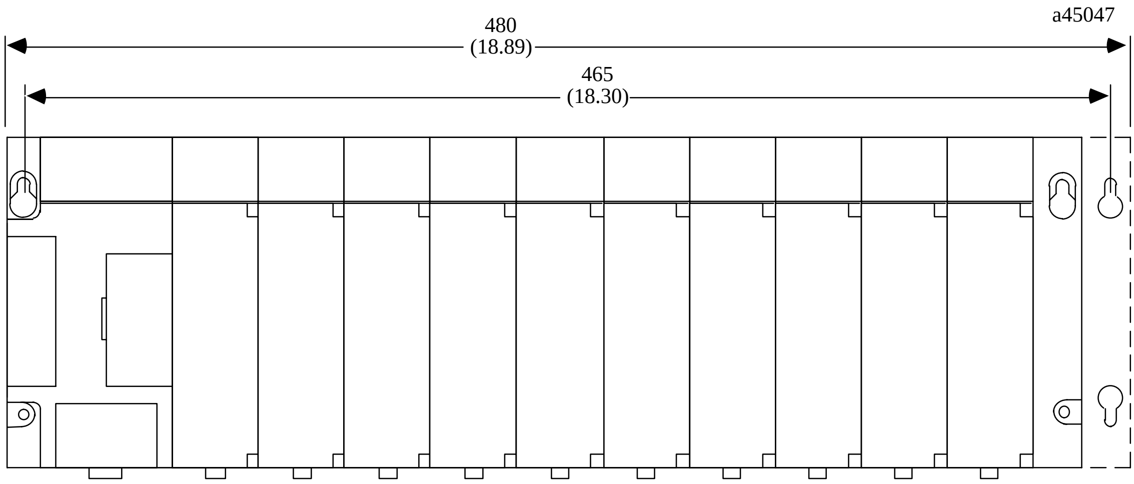


Figure 1.7 – Baseplate Adapter Bracket Installation

Dimensions for rack mounting of the 10-slot baseplate with the adapter bracket attached are shown in the following figure.



DIMENSIONS IN MILLIMETERS INCHES, ARE IN PARENTHESIS

Figure 1.8 – Baseplate Mounting Dimensions for 19″ Rack Installation

3.4. Rack Number DIP Switch

Each expansion and remote rack is identified with a unique number between 1 and 4 (1 and 7 in a system with a model 351 or 352 CPU), called a Rack Number. These rack numbers are selected by configuration of a three-position DIP switch located on each expansion baseplate directly above the connector for slot 1 (switches must be configured before the power supply is installed).

In an Alspa C80–35 PLC system rack number 0 must always be present and is assigned to the CPU rack (the CPU baseplate does not have this DIP switch). The other racks do not need to be contiguously numbered, although for consistency and clarity, it is recommended that rack numbers not be skipped (use 1, 2, 3 - not 1, 3). Rack numbers must not be duplicated in an expansion system having multiple racks.

To select the rack number, set the switches to either the open (binary 1) or closed (binary 0) position. The label above the switch shows the switch positions for each rack number. The following figure shows this DIP switch package with an example of a rack number selected (rack 2 selected in the example).

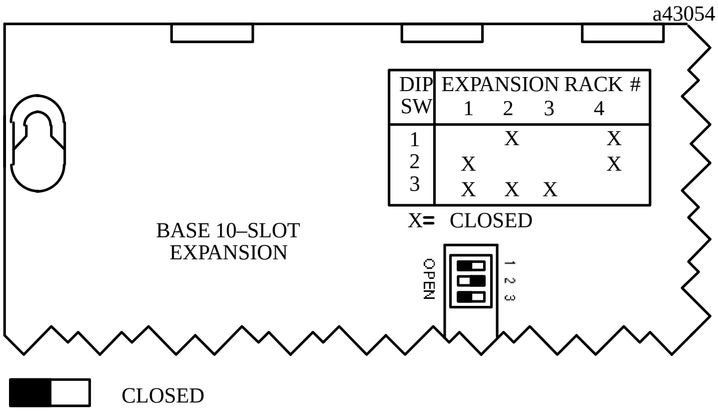


Figure 1.9 – Example of Rack Number Configuration (Rack 2 Selected)

Note

An I/O system controlled by a PC with a Personal Computer Interface card (PCIF-35) can have a maximum of four baseplates (DIP switch positions 5, 6 and 7 are not valid in this case).

3.5. Expansion System Cable Connections

The following figure shows cable connections in a typical I/O expansion system. Included in the figure are both remote and expansion baseplates. A remote system can consist of any combination of remote and expansion baseplates as long as recommanded distance and cable requirements are followed. *The I/O system can be controlled by either an Alspa C80–35 Programmable Logic Controller or by a Personal Computer (with a Personal Computer Interface card installed). Both options are shown in the illustration.*

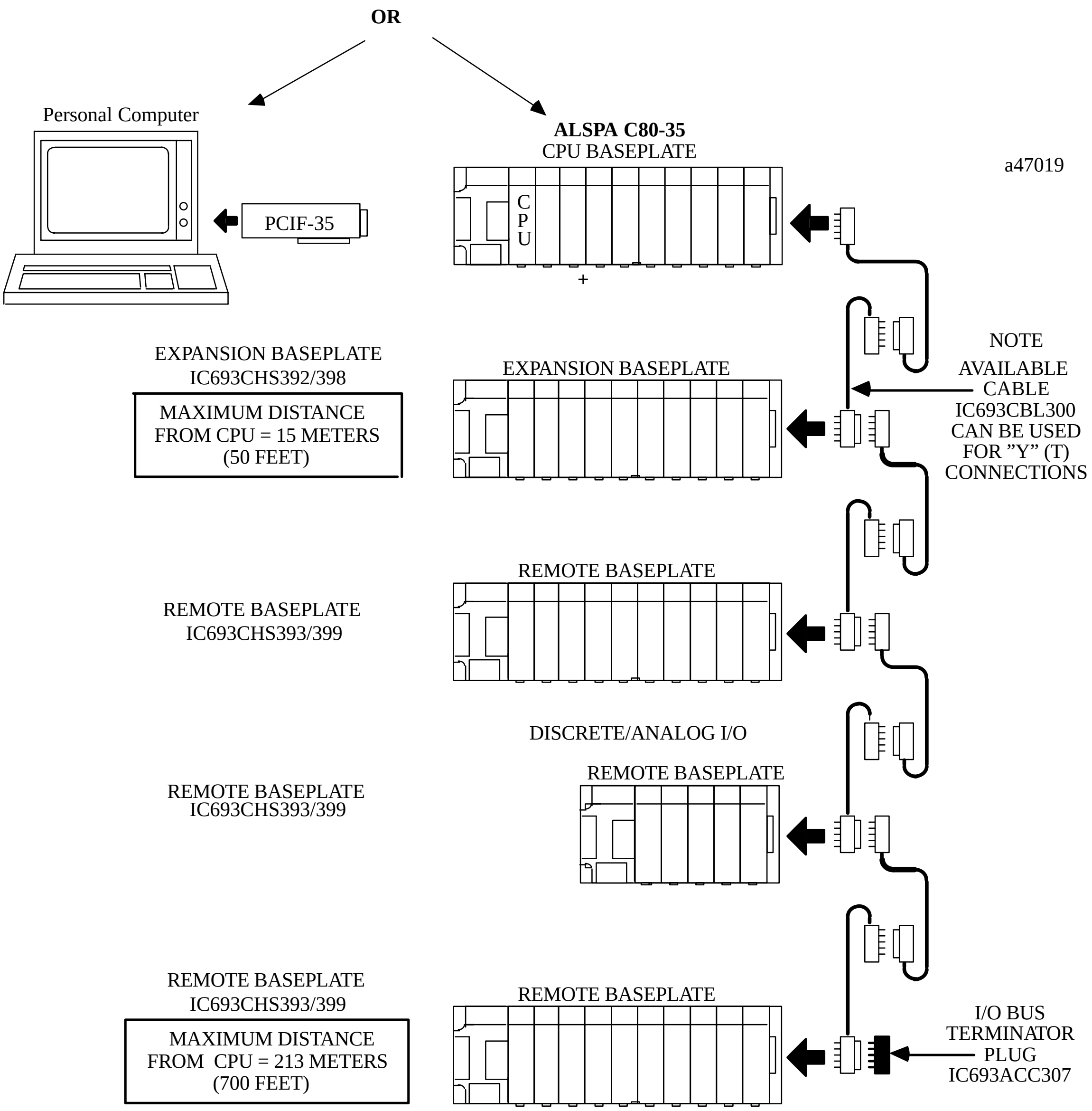


Figure 1.10 – Example of Connecting Baseplates in an I/O Expansion System

Note

Each signal pair on the I/O bus must be terminated at the end of the I/O bus with 120 ohm resistors. This termination can be done with the I/O Bus Terminator Plug, by using the 15 meter (50 foot) cable with built-in terminating resistors, *or* by building a custom cable with the resistors installed in connectors at the end of the bus.

3.6. I/O Expansion Cables

Several prewired cables may be purchased from ALSTOM. All of these cables have a continuous, or 100% shield. Custom built cables with lengths greater than 15 meters (50 feet), the recommended cable type must be used (see Table 1.4, page 1–17).

Catalog Number	Length
IC693CBL300	1 meter (3 feet), continuous shield
IC693CBL301	2 meters (6 feet), continuous shield
IC693CBL302	15 meters (50 feet), continuous shield
IC693CBL312	0.15 meter (0.5 feet), continuous shield
IC693CBL313	7.5 meters (25 feet), continuous shield
IC693CBL314	15 meters (50 feet), continuous shield

Table 1.3 – I/O Expansion Cables (Prewired)

Note

The 1 meter cable (IC693CBL300) can be used as the ”Y” (T) adapter between cables and remote baseplates in a remote expansion system. See the following discussion of remote baseplates for details.

Also note that *all of the available prewired expansion cables can be used with either the expansion or remote baseplates* as long as cable length guidelines are followed, as described in this paragraph.

3.7. Building remote Cables

The following information is provided to help you to build the cables required when installing a system that requires remote baseplates and the distances between baseplates are not easily adapted to purchased cables. The total length of the remote link depends on the type of cable that you use, with the maximum total length being 213 meters (700 feet) when Belden type 8107 cable is used. *Use of other types of cable may reduce the total length of the remote link.*

The maximum cable length in the figure is the total number of meters from the Alspa C80–35 CPU baseplate to the last baseplate in the system. The absolute maximum cable lengths are:

- expansion baseplates = 15 meters (50 feet),
- remote baseplates = 213 meters (700 feet) with recommended cable type.

Specifications for connectors and recommended cable type for building cables for an I/O expansion link are listed in the following table.

Item	Description
Cable:	Belden 8107: Computer cable, overall foil/braid shield, twisted-pair 30 volt/80°C (176°F) 0.21 mm^2 (24 AWG) tinned copper, 7 x 32 stranding Velocity of propagation = 70% * Nominal impedance = 100Ω *
25 Pin Male Connector:	Crimp - Plug = Amp 207464-1; Pin = Amp 66506-9 Solder - Plug = Amp 747912-2
25 Pin Female Connector:	Crimp - Receptacle = Amp 207463-2; Pin = Amp 66504-9 Solder - Receptacle = Amp 747913-2
Connector Shell:	Kit - Amp 207908-7 Metal-Plated Plastic (Plastic with Nickel over Copper) ** Crimp Ring - AMP 745508-1, Split Ring Ferrules

* Critical Information

** Vendor part numbers listed for user assembled cables are provided for reference only and do not suggest or imply that they are preferred. Any part that meets the same specification can be used.

Table 1.4 – Connector/Cable Specifications

3.7.1. Expansion Port Pin Assignments

The following table lists the expansion port pin assignments that you will need when building remote cables. Note that all connections between cables are point-to-point, that is, pin 2 of one end connects to pin 2 of the opposite end, pin 3 to pin 3, etc. (See wiring diagrams for pin 1 connections Figure 1.11 to Figure 1.15).

Pin Number	Signal Name	Function
16	DIODT	I/O Serial Data Positive
17	DIODT/	I/O Serial Data Negative
24	DIOCLK	I/O Serial Clock Positive
25	DIOCLK/	I/O Serial Clock Negative
20	DRSEL	Remote Select Positive
21	DRSEL/	Remote Select Negative
12	DRPERR	Parity Error Positive
13	DRPERR/	Parity Error Negative
8	DRMRUN	Remote Run Positive
9	DRMRUN/	Remote Run Negative
2	DFRAME	Cycle Frame Positive
3	DFRAME/	Cycle Frame Negative
1	FGND	Frame Ground
7	0V	Logic Ground

Table 1.5 – Expansion Port Pin Assignments

3.7.2. Shield Treatment

All ALSTOM factory made cables are made with a *continuous*, or 100% shield. This means that the braided cable shield is connected to the metal shell of the connector around the entire perimeter of the connector. This provides a low impedance path to frame ground for any noise energy that is coupled onto the cable shield.

For custom length cables made per Figure 1.12 the best noise immunity is achieved when using a metalized connector cover that makes contact with the cable's braided and foil shielding on the cable side and with the connector shell on the terminating end.

Note

It is ***not sufficient*** to only solder the drain wire to the connector shell. It is required that the cable's shield be continuous across the entire length of the cable, including at the terminations. Figure 1.11 shows the recommended method for folding the braided shield back before inserting the cable into a metallized cover.

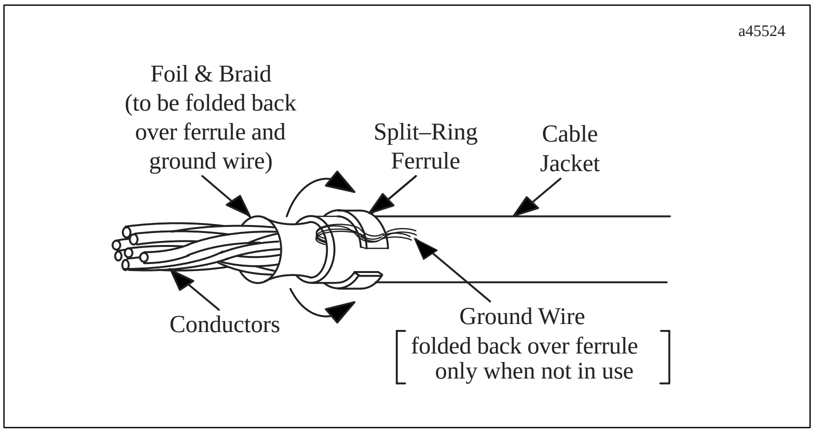


Figure 1.11 – How to use Split-Ring Ferrules for Foil and Braided Cable Shield

For typical industrial applications, all expansion and remote baseplate cables can be made with plastic shell covers and should be wired as shown in Figure 1.14. In either case, pin 1 should be wired into both ends of the custom length cable and the recommendations listed below should be followed for the ”Y” cables treatment in the remote (IC693CHS392/399) baseplates.When using 100% shielded cables all local (CPU and expansion) baseplates in the system must be solidly referenced to the same ground point or a potential difference between baseplates could disturb signal transmission. In remote baseplates, IC693CHS393E (and earlier) and IC693CHS399D (and earlier), it is necessary to remove pin 1 of the mating cable where the cable plugs into the baseplate. This means that when using a factory made ”Y” cable, IC693CBL300, **you must break pin 1 out** of the male end where it plugs into the remote baseplate before using it with one of these baseplates. *Custom built ”Y” cables for these baseplates should be built using Figure 1.15.*

Remote baseplates IC693CHS393F (and later) and IC693CHS399E (and later) have a change inside the baseplate which alleviates the need to remove pin 1 from the mating cable. When using factory made ”Y” cable with these baseplates, it is ***not*** necessary to remove pin 1 from the cable. Custom built ”Y” cables for these baseplates can be made using either Figure 1-13 or Figure 1-14. Figure 1-14 shows how the factory made ”Y” cable are made.

By removing pin 1 in custom built ”Y” cables made for the earlier versions of remote baseplates, the pin 7 (0V) signal reference originates in the main (CPU) baseplate. In these earlier versions of the remote baseplates, pin 1 was tied to pin 7 (0V) and also AC coupled to the remote frame ground. When using these baseplates in combination with the 100% shielded ”Y” cables, the pin 7 (0V) reference would be improperly DC coupled to the remote frame ground through the D-subminiature connector shell, which is DC coupled to the remote frame ground.

In the remote baseplates IC693CHS393F (and later) and IC693CHS399E (and later), the pin 1 shield signal is DC coupled to the remote frame ground and *not* attached to pin 7 (0V). This allows the best noise immunity by providing a good continuous cable shield and still allows the pin 7 (0V) signal reference to originate in the CPU baseplate without the need for removing pin 1 in any factory or custom built cable. The D-subminiature connector shell is still DC coupled to the remote frame ground.

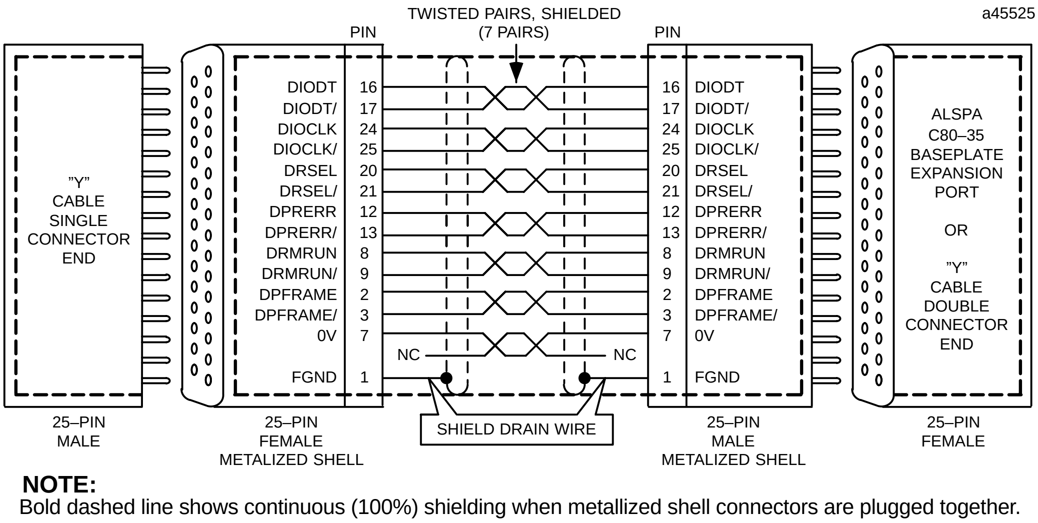
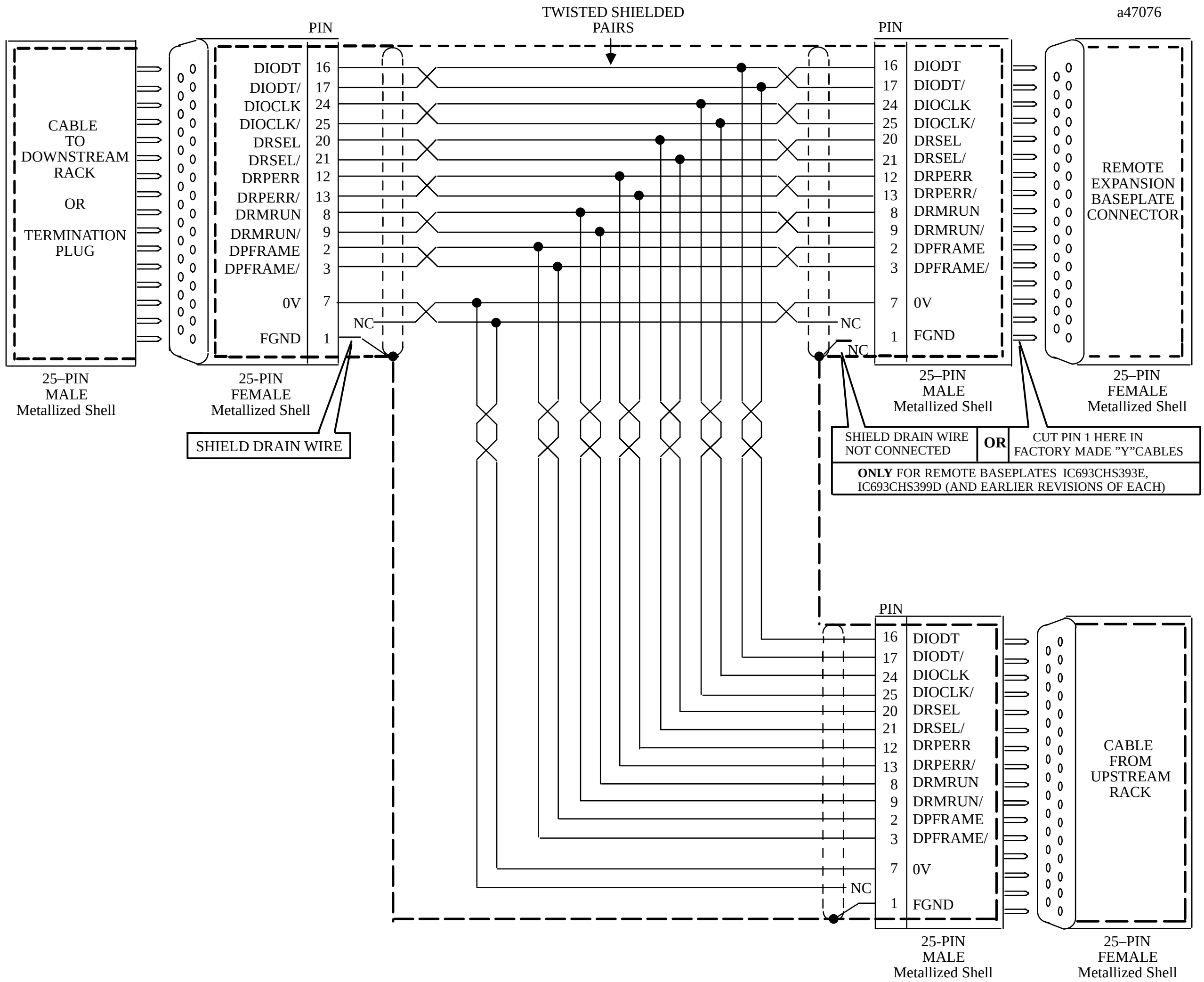
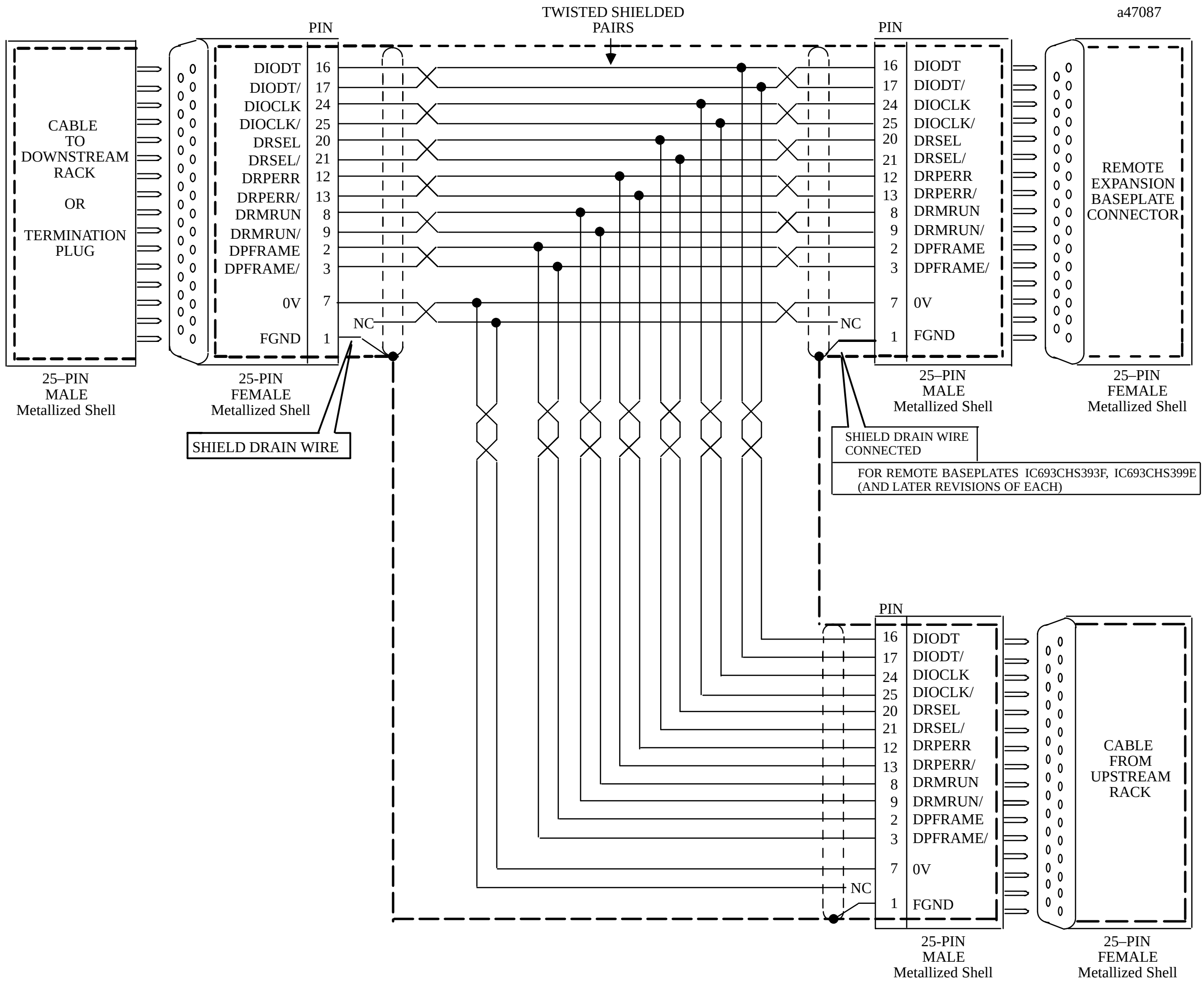


Figure 1.12 – Point-To-Point Cable Wiring Diagram for Custom Length Cables



NOTE:
Bold dashed line shows continuous (100%) shielding when metallized shell connectors are plugged together.

Figure 1.13 – Earlier Revisions of Remote baseplate (IC693CHS393/399) Custom "Y" Cable Wiring Diagram



NOTE:
Bold dashed line shows continuous (100%) shielding when metallized shell connectors are plugged together.

**Figure 1.14 – Current Remote baseplate (IC693CHS393/399)
Custom ”Y” Cable Wiring Diagram**

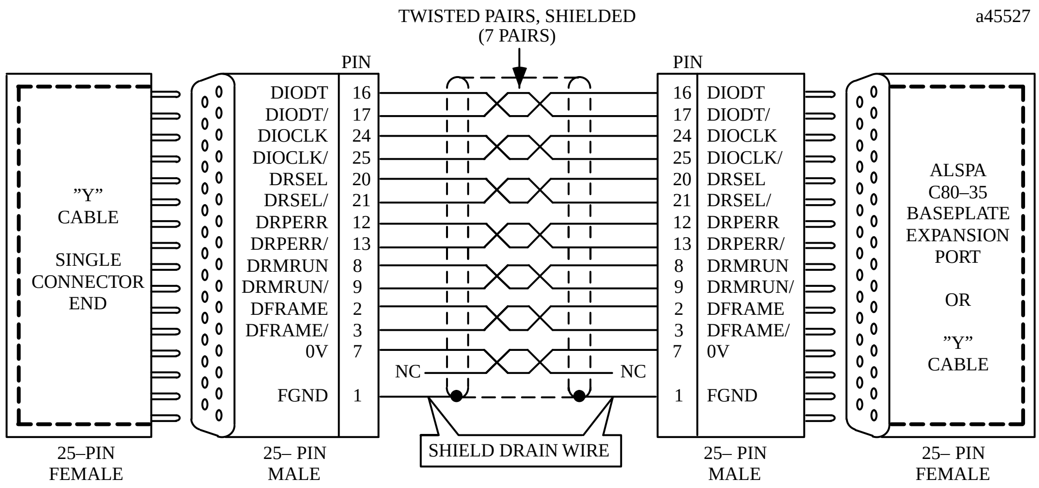


Figure 1.15 – Point-To-Point Cable Wiring Diagram for Requiring Less Noise Immunity Applications

Making an 100% Shielded Cable

Use the following steps to build an 100% shielded cable:

1. Strip approximately 15 cm (5/8 inch) of insulation from your custom cable to expose the shield.
2. Remove the male Pin 1 from any connector plugging directly into an older version remote baseplate (IC693CHS393E, IC693CHS399D or earlier).
3. Put split-ring ferrule over cable insulation (Figure 1.11)
4. Fold the shield back over top of the cable insulation and ferrule.
5. Place the collar of the metal hood over top of the folded shield and securely clamp the hood.
6. Test your cable for continuity between both connector shells. If the metalized connector hood is not making proper contact with the cable shield at either end, the continuity will be intermittent.
7. Plug the metal hooded cable onto a remote baseplate expansion port connector or into an "Y" cable and securely tighten the two screws. Installing and tightening the screws will electrically connect the shield to the remote baseplate frame ground, which should in turn be connected to earth ground.

3.7.3. I/O Expansion Bus Termination

When two or more baseplates are cabled together in an expansion system, the I/O expansion bus must be properly terminated. The I/O bus *must be terminated* at the last baseplate in an expansion system. Each signal pair is terminated with 120 ohm, 1/4 watt resistors wired between the appropriate pins, as follows (see Table 1.5):

pins 16 - 17; 24 - 25, 20 - 21; 12 - 13; 8 - 9; 2 - 3

The I/O bus termination can be done one of the following ways:

- By installing an *I/O Bus Terminator Plug*, catalog number IC693ACC307, on the last expansion baseplate (local expansion baseplate or remote baseplate) in the system. The Terminator Plug has a resistor pack physically mounted inside of a connector. The I/O Bus Terminator Plug is shipped with each baseplate; only the last baseplate in the expansion chain can have the I/O Bus Terminator Plug installed. Unused I/O Bus Terminator Plugs can be discarded or saved as spares.
- If an expansion system has only one expansion baseplate, the I/O bus can be terminated by installing as the last cable, the 15 meter (50 feet) I/O Expansion cable, catalog number IC693CBL302. This cable has the termination resistors installed in the end that connects to the expansion baseplate connector.
- You can build a custom length cable with termination resistors wired to the appropriate pins for installation at the end of the bus.

4. POWER SUPPLIES

- IC693324, Standard 120/240 VAC or 125 VDC input, 30 watts total output,
- CE693330, High Capacity 120/240 VAC or 125 VDC, 30 watts total output,
- IC693325, 24/48 VDC input, 30 watts total output,
- CE693331, High Capacity 24 VDC input, 30 watts total output.

4.1. Standard Power Supply, 120/240 VAC or 125 VDC Input

The Alspa C80–35 system AC/DC input Standard Power Supply (IC693PWR324) is available as a 30 watts wide range supply which can operate from a voltage source in the range of 100 to 240 VAC or 125 VDC. This power supply provides +5 VDC output, +24 VDC relay power output which provides power to circuits on Alspa C80–35 Output Relay modules and isolated 24 VDC output. The isolated +24 VDC is used internally by some modules and can be used to provide power for some Input modules. The load capacities for each output of the power supply are shown in the following table.

Catalog Number	Load Capacity	Input	Output Capacities (Voltage/Power*)		
IC693PWR324	30 watts	100 to 240 VAC or 125 VDC	+5 VDC 15 watts	+24 VDC Isolated 20 watts	+24 VDC Relay 15 watts

* Total of all outputs combined cannot exceed 30 watts.

Table 1.6 – Standard AC/DC Input Power Supply Capacities for Alspa C80–35 Baseplates

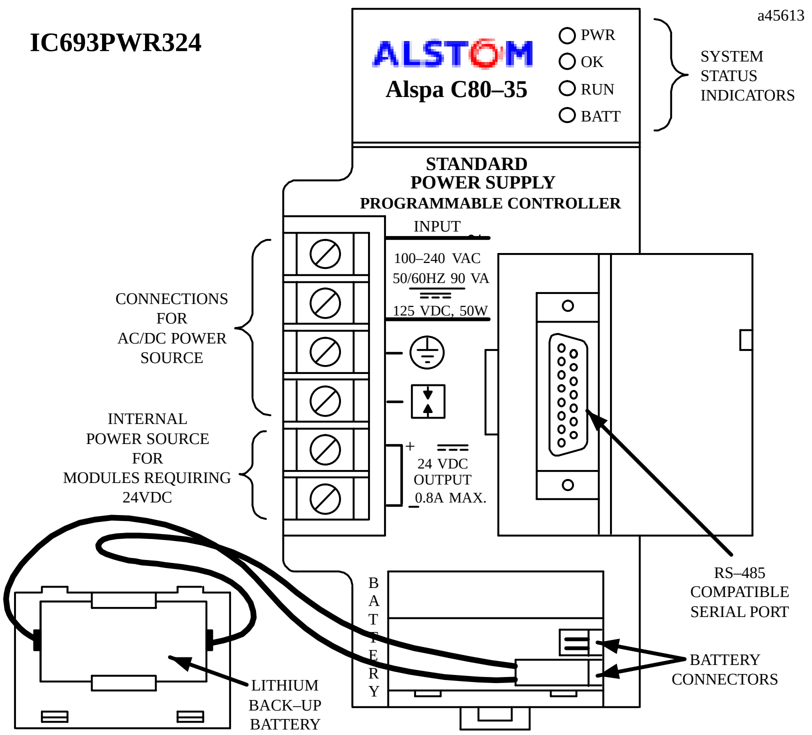


Figure 1.16 – Standard AC/DC Input Power Supply - IC693PWR324

Power supplies must be installed in the leftmost slot in all baseplates and are connected to the backplane through the backplane connector in the slot in which they are installed.

Note

Previous versions of this power supply had five terminals on the terminal block. The new version (see Figure 1.16), which has six terminals, is functionally the same as the previous version. The change was made to conform to European Union (EU or CE) Directives.

4.1.1. Output voltage connection to backplane

The following figure illustrates how these three output voltages are connected internally to the backplane on the baseplate. The voltage and power required by modules installed on the baseplate is available on the baseplate connectors.

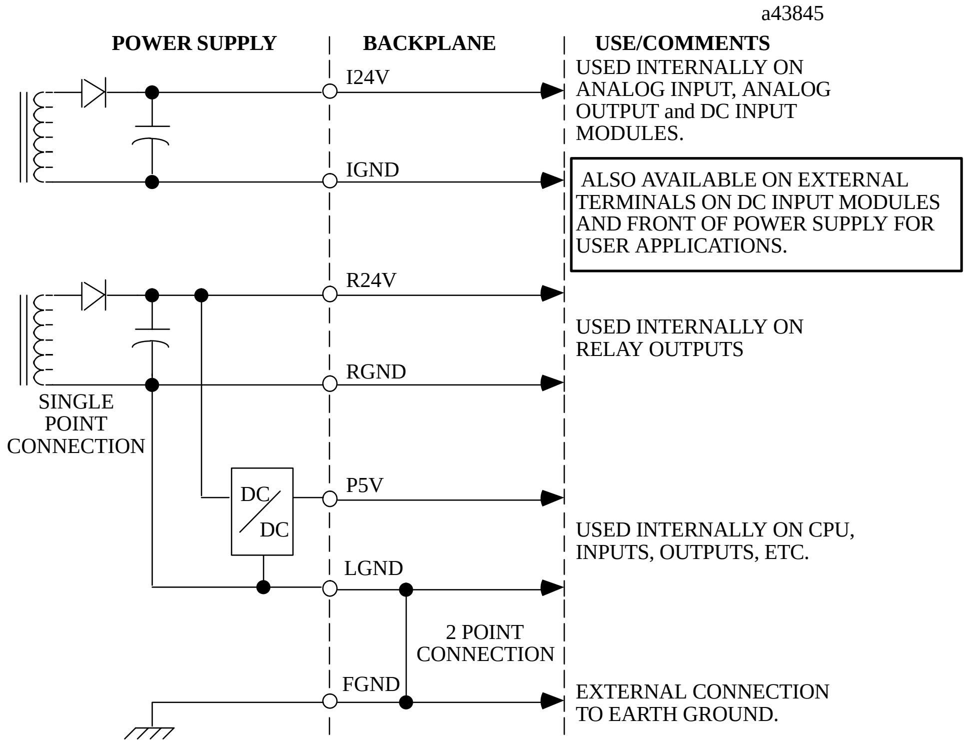


Figure 1.17 – Interconnection of Power Supplies

Nominal Rated Voltage	120/240 VAC or 125 VDC
Input Voltage Range	
AC	85 to 264 VAC
DC	100 to 300 VDC
Input Power (Maximum with Full Load)	90 VA with VAC Input 50 W with VDC Input
Inrush Current	4A peak, 250 ms maximum
Output Power	15 watts maximum: 5 VDC and 24 VDC Relay 20 watts maximum: 24 VDC Isolated *30 watts maximum total (all three outputs)*
Output Voltage	5 VDC: 5.0 VDC to 5.2 VDC (5.1 VDC nominal) Relay 24 VDC: 24 to 28 VDC Isolated 24 VDC: 21.5 VDC to 28 VDC
Protective Limits	
Overvoltage	5 VDC output: 6.4 to 7 V
Overcurrent	5 VDC output: 4 A maximum
Holdup Time:	20 ms minimum

Table 1.7 – Specifications for Standard AC/DC Input Power Supply

4.1.2. Field Wiring Connections to Standard AC/DC Power Supply

The Standard AC/DC power supply has six terminals for user connections. These connections are described below.

4.1.2.1. AC Power Source Connections

The Hot, Neutral and Ground wires from the 120 VAC power source or L1, L2 and Ground wires from the 240 VAC power source connect to the system through the top three protected terminals on the terminal connector on the power supply faceplate.

4.1.2.2. Overvoltage Protection Devices

The overvoltage protection devices for this power supply are connected internally to pin 4 on the user terminal board. This pin is normally connected to frame ground (pin 3) with the supplied jumper strap which is installed at the factory. If overvoltage protection is not required *or* is supplied upstream, this feature can be disabled by leaving pin 4 unconnected by removing the jumper strap.

If you want to Hi-pot test this supply, overvoltage protection *must be disabled* during the test by removing the terminal board strap. Re-enable overvoltage protection after testing by reinstalling the strap.

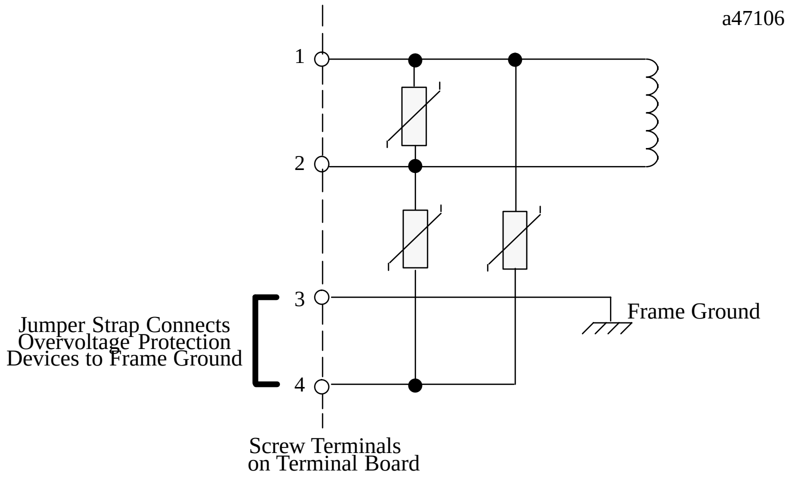


Figure 1.18 - Overvoltage Protection Devices and Jumper Strap

4.1.2.3. DC Power Source Connections

The + and – wires from the 125 VDC nominal power source connect to the top two protected terminals on the terminal connector.

4.1.2.4. Isolated 24 VDC Supply

The bottom two terminals provide connections to the internally supplied Isolated 24 volt DC output which can be used to provide power for input circuits (within power limitations of the supply).

Caution

If the Isolated 24 VDC supply is overloaded or shorted, the Programmable Logic Controller or PC will stop operation.

4.2. High Capacity Power Supply, 120/240 VAC or 125 VDC Input

The Alspa C80–35 system AC/DC input High Capacity power supply (CE693PWR330) is available as a 30 watt wide range supply which can operate from a voltage source in the range of 100 to 240 VAC or 125 VDC. This power supply provides +5 VDC output, +24 VDC relay power output which provides power to circuits on Alspa C80–35 Output Relay modules and isolated 24 VDC output. *For applications requiring greater +5V current capacity than is available with the standard supply, this supply allows all 30 watts to be consumed by the +5V.* The isolated 24 VDC is used internally by some modules and can be used to provide power for some Input modules. The load capacities for each output of the power supply are shown in the following table.

Catalog Number	Load Capacity	Input	Output Capacities (Voltage/Power *)		
CE693PWR330	30 watts	100 to 240 VAC or 125 VDC	+5 VDC 30 watts	+24 VDC Isolated 20 watts	+24 VDC Relay 15 watts

* ***Total of all outputs combined cannot exceed 30 watts.***

Table 1.8 – High Capacity AC/DC Input Power Supply Capacities

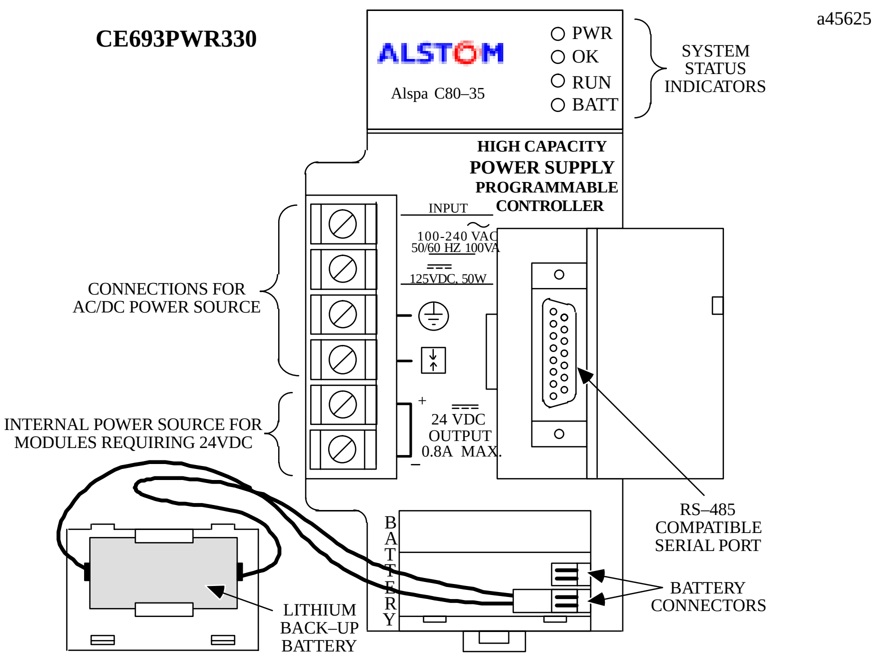


Figure 1.19 – High Capacity AC/DC Input Power Supply - CE693PWR330

4.2.1. Output Voltage Connections to Backplane

The following figure illustrates how these three output voltages are connected internally to the backplane on the baseplate. The voltage and power required by modules installed on the baseplate is available on the baseplate connectors.

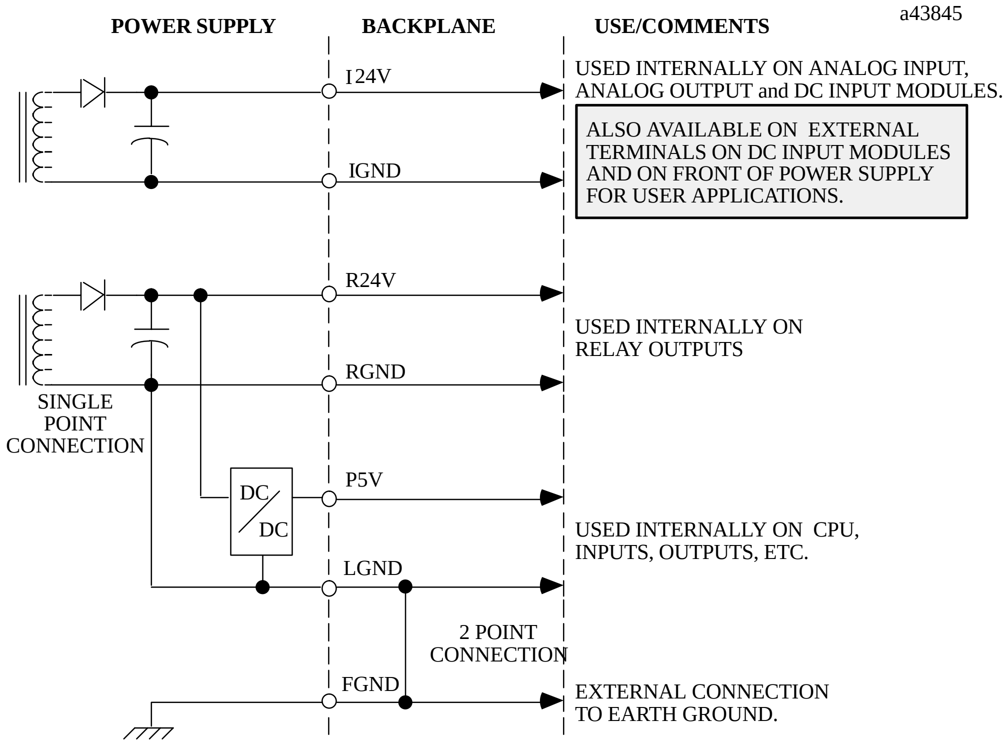


Figure 1.20 – Interconnection of Power Supplies

Nominal Rated Voltage	120/240 VAC or 125 VDC
Input Voltage Range	
AC	85 to 264 VAC
DC	100 to 300 VDC
Input Power (Maximum with Full Load)	100 VA with VAC Input 50 W with VDC Input
Inrush Current	4A peak, 250 ms maximum
Output Power	30 watts maximum: 5 VDC 15 watts maximum: 24 VDC Relay 20 watts maximum: 24 VDC Isolated ***NOTE:*** *30 watts maximum total (all three outputs)*
Output Voltage	5 VDC: 5.0 VDC to 5.2 VDC (5.1 VDC nominal) Relay 24 VDC: 24 to 28 VDC Isolated 24 VDC: 21.5 VDC to 28 VDC
Protective Limits	
Overvoltage:	5 VDC output: 6.4 to 7 V
Overcurrent:	5 VDC output: 6.5 A maximum
Holdup Time:	20 ms minimum

Table 1.9 – Specifications for High Capacity AC/DC Input Power Supply

4.2.2. Field Wiring Connections to High Capacity AC/DC Power Supply

The High Capacity AC/DC power supply has six terminals for user connections. These connections are described below.

4.2.2.1. AC Power Source Connections

The Hot, Neutral and Ground wires from the 120 VAC power source or L1, L2 and Ground wires from the 240 VAC power source connect to the system through the top three protected terminals on the terminal connector on the power supply faceplate.

4.2.2.2. Overvoltage Protection Devices

The overvoltage protection devices for this power supply are connected internally to pin 4 on the user terminal board. This pin is normally connected to frame ground (pin 3) with the supplied jumper strap which is installed at the factory. If overvoltage protection is not required *or* is supplied upstream, this feature can be disabled by leaving pin 4 unconnected by removing the jumper strap.

If you want to Hi-pot test this supply, overvoltage protection *must be disabled* during the test by removing the terminal board strap. Re-enable overvoltage protection after testing by reinstalling the strap.

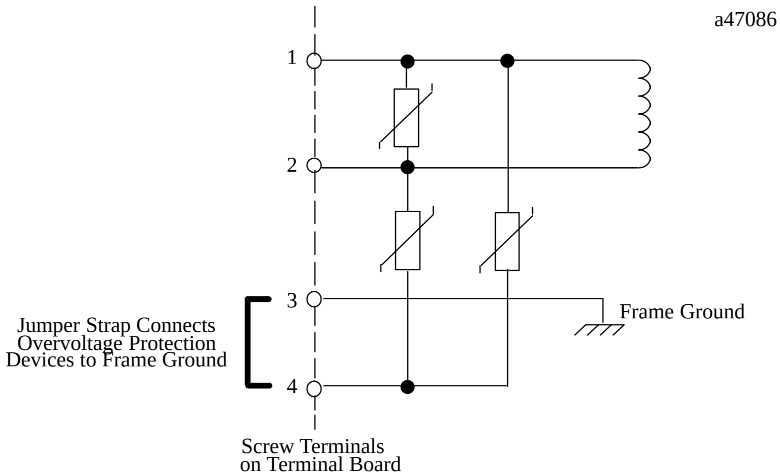


Figure 1.21 – Overvoltage Protection Devices and Jumper Strap

4.2.2.3. DC Power Source Connections

The + and – wires from the 125 VDC nominal power source connect to the top two protected terminals on the terminal connector.

4.2.2.4. Isolated 24 VDC Supply

The bottom two connections provide terminals for connections to the internally supplied Isolated 24 volt DC output which can be used to provide power for input circuits (within power limitations of the supply).

Caution

If the Isolated 24 VDC supply is overloaded or shorted, the Programmable Logic Controller or PC will stop operation.

4.3. Power Supply, 24/48 VDC Input

The Alspa C80–35 DC input power supply (IC693PWR325) is available as a 30 watt wide range supply designed for 24 VDC or 48 VDC nominal inputs. It will accept an input voltage range from 18 VDC to 56 VDC. Although it is capable of maintaining all outputs within specifications with input voltages as low as 18 VDC, it will not start with initial input voltages of less than 21 VDC. This power supply provides +5 VDC output, +24 VDC relay power output which provides power to circuits on Alspa C80–35 Output Relay modules and isolated 24 VDC output. The isolated 24 VDC can be used to provide power for some Input modules. The load capacities for each output of the power supply are shown in the following table.

Catalog Number	Load Capacity	Input	Output Capacities (Voltage/Power*)		
IC693PWR325	30 watts	24 or 48 VDC	+5 VDC 15 watts	+24 VDC Isolated 20 watts	+24 VDC Relay 15 watts

* Total of all outputs combined cannot exceed 30 watts.

Table 1.10 – DC Input Power Supply Capacities for Alspa C80–35 Baseplates

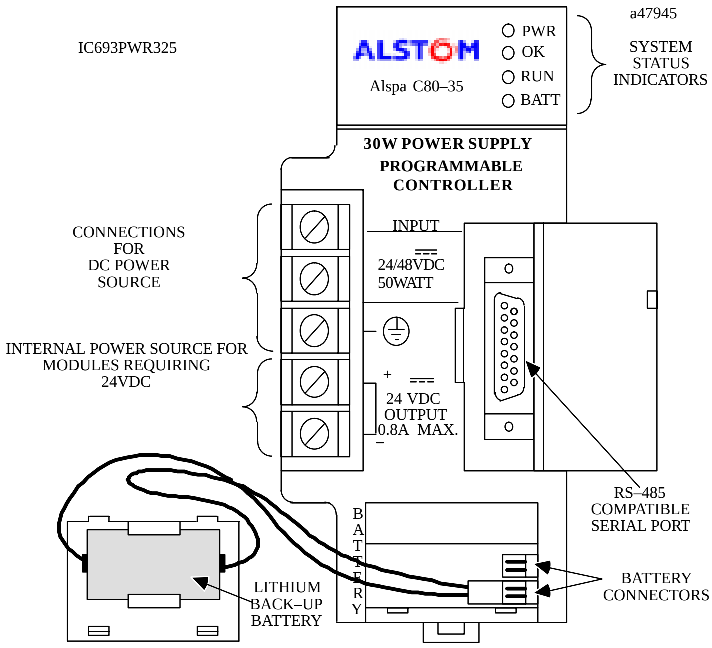


Figure 1.22 – Alspa C80–35 DC Input Power Supply - IC693PWR325

4.3.1. Output Voltage Connections to Backplane

The following figure illustrates how these three output voltages are connected internally to the backplane on the baseplate. The voltage and power required by modules installed on the baseplate is available on the baseplate connectors.

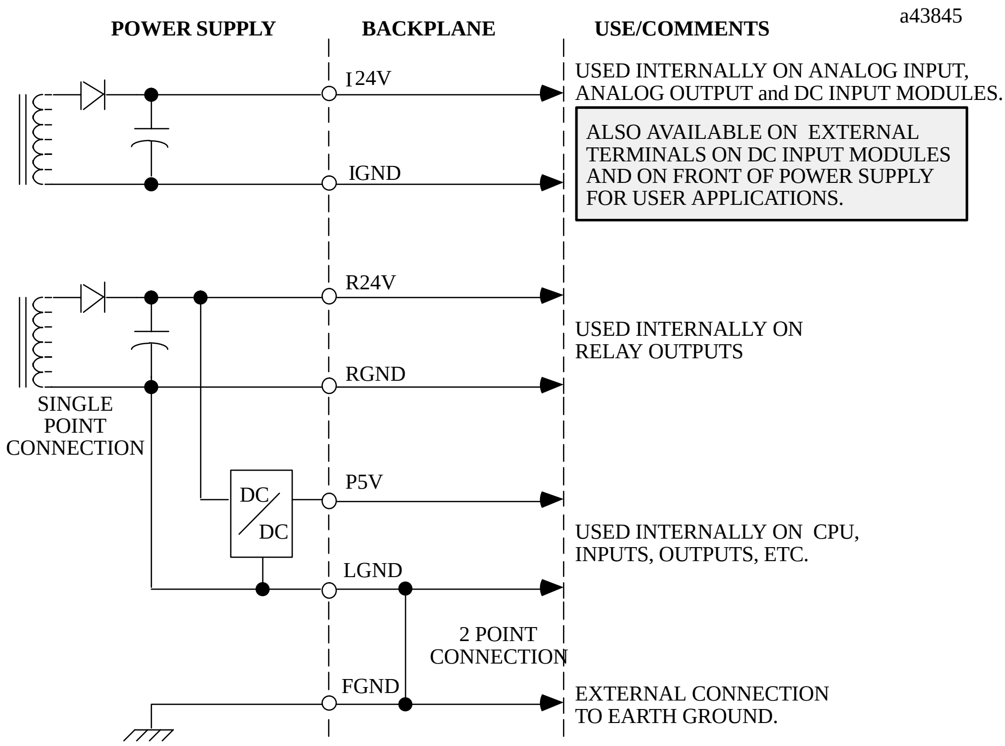


Figure 1.23 – Interconnection of Power Supplies

Nominal Rated Voltage Input Voltage Range **Start** **Run**	24 or 48 VDC 21 to 56 VDC 18 to 56 VDC
Input Power	50 watts maximum at full load
Inrush Current	4A peak, 100 ms maximum
Output Power	15 watts maximum: 5 VDC and 24 VDC Relay 20 watts maximum: 24 VDC Isolated *30 watts maximum total (all three outputs)*
Output Voltage	5 VDC: 5.0 VDC to 5.2 VDC (5.1 VDC nominal) Relay 24 VDC: 24 to 28 VDC Isolated 24 VDC: 21.5 VDC to 28 VDC
Protective Limits **Overvoltage** **Overcurrent**	 5 VDC output: 6.4 to 7 V 5 VDC output: 4 A maximum
Holdup Time:	14 ms minimum

Table 1.11 – Specifications for 24/48 VDC Input Power Supply

4.3.2. Field Wiring Connections to DC Input Power Supply

4.3.2.1. DC Power Source Connections

The + and – wires from the 24/48 VDC power source connect to the top two protected terminals on the terminal connector.

4.3.2.2. Isolated 24 VDC Supply

The bottom two connections provide terminals for connections to the internally supplied Isolated 24 volt DC output which can be used to provide power for input circuits (within power limitations of the supply).

4.3.3. Calculating Input Power Requirements for DC Input Power Supply

The following graph is a typical 24/48 VDC power supply efficiency curve. A basic procedure for determining efficiency of the 24/48 VDC power supply follows the figure.

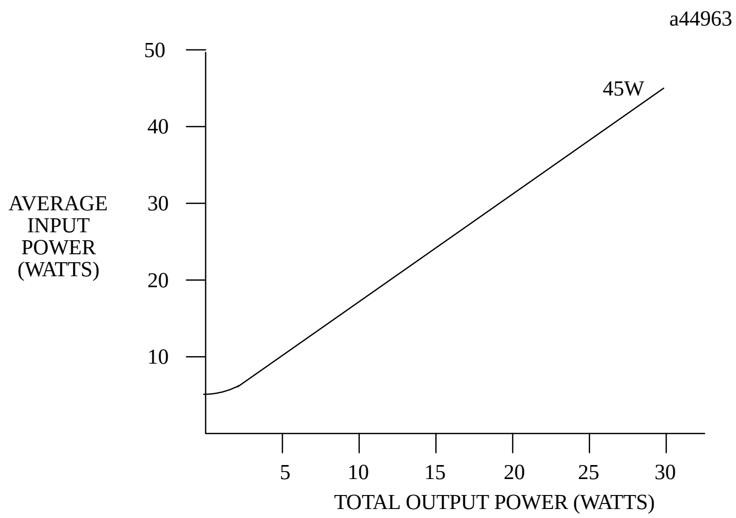


Figure 1.24 – Typical Efficiency Curve for 24/48 VDC Power Supply

Note

Start-up surge at full load is 4 amps for 250 milliseconds (maximum).

- Determine total output load from typical specifications listed for individual modules in Chapters 2 and 3.
- Use the graph to determine average input power.
- Divide the input power by the operating source voltage to determine the input current requirements.
- Use the lowest input voltage to determine the maximum input current.
- Allow for start-up surge current requirements.
- Allow margins (10% to 20%) for variations.

4.4. High Capacity Power Supply, 24 VDC Input

The Alspa C80–35 DC input High Capacity power supply (CE693PWR331) is available as a 30 watt wide range supply designed for 24 VDC nominal inputs. It will accept an input voltage range from 12 VDC to 30 VDC. Although it is capable of maintaining all outputs within specifications with input voltages as low as 12 VDC, it will not start with initial input voltages of less than 18 VDC. This power supply provides +5 VDC output, +24 VDC relay power output which provides power to circuits on Alspa C80–35 Output Relay modules and isolated 24 VDC output.

For applications requiring greater +5V current capacity than is available with the standard supply, this supply allows all 30 watts to be consumed by the +5V. The isolated 24 VDC can be used to provide power for some Input modules. The load capacities for each output of the power supply are shown in the following table.

Catalog Number	Load Capacity	Input	Output Capacities (Voltage/Power *)		
CE693PWR331	30 watts	12 to 30 VDC	+5 VDC 30 watts	+24 VDC Isolated 20 watts	+24 VDC Relay 15 watts

* Total of all outputs combined cannot exceed 30 watts.

Table 1.12 – High Capacity DC Input Power Supply Capacities

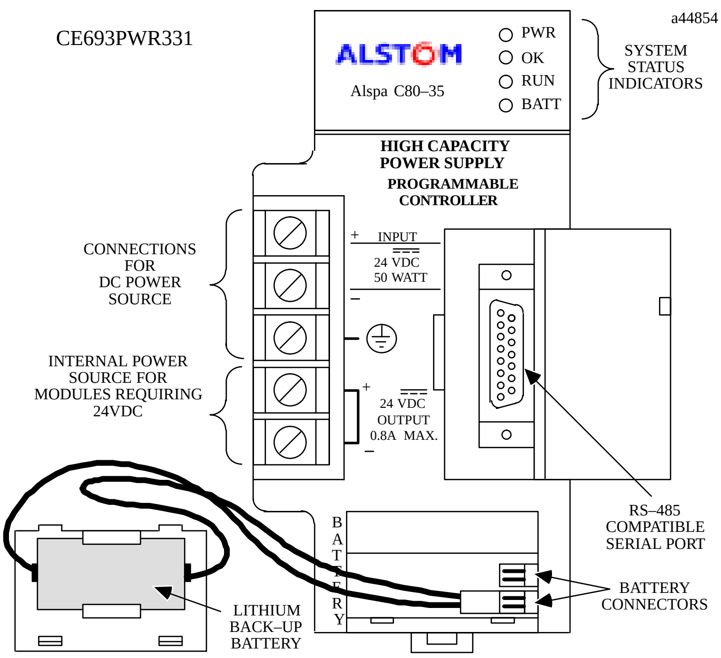


Figure 1.25 – Alspa C80–35 DC Input High Capacity Power Supply - CE693PWR331

4.4.1. Output Voltage Connections to Backplane

The following figure illustrates how these three output voltages are connected internally to the backplane on the baseplate. The voltage and power required by modules installed on the baseplate is available on the baseplate connectors.

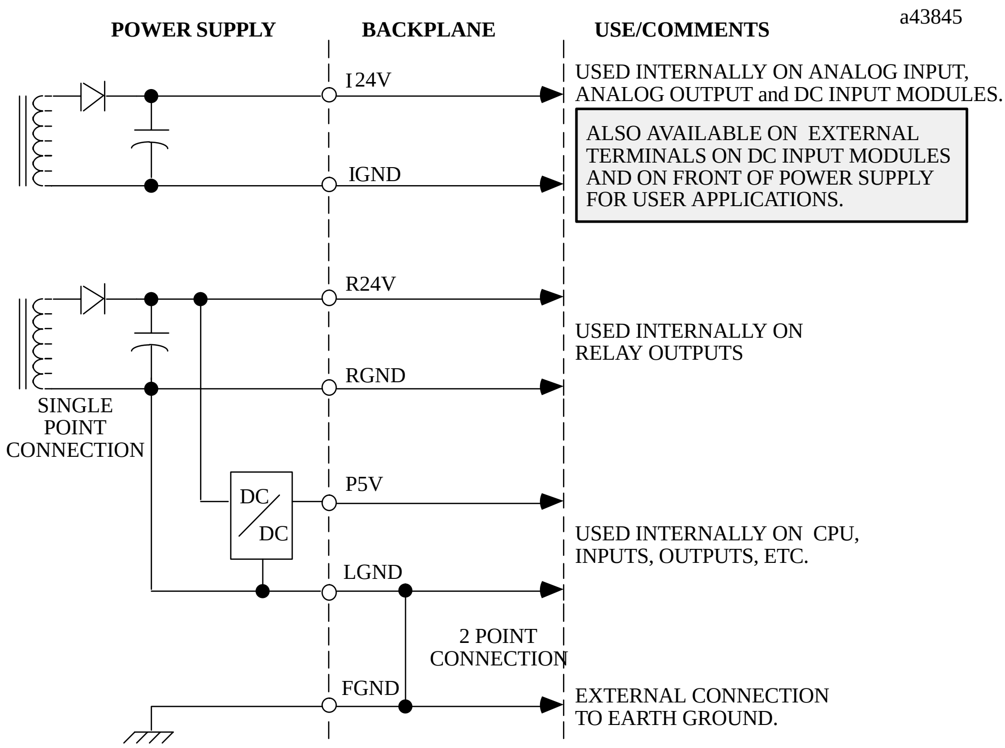


Figure 1.26 – Interconnection of Power Supplies

Nominal Rated Voltage	24 VDC
Input Voltage Range	
Start	18 to 30 VDC
Run	12 to 30 VDC
Input Power	50 watts maximum at full load
Inrush Current	*
Output Power	30 watts maximum: 5 VDC ** 15 watts maximum: 24 VDC Relay 20 watts maximum: 24 VDC Isolated *30 watts maximum total (all three outputs)*
Output Voltage	5 VDC: 5.0 VDC to 5.2 VDC (5.1 VDC nominal) Relay 24 VDC: 19.2 to 28.8 VDC Isolated 24 VDC: 19.2 VDC to 28.8 VDC
Protective Limits	
Overvoltage:	5 VDC output: 6.4 to 7 V
Overcurrent;	5 VDC output: 7 A maximum
Holdup Time:	10 ms minimum
Standards	Refer to data sheet ALS 53002 for product standards and general specifications.

* Dependent on installation and power supply impedance characteristics.
** Derate per Figure 1.27 at ambient temperatures above 50°C (122°F).

Table 1.13 – Specifications for 24VDC Input High Capacity Power Supply

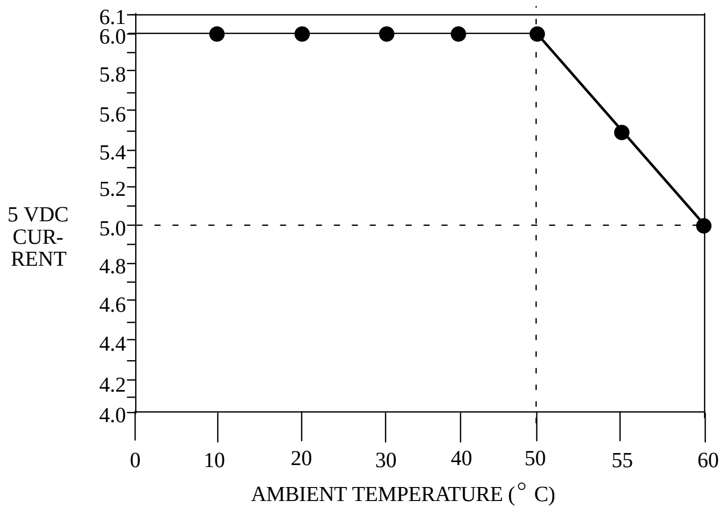


Figure 1.27 – 5 VDC Current Output Derating for Temperatures above 50°C (122°F)

4.4.2. Field Wiring Connections to DC Input High Capacity Power Supply

4.4.2.1. DC Power Source Connections

The + and – wires from the 24 VDC power source connect to the top two protected terminals on the terminal connector.

4.4.2.2. Isolated 24 VDC Supply

The bottom two connections provide terminals for connections to the internally supplied Isolated 24 volt DC output which can be used to provide power for input circuits (within power limitations of the supply).

4.4.3. Calculating Input Power Requirements for DC Input Power Supply

Use the following procedure to determine input power requirements for the 24 VDC High Capacity Power Supply:

- Determine total output load from typical specifications listed for individual modules in Chapters 2 and 3,
- Multiply the output power by 1.5,
- Divide the input power by the operating source voltage to determine the input current requirements,
- Use the lowest input voltage to determine the maximum input current,
- Allow for start-up surge current requirements,
- Allow margins (10% to 20%) for variations.

4.4.4. Status Indicators on Power Supply (All Supplies)

Four LEDs on the power supply are located at the upper right front of the faceplate. The purpose of these LEDs is as follows:

PWR

The top green LED, labeled **PWR**, provides an indication of the operating state of the power supply. The LED is *ON* when the power supply has a correct source of power and is operating properly and *OFF* when a power supply fault occurs or power is not applied.

OK

The second green LED, labeled **OK**, is steady *ON* if the PLC is operating properly and *OFF* if a problem is detected by the PLC.

RUN

The third green LED, labeled **RUN**, is steady *ON* when the PLC is in the RUN mode.

BATT

The bottom red LED, labeled **BATT**, will be *ON* if the CMOS RAM backup battery voltage is too low to maintain the memory under a loss of power condition; otherwise it remains *OFF.* If this LED is ON, the Lithium battery must be replaced before removing power from the rack, or PLC memory may be lost.

4.5. Overcurrent Protection (All Supplies)

The 5V logic output is electronically limited to 3.5 amps (7 amps for high capacity supplies). An overload (including short circuits) of the total output power is sensed internally and causes the supply to shut down. The supply will continually try to restart until the overload is removed. An internal fuse in the input line is provided as a backup. The supply will usually shutdown before the fuse blows. The fuse protects against internal supply faults.

Timing Diagram

The timing diagram below shows the relationship of the DC input to the DC outputs and to the system signal (PSOK) generated by the power supply. When power is first applied, the PSOK signal goes false. This line remains false for a minimum of 20 msec after the +5V bus is within specifications, then it becomes true.

If DC input power is interrupted, the +5V bus will remain within specifications and PSOK will remain true a minimum of 10 milliseconds. PSOK then goes false. The +5V bus will remain within specifications for an additional 4 milliseconds minimum to allow an orderly shutdown of the system.

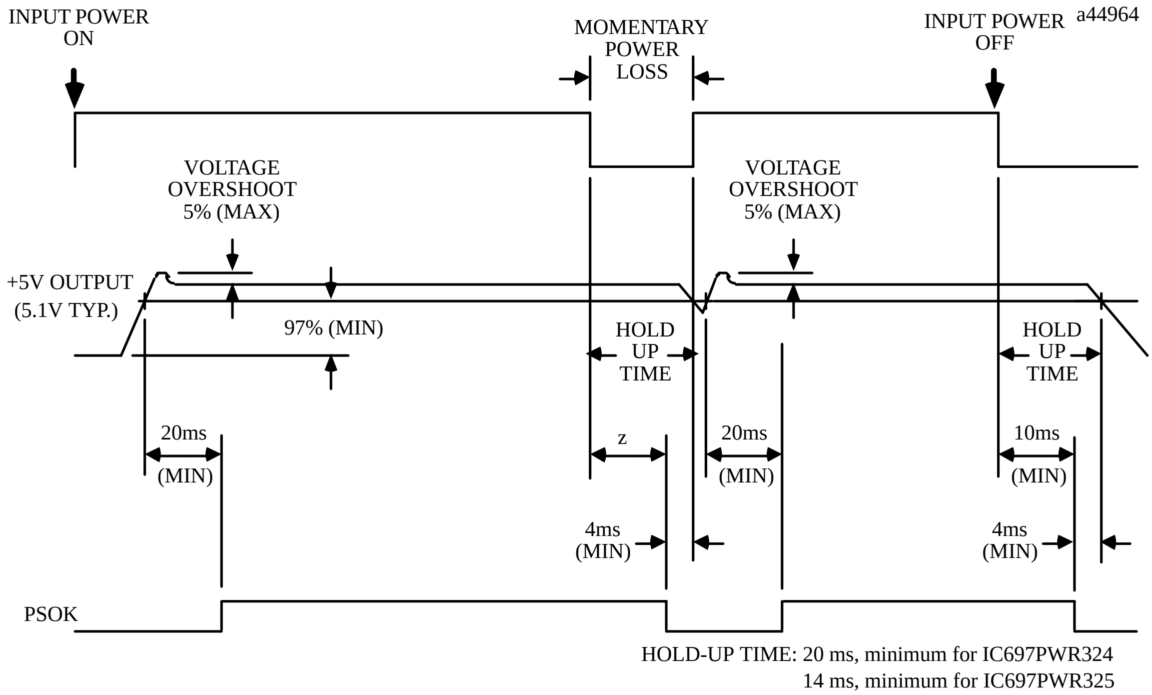


Figure 1.28 – Timing Diagram for all Alspa C80–35 Power Supplies

4.6. CPU Serial Port Connector on Power Supply (All Supplies)

A 15-pin D-type female connector, accessed by opening the hinged door on the right front of the power supply, provides the connection to a serial port which is used to connect the programmer for Alspa P8–25/35 programming software, to connect the Hand-Held Programmer to the PLC, or for connection of other serial devices to the SNP (*Serial Network Protocol*) Port. This serial port is RS-485 compatible.

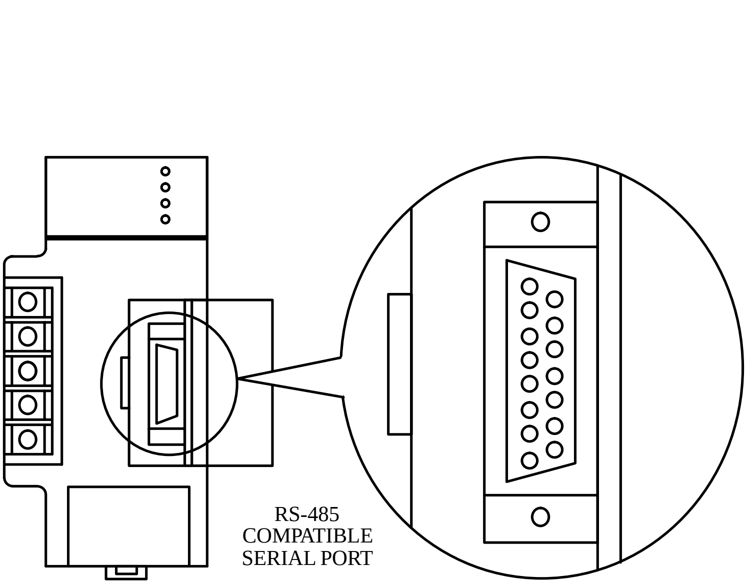


Figure 1.29 – Serial Port Connector

CPU Serial Port Considerations

Note

The serial port connector is only functional in a power supply that is installed in a baseplate that also contains the CPU. This includes the 5 and 10-slot baseplates with built-in CPU for Models 311, 313 and 323 and the 5 and 10-slot CPU baseplates for Models 331, 341, 351 and 352.

The serial port is not functional when a power supply is installed in a Model 331, 341, 351 or Model 352 expansion or remote baseplate.

Additionally, any device connected to the serial port that uses +5 VDC power from the Alspa C80–35 power supply ***must be included*** in the calculation for maximum power consumption (see Chapter 3, Table 3.2: *Sample Calculations for Power Supply Loads*).

4.7. Backup Battery for RAM Memory (All Supplies)

The long-life Lithium battery (IC693ACC301) used to maintain the contents of the CMOS RAM memory in the CPU is accessed by removing the cover plate located at the bottom of the power supply faceplate. This battery is mounted on a plastic clip attached to the inside of this cover.

The battery connects to the CPU through a cable which has one end wired to the positive and negative sides of the battery and the other end wired to a connector that mates with one of two identical connectors mounted on the PLC. This battery may be replaced with power applied to the PLC.

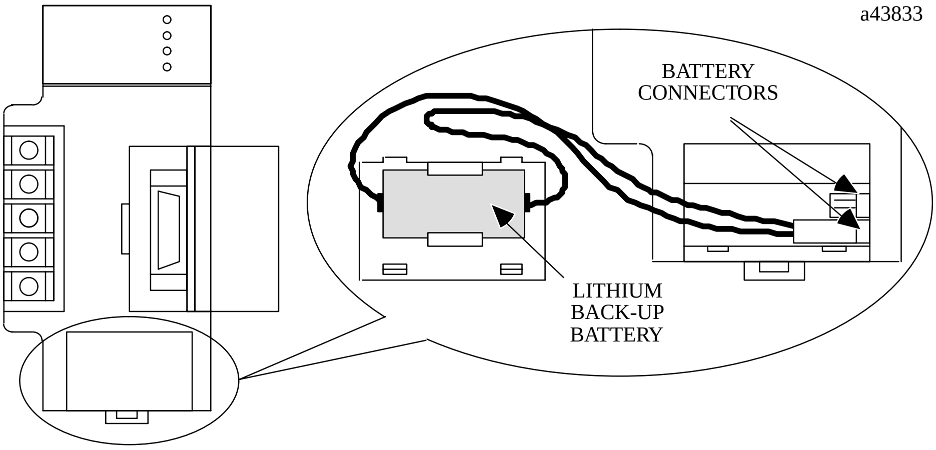


Figure 1.30 – Backup Battery for RAM Memory

Caution

If a Low Battery Warning (BATT LED turns ON) occurs, replace the battery located in the power supply *Before* removing power from the rack. Otherwise, there is a possibility that data will be corrupted or the application program will be cleared from memory.

Operation of Models 341/351/352 Without a Battery

This information is applicable only to systems with I/O being controlled by one of the affected Alspa C80–35 CPUs. When using a Model 341, 351 or 352 CPU in a system without a battery, a standard 0.1” ***berg*** jumper should be installed across either of the two power supply battery connectors to ensure proper operation of the CPU. This jumper should not be installed if a battery is plugged into either the power supply or CPU battery connector.

4.8. Battery Accessory Kit

A Battery Accessory Kit (IC693ACC315) is available for the baseplates with embedded CPUs. The Battery Accessory Kit consists of a battery with an attached connector mounted on a circuit board. The battery maintains the contents of RAM memory when power is removed from the PLC and the power supply module is removed. The Battery Accessory can be installed on any of the following programmable controller baseplates:

- IC693CPU311 (5-slot with CPU),
- IC693CPU313 (5-slot with CPU),
- IC693CPU323 (10-slot with CPU).

When the Battery Accessory is removed, a power supply module with a good battery must be installed and/or AC or DC power applied within 20 minutes to avoid losing CPU data.

Battery Accessory Installation

1. Insert the plug on the end of the battery cable into the 2-pin connector on the Battery Accessory board. The battery plug is normally not plugged into the accessory connector. This prevents accidental discharge of the battery during storage and handling.
2. Align the backplane connector on the Battery Accessory board with the power supply connector on the baseplate backplane. Push the Battery Accessory board toward the baseplate until it is fully seated.
3. If the baseplate is to be shipped with the Battery Accessory board installed, ensure that the board is held in place by packing material or cable ties. The cable ties can be installed in holes provided on both ends of the accessory board and secured to the backplane.

Battery life for a new battery installed in a backplane is about two years.

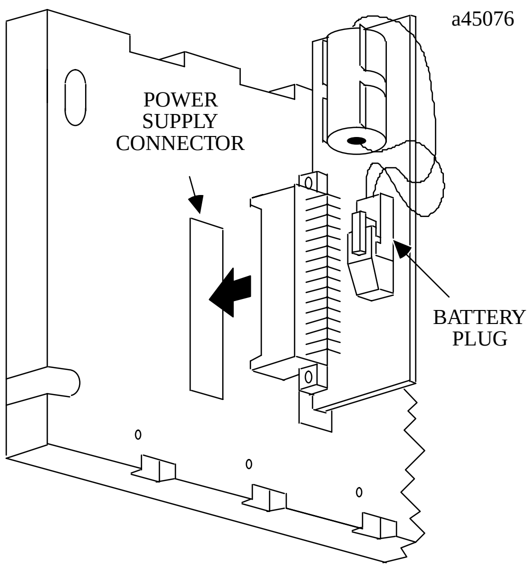


Figure 1.31 – Battery Accessory Installation

5. I/O MODULE INSTALLATION AND WIRING

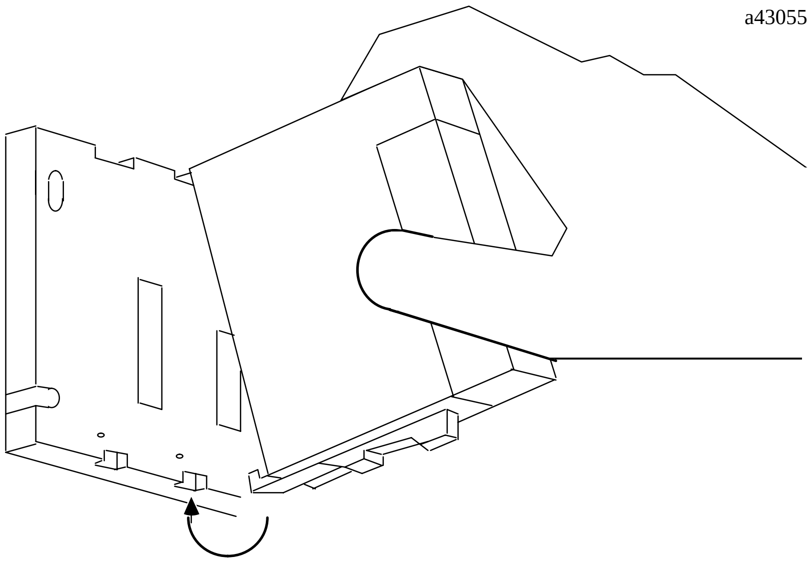
This paragraph provides information on installing I/O modules and information relevant to field wiring to and from those modules.

5.1. Installation and Removal of I/O Modules

The following procedures and recommendations should be followed when installing and removing I/O modules.

5.1.1. Inserting a Module

- Select the slot into which the module is to be inserted. Grasp the module firmly with the terminal board toward you and with the rear hook facing away from you.
- Align the module with the desired base slot and connector. Tilt the module upwards so that the top rear hook of the module engages the slot on the baseplate.
- Swing the module downward until the connectors mate and the lock-lever on the bottom of the module snaps into place engaging the baseplate notch.
- Visually inspect the module to be sure that it it properly seated.

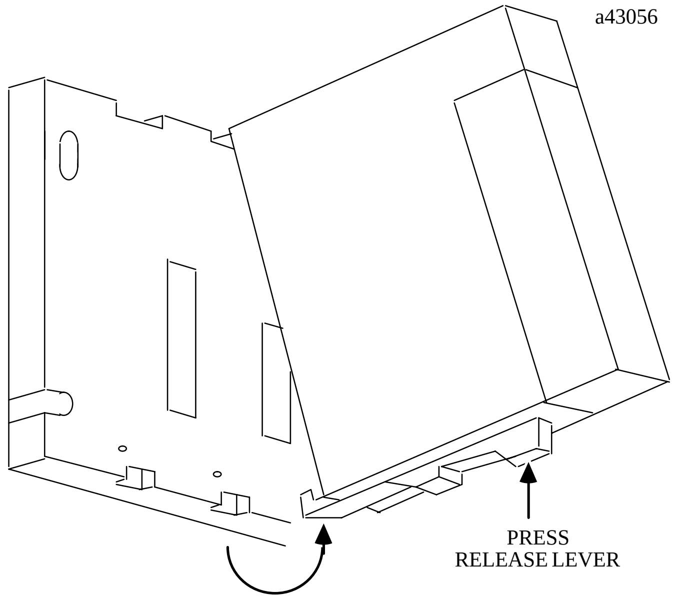


WARNING

Do not insert or remove modules with power applied. This could cause the Programmable Logic Controller to Stop, damage may be incurred to the module, or may result in personal injury.

5.1.2. Removing a Module

- Locate the release lever at the bottom of the module and firmly press it up towards the module.
- While holding the module firmly at the top and fully depressing the release lever, swing the module upward (release lever must be free of its retaining slot).
- Disengage the hook at the top rear of the module by raising the module up and moving it away from the faceplate.



WARNING

Voltages from user devices may be present on a module's screw terminals even though power to the rack is turned off. Care must be taken any time you are handling the module's removable terminal board or any of the wires connected to it.

5.2. Wiring to I/O Modules

Wiring connections to and from user supplied input and output field devices is made to the detachable terminal board supplied with I/O modules having up to 16 points. *I/O modules with 32 points have two 24-pin connectors on the front of the module which must be connected through a cable to field devices.* The removable terminal board makes it easy to prewire field wiring to the user supplied input and output devices and to replace modules in the field without disturbing existing field wiring.

WARNING

When handling terminal boards, be aware that voltages from the user's field devices may be present on a module's screw terminals even though power to a baseplate is turned off. Failure to observe this warning could cause damage to the equipment or cause injury to personnel. Care must be taken any time that you are handling the module's terminal board or any wires connected to it.

5.2.1. Connections to Detachable Terminal Boards

All of the detachable I/O terminal boards for Alspa C80–35 I/O modules have 20 screw terminals and will accept from two 0.36 mm^2 (AWG No. 22) to one 2.1 mm^2 (AWG No. 14) or two 1.32 mm^2 (AWG No. 16) copper 90° C (194° F) wires. Each terminal can accept solid or stranded wires, but the wires into any given terminal should be the same type. The suggested torque for the I/O terminal boards is from 1.09 Nm to 1.30 Nm. For 24 volt DC input, an internal 24 volt power source can be connected to two terminals on the connector.

Also, a 24 volt DC output is available on the power supply for a limited number of outputs. Wires are routed to and from the terminals out of the bottom of the terminal board cavity.

5.2.2. Connections to High Density I/O Modules

High Density discrete I/O modules (32 Inputs or 32 Outputs) are connected to field devices through a cable, or cables, connected to pin connectors on the front of the I/O module. As mentioned above, High Density I/O modules have two 24-pin connectors. For detailed information on High Density I/O modules, refer to the discussion of "High Density I/O Modules" beginning Chapter 2, § 4.

5.2.3. Installing a Terminal Board

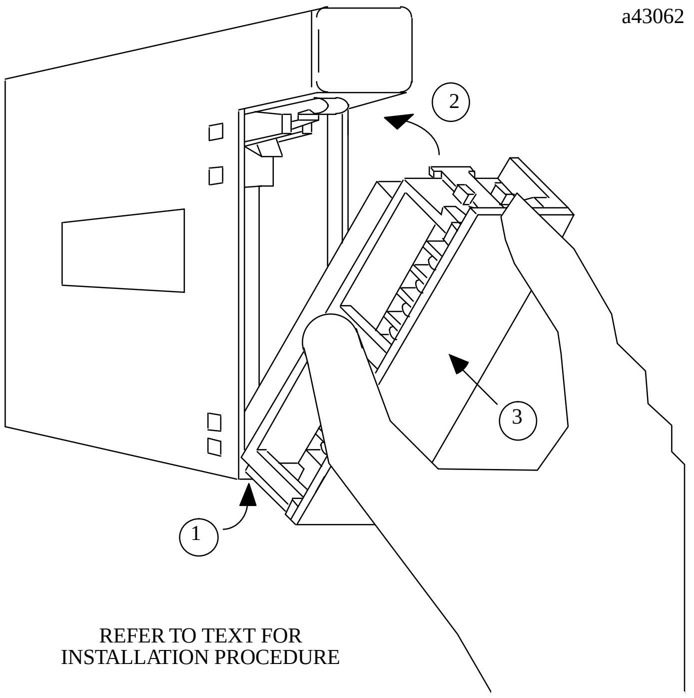
To install a terminal board with no wires attached:

- Hook the hinge located on the bottom of the terminal board to the lower slot on the module. See (1) below.
- Push the terminal board towards the module until it snaps into place. See (2) below).
- Open the terminal board cover and ensure that the latch on the module is securely holding the terminal board in place. See (3) below.

When installing a terminal board that has wiring attached verify that the terminal board is connected to the proper module type. The following figure shows the recommended procedure for installation of a terminal board.

Caution

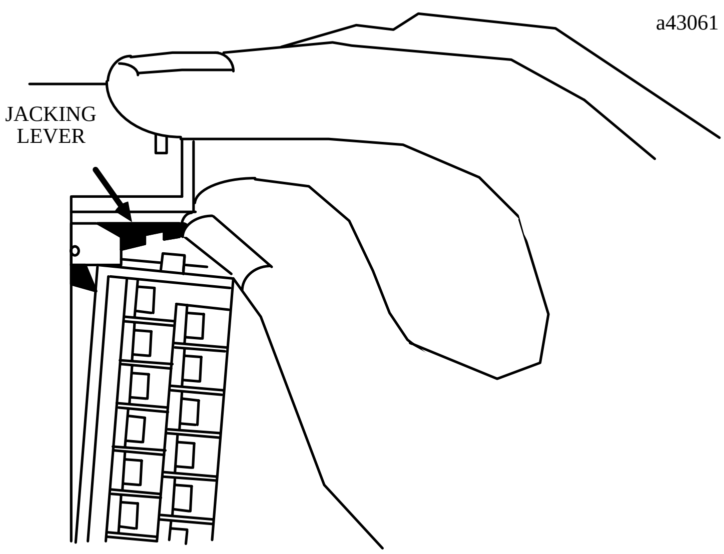
Check the labels on the hinged door and the module to ensure that they match. If a prewired terminal board is installed on the wrong module type, the module may be damaged.



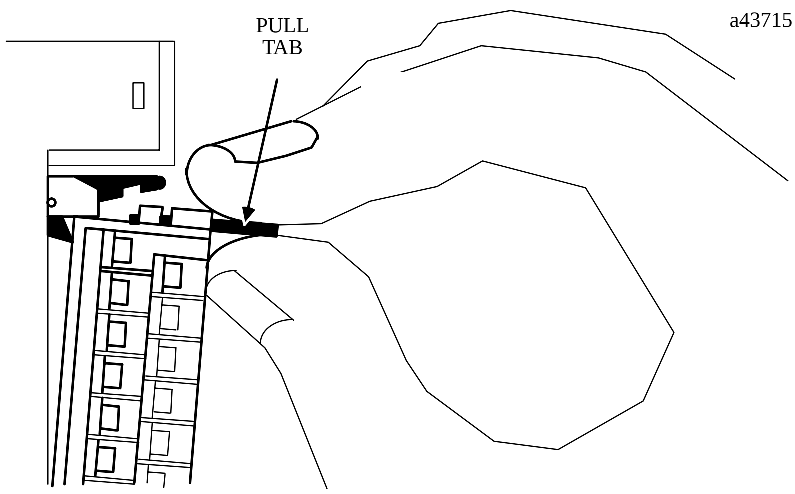
5.2.4. Removing a Terminal Board

To remove a terminal board:

- Open the plastic terminal board cover.
- Push up on the jacking lever as shown below to release the terminal block.



- Grasp the pull-tab and pull towards you until the contacts have separated from the module housing and the hook has disengaged for full removal.



5.2.5. Terminal Board Posts

Notice that the terminal board has three posts on the left side. The top and bottom posts hold the terminal board cover in place. The purpose of the middle post is to keep the cable wired to the terminal board in place. This middle post can be easily snapped off if you do not require it to hold the wiring in place.

Since minimal force is required to snap off the middle post, you should be careful that you do not inadvertently snap it off if you are using it to keep your wire runs in place.

5.2.6. Field Wiring Considerations

It is recommended that the following procedures be followed when routing and connecting field wiring from user devices to the PLC (or PC) or to Output devices to be controlled by the PLC (or PC).

- All low level signal wires should be run separately from other field wiring.
- AC power wiring should be run separately from DC field wiring.

WARNING

You should calculate the maximum current for each wire and observe proper wiring practices. Failure to do so may cause injury to personnel or damage to equipment.

- Field wiring should not be routed close to any device that could be a potential source of electrical interference.
- If severe noise problems are present, additional power supply filtering or an isolation transformer may be required.
- Ensure that proper grounding procedures, as previously described, are followed to minimize potential safety hazards to personnel.
- Label all wires to and from I/O devices. Record circuit identification numbers or other pertinent data on the inserts which go in the module’s faceplate door.

6. MECHANICAL SPARE PARTS KITS

Two spare parts kits (IC693ACC319 and IC693ACC320) are available that provide mechanical spare parts for I/O CPU, PCM, power supply and other special module assemblies. These kits provide the parts that allow you to replace mechanical parts such as the module levers, or module doors that may accidentally break. A description of the contents of each of the kits is provided in the following table.

Spare Parts Kit	Contents
IC693ACC319: Spare parts kit for I/O, CPU,and PCM modules	(qty. 10) I/O, CPU, PCM case lever (qty. 10) Spring pins cap (qty. 2) PCM module front cover (qty. 2) PCM lens cap (qty. 2) CPU module case
IC693ACC320: Spare parts kit for power supplies	(qty. 2) Power supply lever (qty. 2) Spring pin for power supply lever (qty. 2) Spring for power supply lever (qty. 2) Power supply lens cap (qty. 2) Power supply terminal cover

Table 1.14 – Mechanical Spare Parts Kits

Chapter 2 Discrete I/O Module Specifications

This chapter contains specifications and wiring information for Alspa C80–35 Discrete I/O modules. Modules are listed by module type: Input, Output, mixed Input/Output and High-Density. Table 2.1 is an aid to locating I/O module specifications and wiring information in this chapter. Table 2.2 lists fuses on applicable output modules and the power supply. Table 2.3 lists the load requirements for each I/O module.

Catalog Number	Description of Module	Number of I/O Points	Page Number
IC693MDL230	Input - 120 VAC Isolated	8	2–8
IC693MDL231	Input - 240 VAC Isolated	8	2–10
IC693MDL240	Input - 120 VAC	16	2–12
IC693MDL241	Input - 24 VAC/DC Positive/Negative Logic	16	2–14
IC693MDL632	Input - 125 VDC Positive/Negative Logic	8	2–16
IC693MDL634	Input - 24 VDC Positive/Negative Logic	8	2–18
IC693MDL645	Input - 24 VDC Positive/Negative Logic	16	2–20
IC693MDL646	Input - 24 VDC Positive/Negative Logic, FAST	16	2–22
CF693MDL100	Input – 48 VDC Positive/Negative Logic, FAST	16	2–24
CF693MDL101	Input – 24 VDC Positive/Negative Logic	16	2–26
CF693MDL102	Input – 48 VDC Positive/Negative Logic	16	2–28
CF693MDL103	Input – 110/125 VDC Positive/Negative Logic	16	2–30
IC693MDL654	Input - 5/12 VDC (TTL) Positive/Negative Logic	32	2–80
IC693MDL655	Input - 24 VDC Positive/Negative Logic	32	2–86
IC693ACC300	Input Simulator	8 or 16	2–32
IC693MDL310	Output - 120 VAC, 0.5A	12	2–34
IC693MDL330	Output - 120/240 VAC, 2A	8	2–36
IC693MDL340	Output - 120 VAC, 0.5A	16	2–38
IC693MDL390	Output - 120/240 VAC Isolated, 2A	5	2–40
IC693MDL730	Output - 12/24 VDC Positive Logic, 2A	8	2–42
IC693MDL731	Output - 12/24 VDC Negative Logic, 2A	8	2–44
IC693MDL732	Output - 12/24 VDC Positive Logic, 0.5A	8	2–46

Table 2.1 – Guide to Page Location for Discrete I/O Module Specifications

Catalog Number	Description of Module	Number of I/O Points	Page Number
IC693MDL733	Output - 12/24 VDC Negative Logic, 0.5A	8	2–48
IC693MDL734	Output - 125 VDC Positive/Negative Logic, 1A	6	2–50
IC693MDL740	Output - 12/24 VDC Positive Logic, 0.5A	16	2–52
IC693MDL741	Output - 12/24 VDC Negative Logic, 0.5A	16	2–54
IC693MDL742	Output - 12/24 VDC Positive Logic ESCP, 1A	16	2–56
IC693MDL752	Output - 5/24 VDC (TTL) Negative Logic, 0.5A	32	2–91
IC693MDL753	Output - 12/24 VDC Positive Logic, 0.5A	32	2–97
IC693MDL930	Output - Relay, N.O., 4A Isolated	8	2–58
IC693MDL931	Output - Isolated Relay, N.C. and Form C, 8A	8	2–61
CF693MDL150	Output - Isolated Relay, N.O., 6A	8	2–64
IC693MDL940	Output - Relay, N.O., 2A	16	2–68
IC693MAR590	Input/Output - 120 VAC Input, Relay Output	8/8	2–71
IC693MDR390	Input/Output - 24 VDC Input, Relay Output	8/8	2–74

Table 2.1 – Guide to Page Location for Discrete I/O Module Specifications (continued)

Catalog Number	Module Type	Current Rating	Quantity on Module	ALSTOM Fuse Part Number	Third Party Source and Part Number
IC693MDL310	120 VAC, 0.5A	3A	2	44A724627-111 (1)	Bussman, GMC-3 Littlefuse - 239003
IC693MDL330	120/240 VAC, 1A	5A	2	44A724627-114 (1)	Bussman, GDC-5 Bussman S506-5
IC693MDL340	120 VAC, 0.5A	3A	2	44A724627-111 (1)	Bussman, GMC-3 Littlefuse - 239003
IC693MDL390	120/240 VAC, 2A	3A	5	44A724627-111 (1)	Bussman GMC-3 Littlefuse - 239003
IC693MDL730	12/24 VDC Positive Logic, 2A	5A	2	259A9578P16 (1)	Bussman, AGC-5 Littlefuse - 312005
IC693MDL731	12/24 VDC Negative Logic, 2A	5A	2	259A9578P16 (1)	Bussman, AGC-5 Littlefuse - 312005
IC693PWR324 and CE693PWR330	120/240 VAC or 125 VDC Input, 30 Watt Power Supply	2A 1A 5A	1 1 1	44A724627–109 (2) (4) A60L-0001-0290#LM10 A60L-0001-0290#LM50	Bussman, 215–002 (GDC–2 OR GMC–2) Littlefuse – 239–002 44A72462 8-003 (3) 44A72462 8-007 (3)
IC693PWR325	24/48 VDC Input, 30 Watt Power Supply	5A 1A 5A	1 1 1	44A724627-114 (2) A60L-0001-0290#LM10 A60L-0001-0290#LM50	Bussman, MDL-5 Littlefuse - 313005 44A724628-003 (3) 44A724628-007 (3)

(1) Mounted in clip. Accessible by removing circuit board from module housing.
(2) Line fuse. Mounted in clip - accessible by removing module front.
(3) Soldered into circuit board. Not easily field replaceable.
(4) Meets both European and American standards.

Table 2.2 – List of Fuses

1. POWER SUPPLY LOAD CAPACITY

The load capacity of the power supply in an Alspa C80–35 PLC baseplate is the sum of the internal loads placed on it by all of the hardware components residing in the baseplate (backplane, modules, etc.). The power output of the power supply voltages is 30 watts, maximum. The load required for each module is expressed in milliamps for each voltage. You must ensure that the sum of all loads for modules in a baseplate does not exceed the maximum rating for the power supply. Use of the isolated +24 Volt power supply output is optional; however, this output can be used to drive a limited number of input devices.

The following table shows the DC load required by each Alspa C80–35 discrete I/O module. All load requirements are in milliamps. Input and Output module current ratings are with all inputs or outputs on. Note that the figures listed are maximum requirements, not typical. Load requirements for other Alspa C80–35 PLC components installed in a baseplate must be included in the total load calculations. Load requirements for all Alspa C80–35 PLC components can be found in *ALS 52117 Alspa C80–35 PLC Installation Manual*. Three voltages are listed in the table:

- +5 VDC provides primary power to operate most internal circuits,
- +24 VDC Relay Power provides power for circuits that drive the relays on Relay modules,
- +24 VDC Isolated provides power to operate a number of input circuits (input modules only).

Catalog Number	Description	+5 VDC	+24 VDC Relay Power	+24 VDC Isolated
IC693MDL230	120 VAC Isolated, 8 Point Input	60	-	-
IC693MDL231	240 VAC Isolated, 8 Point Input	60	-	-
IC693MDL240	120 VAC, 16 Point Input	90	-	-
IC693MDL241	24 VAC/DC Pos/Neg logic, 16 Point	80	-	125
IC693MDL632	125 VDC Pos/Neg Logic, 8 Point Input	40	-	-
IC693MDL634	24 VDC Pos/Neg Logic, 8 Point Input	80	-	125
IC693MDL645	24 VDC Pos/Neg Logic, 16 Point Input	80	-	125
IC693MDL646	24 VDC Pos/Neg Logic, FAST, 16 Point Input	80	-	125
CF693MDL100	48 VDC Pos/Neg Logic, FAST, 16 Point Input	80	-	-
CF693MDL101	24VDC Pos/Neg Logic, 16 Point Input	80	-	90
CF693MDL102	48 VDC Pos/Neg Logic, 16 Point Input	80	-	-
CF693MDL103	110/125 VDC Pos/Neg Logic, 16 Point Input	80	-	-
IC693MDL654	5/12 VDC (TTL) Pos/Neg Logic, 32 Point	195/44*	-	-
IC693MDL655	24 VDC Pos/Neg, 32 Point Input	195	-	224

Table 2.3 – Load Requirements (mA) for Discrete I/O Modules

Catalog Number	Description	+5 VDC	+24 VDC Relay Power	+24 VDC Isolated
IC693ACC300	Input Simulator, 8/16 Points	120	-	-
IC693MDL310	120 VAC, 0.5A, 12 Point Output	210	-	-
IC693MDL330	120/240 VAC, 1A, 8 Point Output	160	-	-
IC693MDL340	120 VAC, 0.5A, 16 Point Output	315	-	-
IC693MDL390	120/240 VAC Isolated, 2A, 5 Point Output	110	-	-
IC693MDL730	12/24 VDC Positive Logic, 2A, 8 Point Output	55	-	-
IC693MDL731	12/24 VDC Negative Logic, 2A, 8 Point Output	55	-	-
IC693MDL732	12/24 VDC Positive Logic, 0.5A, 8 Point Output	50	-	-
IC693MDL733	12/24 VDC Negative Logic, 0.5A, 8 Point Output	50	-	-
IC693MDL734	125 VDC Pos/Neg Logic, 6 Point Output	90	-	-
IC693MDL740	12/24 VDC Positive Logic, 0.5A, 16 Point Output	110	-	-
IC693MDL741	12/24 VDC Negative Logic, 0.5A, 16 Point Output	110	-	-
IC693MDL742	12/24 VDC Pos. Logic ESCP, 1A, 16 Point Output	130	-	-
IC693MDL752	5/24 VDC (TTL) Negative Logic, 0.5A, 32 Point	260	-	-
IC693MDL753	12/24 VDC Positive Logic, 0.5A, 32 Point Output	260	-	-
IC693MDL930	Relay, N.O., 4A Isolated, 8 Point Output	6	70	-
IC693MDL931	Relay, N.C. and Form C, 8A Isolated, 8 Point Out	45	100	-
CF693MDL150	Relay, N.O. 6A Isolated, 8 Point Output	40	25–80*	-
IC693MDL940	Relay, N.O., 2A, 16 Point Output	7	135	-
IC693MAR590	120 VAC Input, relay Output, 8 In/8 Out	80	70	-
IC693MDR390	24 VDC Input, Relay Output, 8 In/8 Out	80	70	-

* Refer to the applicable module specifications for more details.

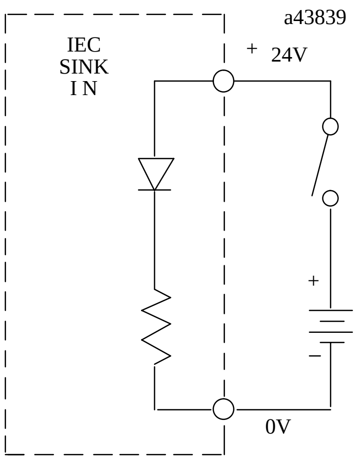
Table 2.3 – Load Requirements (mA) for Discrete I/O Modules (continued)

2. DEFINITION OF POSITIVE AND NEGATIVE LOGIC

The IEC definitions for positive logic and negative logic, as applied to Alspa C80–35 I/O modules, are defined as follows.

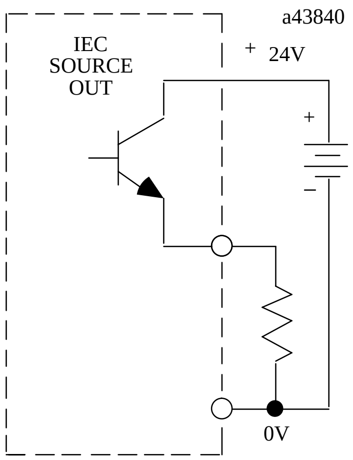
2.1. Positive Logic - Input Modules

Input modules designed with positive logic characteristics sink current from the input device to the user common or negative power bus. The input device is connected between the positive power bus and the input terminal.



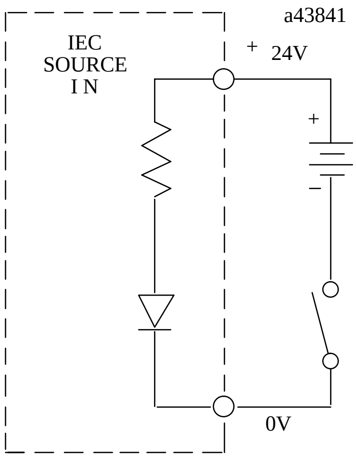
2.2. Positive Logic - Output Modules

Output modules designed with positive logic characteristics source current to the loads from the user common or positive power bus. The load is connected between the negative power bus and the module output.



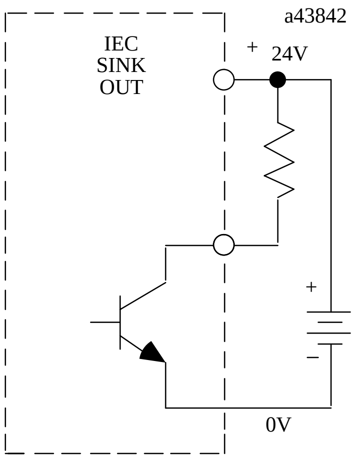
2.3. Negative Logic - Input Modules

Input modules designed with negative logic characteristics source current through the input device to the user common or positive power bus. The input device is connected between the negative power bus and the input terminal.



2.4. Negative Logic - Output Modules

Output modules designed with negative logic characteristics sink current from the loads to the user common or negative power bus. The load is connected between the positive power bus and the output terminal.



3. I/O MODULE SPECIFICATIONS

The following pages contain specifications for each of the Alspa C80–35 discrete I/O modules. For each module, the following technical information is provided:

- A description of the module.
- A list of specifications for the module.
- An illustration showing field wiring information, including appropriate user connections to the detachable terminal board or connector(s) and an example of the module's input or output circuitry for user interface information.
- Where applicable, a graph that provides temperature derating information for the module.

Refer to Table 2.1 for a listing of the starting page location for each of the modules described in this chapter.

3.1. 120 Volt AC Isolated Input, 8 Point IC693MDL230

The ***120 volt AC Isolated Input*** module for the Alspa C80–35 Programmable Logic Controller provides 8 isolated input points, each with a common power input terminal. The input circuits are reactive (resistor/capacitor) inputs. Current into an input point results in a logic 1 in the input status table (%I). Input characteristics are compatible with a wide range of user-supplied input devices, such as: pushbuttons, limit switches and electronic proximity switches. Power to operate the field devices must be supplied by the user. This module requires an AC power source, *it cannot be used with a DC power source.*

LED indicators which provide the ON/OFF status of each point are located at the top of the module. This LED block has a horizontal row with eight green LEDs labeled A1 to 8 (points 1 to 8). An insert goes between the inside and outside surface of the hinged door. The surface towards the inside of the module (when the hinged door is closed) has circuit wiring information and circuit identification information can be recorded on the outside surface. The outside left edge of the insert is color-coded red to indicate a high-voltage module. This module can be installed in any I/O slot of a 5 or 10-slot baseplate in an Alspa C80–35 PLC system.

Rated Voltage	120 volts AC, 50/60 Hz
Input Voltage Range	0 to 132 volts AC, 50/60 Hz
Inputs per Module	8 (each input point has a separate common)
Isolation	1500 volts RMS between field side and logic side 500 volts RMS between inputs
Input Current	14.5 mA (typical) at rated voltage
Input Characteristics:	
On-state Voltage	74 to 132 volts AC
Off-state Voltage	0 to 20 volts AC
On-state Current	6 mA minimum
Off-state Current	2.2 mA maximum
On response Time	30 ms maximum
Off response Time	45 ms maximum
Power Consumption	60 mA (all inputs on) from 5 volt bus on backplane

Refer to data sheet ALS 53002 for product standards and general specifications.

Table 2.4 – Specifications for IC693MDL230

FIELD WIRING INFORMATION

The following figure provides wiring information for connecting user supplied input devices and power source to the 120 volt AC Isolated input module. Note that since each input is isolated (separate) from each of the other inputs, each input can be powered by a separate AC power source.

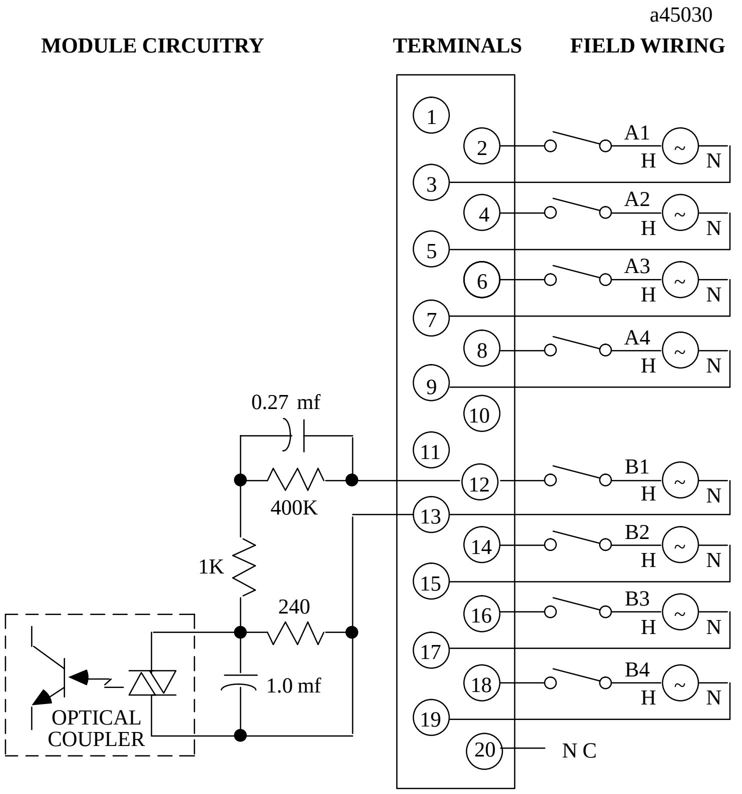


Figure 2.1 – Field Wiring - 120 Volt AC Isolated Input Module - IC693MDL230

3.2. 240 Volt AC Isolated Input, 8 Point IC693MDL231

The ***240 volt AC Isolated Input*** module for the Alspa C80–35 Programmable Logic Controller provides 8 isolated input points, each with a common power input terminal. The input circuits are reactive (resistor/capacitor) inputs. Current into an input point results in a logic 1 in the input status table (%I). Input characteristics are compatible with a wide range of user-supplied input devices, such as: pushbuttons, limit switches and electronic proximity switches. Power to operate the field devices must be supplied by the user. This module requires an AC power source, *it cannot be used with a DC power source*.

LED indicators which provide the ON/OFF status of each point are located at the top of the module. This LED block has a horizontal row with eight green LEDs labeled A1 to 8 (points 1 to 8). An insert goes between the inside and outside surface of the hinged door. The surface towards the inside of the module (when the hinged door is closed) has circuit wiring information and circuit identification information can be recorded on the outside surface. The outside left edge of the insert is color-coded red to indicate a high-voltage module.

This module can be installed in any I/O slot of a 5 or 10-slot baseplate in an Alspa C80–35 PLC system.

Rated Voltage	240 volts AC, 50/60 Hz
Input Voltage Range	0 to 264 volts AC, 50/60 Hz
Inputs per Module	8 (each input point has a separate common)
Isolation	1500 volts RMS between field side and logic side 500 volts RMS between inputs
Input Current	15 mA (typical) at rated voltage
Input Characteristics:	
On-state Voltage	148 to 264 volts AC
Off-state Voltage	0 to 40 volts AC
On-state Current	6 mA minimum
Off-state Current	2.2 mA maximum
On response Time	30 ms maximum
Off response Time	45 ms maximum
Power Consumption	60 mA (all inputs on) from 5 volt bus on backplane

Refer to data sheet ALS 53002 for product standards and general specifications.

Table 2.5 – Specifications for IC693MDL231

FIELD WIRING INFORMATION

The following figure provides wiring information for connecting user supplied input devices and power source to the 240 volt AC Isolated input module. Note that since each input is isolated (separate) from each of the other inputs, each input can be powered by a separate AC power source.

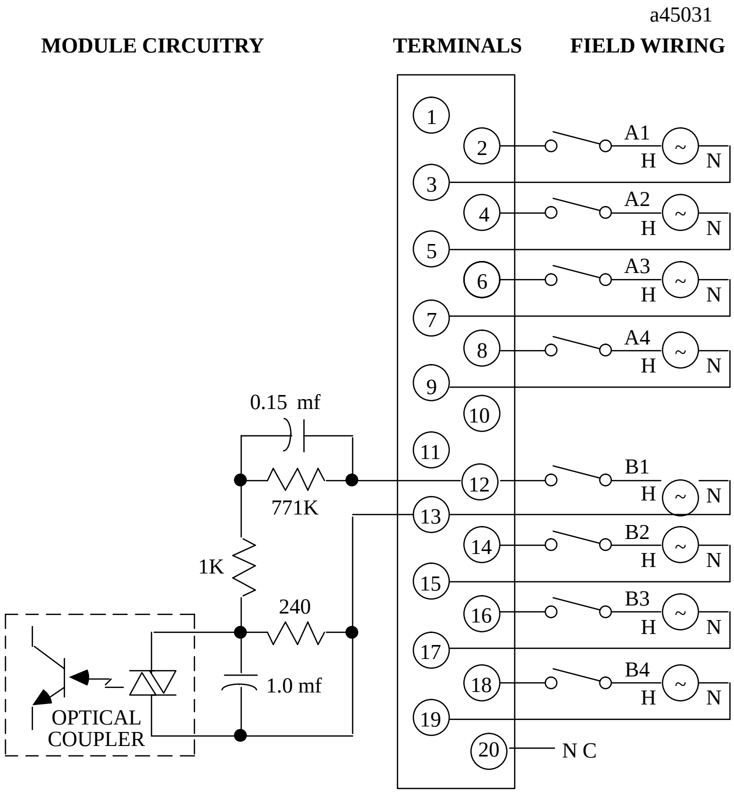


Figure 2.2 – Field Wiring - 240 Volt AC Isolated Input Module - IC693MDL231

3.3. 120 Volt AC Input, 16 Point IC693MDL240

The ***120 volt AC Input*** module for the Alspa C80–35 Programmable Logic Controller provides 16 input points with one common power input terminal. The input circuits are reactive (resistor/capacitor) inputs. Current into an input point results in a logic 1 in the input status table (%I). Input characteristics are compatible with a wide range of user-supplied input devices, such as: pushbuttons, limit switches and electronic proximity switches. Power to operate the field devices must be supplied by the user. This module requires an AC power source, *it cannot be used with a DC power source.*

LED indicators which provide the ON/OFF status of each point are located at the top of the module. This LED block has two horizontal rows with eight green LEDs in each row; the top row labeled A1 to 8 (points 1 to 8) and the bottom row labeled B1 to 8 (points 9 to 16). An insert goes between the inside and outside surface of the hinged door. The surface towards the inside of the module (when the hinged door is closed) has circuit wiring information and circuit identification information can be recorded on the outside surface. The outside left edge of the insert is color-coded red to indicate a high-voltage module. This module can be installed in any I/O slot of a 5 or 10-slot baseplate in an Alspa C80–35 PLC system.

Rated Voltage	120 volts AC
Input Voltage Range	0 to 132 volts AC, 50/60 Hz
Inputs per Module*	16 (one group with a single common)
Isolation	1500 volts RMS between field side and logic side
Input Current	12 mA (typical) at rated voltage
Input Characteristics:	
On-state Voltage	74 to 132 volts AC
Off-state Voltage	0 to 20 volts AC
On-state Current	6 mA minimum
Off-state Current	2.2 mA maximum
On response Time	30 ms maximum
Off response Time	45 ms maximum
Consumption	90 mA (all inputs on) from 5 volt bus on backplane

* Number of inputs on is dependent upon ambient temperature as shown in Figure 2.4.
Refer to data sheet ALS 53002 for product standards and general specifications.

Table 2.6 – Specifications for IC693MDL240

FIELD WIRING INFORMATION

The following figure provides wiring information for connecting user supplied input devices and power source to the 120 volt AC input module.

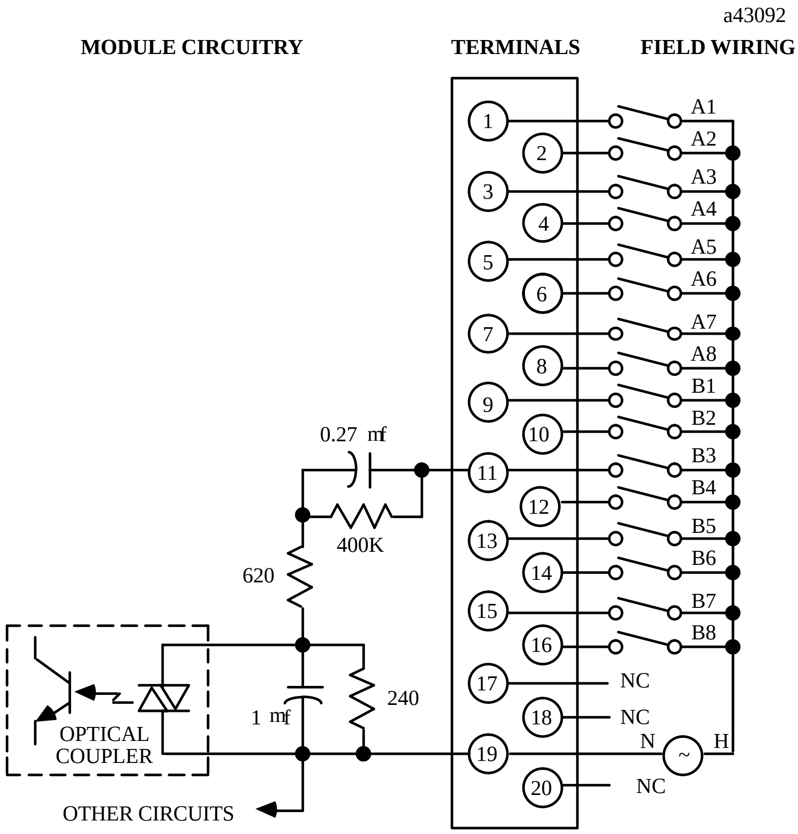


Figure 2.3 – Field Wiring - 120 Volt AC Input Module - IC693MDL240

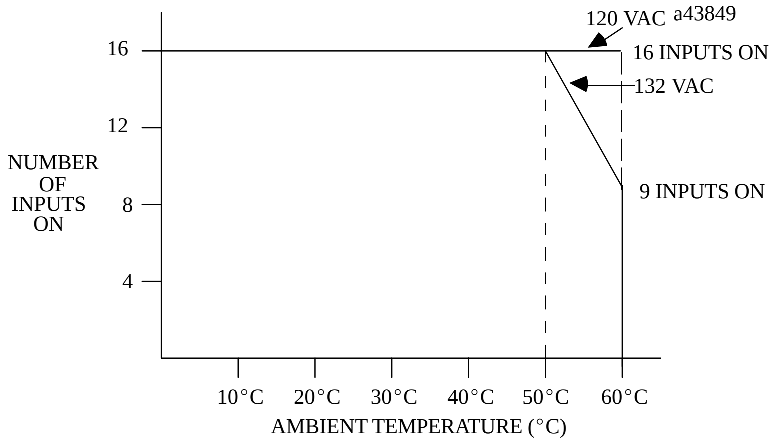


Figure 2.4 – Input Points vs. Temperature for IC693MDL240

3.4. 24 Volt AC/DC Positive/Negative Logic Input, 16 Point IC693MDL241

The ***24 volt AC/DC Positive/Negative Input*** module for the Alspa C80–35 Programmable Logic Controller provides 16 input points in one group with a common power input terminal. This input module is designed to have either positive or negative logic characteristics in the DC input mode. This input module is designed to function with AC or DC user inputs. Input characteristics are compatible with a wide range of user-supplied input devices, such as: pushbuttons, limit switches and electronic proximity switches. Current into an input point results in a logic 1 in the input status table (%I). Power to operate the field devices can be supplied by the user, or an Isolated +24 VDC supply on the power supply (+24V OUT and 0V OUT terminals) can power a limited number of DC inputs.

LED indicators which provide the ON/OFF status of each point are located at the top of the module. This LED block has two horizontal rows with eight green LEDs in each row; the top row labeled A1 to 8 (points 1 to 8) and the bottom row labeled B1 to 8 (points 9 to 16). An insert goes between the inside and outside surface of the hinged door. The surface towards the inside of the module (when the hinged door is closed) has circuit wiring information and circuit identification information can be recorded on the outside surface. The outside left edge of the insert is color-coded blue to indicate a low-voltage module. This module can be installed in any I/O slot of a 5 or 10-slot baseplate in an Alspa C80–35 PLC system.

Rated Voltage	24 volts AC or 24 volts DC
Input Voltage Range	0 to +30 volts DC or 0 to +30 volts AC, 50/60 Hz
Inputs per Module*	16 (one group with a single common)
Isolation	1500 volts between field side and logic side
Input Current	7 mA (typical) at rated voltage
Input Characteristics	
On-state Voltage	11.5 to 30 volts AC or DC
Off-state Voltage	0 to +4 volts AC or DC
On-state Current	3.2 mA minimum
Off-state Current	1 mA maximum
On response Time	12 ms typical
Off response Time	28 ms typical
Power Consumption: 5V	80 mA (all inputs on) from 5 volt bus on backplane
Power Consumption: 24V	125 mA from the Isolated 24 volt backplane bus or from user supplied power

* Number of inputs on is dependent upon ambient temperature as shown in Figure 2.6.
Refer to data sheet ALS 53002 for product standards and general specifications.

Table 2.7 – Specifications for IC693MDL241

FIELD WIRING INFORMATION

The following figure provides wiring information for connecting user supplied input devices and power source to the 24 volt AC/DC positive/negative logic input module.

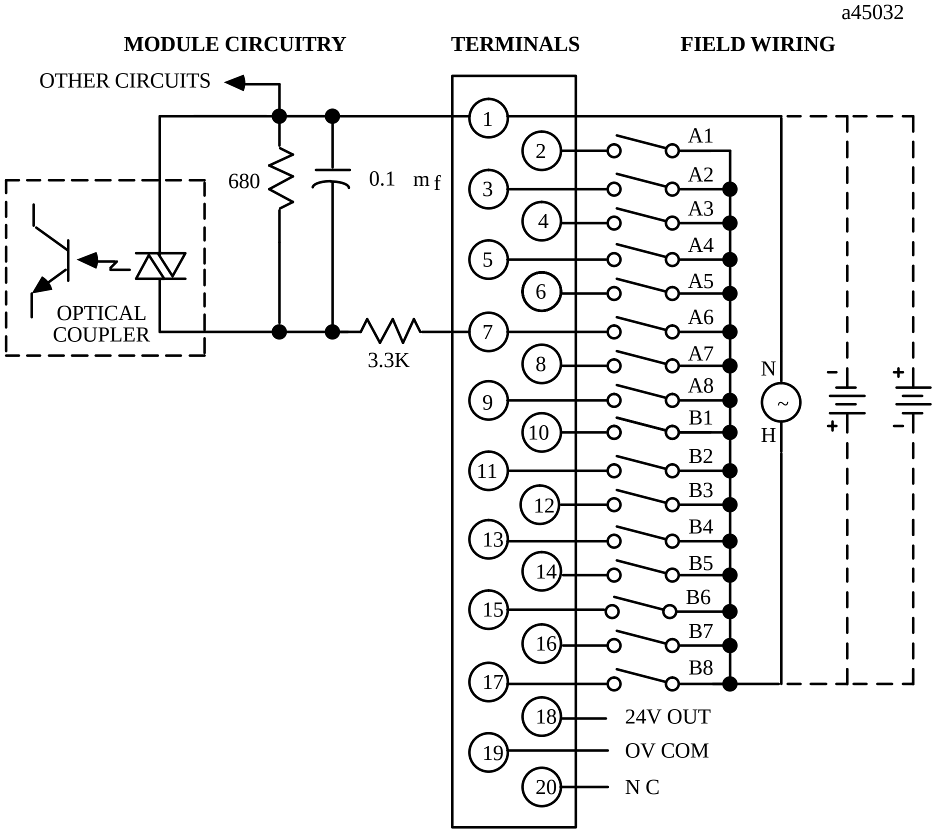


Figure 2.5 – Field Wiring - 24 Volt AC/DC Pos/Neg Logic Input Module - IC693MDL241

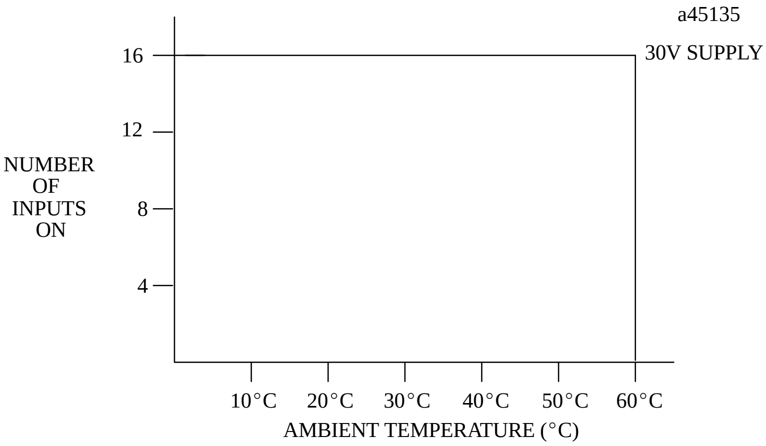


Figure 2.6 – Input Points vs. Temperature for IC693MDL241

3.5. 125 Volt DC Positive/Negative Logic Input, 8 Point IC693MDL632

This ***125 volt DC Positive/Negative Logic Input*** module provides 8 input points in two isolated groups with four points in each group. Each group has a separate common associated with it (the two commons are not tied together inside the module). The input module is designed to have either positive logic characteristics in that it sinks current from the input devices to the user common or negative power bus, or negative logic characteristics in that it sources current through the input devices to the user common or positive power bus. The input device is connected between the power bus and the module input. Current into an input point results in a logic 1 in the input status table (%I). Input characteristics are compatible with a wide range of input devices, such as: pushbuttons, limit switches and electronic proximity switches. Power to operate field devices must be supplied by the user.

LED indicators which provide the ON/OFF status of each point are located at the top of the module. This LED block has two horizontal rows with eight green LEDs in each row. This module uses the top row labeled A1 to 8 (points 1 to 8). An insert goes between the inside and outside surface of the hinged door. The surface towards the inside of the module (when the hinged door is closed) has circuit wiring information and circuit identification information can be recorded on the outside surface. The outside left edge of the insert is color-coded red to indicate a high-voltage module.

This module can be installed in any I/O slot of a 5 or 10-slot baseplate in an Alspa C80–35 PLC system.

Rated Voltage	125 volts DC (Positive or Negative Logic)
Input Voltage Range	0 to +150 volts DC
Inputs per Module*	8 (two groups of four inputs)
Isolation	1500 volts between field side and logic side 500 volts between groups
Input Current	4.5 mA typical
Input Characteristics	
Guaranteed On-state Voltage	90 to 150 volts DC
Guaranteed Off-state Voltage	0 to 30 volts DC
Guaranteed On-state Current	3.1 mA
Guaranteed Off-state Current	1.1 mA maximum
On response Time	7 ms typical
Off response Time	7 ms typical
Internal Power Consumption	40 mA from the 5 volt bus on the backplane 36 mA (typical) from user input supply (all inputs ON)

* Number of inputs on is dependent upon ambient temperature as shown in Figure 2.8.
Refer to data sheet ALS 53002 for product standards and general specifications.

Table 2.8 – Specifications for IC693MDL632

FIELD WIRING INFORMATION

The following figure provides wiring information for connecting user supplied input devices and power source to the 125 volt DC positive/negative logic input module. The negative logic connections are shown in dashed lines.

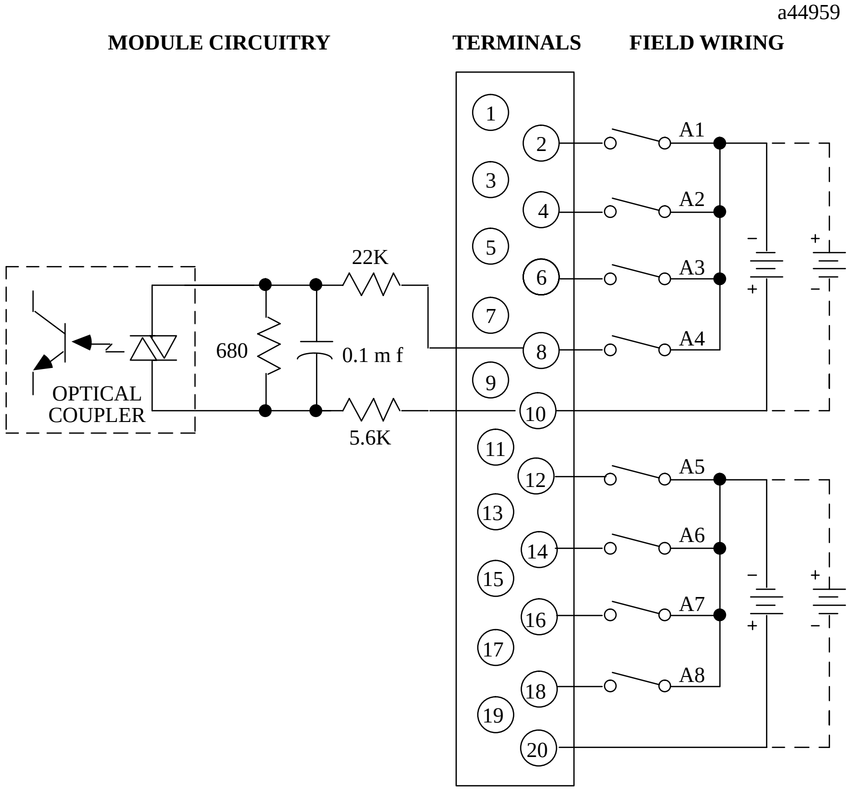


Figure 2.7 – Field Wiring - 125 Volt DC Positive /Negative Logic Input Module - IC693MDL632

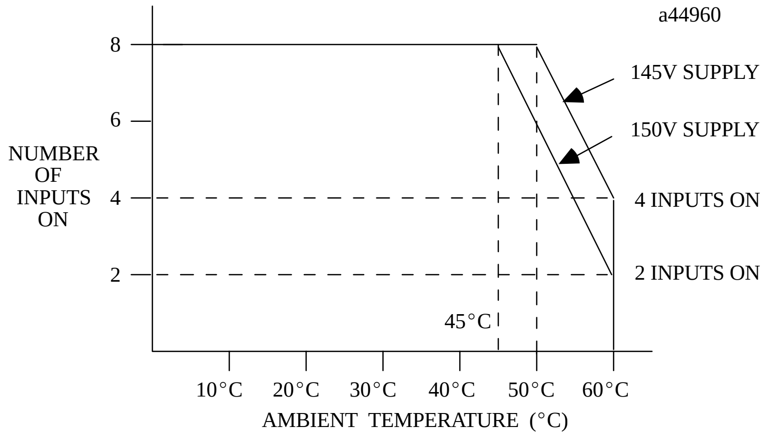


Figure 2.8 – Input Points vs. Temperature for IC693MDL632

3.6. 24 Volt DC Positive/Negative Logic Input, 8 Point IC693MDL634

The ***24 volt DC Positive/Negative Logic Input*** module for the Alspa C80–35 Programmable Logic Controller provides 8 input points in one group with a common power input terminal. This input module is designed to have either positive logic or negative logic characteristics. Input characteristics are compatible with a wide range of user-supplied input devices, such as: pushbuttons, limit switches and electronic proximity switches. Current into an input point results in a logic 1 in the input status table (%I). Power to operate the field devices can be supplied by the user, or an Isolated +24 VDC supply on the power supply (+24V OUT and 0V OUT terminals) can power a limited number of inputs.

LED indicators which provide the ON/OFF status of each point are located at the top of the module. This LED block has two horizontal rows with eight green LEDs in each row; the top row labeled A1 to 8 (points 1 to 8) is used by this module. An insert goes between the inside and outside surface of the hinged door. The surface towards the inside of the module (when the hinged door is closed) has circuit wiring information and circuit identification information can be recorded on the outside surface. The outside left edge of the insert is color-coded blue to indicate a low-voltage module. This module can be installed in any I/O slot of a 5 or 10-slot baseplate in an Alspa C80–35 PLC system.

Rated Voltage	24 volts DC
Input Voltage Range	0 to +30 volts DC
Inputs per Module	8 (one group with a single common)
Isolation	1500 volts between field side and logic side
Input Current	7 mA (typical) at rated voltage
Input Characteristics	
On-state Voltage	11.5 to 30 volts DC
Off-state Voltage	0 to +5 volts DC
On-state Current	3.2 mA minimum
Off-state Current	1.1 mA maximum
On response Time	7 ms typical
Off response Time	7 ms typical
Power Consumption: 5V	45 mA (all inputs on) from 5 volt bus on backplane
Power Consumption: 24V	62 mA from the Isolated 24 volt backplane bus or from user supplied power

Refer to data sheet ALS 53002 for product standards and general specifications.

Table 2.9 – Specifications for IC693MDL634

FIELD WIRING INFORMATION

The following figure provides wiring information for connecting user supplied input devices and power source to the 24 volt DC positive/negative logic input module.

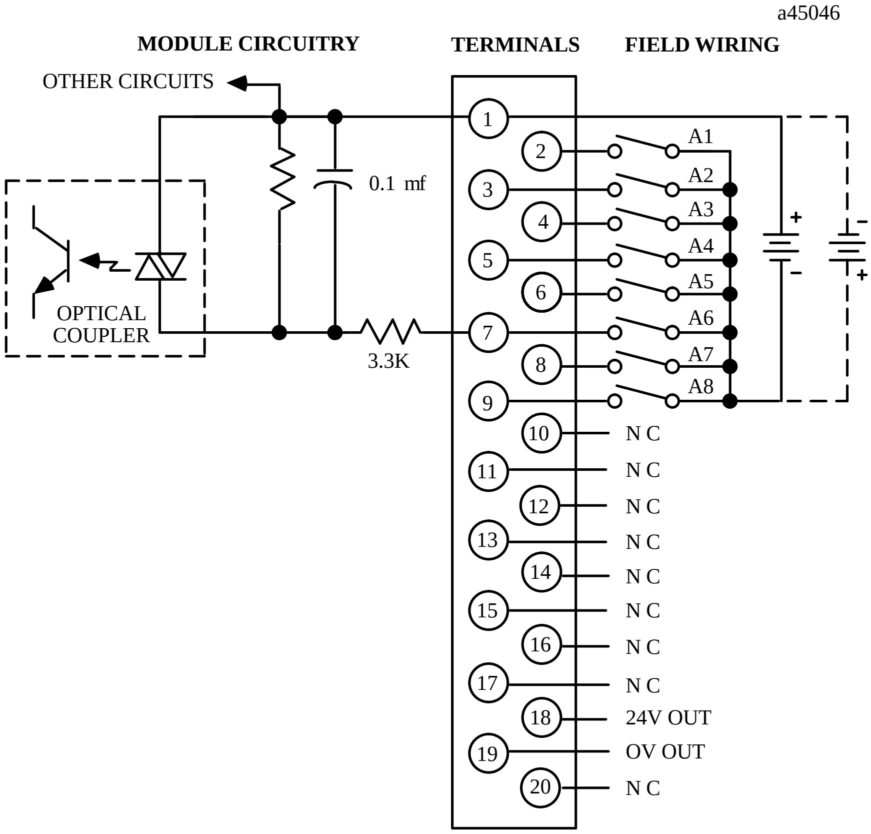


Figure 2.9 – Field Wiring - 24 Volt Positive/Negative Logic Input Module - IC693MDL634

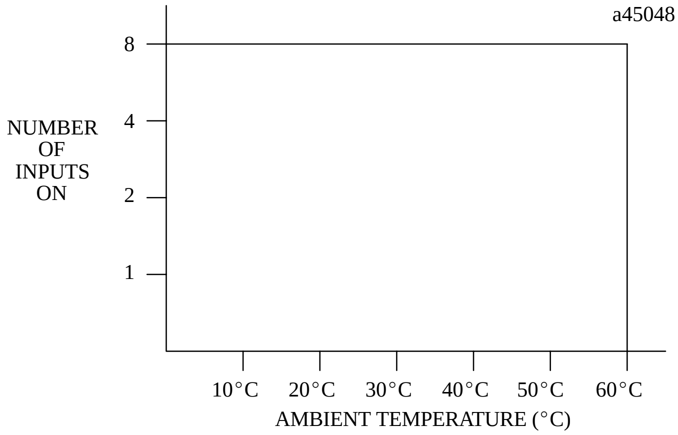


Figure 2.10 – Input Points vs. Temperature for IC693MDL634

3.7. 24 Volt DC Positive/Negative Logic Input, 16 Point IC693MDL645

The ***24 volt DC Positive/Negative Logic Input*** module for the Alspa C80–35 Programmable Logic Controller provides 16 input points in one group with a common power input terminal. This input module is designed to have either positive logic or negative logic characteristics. Input characteristics are compatible with a wide range of user-supplied input devices, such as: pushbuttons, limit switches and electronic proximity switches. Current into an input point results in a logic 1 in the input status table (%I). Power to operate the field devices can be supplied by the user, or an Isolated +24 VDC supply on the power supply (+24V OUT and 0V OUT terminals) can power a limited number of inputs.

LED indicators which provide the ON/OFF status of each point are located at the top of the module. This LED block has two horizontal rows with eight green LEDs in each row; the top row labeled A1 to 8 (points 1 to 8) and the bottom row labeled B1 to 8 (points 9 to 16). An insert goes between the inside and outside surface of the hinged door. The surface towards the inside of the module (when the hinged door is closed) has circuit wiring information and circuit identification information can be recorded on the outside surface. The outside left edge of the insert is color-coded blue to indicate a low-voltage module. This module can be installed in any I/O slot of a 5 or 10-slot baseplate in an Alspa C80–35 PLC system.

Rated Voltage	24 volts DC
Input Voltage Range	0 to +30 volts DC
Inputs per Module	16 (one group with a single common)
Isolation	1500 volts between field side and logic side
Input Current	7 mA (typical) at rated voltage
Input Characteristics	
On-state Voltage	11.5 to 30 volts DC
Off-state Voltage	0 to +5 volts DC
On-state Current	3.2 mA minimum
Off-state Current	1.1 mA maximum
On response Time	7 ms typical
Off response Time	7 ms typical
Power Consumption: 5V	80 mA (all inputs on) from 5 volt bus on backplane
Power Consumption: 24V	125 mA from the Isolated 24 volt backplane bus or from user supplied power

Refer to data sheet ALS 53002 for product standards and general specifications.

Table 2.10 – Specifications for IC693MDL645

FIELD WIRING INFORMATION

The following figure provides wiring information for connecting user supplied input devices and power source to the 24 volt DC positive/negative logic input module.

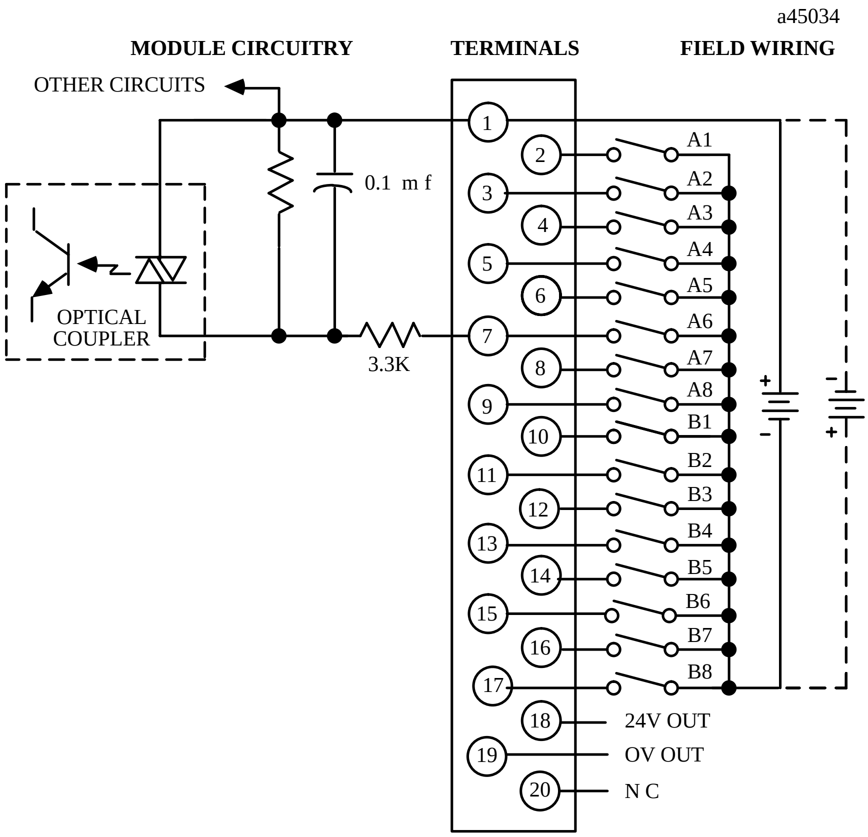


Figure 2.11 – Field Wiring - 24 Volt DC Positive/Negative Logic Input Module - IC693MDL645

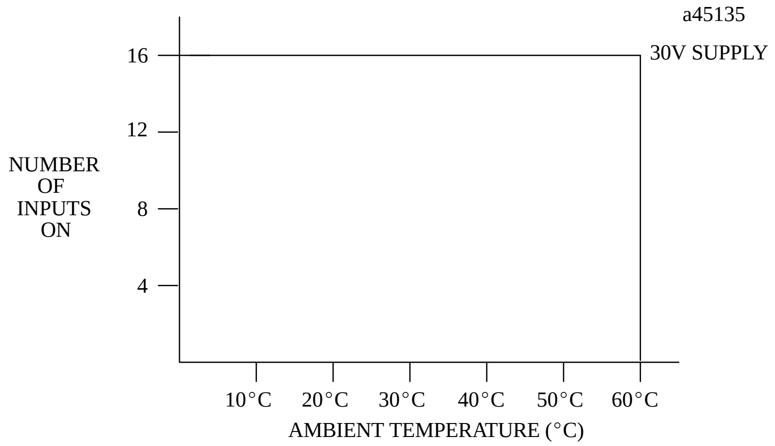


Figure 2.12 – Input Points vs. Temperature for IC693MDL645

3.8. 24 Volt DC Positive/Negative Logic Input, FAST, 16 Point IC693MDL646

This ***24 volt DC Positive/Negative Logic Input (FAST)*** module for the Alspa C80–35 Programmable Logic Controller provides 16 input points in one group with a common power input terminal. *The on and off response times for this module are typically 1 ms.* This input module is designed to have either positive logic or negative logic characteristics. Input characteristics are compatible with a wide range of user-supplied input devices, such as: pushbuttons, limit switches and electronic proximity switches. Current into an input point results in a logic 1 in the input status table (%I). Power to operate the field devices can be supplied by the user, or an Isolated +24 VDC supply on the power supply (+24V OUT and 0V OUT terminals) can power a limited number of inputs.

LED indicators which provide the ON/OFF status of each point are located at the top of the module. This LED block has two horizontal rows with eight green LEDs in each row; the top row labeled A1 to 8 (points 1 to 8) and the bottom row labeled B1 to 8 (points 9 to 16). An insert goes between the inside and outside surface of the hinged door. The surface towards the inside of the module (when the hinged door is closed) has circuit wiring information and circuit identification information can be recorded on the outside surface. The outside left edge of the insert is color-coded blue to indicate a low-voltage module. This module can be installed in any I/O slot of an Alspa C80–35 PLC system.

Rated Voltage	24 volts DC
Input Voltage Range	0 to +30 volts DC
Inputs per Module	16 (one group with a single common)
Isolation	1500 volts between field side and logic side
Input Current	7 mA (typical) at rated voltage
Input Characteristics	
On-state Voltage	11.5 to 30 volts DC
Off-state Voltage	0 to +5 volts DC
On-state Current	3.2 mA minimum
Off-state Current	1.1 mA maximum
On response Time	1 ms typical
Off response Time	1 ms typical
Power Consumption: 5V	80 mA (all inputs on) from 5 volt bus on backplane
Power Consumption: 24V	125 mA from the Isolated 24 volt backplane bus or from user supplied power

Refer to data sheet ALS 53002 for product standards and general specifications.

Table 2.11 – Specifications for IC693MDL646

FIELD WIRING INFORMATION

The following figure provides wiring information for connecting user supplied input devices and power source to the 24 volt DC positive/negative logic FAST input module.

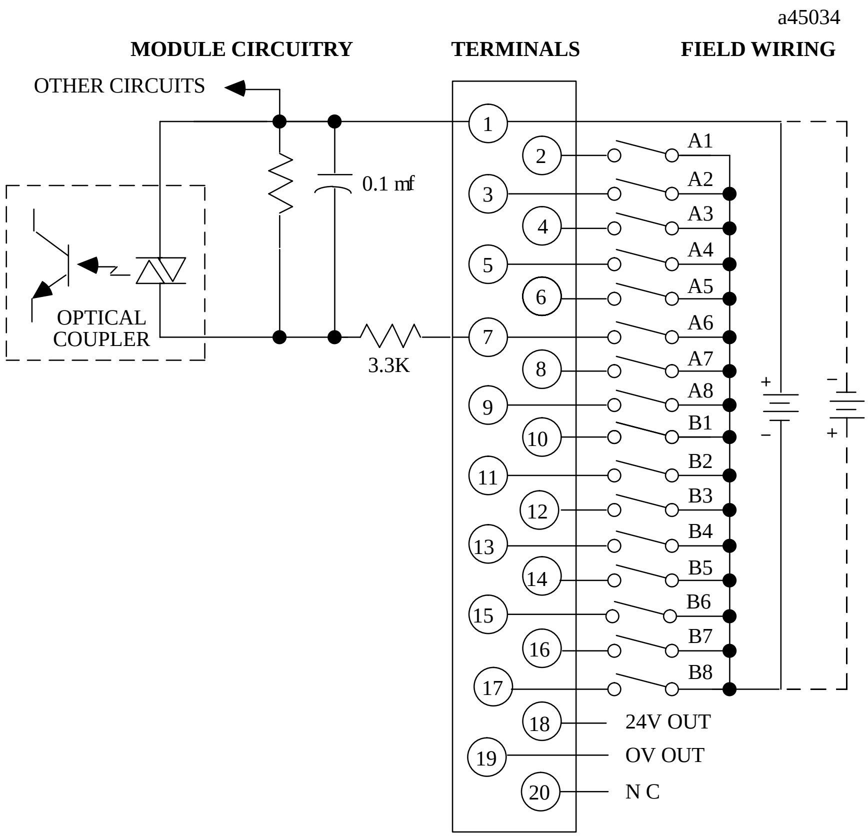


Figure 2.13 – Field Wiring - 24 Volt DC Pos/Neg FAST Logic Input Module - IC693MDL646

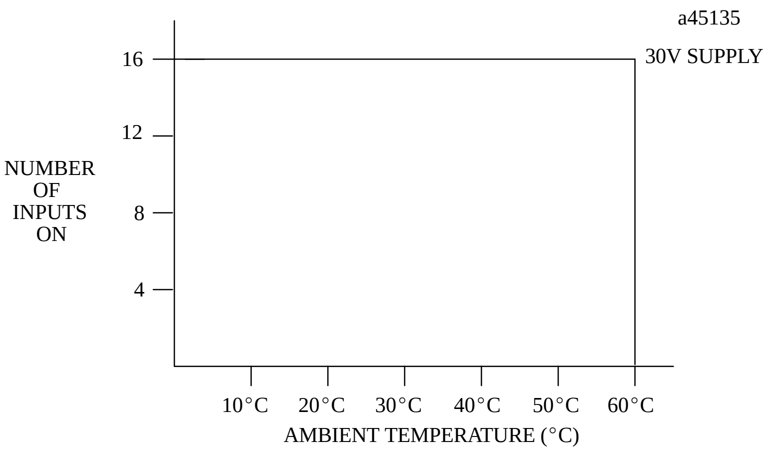


Figure 2.14 – Input Points vs. Temperature for IC693MDL646

3.9. 48 Volt DC Positive/Negative Logic Input FAST, 16 Point CF693MDL100

The ***48 volt DC Positive/Negative Logic Input (FAST)*** module for the Alspa C80–35 Programmable Logic Controller provides 16 input points in one group with a common power input terminal. This input module is designed to have either positive logic or negative logic characteristics. Input characteristics are compatible with a wide range of user-supplied input devices. Current into an input point results in a logic 1 in the input status table (%I). Power to operate the field devices must be supplied by the user.

LED indicators which provide the ON/OFF status of each point are located at the top of the module. This LED block has two horizontal rows with eight green LEDs in each row; the top row labeled A1 to 8 (points 1 to 8) and the bottom row labeled B1 to 8 (points 9 to 16). An insert goes between the inside and outside surface of the hinged door. The surface towards the inside of the module (when the hinged door is closed) has circuit wiring information and circuit identification information can be recorded on the outside surface. The outside left edge of the insert is color-coded blue to indicate a low-voltage module. This module can be installed in any I/O slot of a 5 or 10-slot baseplate in an Alspa C80–35 PLC system.

Rated Voltage	48 volts DC
Input Voltage Range	0 to +60 volts DC
Inputs per Module	16 (one group with a single common)
Isolation	2500 volts between field side and logic side
Input Current	4.7 mA (typical) at rated voltage
Input Characteristics	
On-state Voltage	30 to 60 volts DC
Off-state Voltage	0 to +10 volts DC
On-state Current	2.5 mA minimum
Off-state Current	0.5 mA maximum
On response Time	≤1 ms typical
Off response Time	≤1 ms typical
Power Consumption: 5V	80 mA (all inputs on) from 5 volt bus on backplane
Power Consumption: 48V	85 mA from user supplied power

Table 2.12 – Specifications for CF693MDL100

FIELD WIRING INFORMATION

The following figure provides wiring information for connecting user supplied input devices and power source to the 48 volt DC positive/negative FAST logic input module.

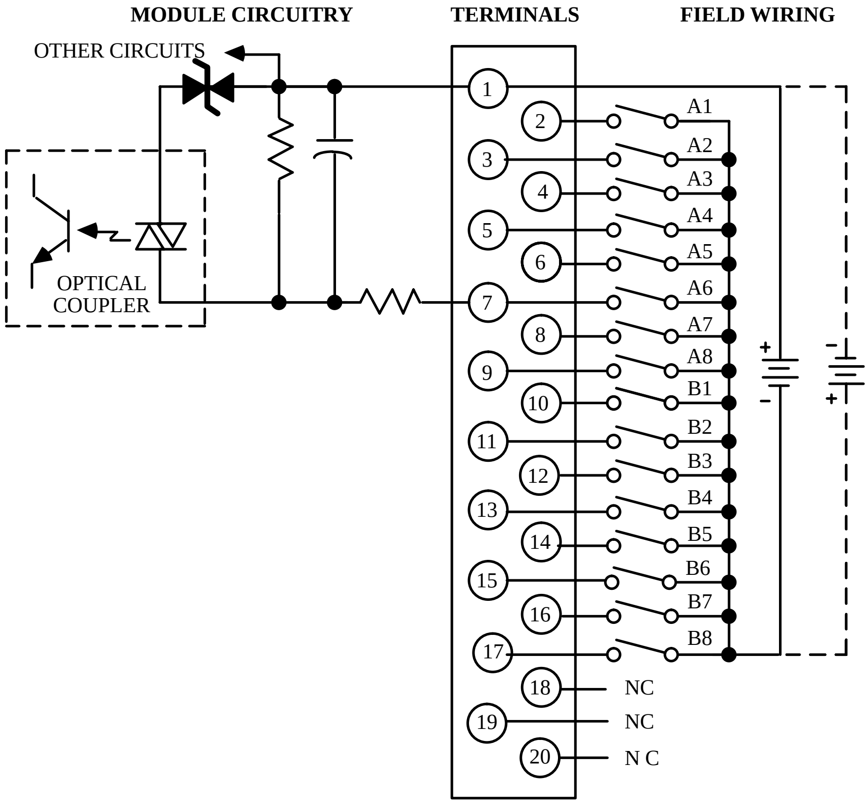


Figure 2.15 – Field Wiring - 48 Volt DC Pos/Neg FAST Logic Input Module - CF693MDL100

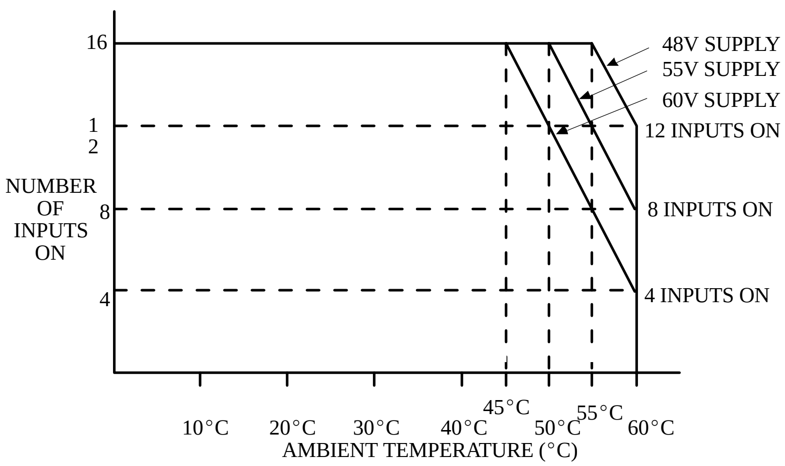


Figure 2.16 – Input Points vs. Temperature for CF693MDL100

3.10. 24 Volt DC Positive/Negative Logic Input, 16 Point CF693MDL101

This ***24 volt DC Positive/Negative Logic Input*** module provides 16 input points in four isolated groups with four points in each group. Each group has a separate common associated with it (the two commons are not tied together inside the module). The input module is designed to have either positive logic characteristics in that it sinks current from the input devices to the user common or negative power bus, or negative logic characteristics in that it sources current through the input devices to the user common or positive power bus. The input device is connected between the power bus and the module input. Current into an input point results in a logic 1 in the input status table (%I). Input characteristics are compatible with a wide range of industrial input devices. Power to operate field devices must be supplied by the user.

LED indicators which provide the ON/OFF status of each point are located at the top of the module. This LED block has two horizontal rows with eight green LEDs in each row. This module uses the top row labeled A1 to 8 (points 1 to 8) and the bottom row labeled B1 to B8 (points 9 to 16). An insert goes between the inside and outside surface of the hinged door. The surface towards the inside of the module (when the hinged door is closed) has circuit wiring information and circuit identification information can be recorded on the outside surface. The outside left edge of the insert is color-coded blue to indicate a low-voltage module.

This module can be installed in any I/O slot of a 5 or 10-slot baseplate in an Alspa C80–35 PLC system.

Rated Voltage	24 volts DC (Positive or Negative Logic)
Input Voltage Range	0 to +30 volts DC
Inputs per Module*	16 (four groups of four inputs)
Isolation	2500 volts between field side and logic side 2500 volts between groups
Input Current	5 mA typical
Input Characteristics	
Guaranteed On-state Voltage	18 to 30 volts DC
Guaranteed Off-state Voltage	0 to 4 volts DC
Guaranteed On-state Current	3 mA
Guaranteed Off-state Current	1 mA maximum
On response Time	7 ms typical
Off response Time	7 ms typical
Power Consumption: +5V	80 mA from the 5 volt bus on the backplane (all inputs ON)
Power Consumption: +24V	90 mA (typical) from user input supply (all inputs ON)

* Number of inputs ON is dependent upon ambient temperature as shown in Figure 2.18.

Table 2.13 – Specifications for CF693MDL101

FIELD WIRING INFORMATION

The following figure provides wiring information for connecting user supplied input devices and power source to the 24 volt DC positive/negative logic input module.

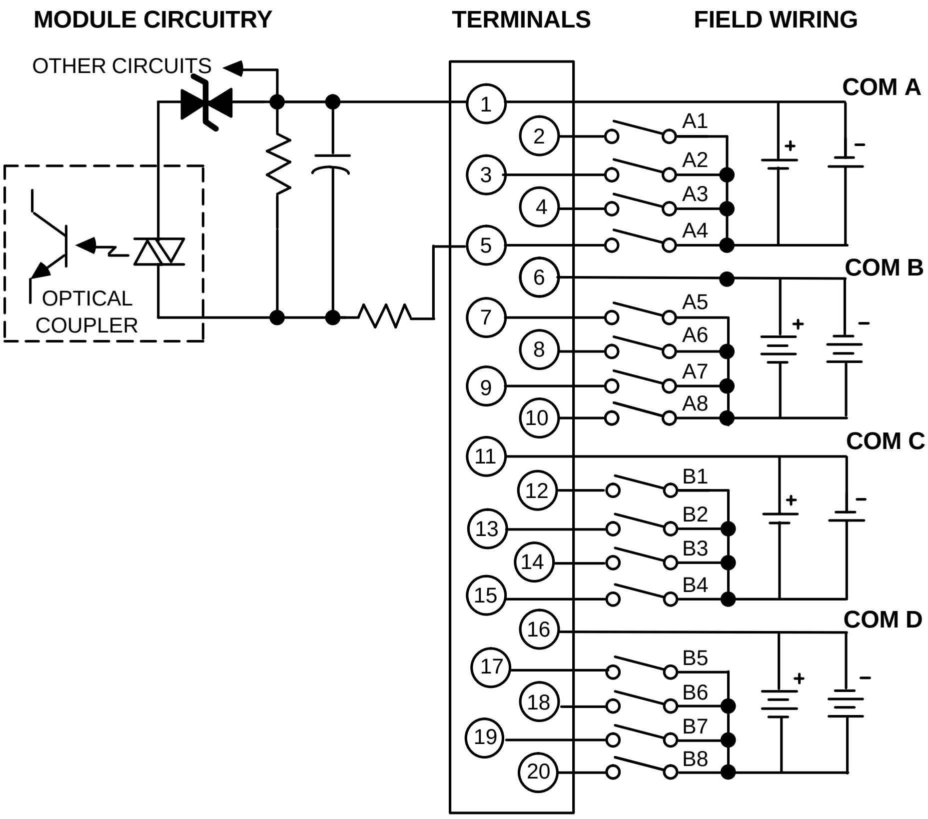


Figure 2.17 – Field Wiring - 24 Volt DC Positive /Negative Logic Input Module - CF693MDL101

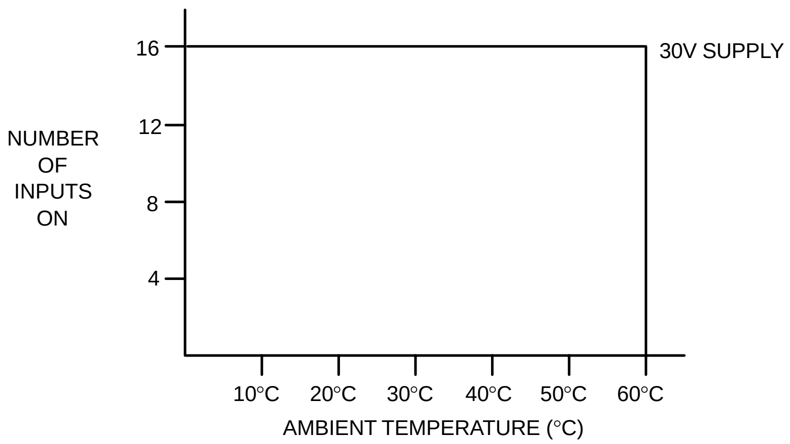


Figure 2.18 – Input Points vs. Temperature for CF693MDL101

3.11. 48 Volt DC Positive/Negative Logic Input, 16 Point CF693MDL102

This ***48 volt DC Positive/Negative Logic Input*** module provides 16 input points in four isolated groups with four points in each group. Each group has a separate common associated with it (the two commons are not tied together inside the module). The input module is designed to have either positive logic characteristics in that it sinks current from the input devices to the user common or negative power bus, or negative logic characteristics in that it sources current through the input devices to the user common or positive power bus. The input device is connected between the power bus and the module input. Current into an input point results in a logic 1 in the input status table (%I). Input characteristics are compatible with a wide range of industrial input devices. Power to operate field devices must be supplied by the user.

LED indicators which provide the ON/OFF status of each point are located at the top of the module. This LED block has two horizontal rows with eight green LEDs in each row. This module uses the top row labeled A1 to 8 (points 1 to 8) and the bottom row labeled B1 to B8 (points 9 to 16). An insert goes between the inside and outside surface of the hinged door. The surface towards the inside of the module (when the hinged door is closed) has circuit wiring information and circuit identification information can be recorded on the outside surface. The outside left edge of the insert is color-coded blue to indicate a low-voltage module.

This module can be installed in any I/O slot of a 5 or 10-slot baseplate in an Alspa C80–35 PLC system.

Rated Voltage	48 volts DC (Positive or Negative Logic)
Input Voltage Range	0 to +58 volts DC
Inputs per Module*	16 (four groups of four inputs)
Isolation	2500 volts between field side and logic side 2500 volts between groups
Input Current	5 mA typical
Input Characteristics	
Guaranteed On-state Voltage	36 to 58 volts DC
Guaranteed Off-state Voltage	0 to 9 volts DC
Guaranteed On-state Current	3 mA
Guaranteed Off-state Current	1 mA maximum
On response Time	7 ms typical
Off response Time	7 ms typical
Power Consumption: +5V	80 mA from the 5 volt bus on the backplane (all inputs ON)
Power Consumption: +48V	90 mA from user input supply (all inputs ON)

* Number of inputs ON is dependent upon ambient temperature as shown in Figure 2.20.

Table 2.14 – Specifications for CF693MDL102

FIELD WIRING INFORMATION

The following figure provides wiring information for connecting user supplied input devices and power source to the 48 volt DC positive/negative logic input module.

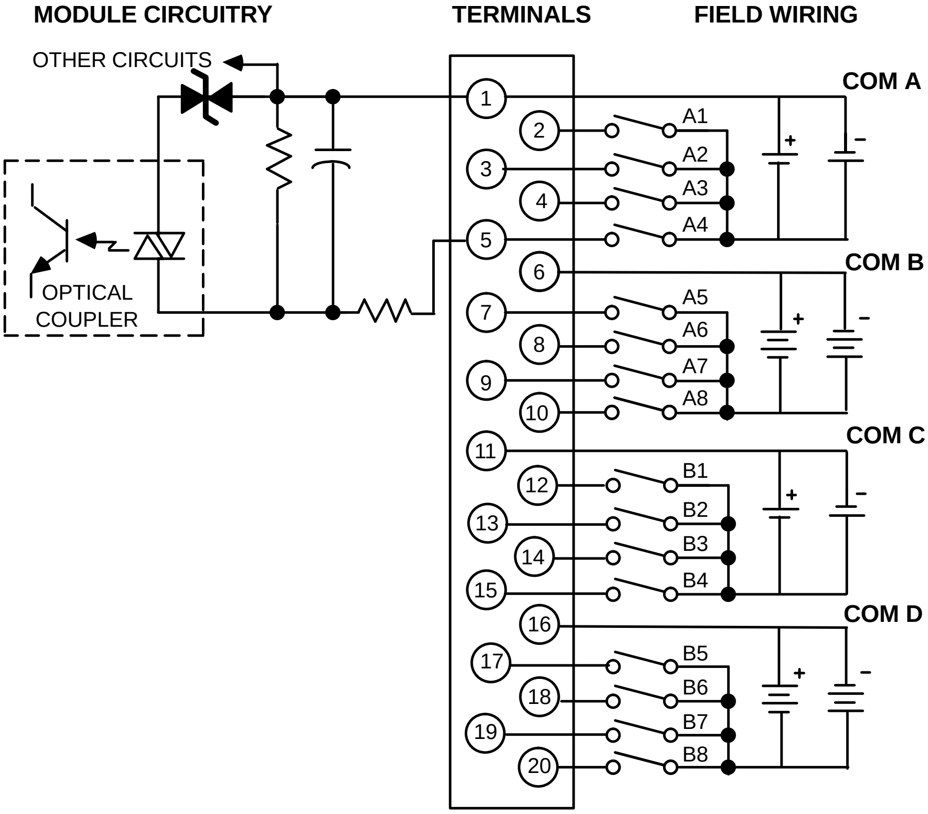


Figure 2.19 – Field Wiring - 48 Volt DC Positive /Negative Logic Input Module - CF693MDL102

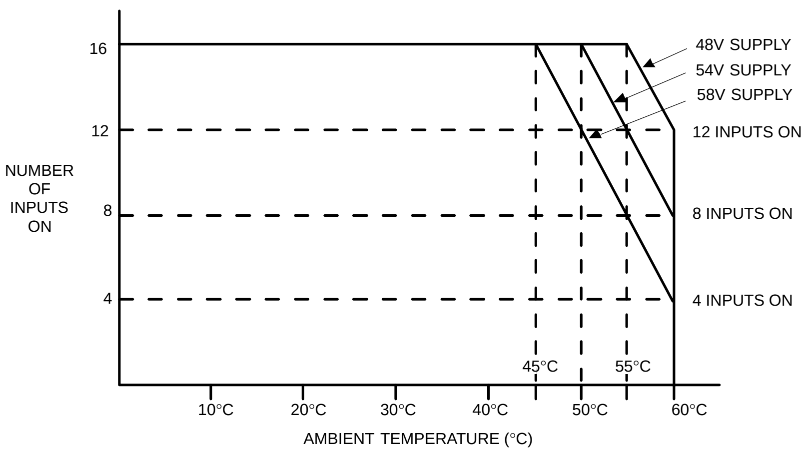


Figure 2.20 – Input Points vs. Temperature for CF693MDL102

3.12. 110/125 Volt DC Positive/Negative Logic Input, 16 Point CF693MDL103

This ***110/125 volt DC Positive/Negative Logic Input*** module provides 16 input points in four isolated groups with four points in each group. Each group has a separate common associated with it (the two commons are not tied together inside the module). The input module is designed to have either positive logic characteristics in that it sinks current from the input devices to the user common or negative power bus, or negative logic characteristics in that it sources current through the input devices to the user common or positive power bus. The input device is connected between the power bus and the module input. Current into an input point results in a logic 1 in the input status table (%I). Input characteristics are compatible with a wide range of industrial input devices. Power to operate field devices must be supplied by the user.

LED indicators which provide the ON/OFF status of each point are located at the top of the module. This LED block has two horizontal rows with eight green LEDs in each row. This module uses the top row labeled A1 to 8 (points 1 to 8) and the bottom row labeled B1 to B8 (points 9 to 16). An insert goes between the inside and outside surface of the hinged door. The surface towards the inside of the module (when the hinged door is closed) has circuit wiring information and circuit identification information can be recorded on the outside surface. The outside left edge of the insert is color-coded red to indicate a high-voltage module.

This module can be installed in any I/O slot of a 5 or 10-slot baseplate in an Alspa C80–35 PLC system.

Rated Voltage	110/125 volts DC (Positive or Negative Logic)
Input Voltage Range	0 to +150 volts DC
Inputs per Module*	16 (four groups of four inputs)
Isolation	2500 volts between field side and logic side 2500 volts between groups
Input Current	5 mA typical (110V) 6 mA typical (125V)
Input Characteristics	
Guaranteed On-state Voltage	82 to 150 volts DC
Guaranteed Off-state Voltage	0 to 18 volts DC
Guaranteed On-state Current	3 mA
Guaranteed Off-state Current	1 mA maximum
On response Time	7 ms typical
Off response Time	7 ms typical
Power Consumption: +5V	80 mA from the 5 volt bus on the backplane (all inputs ON)
Power Consumption: +110V	90 mA from user input supply (all inputs ON)
+125V	105 mA from user input supply (all inputs ON)

* Number of inputs ON is dependent upon ambient temperature as shown in Figure 2.22.

Table 2.15 – Specifications for CF693MDL103

FIELD WIRING INFORMATION

The following figure provides wiring information for connecting user supplied input devices and power source to the 110/125 volt DC positive/negative logic input module.

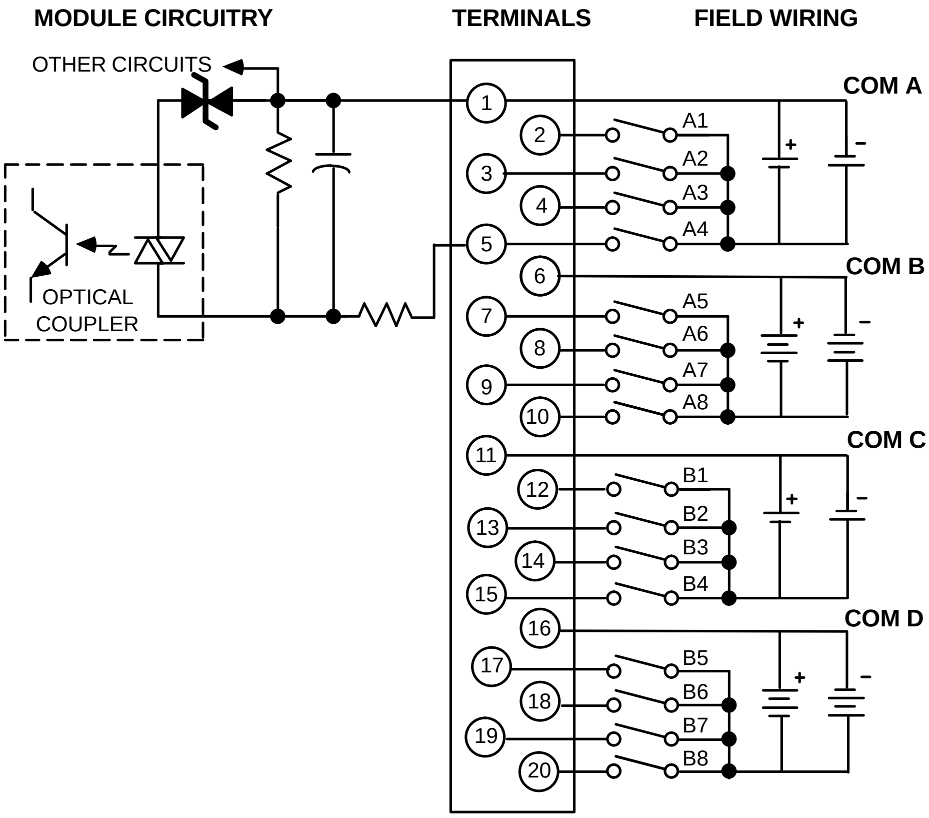


Figure 2.21 – Field Wiring - 110/125 Volt DC Positive /Negative Logic Input Module - CF693MDL103

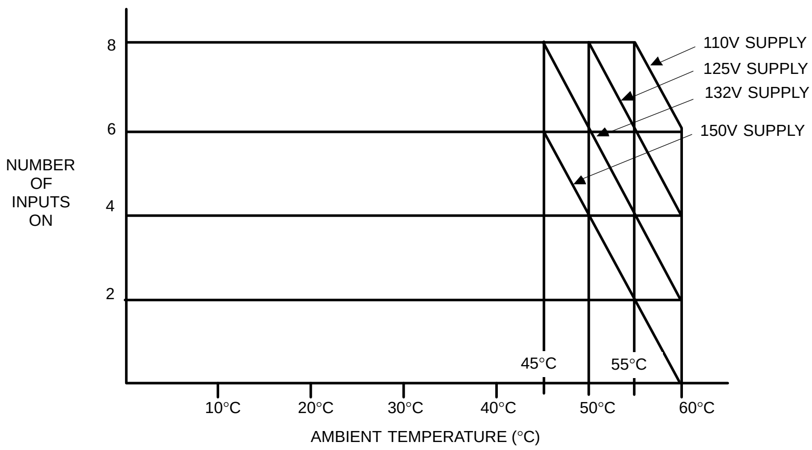


Figure 2.22 – Input Points vs. Temperature for CF693MDL103

3.13. Input Simulator, 8/16 Point IC693ACC300

The ***Input Simulator*** module for the Alspa C80–35 Programmable Logic Controller has 16 two-position switches on the front of the module. Each switch can be programmed as a discrete input device. This module allows simulation of either 8 point or 16 point input modules. A switch, located in the rear of the module, allows configuration of the module for either 8 or 16 points. When the mode switch is set for 8 points, only the first 8 switches can be used. A switch in the ON position results in a logic 1 in the input table (%I). This module requires no field connections. The Input Simulator is a valuable tool when developing programs and troubleshooting since it can be substituted for actual inputs until the program or system is debugged. It can also remain permanently in the system to provide 8 or 16 conditional input contacts for manual control of output devices.

There are two rows of green LED indicators which correspond to the position of each switch. The corresponding LED turns ON when the switch is placed in the ON position, and is OFF when the switch is in the OFF position. The LEDs are arranged in two rows with 8 LEDs in each row. The top row is labeled A1 to A8, and the bottom row is labeled B1 to B8.

This module can be installed in any I/O slot of a 5 or 10-slot baseplate in an Alspa C80–35 PLC system.

Inputs per Module	8 or 16 (switch selectable)
Off Response Time	20 ms maximum
On Response Time	30 ms maximum
Internal Power Consumption	120 mA (all inputs on) from 5 volt bus on backplane

Refer to data sheet ALS 53002 for product standards and general specifications.

Table 2.16 – Specifications for IC693ACC300

The Input Simulator module does not require any field wiring - just set the mode switch on the back of the module to 8 or 16 and install the module in the selected I/O slot in a baseplate. An illustration of the module is shown in the following figure.

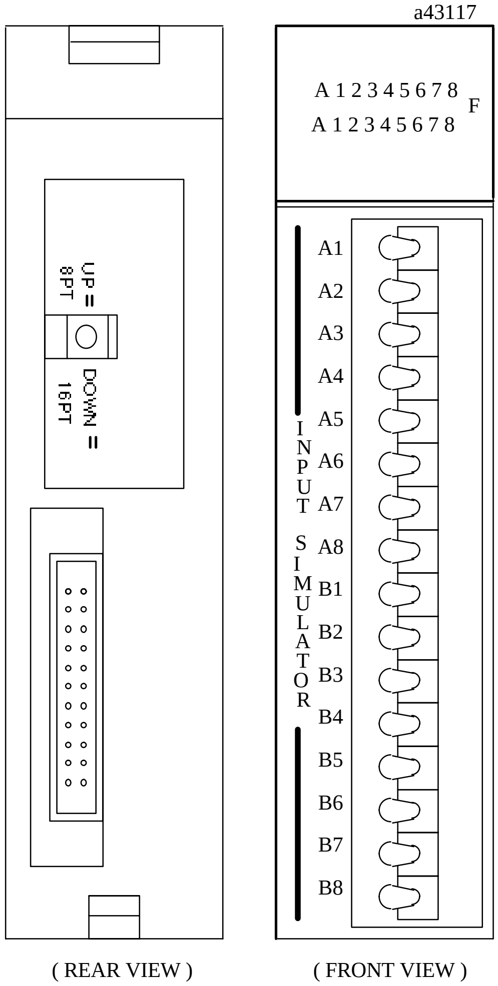


Figure 2.23 – Input Simulator Module

3.14. 120 Volt AC Output - 0.5 Amp, 12 Point IC693MDL310

The ***120 volt, 0.5 Amp AC Output*** module provides 12 output points in two isolated groups with six points in each group. Each group has a separate common associated with it (the two commons are not tied together inside the module). This allows each group to be used on different phases of the AC supply, or powered from the same supply. Each group is protected with a 3 amp fuse and an RC snubber is provided for each output to protect against transient electrical noise on the power line. This module provides a high-degree of inrush current (10x the rated current) which makes the outputs suitable for controlling a wide range of inductive and incandescent loads. AC Power to operate loads connected to outputs must be user supplied. This module requires an AC power source.

LED indicators which provide the ON/OFF status of each point are at the top of the module. The LEDs are arranged in two horizontal rows with eight green LEDs in each row and a red LED centered between and to the right of the two rows. This module uses the first six LEDs, labeled A1 to 6 in the top row and the first six LEDs, labeled B1 to 6, in the bottom row, for output status. The red LED (labeled F) functions as a blown fuse indicator that turns ON if any of the fuses should blow. An insert goes between the inside and outside surface of the hinged door. The surface towards the inside of the module (when the hinged door is closed) has circuit wiring information and circuit identification information can be recorded on the outside surface. The outside left edge of the insert is color-coded red to indicate a high-voltage module. This module can be installed in any I/O slot of a 5 or 10-slot baseplate in an Alspa C80–35 PLC system. *Although this module is configured as a 16 point output, only outputs 1 to 6 and 9 to 14 are available to be referenced in your program.* For example, if the starting reference is Q0017, then valid references are Q17 to Q22 and Q25 to Q30.

Rated Voltage	120 volts AC
Output Voltage Range	85 to 132 volts AC, 50/60 Hz
Outputs per Module	12 (two groups of six outputs each)
Isolation	1500 volts RMS between field side and logic side 500 volts RMS between each group
Output Current*	0.5 amp maximum per point 1 amp maximum per group at 60°C (140°F) 2 amps maximum per group at 50°C (122°F)
Output Characteristics	
Inrush Current	5 amps maximum for one cycle
Minimum Load Current	50 mA
Output Voltage Drop	1.5 volts maximum
Output Leakage Current	3 mA maximum at 120 volts AC
On Response Time	1 ms maximum
Off Response Time	1/2 cycle maximum
Power Consumption	210 mA (all outputs on) from 5 volt bus on backplane

* Number of inputs on is dependent upon ambient temperature as shown in Figure 2.25.
Refer to data sheet ALS 53002 for product standards and general specifications.

Table 2.17 – Specifications for IC693MDL310

FIELD WIRING INFORMATION

The following figure provides wiring information for connecting user supplied input devices and power source to the 120 volt AC output module.

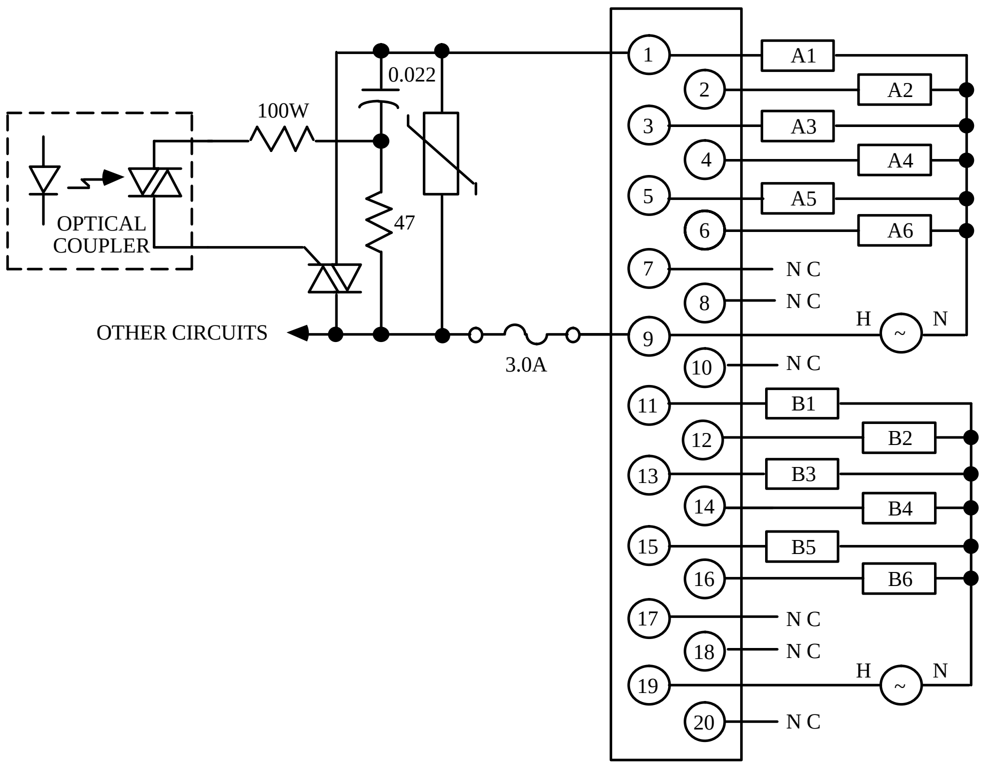


Figure 2.24 – Field Wiring - 120 Volt AC Output, 0.5 Amp Module - IC693MDL310

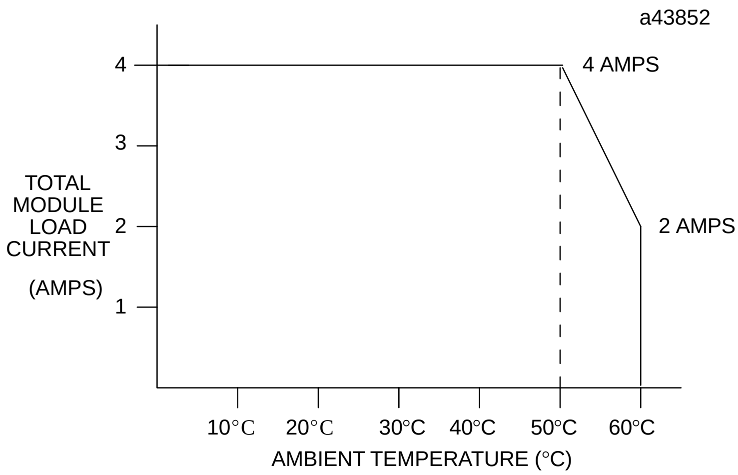


Figure 2.25 – Input Points vs. Temperature for IC693MDL310

3.15. 120/240 Volt AC Output - 2 Amp, 8 Point IC693MDL330

This 2 amp AC output module has a catalog number with a D or later suffix (i.e., IC693MDL330D); previous versions (modules with a C or earlier suffix) were rated at 1 amp. The ***120/240 volt, 2 Amp AC Output*** module for the Alspa C80–35 Programmable Logic Controller provides 8 output points in two isolated groups with four points in each group. Each group has a separate common associated with it. The two commons are not tied together inside the module. This allows each group to be used on different phases of the AC supply, or they can be powered from the same supply. Each group is protected with a 5 amp fuse for each common and an RC snubber is provided for each output to protect against transient electrical noise on the power line. This module provides a high-degree of inrush current (10x the rated current) which makes the outputs suitable for controlling a wide range of inductive and incandescent loads. AC Power to operate loads connected to outputs must be supplied by the user. This module requires an AC power source, it can not be used with a DC power source.

LED indicators which provide the ON/OFF status of each point are located at the top of the module. There are two horizontal rows with eight green LEDs in each row and a red LED centered between and to the right of the two rows. This module uses the upper eight LEDs, labeled A1 to 8 for output status. The red LED is a blown fuse indicator that turns ON if any of the fuses should blow. An insert goes between the inside and outside surface of the hinged door. The surface towards the inside of the module (when the hinged door is closed) has circuit wiring information and circuit identification information can be recorded on the outside surface. The outside left edge of the insert is color-coded red to indicate a high-voltage module. This module can be installed in any I/O slot of a 5 or 10-slot baseplate in an Alspa C80–35 PLC system.

Rated Voltage	120/240 volts AC
Output Voltage Range	85 to 264 volts AC, 50/60 Hz
Outputs per Module	8 (two groups of four outputs each)
Isolation	1500 volts RMS between field side and logic side 500 volts RMS between each group
Output Current*	2 amp maximum per point 4 amps maximum per group at 40° C (104°F)
Output Characteristics	
Inrush Current	20 amps maximum for one cycle
Minimum Load Current	100 mA
Output Voltage Drop	1.5 volts maximum
Output Leakage Current	3 mA maximum at 120 volts AC 6 mA maximum at 240 volts AC
On Response Time	1 ms maximum
Off Response Time	1/2 cycle maximum
Power Consumption	160 mA (all outputs on) from 5 volt bus on backplane

* Number of inputs on is dependent upon ambient temperature as shown in Figure 2.27.
Refer to data sheet ALS 53002 for product standards and general specifications.

Table 2.18 – Specifications for IC693MDL330

FIELD WIRING INFORMATION

The following figure provides wiring information for connecting user supplied input devices and power source to the 120/240 volt AC output, 2 Amp module.

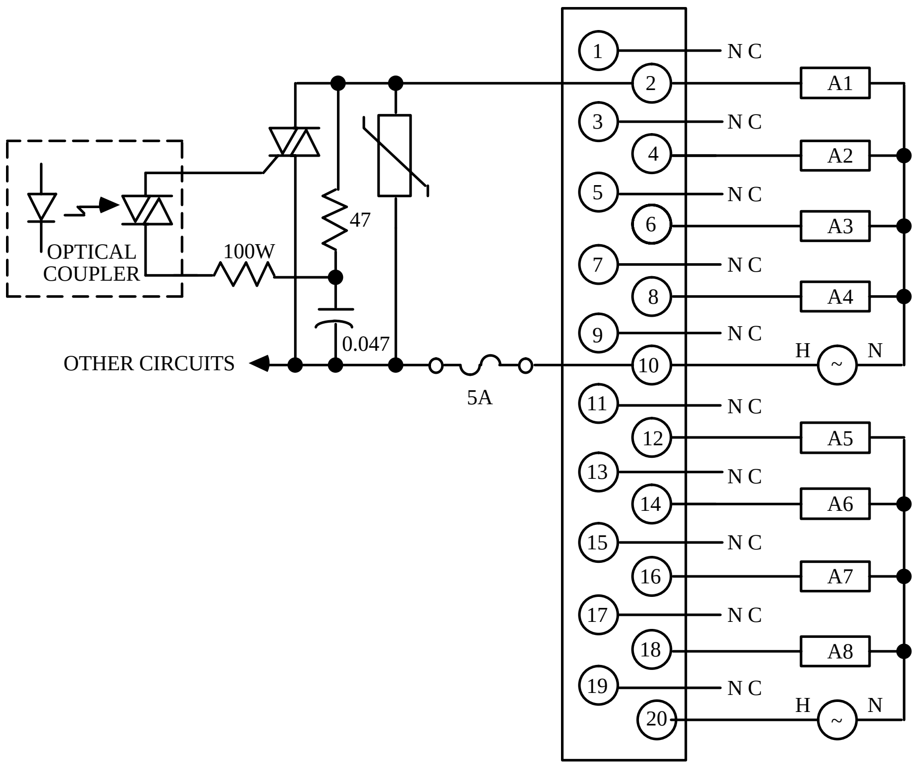


Figure 2.26 – Field Wiring - 120/240 Volt AC Output, 2 Amp Module - IC693MDL330

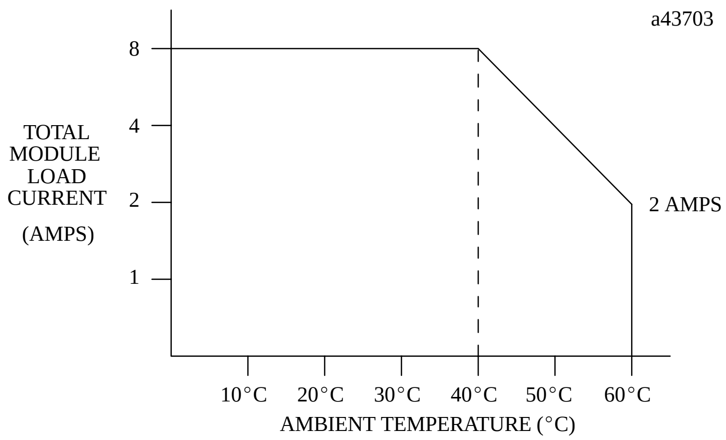


Figure 2.27 – Input Points vs. Temperature for IC693MDL330

3.16. 120 Volt AC Output - 0.5 Amp, 16 Point IC693MDL340

The ***120 volt, 0.5 Amp AC Output*** module provides 16 output points in two isolated groups with eight points in each group. Each group has a separate common associated with it (the two commons are not tied together inside the module). This allows each group to be used on different phases of the AC supply, or they can be powered from the same supply. Each group is protected with a 3 amp fuse and an RC snubber is provided for each output to protect against transient electrical noise on the power line. This module provides a high-degree of inrush current which makes the outputs suitable for controlling a wide range of inductive and incandescent loads. AC Power to operate loads connected to outputs must be supplied by the user. This module requires an AC power source.

LED indicators which provide the ON/OFF status of each point are located at the top of the module. There are two horizontal rows with eight green LEDs in each row and a red LED centered between and to the right of the two rows. This module uses the two rows of green LEDs, labeled A1 to 8 and B1 to 8 for output status. The red LED (labeled F) is a blown fuse indicator that turns ON if either of the fuses should blow. A load must be connected to the blown fuse for the indicator to light. An insert goes between the inside and outside surface of the hinged door. The surface towards the inside of the module (when the hinged door is closed) has circuit wiring information and circuit identification information can be recorded on the outside surface. The outside left edge of the insert is color-coded red to indicate a high-voltage module. This module can be installed in any I/O slot of a 5 or 10-slot baseplate in an Alspa C80–35 PLC system.

Rated Voltage	120 volts AC
Output Voltage Range	85 to 132 volts AC, 50/60 Hz
Outputs per Module	16 (two groups of eight outputs each)
Isolation	1500 volts RMS between field side and logic side 500 volts RMS between each group
Output Current	0.5 amp maximum per point 3 amps maximum per group
Output Characteristics	
Inrush Current	20 amps maximum for one cycle
Minimum Load Current	50 mA
Output Voltage Drop	1.5 volts RMS
Output Leakage Current	2 mA maximum at 120 volts AC
On Response Time	1 ms maximum
Off Response Time	1/2 cycle maximum
Power Consumption	315 mA (all outputs ON) from 5 volt bus on backplane

Refer to data sheet ALS 53002 for product standards and general specifications.

Table 2.19 – Specifications for IC693MDL340

FIELD WIRING INFORMATION

The following figure provides wiring information for connecting user supplied input devices and power source to the 120 volt AC output module.

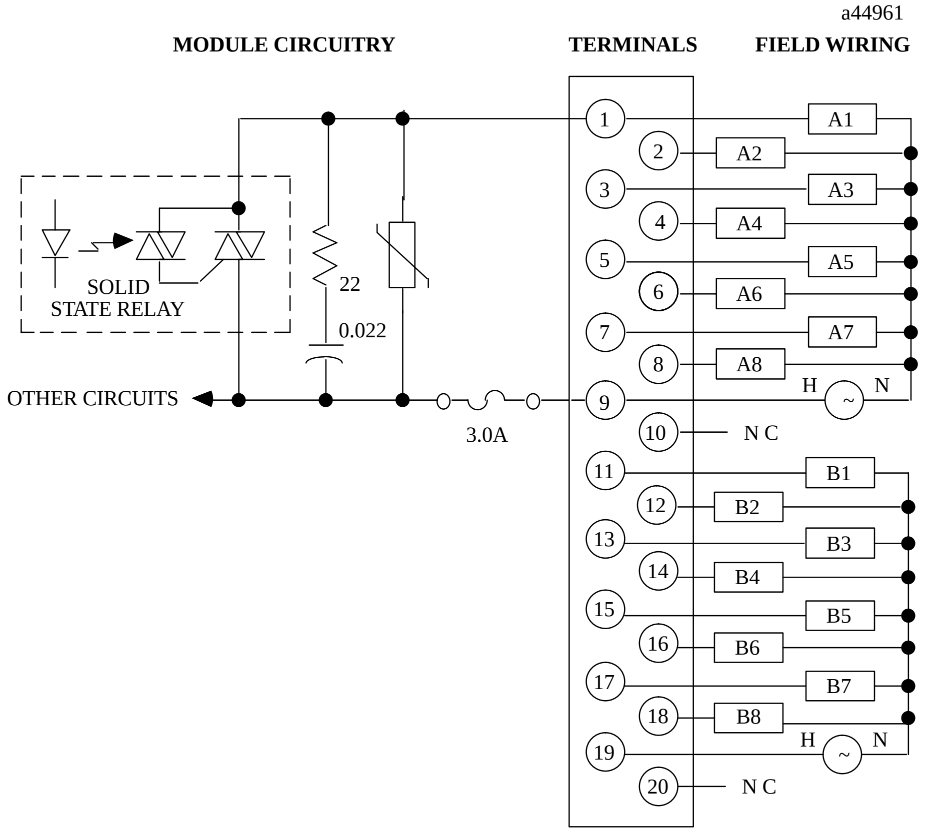


Figure 2.28 – Field Wiring - 120 Volt AC Output, 0.5 Amp Module - IC693MDL340

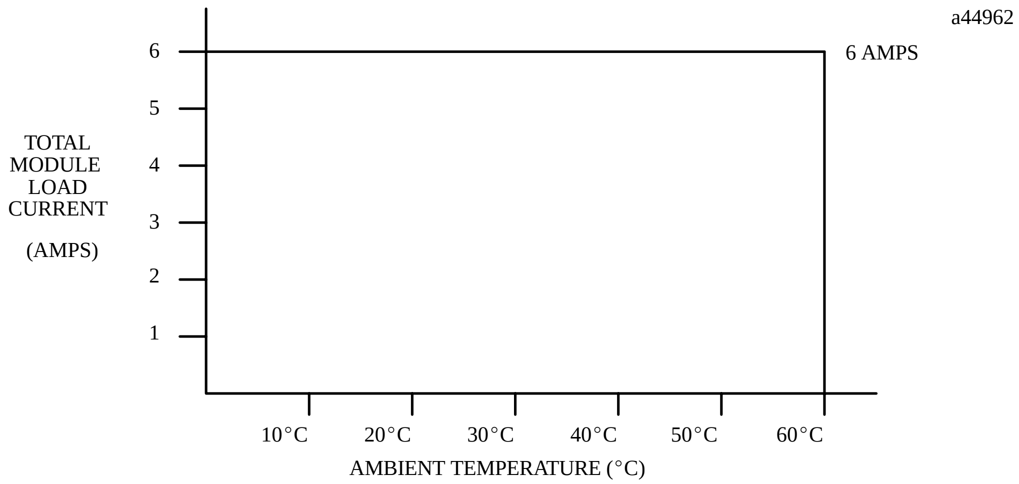


Figure 2.29 – Load Current vs. Temperature for IC693MDL340

3.17. 120/240 Volt AC Isolated Output - 2 Amp, 5 Point IC693MDL390

The ***120/240 volt, 2 Amp Isolated AC Output*** module for the Alspa C80–35 Programmable Logic Controller provides 5 isolated output points with each point having a separate common. Each output circuit is isolated from the others relative to the AC power source; commons are not tied together inside the module. This allows each output circuit to be used on different phases of the AC supply, or they can be powered from the same supply. Outputs are individually fused with a 3 amp fuse and an RC snubber is provided for each output to protect against transient electrical noise on the power line. This module provides a high-degree of inrush current (greater than 10x the rated current) making the outputs suitable for controlling a wide range of inductive and incandescent loads. AC Power to operate the loads connected to the outputs must be supplied by the user. ***This module requires an AC power source, it can not be used with a DC power source.***

LED indicators which provide the ON/OFF status of each point are located at the top of the module. These LEDs are arranged in two horizontal rows with eight green LEDs in each row and a red LED centered between and to the right of the two rows. This module uses the first five LEDs, labeled A1 to 5 in the top row for output status. The red LED is a blown fuse indicator that turns ON if any fuse should blow. An insert goes between the inside and outside surface of the hinged door. The surface towards the inside of the module (when the hinged door is closed) has circuit wiring information and circuit identification information can be recorded on the outside surface. The outside left edge of the insert is color-coded red to indicate a high-voltage module. This module can be installed in any I/O slot of a 5 or 10-slot baseplate in an Alspa C80–35 PLC system and *it should be configured as an 8 point output with programs referencing the five least significant bits.*

Rated Voltage	120/240 volts AC
Output Voltage Range	85 to 264 volts AC, 50/60 Hz
Outputs per Module	5 (each output isolated from the others)
Isolation	1500 volts RMS between field side and logic side 500 volts RMS between each output
Output Current*	2 amps maximum per point 5 amps maximum per module at 45° C (113° F) 2 amps maximum per module at 60° C (140° F)
Output Characteristics	
Inrush Current	25 amps maximum for one cycle
Minimum Load Current	100 mA
Output Voltage Drop	1.5 volts maximum
Output Leakage Current	3 mA maximum at 120 volts AC 6 mA maximum at 240 volts AC
On Response Time	1 ms maximum
Off Response Time	1/2 cycle maximum
Power Consumption	110 mA (all outputs on) from 5 volt bus on backplane

* Number of inputs on is dependent upon ambient temperature as shown in Figure 2.31.
Refer to data sheet ALS 53002 for product standards and general specifications.

Table 2.20 – Specifications for IC693MDL390

FIELD WIRING INFORMATION

The following figure provides wiring information for connecting user supplied input devices and power source to the 120/240 volt isolated AC output module.

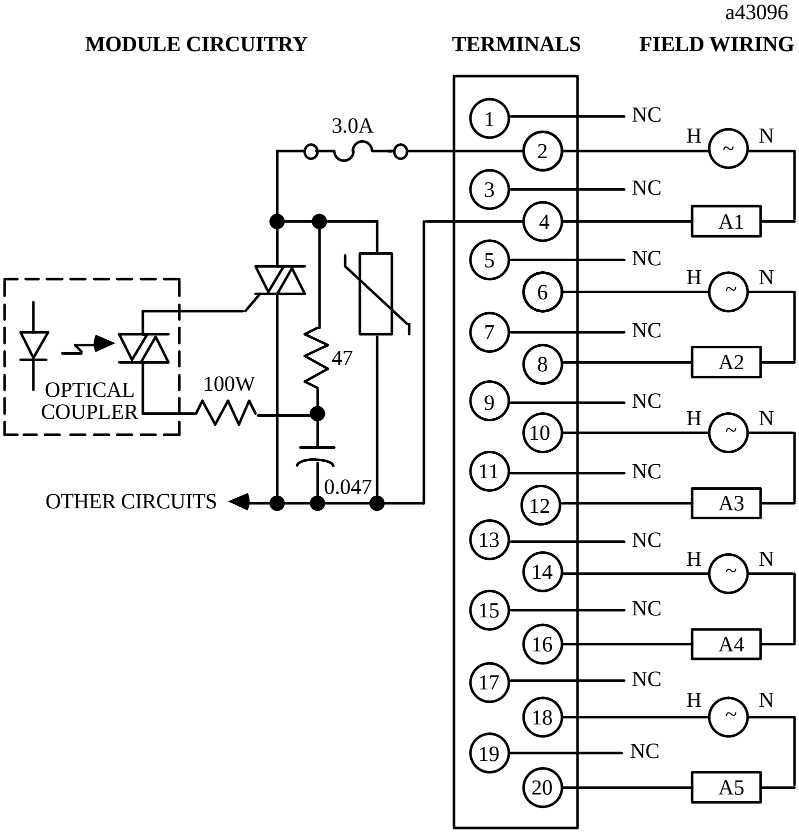


Figure 2.30 – Field Wiring - 120/240 Volt Isolated AC Output Module - IC693MDL390

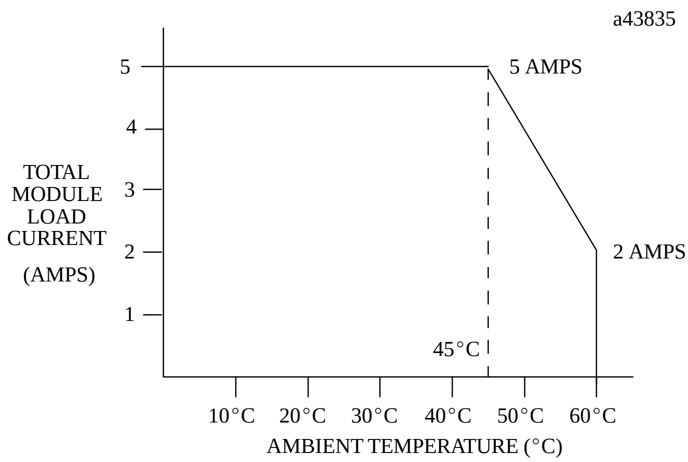


Figure 2.31 – Load Current vs. Temperature for IC693MDL390

3.18. 12/24 Volt DC Positive Logic Output - 2 Amp, 8 Point IC693MDL730

The ***12/24 volt DC Positive Logic 2 Amp Output*** module for the Alspa C80–35 Programmable Logic Controller provides 8 output points in one group with a common power input terminal. This output module is designed to have positive logic characteristics in that it sources current to the loads from the user common or positive power bus. The output device is connected between the negative power bus and the module output. The output characteristics are compatible with a wide range of user-supplied load devices, such as: motor starters, solenoids and indicators. Power to operate the field devices must be supplied by the user.

LED indicators which provide the ON/OFF status of each point are located at the top of the module. This LED block has two horizontal rows with eight green LEDs in each row. This module uses the top row labeled A1 to 8 (points 1 to 8). A red LED on the right and centered between the two rows of green LEDs functions as a blown fuse indicator; it turns ON when any fuse is blown. The module has two 5 Amp fuses with each fuse protecting four outputs; the first fuse protects A1 - A4, the second fuse protects A5 - A8. The fuses are electrically connected to the same common. An insert goes between the inside and outside surface of the hinged door. The surface towards the inside of the module (when the hinged door is closed) has circuit wiring information and circuit identification information can be recorded on the outside surface. The outside left edge of the insert is color-coded blue to indicate a low-voltage module.

This module can be installed in any I/O slot of a 5 or 10-slot baseplate in an Alspa C80–35 PLC system.

Rated Voltage	12/24 volts DC
Output Voltage Range	12 to 24 volts DC (+20%, –15%)
Outputs per Module	8 (one group of eight outputs)
Isolation	1500 volts between field side and logic side
Output Current*	2 amps maximum per point 2 amps maximum per fuse at 60°C (140°F) 4 amps maximum per fuse at 50°C (122°F)
Output Characteristics	
Inrush Current	9.4 amps for 10 ms
Output Voltage Drop	1.2 volts maximum
Off-state Leakage	1 mA maximum
On Response Time	2 ms maximum
Off Response Time	2 ms maximum
Power Consumption	55 mA (all outputs on) from 5 volt bus on backplane

* Number of inputs on is dependent upon ambient temperature as shown in Figure 2.33.
Refer to data sheet ALS 53002 for product standards and general specifications.

Table 2.21 – Specifications for IC693MDL730

FIELD WIRING INFORMATION

The following figure provides wiring information for connecting user supplied load devices and power source to the 12/24 volt DC positive logic 2 amp output module.

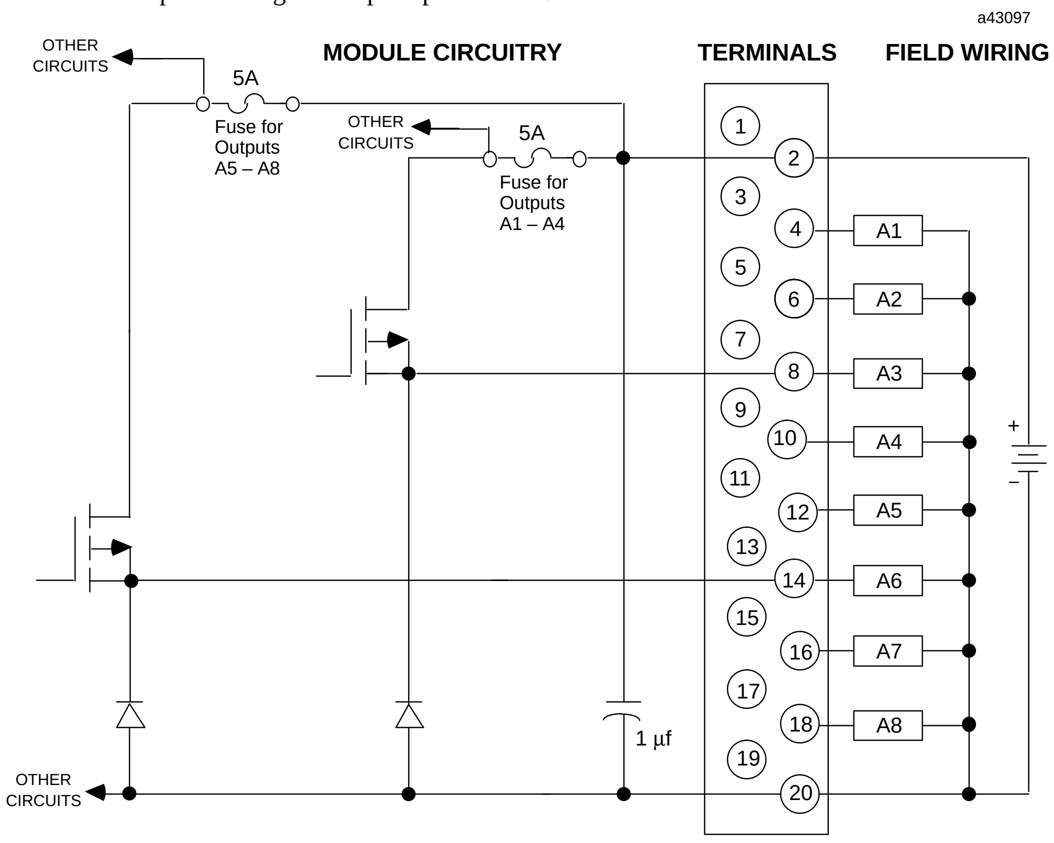


Figure 2.32 – Field Wiring - 12/24 Volt DC Positive Logic - 2 Amp Output Module - IC693MDL730

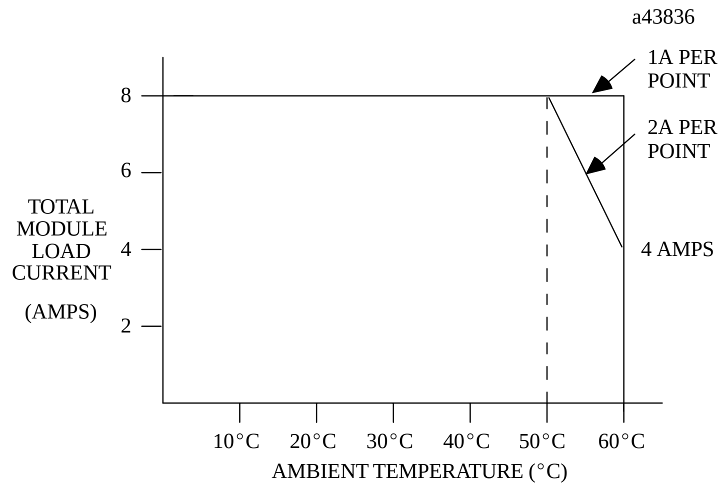


Figure 2.33 – Load Current vs. Temperature for IC693MDL730

3.19. 12/24 Volt DC Negative Logic Output - 2 Amp, 8 Point IC693MDL731

The ***12/24 volt DC Negative Logic 2 Amp Output*** module for the Alspa C80–35 Programmable Logic Controller provides 8 output points in one group with a common power output terminal. This output module is designed to have negative logic characteristics in that it sinks current from the loads to the user common or negative power bus. The output device is connected between the positive power bus and the module output. The output characteristics are compatible with a wide range of user-supplied load devices, such as: motor starters, solenoids and indicators. Power to operate the field devices must be supplied by the user.

LED indicators which provide the ON/OFF status of each point are located at the top of the module. This LED block has two horizontal rows with eight green LEDs in each row. This module uses only the top row labeled A1 to 8 (points 1 to 8). A red LED on the right and centered between the two rows of green LEDs functions as a blown fuse indicator; it turns ON when any fuse is blown. The module has two 5 amp fuses with each fuse protecting four outputs; the first fuse protects A1 - A4, the second fuse protects A5 - A8. The fuses are electrically connected to the same common. An insert goes between the inside and outside surface of the hinged door. The surface towards the inside of the module (when the hinged door is closed) has circuit wiring information and circuit identification information can be recorded on the outside surface. The outside left edge of the insert is color-coded blue to indicate a low-voltage module. This module can be installed in any I/O slot of a 5 or 10-slot baseplate in an Alspa C80–35 PLC system.

Rated Voltage	12/24 volts DC
Output Voltage Range	12 to 24 volts DC (+20%, –15%)
Outputs per Module	8 (one group of eight outputs)
Isolation	1500 volts between field side and logic side
Output Current*	2 amps maximum per point 4 amps maximum per fuse at 50° C (122° F) 2 amps maximum per fuse at 60° C (140° F)
Output Characteristics	
Output Voltage Drop	0.75 volts maximum
Off-state Leakage	1 mA maximum
On Response Time	2 ms maximum
Off Response Time	2 ms maximum
Int Power Consumption	55 mA (all outputs on) from 5 volt bus on backplane

* Number of inputs on is dependent upon ambient temperature as shown in Figure 2.35.
Refer to data sheet ALS 53002 for product standards and general specifications.

Table 2.22 – Specifications for IC693MDL731

FIELD WIRING INFORMATION

The following figure provides wiring information for connecting user supplied load devices and power source to the 12/24 volt DC negative logic 2 amp output module.

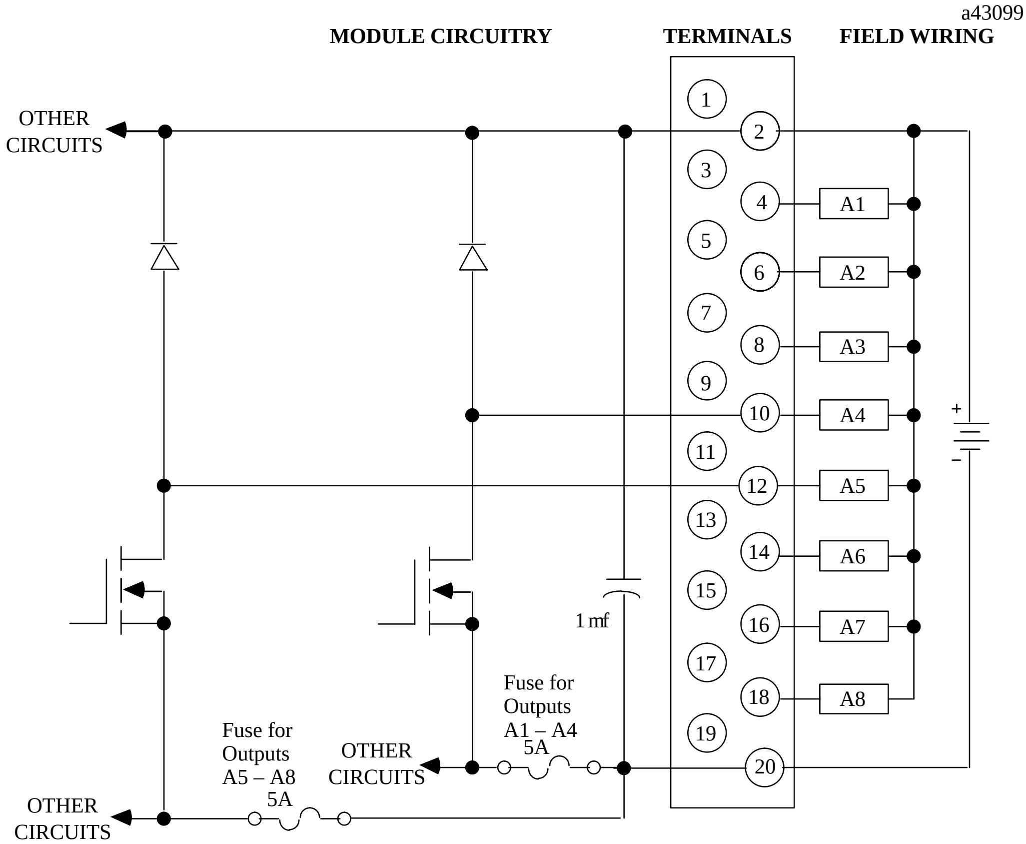


Figure 2.34 – Field Wiring - 12/24 Volt DC Negative Logic - 2 Amp Output Module - IC693MDL731

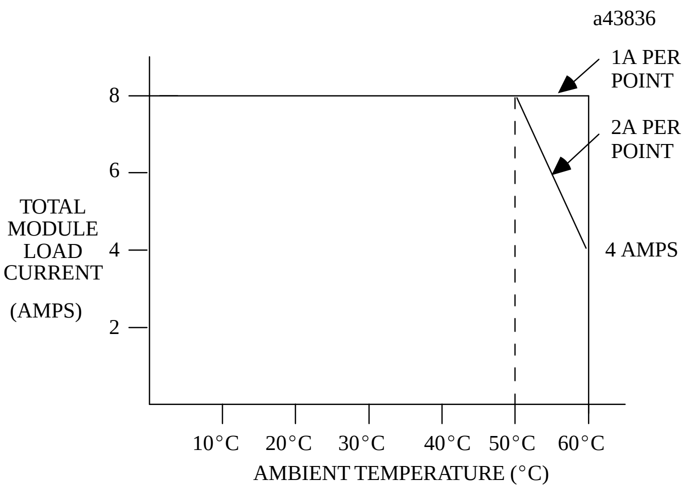


Figure 2.35 – Load Current vs. Temperature for IC693MDL731

3.20. 12/24 Volt DC Positive Logic Output - 0.5 Amp, 8 Point IC693MDL732

This ***12/24 volt DC Positive Logic 0.5 Amp Output*** module for the Alspa C80–35 Programmable Logic Controller provides 8 output points in one group of eight with a common power output terminal. This output module is designed to have positive logic characteristics in that it sources current to the loads from the user common or positive power bus. The output device is connected between the negative power bus and the module output. The output characteristics are compatible with a wide range of user-supplied load devices, such as: motor starters, solenoids and indicators. Power to operate the field devices must be supplied by the user.

LED indicators which provide the ON/OFF status of each point are located at the top of the module. This LED block has two horizontal rows with eight green LEDs in each row with the top row labeled A1 to 8 (points 1 to 8) and the bottom row labeled B1 to 8 (points 9 to 16). An insert goes between the inside and outside surface of the hinged door. The surface towards the inside of the module (when the hinged door is closed) has circuit wiring information and circuit identification information can be recorded on the outside surface. The outside left edge of the insert is color-coded blue to indicate a low-voltage module. There are no fuses on this module.

This module can be installed in any I/O slot of a 5 or 10-slot baseplate in an Alspa C80–35 PLC system.

Rated Voltage	12/24 volts DC
Output Voltage Range	12 to 24 volts DC (+20%, –15%)
Outputs per Module	8 (one group of eight outputs)
Isolation	1500 volts between field side and logic side
Output Current	0.5 amps maximum per point 2 amps maximum per common
Output Characteristics	
Inrush Current	4.78 amps for 10 ms
Output Voltage Drop	1 volt maximum
Off-state Leakage	1 mA maximum
On Response Time	2 ms maximum
Off Response Time	2 ms maximum
Power Consumption	50 mA (all outputs on) from 5 volt bus on backplane

Refer to data sheet ALS 53002 for product standards and general specifications.

Table 2.23 – Specifications for IC693MDL732

FIELD WIRING INFORMATION

The following figure provides wiring information for connecting user supplied load devices and power source to the 12/24 volt DC positive logic - 0.5 amp output module.

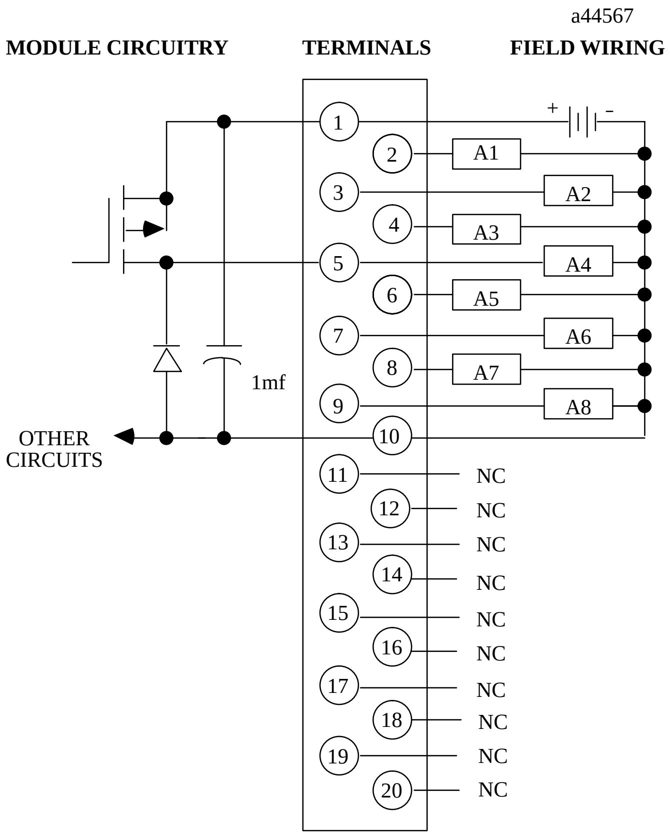


Figure 2.36 – Field Wiring - 12/24 Volt DC Positive Logic - 0.5 Amp, Output Module - IC693MDL732

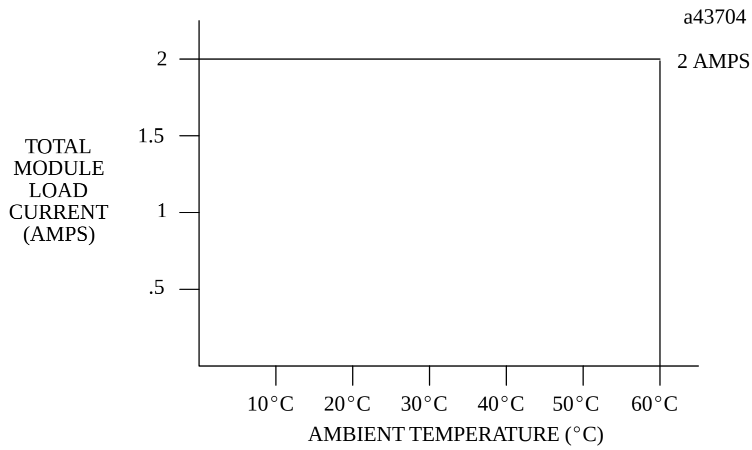


Figure 2.37 – Load Current vs. Temperature for IC693MDL732

3.21. 12/24 Volt DC Negative Logic 0.5 Amp Output - 8 Point IC693MDL733

The ***12/24 volt DC Negative Logic 0.5 Amp Output*** module for the Alspa C80–35 Programmable Logic Controller provides 8 output points in one group with a common power output terminal. This output module is designed to have negative logic characteristics in that it sinks current from the loads to the user common or negative power bus. The output device is connected between the positive power bus and the module output. The output characteristics are compatible with a wide range of user-supplied load devices, such as: motor starters, solenoids and indicators. Power to operate the field devices must be supplied by the user.

LED indicators which provide the ON/OFF status of each point are located at the top of the module. This LED block has two horizontal rows with eight green LEDs in each row; the top row labeled A1 to 8 (points 1 to 8) is used by this module. An insert goes between the inside and outside surface of the hinged door. The surface towards the inside of the module (when the hinged door is closed) has circuit wiring information and circuit identification information can be recorded on the outside surface. The outside left edge of the insert is color-coded blue to indicate a low-voltage module. There are no fuses on this module.

This module can be installed in any I/O slot of a 5 or 10-slot baseplate in an Alspa C80–35 PLC system.

Rated Voltage	12/24 volts DC
Output Voltage Range	12 to 24 volts DC (+20%, –15%)
Outputs per Module	8 (one group)
Isolation	1500 volts between field side and logic side
Output Current*	0.5 amps maximum per point 2 amps maximum per common
Output Characteristics	
Output Voltage Drop	0.5 volts maximum
Off-state Leakage	1 mA maximum
On Response Time	2 ms maximum
Off Response Time	2 ms maximum
Int. Power Consumption	50 mA (all outputs on) from 5 volt bus on backplane

* Number of inputs on is dependent upon ambient temperature as shown in Figure 2.39.
Refer to data sheet ALS 53002 for product standards and general specifications.

Table 2.24 – Specifications for IC693MDL733

FIELD WIRING INFORMATION

The following figure provides wiring information for connecting user supplied load devices and power source to the 8 point 12/24 volt DC negative logic 0.5 amp output module.

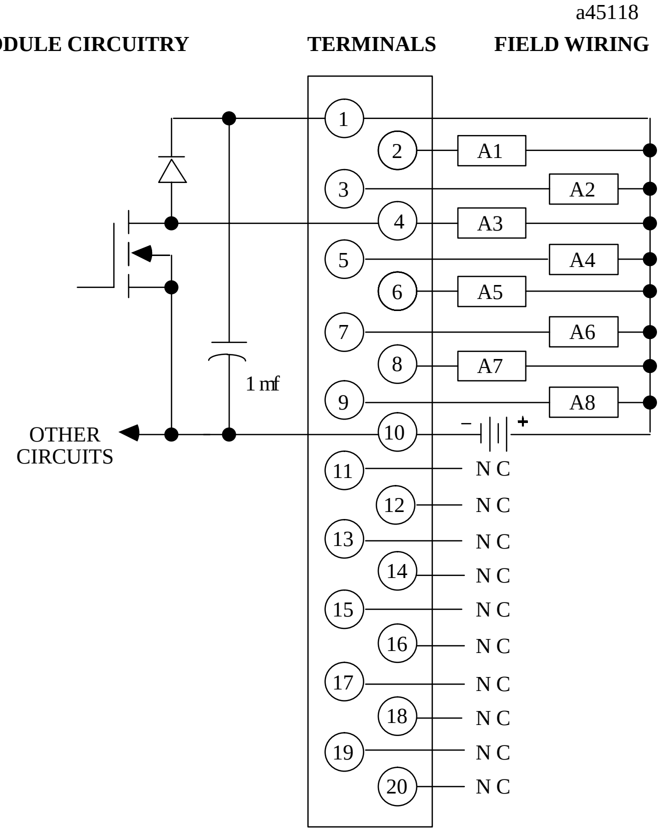


Figure 2.38 – Field Wiring - 12/24 Volt DC Negative Logic - 0.5 Amp Output Module - IC693MDL733

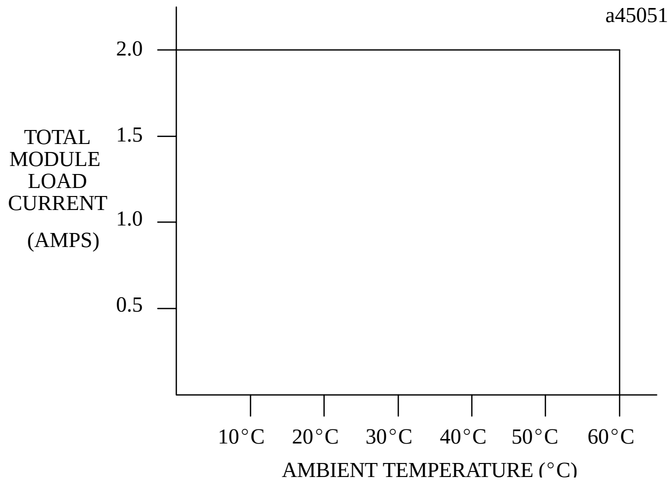


Figure 2.39 – Load Current vs. Temperature for IC693MDL733

3.22. 125 Volt DC Positive/Negative Logic 1 Amp Output - 6 Point IC693MDL734

The ***125 volt DC Positive/Negative Logic 1 Amp Output*** module for the Alspa C80–35 Programmable Logic Controller provides 6 isolated output points . Each output has a separate common output terminal associated with it. This output module is designed to have either *positive logic* characteristics in that it sources current to the loads from the user common or positive power bus; or *negative logic* characteristics in that it sinks current from the loads to the user common or negative power bus. The output characteristics are compatible with a wide range of user-supplied load devices, such as: motor starters, solenoids and indicators. Power to operate the field devices must be supplied by the user.

LED indicators which provide the ON/OFF status of each point are located at the top of the module. This LED block has two horizontal rows with eight green LEDs in each row. This module uses the first six LEDs in the top row, labeled A1 to 6 (points 1 to 6) for output status. An insert goes between the inside and outside surface of the hinged door. The surface towards the inside of the module (when the hinged door is closed) has circuit wiring information and circuit identification information can be recorded on the outside surface. The outside left edge of the insert is color-coded red to indicate a high-voltage module. External fusing is recommended. Two amp loads can be driven by wiring and driving two outputs in parallel.

This module can be installed in any I/O slot of a 5 or 10-slot baseplate in an Alspa C80–35 PLC system.

Rated Voltage	125 volts DC
Output Voltage Range	+10.8 to +150 volts DC
Outputs per Module	6 (isolated)
Isolation	1500 volts between field side and logic side 500 volts between outputs
Output Current	1 amp maximum per point
Output Characteristics	
Inrush Current	15.89 amps for 10 ms
Output Voltage Drop	1 volt maximum
Off-state Leakage	1 mA maximum
On Response Time	7 ms maximum
Off Response Time	5 ms maximum
Power Consumption	90 mA (all outputs on) from 5 volt bus on backplane

Refer to data sheet ALS 53002 for product standards and general specifications.

Table 2.25 – Specifications for IC693MDL734

FIELD WIRING INFORMATION

The following figure provides wiring information for connecting user supplied load devices and power source to the 125 volt DC positive/negative logic 1 amp output module.

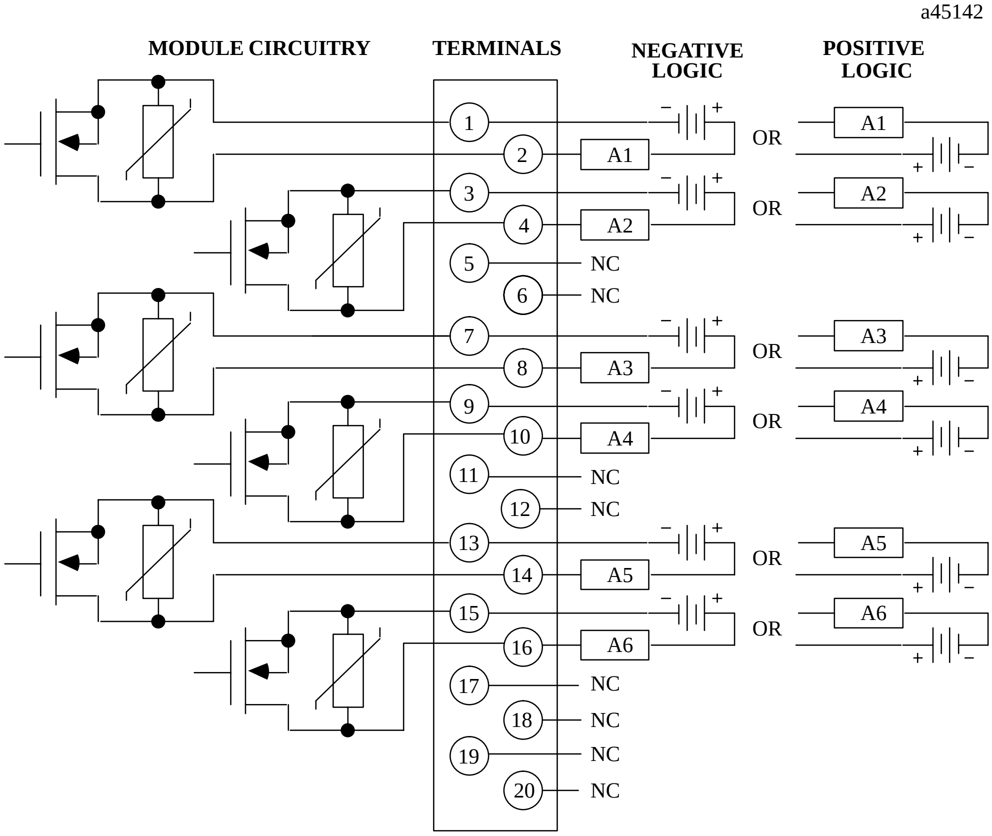


Figure 2.40 – Field Wiring - 125 Volt DC Positive/Negative Logic - 1 Amp Output Module - IC697MDL734

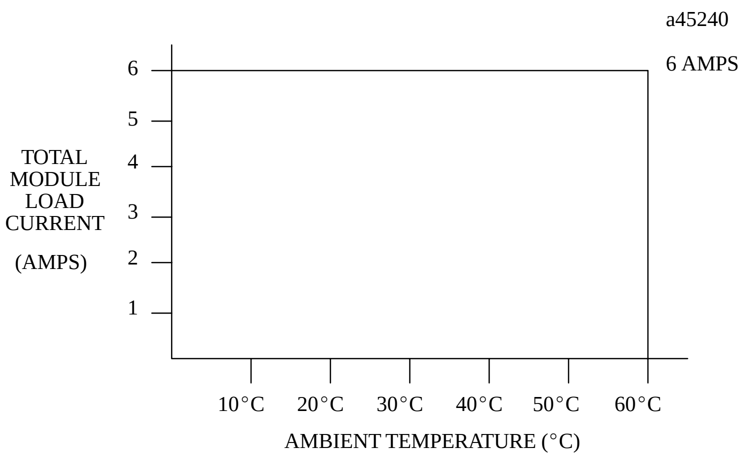


Figure 2.41 – Load Current vs. Temperature for IC693MDL734

3.23. 12/24 Volt DC Positive Logic Output - 0.5 Amp, 16 Point IC693MDL740

The ***12/24 volt DC Positive Logic 0.5 Amp Output*** module for the Alspa C80–35 Programmable Logic Controller provides 16 output points in two groups of eight with a common power output terminal for each group. This output module is designed to have positive logic characteristics in that it sources current to the loads from the user common or positive power bus. The output device is connected between the negative power bus and the module output. The output characteristics are compatible with a wide range of user-supplied load devices, such as: motor starters, solenoids and indicators. Power to operate the field devices must be supplied by the user.

LED indicators which provide the ON/OFF status of each point are located at the top of the module. This LED block has two horizontal rows with eight green LEDs in each row with the top row labeled A1 to 8 (points 1 to 8) and the bottom row labeled B1 to 8 (points 9 to 16). An insert goes between the inside and outside surface of the hinged door. The surface towards the inside of the module (when the hinged door is closed) has circuit wiring information and circuit identification information can be recorded on the outside surface. The outside left edge of the insert is color-coded blue to indicate a low-voltage module. There are no fuses on this module.

This module can be installed in any I/O slot of a 5 or 10-slot baseplate in an Alspa C80–35 PLC system.

Rated Voltage	12/24 volts DC
Output Voltage Range	12 to 24 volts DC (+20%, –15%)
Outputs per Module	16 (two groups of eight outputs each)
Isolation	1500 volts between field side and logic side 500 volts between groups
Output Current	0.5 amps maximum per point 2 amps maximum per common
Output Characteristics	
Inrush Current	4.78 amps for 10 ms
Output Voltage Drop	1 volt maximum
Off-state Leakage	1 mA maximum
On Response Time	2 ms maximum
Off Response Time	2 ms maximum
Power Consumption	110 mA (all outputs on) from 5 volt bus on backplane

Refer to data sheet ALS 53002 for product standards and general specifications.

Table 2.26 – Specifications for IC693MDL740

FIELD WIRING INFORMATION

The following figure provides wiring information for connecting user supplied load devices and power source to the 12/24 volt DC positive logic - 0.5 amp output module.

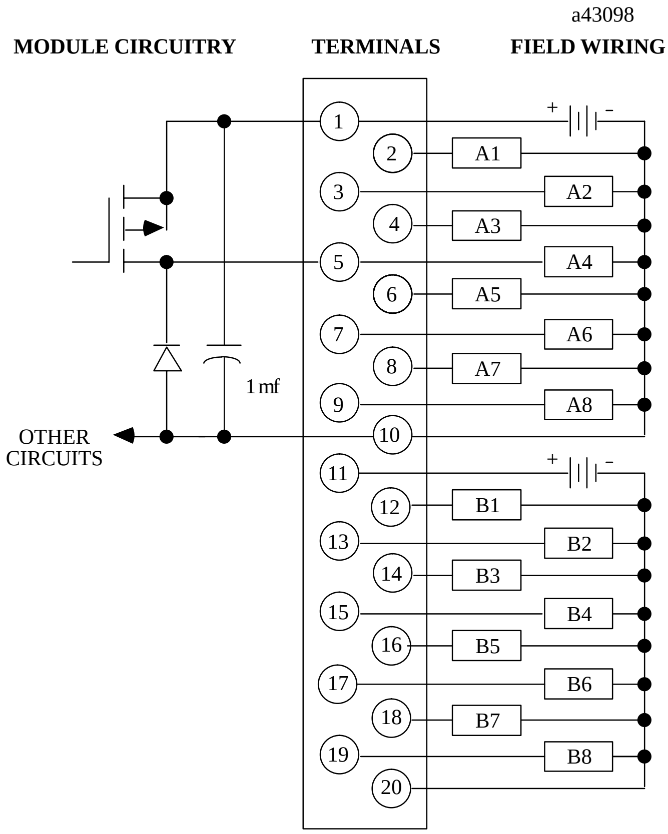


Figure 2.42 – Field Wiring - 12/24 Volt DC Positive Logic - 0.5 Amp, Output Module - IC693MDL740

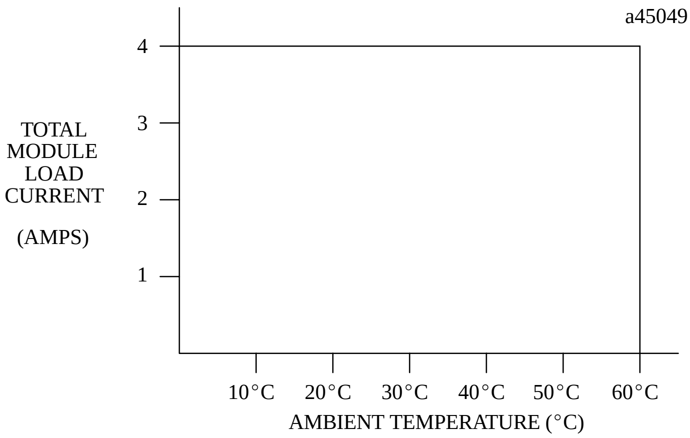


Figure 2.43 – Load Current vs. Temperature for IC693MDL740

3.24. 12/24 Volt DC Negative Logic 0.5 Amp Output - 16 Point IC693MDL741

The ***12/24 volt DC Negative Logic 0.5 Amp Output*** module for the Alspa C80–35 Programmable Logic Controller provides 16 output points in two groups. Each group has a common power output terminal. This output module is designed to have negative logic characteristics in that it sinks current from the loads to the user common or negative power bus. The output device is connected between the positive power bus and the module output. The output characteristics are compatible with a wide range of user-supplied load devices, such as: motor starters, solenoids and indicators. Power to operate the field devices must be supplied by the user.

LED indicators which provide the ON/OFF status of each point are located at the top of the module. This LED block has two horizontal rows with eight green LEDs in each row; the top row labeled A1 to 8 (points 1 to 8)and the bottom row labeled B1 to 8 (points 9 to 16). An insert goes between the inside and outside surface of the hinged door. The surface towards the inside of the module (when the hinged door is closed) has circuit wiring information and circuit identification information can be recorded on the outside surface. The outside left edge of the insert is color-coded blue to indicate a low-voltage module. There are no fuses on this module.

This module can be installed in any I/O slot of a 5 or 10-slot baseplate in an Alspa C80–35 PLC system.

Rated Voltage	12/24 volts DC
Output Voltage Range	12 to 24 volts DC (+20%, –15%)
Outputs per Module	16 (two groups of eight outputs each)
Isolation	1500 volts between field side and logic side 500 volts between groups
Output Current	0.5 amps maximum per point 2 amps maximum per common
Output Characteristics	
Output Voltage Drop	0.5 volts maximum
Off-state Leakage	1 mA maximum
On Response Time	2 ms maximum
Off Response Time	2 ms maximum
Power Consumption	110 mA (all outputs on) from 5 volt bus on backplane

Refer to data sheet ALS 53002 for product standards and general specifications.

Table 2.27 – Specifications for IC693MDL741

FIELD WIRING INFORMATION

The following figure provides wiring information for connecting user supplied load devices and power source to the 12/24 volt DC negative logic 0.5 amp output module.

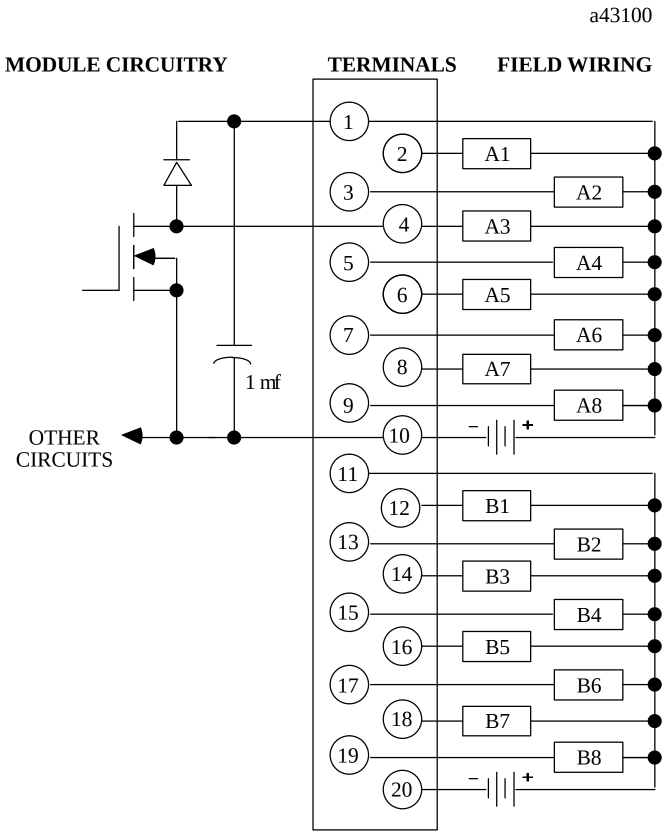


Figure 2.44 – Field Wiring - 12/24 Volt DC Negative Logic - 0.5 Amp Output Module - IC693MDL741

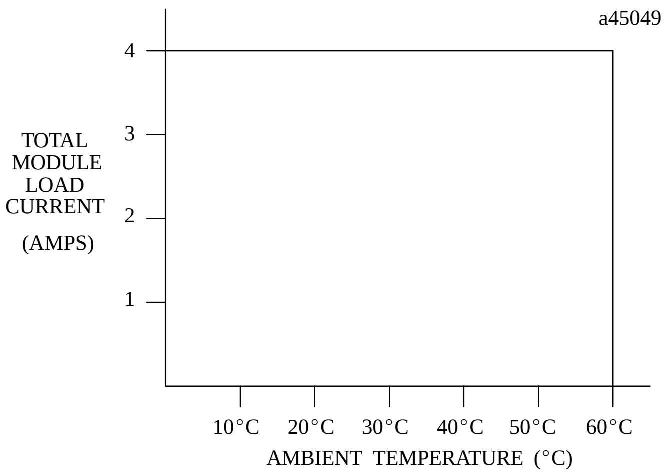


Figure 2.45 – Load Current vs. Temperature for IC693MDL741

3.25. 12/24 Volt DC Positive Logic ESCP Output - 1 Amp, 16 Point IC693MDL742

The ***12/24 volt DC Positive Logic 1 Amp Electronic Short Circuit Protection (ESCP) Output*** module for the Alspa C80–35 PLC provides 16 output points in two groups of eight with a common power output terminal for each group. This output module is designed to have positive logic characteristics in that it sources current to the loads from the user common or positive power bus. The output device is connected between the negative power bus and the module output. The output characteristics are compatible with a wide range of user-supplied load devices, such as: motor starters, solenoids and indicators. Power to operate the field devices must be supplied by the user.

LED indicators that provide the ON/OFF status of each point are located at the top of the module. This LED block has two horizontal rows with eight green LEDs in each row with the top row labeled A1 - A8 (points 1 to 8) and the bottom row labeled B1 - B8 (points 9 to 16). A red LED on the right centered between the two rows of green LEDs functions as a tripped electronic short circuit protection indicator; it turns ON when any short circuit protection trip occurs. The common signal for each group is monitored electronically. If a short circuit occurs, the output points in the group turn off and the red LED turns on. The LEDs indicating output point status will not turn off. This protection does not protect individual outputs from exceeding their ratings, but will protect the board in case of a short circuited load. To reset electronic short circuit protection remove the 12/24 VDC user supply to the module. The module has two electronic short circuit protection circuits; each protects eight outputs - the first circuit protects A1 - A8, the second circuit protects B1 - B8.

An insert goes between the inside and outside surface of the hinged door. The surface towards the inside of the module (when the hinged door is closed) has circuit wiring information and circuit identification information can be recorded on the outside surface. The outside left edge of the insert is color-coded blue to indicate a low-voltage module. There are no fuses on this module. This module can be installed in any I/O slot of a 5 or 10-slot baseplate in an Alspa C80–35 PLC system.

Rated Voltage	12/24 volts DC
Output Voltage Range	12 to 24 volts DC (+20%, –15%)
Outputs per Module	16 (two groups of eight outputs each)
Isolation	1500 volts between field side and logic side
	500 volts between groups
Output Current*	1 amp maximum per point 4 amps maximum per group at 50°C 3 amps maximum per group at 60°C
Output Characteristics	
Inrush Current	5.2 amps for 10 ms
Output Voltage Drop	1.2 volts maximum
Off-state Leakage	1 mA maximum
On Response Time	2 ms maximum
Off Response Time	2 ms maximum
Power Consumption	130 mA (all outputs on) from 5 volt bus on backplane

* Number of inputs on is dependent upon ambient temperature as shown in Figure 2.47.
Refer to data sheet ALS 53002 for product standards and general specifications.

Table 2.28 – Specifications for IC693MDL742

FIELD WIRING INFORMATION

The following figure provides wiring information for connecting user supplied load devices and power source to the 12/24 volt DC positive logic ESCP - 1 amp output module.

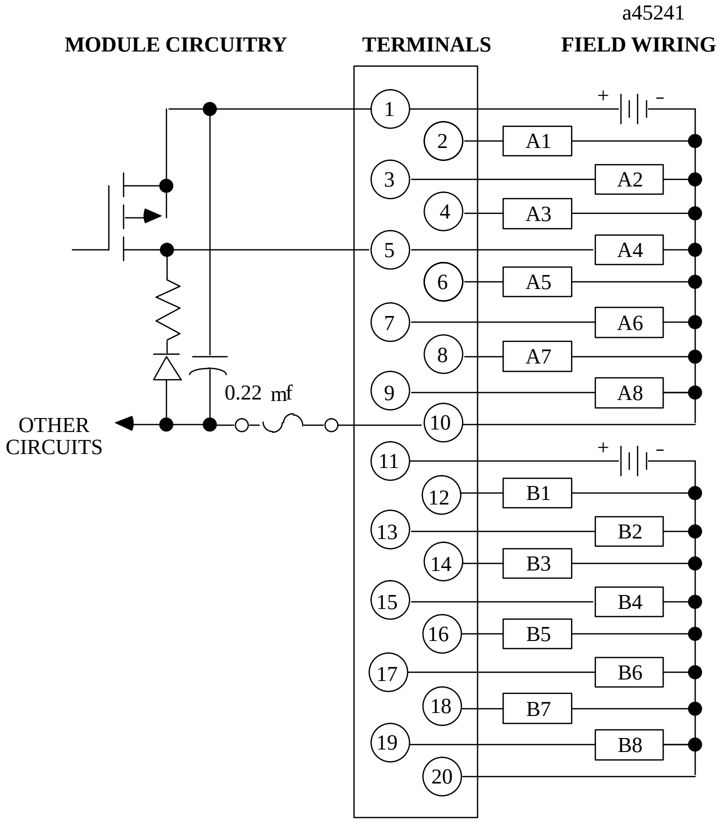


Figure 2.46 – Field Wiring - 12/24 Volt DC Positive Logic ESCP - 1 Amp, Output Module - IC693MDL742

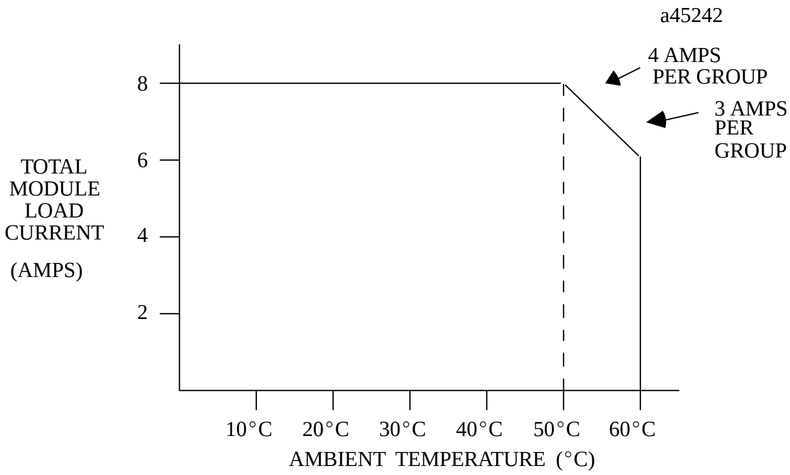


Figure 2.47 – Load Current vs. Temperature for IC693MDL742

3.26. Isolated Relay Output, N.O., 4 Amp - 8 Point IC693MDL930

The ***4 Amp Isolated Relay Output*** module for the Alspa C80–35 Programmable Logic Controller provides 8 normally-open relay circuits for controlling output loads provided by the user. The output switching capacity of each circuit is 4 amps. Each output point is isolated from the other points and each point has a separate common power output terminal. The relay outputs can control a wide range of user-supplied load devices, such as: motor starters, solenoids and indicators. The user must supply the AC or DC power to operate the field devices connected to this module. There are no fuses on this module.

LED indicators which provide the ON/OFF status of each point are located at the top of the module. The LEDs are arranged in two horizontal rows with eight green LEDs in each row. This module uses the top row labeled A1 to 8 (points 1 to 8); the bottom row is not used. An insert goes between the inside and outside surface of the hinged door. The surface towards the inside of the module (when the hinged door is closed) has circuit wiring information and circuit identification information can be recorded on the outside surface. The outside left edge of the insert is color-coded red to indicate a high-voltage module. This module can be installed in any I/O slot of a 5 or 10-slot baseplate in an Alspa C80–35 PLC system.

Rated Voltage	24 volts DC, 120/240 volts AC
Operating Voltage	5 to 30 volts DC
	5 to 250 volts AC, 50/60 Hz
Outputs per Module	8 isolated outputs
Isolation	1500 volts between field side and logic side
	500 volts between groups
Maximum Load*	4 amps resistive maximum per output
	2 amps pilot duty per output
	20 amps maximum per module for UL installations
Minimum Load	10 mA
Maximum Inrush	5 amps
On Response Time	15 ms maximum
Off Response Time	15 ms maximum
Int. Power Consumption	6 mA (all outputs on) from 5 volt bus on backplane
	70 mA (all outputs on) from relay 24V bus on backplane

* Number of inputs on is dependent upon ambient temperature as shown in Figure 2.49.
Refer to data sheet ALS 53002 for product standards and general specifications.

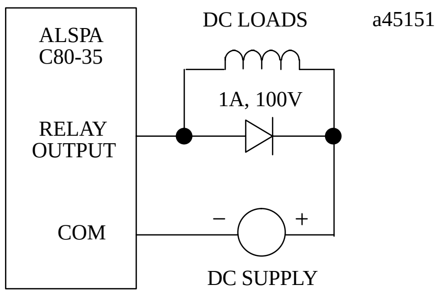
Table 2.29 – Specifications for IC693MDL930

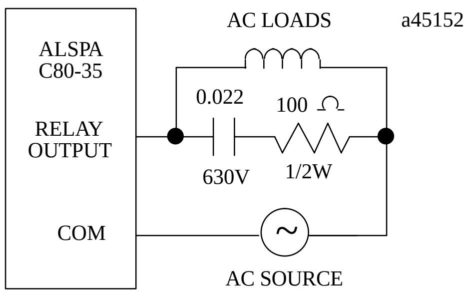
Operating Voltage	Maximum Current for Load Type		Typical Contact Life (number of Operations)
	Resistive	Lamp or Solenoid*	
24 to 120 VAC	4 amps	2 amps	150 000
24 to 120 VAC	1 amp	0.5 amp	500 000
24 to 120 VAC	0.1 amp	0.05 amp	1 000 000
240 VAC	4 amps	2 amps	50 000
240 VAC	0.1 amp	0.05 amp	500 000
240 VAC	1 amp	0.5 amp	200 000
24 VDC	-	3 amps	50 000
24 VDC	4 amps	2 amps	100 000
24 VDC	1 amp	0.5 amp	500 000
24 VDC	0.1 amp	0.05 amp	1 000 000
125 VDC	0.2 amp	0.1 amp	300 000

* Assumes a 7 ms time constant

Table 2.30 – Load Current Limitations for IC693MDL930

Relay contact life, when switching inductive loads, will approach resistive load contact life if suppression circuits are used. The following figures are examples of typical suppression circuits for AC and DC loads. The 1A, 100V diode shown in the DC load typical suppression circuit is an industry standard 1N4934.





FIELD WIRING INFORMATION

The following figure provides wiring information for connecting user supplied load devices and power source to the 4 amp Relay Output module.

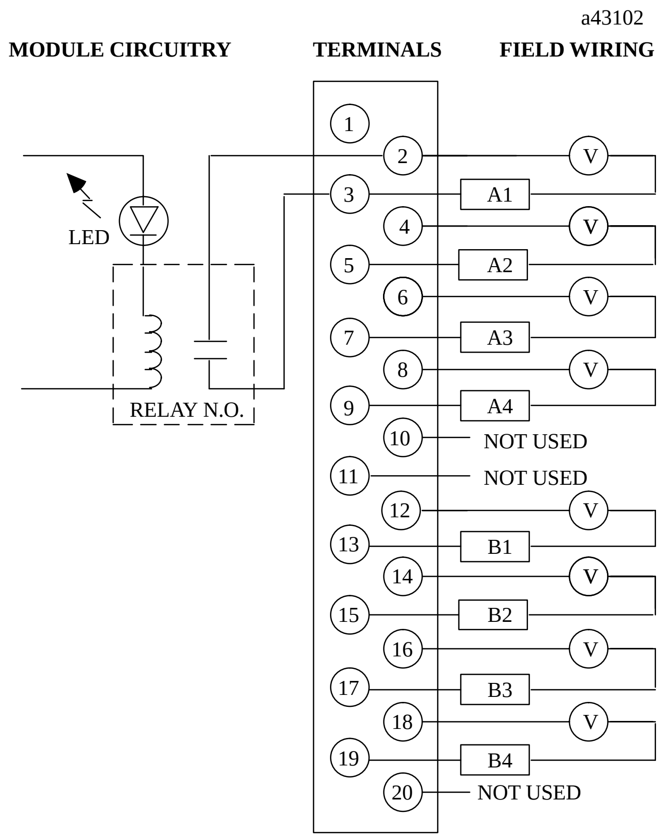


Figure 2.48 – Field Wiring - 4 Amp Isolated Relay Output Module - IC693MDL930

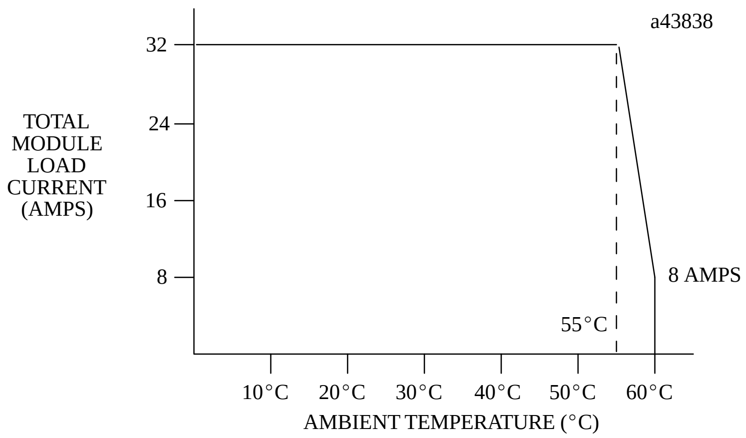


Figure 2.49 – Load Current vs. Temperature for IC693MDL930

3.27. Isolated Relay Output, N.C. and Form C, 8 Amp - 8 Point IC693MDL931

This ***8 Amp* I*solated Relay Output*** module for the Alspa C80–35 Programmable Logic Controller provides 4 normally-closed and 4 Form C relay circuits for controlling output loads provided by the user. The output switching capacity of each circuit is 8 amps for the normally-closed contacts or the normally open contacts. Each output relay is isolated from the other relays and each relay has a separate common power output terminal. The relay outputs can control a wide range of user-supplied load devices, such as: motor starters, solenoids and indicators. The user must supply the AC or DC power to operate the field devices connected to this module. There are no fuses on this module.

LED indicators which provide the ON/OFF status of each point are located at the top of the module. The LEDs are arranged in two horizontal rows with eight green LEDs in each row. This module uses the top row labeled A1 to 8 (points 1 to 8) for output status; the bottom row is not used and the fuse LED is not used. An insert goes between the inside and outside surface of the hinged door. The surface towards the inside of the module (when the hinged door is closed) has circuit wiring information and circuit identification information can be recorded on the outside surface. The outside left edge of the insert is color-coded red to indicate a high-voltage module. This module can be installed in any I/O slot of a 5 or 10-slot baseplate in an Alspa C80–35 PLC system.

Rated Voltage	24 volts DC, 120/240 volts AC, 50/60 Hz
Output Voltage Range	5 to 30 volts DC
	5 to 250 volts AC, 50/60 Hz
Outputs per Module	8 isolated outputs
Isolation	1500 volts between field side and logic side
	500 volts between groups
Maximum Load*	8 amps resistive maximum per output
	20 amps maximum per module for UL installations
Minimum Load	10 mA
Inrush Current	8 amps maximum for one cycle
On Response Time	15 ms maximum
Off Response Time	15 ms maximum
Internal Power Consumption	45 mA (all outputs on) from 5 volt bus on backplane
	100 mA (all outputs on) from relay 24V bus on backplane

* Number of inputs on is dependent upon ambient temperature as shown in Figure 2.51.
Refer to data sheet ALS 53002 for product standards and general specifications.

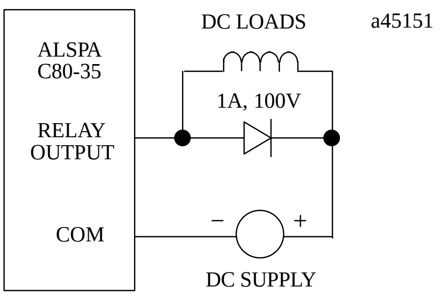
Table 2.31 – Specifications for IC693MDL931

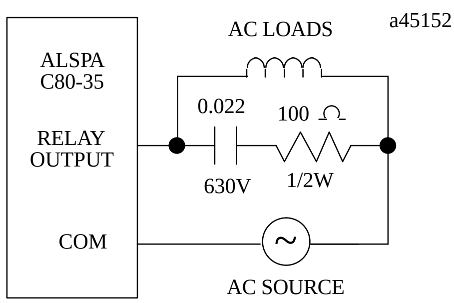
Operating Voltage	**Maximum Current for Load Type**		**Typical Contact Life (number of operations)**
	Resistive	**Lamp or Solenoid***	
5 to 120 VAC	8 amps	3 amps	200 000
	6 amps	2.5 amps	300 000
	4 amps	1.5 amps	400 000
	1 amp	0.5 amp	1 100 000
240 VAC	8 amps	3 amps	100 000
	6 amps	2.5 amps	150 000
	4 amps	1.5 amps	200 000
	1 amp	0.5 amp	800 000
24 VDC	8 amps	3 amps	100 000
	6 amps	2.5 amps	150 000
	4 amps	1.5 amps	200 000
	1 amp	0.5 amp	800 000
48 VDC	1.5 amps	-	100 000
100 VDC	0.5 amp	-	100 000
125 VDC	0.38 amp	0.12 amp	100 000
150 VDC	0.30 amp	0.10 amp	100 000

* For inductive loads

Table 2.32 – Load Current limitations for IC693MDL931

Relay contact life, when switching inductive loads, will approach resistive load contact life if suppression circuits are used. The following figures are examples of typical suppression circuits for AC and DC loads. The 1A, 100V diode shown in the DC load typical suppression circuit is an industry standard 1N4934.





FIELD WIRING INFORMATION

The following figure provides wiring information for connecting user supplied load devices and power source to the 8 amp Isolated Relay Output module.

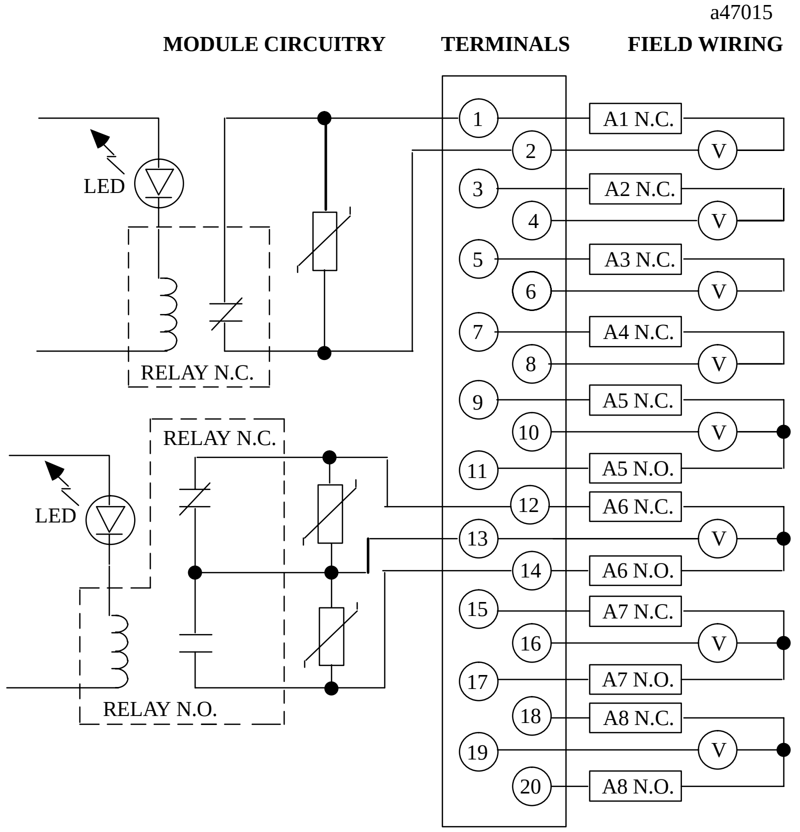


Figure 2.50 – Field Wiring - Isolated Relay Output, N.C. and Form C, 8 Amp Module - IC693MDL931

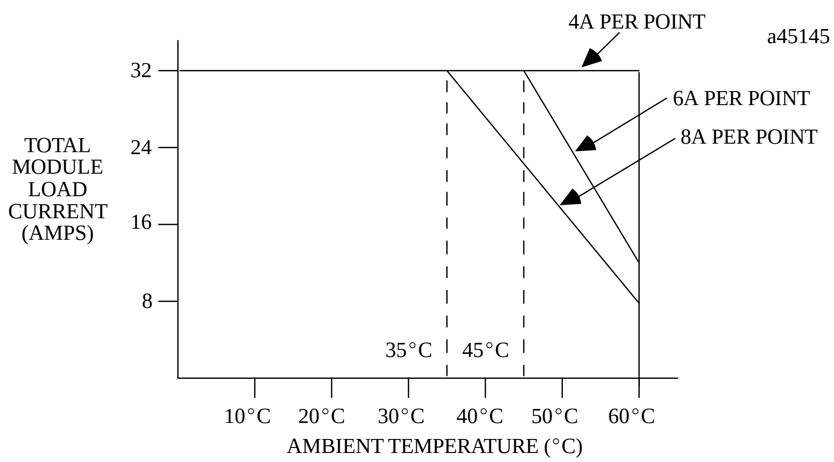


Figure 2.51 – Load Current vs. Temperature for IC693MDL931

3.28. Safety Isolated Relay Output, N.O. 6 Amp – 8 Point CF693MDL150

The **Safety Isolated Relay Output** module for the Alspa C80–35 PLC provides 8 normally–open relay circuits for controlling output loads by the user. The output switching capacity of each circuit depends on the input voltage used. Each output relay is isolated from the other relays and each relay has a separate common power output terminal. The relay outputs can control a wide range of user–supplied load devices, such as: motor starters, solenoids and indicators. The user must supply the AC or DC power to operate the field devices connected to this module. There is no fuse on this module.

LED indicators which provide the ON/OFF status of each point are located at the top of the module. The LEDs are arranged in two horizontal rows with eight green LEDs in each row and one red LED. This module uses the top row labeled A1 to A8 (points 1 to 8) for output status; the bottom row is used to give information about the board status (labeled B1 to B3: Relay 24V bus OK, Safety input, Relay 24V common on board OK) and provides some additional LEDs labeled B4 to B8 available for customer purposes. The red LED labeled F indicate a failure (over coil current) in safety mode.

An insert goes between the inside and outside surface of the hinged door. The surface towards the inside of the module (when the hinged door is closed) has circuit wiring information and circuit identification information can be recorded on the outside surface. The outside left edge of the insert is color–coded red to indicate a high–voltage module. This module can be installed in any I/O slot of a 5 or 10–slot baseplate in an Alspa C80–35 PLC system.

Rated Voltage Output	24 or 48 or 110 volts DC
	250 volts AC, 50/60 Hz
Output Voltage range	0 to 132 volts DC
	5 to 250 volts AC, 50/60 Hz
Outputs per Module	8 isolated outputs
Maximum Load	6 amps resistive per output for 250 volts AC
	6 amps resistive per output for 24 volts DC
	1 amp resistive per output for 48 volts DC
	0.5 amp resistive per output for 110 volts DC
On Response Time	10 msec maximum
Off Response Time	10 msec maximum
Input Voltage Range *	19.2 to 132 volts DC
Input per Module *	1 isolated input
Input Current *	10 mA maximum
Isolation	2500 volts AC between field and logic side
	1000 volts AC between outputs and outputs/input
Internal Power Consumption	40 mA (all outputs ON) from the 5 volt bus on backplane
	80 mA (all outputs ON) from relay 24V bus on backplane
	25 mA (one output ON) from relay 24V bus on backplane
Operating Temperature	0 to 60°C (32 to 140°F)
Storage Temperature	–40 to +85°C (–40 to +185°F)
Humidity	5 to 95% non–condensing

* for the single safety input

Table 2.33 – Specifications for CF693MDL150

The Safety Relay Output module may be used in 2 modes: Safety mode and Normal mode.

In **Normal mode**, the jumper S3 is removed and the total coil current detection is inoperative. Several relay outputs can be activated together. The module is used as a standard relay output module. The safety input needs to be supplied with a DC voltage. Current into safety input results in a logic 1 in the input table %I+8 and is required to enable any relay output switch ON.

In **Safety mode**, only one single relay output may be active. The jumpers S2 and S3 are necessarily set and if more than one coil is supplied, an over current is detected and all outputs are reset. The safety input needs to be supplied with a DC voltage. Current into safety input results in a logic 1 in the input table %I+8 and is required to enable any relay output switch ON.

References used

The number of modules which can be installed in a system depends on the amount of %I and %Q available. Each module uses 16 %I references and 16 %Q references.

When planning the module configuration for your application you must also consider the load capacity of the installed power supply and the total load requirements of all modules that are installed in the baseplate.

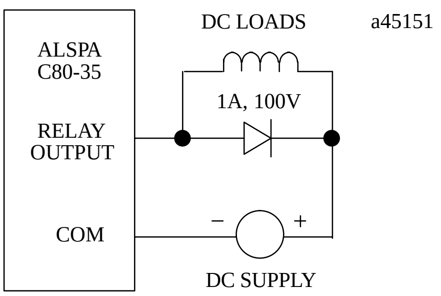
% Locations	Description	
%Q to %Q+7	Output state relays output	
%Q+8	Output state LED B4	
%Q+9	Output state LED B5	
%Q+10	Reset over current coil memorisation	(Safety mode)
%Q+11	Enable Relay 24V common on board	(Safety mode)
%Q+12	Output state over current coil test	(Safety mode)
%Q+13	Output state LED B6	
%Q+14	Reserved	
%Q+15	Reserved	
%I to %I+7	State relays output status	1= Relay ON
%I+8	Safety isolated input state	1= input ON 0= input OFF
%I+9	Relay 24V common on board status	1= Voltage OK
%I+10	Over current status	1= Over current failure
%I+11	Enable Relay 24V status	1= Enable
%I+12	Over current coil test status	1= Enable test
%I+13	Relay 24V bus status (on backplane)	1= Voltage OK
%I+14	Reserved	
%I+15	Reserved	

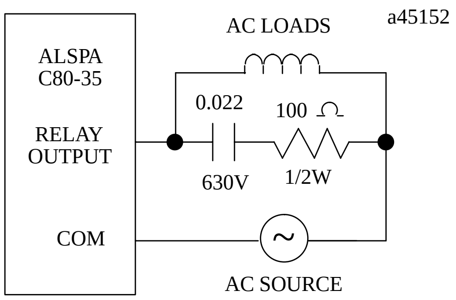
Table 2.34 – Output/Input table for CF693MDL150

Operating Voltage	Maximum Current for Load Type		Typical Contact Life (number of Operations)
	Resistive	Lamp or Solenoid*	
24 VDC	6 amps	1.5 amp	500.000
	2 amps	0.5 amp	5.000.000
48 VDC	1 amp	0.35 amp	5.000.000
110 VDC	0.5 amp	0.1 amp	5.000.000
250 VAC	6 amps	–	100.000
	2 amps	–	400.000

Table 2.35 – Load Current Limitations for CF693MDL150

Relay contact life, when switching inductive loads, will approach resistive load contact life if suppression circuits are used. The following figures are examples of typical suppression circuits for AC and DC loads. The 1A, 100V diode shown in the DC load typical suppression circuit is an industry standard 1N4934.





FIELD WIRING INFORMATION

The following figure provides wiring information for connecting user supplied load devices and power source to the safety Isolated Relay Output module.

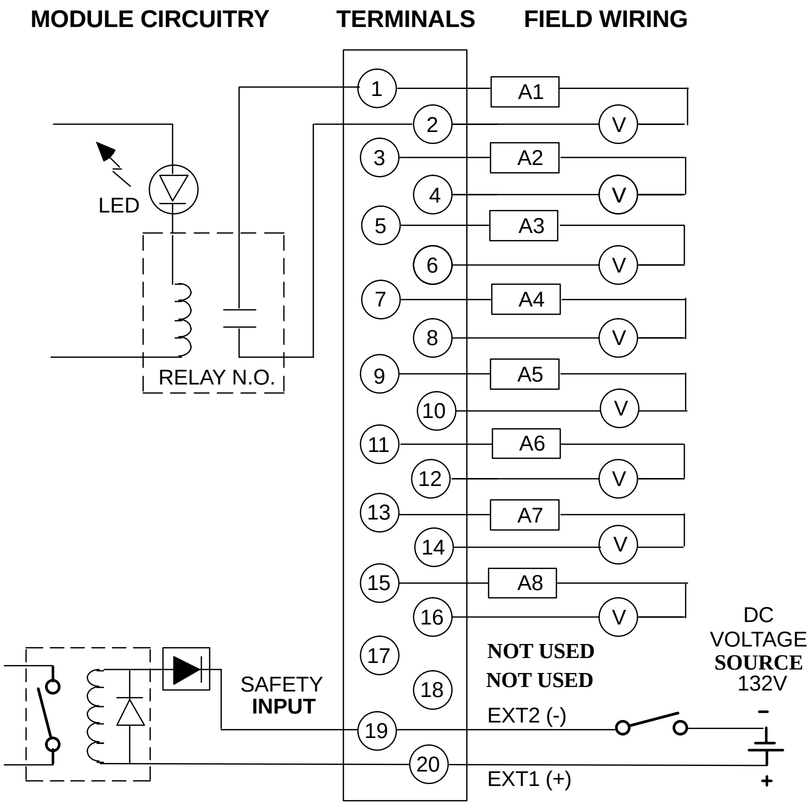


Figure 2.52 – Field Wiring - Safety Isolated Relay Output Module - CF693MDL150

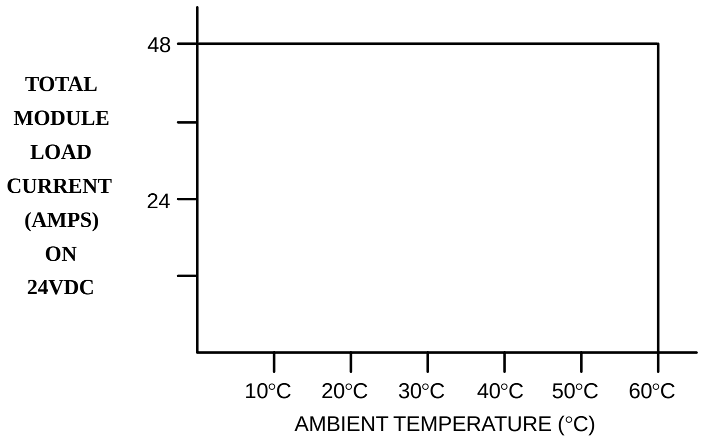


Figure 2.53 – Load Current vs. Temperature for CF693MDL150

3.29. Relay Output, N.O., 2 Amp - 16 Point IC693MDL940

The ***2 Amp Relay Output*** module for the Alspa C80–35 Programmable Logic Controller provides 16 normally-open relay circuits for controlling output loads provided by the user. The output switching capacity of each output is 2 amps. The output points are arranged in four groups of four points each. Each group has a common power output terminal. The relay outputs can control a wide range of user-supplied load devices, such as: motor starters, solenoids and indicators. Power for the internal relay circuits is provided by the +24 volt DC bus on the backplane. The user must supply the AC or DC power to operate field devices. There are no fuses on this module.

LED indicators which provide the ON/OFF status of each point are located at the top of the module. The LEDs are arranged in two horizontal rows with eight green LEDs in each row; the top row labeled A1 to 8 (points 1 to 8) and the bottom row labeled B1 to 8 (points 9 to 16). An insert goes between the inside and outside surface of the hinged door. The surface towards the inside of the module (when the hinged door is closed) has circuit wiring information and circuit identification information can be recorded on the outside surface. The outside left edge of the insert is color-coded red to indicate a high-voltage module. This module can be installed in any I/O slot of a 5 or 10-slot baseplate in an Alspa C80–35 PLC system.

Rated Voltage	24 volts DC, 120/240 volts AC
Operating Voltage	5 to 30 volts DC
	5 to 250 volts AC, 50/60 Hz
Outputs per Module	16 (four groups of four outputs each)
Isolation	1500 volts between field side and logic side
	500 volts between groups
Maximum Load	2 amps pilot duty maximum per output
	4 amps maximum per common
Minimum Load	10 mA
Maximum Inrush	5 amps
On Response Time	15 ms maximum
Off Response Time	15 ms maximum
Int. Power Consumption	7 mA (all outputs on) from 5 volt bus on backplane
	135 mA (all outputs on) from relay 24V bus on backplane

Refer to data sheet ALS 53002 for product standards and general specifications.

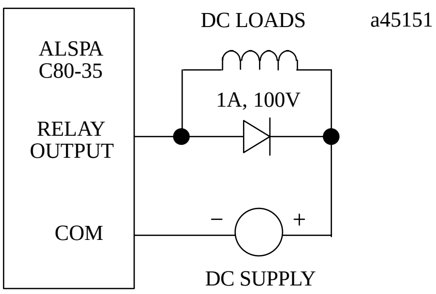
Table 2.36 – Specifications for IC693MDL940

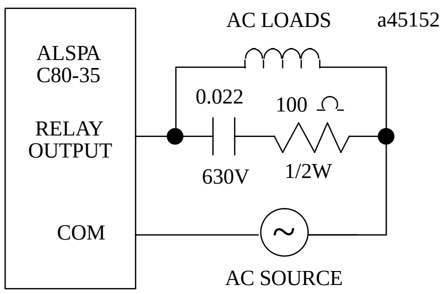
Operating Voltage	Maximum Current for Load Type		Typical Contact Life (Number of Operations)
	Resistive	Lamp or Solenoid*	
24 to 120 VAC	2 amps	1 amp	300 000
24 to 120 VAC	1 amp	0.5 amp	500 000
24 to 120 VAC	0.1 amp	0.05 amp	1 000 000
240 VAC	2 amps	1 amp	150 000
240 VAC	1 amp	0.5 amp	200 000
240 VAC	0.1 amp	0.05 amp	500 000
24 VDC	-	2 amps	100 000
24 VDC	2 amps	1 amp	300 000
24 VDC	1 amp	0.5 amp	500 000
24 VDC	0.1 amp	0.05 amp	1 000 000
125 VDC	0.2 amp	0.1 amp	300 000

* Assumes a 7 ms time constant

Table 2.37 – Load Current Limitations for IC693MDL940

Relay contact life, when switching inductive loads, will approach resistive load contact life if suppression circuits are used. The following figures are examples of typical suppression circuits for AC and DC loads. The 1A, 100V diode shown in the DC load typical suppression circuit is an industry standard 1N4934.





FIELD WIRING INFORMATION

The following figure provides wiring information for connecting user supplied load devices and power source to the 2 amp N.O. Relay output module.

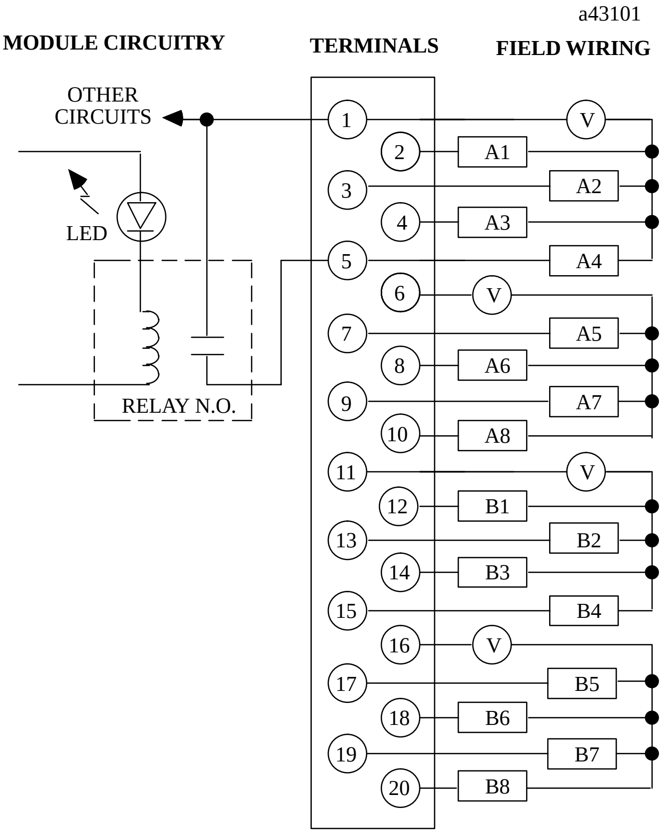


Figure 2.54 – Field Wiring - N.O. Relay Output, 2 Amp Output Module - IC693MDL940

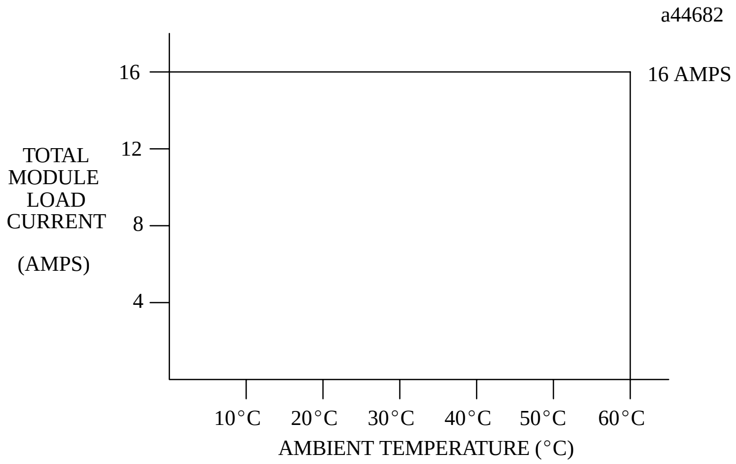


Figure 2.55 – Load Current vs. Temperature for IC693MDL940

3.30. 120 Volt AC Input, Relay Output, 8 Inputs/8 Outputs IC693MAR590

The ***120 volt AC Input/Relay Output*** module for the Alspa C80–35 Programmable Logic Controller provides 8 input points with one common power input terminal and 8 normally-open relay circuits in the same module. The input circuits are reactive (resistor/capacitor) inputs and are arranged as one group of 8 inputs. The output points are arranged in two groups of four points each. Each group has a common power output terminal.

Input characteristics are compatible with a wide range of user-supplied devices, such as: pushbuttons, limit switches and electronic proximity switches. Current to an input results in a logic 1 in the input status table (%I). Power to operate the field devices must be supplied by the user. This module’s input section requires an AC power source, it cannot be used with a DC power source.

The normally-open relay circuits are used for controlling output loads provided by the user. The output switching capacity of each output is 2 amps. The relay outputs can control a wide range of user-supplied load devices, such as: motor starters, solenoids and indicators. Power for the internal relay circuits is provided by the +24 volt DC bus on the backplane. The user must supply the AC or DC power to operate field devices. There are no fuses on this module.

LED indicators which provide the ON/OFF status of each point are located at the top of the module. The LEDs are arranged in two horizontal rows with eight green LEDs in each row. The top row is labeled A1 to 8 (input points 1 to 8) and the bottom row is is labeled B1 to B8 (relay output points 1 to 8). An insert goes between the inside and outside surface of the hinged door. The surface towards the inside of the module (when the hinged door is closed) has circuit wiring information and circuit identification information can be recorded on the outside surface. The outside left edge of the insert is color-coded red to indicate a high-voltage module.

This module can be installed in any I/O slot of a 5 or 10-slot baseplate in an Alspa C80–35 PLC system.

Inputs	
Rated Voltage	120 volts AC
Input Voltage range	0 to 132 volts AC
Inputs per Module	8 (one group of eight inputs)
Isolation	1500 volts RMS between field and logic side 500 volts RMS between inputs
Input Current	12 mA (typical) at rated voltage
Input Characteristics	
Guaranteed On-State Voltage	74 to 132 volts AC
Guaranteed Off-State Voltage	0 to 20 volts AC
Guaranteed On-State Current	6 mA (minimum)
Guaranteed Off-State Current	2.2 mA (maximum)
On Response Time	30 ms typical
Off Response Time	45 ms typical
Outputs	
Rated Voltage	24 VDC, 120/240 VAC
Operating Voltage	5 to 30 volts DC 5 to 250 volts AC, 50/60 Hz
Outputs per Module	8 (two groups of four outputs each)
Isolation	1500 volts RMS between field and logic side 500 volts RMS between groups
Maximum Load*	2 amps maximum per output 4 amps maximum per common
Minimum Load	10 mA
Maximum Inrush	5 amps
On Response Time	15 ms maximum
Off Response Time	15 ms maximum
Internal Power Consumption	80 mA (all I/O on) from +5V backplane bus 70 mA (all outputs on) from relay +24V backplane bus

* Maximum load current is dependent on operating voltage as shown in Table 2.39.
Refer to data sheet ALS 53002 for product standards and general specifications.

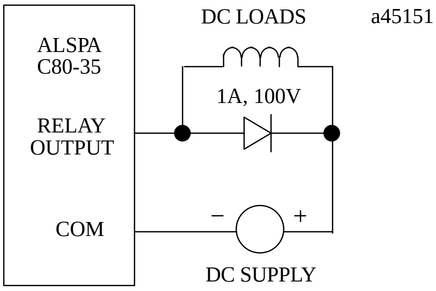
Table 2.38 – Specifications for IC693MAR590

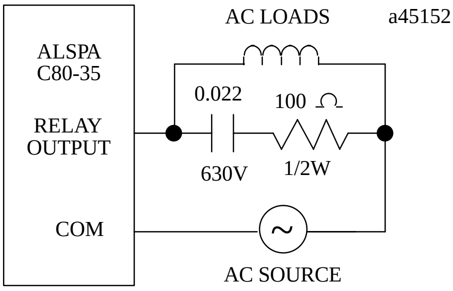
Operating Voltage	Maximum Current for Load Type		Typical Contact Life
	Resistive	Lamp or Solenoid*	(number of Operations)
240 VAC, 120 VAC, 24 VDC	2 amps	0.6 amp	200 000
240 VAC, 120 VAC, 24 VDC	1 amp	0.3 amp	400 000
240 VAC, 120 VAC, 24 VDC	0.5 amp	0.1 amp	800 000

* For inductive loads

Table 2.39 – Load Current Limitations for IC693MAR590

Relay contact life, when switching inductive loads, will approach resistive load contact life if suppression circuits are used. The following figures are examples of typical suppression circuits for AC and DC loads. The 1A, 100V diode shown in the DC load typical suppression circuit is an industry standard 1N4934.





FIELD WIRING INFORMATION

The following figure provides wiring information for connecting user supplied input and load devices, and power source(s) to the 120 Volt Input/Relay Output module.

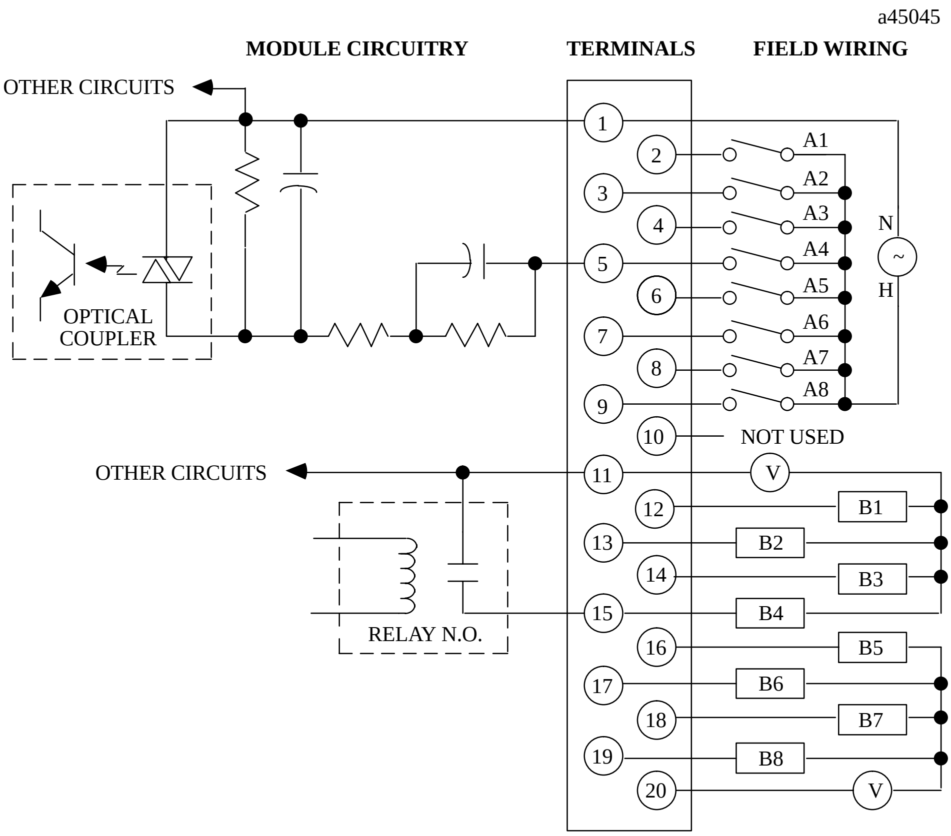


Figure 2.56 – Field Wiring 120 VAC Input/Relay Output Module - IC693MAR590

3.31. 24 Volt DC Input, Relay Output, 8 Inputs/8 Outputs IC693MDR390

The ***24 volt DC Input/Relay Output*** module for the Alspa C80–35 Programmable Logic Controller provides 8 input points with one common power input terminal and 8 normally-open relay circuits in the same module. The input circuits are designed to have either positive or negative characteristics in that they sink or source current to/from the input devices to/from the user common and are arranged as one group of 8 inputs. The relay output circuits are arranged in two groups of four circuits each. Each group has a common power output terminal.

Input characteristics are compatible with a wide range of user-supplied devices, such as: pushbuttons, limit switches and electronic proximity switches. Current to an input results in a logic 1 in the input status table (%I). Power to operate the field devices must be supplied by the user.

The normally-open relay circuits are used for controlling output loads provided by the user. The output switching capacity of each output is 2 amps. The relay outputs can control a wide range of user-supplied load devices, such as: motor starters, solenoids and indicators. Power for the internal relay circuits is provided by the +24 volt DC bus on the backplane. The user must supply the AC or DC power to operate field devices. There are no fuses on this module.

LED indicators which provide the ON/OFF status of each point are located at the top of the module. The LEDs are arranged in two horizontal rows with eight green LEDs in each row. The top row is labeled A1 to 8 (input points 1 to 8) and the bottom row is is labeled B1 to B8 (relay output points 1 to 8). An insert goes between the inside and outside surface of the hinged door. The surface towards the inside of the module (when the hinged door is closed) has circuit wiring information and circuit identification information can be recorded on the outside surface. The top half of the outside left edge of the insert is color-coded blue to indicate low-voltage circuits and the bottom half of the outside left edge is color-coded red to indicate high-voltage circuits.

This module can be installed in any I/O slot of a 5 or 10-slot baseplate in an Alspa C80–35 PLC system.

Inputs	
Rated Voltage	24 volts DC
Input Voltage range	–30 to +32 volts DC
Inputs per Module	8 (one group of eight inputs)
Isolation	1500 volts RMS between field and logic side 500 volts RMS between inputs
Input Current	7.5 mA (typical) at rated voltage
Input Characteristics	
Guaranteed On-State Voltage	15 to 32 volts DC
Guaranteed Off-State Voltage	0 to +5 volts DC
Guaranteed On-State Current	4 mA (minimum)
Guaranteed Off-State Current	1.5 mA (maximum)
On Response Time	1 ms typical
Off Response Time	1 ms typical
Outputs	
Rated Voltage	24 VDC, 120/240 VAC
Operating Voltage	5 to 30 volts DC 5 to 250 volts AC, 50/60 Hz
Outputs per Module	8 (two groups of four outputs each)
Isolation	1500 volts RMS between field and logic side 500 volts RMS between groups
Maximum Load*	2 amps maximum per output 4 amps maximum per common
Minimum Load	10 mA
Maximum Inrush	5 amps
On Response Time	15 ms maximum
Off Response Time	15 ms maximum
Internal Power Consumption	80 mA (all I/O on) from +5V backplane bus 70 mA (all outputs on) from relay +24V backplane bus

* Maximum load current is dependent on operating voltage as shown in Table 2.41.
Refer to data sheet ALS 53002 for product standards and general specifications.

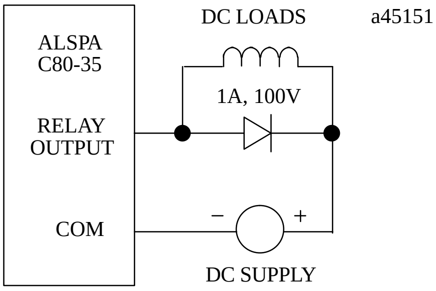
Table 2.40 – Specifications for IC693MDR390

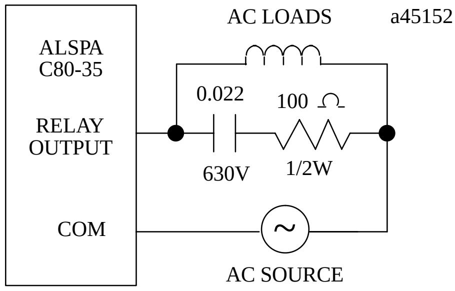
Operating Voltage	Maximum Current for Load Type		Typical Operations (number of Operations)
	Resistive	Lamp or Solenoid*	
240 VAC, 120 VAC, 24 VDC	2 amps	0.6 amp	200 000
240 VAC, 120 VAC, 24 VDC	1 amp	0.3 amp	400 000
240 VAC, 120 VAC, 24 VDC	0.5 amp	0.1 amp	800 000

* For inductive loads

Table 2.41 – Load Current Limitations for IC693MDR390

Relay contact life, when switching inductive loads, will approach resistive load contact life if suppression circuits are used. The following figures are examples of typical suppression circuits for AC and DC loads. The 1A, 100V diode shown in the DC load typical suppression circuit is an industry standard 1N4934.





FIELD WIRING INFORMATION

The following figure provides wiring information for connecting user supplied input and load devices, and power source(s) to the 24 Volt Input/Relay Output module.

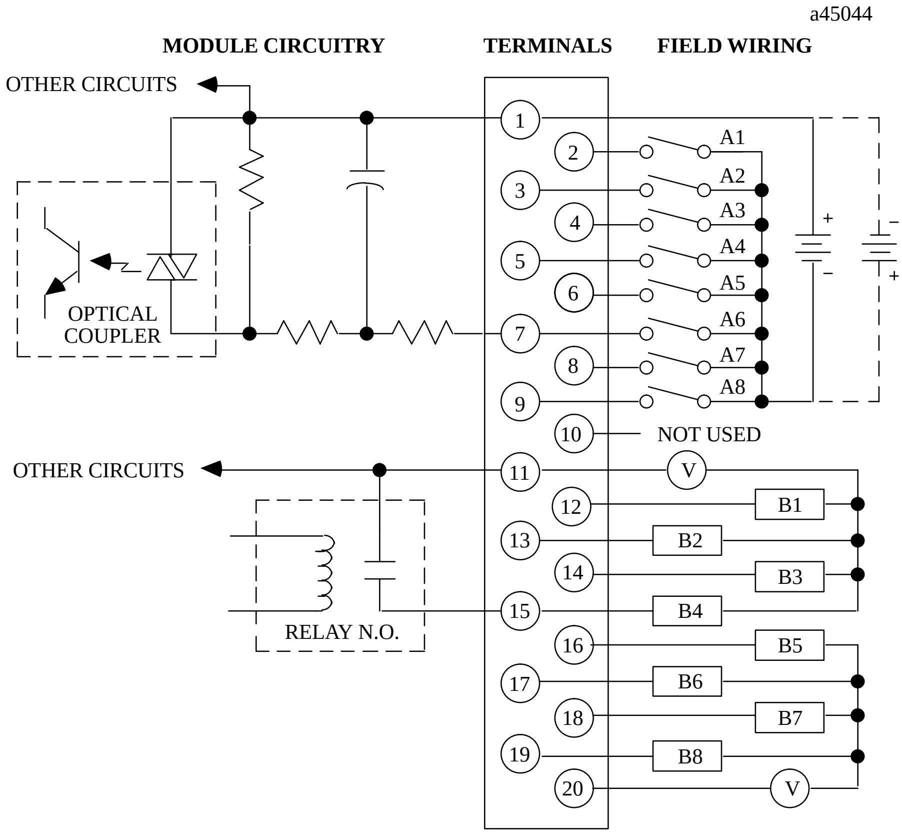


Figure 2.57 – Field Wiring 24 VDC Input/Relay Output Module - IC693MDR390

4. HIGH DENSITY I/O MODULES (32 POINTS)

High density I/O modules for the Alspa C80–35 Programmable Logic Controller have 32 points per module. These 32 point modules allow a maximum of 320 I/O points (as compared to 16 point modules which allow a maximum of 160 I/O points in a single baseplate) to be contained in a single baseplate. The available 32 point I/O modules are:

- IC693MDL654, 5/12 VDC (TTL) Positive/Negative Logic 32 Point Input Module,
- IC693MDL655, 24 VDC Positive/Negative Logic 32 Point Input Module,
- IC693MDL752, 5/12/24 VDC (TTL), 0.5A, Negative Logic 32 Point Output Module,
- IC693MDL753, 12/24 VDC, 0.5A, Positive Logic 32 Point Output Module.

These modules are designed to interface low level DC signals to and from the Alspa C80–35 Programmable Logic Controller. They are ideally suited for use with applications such as interfaces to annunciator panels, pushbutton switches, indicator lamps and other applications requiring low-voltage, low-current inputs and outputs.

The following procedures are recommended when routing and connecting field wiring from user devices to these modules:

- Low level signal wires should be routed separately from other field wiring such as high voltage AC sources (120 VAC, or greater) or wiring connected to inductive loads, such as relay coils, contactors or small motors. Route the low level signal wires from these modules at least 10 cm (4 inches) from other I/O wiring.
- Low level signal wires should not be routed close to any device that could be a potential source of electrical interference.
- Follow proper grounding procedures as outlined in Chapter 3 in the *ALS 52117 Alspa C80–35 PLC Installation Manual*. When applicable, ground cable shields to minimize noise currents.

4.1. Cables for 32 Point I/O Modules

32 point modules are available that have two 24-pin connectors for user connections from the modules to field devices. These connectors are mounted on the front of the appropriate modules. The method of connection and cable information is described below.

Catalog numbers for 32 point modules are: IC693MDL654, IC693MDL655, IC693MDL752 and IC693MDL753. Connections to input circuits are made from the user's input devices to two male (pin-type) 24-pin connectors (Fujitsu FCN-365P024-AU) mounted on the front of the module. The connector mounted on the right of the module (front view) interfaces with groups A and B; the connector on the left side of the module interfaces with groups C and D. A pre-wired (IC693CBL315) cable is available from ALSTOM for field connections to these modules, or you can build your own cable.

4.1.1. I/O Interface Cable, IC693CBL315

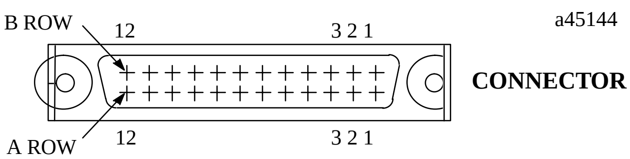
This cable assembly (IC693CBL315) 3 meters (10 feet) is for use with all Alspa C80–35 programmable controller High-Density (32 point) I/O modules that have the Fujitsu 24-pin user I/O connector mounted on the front of each module. The cabel has a 24–pin connector on one end and etripped and tinned wires on the other end. This I/O Interface Cables is for use with I/O modules IC693MDL654, MDL655, MDL752 and MDL753. *This cable is not intended to be used with the Alspa C80–35 Axis Positioning Modules (APM).* Note that this cable replaces a previous version of the cable, IC693CBL310, which is now obsolete. The only difference between the two cables is that the color codes are different.

Pin Number	Pair Number	Wire Color Code
A1	1	BROWN
A2	1	BROWN/BLACK
A3	2	RED
A4	2	RED/BLACK
A5	3	ORANGE
A6	3	ORANGE/BLACK
A7	4	YELLOW
A8	4	YELLOW/BLACK
A9	5	DARK GREEN
A10	5	DARK GREEN/BLACK
A11	6	DARK BLUE
A12	6	DARK BLUE/BLACK

Pin Number	Pair Number	Wire Color Code
B1	7	VIOLET
B2	7	VIOLET/BLACK
B3	8	WHITE
B4	8	WHITE/BLACK
B5	9	GRAY
B6	9	GRAY/BLACK
B7	10	PINK
B8	10	PINK/BLACK
B9	11	LIGHT BLUE
B10	11	LIGHT BLUE/BLACK
B11	12	LIGHT GREEN
B12	12	LIGHT GREEN/BLACK

Table 2.42 – Wire List for I/O Interface Cable, IC693CBL315

A ***Field Wiring Work Sheet*** can be found following the specifications for each of the 32-point I/O modules that use the IC693CBL315 I/O Interface Cable. This work sheet provides all the information needed for wiring the module to field devices and may be copied for use as needed.



Note

Each wire pair has a solid color wire and that same color wire with a black tracer. For example, Pair 1 has a solid brown wire paired with a brown wire with a black tracer.

4.1.2. Building Cables for 24-Pin Connectors

Cables connecting the module to field devices can be built to lengths as required for individual applications. The mating female (socket type) 24-pin connectors must be purchased by the user. The 24-pin connector accessory kits can be ordered as an accessory kit from ALSTOM. Catalog numbers for these connectors and their associated parts are listed in the following table. The list includes catalog numbers for three types of connectors: solder pin, crimp pin and ribbon cable. *Each accessory kit contains enough components (D-connectors, backshells, contact pins, etc.) to assemble ten single-ended cables of the type specified for each kit.*

ALSTOM Catalog Number	Vendor Catalog Number	Description
IC693ACC316	FCN-361J024-AU	Solder eyelet receptacle
(Solder Eyelet Type)	FCN-360C024-B	Backshell (for above)
IC693ACC317	FCN-363J024	Crimp wire receptacle
(Crimp Type)	FCN-363J-AU	Crimp pin (for above, 24 needed)
	FCN-360C024-B	Backshell (for above)
IC693ACC318	FCN-367J024-AUF	IDC (ribbon) receptacle, closed cover
(Ribbon or IDC Type)	FCN-367J024-AUH	IDC (ribbon) receptacle, open cover

Table 2.43 – Catalog Numbers for 24-Pin Connectors

Note that additional tools from Fujitsu are required to properly assemble the crimped contact and ribbon cable type connectors. The solder eyelet connectors (as provided in IC693ACC316) do not require any special tooling.

Crimped Contact Connectors (as provided in IC693ACC317) require :

Hand Crimping Tool	FCN-363T-T005/H
Contact Extraction Tool	FCN-360T-T001/H

Ribbon Cable Connectors (as provided in IC693ACC318) require :

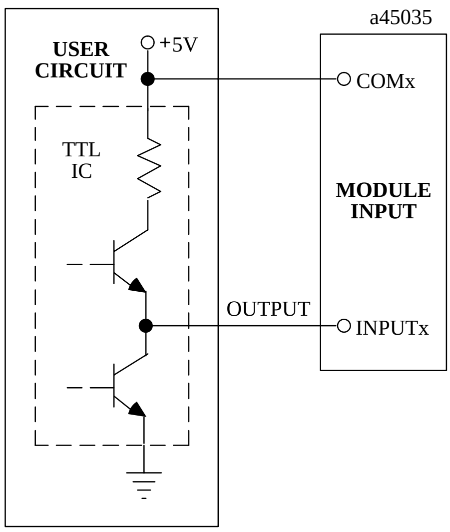
Cable Cutter	FCN-707T-T001/H
Hand Press	FCN-707T-T101/H
Locator Plate	FCN-367T-T012/H

These tools need to be ordered from an authorized Fujitsu distributor.

It is recommended that you order any necessary connector tooling with sufficient lead time to meet your assembly requirements for these connectors. These tools are generally not stock items and can have significant lead times from distribution. If you have any further questions about this issue, please feel free to contact the ALSTOM PLC Hotline.

4.2. 5/12 VDC (TTL) Positive/Negative Logic, 32 Point Input IC693MDL654

The ***5/12 volt DC (TTL) Positive/Negative Logic Input*** module for the Alspa C80–35 Programmable Logic Controller provides 32 discrete TTL voltage threshold input points. The inputs are arranged in four isolated groups of eight (A1 - A8, B1 - B8, C1 - C8 and D1 - D8); each group has its own common. The inputs are positive or negative logic inputs and will operate at levels up to 15V. To be compatible with TTL outputs, the negative logic configuration should be used as shown in the following diagram.



A single, regulated +5V supply (current limited to approximately 150 mA) is available through the I/O connectors on the front of the module. This supply is generated on the module and is isolated from the backplane. Its power input comes from the +5V logic supply on the PLC backplane. By installing jumpers on the appropriate pins on the I/O connector, you can choose to power the inputs from this internal supply instead of powering them with an external user provided supply. If this internal supply is used to power the inputs, additional loading will be placed on the PLC's +5V power supply. Backplane isolation between the field side and logic side is provided by opto-couplers on the module. There are no special fault or alarm diagnostics reported. LED indicators (labeled A1 - A8, B1 - B8, C1 - C8, D1 - D8) at the top of the module provide the ON/OFF status of each input point.

This module is configured as a 32-point input type and uses 32 bits of discrete %I input data. Current into an input point results in a logic 1 in the input status table. This module can be installed in any I/O slot of a 5 or 10-slot baseplate in an Alspa C80–35 PLC system.

Connections to the input circuits are made from the user's input devices to two male (pin-type) 24-pin connectors (Fujitsu FCN-365P024-AU) mounted on the front of the module. The connector mounted on the right of the module (front view) interfaces with groups A and B. The connector on the left side of the module interfaces with groups C and D.

Wiring from the module's connectors to field devices is made through a cable having a mating female connector on one end and stripped and tinned wires on the other end. You can purchase a pre-wired cable, catalog number IC693CBL315 (two required) or, if required for your application, build your own cable. Refer to "Building Cables for 24-Pin Connectors" on page 2–79 of this manual for more information on building these cables.

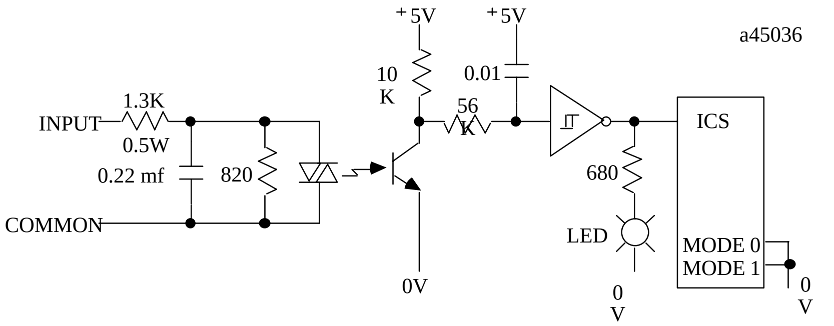
Rated Voltage	5 to 12 volts DC, Positive or Negative Logic
Input Voltage Range	0 to 15 volts DC
Inputs per Module*	32 (four groups of eight inputs each)
Isolation	1500 volts between field side and logic side 250 volts between groups
Input Current	3.0 mA (typical ON current at 5 VDC) 8.5 mA (typical ON current at 12 VDC)
Input Characteristics	
Guaranteed On-state Voltage	4.2 to 15 volts DC
Guaranteed Off-state Voltage	0 to 2.6 volts DC
Guaranteed On-state Current	2.5 mA (minimum)
Guaranteed Off-state Current	1.2 mA (maximum)
On response Time	1 ms maximum
Off response Time	1 ms maximum
Internal Power Consumption	195 mA (maximum) from +5V bus on backplane; (29 mA + 0.5 mA/point ON + 4.7 mA/LED ON) 440 mA (maximum) from +5V bus on backplane (*if module isolated +5V supply used to power inputs and all 32 inputs ON)* 96 mA (typical) from user input supply at 5 VDC and all 32 inputs ON) 272 mA (typical) from user input supply at 12 VDC and all 32 inputs ON)
Isolated +5V Supply	+5 volts DC ±5%
Current limit	150 mA (typical)

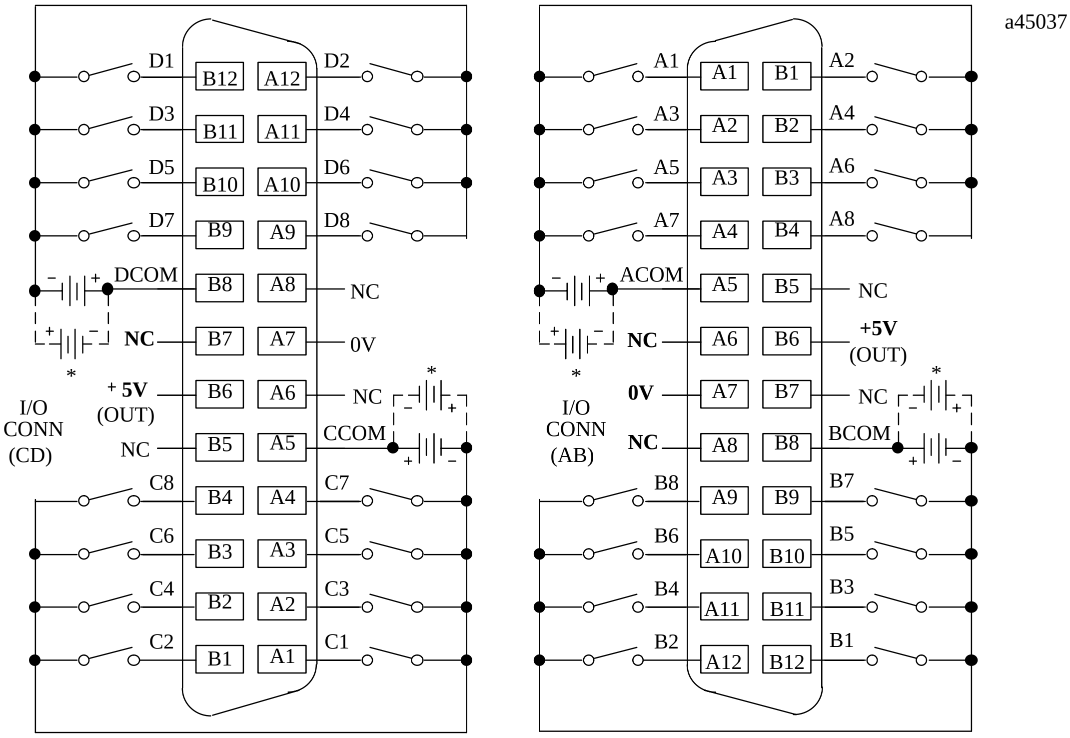
* Maximum number of inputs ON is dependent on ambient temperature as shown in Figure 2.59
Refer to data sheet ALS 53002 for product standards and general specifications.

Table 2.44 – Specifications for IC693MDL654

FIELD WIRING INFORMATION

The following figures provide wiring information for connecting user supplied input devices and power source to the 5/12 volt DC (TTL) pos/neg logic input module.





= FUJITSU CONNECTOR PINS A1 – A12, B1 – B12

*INTERNALLY GENERATED +5V SUPPLY MAY BE USED IN PLACE OF AN EXTERNAL USER SUPPLY

Figure 2.58 – Field Wiring 5/12 Volt DC (TTL) Positive/Negative Logic 32-Point Input Module - IC693MDL654

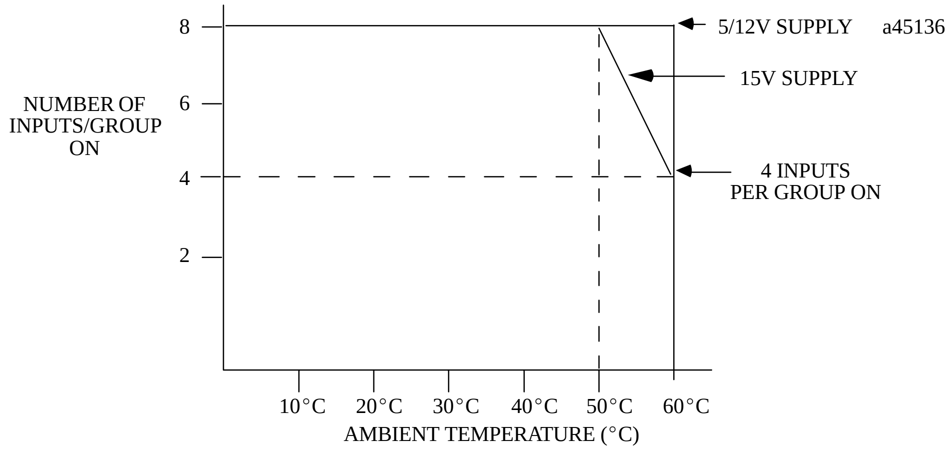


Figure 2.59 – Input Points vs. Temperature for IC693MDL654

FIELD WIRING WORK SHEET FOR IC693MDL654

The following table is provided for the convenience of our customers as an aid to wiring 32-point I/O modules that have 24-pin connectors using cable IC693CBL315. It includes all of the required wiring information in one table. This table has the following information:

- *connector pin number*: A1 to A12 and B1 to B12,
- *cable pair number*: pair 1 to pair 12,
- *wire color code*: base color or base color with tracer color,
- *module point number*: A1 - A8, B1 - B8, C1 - C8, D1 - D8, voltage and common points.

Columns are also provided for circuit references and customer wire numbers. Please copy and use the work sheets on this and the following page as needed when wiring the 5/12 VDC (TTL) Positive/Negative Logic, 32 Point Input module.

Reference	Module Point Number	Connector Pin Number	Cable Pair Number	Wire Color Code	Wire Number
	A1	A1	1	Brown	
	A2	B1	7	Violet	
	A3	A2	1	Brown/Black	
	A4	B2	7	Violet/Black	
	A5	A3	2	Red	
	A6	B3	8	White	
	A7	A4	2	Red/Black	
	A8	B4	8	White/Black	
	A Common	A5	3	Orange	
	N/C	B5	9	Gray	
	N/C	A6	3	Orange/Black	
	+5V OUT	B6	9	Gray/Black	
	0 VOLTS	A7	4	Yellow	
	N/C	B7	10	Pink	
	N/C	A8	4	Yellow/Black	
	B Common	B8	10	Pink/Black	
	B8	A9	5	Dark Green	
	B7	B9	11	Light Blue	
	B6	A10	5	Dark Green/Black	
	B5	B10	11	Light Blue/Black	
	B4	A11	6	Dark Blue	

Table 2.45 – Wiring for Module Groups A and B (connector on right front of module)

Reference	Module Point Number	Connector Pin Number	Cable Pair Number	Wire Color Code	Wire Number
	B3	B11	12	Light Green	
	B2	A12	6	Dark Blue/Black	
	B1	B12	12	Light Green/Black	

Table 2.45 – Wiring for Module Groups A and B (connector on right front of module) (continued)

Reference	Module Point Number	Connector Pin Number	Cable Pair Number	Wire Color Code	Wire Number
	C1	A1	1	Brown	
	C2	B1	7	Violet	
	C3	A2	1	Brown/Black	
	C4	B2	7	Violet/Black	
	C5	A3	2	Red	
	C6	B3	8	White	
	C7	A4	2	Red/Black	
	C8	B4	8	White/Black	
	C Common	A5	3	Orange	
	N/C	B5	9	Gray	
	N/C	A6	3	Orange/Black	
	+5V OUT	B6	9	Gray/Black	
	0 VOLTS	A7	4	Yellow	
	N/C	B7	10	Pink	
	N/C	A8	4	Yellow/Black	
	D Common	B8	10	Pink/Black	
	D8	A9	5	Dark Green	
	D7	B9	11	Light Blue	
	D6	A10	5	Dark Green/Black	
	D5	B10	11	Light Blue/Black	
	D4	A11	6	Dark Blue	
	D3	B11	12	Light Green	
	D2	A12	6	Dark Blue/Black	
	D1	B12	12	Light Green/Black	

Table 2.46 – Wiring for Module Groups C and D (connector on left front of module)

4.3. 24 VDC Positive/Negative Logic, 32 Point Input IC693MDL655

The ***24 volt DC Positive/Negative Logic Input*** module for the Alspa C80–35 Programmable Logic Controller provides 32 discrete input points. The inputs are arranged in four isolated groups of eight (A1 - A8, B1 - B8, C1 - C8 and D1 - D8); each group has its own common. The inputs are positive or negative logic inputs and will operate at levels up to 30V.

Backplane isolation between the field side and logic side is provided by opto-couplers on the module. Isolation is also provided between the four groups of inputs on the module, however each group of eight inputs is referenced to the same user common connection. There are no special fault or alarm diagnostics reported. LED indicators (labeled A1 - A8, B1 - B8, C1 - C8, D1 - D8) at the top of the module provide the ON/OFF status of each input point.

This module is configured as a 32-point input type and uses 32 bits of discrete %I input data. Current into an input point results in a logic 1 in the input status table. Power to operate field devices can be supplied by the user, or from the isolated +24 VDC supply available at the module's I/O connectors. This module can be installed in any I/O slot of a 5 or 10-slot baseplate in an Alspa C80–35 PLC system.

Connections to the input circuits are made from the user's input devices to two male (pin-type) 24-pin connectors (Fujitsu FCN-365P024-AU) mounted on the front of the module. The connector mounted on the right of the module (front view) interfaces with groups A and B. The connector on the left side of the module interfaces with groups C and D.

Wiring from the module's connectors to field devices is made through a cable having a mating female connector on one end and stripped and tinned wires on the other end. You can purchase a pre-wired cable, catalog number IC693CBL315 (two required) or, if required for your application, build your own cable. Refer to "Building Cables for 24-Pin Connectors" on page 2–79 of this manual for more information on building these cables.

Rated Voltage	24 volts DC, Positive or Negative Logic
Input Voltage Range	0 to 30 volts DC
Inputs per Module*	32 (four groups of eight inputs each
Isolation	1500 volts between field side and logic side 250 volts between groups
Input Current	7.0 mA (typical ON current at 24 VDC)
Input Characteristics	
Guaranteed On-state Voltage	11.5 to 30 volts DC
Guaranteed Off-state Voltage	0 to 5 volts DC
Guaranteed On-state Current	3.2 mA (minimum)
Guaranteed Off-state Current	1.1 mA (maximum)
On response Time	2 ms maximum
Off response Time	2 ms maximum
Internal Power Consumption	195 mA (maximum) from +5V bus on backplane; (29 mA +0.5 mA/point ON +4.7 mA/LED ON) 224 mA (typical) from isolated +24V bus on backplane or from user input supply at 24 VDC and all 32 inputs ON)

* Maximum number of inputs ON is dependent on ambient temperature as shown in Figure 2.60.
Refer to data sheet ALS 53002 for product standards and general specifications.

Table 2.47 – Specifications for IC693MDL655

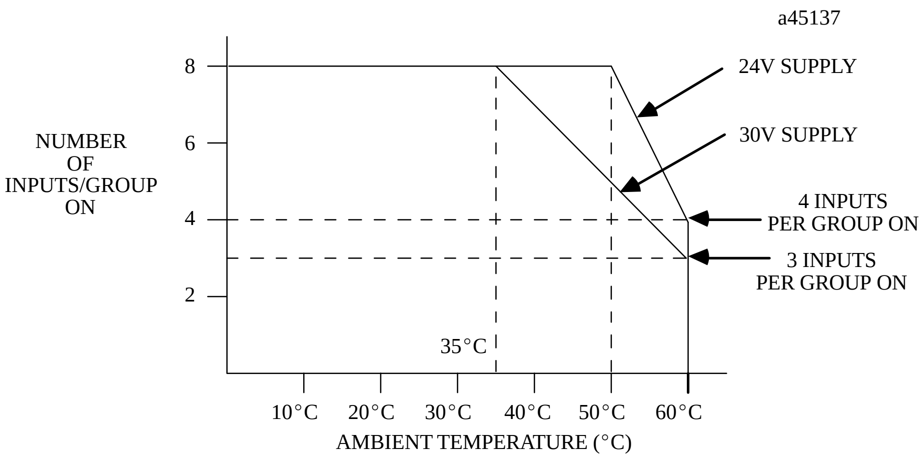
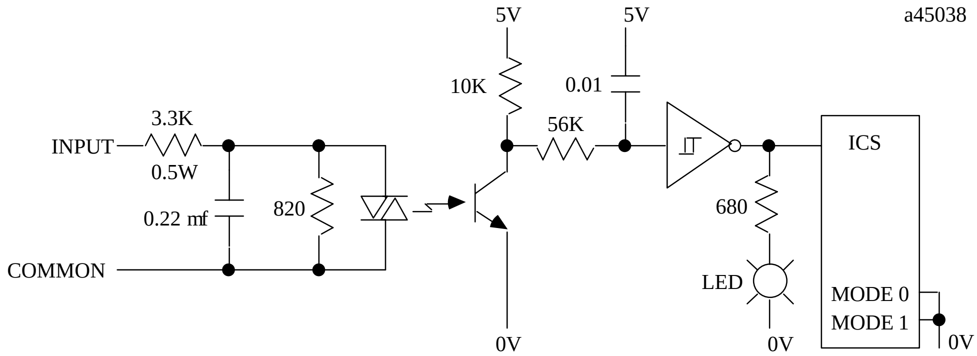


Figure 2.60 – Input Points vs. Temperature for IC694MDL655

FIELD WIRING INFORMATION

The following two figures provide wiring information for connecting user supplied input devices and power source to the 24 volt DC (TTL) positive/negative logic input module. The first figure shows a typical input circuit. The second figure shows how field devices are connected to the module.



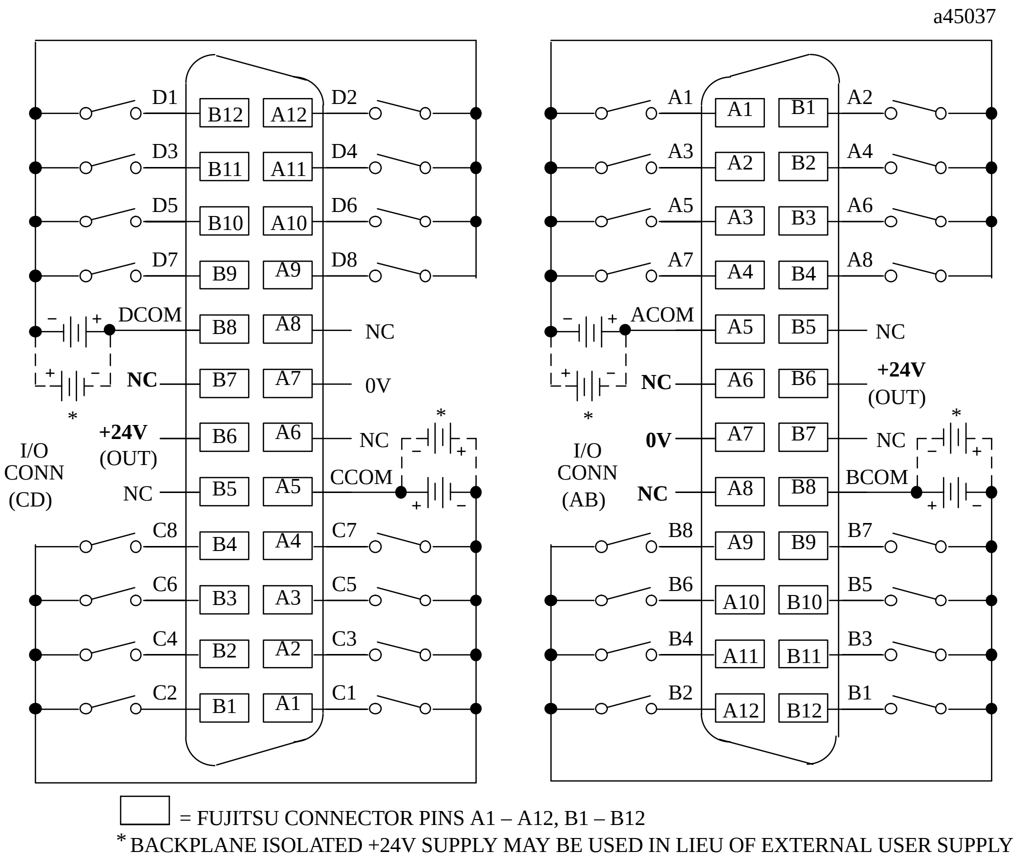


Figure 2.61 – Field Wiring 24 Volt DC Positive/Negative Logic 32-Point Input Module - IC693MDL655

FIELD WIRING WORK SHEET FOR IC693MDL655

The following table is provided for the convenience of our customers as an aid to wiring the 24-pin connectors using cable IC693CBL315. It includes all of the required wiring information in one table. This table has the following information:

- *connector pin number*: A1 to A12 and B1 to B12,
- *cable pair number*: pair 1 to pair 12,
- *wire color code*: base color or base color with tracer color,
- *module point number*: A1 - A8, B1 - B8, C1 - C8, D1 - D8, voltage and common points.

Columns are also provided for circuit references and customer wire numbers. Please copy and use the work sheets on this and the following page as needed when wiring the 24 VDC Positive/Negative Logic, 32 Point Input module.

Reference	Module Point Number	Connector Pin Number	Cable Pair Number	Wire Color Code	Wire Number
	A1	A1	1	Brown	
	A2	B1	7	Violet	
	A3	A2	1	Brown/Black	
	A4	B2	7	Violet/Black	
	A5	A3	2	Red	
	A6	B3	8	White	
	A7	A4	2	Red/Black	
	A8	B4	8	White/Black	
	A Common	A5	3	Orange	
	N/C	B5	9	Gray	
	N/C	A6	3	Orange/Black	
	+24V OUT	B6	9	Gray/Black	
	0 VOLTS	A7	4	Yellow	
	N/C	B7	10	Pink	
	N/C	A8	4	Yellow/Black	
	B Common	B8	10	Pink/Black	
	B8	A9	5	Dark Green	
	B7	B9	11	Light Blue	
	B6	A10	5	Dark Green/Black	
	B5	B10	11	Light Blue/Black	
	B4	A11	6	Dark Blue	
	B3	B11	12	Light Green	
	B2	A12	6	Dark Blue/Black	
	B1	B12	12	Light Green/Black	

Table 2.48 – Wiring for Module Groups A and B (connector on right front of module)

Reference	Module Point Number	Connector Pin Number	Cable Pair Number	Wire Color Code	Wire Number
	C1	A1	1	Brown	
	C2	B1	7	Violet	
	C3	A2	1	Brown/Black	
	C4	B2	7	Violet/Black	
	C5	A3	2	Red	
	C6	B3	8	White	
	C7	A4	2	Red/Black	
	C8	B4	8	White/Black	
	C Common	A5	3	Orange	
	N/C	B5	9	Gray	
	N/C	A6	3	Orange/Black	
	+24V OUT	B6	9	Gray/Black	
	0 VOLTS	A7	4	Yellow	
	N/C	B7	10	Pink	
	N/C	A8	4	Yellow/Black	
	D Common	B8	10	Pink/Black	
	D8	A9	5	Dark Green	
	D7	B9	11	Light Blue	
	D6	A10	5	Dark Green/Black	
	D5	B10	11	Light Blue/Black	
	D4	A11	6	Dark Blue	
	D3	B11	12	Light Green	
	D2	A12	6	Dark Blue/Black	
	D1	B12	12	Light Green/Black	

Table 2.49 – Wiring for Module Groups C and D (connector on left front of module)

4.4. 5/24 Volt DC (TTL) Negative Logic Output, 32 Point IC693MDL752

The ***5/24 volt DC (TTL) Negative Logic Outpu***t module for the Alspa C80–35 Programmable Logic Controller provides 32 discrete outputs. The outputs are arranged in four isolated groups of eight (A1 - A8, B1 - B8, C1 - C8 and D1 - D8); each group has its own common. The outputs are negative logic or sinking type outputs (i.e., the ON state for a point results in an active low output).

The module has two modes of operation. In the TTL mode, the outputs can switch user loads across +5 VDC (±5%) and are capable of sinking a maximum current of 25 mA per point. In the 12/24V mode, the outputs can switch user loads over the range of +12 to –24 VDC (+20%, –15%) and are capable of sinking a maximum current of 0.5A per point. Two pins are provided on the user I/O connectors for each group common. Each pin has a current handling capability of 3 amperes. It is recommended that connections are made to both pins when connecting the common; however, it is a requirement for high current applications (between 3 and 4 amperes).

Each group can be used in the mode of operation needed to satisfy the load requirements for a particular application. For example, group A can drive TTL loads and group B can drive 12 VDC loads, while group C and D can be reserved for driving 24 VDC loads. It is important to note, however that the effects of electrical noise must be considered when mixing TTL and inductive-type loads.

An internal pull-up resistor is provided for each point. The function of each resistor is to passively pull up the output to the user positive side power input (typically +5V for TTL mode) when the output point FET is OFF, thereby providing a high logic level for TTL applications. All 32 outputs are forced OFF when the CPU is stopped. Power to provide current to the loads must be provided by the user. The module also draws a minimum amount of power from the user supply to provide gate drive to the output devices.

Backplane isolation between the field side and logic side is provided by opto-couplers on the module. No special fault or alarm diagnostics are reported. LED indicators (labeled A1 - A8, B1 - B8, C1 - C8, D1 - D8) at the top of the module provide the ON/OFF status of each output point.

This module is configured as a 32-point output type and uses 32 bits of discrete %Q output data. This module can be installed in any I/O slot of a 5 or 10-slot baseplate in an Alspa C80–35 PLC system.

Connections to the output circuits are made from the user's load devices to two male (pin-type) 24-pin connectors (Fujitsu FCN-365P024-AU) mounted on the front of the module. The connector mounted on the right of the module (front view) interfaces with groups A and B. The connector on the left side of the module interfaces with groups C and D.

Wiring from these connectors to field devices is made through a cable having a mating female connector on one end and stripped and tinned wires on the other end. You can purchase a pre-wired cable, catalog number IC693CBL315 (two required) or, if required for your application, build your own cable. Refer to "Building Cables for 24-Pin Connectors" on page 2–79 of this manual for more information on building these cables.

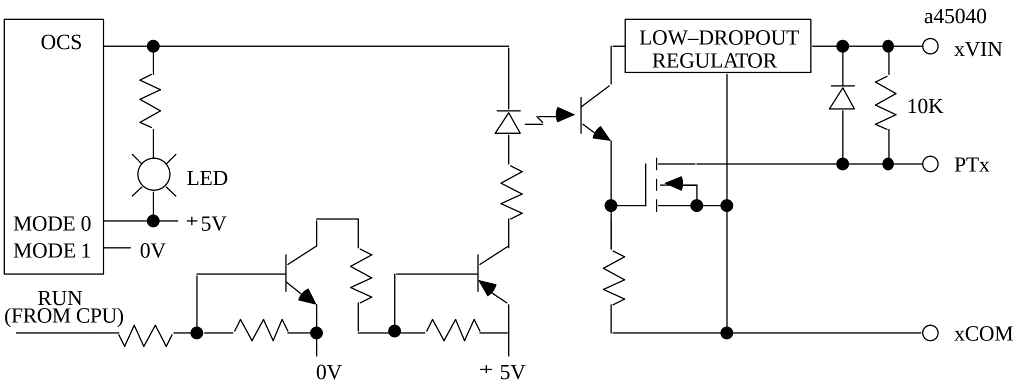
Rated Voltage	5 and 12 to 24 volts DC, negative logic (active low)
Output Voltage Range	4.75 to 5.25 volts DC (TTL mode) 10.2 to 28.8 volts DC (12/24V mode)
Outputs per Module **Isolation**	32 (four groups of eight outputs each) 1500 volts between field side and logic side 250 volts between groups
Output Current	25 mA per point (maximum in TTL mode) 0.5 amps per point (maximum in 12/24V mode); with 4 amps maximum per group and 3 amps maximum per group common pin
Output Characteristics	
Inrush Current	4.6 amps for 10 ms
On-state (active low)	0.4 volts DC (maximum in TTL mode)
Voltage Drop	0.24 volts DC (maximum in 12/24V mode)
Off-state Leakage Current	0.1 mA maximum
On Resp onse Time	0.5 ms maximum
Off Response Time	0.5 ms maximum
Internal Power Consumption	260 mA (maximum) from 5 volt bus on backplane; (13 mA + 3 mA/point ON + 4.7 mA/LED) 12 mA (maximum) per group from user supply at 5 VDC and all eight outputs in group ON 25 mA (maximum) per group from user supply at 12 VDC and all eight outputs in group ON 44 mA (maximum) per group from user supply at 24 VDC and all eight outputs in group ON

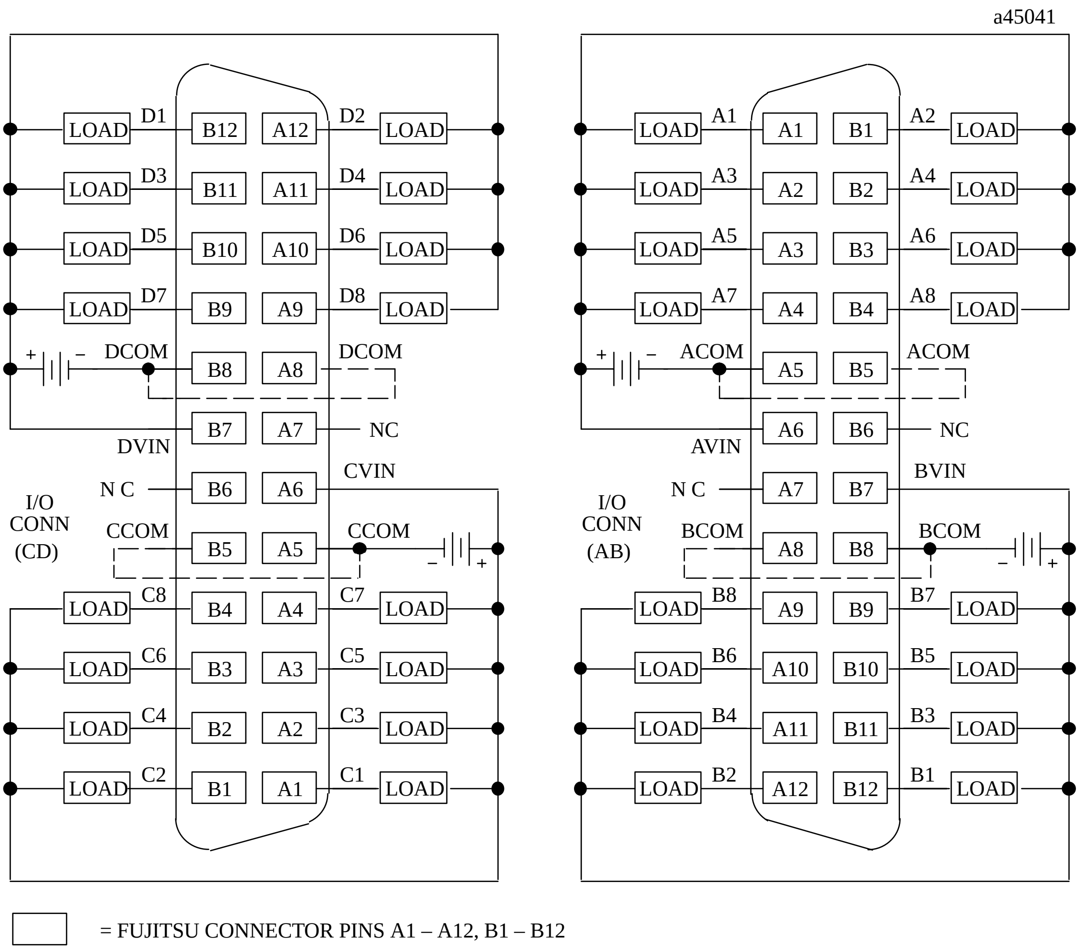
Refer to data sheet ALS 53002 for product standards and general specifications.

Table 2.50 – Specifications for IC693MDL752

FIELD WIRING INFORMATION

The following three figures provide wiring information for connecting user supplied load devices and power source to the 5/24 volt DC negative logic output module.





= FUJITSU CONNECTOR PINS A1 – A12, B1 – B12

Figure 2.62 – Field Wiring - 5/24 Volt DC (TTL) Neg. Logic 32 Point Output Module - IC693MDL752

The following figure provides examples of typical connections to user loads from the 5/24 VDC (TTL) Negative Logic Output module.

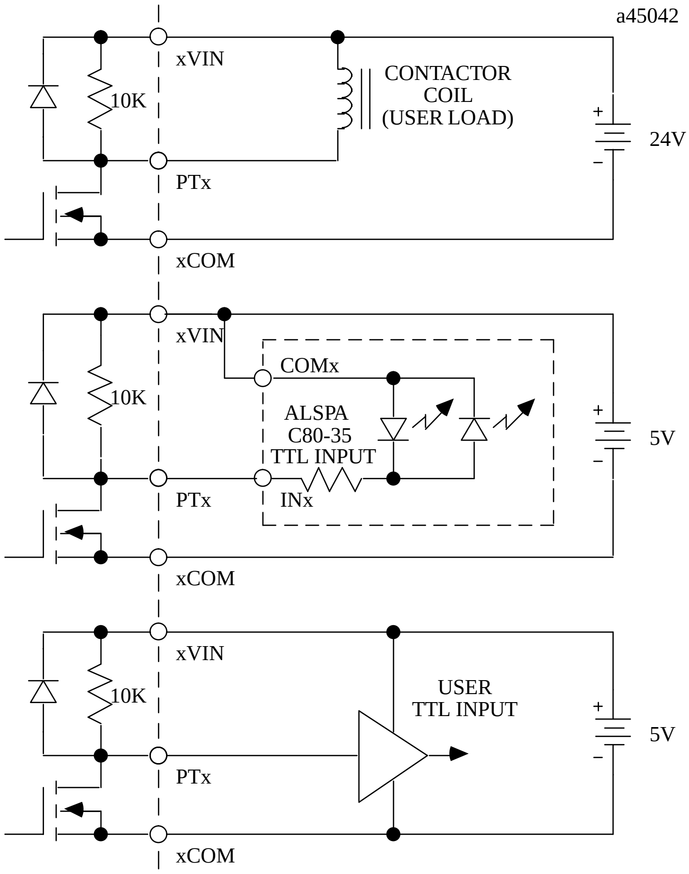


Figure 2.63 – Examples of Connections to User Loads

FIELD WIRING WORK SHEET FOR IC693MDL752

The following table is provided for the convenience of our customers as an aid to wiring the 24-pin connectors using cable IC693CBL315. It includes all of the required wiring information in one table. This table has the following information:

- *connector pin number*: A1 to A12 and B1 to B12,
- *cable pair number*: pair 1 to pair 12,
- *wire color code*: base color or base color with tracer color,
- *module point number*: A1 - A8, B1 - B8, C1 - C8, D1 - D8, voltage and common points.

Columns are also provided for circuit references and customer wire numbers. Please copy and use the work sheets on this and the following page as needed when wiring the 5/24 Volt DC (TTL) Negative Logic, 32 Point Output module.

Reference	Module Point Number	Connector Pin Number	Cable Pair Number	Wire Color Code	Wire Number
	A1	A1	1	Brown	
	A2	B1	7	Violet	
	A3	A2	1	Brown/Black	
	A4	B2	7	Violet/Black	
	A5	A3	2	Red	
	A6	B3	8	White	
	A7	A4	2	Red/Black	
	A8	B4	8	White/Black	
	A Common	A5	3	Orange	
	A Common	B5	9	Gray	
	AVIN	A6	3	Orange/Black	
	N/C	B6	9	Gray/Black	
	N/C	A7	4	Yellow	
	BVIN	B7	10	Pink	
	B Common	A8	4	Yellow/Black	
	B Common	B8	10	Pink/Black	
	B8	A9	5	Dark Green	
	B7	B9	11	Light Blue	
	B6	A10	5	Dark Green/Black	
	B5	B10	11	Light Blue/Black	
	B4	A11	6	Dark Blue	
	B3	B11	12	Light Green	

Table 2.51 – Wiring for Module Groups A and B (connector on right front of module)

Reference	Module Point Number	Connector Pin Number	Cable Pair Number	Wire Color Code	Wire Number
	B2	A12	6	Dark Blue/Black	
	B1	B12	12	Light Green/Black	

Table 2.51 – Wiring for Module Groups A and B (connector on right front of module) (continued)

Reference	Module Point Number	Connector Pin Number	Cable Pair Number	Wire Color Code	Wire Number
	C1	A1	1	Brown	
	C2	B1	7	Violet	
	C3	A2	1	Brown/Black	
	C4	B2	7	Violet/Black	
	C5	A3	2	Red	
	C6	B3	8	White	
	C7	A4	2	Red/Black	
	C8	B4	8	White/Black	
	C Common	A5	3	Orange	
	C Common	B5	9	Gray	
	CVIN	A6	3	Orange/Black	
	N/C	B6	9	Gray/Black	
	N/C	A7	4	Yellow	
	DVIN	B7	10	Pink	
	D Common	A8	4	Yellow/Black	
	D Common	B8	10	Pink/Black	
	D8	A9	5	Dark Green	
	D7	B9	11	Light Blue	
	D6	A10	5	Dark Green/Black	
	D5	B10	11	Light Blue/Black	
	D4	A11	6	Dark Blue	
	D3	B11	12	Light Green	
	D2	A12	6	Dark Blue/Black	
	D1	B12	12	Light Green/Black	

Table 2.52 – Wiring for Module Groups C and D (connector on left front of module)

4.5. 12/24 Volt DC, 0.5A Positive Logic Output, 32 Point IC693MDL753

The ***12/24 volt DC, 0.5A Positive Logic Output*** module for the Alspa C80–35 Programmable Logic Controller provides 32 discrete outputs. The outputs are arranged in four isolated groups of eight (A1 - A8, B1 - B8, C1 - C8 and D1 - D8); each group has its own common. The outputs are positive logic or sourcing type outputs in that they switch the loads on the positive side of the power supply, and therefore supply current to the load.

The outputs can switch user loads over the range of +12 to +24 VDC (+20%, –15%) and are capable of sourcing a maximum current of 0.5 amps per point. Two pins are provided on the user I/O connectors for each group common. Each pin has a current handling capability of 3 amperes. It is recommended that connections are made to both pins when connecting the common; however, it is a requirement for high current applications (between 3 and 4 amperes).

Each group can be used to drive different loads. For example, group A, B and C can drive 24 VDC loads, while group D can be reserved for driving 12 VDC loads. Power to provide current to the loads must be provided by the user. The module also draws a minimum amount of power from the user supply to provide gate drive to the output devices.

Backplane isolation between the field side and logic side is provided by opto-couplers on the module.

All 32 outputs are forced OFF when the CPU is stopped. There are no special fault or alarm diagnostics reported. LED indicators (labeled A1 - A8, B1 - B8, C1 - C8, D1 - D8) at the top of the module provide the ON/OFF status of each output point.

This module is configured as a 32-point output type and uses 32 bits of discrete %Q output data. This module can be installed in any I/O slot of a 5 or 10-slot baseplate in an Alspa C80–35 PLC system.

Connections from the output circuits are made to the user load devices from two male (pin-type) 24-pin connectors (Fujitsu FCN-365P024-AU) mounted on the front of the module. The connector mounted on the right of the module (front view) interfaces with groups A and B. The connector on the left side of the module interfaces with groups C and D.

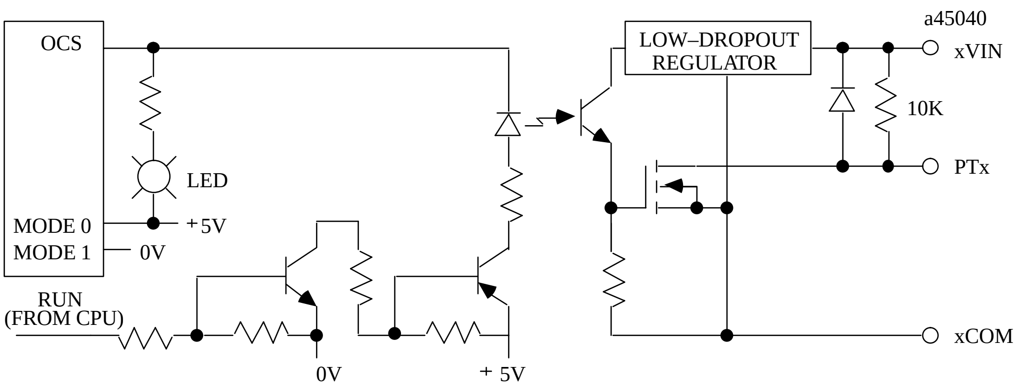
Wiring from these connectors to field devices is made through a cable having a mating female connector on one end and stripped and tinned wires on the other end. You can purchase a pre-wired cable, catalog number IC693CBL315 (two required) with the mating female connector on one end and stripped and tinned wires on the other end or, if required for your application, build your own cable. Refer to “Building Cables for 24-Pin Connectors” on page 2–79 of this manual for more information on building these cables.

Rated Voltage	12 to 24 volts DC, positive logic
Output Voltage Range	10.2 to 28.8 volts DC
Outputs per Module	32 (four groups of eight outputs each)
Isolation	1500 volts between field side and logic side 250 volts between groups
Output Current	0.5 amps per point with 4 amps maximum per group and 3 amps maximum per group common pin
Output Characteristics	
Inrush Current	5.4 amps for 10 ms
On-state Voltage Drop	0.3 volts DC
Off-state Leakage Current	0.1 mA maximum
On Response Time	0.5 ms maximum
Off Response Time	0.5 ms maximum
Internal Power Consumption	260 mA (maximum) from 5 volt bus on backplane; (13 mA + 3 mA/point ON + 4.7 mA/LED) 16.5 mA (maximum) per group from user supply at 24 VDC and all eight outputs in group ON 9.6 mA (maximum) per group from user supply at 12 VDC and all eight outputs in group ON

Refer to data sheet ALS 53002 for product standards and general specifications.

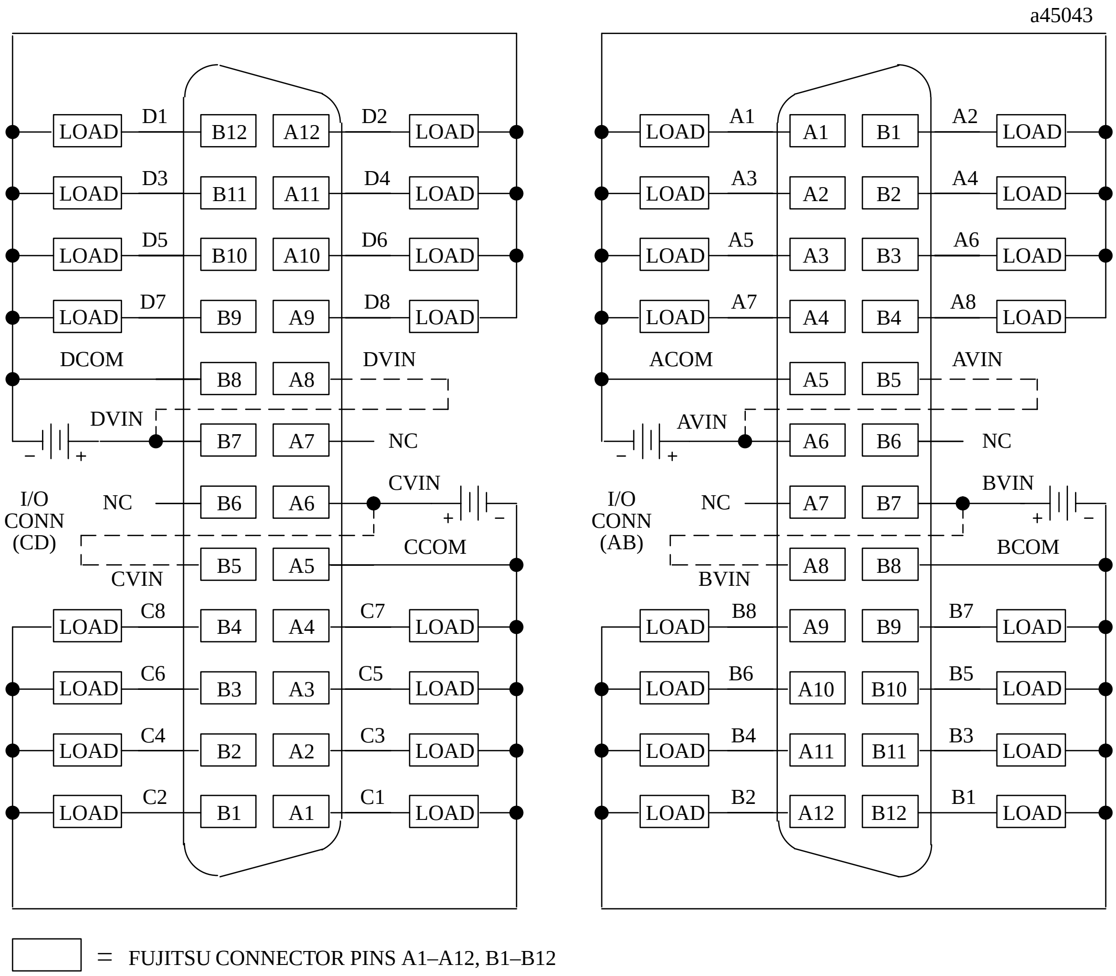
Table 2.53 – Specifications for IC693MDL753

TYPICAL CIRCUIT



4.6. Field Wiring Information

The following figure provides wiring information for connecting user supplied load devices and power source to the 12/24 volt DC, 0.5A positive logic output module.



NOTE: IF TOTAL LOAD CURRENT IS GREATER THAN 3A FOR A GROUP USE BOTH *VIN PINS (FOR APPLICABLE GROUP OR GROUPS) BY ADDING A SECOND WIRE AS SHOWN BY THE DASHED LINES.

Figure 2.64 – Field Wiring - 12/24 Volt DC, 0.5A Positive Logic 32 Point Output Module - IC693MDL753

FIELD WIRING WORK SHEET FOR IC693MDL753

The following table is provided for the convenience of our customers as an aid to wiring the 24-pin connectors using cable IC693CBL315. It includes all of the required wiring information in one table. This table has the following information:

- *connector pin number*: A1 to A12 and B1 to B12,
- *cable pair number*: pair 1 to pair 12,
- *wire color code*: base color or base color with tracer color,
- *module point number*: A1 - A8, B1 - B8, C1 - C8, D1 - D8, voltage and common points.

Columns are also provided for circuit references and customer wire numbers. Please copy and use the work sheets on this and the following page as needed when wiring the 12/24 Volt DC, 0.5A Positive Logic, 32 Point Output module.

Reference	Module Point Number	Connector Pin Number	Cable Pair Number	Wire Color Code	Wire Number
	A1	A1	1	Brown	
	A2	B1	7	Violet	
	A3	A2	1	Brown/Black	
	A4	B2	7	Violet/Black	
	A5	A3	2	Red	
	A6	B3	8	White	
	A7	A4	2	Red/Black	
	A8	B4	8	White/Black	
	A Common	A5	3	Orange	
	AVIN	B5	9	Gray	
	AVIN	A6	3	Orange/Black	
	N/C	B6	9	Gray/Black	
	N/C	A7	4	Yellow	
	BVIN	B7	10	Pink	
	BVIN	A8	4	Yellow/Black	
	B Common	B8	10	Pink/Black	
	B8	A9	5	Dark Green	
	B7	B9	11	Light Blue	
	B6	A10	5	Dark Green/Black	
	B5	B10	11	Light Blue/Black	
	B4	A11	6	Dark Blue	
	B3	B11	12	Light Green	

Table 2.54 – Wiring for Module Groups A and B (connector on right front of module)

Reference	Module Point Number	Connector Pin Number	Cable Pair Number	Wire Color Code	Wire Number
	B2	A12	6	Dark Blue/Black	
	B1	B12	12	Light Green/Black	

Table 2.54 – Wiring for Module Groups A and B (connector on right front of module) (Continued)

Reference	Module Point Number	Connector Pin Number	Cable Pair Number	Wire Color Code	Wire Number
	C1	A1	1	Brown	
	C2	B1	7	Violet	
	C3	A2	1	Brown/Black	
	C4	B2	7	Violet/Black	
	C5	A3	2	Red	
	C6	B3	8	White	
	C7	A4	2	Red/Black	
	C8	B4	8	White/Black	
	C Common	A5	3	Orange	
	CVIN	B5	9	Gray	
	CVIN	A6	3	Orange/Black	
	N/C	B6	9	Gray/Black	
	N/C	A7	4	Yellow	
	DVIN	B7	10	Pink	
	DVIN	A8	4	Yellow/Black	
	D Common	B8	10	Pink/Black	
	D8	A9	5	Dark Green	
	D7	B9	11	Light Blue	
	D6	A10	5	Dark Green/Black	
	D5	B10	11	Light Blue/Black	
	D4	A11	6	Dark Blue	
	D3	B11	12	Light Green	
	D2	A12	6	Dark Blue/Black	
	D1	B12	12	Light Green/Black	

Table 2.55 – Wiring for Module Groups C and D (connector on left front of module)

Chapter 3 Analog I/O Module Specifications

This chapter describes the currently available Analog Input and Output modules for the Alspa C80–35 Programmable Logic Controller. Module specifications and wiring information are provided for each of the available Analog I/O modules. The first part of this chapter describes how analog information is handled in the Alspa C80–35 PLC, followed by a description of each of the modules. Specific information for a particular analog module can be found in the description of that module.

Currently available Analog I/O modules are listed in the following table (Table 3.1) along with the starting page number where the description of each module can be found.

Catalog Number	Description of Module	Number of Channels	Page Number
IC693ALG220	Analog Input, Voltage	4 channel	3–16
IC693ALG221	Analog Input, Current	4 channel	3–21
IC693ALG222	Analog Input, Voltage (High-Density)	16 channel	3–26
IC693ALG223	Analog Input, Current (High-Density)	16 channel	3–45
IC693ALG390	Analog Output, Voltage	2 channel	3–63
IC693ALG391	Analog Output, Current	2 channel	3–68
IC693ALG392	Analog Output, Current/Voltage	8-channel	3–75
IC693ALG442	Analog Combo Module, Current/Voltage	4 channels In 2 channels Out	3–97

Table 3.1 – Guide to Page Location for Analog I/O Module Specifications

Load Requirements for Analog I/O Modules

The following table (Table 3-2) shows the DC load required by each Alspa C80–35 analog I/O module. All ratings are in milliamps. Input and Output module current ratings are with all inputs or outputs on. Note that the figures listed are maximum requirements, not typical. Load requirements for other Alspa C80–35 PLC components installed in a baseplate must be included in the total load calculations. Load requirements for all Alspa C80–35 PLC components can be found in *ALS 52117 Alspa C80–35 PLC Installation Manual*. Three voltages are listed in the table:

- +5 VDC provides primary power to operate most internal circuits,
- +24 VDC Relay Power provides power for circuits that drive the relays on Relay modules,
- +24 VDC Isolated provides power to operate a number of input circuits (input modules only). This can also be used as the power input for some analog modules to power user-side circuitry.

Catalog Number	Description	+5 VDC	+24 VDC Relay Power	+24 VDC Isolated
IC693ALG220	Analog Input, Voltage, 4 Channels	27 mA	-	98 mA
IC693ALG221	Analog Input, Current, 4 Channels	25 mA	-	100 mA
IC693ALG222	High-Density Analog Input, Voltage, 16 Channels	112 mA		41 mA
IC693ALG223	High-Density Analog Input, Current, 16 Channels	120 mA	-	*
IC693ALG390	Analog Output, Voltage, 2 Channels	32 mA	-	120 mA
IC693ALG391	Analog Output, Current, 2 Channels	30 mA	-	215 mA
IC693ALG392	High Density Analog Output, Current/Voltage, 8 Channels	110 mA	-	*
IC693ALG442	Analog Combo, Current/Voltage, 4 Ch In/2 Ch Out	300 mA	-	*

* Module analog power must be supplied by an external user supply. See individual module specifications for more information.

Table 3.2 – Load Requirements (mA) for Analog I/O Modules

I/O Installation and Wiring

For information on installation, removal, and recommended wiring practices for Alspa C80–35 I/O modules, refer to Chapter 1.

Analog Terminology

There are several terms relating to measurements at analog I/O terminals that you should be familiar with. Refer to the Glossary for a list of these terms and their definitions. Additionally, the following pages describe how analog information is handled in the Alspa C80–35 PLC. Specific information for individual modules can be found in the description of that module.

1. HARDWARE DESCRIPTION OF ANALOG MODULES

Analog modules provide inputs and outputs with continuous values, as compared with digital input and output modules which have discrete values of ON or OFF. Analog modules convert digital words to analog signals, or analog signals to digital words, depending on whether the module is an output module or an input module.

1.1. Differential Inputs

The %AI data table is a storage location within the Alspa C80–35 CPU where the input information is stored. The Alspa C80–35 PLC has current and voltage analog input modules available; however, the Alspa C80–35 CPU does not recognize a difference between the two types of analog modules.

The Alspa C80–35 PLC system must be configured by the user as described in the *ALS 52117 Alspa C80–35 PLC Installation Manual* and the *ALS 52201 Alspa P8–25/35/05 Programming Software for Alspa C80–35, C80–25 and C80–05 PLCs User's Manual*. After configuration, the four analog input channels will correspond to 64 bits in the data table (256 bits for the high-density 16 channel analog input modules).

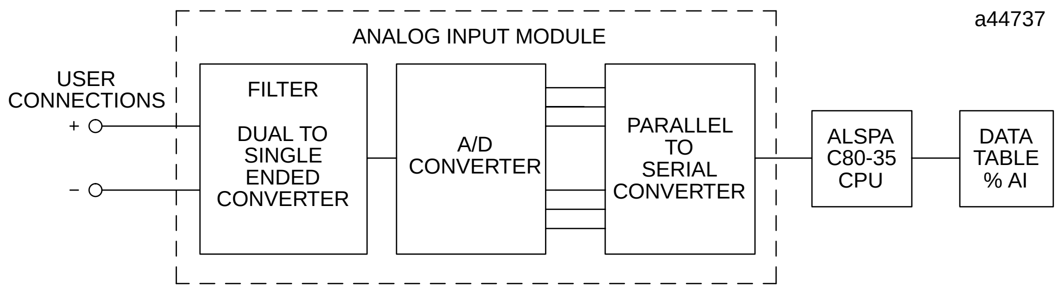


Figure 3.1 – Analog Input Block Diagram

The analog inputs are differential; that is, the converted data is the difference between the voltages IN+ and IN– as shown in Figure 3.2. The differential input configuration is much less sensitive to noise and ground currents. Both inputs are referenced to a common voltage, referred to as COM. The average voltage of the IN terminals with respect to COM is referred to as *Common Mode Voltage*. Different signal sources may have different common mode voltages, shown as V (CM1) and V (CM2). This common mode voltage may be caused by differences in location of circuit grounds, or by the nature of the input signal itself.

To reference floating sources and limit common mode voltages, the COM terminal should be connected to either side of the input at the source itself. Without special design considerations, the summation of the common mode voltage, the differential input voltage and noise on the lines referenced to the COM terminals is limited to ±11 volts, or damage may result to the module. The input modules provide some filtering to protect against high frequency spikes, but low frequency signals exceeding this will produce erroneous conversions.

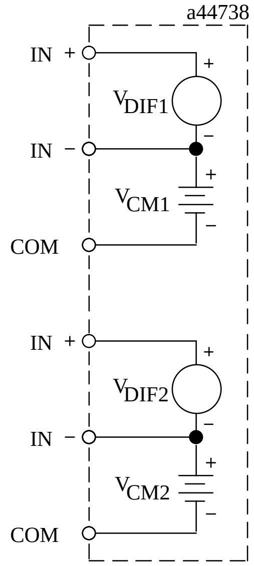


Figure 3.2 – Analog Input Common Mode Voltage

1.2. Outputs

The %AQ data table is a memory location within the Alspa C80–35 CPU where the output information is stored. The Alspa C80–35 PLC has current and voltage analog output modules available; however, the Alspa C80–35 CPU does not recognize the difference between the two types of analog outputs. The user must configure the Alspa C80–35 PLC system as described in the *ALS 52117 Alspa C80–35 PLC Installation Manual* and the *ALS 52201 Alspa P8–25/35/05 Programming Software for Alspa C80–35, C80–25 and C80–05 PLCs User's Manual*. After configuration, the two analog outputs will correspond to 32 bits in the data table.

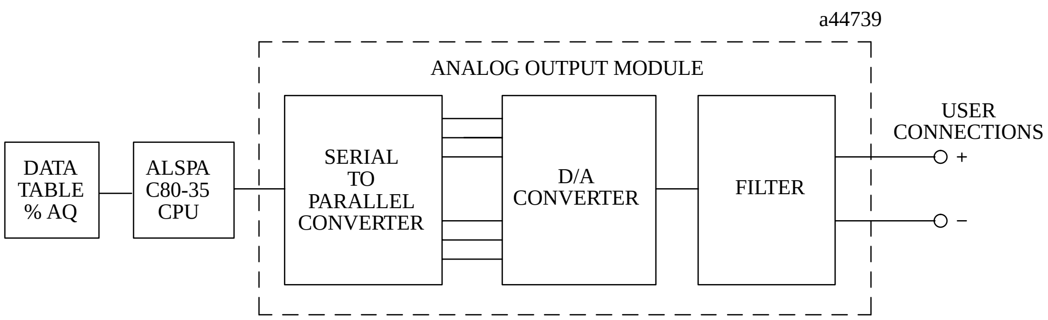


Figure 3.3 – Analog Output Block Diagram

1.3. CPU Interface to Analog Modules

The Alspa C80–35 PLC uses the data within the %AQ and %AI data tables to drive or record analog values as shown in Figure 3.1 and Figure 3.3. The analog data is handled in a 2’s complement format. Two’s complement, for conversion purposes, consists of a binary code for positive magnitudes (represented by a 0 (zero) in the most significant bit), and the 2’s complement of each positive number to represent its negative. To convert negative numbers from 2’s complement to binary, invert each bit and add one. The operation below is an example conversion of a 16-bit word.

```
   2’s Complement                 Binary

  1100101101010000            0011010010101111
                             +               1
                             -----------------
                             –0011010010110000
```

Working in decimal format, instead of hexadecimal, within the data tables will allow easier calculations when you are working with analog data. You can use the data in the %AQ and %AI data tables for any math or data function without having to do any conversion or 2’s complement math. When using raw data in any math calculations, you would usually use double precision math.

You can find corresponding data words and analog values for programming purposes by using the following equations and the values in Table 3.3.

$$\text{Data Word} = \frac{(\text{Analog Value} - \text{Offset})}{\text{Resolution}^{1}} \times 2^{n}$$

$$\text{Analog Value} = \frac{\text{Data Word} \times \text{Resolution}^{1}}{2^{n}} + \text{Offset}$$

[1] analog value/bit; ^{n} = number of disregarded LSBs

Module	Disregarded LSB	Offset	Analog Range	Resolution	Resolution Per Bit
Analog Voltage Output	3	0V	20V	13 bits	2.5 mV/bit
Analog Current Output					
4 to 20 mA Range	3	4 mA	16 mA	12 bits	4 µA/bit
0 to 20 mA Range	3	0 mA	20 mA	12 bits	5 µA/bit
Analog Voltage Input	4	0 V	20 V	12 bits	5 mV/bit
Analog Current Input					
4 to 20 mA Range	3	4 mA	16 mA	12 bits	4 µA/bit
0 to 20 mA Range	3	0 mA	20 mA	12 bits	5 µA/bit
Analog Current Input 16-Channel					
4 to 20 mA Range	3	4 mA	16 mA	12 bits	4 µA/bit
0 to 20 mA Range	3	0 mA	20 mA	12 bits	5 µA/bit
4 to 20 mA Range Enhanced	n/a	4 mA	20 mA	12 bits	5 µA/bit
Analog Voltage Input 16-Channel					
0 to +10V Range	3	0 V	10 V	12 bits	2.5 mV/bit
–10 to +10V Range	4	0 V	20 V	12 bits	5 mV/bit
Analog Current/Voltage Output 8-Channel					
0 to +10V Range	n/a	0 V	10 V	15 bits	2.5 mV/bit
–10 to +10V Range	n/a	0 V	20 V	16 bits	5 mV/bit
4 to 20 mA Range	n/a	4 mA	16 mA	15 bits	4 µA/bit
0 to 20 mA Range	n/a	0 mA	20 mA	15 bits	5 µA/bit

Table 3.3 – Equation Values for Analog Modules

Example 1: if you want a 12 mA setpoint for a current input (4 - 20 mA range) for the 16-Channel Current Input module (IC693ALG223) use the first equation to find the corresponding data word as shown below.

$$\text{Data Word} = \frac{(12\text{ mA} - 4\text{ mA})}{4\ \mu\text{A}} \times 2^3 = 16000$$

Example 2: if you want a 5V setpoint for a voltage input (0 to +10V range) for the 16-Channel Voltage Input module (IC693ALG222) use the first equation to find the corresponding data word as shown below.

$$\text{Data Word} = \frac{5\text{V}}{2.5\text{ mV}} \times 2^3 = 16000$$

Example 3: if you want a 5 volt setpoint for a 4-Channel Voltage Input module (IC693ALG220), use the first equation to find the corresponding data word as shown below.

$$\text{Data Word} = \frac{(5\text{V} - 0\text{V})}{5\text{ mV}} \times 2^4 = 16000$$

1.4. Placement of A/D and D/A Bits within the Data Tables

Since converters used in the analog modules are 13-bit converters, not all of the 16 bits in the data tables contain data required for the conversion. A version of the 12 bits is placed within the 16-bit data word corresponding to the analog point (in %AQ or %AI tables). The Alspa C80–35 system handles the integration differently for the various analog modules.

The Alspa C80–35 system disregards the data placed in the extra bits in the %AQ table and uses those bits for communications with the module. The CPU also converts the data in the %AQ data word from 2's complement to sign magnitude format before sending the data to the output module. The CPU does not manipulate the data from the input modules before placing it within the word in the %AI data table. The bits in the %AI data table which were not used in the conversion by the input module are forced to 0 (zero) by the analog input module. An example of the bit placement for an analog current output data word is shown below. This example is for the Analog Current output module, catalog number IC693ALG391.

MSB LSB

S	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0	X	X	X

S=sign bit
X=not converter bits

Analog values are scaled over the range of the converter. Factory calibration adjusts the analog value per bit (resolution) to a multiple of full scale (thas is, 4 microamps/bit). This calibration leaves a normal 12-bit converter with 4000 counts (normally 2 (12) = 4096 counts). The data is then scaled with the 4000 counts over the analog range. For example, the data to the D/A converter for the analog current output is scaled as shown in Figure 3.4.

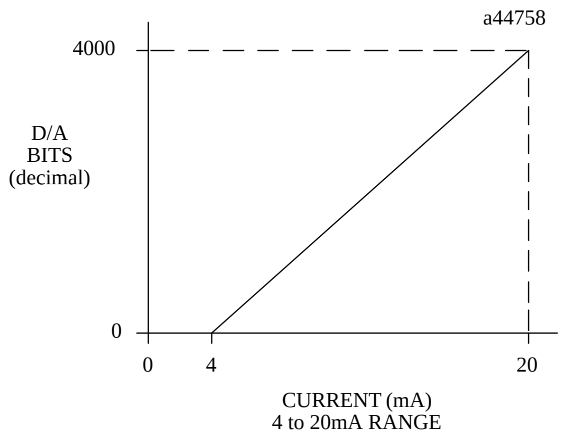


Figure 3.4 – D/A Bits vs. Current Output for IC693ALG391

More detailed information on placement and scaling for the analog modules can be found within their respective specifications.

1.5. Stair Step Effect of Output

Because the converted bits (12 bits) in the data word (16 bits) are not right-justified, the placement of the converted bits causes the output, or input, to be a stair step. The net effect of the stair step for an output module is that not every increase in the %AQ data table will cause an increase in the output. The net effect for an input module is that an increased input will not cause the LSB (Least Significant Bit) of the data word in the %AI table to change. The size of the step depends on the range of the analog signal, the resolution of the conversion and the number of LSBs disregarded. These factors can be used to calculate the size of the step.

For example, the analog output module provides outputs from 4 to 20 mA in 12 bits. Therefore, each bit represents (20-4 mA)/2^{12} bits = 3.906 µA/bit. However, factory calibration adjusts for an even number of microamps per bit (4 µA/bit). Since the three LSBs in the %AQ output are not used in the conversion, an 8 count (2^3) increase in the %AQ output is needed to change the analog output by 4 µA. The software rounding algorithm causes the step to rotate between a count of 7 and a count of 9 instead of 8. The values supplied in Table 3.3 provide you with the information needed to calculate step sizes.

The following figure shows a portion of the analog current output versus the corresponding data word in %AQ.

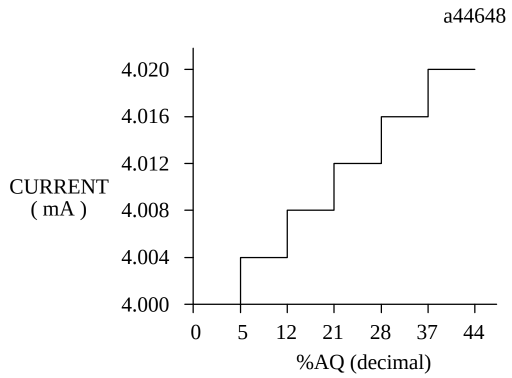


Figure 3.5 – Stair Step Effect on Analog Values

Although the analog signals are stair step, they can be approximated with a linear graph. The following figures show the relationship between voltage and current in the %AQ and %AI data words.

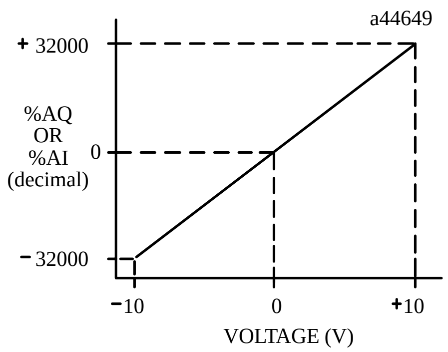


Figure 3.6 – Voltage vs. Data Word

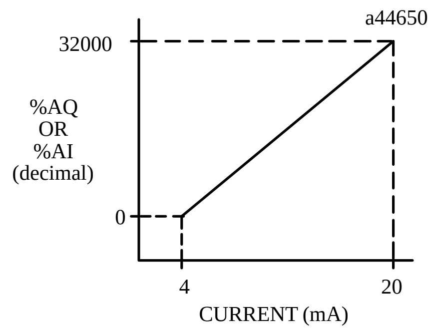


Figure 3.7 – Current vs. Data Word

1.6. Scaling

The data may be changed to a scale more suited to your application. This may be accomplished through programming with Alspa P8–25/35/05 software. The formula for the data conversion is shown below.

$$\frac{\textbf{Data Word (\%AQ or \%AI)}}{\textbf{32000}} = \frac{\textbf{Application Data Value – Application Offset}}{\textbf{Application Maximum Value – Application Minimum Value}}$$

For analog inputs, the application data value is what you will need to calculate for based on the analog data word. For analog outputs, the analog data word is what you will need to calculate for based on the application data value and maximum range. An example of scaling is a 0 to 10 volt signal that actually represents 0 to 2000 rpm. For an output signal, the following factor would be used.

$$\frac{\textbf{Data Word}}{\textbf{32000}} = \frac{\textbf{Xrpm – 0}}{\textbf{2000 rpm – 0 rpm}}$$

Solving the above equation,

scaling an input in a program: X_{rpm} = %AI ÷ 16.
scaling an output in a program as: %AQ = X_{rpm} x 16.

Another example would be a 1 to 5 volt signal which actually represents 4 to 20 mA. If you want to use values in your program that are actually mA values, use the following equation for calculating scaling factors.

$$\frac{\textbf{Data Word}}{\textbf{32000}} = \frac{\textbf{XmA – 4 mA}}{\textbf{20mA – 4 mA}}$$

Solving the above equation,

scaling an input in a program: X_{mA} = (%AI ÷ 2000) + 4
scaling an output in a program: %AQ = (X_{mA} x 2000) – 8000

With the placement and scaling known, you can modify the data from the %AI table or the data to the %AQ table by the scale factor to satisfy your application needs.

2. PERFORMANCE MEASURMENTS

The performance of analog modules can be measured by resolution, accuracy, linearity and cross-channel rejection. Resolution of the module is the weight assigned to the least significant bit in the conversion process. For example, 4 μA/bit is the resolution of the analog current output module. A module with 8 μA/bit has half the resolution of the analog current output module. The resolution of a module is determined by the converter used in the analog module. The accuracy of the module is dependent upon the tolerances of components used in the module's circuitry. Accuracy is the maximum difference between the expected and measured values. Linearity is the difference between the measured change and the ideal one LSB change between any two adjacent channels. Cross-channel rejection is the influence on one channel when the input to another channel is changed.

2.1. Field Wiring

Connections to an Analog module from user devices are made to screw terminals on a removable 20-terminal connector block mounted on the front of the module. Actual terminals used are shown in the specifications for the individual modules.

Technological advances used in the analog modules are aimed at making equipment smaller, faster, or more sensitive. This effort increases the concern for electrical noise. Therefore, shielding and grounding are important when installing an Alspa C80–35 PLC system. It is impossible to provide a practical guide for installation of equipment that covers all possible situations. However, some guidelines are suggested below. To minimize capacitive loading and noise, all field connections to the module should be wired to the I/O terminal board using a good grade of twisted, shielded instrumentation cable. Refer to the Glossary for a definition of terms relating to measurement of analog I/O terminals.

2.2. Shielding for Analog Input Modules

Generally, the shield for inputs to a module should be grounded at the analog source. However, ground connections for each channel, labeled COM and GND, on the terminal board are provided for connecting shields at the analog input module if desired. The COM connection provides access to the common of the analog circuitry in the module. The GND connection provides access to the baseplate (frame ground). The shields may be connected to either COM or GND.

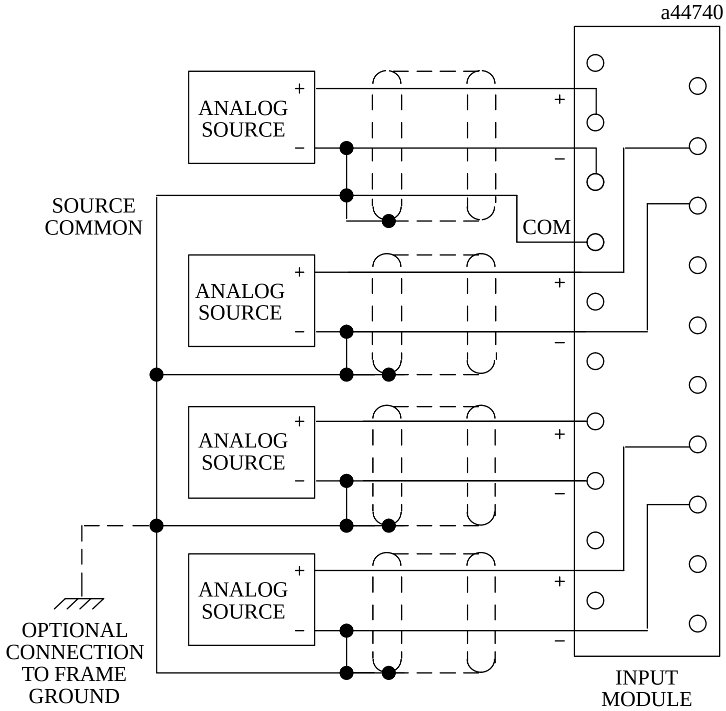


Figure 3.8 – Shield Connections for Analog Input Modules

For an unbalanced source, the ground shield should be connected to the source common or ground as shown in Figure 3.8. If all of the source inputs to this module come from the same location and are referenced to the same common, a connection is made as shown in the figure. If the inputs to any one analog input module come from multiple sources, you should connect each of the source common points together and then connect to the module at only one terminal, such as COM, as shown in the figure. This scheme will eliminate multiple grounding or ground loops which can cause false input data. An optional way to connect the shields is to connect only the end at the module to the module at the GND terminal screw which is directly connected to frame ground via the module.

In extreme noise environments, a ground braid may be used to connect the frame ground on the user terminal connector to earth ground. This additional connection will bypass noise around the module.

2.3. Shielding for Analog Output Modules

For analog output modules, the shield is normally grounded at only the source end (the module) as shown in Figure 3.9. The GND connection provides access to the baseplate (frame ground) resulting in superior rejection of noise caused by any shield drain currents. In extreme noise environments, a ground braid may be used to connect the frame ground on the user terminal connector to earth ground. This additional connection will bypass noise around the module.

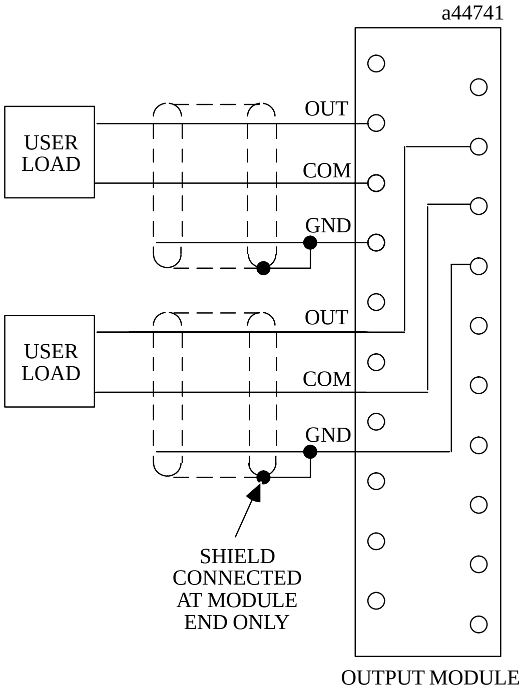


Figure 3.9 – Shield Connections for Analog Output Modules

For additional system grounding information, refer to the discussion on system grounding in Chapter 3 in *ALS 52117 Alspa C80–35 PLC Installation Manual*.

3. MAXIMUM NUMBER OF ANALOG MODULES PER SYSTEM

The maximum number of modules installed in a system depends on several factors, including available references for each CPU model, current consumption for each module to be installed, slots available in baseplate(s), selectable configuration parameters and, where applicable, whether Isolated +24 VDC is supplied by the PLC backplane or by a user provided supply. Before installing modules in a baseplate, verify that the total current consumption of all of those modules does not exceed the power rating of the PLC Standard Power Supply (30 watts maximum, all voltages). The following tables will help you determine the maximum number of analog I/O modules that can be installed in an Alspa C80–35 PLC system. **Calculations assume maximum number of references used. Modules with selectable references can have more modules per system.**

Analog Module	**%AI References (maximum)**	**%AQ References (maximum)**	**%I References**	**Current from +5 VDC** (1)	**Current from Isolated +24 VDC** (1)
IC693ALG220	4	–	–	27	98
IC693ALG221	4	–	–	25	100
IC693ALG222	16	–	8 to 40	112	41
IC693ALG223	16	–	8 to 40	120	user supplied
IC693ALG390	–	2	–	32	120 (2)
IC693ALG391	–	2	–	30	215 (2)
IC693ALG392	–	8	8 or 16	110	user supplied
IC693ALG442	4	2	8, 16, or 24	95	user supplied

(1) Maximum current available from Standard AC/DC and DC power supply: +5 VDC = 15W (3000 mA); Isolated +24 VDC = 20W (830 mA). High Capacity AC/DC and DC power supplies provide 30W (6000 mA) for +5 VDC; Isolated +24 VDC = 20W (830 mA). ***For all supplies – maximum total power for all outputs cannot exceed 30 watts.***
(2) Supplied from Isolated +24 VDC on backplane, or from user supply.

Table 3.4 – User Reference and Current (mA) Requirements

CPU Model	**%AI**	**%AQ**	**%I**
311 and 313	64 words	32 words	512
331	128 words	64 words	512
341	1024 words	256 words	512
351	2048 words	512 words	2048

Table 3.5 – User References Available per System

Analog Module Type	CPU Model 311/313[1]	CPU Model 331/341/351[1]
IC693ALG220 and *IC693ALG221* Input Module, 4-Channel	5 (5-slot baseplate) 8 (10-slot baseplate)	40 (Model 331/341) 64 (Model 351)
IC693ALG222 and *IC693ALG223* Input Module, 16-Channel	4 (5-slot baseplate) 4 (10-slot baseplate)	8 (Model 331) 12 (Model 341) 51 (Model 351)
IC693ALG390 Voltage Output Module, 2-Channel	5 (5-slot baseplate) 6 (10-slot baseplate)	16 (Model 331) 30 (Model 341) 48 (Model 351)
IC693ALG391 Current Output Module, 2-Channel	3 (5-slot baseplate) 3 (10-slot baseplate)	15 (Model 331)[2] 15 (Model 341)[2] 24 (Model 351)[2]
IC693ALG392 Output Module, 8-Channel	4 (5-slot baseplate) 4 (10-slot baseplate)	8 (Model 331) 32 (Model 341) 79 (Model 351)
IC693ALG442 Combination Input/Output Module, 4-Ch In/2-Ch Out	5 (5-slot baseplate) 10 (10-slot baseplate)	21 (Model 331/341) 79 (Model 351)

(1) Maximum I/O slots available per system; Model 311/313 (5 or 10), Model 331/341 (49), Model 351 (79).
(2) More if +24 VDC is user supplied (32 for Model 331, 49 for Model 341, 79 for Model 351).

Table 3.6 – Maximum Number of Analog Modules per System

4. ANALOG I/O MODULE SPECIFICATIONS

The following pages contain general information on Alspa C80–35 analog modules and specifications for each of the Alspa C80–35 analog I/O modules. For each module, the following technical information is provided:

- A description of the module.
- A list of specifications for the module.
- An illustration showing field wiring information, including appropriate user connections to the detachable terminal board, or connector and an example of the module's input or output circuitry for user interface information.
- A graph that provides temperature derating information (where applicable) for the module.

These Analog modules are described in the following pages:

4.1. Analog Voltage Input - 4 Channel IC693ALG220

The ***4-Channel Analog Voltage Input*** module for the Alspa C80–35 Programmable Logic Controller provides four input channels, each capable of converting an analog input signal to a digital signal for use as required by your application. The Analog Voltage Input module is capable of converting inputs in the range of –10 to +10 volts. Conversion speed for each of the four channels is one millisecond. This provides an update rate of four milliseconds for any channel. Resolution of the converted signal is 12 bits binary (1 part in 4096).

User data in the %AI registers is in 16-bit 2’s complement format. The placement of the 12 bits from the A/D converter in the %AI data word is shown below. The relationship between the voltage input and the data from the A/D converter is shown in Figure 3.10.

MSB															LSB
S	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0	X	X	X	X

X = not applicable to this discussion.
S = sign bit

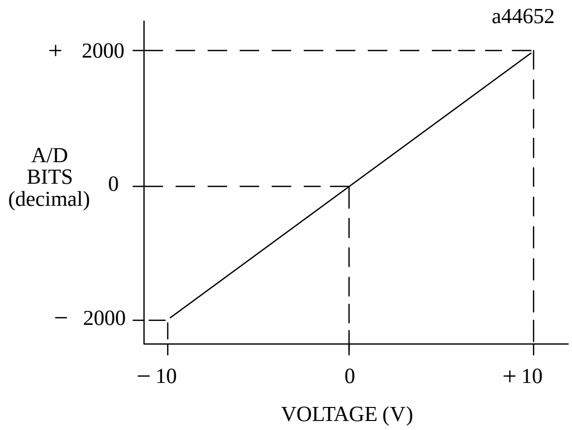


Figure 3.10 – A/D Bits vs. Voltage Input

Scaling of the input is shown below in Figure 3.11.

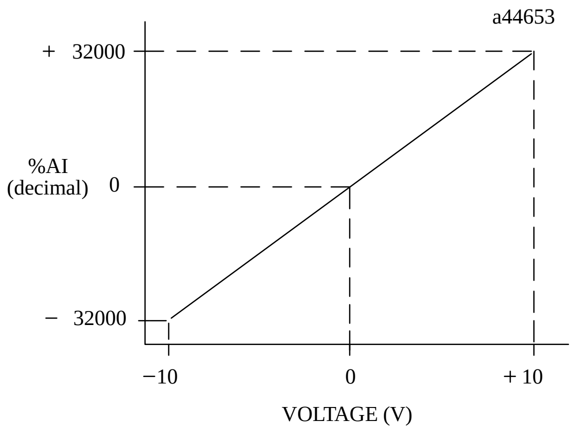


Figure 3.11 – Scaling for Voltage Input

A limited current input mode is also provided in the module. A jumper is provided on the user terminal connector for each channel, which may be used to connect the internal 250 ohm shunt resistor into the circuit. The shunt resistor effectively provides a –40 to +40 mA current input range. However, the input current should generally not exceed ±20 mA, to avoid self-heating of the input resistor and a corresponding loss of accuracy. A 4 to 20 mA input corresponds to a 1 to 5 volt input to the voltage input module; therefore, the resolution of the 4 to 20 mA input signal is approximately 10 bits binary (1 part in 1024). The resolution can be increased to approximately 11 bits (1 part in 2048) by using a precision 250 ohm resistor in place of the jumper. The resistor causes the voltage input module to see a 4 to 20 mA input as 2 to 10 volts.

The main power source for the module is derived from the isolated +24 VDC power supplied by the PLC power supply. This voltage is routed through an inverter/regulator to produce the operating voltages for the module. This module also consumes 27 mA from the +5 VDC output of the PLC power supply. An LED at the top of the module's faceplate is ON when the module's power supply is operating. The module provides electrical isolation of externally generated noise between the field wiring and the backplane through optical isolation.

To minimize the capacitive loading and noise, all field connections to the module should be wired using a good grade of twisted, shielded instrumentation cable. The shields can be connected to either COM or GND. The COM connection provides access to the common of the analog circuitry in the module. The GND connection provides access to the baseplate (frame ground).

This module can be installed in any I/O slot of a 5 or 10-slot baseplate in an Alspa C80–35 PLC system. A maximum of six Analog Voltage Input modules can be installed in a baseplate.

Note

Connect the + and – terminals together for all unused inputs in order to minimize any fluctuations in the analog input table for the unused points.

Voltage Range	–10 to +10 volts [1]
Calibration	Factory calibrated
Update Rate	4 msec (all four channels)
Resolution	5 mV/20 µA, (1 LSB = 5 mV)
Absolute Accuracy[2]	±10 mV/40 µA (typical) over operating temperature ±30 mV/160 µA (maximum) over operating temperature
Linearity	< 1 Least Significant Bit
Isolation	1500 volts between field side and logic side
Cross-Channel Rejection	> 80 dB
Input Impedance	> 9 Megohms (voltage mode) 250 ohms (current mode)
Input Filter Response	17 Hz
Internal Power Consumption	27 mA from +5 volt bus on the backplane 98 mA from the isolated +24 volt backplane bus

(1) Both inputs must be within ± 11 volts of COM, including any noise present on the inputs.
(2) In the presence of severe RF interference (IEC 801-3, 10V/m), accuracy may be degraded to ± 100 mV/400 mA.
Refer to data sheet ALS 53002 for product standards and general specifications.

Table 3.7 – Specifications for Analog Voltage Input Module - IC693ALG220

4.1.1. Analog Voltage Input Block Diagram

The following figure is a block diagram of the 4-Channel Analog Voltage Input Module.

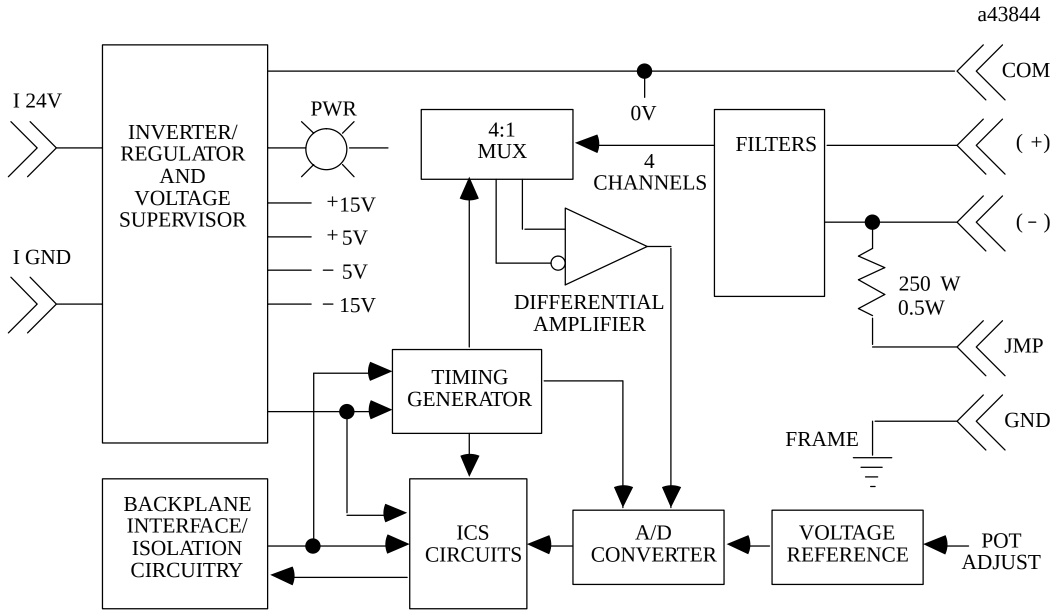


Figure 3.12 – Analog Voltage Input Module Block Diagram for IC693ALG220

4.1.2. Field Wiring Information

The following figure provides information for connecting field wiring to the 4-Channel Analog Voltage Input module.

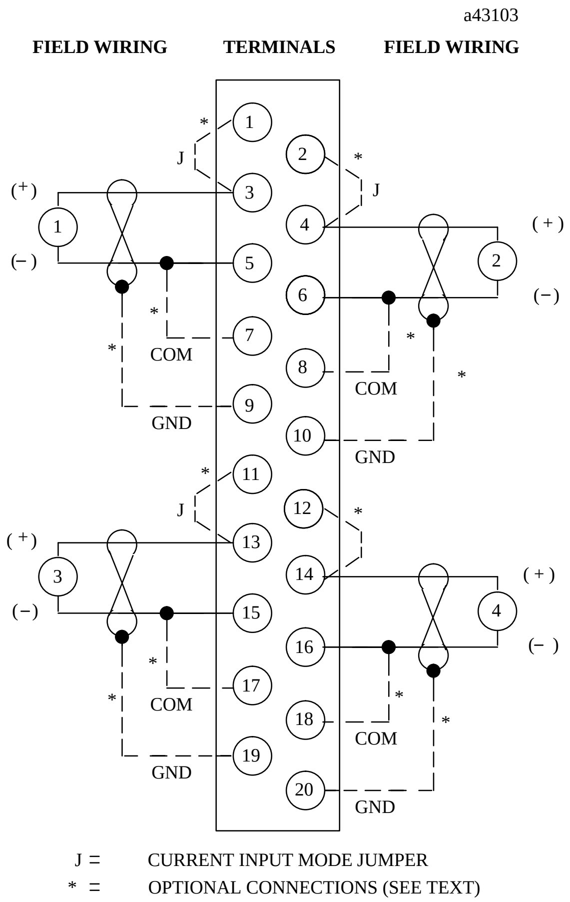


Figure 3.13 – Field Wiring for 4-Channel Analog Voltage Input Module

Note

The (–) side of the voltage source may also be tied to the COM terminal if the source is floating to limit common-mode voltages. The COM connection provides access to the common of the analog circuitry in the module. The GND connection provides access to the baseplate (frame ground).

4.2. Analog Current Input - 4 Channel IC693ALG221

The ***4-Channel Analog Current Input module*** for the Alspa C80–35 Programmable Logic Controller provides four input channels, each capable of converting an analog input signal to a digital signal for use as required by your application. This module provides two input ranges. The default range is 4 to 20 mA with user data scaled so that 4 mA corresponds to a count of 0 and 20 mA corresponds to a count of 32000 with each 1000 counts representing 0.5 mA. When a jumper is added to the I/O terminal board, the input range is changed to 0 to 20 mA with user data scaled so that 0 mA corresponds to a count of 0 and 20 mA corresponds to a count of 32000 with each 800 counts representing 0.5 mA. Two range jumpers can be fitted on the module; one for channels one and two, and the other for channels three and four.

Conversion speed for each of the four channels is one-half millisecond. This provides an update rate of two milliseconds for any channel. Resolution of the converted signal is 12 bits binary (1 part in 4096) over either range. User data in the %AI registers is in 16-bit 2's complement format. The placement of the 12 bits from the A/D converter in the %AI data word is shown below. The relationship between the current input and the data from the A/D converter is shown in Figure 3.14 and Figure 3.15.

MSB															LSB
X	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0	X	X	X

X=not applicable to this discussion.

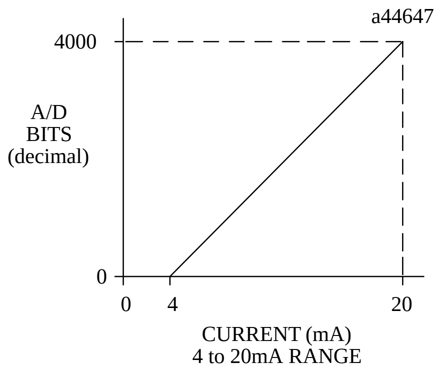


Figure 3.14 – A/D Bits vs. Current Input, 4 to 20 mA

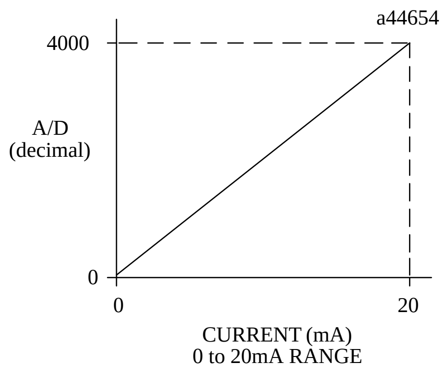


Figure 3.15 – A/D Bits vs. Current Input, 0 to 20 mA

If the current source is reversed into the input, or is less than the low end of the current range, then the module will output a data word corresponding to the low end of the current range (0000H in %AI). If an input that is out of range is entered (that is, it is greater than 20 mA), the A/D converter will output up to full scale (corresponding to 7FF8H in %AI).

Scaling of the input is shown in Figure 3.16 and Figure 3.17.

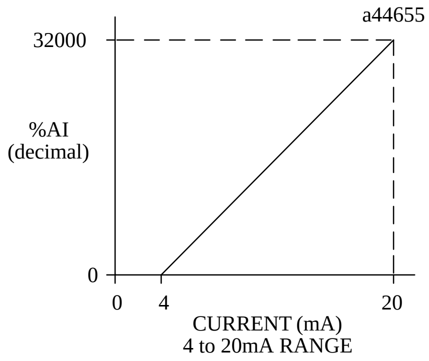


Figure 3.16 – Scaling for Analog Current Input Module, 4 to 20 mA

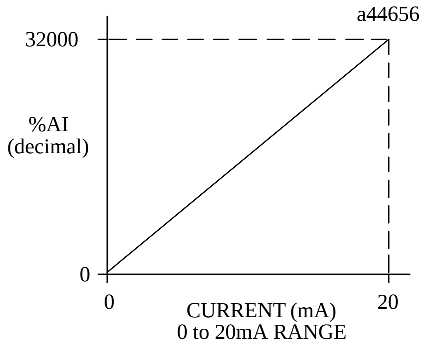


Figure 3.17 – Scaling for Analog Current Input Module, 0 to 20 mA

Input protection for the module is sufficient to guarantee operation with reduced performance with up to 200V common-mode. The module provides electrical isolation of externally generated noise between field wiring and the backplane through the use of optical isolation.

To minimize the capacitive loading and noise, all field connections to the module should be wired using a good grade of twisted, shielded instrumentation cable. The shields can be connected to either COM or GND. The COM connection provides access to the common of the analog circuitry in the module. The GND connection provides access to the baseplate (frame ground).

An LED at the top of the faceplate is ON when the module's power supply is operating. The main power source for the module is the isolated +24 VDC power supplied by the PLC power supply. This voltage is routed through an inverter/regulator to provide the operating voltage for the module. This module also consumes power from the +5 VDC output of the PLC power supply to drive the isolation circuitry. This module can be installed in any I/O slot of a 5 or 10-slot baseplate in an Alspa C80–35 PLC system. See § 3., page 3–13 to determine the number of Analog Current Input modules that can be installed in a baseplate.

Input Current Ranges	4 to 20 mA and 0 to 20 mA
Calibration	Factory calibrated to 4 µA per count
Update Rate	2 msec (all four channels)
Resolution at 4-20 mA	4 µA (1 LSB = 4 µA)
Resolution at 0-20 mA	5 µA (1 LSB = 5 µA)
Absolute Accuracy*	0.1% full scale + 0.1% reading
Common Mode Voltage	200 volts
Linearity	< 1 Least Significant Bit
Isolation	1500 volts between field side and logic side
Common Mode Rejection	> 70 dB at DC; >70 dB at 60 Hz
Cross-Channel Rejection	> 80 dB from DC to 1 kHz
Input Impedance	250 ohms
Input Filter Response	325 Hz
Internal Power Consumption	100 mA from the isolated +24 volt supply 25 mA from+5 volt bus on the backplane

* In the presence of severe RF interference (IEC 801-3, 10V/m), accuracy may be degraded to ±0.5% FS.
Refer to data sheet ALS 53002 for product standards and general specifications.

Table 3.8 – Specifications for Analog Current Input Module - IC693ALG221

4.2.1. Analog Current Input Block Diagram

The following figure is a block diagram of the 4-Channel Analog Current Input Module.

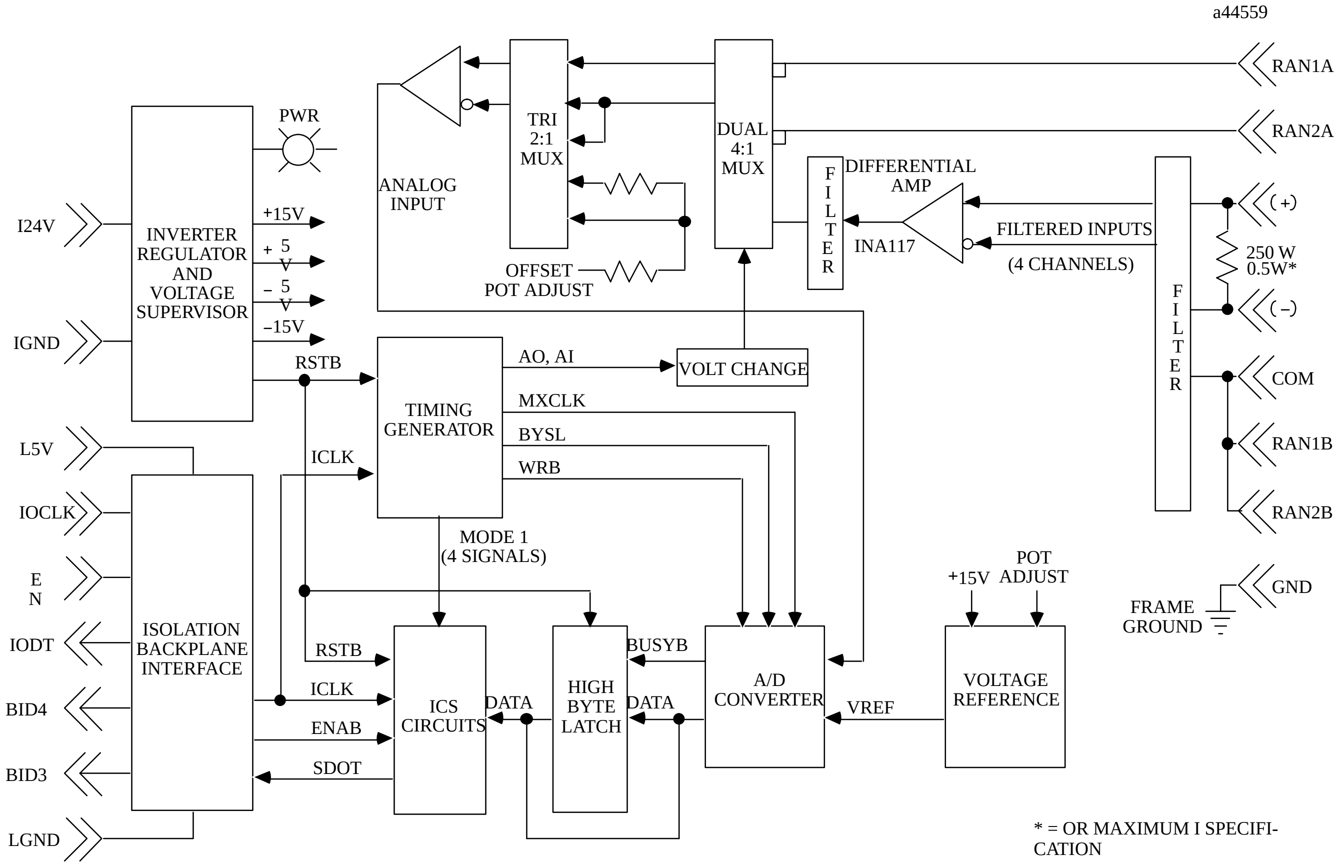


Figure 3.18 – Analog Current Input Module Block Diagram - IC693ALG221

4.2.2. Field Wiring Information

The following figure provides information for connecting field wiring to the user terminal board on the 4-Channel Analog Current Input Module.

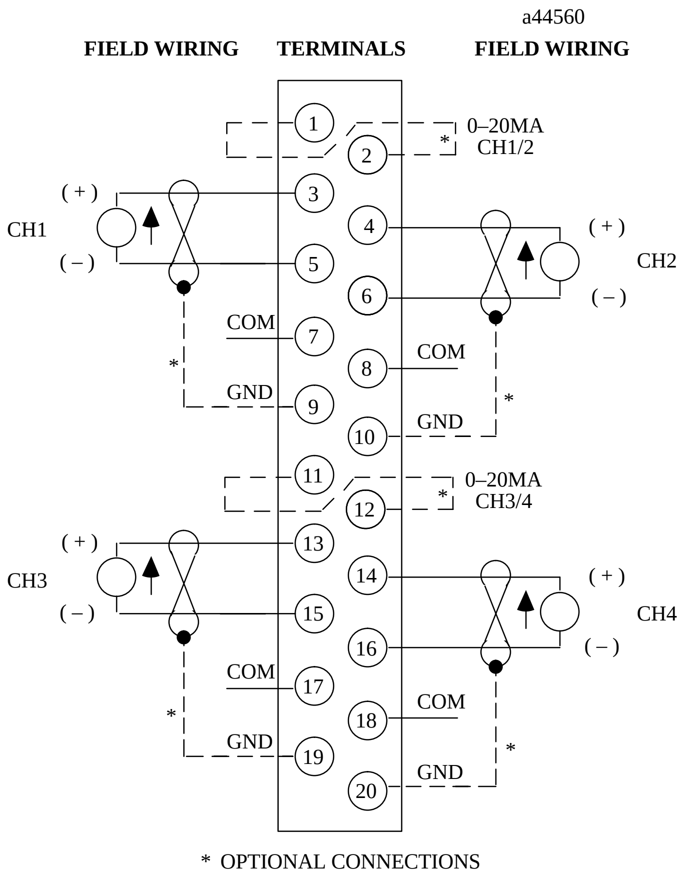


Figure 3.19 – Field Wiring for 4 Channel Analog Current Input Module

Note

The current source may also be tied to the COM terminal if the source is floating to limit common-mode voltages.

4.3. Analog Voltage Input - 16 Channel IC693ALG222

The ***16-Channel Analog Voltage Input*** module provides up to 16 single-ended or eight differential input channels, each capable of converting an analog input signal to a digital value for use as required by your application. This module provides two input ranges:

- 0 to 10 V (unipolar),
- –10 to +10 V (bipolar).

4.3.1. Voltage Ranges and Input Modes

The default input mode and range is single-ended, unipolar, with the user data scaled so that 0 volts corresponds to a count of 0 and 10 volts corresponds to a count of +32000. The other range and mode are selected by changing the configuration parameters using the Alspa P8 or Alspa P80 configurator software or the Hand-Held Programmer. The range can be configured for bipolar –10 to +10 V where –10 V corresponds to a count of –32000, 0 V corresponds to a count of 0, and +10 V corresponds to a count of +32000.

High and Low alarm limits are available on all ranges. Ranges can be configured on a per channel basis.

4.3.2. Power Requirements and LEDs

This module consumes a maximum of 112 mA from the 5V bus on the PLC backplane. It also requires a maximum of 41 mA from the backplane Isolated+24 Volt DC supply to power the on-board power converter that provides isolated ±5V supplies to power the user-side circuitry (see Table 3.6, page 3–14, Specifications).

There are two green LED indicators on the module which provide module and user supply status. The top LED, **MODULE OK** provides module status information on power-up as follows:

- *ON*: status is OK, module configured;
- *OFF*: no backplane power or software not running (watchdog timer timed out);
- *Continuous rapid flashing*: configuration data not received from CPU;
- *Slow flashes, then OFF*: failed power-up diagnostics or encountered code execution error.

The bottom LED, **Power Supply OK**, indicates that the internally generated user-side +5V supply is above a minimum designated level.

4.3.3. Location in System

This module can be installed in any I/O slot of a 5 or 10-slot baseplate in an Alspa C80–35 PLC system.

4.3.4. References Used

The number of 16-Channel Analog Voltage Input modules which may be installed in a system depends on the amount of %AI and %I references available. Each module uses 1 to 16 %AI references (depending on the number of channels enabled) and from 8 to 40 %I references (depending on alarm status configuration).

The available %AI references are: 64 in Models 311, 313 and 323 system, 128 in a Model 331 system, 1024 in a Model 341 system, and 2048 in Models 351 and 352 system.

The maximum number of 16-Channel Analog Voltage Input modules which may be installed in a system are:

- 4 in a Model 311, 313 or Model 323 system.
- 8 in a Model 331 system.
- 12 in a Model 341 system.
- 51 in a Model 351 or 352 system.

When planning the module configuration for your application you must also consider the load capacity of the installed power supply and the total load requirements of all modules that are installed in the baseplate.

Refer to the *ALS 52117 Alspa C80–35 PLC Installation Manual* for details on power supplies and module load requirements.

Number of Channels	1 to 16 selectable, single-ended 1 to 8 selectable, differential
Input Current Ranges	0V to +10V (unipolar) or –10V to +10V (bipolar); selectable each channel
Calibration	Factory calibrated to: 2.5 mV per count on 0V to +10V (unipolar) range 5 mV per count on –10 to +10V (bipolar) range
Update Rate	6 msec (all 16 single-ended channels) 3 msec (all 8 differential channels)
Resolution at 0V to +10V	2.5 mV (1 LSB = 2.5 mV)
Resolution at –10V to +10V	5 mV (1 LSB = 5 mV)
Absolute Accuracy(2)	± 0.25% of full scale at 25°C (77°F) ± 0.5% of full scale over specified operating temperature range
Linearity	< 1 LSB
Isolation	1500 volts between field side and logic side
Common Mode Voltage (Differential)	± 11V (bipolar range) (1)
Cross-Channel Rejection	> 80 dB from DC to 1 kHz
Input Impedance	>500K ohms (single-ended mode) >1M ohms (differential mode)
Input Filter Response	41 Hz (single-ended mode) 82 Hz (differential mode)
Internal Power Consumption	112 mA (maximum) from the backplane +5 VDC bus 41 mA (maximum) from the backplane Isolated +24 VDC supply

1.The summation of the differential input, common-mode voltage, and noise must not exceed ± 11 volts when referenced to COM.

2.In the presence of severe RF interference (IEC 801-3, 10V/m), accuracy may be degraded to ± 5% FS.
Refer to data sheet ALS 53002 for product standards and general specifications.

Table 3.9 – Specifications for 16-Channel Analog Voltage Input Module, IC693ALG222

4.3.5. CPU Interface to the 16-Channel Analog Voltage Input Module

The Alspa C80–35 PLC uses the data within the %AI data table to record analog values for use by the programmable controller. This scheme for the 16-Channel Analog Voltage Input module is shown below. More information on the CPU interface to analog modules can be found at the beginning of this chapter.

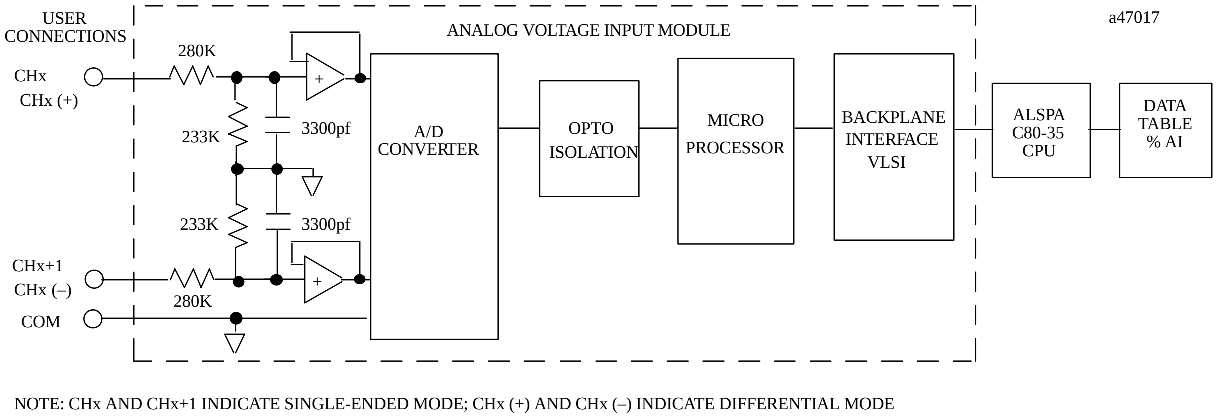


Figure 3.20 – 16-Channel Analog Voltage Input Module Block Diagram - IC693ALG222

4.3.6. Placement of A/D Bits within the Data Tables

Since converters used in the analog modules are 12-bit converters, not all of the 16 bits in the data tables contain data required for the conversion. A version of the 12 bits is placed within the 16-bit data word corresponding to the analog point (in the %AI table). The Alspa C80–35 PLC system handles the integration differently for the various analog modules.

The CPU does not manipulate the data from the input modules before placing it within the word in the %AI data table. The bits in the %AI data table which were not used in the conversion by the input module are either forced to 0 (zero) by the analog input module. Placement of the 12 data bits from the A/D converter for an analog current input data word for the 16-Channel Analog Voltage Input module in unipolar range is shown below.

MSB LSB

X	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0	X	X	X

X=not converted bits

Analog values are scaled over the range of the converter. Factory calibration adjusts the analog value per bit (resolution) to a multiple of full scale (that is, 2.5 mV/bit for unipolar; 5 mV/bit for bipolar). This calibration leaves a normal 12-bit converter with 4000 counts (normally $2^{12} = 4096$ counts). The data is then scaled with the 4000 counts over the analog range. For example, the data to the A/D converter for the 16-Channel Analog Voltage Input is scaled as shown below.

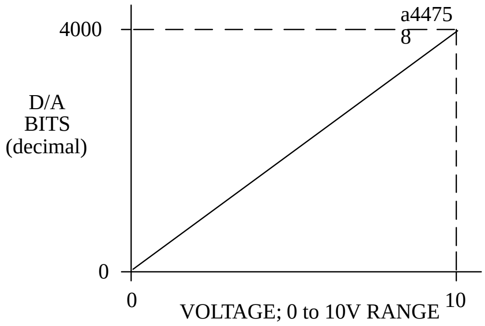


Figure 3.21 – A/D Bits vs. Voltage Input for IC693ALG222

4.3.7. Configuration

The 16-Channel Analog Voltage Input module can be configured using either the Alspa P8–25/35/05 or P80 Programming Software configurator function or with the Hand-Held Programmer.

The parameters that may be configured are described in the following table. Configuration procedures using Alspa P8–25/35/05 Programming Software and the Hand-Held Programmer are described in the following pages.

Parameter Name	Description	Values	Default Values	Units
Active Channels	Number of channels converted	1 to 16	1 (Alspa P8–25/35/05) 16 (Hand-Held programmer)	n/a
Ref Adr	Starting address for %AI reference type	standard range	%AI0001, or next highest available address	n/a
Ref Adr	Starting address for %I reference type	standard range	%I00001, or next highest available address	n/a
%I Size	Number of %I status locations	8, 16, 24, 32, 40	8 (Alspa P8–25/35/05) 40 (Hand-Held Programmer)	bits
Range	Range	0 to 10V or –10 to 10V	0 to 10V	n/a
Alarm Low	Low limit alarm value	–32767 to +32759	0	User counts
Alarm High	High limit alarm value	–32766 to +32760	+32000	User counts

Table 3.10 – Configuration Parameters for IC693ALG222

For more information on configuration, see

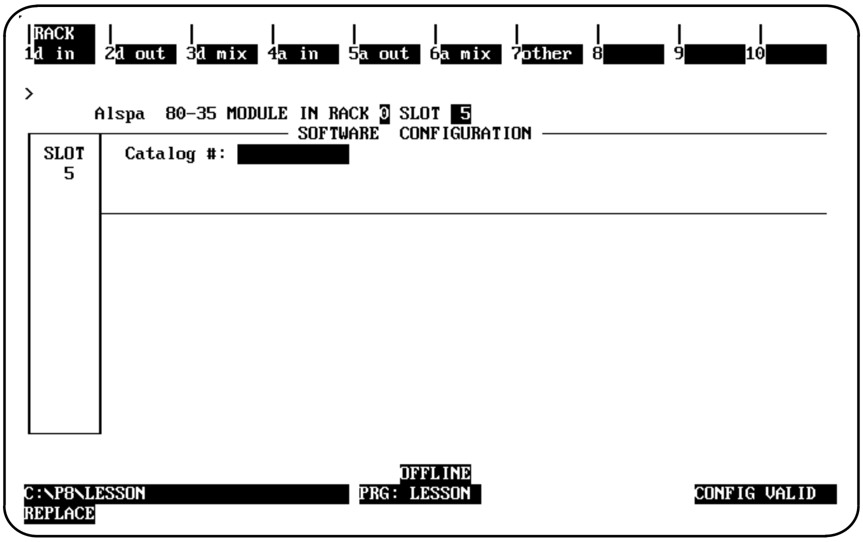
- Configuration Using Alspa P8–25/35/05 or P80 Programming Software beginning on page 3–32 and
- Configuration Using the Hand–Held Programmer beginning on page 3–36.

4.3.7.1. Configuration Using Alspa P8–25/35/05 Software

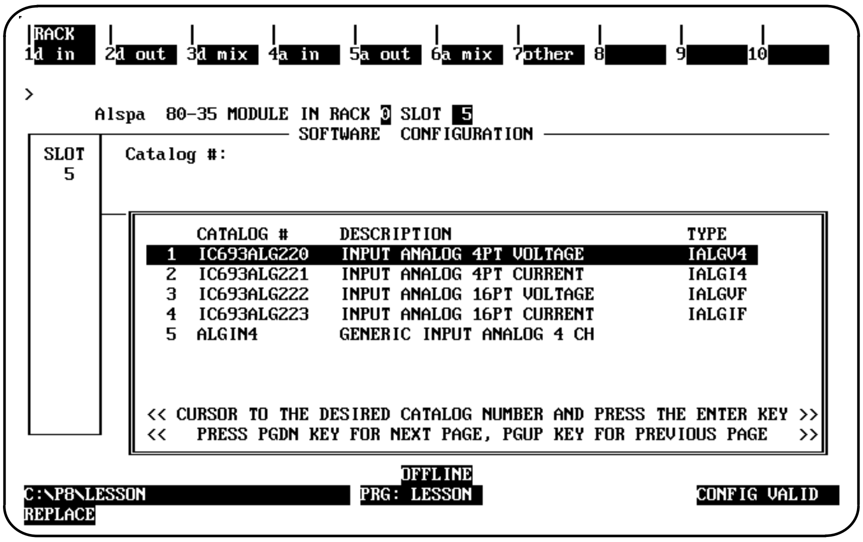
This paragraph describes how you can configure the 16-Channel High Density Analog Voltage Input module using the configurator function in Alspa P8–25/35/05 Programming Software. *Configuration can also be done using Alspa P80 Programming Software. For details refer to the Alspa P80 online help.*

To configure a 16-Channel Analog Voltage Input Module on the I/O Configuration Rack screen:

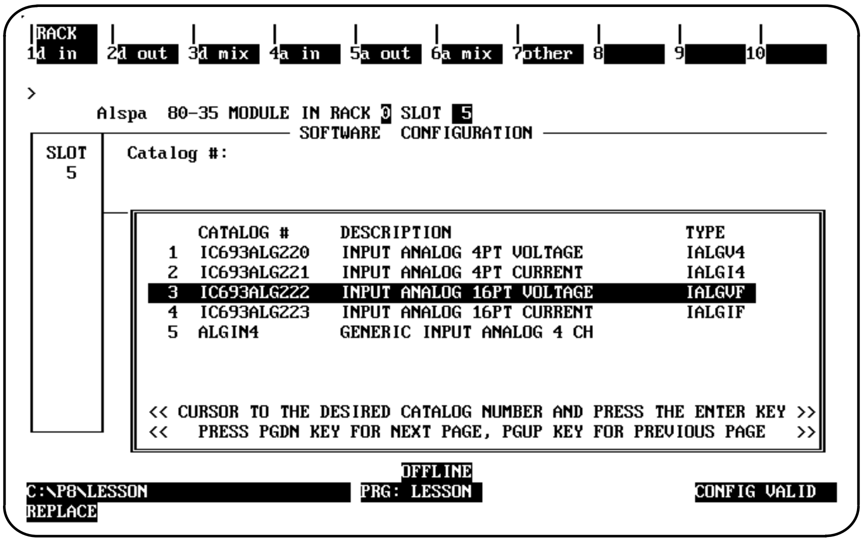
1. Move the cursor to the slot where the module will be located and press the **`m35 io`** softkey (F1). In the following example screen, the module will be placed in slot 5 of the main rack.



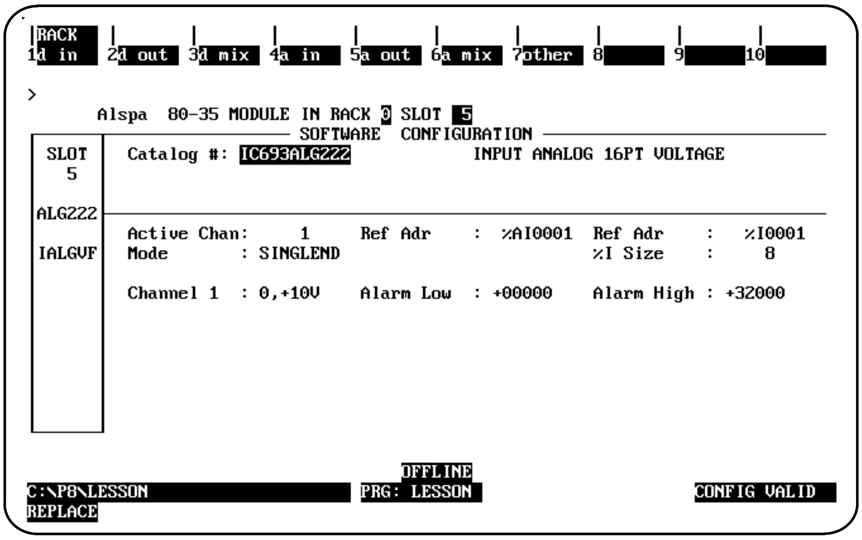
2. Press the **`a in`**, softkey (F4) to display a list of available analog input modules and their catalog numbers.



3. To select the 16-Channel Analog Voltage Input Module, position the cursor on the catalog number for the module, IC693ALG222, and press the **`Enter`** key.



4. After pressing the **Enter** key, the first detail screen, shown below, is displayed. You can then configure the module as required for your application.



Note

Only enabled (active) channels are displayed on the screen.

5. Use the parameter descriptions provided in the following table to help you make selections for the parameters on this screen.

Parameter	Description
Active Channel	Enter a number from 1* to 16 for Single Ended or 1* to 8 for Differential. This number represents the number of channels to be converted. Channels are scanned in sequential, contiguous order, with channel No. 1 being the first channel scanned. If more than eight channels are selected, a second detail screen will be displayed to allow you to Enter data in channels 9 to 16.
Reference Address	The first *Reference Address* field contains the reference address for %AI data. The address points to the location in %AI memory where input data to the module begins. Each channel provides 16 bits of analog input data as an integer value from 0 to 32760 or –32767 to 32752, depending on the range type selected.
Reference Address	The second *Reference Address* field contains the reference address for %I data. The address points to the location in %I memory where status information from the module begins. You can select the number of %I status locations reported to the PLC by editing the value in the *%I Size* field.
Mode	The *Mode* field describes what type user connection to the terminal board is desired. In *Single Ended mode, there are 16 inputs referenced to a single common. In Differential mode each of the 8 inputs has its own signal and common, thereby using two points on the terminal board for each channel.
%I Size	Enter the number of %I locations reported to the PLC. Choices are 0, 8, 16, 24, 32, or 40. The data is brought back in the following format:
	<u>First eight %I locations</u>: (available for %I SIZE values 8, 16, 24, 32 and 40) • %I = Module OK: 0 = module NOT OK; 1 = module OK. • %I+1 = User Supply OK: 0 = below limit; 1 = user supply OK. • %I+2 to %I+7 = Reserved for future modules.
	<u>Second eight %I locations</u>: (available for %I SIZE values 16, 24, 32 and 40) • %I+8 = Channel No. 1 ALARM LO 0 = above limit; 1 = below or equal to limit. • %I+9 = Channel No. 1 ALARM HI: 0 = below limit; 1 = above or equal to limit. • %I+10 = Channel No. 2 ALARM LO: 0 = above limit; 1 = below or equal to limit. • %I+11 = Channel No. 2 ALARM HI: 0 = below limit; 1 = above or equal to limit. • %I+12 = Channel No. 3 ALARM LO: 0 = above limit; 1 = below or equal to limit. • %I+13 = Channel No. 3 ALARM HI: 0 = below limit; 1 = above or equal to limit. • %I+14 = Channel No. 4 ALARM LO: 0 = above limit; 1 = below or equal to limit. • %I+15 = Channel No. 4 ALARM HI: 0 = below limit; 1 = above or equal to limit.
	<u>Third eight %I locations</u>: (available for %I SIZE values 24, 32 and 40) • %I+16 = Channel No. 5 ALARM LO 0 = above limit; 1 = below or equal to limit. • %I+17 = Channel No. 5 ALARM HI: 0 = below limit; 1 = above or equal to limit. • %I+18 = Channel No. 6 ALARM LO: 0 = above limit; 1 = below or equal to limit. • %I+19 = Channel No. 6 ALARM HI: 0 = below limit; 1 = above or equal to limit. • %I+20 = Channel No. 7 ALARM LO: 0 = above limit; 1 = below or equal to limit. • %I+21 = Channel No. 7 ALARM HI: 0 = below limit; 1 = above or equal to limit. • %I+22 = Channel No. 8 ALARM LO: 0 = above limit; 1 = below or equal to limit. • %I+23 = Channel No. 8 ALARM HI: 0 = below limit; 1 = above or equal to limit.
	<u>Fourth eight %I locations</u>: (available for %I SIZE values 32 and 40) • %I+24 = Channel No. 9 ALARM LO 0 = above limit; 1 = below or equal to limit. • %I+25 = Channel No. 9 ALARM HI: 0 = below limit; 1 = above or equal to limit. • %I+26 = Channel No. 10 ALARM LO: 0 = above limit; 1 = below or equal to limit. • %I+27 = Channel No. 10 ALARM HI: 0 = below limit; 1 = above or equal to limit. • %I+28 = Channel No. 11 ALARM LO: 0 = above limit; 1 = below or equal to limit. • %I+29 = Channel No. 11 ALARM HI: 0 = below limit; 1 = above or equal to limit. • %I+30 = Channel No. 12 ALARM LO: 0 = above limit; 1 = below or equal to limit. • %I+31 = Channel No. 12 ALARM HI: 0 = below limit; 1 = above or equal to limit.

Table 3.11 – Parameter Descriptions for Configuration

Parameter	Description
%I Size (cont'd)	Fifth eight %I locations: (available for %I SIZE value 40) ● %I+32 = Channel No. 13 ALARM LO 0 = above limit; 1 = below or equal to limit. ● %I+33 = Channel No. 13 ALARM HI: 0 = below limit; 1 = above or equal to limit. ● %I+34 = Channel No. 14 ALARM LO: 0 = above limit; 1 = below or equal to limit. ● %I+35 = Channel No. 14 ALARM HI: 0 = below limit; 1 = above or equal to limit. ● %I+36 = Channel No. 15 ALARM LO: 0 = above limit; 1 = below or equal to limit. ● %I+37 = Channel No. 15 ALARM HI: 0 = below limit; 1 = above or equal to limit. ● %I+38 = Channel No. 16 ALARM LO: 0 = above limit; 1 = below or equal to limit. ● %I+39 = Channel No. 16 ALARM HI: 0 = below limit; 1 = above or equal to limit.
Range	Select the range. Choices are *0 to 10V or –10 to 10V. In the 0 to 10V default range, input voltage values ranging from 0 to 10V report 0 to 32 000 integer values to the CPU. In the –10 to 10V range, input voltage values ranging from –10 to 10V report –32 000 to 32 000 integer values to the CPU.
Alarm Low	Enter a value that causes an alarm low indication to be passed to the PLC. Each channel has a low limit alarm value (ALARM LO), which causes %I points to be set. Values Entered without a sign are assumed to be positive. Value checking should be done to determine if the alarm low values are allowed for the appropriate range. The values allowed are: ● 0 to 10V Range= 0 to 32760 ● –10 to 10V Range = –32767 to 32752
Alarm High	Enter a value that causes an alarm high indication to be passed to the PLC. Each channel has a high limit alarm value (ALARM HI), which causes %I points to be set. Values Entered without a sign are assumed to be positive. Value checking should be done to determine if the alarm high values are allowed for the appropriate range. The values allowed are: ● 0 to 10V Range= 0 to 32760 ● –10 to 10V Range = –32767 to 32752

* Default selection.

Table 3.11 – Parameter Descriptions for Configuration (continued)

6. Press **`Rack`** (Shift-F1) or the **`Escape`** key to return to the rack display.

4.3.7.2. Configuration Using the Hand–Held Programmer

You can also configure the 16-Channel Analog Voltage Input module using the Alspa C80–35 Hand–Held Programmer. In addition to the information in this paragraph, refer to *ALS 52202 Hand–Held Programmer for Alspa C80–35, C80–25 and C80–05 PLCs User's Manual* for more information on configuration of Intelligent I/O modules.

Although you can change the number of actively scanned channels with the Alspa P8–25/35/05 configurator function, the Hand–Held Programmer does not support editing the number of actively scanned channels. If the 16-Channel Analog Voltage Input module is initialized by a Hand–Held Programmer, the number of actively scanned channels is 16.

If a module had been previously configured with Alspa P8–25/35/05 software and the number of actively scanned channels has been changed from 16, that number will be displayed on the bottom line of the Hand–Held Programmer display following the AI. You can edit data with the Hand–Held Programmer only for the active channels, but can not change the number of actively scanned channels.

Module Present

If a module is physically present in a system, it can be added to the system's configuration by reading the module into it. For example, assume that a 16-Channel Analog Voltage Input module is installed in slot 3 of a Model 311 PLC system. It can be added to the configuration with the following sequence. Use the Up and Down cursor keys or the # key to display the selected slot.

Initial Display

```
R0:03 EMPTY   >S
```

To add the IC693ALG222 module to the configuration, press the **READ/VERIFY** key. The following screen will be displayed:

```
R0:03 HI-DEN V >S
 I40:I_
```

Selecting %I Reference

At this point the starting %I reference address for the status data returned from the module must be entered. Notice that the length of the status field (**40**) is displayed as the first two digits following the first **I** on the second line of the display.

Note

This field cannot be changed with the Hand–Held Programmer. However, it can be changed using the Alspa P8–25/35/05 software configurator function. The Hand–Held Programmer will always reflect the currently active length of the status field.

Pressing the **ENT** key will allow the PLC to select the starting address of the status data. You can select a specific starting address by pressing the key sequence for the desired address and pressing the **ENT** key. For example to specify the starting address as I17, press the key sequence **1**, **7, ENT**. The following screen will be displayed:

```
R0:03 HI–DEN V >S
 I40:I17–I56
```

Selecting %AI Reference

After the starting %I address has been selected, pressing the **ENT** key again will cause the following screen to be displayed:

```
R0:03 HI–DEN V >S
 AI16:AI_
```

This screen allows you to select the starting address for the %AI reference. Note that the length of the status field (**16**) is displayed as the first two digits following the first **AI** on the second line of the display.

Note

This field cannot be changed with the Hand–Held Programmer. However, it can be changed using the Alspa P8–25/35/05 software configurator function. The Hand–Held Programmer will always reflect the currently active length of the status field.

In the AI field you can select the next available address (the default) by pressing the **ENT** key or by entering a specific address. To enter a specific address, press the starting reference number keys and the **ENT**. key (for example **3, 5**, then **ENT**.

```
R0:03 HI-DEN V >S
 AI16:AI035-AI051
```

You can press the **CLR** key at any time to abort the configuration you have just selected and return the slot to EMPTY.

Removing Module From Configuration

If required, this module can be removed from the current configuration. Assume that the module is currently configured in rack 0, slot 3. It can be deleted with the following sequence:

Initial Display

```
R0:03 HI-DEN V >S
 AI16:AI_
```

To delete the module, press the **DEL**, **ENT** key sequence. The display will then be:

```
R0:03 EMPTY    >S
```

Selecting Module Mode

To display the module mode, press the → key. The display will show the current mode of the module. The default mode is Single Ended.

Initial Display

```
R0:03 HI-DEN V >S
 HI-DEN V:SINGLE
```

You can toggle between the Single Ended and Differential modes by pressing the ± key. Each mode will be selected as shown. The range selected is the one currently displayed.

Initial Display

```
R0:03 HI-DEN V >S
 HI-DEN V:DIFFERE
```

When the desired mode for the module is displayed on the screen you can selected it by pressing the **ENT** key.

Selecting Input Channel Ranges

The range for each of the 16 channels can be displayed and selected or changed as described below. Assume that the %AI address is as previously selected.

Initial Display

```
R0:03 HI-DEN V >S
 HI-DEN V:SINGLE
```

To display the channel ranges press the → key. The display will show Channel 1 (or the currently selected channel) and the first available range.

```
R0:03 HI-DEN V >S
CHAN 1: 0 - 10
```

You can toggle through the range for each channel by pressing the ± key. Each range will be displayed as shown. The range selected is the one currently displayed.

```
R0:03 HI-DEN V >S
CHAN 1:-10 - 10
```

Alarm Limits Display

To view the alarm limits for the channel currently displayed, press the → key again (the first time caused the channel ranges to be available for editing). The following screen is displayed:

```
R0:03 HI–DEN V >S
CH 1 LO:     0
```

The display is the entry field for the low alarm limit for the displayed channel (in this case, Channel 1). You can enter the desired low alarm limit value using the numeric keys and the ± key for specifying negative values. Enter the low alarm limit using a value within the valid limits as listed in Table 3.10 After you have entered the low alarm limit value, press the → key again to advance to the high alarm limit display for this channel. The following screen is displayed at this time.

```
R0:03 HI–DEN V >S
CH 1: HI: 32000
```

The display shows the entry field for the high alarm limit for the currently displayed channel. You can enter positive or negative numbers (see Table 3.10) using the ± and numeric keys. After selecting the low and high alarm limits for channel 1 (or the currently displayed channel), you can view the next channel by pressing the → key.

```
R0:03 HI–DEN V >S
CHAN 2:0 – 10
```

Edit the range, and low and high alarm limits as described for Channel 1. All active channels can be changed in this manner. Return to the initial display screen by pressing the **ENT** key or by pressing the ← key until the initial screen is displayed.

Saved Configurations

Configurations that contain a 16-Channel Analog Voltage Input module can be saved to an EEPROM or MEM card and read into the CPU at a later time. MEM cards and EEPROMs containing these configurations can be read into any Release 4 or later CPU. Refer to Chapter 2 of the *ALS 52202 Hand–Held Programmer for Alspa C80–35, C80–25 and C80–05 PLCs User's Manual* for detailed information on the Save and Restore operations.

4.3.8. Field Wiring Connections

Connections to this module from user devices are made to screw terminals on a removable 20-terminal connector block mounted on the front of the module. The actual terminals used are described in the following table and are shown in the following wiring diagrams.

4.3.8.1. Terminal Assignments

Pin assignments for the 20 terminal I/O connector on the 16-Channel Analog Voltage Input module are as shown in the following table.

Pin Number	Signal Name	Signal Definition
1	n/a	not used
2	n/a	not used
3	CH1	Single Ended Channel 1, Differential Channel 1 (Positive terminal)
4	CH2	Single Ended Channel 2, Differential Channel 1 (Negative terminal)
5	CH3	Single Ended Channel 3, Differential Channel 2 (Positive terminal)
6	CH4	Single Ended Channel 4, Differential Channel 2 (Negative terminal)
7	CH5	Single Ended Channel 5, Differential Channel 3 (Positive terminal)
8	CH6	Single Ended Channel 6, Differential Channel 3 (Negative terminal)
9	CH7	Single Ended Channel 7, Differential Channel 4 (Positive terminal)
10	CH8	Single Ended Channel 8, Differential Channel 4 (Negative terminal)
11	CH9	Single Ended Channel 9, Differential Channel 5 (Positive terminal)
12	CH10	Single Ended Channel 10, Differential Channel 5 (Negative terminal)
13	CH11	Single Ended Channel 11, Differential Channel 6 (Positive terminal)
14	CH12	Single Ended Channel 12, Differential Channel 6 (Negative terminal)
15	CH13	Single Ended Channel 13, Differential Channel 7 (Positive terminal)
16	CH14	Single Ended Channel 14, Differential Channel 7 (Negative terminal)
17	CH15	Single Ended Channel 15, Differential Channel 8 (Positive terminal)
18	CH16	Single Ended Channel 16, Differential Channel 8 (Negative terminal)
19	COM	Common connection for Single Ended Channels
20	GND	Frame ground connections for cable shields

Table 3.12 – Terminal Pin Assignments for IC693ALG222

4.3.8.2. Analog Voltage Input Block Diagram

The following figure is a block diagram of the 16-Channel Analog Voltage Input Module.

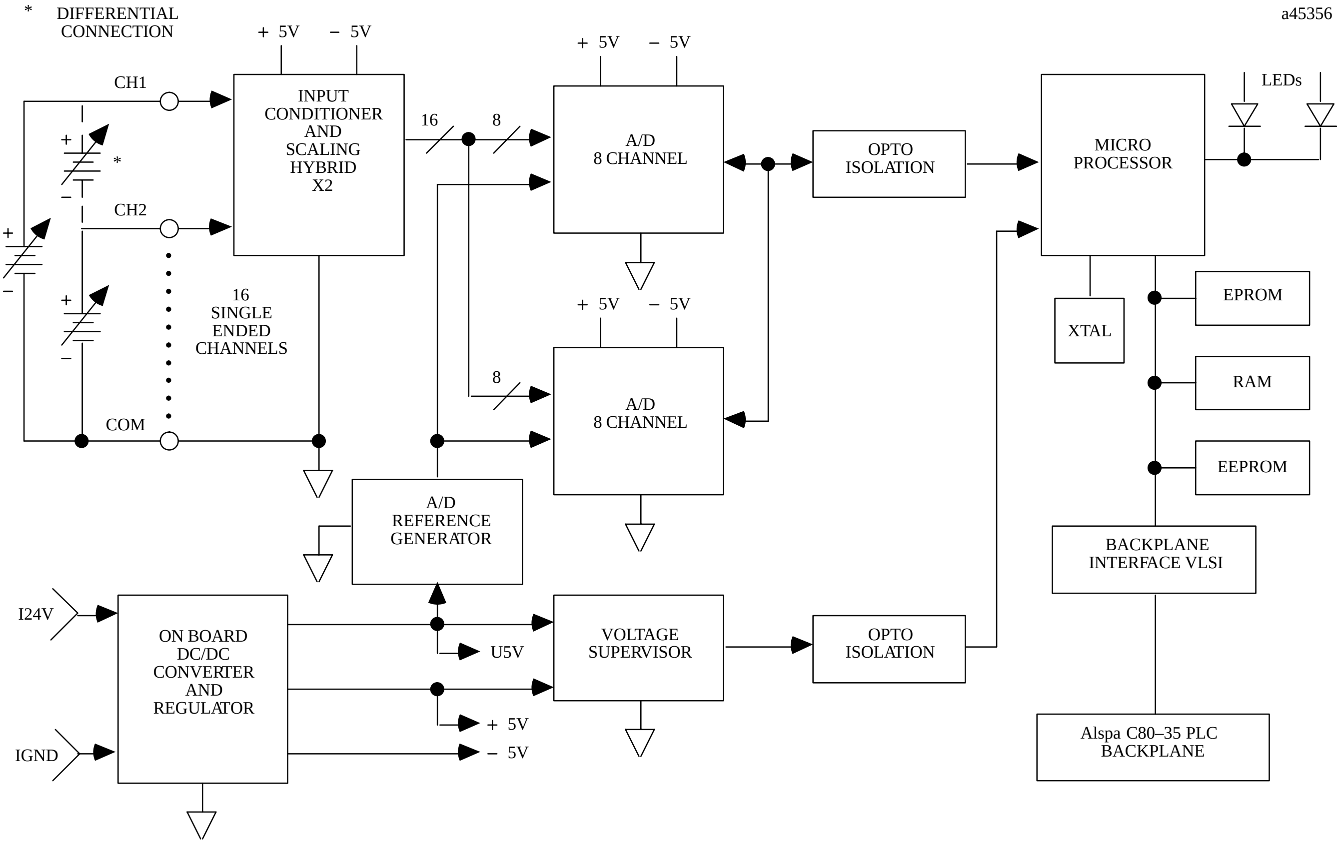


Figure 3.22 – 16-Channel Analog Voltage Input Module Block Diagram - IC693ALG222

4.3.8.3. Field Wiring Information

The following figures provide information for connecting field wiring to the user terminal board on the 16-Channel Analog Voltage Input Module.

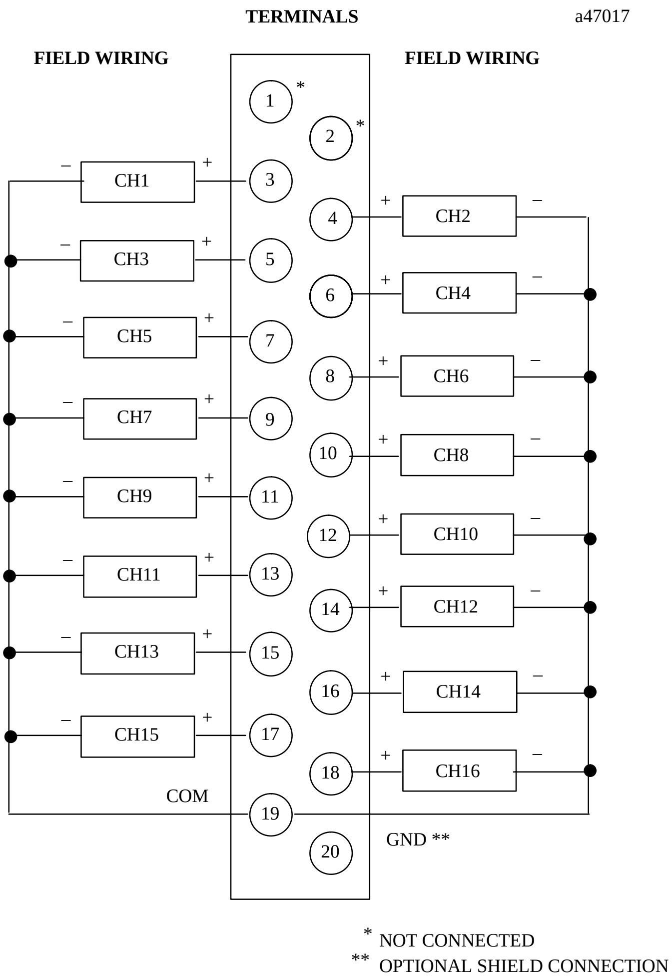


Figure 3.23 – Field Wiring for 16-Channel Analog Voltage Input Module - IC693ALG222 (Single-Ended Mode)

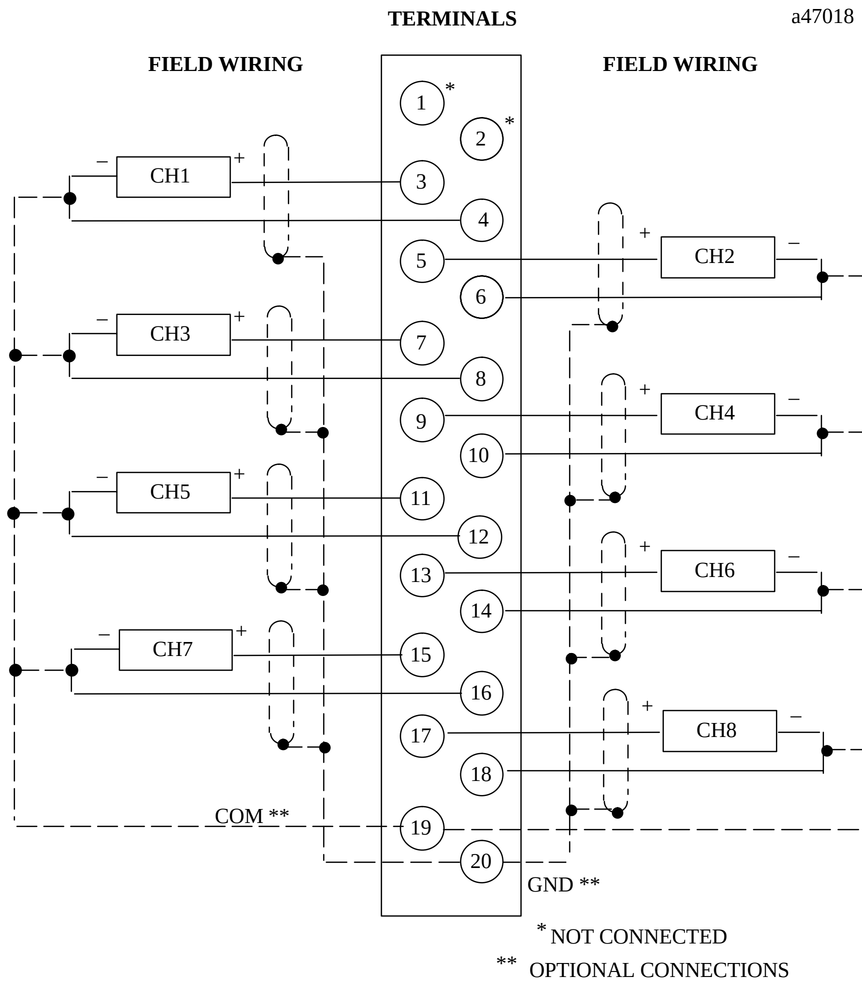


Figure 3.24 – Field Wiring for 16-Channel Analog Voltage Input Module - IC693ALG222 (Differential Mode)

4.4. Analog Current Input - 16 Channel IC693ALG223

The ***16-Channel Analog Current Input*** module provides up to 16 single-ended input channels, each capable of converting an analog input signal to a digital value for use as required by your application. This module provides three input ranges:

- 4 to 20 mA,
- 0 to 20 mA,
- 4 to 20 mA Enhanced.

4.4.1. Current Ranges

The default range is 4 to 20 mA with user data scaled so that 4 mA corresponds to a count of 0 and 20 mA corresponds to a count of 32000. The other ranges are selected by changing the configuration parameters using the Alspa P8 configurator software or the Hand–Held Programmer. The range can be configured so that the input range is 0 to 20 mA with user data scaled so that 0 mA corresponds to a count of 0 and 20 mA corresponds to a count of 32000. Full 12-bit resolution is available over the 4 to 20 and 0 to 20 mA ranges.

A 4 to 20 mA Enhanced range can also be selected. When this range is selected, 0 mA corresponds to a count of –8000, 4 mA corresponds to a count of 0 (zero) and 20 mA corresponds to a count of +32000. The Enhanced range uses the same hardware as the 0 to 20 mA range but automatically provides 4 to 20 mA range scaling with the exception that negative digital values are provided to the user for input current levels between 4 mA and 0 mA. This gives you the capability of selecting a low alarm limit that detects when the input current falls from 4 mA to 0 mA, which provides for open-wire fault detection in 4 to 20 mA applications. High and Low alarm limits are available on all ranges. Ranges can be configured on a per channel basis. The module also reports module status and user-side supply status to the CPU.

4.4.2. Power Requirements and LEDs

This module consumes 120 mA from the 5V bus on the PLC backplane and also requires 65 mA plus current loop current(s) from a user supplied +24V supply (see Table 3.13: Specifications).

There are two green LED indicators on the module which provide module and user supply status. The top LED, **MODULE OK** provides module status information on power-up as follows:

- *ON*: status is OK, module configured.
- *OFF*: no backplane power or software not running (watchdog timer timed out).
- *Continuous rapid flashing*: configuration data not received from CPU.
- *Slow flashes, then OFF*: failed power-up diagnostics or encountered code execution error.

The bottom LED, **User Supply OK**, indicates that the user provided 24V supply is within specifications, thereby enabling the analog side of the module to work properly.

4.4.3. Location in System

This module can be installed in any I/O slot of a 5 or 10-slot baseplate in an Alspa C80–35 PLC system.

4.4.4. References Used

The number of 16-Channel Analog Current Input modules which may be installed in a system depends on the amount of %AI and %I references available. Each module uses 1 to 16 %AI references (depending on the number of channels enabled) and from 8 to 40 %I (depending on alarm status configuration) references.

The available %AI references are: 64 in Models 311, 313 and 323 system, 128 in a Model 331 system, 1024 in a Model 341 system, and 2048 in Models 351 and 352 system.

The maximum number of 16-Channel Analog Current Input modules which may be installed in a system are:

- 4 in Models 311, 313 or 323 system.
- 8 in a Model 331 system.
- 49 in a Model 341 system.
- 79 in Model 351 and 352 system.

When planning the module configuration for your application you must also consider the load capacity of the installed power supply and the total load requirements of all modules that are installed in the baseplate.

Refer to the *ALS 52117 Alspa C80–35 PLC Installation Manual* for details on power supplies and module load requirements.

Number of Channels	1 to 16 selectable; single ended
Input Current Ranges	0 to 20 mA, 4 to 20 mA and 4 to 20 mA Enhanced (selectable per channel)
Calibration	Factory calibrated to: 4 µA per count on 4 to 20 mA range 5 µA per count on 0 to 20 mA and 4 to 20 mA Enhanced range
Update Rate	13 msec (all 16 channels)
Resolution at 4-20 mA	4 µA (4 µA/bit)
Resolution at 0-20 mA	5 µA (5 µA/bit)
Resolution at 4-20 mA Enhanced	5 µA (5 µA/bit)
Absolute Accuracy*	± 0.25% of full scale at 25°C (77°F): ± 0.5% of full scale over specified operating temperature range
Linearity	< 1 LSB from 4 to 20 mA (4 to 20 mA range) < 1 LSB from 100 µA to 20 mA (0 to 20 mA and 4 to 20 mA Enhanced ranges)
Isolation	1500 volts between field side and logic side
Common Mode Voltage	0 volts (single-ended channels)
Cross-Channel Rejection	> 80 dB from DC to 1 kHz
Input Impedance	250 ohms
Input Low Pass Filter Response	19 Hz
External Supply Voltage Range	20 to 30 VDC
External Supply Voltage Ripple	10%
Internal Power Consumption	120 mA from the +5 volt bus on the backplane 65 mA from 24 VDC external user supply (in addition to current loop currents)

* In the presence of severe RF interference (IEC 801-3, 10V/m), accuracy may be degraded to ± 5% FS.
Refer to data sheet ALS 53002 for product standards and general specifications.

Table 3.13 – Specifications for 16-Channel Analog Current Input Module, IC693ALG223

4.4.5. CPU Interface to the 16-Channel Analog Current Input Module

The Alspa C80–35 PLC uses the data within the %AI data table to record analog values for use by the programmable controller. This scheme is shown in Figure 3.25 for the 16-Channel Analog Current Input module. *More detailed information on the CPU interface to analog modules can be found at the beginning of this chapter.*

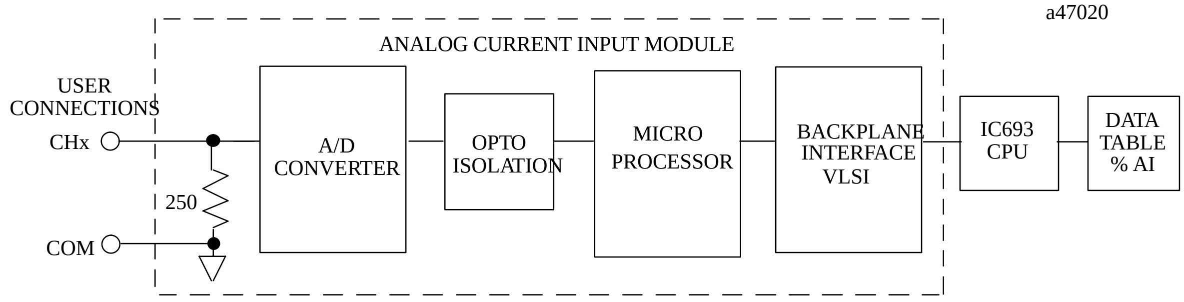


Figure 3.25 – 16-Channel Analog Current Input Module Block Diagram - IC693ALG223

4.4.6. Placement of A/D Bits within the Data Tables

Since converters used in the analog modules are 12-bit converters, not all of the 16 bits in the data tables contain data required for the conversion. A version of the 12 bits is placed within the 16-bit data word corresponding to the analog point (in the %AI table). The Alspa C80–35 PLC system handles the integration differently for the various analog modules.

The CPU does not manipulate the data from the input modules before placing it within the word in the %AI data table. The bits in the %AI data table which were not used in the conversion by the input module are forced to 0 (zero) by the analog input module. Placement of the 12 data bits from the A/D converter for an analog current input data word for the 16-Channel Analog Current Input module is shown below.

MSB LSB

X	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0	X	X	X

X=not converted bits

Analog values are scaled over the range of the converter. Factory calibration adjusts the analog value per bit (resolution) to a multiple of full scale (that is, 4 µA/bit). This calibration leaves a normal 12-bit converter with 4000 counts (normally 2^{12} = 4096 counts). The data is then scaled with the 4000 counts over the analog range. For example, the data to the A/D converter for the 16-Channel Analog Current Input is scaled as shown Figure 3.26.

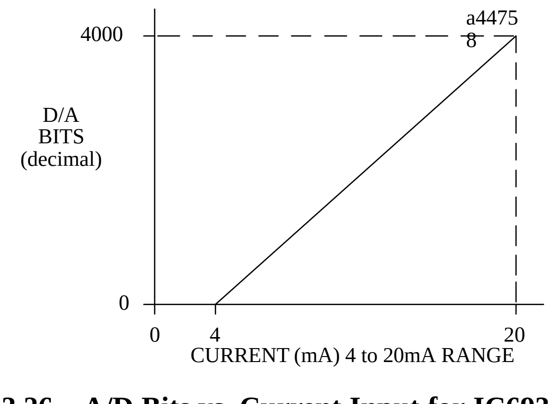


Figure 3.26 – A/D Bits vs. Current Input for IC693ALG223

4.4.7. Configuration

The 16-Channel Analog Current Input module can be configured using either the Alspa P8–25/35/05 or P80 Programming Software configurator function or with the Hand–Held Programmer.

The parameters that may be configured are described in the following table. Configuration procedures using Alspa P8 or Alspa P80 Programming Software and the Hand–Held Programmer are described in the following pages.

Parameter Name	Description	Values	Default Values	Units
Active Channels	Number of channels converted	1 to 16	1 (Alspa P8–25/35/05) 16 (Hand–Held Programmer)	n/a
Ref Adr	Starting address for %AI reference type	standard range	%AI0001, or next highest available address	n/a
Ref Adr	Starting address for %I reference type1	standard range	%I00001, or next highest available address	n/a
%I Size	Number of %I status locations	8, 16, 24, 32, 40	8 (Alspa P8–25/35/05) 40 (Hand–Held Programmer)	bits
Range	Type of input and range	4-20, 0-20, or 4-20+ (Enhanced)	4-20	n/a
Alarm Low	Low limit alarm value	–8000 to +32759	0	User counts
Alarm High	High limit alarm value	–7999 to +32760	+32000	User counts

Table 3.14 – Configuration Parameters

For more information on configuration, see:

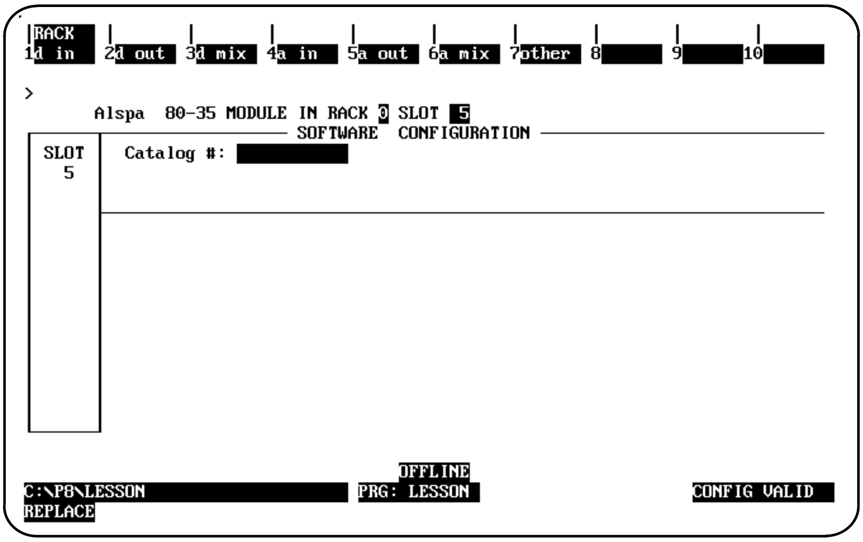
- Configuration Using Alspa P8–25/35/05 or P80 Programming Software beginning on § 4.4.7.1..
- Configuration Using the Hand–Held Programmer beginning on § 4.4.7.2..

4.4.7.1. Configuration Using Alspa P8–25/35/05 Software

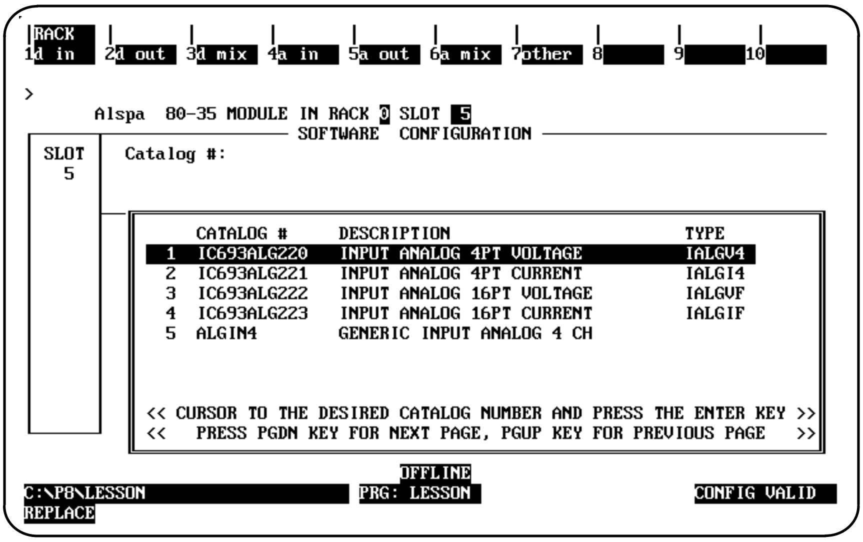
This paragraph describes how you can configure the 16-Channel High Density Analog Current Input module using the configurator function in Alspa P8–25/35/05 Programming Software. *Configuration can also be done using Alspa P80 Programming Software. For details refer to the Alspa P80 online help.*

To configure a 16-Channel Analog Input Module on the I/O Configuration Rack screen:

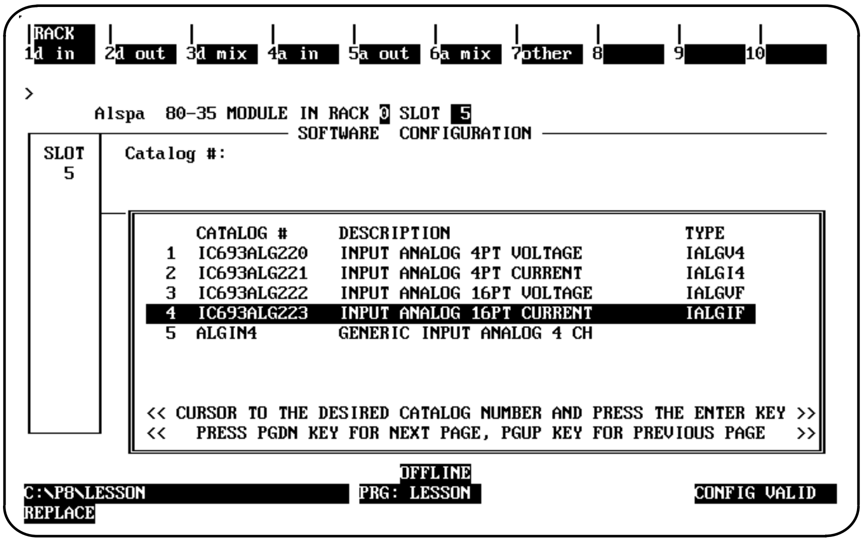
1. Move the cursor to the slot where the module will be located and press the **`m35 io`** softkey (F1). In the following example screen, the module will be placed in slot 5 of the main rack.



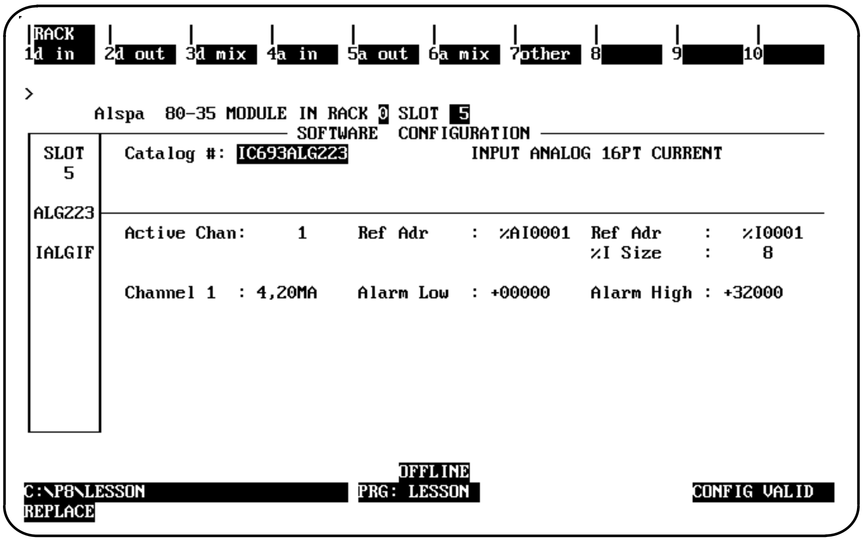
2. Press the **`a in`**, softkey (F4) to display a list of available analog input modules and their catalog numbers.



3. To select the 16-Channel Analog Input Module, position the cursor on the catalog number for the module, IC693ALG223, and press the **`Enter`** key.



4. After pressing the Enter key, the first detail screen, shown below, is displayed.



Note

Only enabled (active) channels are displayed on the screen

5. Use the parameter descriptions provided in the following table to help you make selections for the parameters on this screen.

<table>
<tr><th>Parameter</th><th>Description</th></tr>
<tr><td>Active Channel</td><td>Enter a number from 1* to 16. This number represents the number of channels to be converted. Channels are scanned in sequential, contiguous order, with channel No. 1 being the first channel scanned. If more than eight channels are selected, a second detail screen will be displayed to allow you to Enter data in channels 9 to 16.</td></tr>
<tr><td>Reference Address</td><td>The first Reference Address field contains the reference address for %AI data. The address points to the location in %AI memory where input data to the module begins. Each channel provides 16 bits of analog input data as an integer value from 0 to 32760 or –8000 to 32760, depending on the range type selected.</td></tr>
<tr><td>Reference Address</td><td>The second Reference Address field contains the reference address for %I data. The address points to the location in %I memory where status information from the module begins. You can select the number of %I status locations reported to the PLC by editing the value in the %I Size field.</td></tr>
<tr><td rowspan="5">%I Size</td><td>Enter the number of %I locations reported to the PLC. Choices are 8, 16, 24, 32, or 40. The data is brought back in the following format:</td></tr>
<tr><td><u>First eight %I locations</u>: (available for %I SIZE values 8, 16, 24, 32 and 40)

• %I = Module OK: 0 = module NOT OK; 1 = module OK.
• %I+1 = User Supply OK: 0 = below limit; 1 = user supply OK.
• %I+2 to %I+7 = Reserved for future modules.</td></tr>
<tr><td><u>Second eight %I locations</u>: (available for %I SIZE values 16, 24, 32 and 40)

• %I+8 = Channel No. 1 ALARM LO 0 = above limit; 1 = below or equal to limit.
• %I+9 = Channel No. 1 ALARM HI: 0 = below limit; 1 = above or equal to limit.
• %I+10 = Channel No. 2 ALARM LO: 0 = above limit; 1 = below or equal to limit.
• %I+11 = Channel No. 2 ALARM HI: 0 = below limit; 1 = above or equal to limit.
• %I+12 = Channel No. 3 ALARM LO: 0 = above limit; 1 = below or equal to limit.
• %I+13 = Channel No. 3 ALARM HI: 0 = below limit; 1 = above or equal to limit.
• %I+14 = Channel No. 4 ALARM LO: 0 = above limit; 1 = below or equal to limit.
• %I+15 = Channel No. 4 ALARM HI: 0 = below limit; 1 = above or equal to limit.</td></tr>
<tr><td><u>Third eight %I locations</u>: (available for %I SIZE values 24, 32 and 40)

• %I+16 = Channel No. 5 ALARM LO 0 = above limit; 1 = below or equal to limit.
• %I+17 = Channel No. 5 ALARM HI: 0 = below limit; 1 = above or equal to limit.
• %I+18 = Channel No. 6 ALARM LO: 0 = above limit; 1 = below or equal to limit.
• %I+19 = Channel No. 6 ALARM HI: 0 = below limit; 1 = above or equal to limit.
• %I+20 = Channel No. 7 ALARM LO: 0 = above limit; 1 = below or equal to limit.
• %I+21 = Channel No. 7 ALARM HI: 0 = below limit; 1 = above or equal to limit.
• %I+22 = Channel No. 8 ALARM LO: 0 = above limit; 1 = below or equal to limit.
• %I+23 = Channel No. 8 ALARM HI: 0 = below limit; 1 = above or equal to limit.</td></tr>
<tr><td><u>Fourth eight %I locations</u>: (available for %I SIZE values 32 and 40)

• %I+24 = Channel No. 9 ALARM LO 0 = above limit; 1 = below or equal to limit.
• %I+25 = Channel No. 9 ALARM HI: 0 = below limit; 1 = above or equal to limit.
• %I+26 = Channel No. 10 ALARM LO: 0 = above limit; 1 = below or equal to limit.
• %I+27 = Channel No. 10 ALARM HI: 0 = below limit; 1 = above or equal to limit.
• %I+28 = Channel No. 11 ALARM LO: 0 = above limit; 1 = below or equal to limit.
• %I+29 = Channel No. 11 ALARM HI: 0 = below limit; 1 = above or equal to limit.
• %I+30 = Channel No. 12 ALARM LO: 0 = above limit; 1 = below or equal to limit.
• %I+31 = Channel No. 12 ALARM HI: 0 = below limit; 1 = above or equal to limit.</td></tr>
</table>

Table 3.15 – Parameter Descriptions for Configuration

Parameter	Description
%I Size (cont'd)	<u>Fifth eight %I locations</u>: (available for %I SIZE value 40) ● %I+32 = Channel No. 13 ALARM LO 0 = above limit; 1 = below or equal to limit. ● %I+33 = Channel No. 13 ALARM HI: 0 = below limit; 1 = above or equal to limit. ● %I+34 = Channel No. 14 ALARM LO: 0 = above limit; 1 = below or equal to limit. ● %I+35 = Channel No. 14 ALARM HI: 0 = below limit; 1 = above or equal to limit. ● %I+36 = Channel No. 15 ALARM LO: 0 = above limit; 1 = below or equal to limit. ● %I+37 = Channel No. 15 ALARM HI: 0 = below limit; 1 = above or equal to limit. ● %I+38 = Channel No. 16 ALARM LO: 0 = above limit; 1 = below or equal to limit. ● %I+39 = Channel No. 16 ALARM HI: 0 = below limit; 1 = above or equal to limit.
Range	Select the type of input range and the ranges. Choices are 4 -20mA,* 0-20mA, or 4-20mA+. In the 4 to 20mA default range, input current values ranging from 4 to 20mA report 0 to 32 000 integer values to the CPU. In the 0 to 20mA range, input current values ranging from 0 to 20mA report 0 to 32 000 integer values to the CPU over an input current range of 0 to 20mA. The enhanced 4 to 20mA range operates like the default 4 to 20mA range, except that negative values are reported when the input current drops below 4mA. In this mode, if 0mA is input, the value reported to the PLC is –8 000.
Alarm Low	Enter a value that causes an alarm low indication to be passed to the PLC. Each channel has a low limit alarm value (ALARM LO), which causes %I points to be set. Values Entered without a sign are assumed to be positive. Value checking should be done to determine if the alarm low values are allowed for the appropriate range. The values allowed are: ● 4 to 20mA Range = 0 to 32759 ● 0 to 20mA Range = 0 to 32759 ● 4 to 20mA+ Range = –8000 to +32759
Alarm High	Enter a value that causes an alarm high indication to be passed to the PLC. Each channel has a high limit alarm value (ALARM HI), which causes %I points to be set. Values Entered without a sign are assumed to be positive. Value checking should be done to determine if the alarm high values are allowed for the appropriate range. The values allowed are: ● 4 to 20mA Range = 1 to 32760 ● 0 to 20mA Range = 1 to 32760 ● 4 to 20mA+ Range = –7999 to 32760

* Default selection.

Table 3.15 – Parameter Descriptions for Configuration (continued)

6. Press **`Rack`** (Shift-F1) or the **`Escape`** key to return to the rack display.

4.4.7.2. Configuration Using the Hand–Held Programmer

You can also configure the 16-Channel Analog Current Input module using the Alspa C80–35 Hand–Held Programmer. In addition to the information in this paragraph, refer to *ALS 52202 Hand–Held Programmer for Alspa C80–35, C80–25 and C80–05 PLCs User's Manual* for more information on configuration of Intelligent I/O modules.

Although you can change the number of actively scanned channels with the Alspa P8–25/35/05 configurator function, the Hand–Held Programmer does not support editing the number of actively scanned channels. If the 16-Channel Analog Input module is initialized by a Hand–Held Programmer, the number of actively scanned channels is 16.

If a module had been previously configured with Alspa P8–25/35/05 software and the number of actively scanned channels has been changed from 16, that number will be displayed on the bottom line of the Hand–Held Programmer display following the AI. You can edit data with the Hand–Held Programmer only for the active channels, but can not change the number of actively scanned channels.

Module Present

If a module is physically present in a system, it can be added to the system's configuration by reading the module into it. For example, assume that a 16-Channel Analog Current Input module is installed in slot 3 of a Model 311 PLC system. It can be added to the configuration with the following sequence. Use the Up and Down cursor keys or the # key to display the selected slot.

Initial Display

```
R0:03 EMPTY   >S
```

To add the IC693ALG223 module to the configuration, press the **READ/VERIFY** key. The following screen will be displayed:

```
R0:03 HI-DEN C >S
 I40:I_
```

Selecting %I Reference

At this point the starting %I reference address for the status data returned from the module must be entered. Notice that the length of the status field (**40**) is displayed as the first two digits following the first **I** on the second line of the display.

Note

This field cannot be changed with the Hand–Held Programmer. However, it can be changed using the Alspa P8–25/35/05 software configurator function. The Hand–Held Programmer will always reflect the currently active length of the status field.

Pressing the **ENT** key will allow the PLC to select the starting address of the status data. You can select a specific starting address by pressing the key sequence for the desired address and pressing the **ENT** key. For example to specify the starting address as I17, press the key sequence **1**, **7, ENT**. The following screen will be displayed:

```
R0:03 HI–DEN C >S
 I40:I17–I56
```

Selecting %AI Reference

After the starting %I address has been selected, pressing the **ENT** key again will cause the following screen to be displayed:

```
R0:03 HI–DEN C >S
 AI16:AI_
```

This screen allows you to select the starting address for the %AI reference. Note that the length of the status field (**16**) is displayed as the first two digits following the first **AI** on the second line of the display.

Note

This field cannot be changed with the Hand–Held Programmer. However, it can be changed using the Alspa P8–25/35/05 software configurator function. The Hand–Held Programmer will always reflect the currently active length of the status field.

In the AI field you can select the next available address (the default) by pressing the **ENT** key or by entering a specific address. To enter a specific address, press the starting reference number keys and the **ENT**. key (for example **3, 5**, then **ENT**.

```
R0:03 HI–DEN C >S
 AI16:AI035–AI051
```

You can press the **CLR** key at any time to abort the configuration you have just selected and return the slot to EMPTY.

Removing Module From Configuration

If required, this module can be removed from the current configuration. Assume that the module is currently configured in rack 0, slot 3. It can be deleted with the following sequence:

Initial Display

```
R0:03 HI–DEN C >S
 AI16:AI_
```

To delete the module, press the **DEL**, **ENT** key sequence. The display will then be:

```
R0:03 EMPTY    >S
```

Selecting Input Channel Ranges

The range for each of the 16 channels can be displayed and selected or changed as described below. Assume that the %AI address is as previously selected.

Initial display

```
R0:03 HI–DEN C >S
 AI16:AI035–AI051
```

To display the channel ranges press the → key. The display will show Channel 1 (or the currently selected channel) and the first available range.

```
R0:03 HI–DEN C >S
CHANNEL 1: 4–20
```

You can toggle through the range for each channel by pressing the ± key. Each range will be displayed as shown. The range selected is the one currently displayed.

```
R0:03 HI–DEN C >S
CHANNEL 1: 0–20
```

```
R0:03 HI–DEN C >S
CHANNEL 1: 4–20+
```

Alarm Limits Display

To view the alarm limits for the channel currently displayed, press the → key again (the first time caused the channel ranges to be available for editing). The following screen is displayed:

```
R0:03 HI–DEN C >S
CHAN 1 LO: 00000
```

The display is the entry field for the low alarm limit for the displayed channel (in this case, Channel 1). You can enter the desired low alarm limit value using the numeric keys and the ± key for specifying negative values. Enter the low alarm limit using a value within the valid limits as listed in Table 3.14. After you have entered the low alarm limit value, press the → key again to advance to the high alarm limit display for this channel. The following screen is displayed at this time.

```
R0:03 HI–DEN C >S
CHAN 1 HI: 32000
```

The display shows the entry field for the high alarm limit for the currently displayed channel. You can enter positive or negative numbers (see) using the ± and numeric keys. After selecting the low and high alarm limits for channel 1 (or the currently displayed channel), you can view the next channel by pressing the → key.

```
R0:03 HI–DEN C >S
CHANNEL 2: 4–20
```

Edit the range, and low and high alarm limits as described for Channel 1. All active channels can be changed in this manner. Return to the initial display screen by pressing the **ENT** key or by pressing the ← key until the initial screen is displayed.

Saved Configurations

Configurations that contain a 16-Channel Analog Current Input module can be saved to an EEPROM or MEM card and read into the CPU at a later time. MEM cards and EEPROMs containing these configurations can be read into any Release 4 or later CPU. Refer to Chapter 2 of the *ALS 52202 Hand–Held Programmer for Alspa C80–35, C80–25 and C80–05 PLCs User's Manual* for detailed information on the Save and Restore operations.

4.4.8. Field Wiring Connections

Connections to this module from user devices are made to screw terminals on a removable 20-terminal connector block mounted on the front of the module. The actual terminals used are described in the following table and are shown in the following wiring diagrams.

4.4.8.1. Terminal Assignments

Pin assignments for the 20 terminal I/O connector on the 16-Channel Analog Current Input module are as shown in the following table.

Pin Number	Signal Name	Signal Definition
1	24VIN	User supplied 24V Input; provides loop power via **24VOUT** terminal (pin 2)
2	24VOUT	+24V loop power tie point
3	CH1	Current Input, Channel 1
4	CH2	Current Input, Channel 2
5	CH3	Current Input, Channel 3
6	CH4	Current Input, Channel 4
7	CH5	Current Input, Channel 5
8	CH6	Current Input, Channel 6
9	CH7	Current Input, Channel 7
10	CH8	Current Input, Channel 8
11	CH9	Current Input, Channel 9
12	CH10	Current Input, Channel 10
13	CH11	Current Input, Channel 11
14	CH12	Current Input, Channel 12
15	CH13	Current Input, Channel 13
16	CH14	Current Input, Channel 14
17	CH15	Current Input, Channel 15
18	CH16	Current Input, Channel 16
19	COM	Common connection to input current sense resistors; user supplied 24V input return or 24VIN return
20	GND	Frame ground connections for cable shields

Table 3.16 – Terminal Pin Assignments

4.4.8.2. Analog Current Input Block Diagram

The following figure is a block diagram of the 16-Channel Analog Current Input Module.

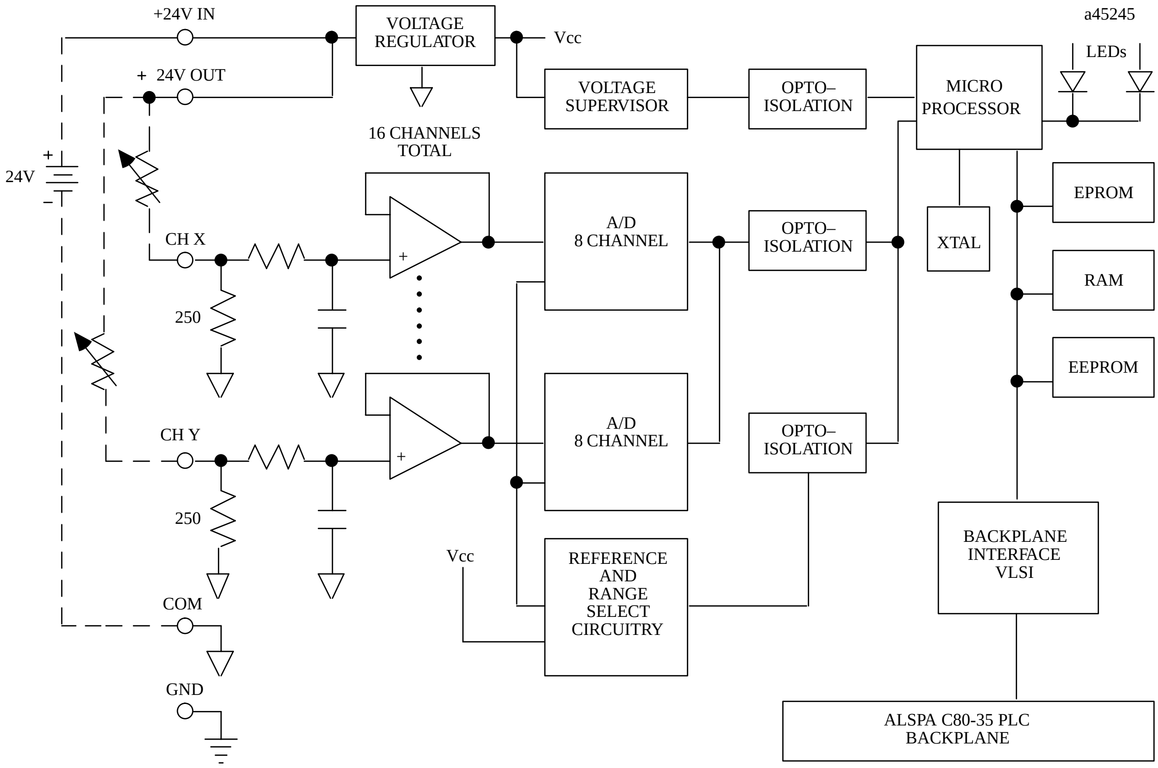


Figure 3.27 – 16-Channel Analog Current Input Module Block Diagram - IC693ALG223

4.4.8.3. Field Wiring Information

The following figure provides information for connecting field wiring to the user terminal board on the 16-Channel Analog Current Input Module.

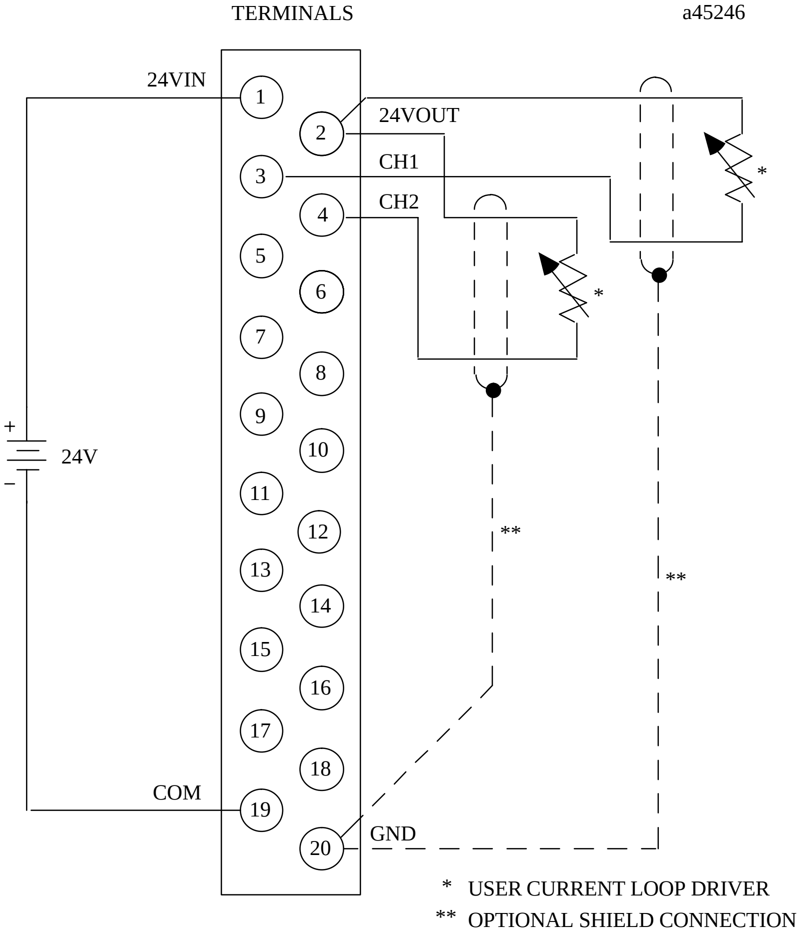


Figure 3.28 – Field Wiring for 16-Channel Analog Current Input Module - IC693ALG223

Note

The current source may also be tied to the COM terminal if the source is floating to limit common-mode voltages.

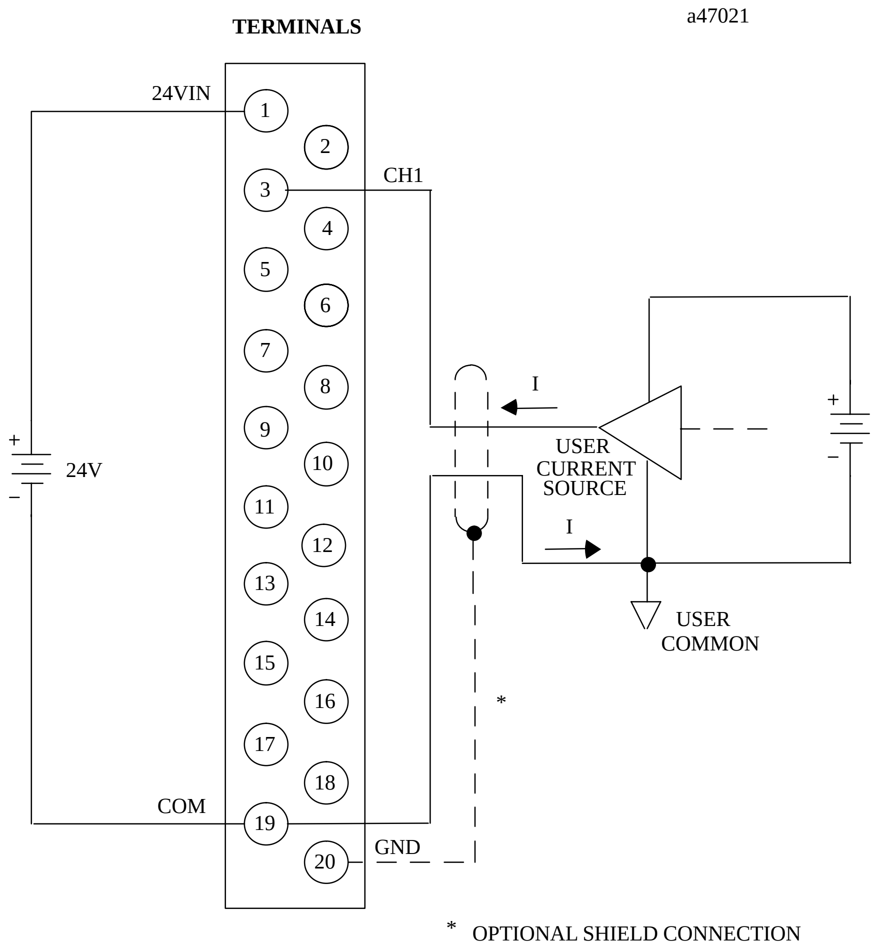


Figure 3.29 – Field Wiring - Alternative User Connections - IC693ALG223

4.5. Analog Voltage Output - 2 Channel IC693ALG390

The ***2-Channel Analog Voltage Output*** module for the Alspa C80–35 Programmable Logic Controller provides two output channels, each capable of converting 13 bits of binary (digital) data to an analog output for use as required by your application. The Analog Voltage Output module is capable of providing outputs in the range of –10 to +10 volts. Resolution of the converted signal is 12 bits binary plus sign which is effectively 13 bits (1 part in 8192). Both channels are updated on every scan (about 5 milliseconds). User data in the %AQ registers is in a 16-bit 2's complement format. The 13 most significant bits from the %AQ register are converted to sign magnitude by the PLC and sent to the module for use by the D/A converter circuitry. The placement of the 13 bits converted to sign magnitude is shown below. The relationship between the voltage output and the data from the D/A converter is shown in Figure 3.30.

MSB | | | | | | | | | | | | | | | LSB

S	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0	X	X	X

S = Sign bit.
X= not applicable to this discussion.

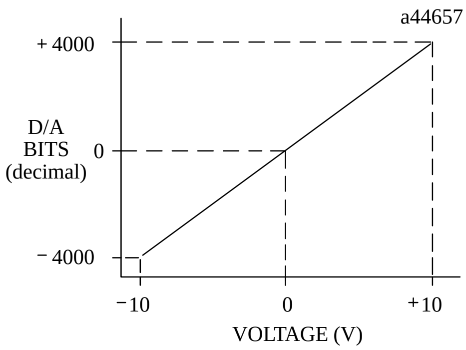


Figure 3.30 – D/A Bits vs. Voltage Output

The state of the module, if the CPU goes to the STOP mode or RESET, can be either *Default to 0 volts* or *Hold-Last-State*. Selection of the desired state is made by configuring the DEF0 jumper on the detachable terminal connector on the module. If the jumper is not installed, the outputs will Hold-Last-State on STOP or RESET. Scaling of the output is shown below.

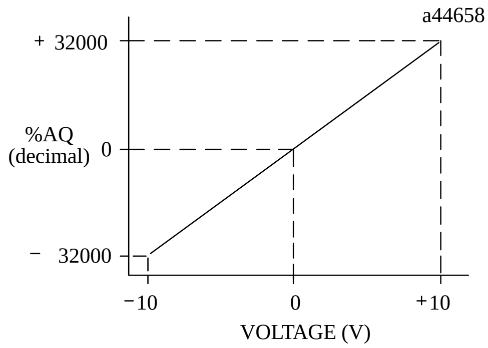


Figure 3.31 – Scaling for Voltage Output

The primary power source for the module is the isolated +24 VDC power supplied by the PLC power supply. Two terminals are provided on the module's terminal connector for user supplied +24 volts. This allows you to provide a standby power supply, so that the outputs can continue to hold their value if the internal supply is lost and Hold Last State is selected. Additionally, you can also supply the module voltage to reduce the load on the PLC isolated +24 VDC power supply. The user supply must be used when the applied voltage is 0.7 volts higher than the isolated +24 VDC supply, which can range from 21.5 volts to 26.5 volts. An LED at the top of the module's faceplate is ON when the module's power supply is operating.

To minimize the capacitive loading and noise, all field connections to the module should be wired using a good grade of twisted, shielded instrumentation cable. The shields should be connected to GND on the user terminal connector block. The GND connection provides access to the baseplate (frame ground) resulting in superior rejection of noise caused by any shield drain currents.

The module provides electrical isolation of externally generated noise between field wiring and the backplane through the use of optical isolation. This module can be installed in any I/O slot of a 5 or 10-slot baseplate in an Alspa C80–35 PLC system. Refer to § 3., page 3–13 to determine the number of Analog Voltage Output modules that can be installed in a system.

Voltage Range	–10 to +10 volts
Calibration	Factory calibrated to 2.5 mV per count
Supply Voltage (nominal)	+24 VDC, from isolated +24 VDC on backplane or user supplied voltage source, and +5 VDC from backplane
External Supply Voltage Range	18 to 30 VDC
External Supply Voltage Ripple	10%
Update Rate	5 msec (both channels) *This update rate is approximate since it is determined by I/O scan time, and is application dependent.*
Resolution	2.5 mV (1 LSB = 2.5 mV)
Absolute Accuracy*	± 5 mV at 25° C (77° F)
Offset	1 mv maximum, 0 to 60° C (32° to 140° F)
Output Loading (maximum)	5 mA (2K ohms minimum resistance)
Output Load Capacitance	2000 pico Farads, maximum
Isolation	1500 volts between field side and logic side
Internal Power Consumption	32 mA from +5 volt supply 120 mA from +24 volt supply (isolated backplane or user supply)

* In the presence of severe RF interference (IEC 801-3, 10V/m), accuracy may be degraded to ±50mV.
Refer to data sheet ALS 53002 for product standards and general specifications.

Table 3.17 – Specifications for Analog Voltage Output Module, IC693ALG390

4.5.1. Analog Voltage Output Block Diagram

The following figure is a block diagram of the 2-Channel Analog Voltage Output Module, IC693ALG390.

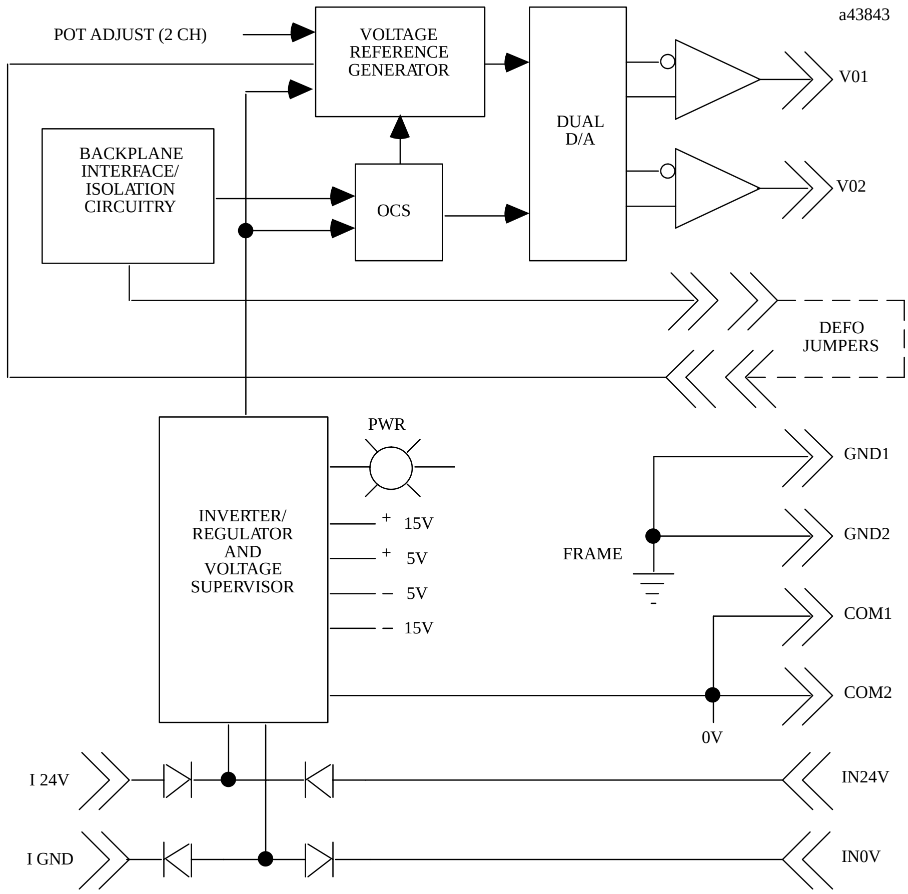


Figure 3.32 – Analog Voltage Output Module Block Diagram - IC693ALG390

4.5.2. Field Wiring Information

The following figure provides information for connecting field wiring to the Analog Voltage Output module.

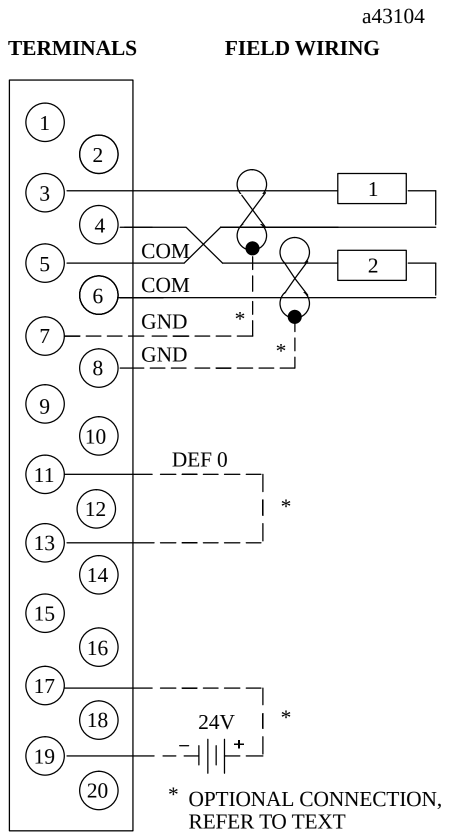


Figure 3.33 – Field Wiring for Analog Voltage Output Module - IC693ALG390

4.6. Analog Current Output - 2 Channel IC693ALG391

The ***2-Channel Analog Current Output*** module for the Alspa C80–35 Programmable Logic Controller provides two output channels, each capable of converting 12 bits of binary (digital) data to an analog output for use as required by your application. The Analog Current Output module is capable of providing outputs in the range of 0 to 20 mA. Resolution of the converted signal is 12 bits binary (1 part in 4096). The sign bit is not used in the conversion process. Both channels are updated on every scan (about 5 milliseconds). User data in the %AQ registers is in a 16-bit 2’s complement format. The 13 most significant bits from the %AQ register are converted to sign magnitude by the PLC and sent to the module. Twelve of the bits are used by the D/A converter; the 13th bit (sign) is used to determine if negative data was sent to the module.

The placement of the 13 bits within the data word is shown below. The relationship between the current output and the data from the D/A converter is shown in Figure 3.34 and Figure 3.35.

MSB LSB

S	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0	X	X	X

S=sign bit
X=not converter bits

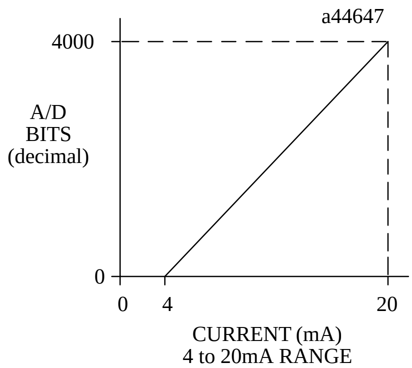


Figure 3.34 – A/D Bits vs. Current Output, 4 to 20 mA

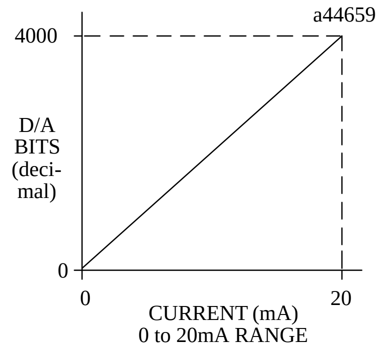


Figure 3.35 – A/D Bits vs. Current Output, 0 to 20 mA

If the module is sent negative data, it outputs the low end of the current range (that is, 4 mA for the 4 to 20 mA range). If a value which is out of range is entered (that is greater than 32767), the software does not accept the value.

This module provides two output ranges. The default range is 4 to 20 mA with user data scaled so that a count of 0 corresponds to 4 mA and a count of 32000 corresponds to 20 mA with each 1000 counts representing 0.5 mA. When a RANGE jumper (either RANGE1 or RANGE2) is added to the I/O terminal board, the output range is 0 to 20 mA with user data scaled so that a count of 0 corresponds to 0 mA and a count of 32000 corresponds to 20 mA with each 800 counts representing 0.5 mA. The range of each output can be programmed individually. The module provides a full 12 bits of resolution in either range. Scaling of the output is as shown in Figure 3.36 and Figure 3.37.

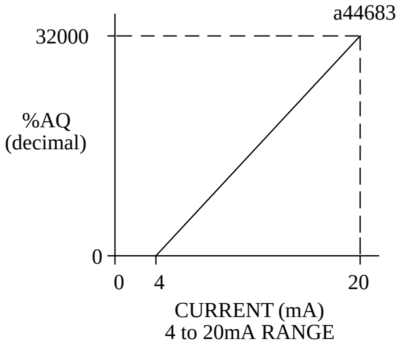


Figure 3.36 – Scaling for Current Output, 4 to 20 mA

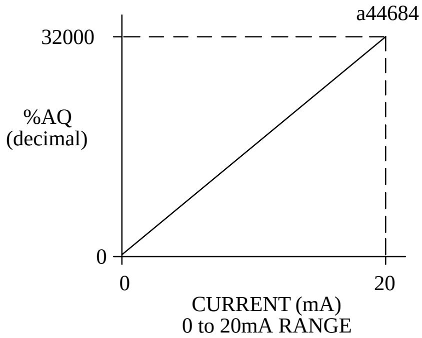


Figure 3.37 – Scaling for Current Output, 0 to 20 mA

The state of the module if the CPU goes to the STOP mode or RESET, can be either *Default to 0/4 mA* or *Hold-Last-State*. Selection of the desired state is made by configuring the DEF0/4 jumper on the detachable terminal board connector on the module. If the jumper is not installed, the outputs will Hold-Last-State on STOP or RESET provided that a backup user supply is connected when the system power goes down. If the DEF0/4 jumper is present, the module defaults to 4 mA on the 4 to 20 mA range or 0 mA on the 0 to 20 mA range on STOP or RESET. One jumper per module is used to program both outputs for Hold-Last-State or DEF0/4.

Each module output may be used as a current source or as a less accurate voltage source. A voltage is output at VOUTx that corresponds to the current output. The selection of current or voltage output is made with a jumper on the I/O terminal board. If no jumper is installed, the module performs as a current source. If the JMPVx jumper is present, the module performs as a voltage source. Each channel has the option of selecting voltage or current. The setting of the current output range determines the voltage range. The voltage range can be increased by using a 250 ohm resistor in place of the voltage jumper from JMPVx to IOUTx. The following table shows the relationship between range settings and voltage outputs.

Range Setting	Voltage Range
4 to 20 mA (no range jumper)	1 to 5 V 2 to 10 V with external resistor
0 to 20 mA (range jumper present)	0 to 5 V 0 to 10 V with external resistor

Table 3.18 – Range Settings vs. Voltage Outputs

The primary power source for the module is the isolated +24 VDC power supplied by the PLC power supply. Two terminals are also provided on the module’s I/O terminal board for user supplied +24 volts. This allows you to provide a standby power supply so that the outputs can continue to hold their value if the internal supply is lost and Hold-Last-State is selected. You may also want to supply the module voltage to reduce the load on the PLC isolated +24 VDC power supply. The user supply will be used when the applied voltage is higher than the isolated +24 VDC supply, which can range from 21.5 volts to 26.5 volts.

An internal voltage source of about +24V is generated in the module to drive the current loop outputs. The current loop drivers on the module are source type drivers. This means that a positive current flows out of the current loop outputs so that the user’s loads can be returned to common. A resistor is placed in series with the common return to limit ground loop currents. To minimize the capacitive loading and noise, all field connections to the module should be wired using a good grade of twisted, shielded instrumentation cable. The shields should be connected to GND on the user terminal connector block. The GND connection provides access to the baseplate (frame ground) resulting in superior rejection of noise caused by any shield drain currents.

An LED on the module’s faceplate is ON when the module’s power supply is operating. The module provides electrical isolation of externally generated noise between field wiring and the backplane through use of optical isolation. This module can be installed in any I/O slot of a 5 or 10-slot baseplate in an Alspa C80–35 PLC system. If user provided supplies are not used to power the module, a maximum of three Analog Current Output modules can be installed in a baseplate.

Output Current Range	4 to 20 mA and 0 to 20 mA
Output Voltage Range [1]	1 to 5 V and 0 to 5 V
Calibration	Factory calibrated to 4µA per count
Supply Voltage (nominal)	+24 VDC, from isolated +24 VDC on backplane or user supplied voltage source, and +5 VDC from backplane
External Supply Voltage Range[2]	20 to 30 VDC
External Supply Voltage Ripple	10%
Update Rate	5 msec (approximate, both channels) *Determined by I/O scan time, and is application dependent.*
Resolution:	
4 to 20 mA	4µA (1 LSB = 4µA)
0 to 20 mA	5µA (1 LSB = 5µA)
1 to 5 V	1 mV (1 LSB = 1 mV)
0 to 5 V	1.25 mV (1 LSB = 1.25 mV)
Absolute Accuracy:[3]	
4 to 20 mA	±8µA at 25°C (77°F)
0 to 20 mA	±10µA at 25°C (77°F)
1 to 5 V	±50 mV at 25°C (77°F)
0 to 5 V	±50 mV at 25°C (77°F)
Maximum Compliance Voltage	25 V
User Load (current mode)	0 to 850 ohms
Output Load Capacitance (current mode)	2000 pF
Output Load Inductance (current mode)	1 H
Maximum Output Loading (voltage mode)	5 mA (2K ohms minimum resistance) (2000 pF maximum capacitance)
Isolation	1500 volts between field and logic side
Internal Power Consumption	30 mA from +5V supply 215 mA from Isolated +24 VDC backplane supply or user supply

(1) Allowable load on the voltage output option can be calculated from the total module current shown in Figure 3.38.
(2) Allowable user supply is dependent on the current load and the ambient temperature as shown in Figure 3.38.
(3) In the presence of severe RF interference (IEC 801-3, 10V/m), accuracy may be degraded to ±80mA (4 to 20 mA range), ±100mA (0 to 20 mA range).

Table 3.19 – Specifications for Analog Current Output Module - IC693ALG391

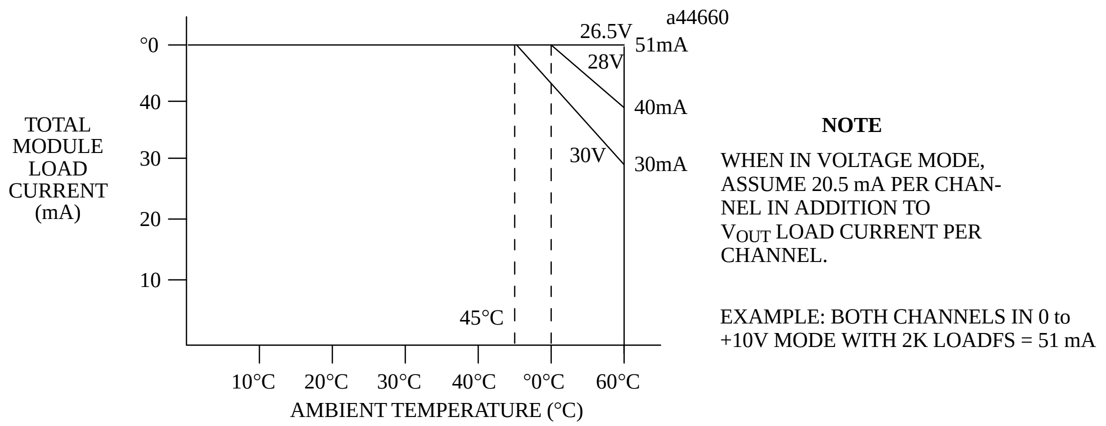


Figure 3.38 – Load Current Derating

4.6.1. Analog Current Output Block Diagram

The following figure is a block diagram of the 2-channel Analog Output module.

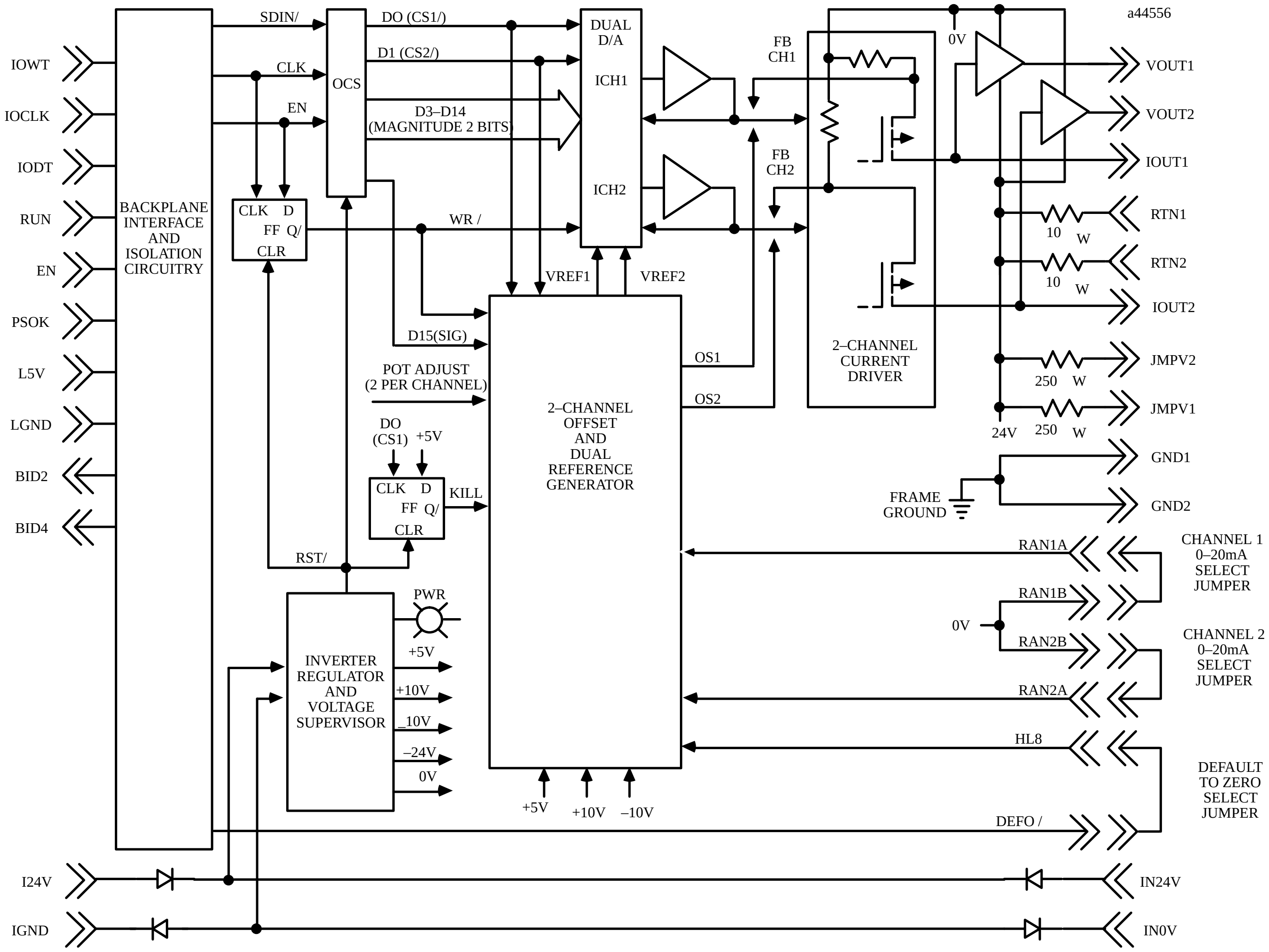


Figure 3.39 – Analog Current Output Module Block Diagram - IC693ALG391

4.6.2. Field Wiring Information

The following two figures provide information for connecting field wiring to the Analog Current Output module. Figure 3.40 shows the connections necessary for the outputs to be used as analog current outputs.

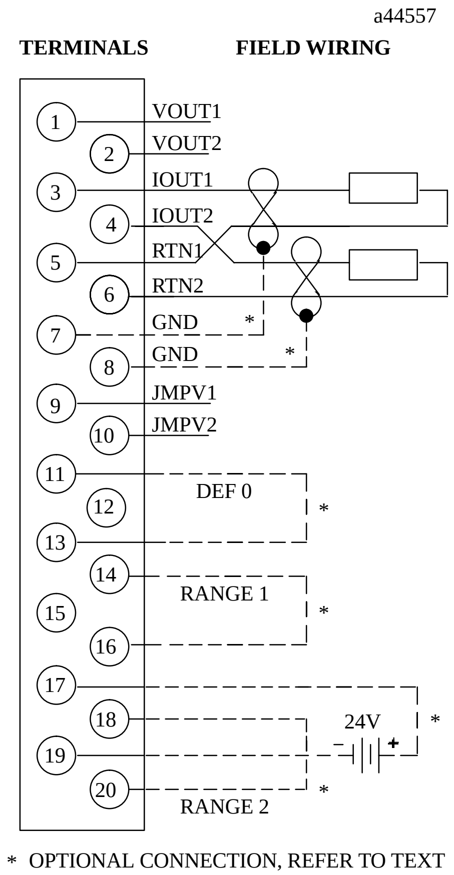


Figure 3.40 – Field Wiring - Analog Current Output Module (Current Mode) - IC693ALG391

Note

An external supply can be used to power the module and the loop current.

Figure 3.41 shows the connections necessary for the outputs of the module to be used as analog voltage outputs.

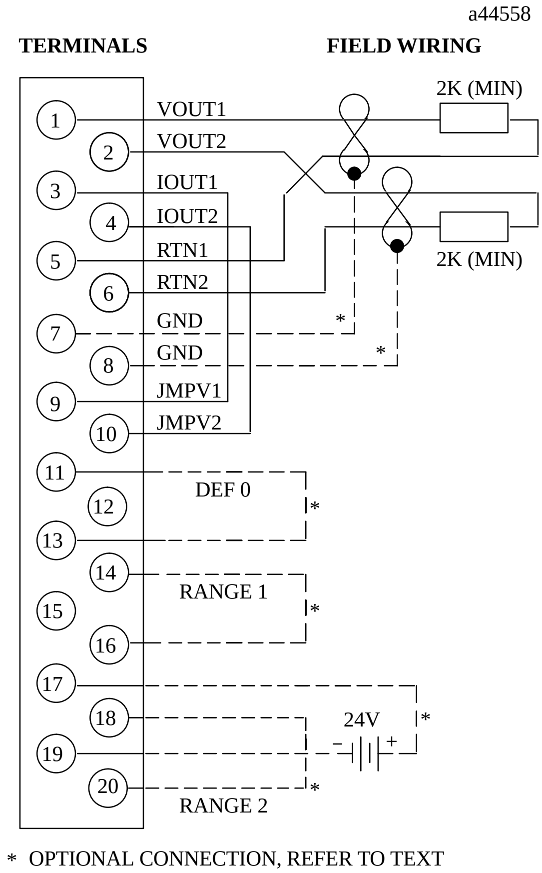


Figure 3.41 – Field Wiring - Analog Current Output Module (Voltage Mode) - IC693ALG391

4.7. Analog Current/Voltage Output - 8 Channel IC693ALG392

The ***8-Channel Analog Current/Voltage Output*** module provides up to eight single-ended output channels with current loop outputs or voltage outputs. Each analog output channel is capable of providing two current output ranges or two voltage output ranges. Each channel can be individually configured for the output range required for your application. The module has no jumpers or switches for configuration.

All ranges can be configured using either the Alspa P8 or Alspa P80 programming software configurator function or the Alspa C80–35 Hand–Held Programmer. The default range is 0 to +10 volts. Configurable current and voltage output ranges are:

- 0 to +10 volts (unipolar),
- –10 to +10 volts (bipolar),
- 0 to 20 milliamps,
- 4 to 20 milliamps.

Each channel is capable of converting 15 to 16 bits (depending on the range selected) of binary (digital) data to an analog output for use as required by your application. All eight channels are updated every 12 ms. User data in the %AQ registers is in a 16-bit 2’s complement format. In current modes, an *open-wire fault* is reported to the CPU for each channel. The module can go to a known last state when system power is interrupted. As long as user power is applied to the module, each output will maintain its last value, or reset to zero, as determined by how you have configured the module.

Note

Please note the following important product information. This version of the 8-Channel Analog Current/Voltage Output module requires the following product versions for compatibility:

CPU: Firmware Versions 3.3 to 4.6:
If your CPU has firmware version 3.3 to 4.6, you ***must*** select 16 %I bits at configuration. If this selection is not made, a *loss of module* fault will occur.

CPU: Firmware Version 5.0 or later:
If your CPU has firmware version 5.0, or later, then the %I configuration will accept 8 or 16 %I bits.

Alspa P8–25/35/05 Software:
Version 5.00, or later, is required to configure the module using the Alspa P8–25/35/05 software configuration function.

Alspa P80 Software:
Version 2.1, or later, is required to configure the module using the Alspa P80 software configuration function.

4.7.1. Current/Voltage Ranges and Output Modes

4.7.1.1. Current Operation

In the 4 to 20 mA range user data is scaled so that 4 mA corresponds to a count of 0 and 20 mA corresponds to a count of 32000. In the 0 to 20 mA range, user data is scaled so that 0 mA corresponds to a count of 0 and 20 mA corresponds to 32000. Note that in the 0 to 20 mA mode, you can enter a value up to 32767 which provides a maximum output of approximately 20.5 mA. Scaling of the current output for both the 4 to 20 mA range and the 0 to 20 mA range is shown below. In current mode the module also provides an open loop fault detect which is reported to the PLC in the %I table.

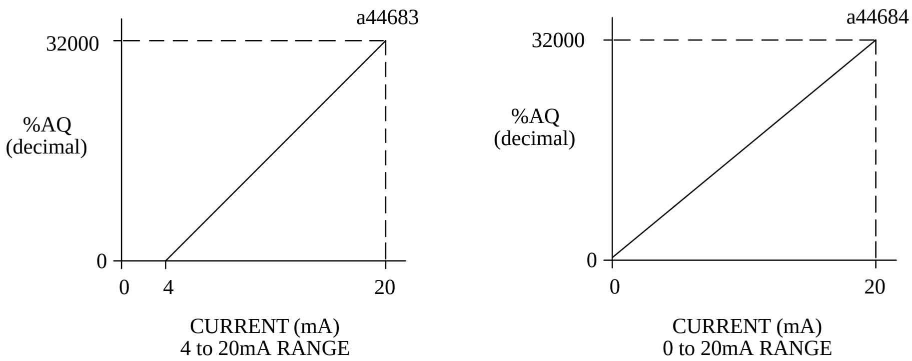


Figure 3.42 – Scaling for Current Output

4.7.1.2. Voltage Operation

For *Voltage Operation* in the default unipolar mode (0 to +10 volts), user data is scaled so that 0 volts corresponds to a count of 0 and +10 volts corresponds to a count of 32000. In this mode, you can enter up to 32767 for an overrange of approximately 10.24 volts output. In the –10 to +10 volt range user data is scaled so that –10 volts corresponds to a count of –32000 and +10 volts corresponds to a count of +32000. In this range, you can enter –32767 to +32767 for an overrange of approximately –10.24 volts to +10.24 volts.

Scaling of the voltage output for both the 0 to +10 volt range and the –10 to +10 volt range is as shown in the following figure.

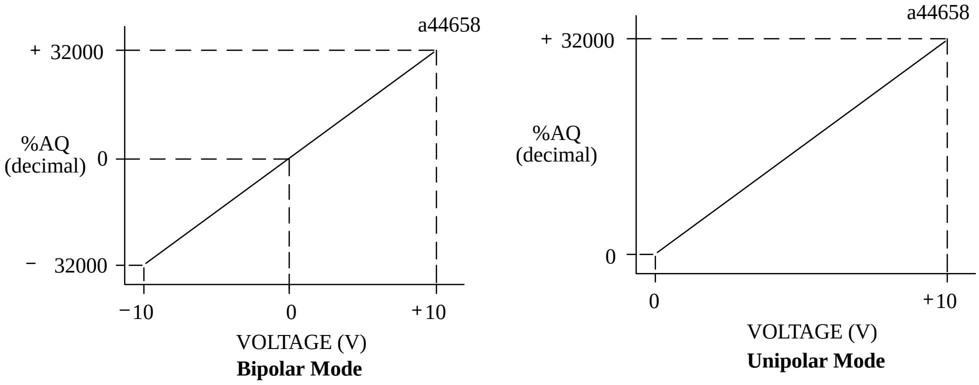


Figure 3.43 – Scaling for Voltage Output

4.7.1.3. CPU Interface to the 8-Channel Analog Current/Voltage Output Module

The Alspa C80–35 PLC uses the data within the %AQ data table to record analog values for use by the programmable controller. This scheme for the 8-Channel Analog Current/Voltage Output module is shown below. More information on the CPU interface to analog modules can be found at the beginning of this chapter.

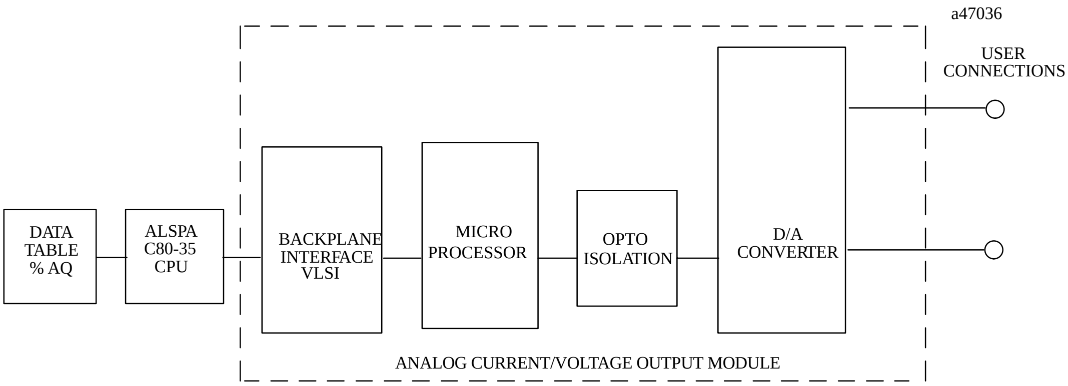


Figure 3.44 – Basic Block Diagram for IC693ALG392

The following table summarizes the above information, including the module output range, user input data range, and the resolution of the selected range

Module Output Range	User Input Data Range	Resolution
4 to 20 mA	0 to 32000	15 bits
0 to 20.5 mA	0 to 32767	15 bits
0 to +10 volts	0 to 32767	15 bits
–10 to +10 volts	–32767 to +32767	16 bits

4.7.1.4. Status Reporting

The Analog Current/Voltage Output module provides status information to the PLC. This status information is updated once each PLC sweep and consists of three items:

- *health of the module* (all ranges).
- *overload or open wire detect* (current mode only).
- *status of the user-supplied power* to the module (all ranges).

4.7.1.5. Power Requirements and LEDs

This module requires a maximum of 110 mA from the 5V bus on the PLC backplane for the logic side The module's analog power *must be supplied* by a user supplied single +24 VDC power source *and* requires a maximum current of 315 mA.

There are two green LED indicators on the module which provide module and user supply status. The top LED, **MODULE OK** provides module status information and the bottom LED, **USER POWER SUPPLY OK indicates** that the user supply is present and is above a minimum designated level. Note that both LEDs are powered from the +5V backplane power bus.

The LEDs have three possible states; *off*, *flashing*, or *on*. The definitions for each of these conditions is described below.

LED / KEY	1	2	3	4	5	6
MODULE OK	Off	Flashing	Flashing	On	On	Off
USER POWER SUPPLY OK	Off	Off	On	Off	On	On

LED STATE

○	**= Off**
◌	**= Flashing**
●	**= On**

KEY	DEFINITION
1	MODOK = No +5V backplane power or module not OK UPSOK = User power may or may not be present
2	MODOK = Module OK, not configured UPSOK = No user power
3	MODOK = Module OK, not configured UPSOK = User power is present
4	MODOK = Module OK and configured UPSOK = No user power
5	MODOK = Module OK and configured UPSOK = User power is present
6	MODOK = Module not OK UPSOK = User power is present

4.7.1.6. Location in System

This module can be installed in any I/O slot of a 5 or 10-slot baseplate in an Alspa C80–35 PLC system.

4.7.1.7. References Used

The number of 8-Channel Analog Current/Voltage Output modules which may be installed in a system depends on the amount of %AQ and %I references available. Each module uses 8 %AQ references (depending on the number of channels enabled) and 8 or 16 %I references (depending on *open wire detect* configuration).

There are 32 %AQ references available in Models 311, 313 and 323 system, 64 %AQ references available in a Model 331 system, 256 %AQ references available in a Model 341 system, and 512 %AQ references availabe in Models 351 and 352 system.

The maximum number of 8-Channel Analog Current/Voltage Output modules that can be installed in a system are:

- 4 in Models 311, 313 or 323 system.
- 8 in a Model 331 system.
- 32 in a Model 340 or 341 system.
- 79 in Models 351 and 352 system.

Other Configuration Considerations

When planning the module configuration for your application you must also consider the load capacity of the installed power supply and the total load requirements of all modules that are installed in the baseplate.

Refer to Chapter 1 in this manual for details on power supply, baseplate, and module load requirements.

The following table lists the specifications for this module. *Note that test conditions, unless otherwise noted, are:* V_{USER} *= 24 VDC at an ambient temperature of 25°C (77°F).*

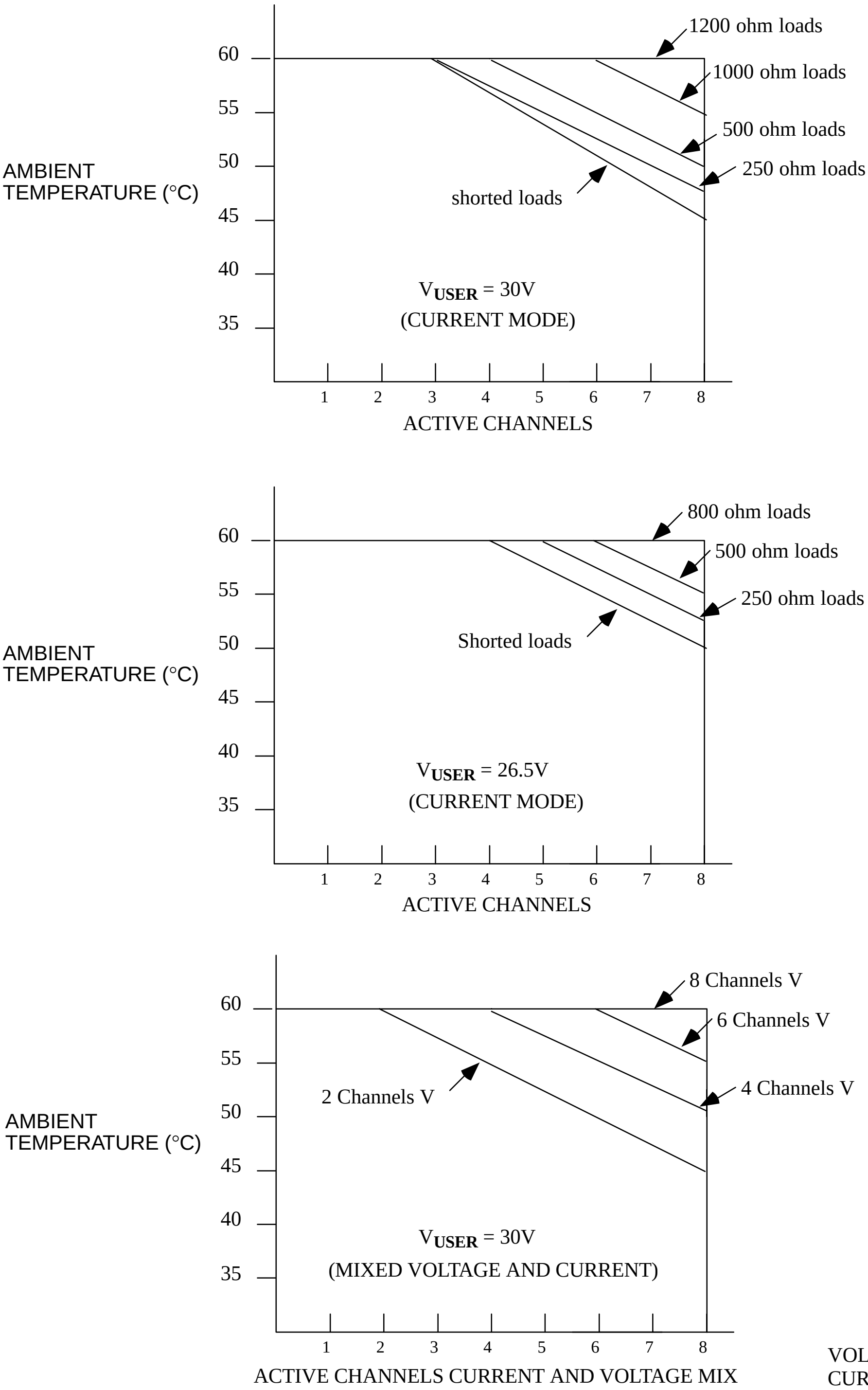
Number of Output Channels	1 to 8 selectable, single-ended
Output Current Range **Output Voltage Range**	4 to 20 mA and 0 to 20 mA 0 to 10 V and –10 to +10 V
Calibration	Factory calibrated to 0.625µA for 0 - 20 mA; 0.5µA for 4 - 20 mA; and 0.3125 mV for voltage (per count)
User Supply Voltage (nominal) **External Supply Voltage Range** **Power Supply Rejection Ratio (PSRR)** (1) **Current** **Voltage**	+24 VDC, from user supplied voltage source 20 to 30 VDC 5 µA/V (typical), 10 µA/V (maximum) 25 mV/V (typical), 50 mV/V (maximum)
External Power Supply Voltage Ripple **Internal Supply Voltage**	10% (maximum) +5 VDC from PLC backplane
Update Rate	8 msec (approximate, all eight channels) *Determined by I/O scan time, and is application dependent.*
Resolution: **4 to 20 mA** **0 to 20 mA** **0 to 10 V** **–10 to +10 V**	 0.5 µA (1 LSB = 0.5 µA) 0.625 µA (1 LSB = 0.625 µA) 0.3125 mV (1 LSB = 0.3125 mV) 0.3125 mV (1 LSB = 0.3125 mV)
Absolute Accuracy:(3) **Current Mode**	 ± 0.1% of full scale at 25°C (77°F), typical ± 0.25% of full scale at 25°C (77°F), maximum ± 0.5% of full scale over operating temperature range (maximum)
Voltage Mode	± 0.25% of full scale at 25°C (77°F), typical ± 0.5% of full scale at 25°C (77°F), maximum ± 1.0% of full scale over operating temperature range (maximum)
Maximum Compliance Voltage	V_{USER} –3V (minimum) to V_{USER} (maximum)
User Load (current mode)	0 to 850Ω (minimum at V_{USER} = 20V, maximum 1350Ω at V_{USER} = 30V) (2)
Output Load Capacitance (current mode)	2000 pF (maximum)
Output Load Inductance (current mode)	1 H
Output Loading (voltage mode) **Output load Capacitance**	5 mA (2K ohms minimum resistance) (1 µF maximum capacitance)
Isolation	1500 volts between field and logic side
Internal Power Consumption	110 mA from +5V PLC backplane supply 315 mA from +24V user supply

(1) PSSR is measured by varying V_{USER} from 24V to 30V.
(2) Load less than 800 W is temperature dependent.
(3) In the presence of severe RF interference (IEC 801-3, 10V/m), accuracy may be degraded to ± 1% FS for current outputs and ± 3% FS for voltage outputs.

Refer to data sheet ALS 53002 for product standards and general specifications.

Table 3.20 – Specifications for IC693ALG392

4.7.1.8. Derating Curves for the 8 Channel Analog Output Module



Maximum Operating Temperature

Select the line for the number of voltage channels used, then add the number of current channels. This is the total number of channels used.

To determine the maximum operating temperature, select the total active channels used (from the bottom of chart), then draw a vertical line to the line for the number of voltage channels.

VOLTAGE CHANNELS HAVE 2K ohm LOADS
CURRENT CHANNELS HAVE SHORTED LOADS

NOTE

For maximum performance and module life, it is recommended that the module be operated at maximum load resistance to offload heat from the module.

Figure 3.45 – Module Derating Curves for IC693ALG392

4.7.2. Configuration

The 8-Channel Analog Current/Voltage Output module can be configured using either the Alspa P8 or Alspa P80 Programming Software configurator function or with the Hand–Held Programmer.

The parameters that may be configured are described in the following table. Configuration procedures using Alspa P8–25/35/05 Programming Software and the Hand–Held Programmer are described in the following pages.

Parameter Name	Description	Values	Default Values	Units
Active Channels	Number of channels converted	1 to 8	1	n/a
%AQAddress	Starting address for %AQ reference type	standard range	%AQ0001, or next highest available address	n/a
%I Address	Starting address for %I reference type	standard range	%I00001, or next highest available address	n/a
%I Size	Number of %I status locations	8 or 16	8	bits
STOP MODE	Output state when module toggled from RUN to STOP mode	HOLD or DEFLOW	HOLD	n/a
Range (Displayed under Stop Mode)	Type of Output Range	0, +10V –10, +10V 4, 20 mA 0, 20 mA	0, 10V	n/a

Table 3.21 – Configuration Parameters for IC693ALG392

For more information on configuration, see

- Configuration Using Alspa P8 or Alspa P80 Programming Software beginning on page 3–84.
- Configuration Using the Hand–Held Programmer beginning on page 3–88.

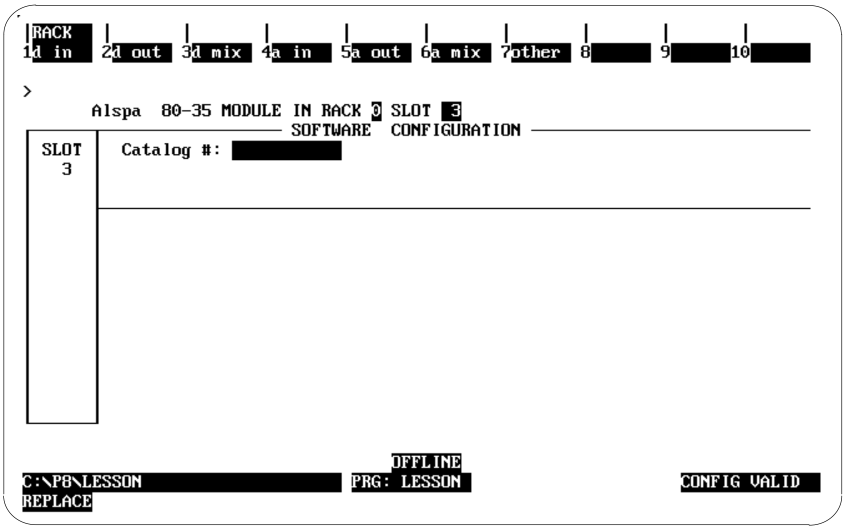
4.7.2.1. Configuration Using Alspa P8–25/35/05 or P80 Software

This paragraph describes how to configure the 8-Channel Analog Current/Voltage Output module using the configurator function in Alspa P8–25/35/05 Programming Software. *Configuration can also be done using Alspa P80 Programming Software. For details refer to the Alspa P80 online help.*

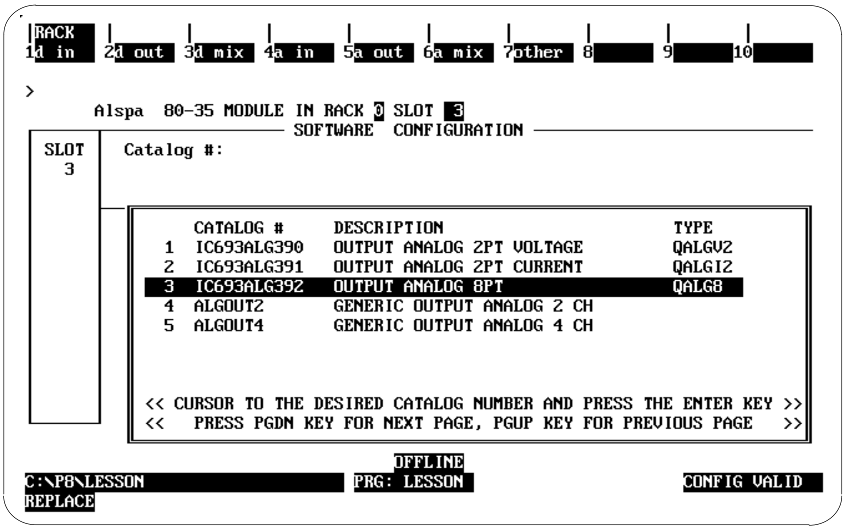
To configure an 8-Channel Analog Current/Voltage Output Module on the I/O Configuration Rack screen:

1. Move the cursor to the desired rack and slot location. The slot may be either unconfigured or previously configured.

2. Press the **`m35 io`** key (**`F1`**). You will then see a screen similar to the following:

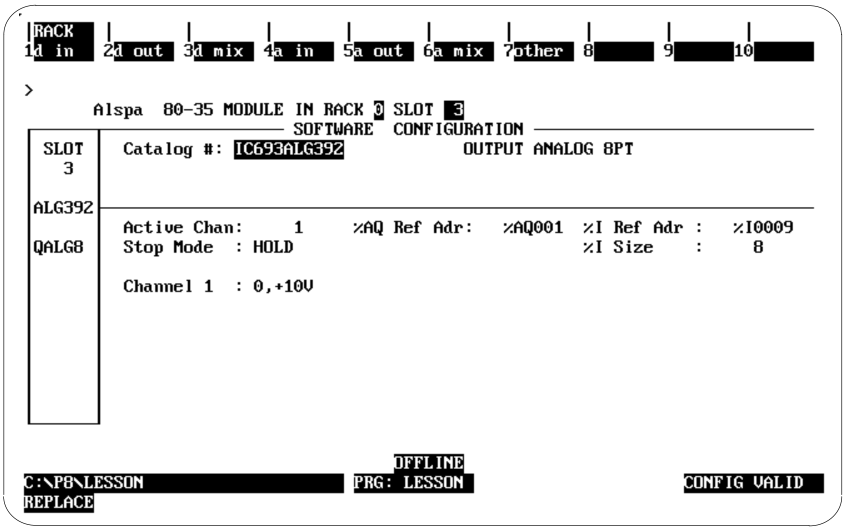


3. Press the **`a out`** key (**`F5`**). Your screen will now look like the one displayed below:



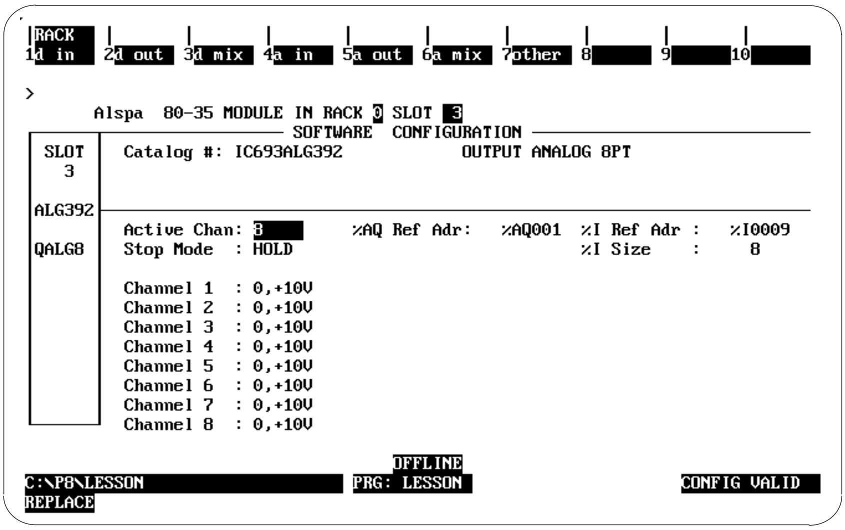
4. Move the cursor to the IC693ALG392 selection as shown above. Then press **`Enter`**.

The next screen that appears will look like the one displayed below:



5. Enter the remaining configuration parameters on this screen. You can move your cursor from field to field by pressing the **`Arrow`** cursor control keys. When you are in the field you want to modify, you can either type in your choice or press the **`Tab`** key to scroll through the available selections (or **`Shift-Tab`** to reverse the direction of the selection list).

   The default number of Active Channels (**`Active Chan:`**) is 1. You will not be able to configure additional channels until you change this field (by typing in the correct number (1 through 8) or by pressing the **`Tab`** key to increment the number). The screen displayed below shows the default selections after changing the **`Active Chan:`** field.



Note

The entry in the **`Stop Mode`** field (**`HOLD`** or **`DEFLOW`**) determines how the outputs will behave when the module is toggled from **`RUN`** to **`STOP`** mode. When this value is set to **`HOLD`** (the default), the outputs will retain their last state. When you change this value to **`DEFLOW`**, the output will go to zero.

Other Configuration Considerations

Channels are scanned in sequential, contiguous order with channel 1 being the first to be scanned. Note that the impact of the Current/Voltage Output module on the CPU scan time is directly proportional to the number of analog channels that you have enabled.

The only allowable entries for the **`%AQ Ref Adr`** are %AQ addresses. The only allowable entries for the **`%I Ref Adr`** are %I addresses.

The entry in **`%I Size`** will only accept 8 or 16. This field denotes the number of bits returned to the user.

The **`%AQ Ref Adr`** field is the reference address for the %AQ data and points to the start of the locations in the %AQ memory where the output data to the module begins. Each channel provides 16 bits of analog output data as an integer value from 0 to 32 760 or –32 767 to 32 752. depending on the range type selected. For detailed information on the data format, see the *CPU Interface to Analog Modules* paragraph in this manual.

The **`%I Ref Adr`** is the reference address for the %I data and points to the start of the locations in the %I memory (the Input Table) where status information from the module is reported. You can select the number of %I status locations reported to the PLC by editing the value in the **`%I Size`** field. Values allowable in the %I Size field are 8 or 16, which refer to the number of %I locations reported to the PLC.

The **`%I Ref Adr`** field will only accept %I for %I Size values 8 or greater; the data brought back is in the format that follows:

The first eight %I locations (available for %I SIZE values 8, 16)

%I Locations	Description
%I	*Module OK*; a 0 (zero) indicates NOT OK, 1 indicates module OK
%I+1	*User Supply OK* – Indicates when user supply is in specified limits; reads a 0 when user supply is below the specified limit, 1 when User supply is OK
%I+2 – %I+7	Reserved for future modules. Not used in this module.

Second eight locations – (available for %I SIZE value of 16)

%I Locations	Description
%I+8	Channel No.1 BROKEN WIRE ; 0 = OK, 1 = Wire broken (I modes only)
%I+9	Channel No.2 BROKEN WIRE ; 0 = OK, 1 = Wire broken (I modes only)
%I+10	Channel No.3 BROKEN WIRE ; 0 = OK, 1 = Wire broken (I modes only)
%I+11	Channel No.4 BROKEN WIRE ; 0 = OK, 1 = Wire broken (I modes only)
%I+12	Channel No.5 BROKEN WIRE ; 0 = OK, 1 = Wire broken (I modes only)
%I+13	Channel No.6 BROKEN WIRE ; 0 = OK, 1 = Wire broken (I modes only)
%I+14	Channel No.7 BROKEN WIRE ; 0 = OK, 1 = Wire broken (I modes only)
%I+15	Channel No.8 BROKEN WIRE ; 0 = OK, 1 = Wire broken (I modes only)

One of four output ranges can be selected. Two are voltage ranges. The default range is 0 to 10V, where output voltage values ranging from 0 to 10 volts correspond to 0 to 32000 integer values from the Alspa C80–35 CPU. The –10 to +10V range, when selected, corresponds from –32 000 to 32 000 from the CPU over an output voltage range of –10 to +10V. The two current ranges are 4 to 20 mA, and 0 to 20 mA. In each of the current ranges values between 0 and 32000 are sent to the module. Depending on which range is selected, will determine if the module is in Current or Voltage mode.

The following table shows values sent from the CPU to the module.

Range	Module Mode	*Allowed Values
0 to 10 V	Voltage	0 to 32767
–10 to 10 V	Voltage	– 32768 to 32767
4 to 20 mA	Current	0 to 32000*
0 to 20 mA	Current	0 to 32767

*Allowed values refers to the values that are valid. If a user sends a value > 32000, the module will truncate that value to 32000 before sending it to the D/A Converter.

Note

Only enabled (active) channels are displayed on the screen.

6. Press **`Shift-F1`** *(Rack)*) or the **`Esc`**ape key to return to the rack display.

4.7.2.2. Configuration Using the Hand–Held Programmer

You can also configure the 8-Channel Analog Current/Voltage Output module using the Alspa C80–35 Hand–Held Programmer. In addition to the information in this paragraph, refer to *ALS 52202 Hand–Held Programmer for Alspa C80–35, C80–25 and C80–05 PLCs User's Manual* for more information on configuration of Intelligent I/O modules.

Although you can change the number of actively scanned channels with the Alspa P8–25/35/05 configurator function, the Hand–Held Programmer does not support editing the number of actively scanned channels. If the 8-Channel Analog Current/Voltage Output module is initialized by a Hand–Held Programmer, the number of actively scanned channels is 8.

If a module had been previously configured with Alspa P8–25/35/05 software and the number of actively scanned channels has been changed from 8, that number will be displayed on the bottom line of the Hand–Held Programmer display following the **AQ** entry. You can edit data with the Hand–Held Programmer only for the active channels, but you can not change the number of actively scanned channels.

Module Present

If a module is physically present in a system, it can be added to the system's configuration by reading the module into the configuration file. For example, assume that an 8-Channel Analog Current/Voltage Output module is installed in slot 3 of a Model 311 PLC system. It can be added to the configuration with the following sequence. Use the ↑ and ↓ arrow cursor keys or the No. key to display the selected slot.

Initial Display

```
R0:03 EMPTY   >S

```

To add the IC693ALG392 module to the configuration, press the **READ/VERIFY**, **ENT** key sequence. The following screen will be displayed:

```
R0:03 AO 1.00 >S
 I16:I_
```

Selecting %I Reference

At this point the starting %I reference address for the status data returned from the module must be entered. Notice that the length of the status field (**16**) is displayed as the first two digits following the first **I** on the second line of the display.

Note

This field cannot be changed with the Hand–Held Programmer. However, it can be changed using the Alspa P8–25/35/05 software configurator function. The Hand–Held Programmer will always reflect the currently active length of the status field.

Pressing the **ENT** key will allow the PLC to select the starting address of the status data. You can select a specific starting address by pressing the key sequence for the desired address and pressing the **ENT** key. For example to specify the starting address as I17, press the key sequence **1**, **7, ENT**. The following screen will be displayed:

```
R0:03 AO 1.00 >S
 I16:I0017–I0032
```

You can press the **CLR** key at any time to abort the configuration you have just selected and return the slot to EMPTY.

After selecting the starting %I address and pressing the **ENT** key, the following screen appears.

```
R0:03 AO 1.00 >S
 AQ8:AQ_
```

Selecting %AQ Reference

This screen allows you to select the starting address for the %AQ reference by specifying the starting reference in the %AQ field. You can select the next available address (the default) or enter a specific address. Pressing the **ENT** key will allow the PLC to select the starting addresses.

To enter a specific address (for example %AQ35), press the starting reference number keys and the **ENT** key. For example, to specify a starting address of %AQ35, press the key sequence **3, 5**, **ENT**.

```
R0:03 AO 1.00 >S
 AQ8:AQ035–AQ043
```

Note that the length of the status field (**8**) is displayed as the first two digits following the first **AQ** on the second line of the display.

Note

This field cannot be changed with the Hand–Held Programmer. However, it can be changed using the Alspa P8–25/35/05 software configurator function. The Hand–Held Programmer will always reflect the currently active length of the status field.

You can press the **CLR** key at any time to abort the configuration you have just selected and return the slot to EMPTY.

Removing Module From Configuration

If required, this module can be removed from the current rack configuration. Assume that the module is currently configured in rack 0, slot 3. It can be deleted with the following sequence:

Initial Display

```
R0:03 AO 1.00 >S
 AQ8:AQ_
```

To delete the module, press the **DEL**, **ENT** key sequence. The display will then be:

```
R0:03 EMPTY    >S
```

If the **CLR** key had been pressed after the **DEL** key (instead of the **ENT** key), the delete operation would have been aborted.

Selecting Module Default Mode

The default STOP mode of the module, either HOLD or DEFLOW, can be displayed and modified, if required, by using the following procedure.

Initial Display

```
R0:03 AO 1.00 >S
 I16:I0017–I0032
```

To display the module‘s default STOP mode, press → →. The display will show the current mode of the module. The default mode is **HOLD**.

```
R0:03 AO 1.00 >S
HLS/DEF:HOLD
```

You can toggle between the HOLD and DEFLOW modes by pressing the ± key. The range selected is the one currently displayed.

```
R0:03 AO 1.00 >S
HLS/DEF:DEF LOW
```

When the desired mode for the module is displayed on the screen it can be accepted by pressing the **ENT** key. To return to the previous screen, press the ← key.

Selecting Output Channel Ranges

The range for each of the 8 channels can be displayed and selected or changed as described below. There are two current and two voltage ranges that can be selected.

Initial Display

```
R0:03 AO 1.00 >S
 I16:I0017–I0032
```

To display the channel ranges press → → →. The display will show Channel 1 (or the currently selected channel) and the first available range.

```
R0:03 AO 1.00 >S
CHAN 1: 0 – 10 V
```

You can toggle through the range for each channel by pressing the ± key. Each range will be displayed as shown. Each of the ranges are shown below. The range that will be selected is the one currently displayed.

```
R0:03 AO 1.00 >S
CHAN 1: –10 – 10
```

```
R0:03 AO 1.00 >S
CHAN 1:4 – 20 MA
```

```
R0:03 AO 1.00 >S
CHAN 1:0 – 20 MA
```

When the desired range for the module is displayed on the screen it can be accepted by pressing the **ENT** key. To return to the previous screen, press the ← key. To view the next channel's range display, press the → key.

```
R0:03 AO 1.00 >S
CHAN 2: 0 – 10 V
```

Edit this channel's range the same as you did for the first channel. The range of all active channels can be changed in the same manner. Return to the initial display screen by pressing the **ENT** key or by pressing the ← key until the initial screen is displayed.

Saved Configurations

Configurations that contain an 8-Channel Analog Current/Voltage Output module can be saved to an EEPROM or MEM card and read from that device into the CPU at a later time. MEM cards and EEPROMs containing these configurations can be read into any Release 4 or later Alspa C80–35 CPU (cannot be read into an Alspa C80–25 CPU). Refer to Chapter 2 of the *ALS 52202 Hand–Held Programmer for Alspa C80–35, C80–25 and C80–05 PLCs User's Manual* for detailed information on the Save and Restore operations.

4.7.3. Field Wiring Connections

Connections to this module from user devices are made to screw terminals on a removable 20-terminal connector block mounted on the front of the module. The actual terminals used are described in the following table and are shown in the following wiring diagrams.

4.7.3.1. Terminal Assignments

Pin assignments for the 20 terminal I/O connector on the 8-Channel Analog Current/Voltage Output module are as shown in the following table.

Pin Number	Signal Name	Signal Definition
1	24VIN	User Supplied +24 Volt Input
2	V CH 1	Channel 1 Voltage Output
3	I CH 1	Channel 1 Current Output
4	V CH 2	Channel 2 Voltage Output
5	I CH 2	Channel 2 Current output
6	V CH 3	Channel 3 Voltage Output
7	I CH 3	Channel 3 Current output
8	V CH 4	Channel 4 Voltage Output
9	I CH 4	Channel 4 Current output
10	V CH 5	Channel 5 Voltage Output
11	I CH 5	Channel 5 Current output
12	V CH 6	Channel 6 Voltage Output
13	I CH 6	Channel 6 Current output
14	V CH 7	Channel 7 Voltage Output
15	I CH 7	Channel 7 Current output
16	V CH 8	Channel 8 Voltage Output
17	I CH 8	Channel 8 Current output
18	V COM	Voltage Common
19	I COM	Current Common/User +24 Volt Return
20	GND	Frame ground connection for cable shields

Table 3.22 – Terminal Pin Assignments for IC693ALG392

4.7.3.2. Analog Current/Voltage Output Block Diagram

The following figure is a block diagram of the 8-Channel Analog Current/Voltage Output Module.

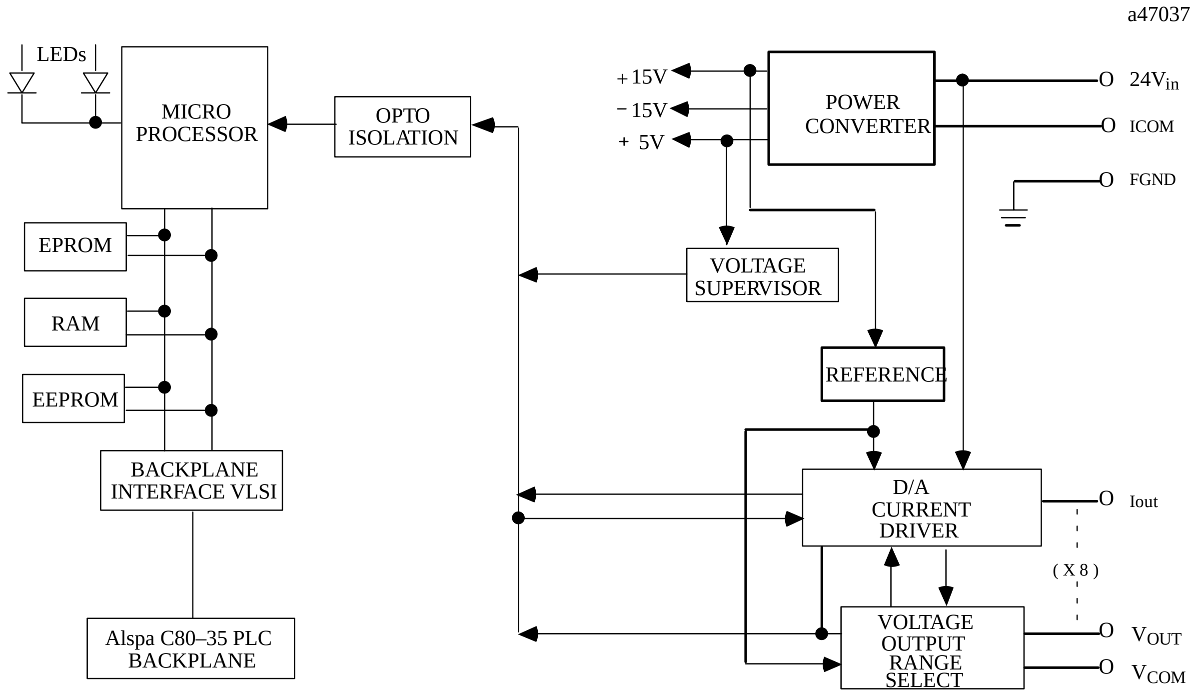


Figure 3.46 – 8-Channel Analog Current/Voltage Output Module Block Diagram - IC693ALG392

4.7.3.3. Field Wiring Information

The following figure provides information for connecting field wiring to the user terminal board on the 8-Channel Analog Current/Voltage Output Module.

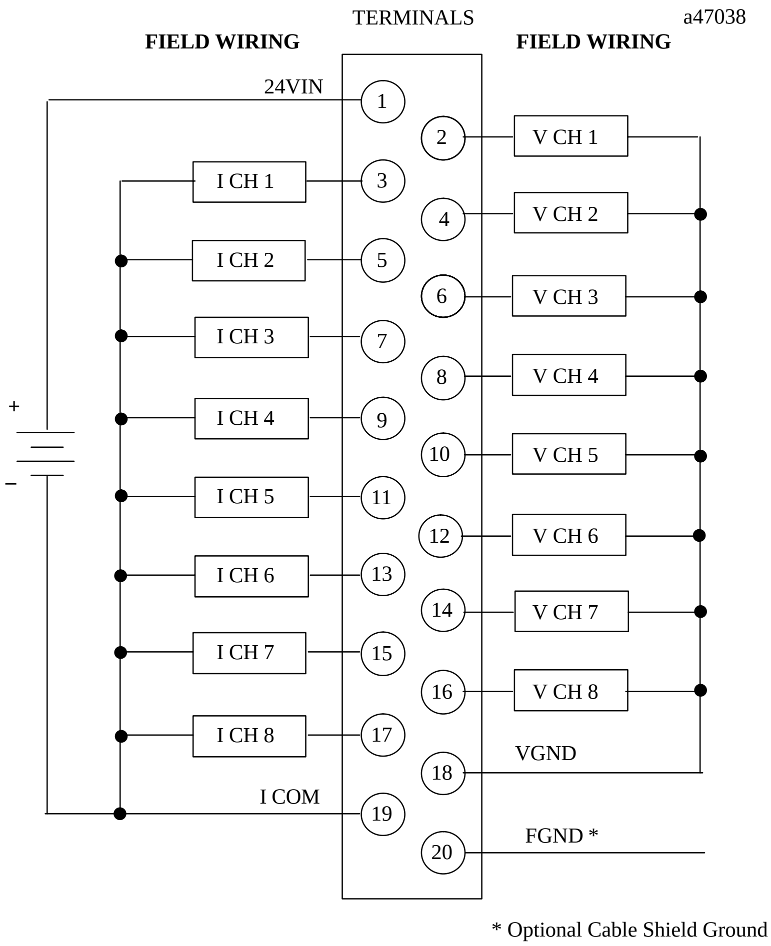


Figure 3.47 – Field Wiring for 8-Channel Analog Current/Voltage Output Module, IC693ALG392

Note

Each channel can be configured independent of other channels to operate as a voltage output ***or*** a current output – *not both simultaneously.*

4.8. Analog Current/Voltage Combination Module 4 Input/2 Output Channels IC693ALG442

The ***Analog Current/Voltage Combination Input/Output*** module provides up to 4 differential input current or voltage channels and 2 single-ended output channels with either current loop outputs or voltage outputs. Each channel can be individually configured for the current or voltage range, as applicable, required for your application. All module configuration is done through software, except for a jumper required for selecting the current input mode. All ranges can be configured using either the Alspa P8–25/35/05 or P80 programming software configurator function or the Alspa C80–35 Hand–Held Programmer.

Note that in this module's description, the module will be simply referred to as the ***Analog Combo Module.***

Each analog input is capable of providing five input ranges (two voltage and three current), which are*:*

- 0 to +10 volts (unipolar) - default range for both input and output channels,
- –10 to +10 volts (bipolar),
- 0 to 20 mA,
- 4 to 20 mA,
- 4 to 20 mA Enhanced.

The default input range is voltage mode 0 to +10 volts (unipolar) with user data scaled so that 0V corresponds to a count of 0 and 10V corresponds to a count of 32767.

Each analog output is capable of providing four output ranges (two voltage and two current):

- 0 to +10 volts (unipolar) - default range for both input and output channels,
- –10 to +10 volts (bipolar),
- 0 to 20 milliamps,
- 4 to 20 milliamps.

Each output channel is capable of converting 15 to 16 bits (depending on the range selected) of binary (digital) data to an analog output for use as required by your application. User data in the%AI and %AQ registers is in a 16-bit 2's complement format. In current modes, an *open-wire fault* is reported to the CPU for each channel. The module can go to a known last state when system power is interrupted. As long as user power is applied to the module, each output will maintain its last value, or reset to the low end of the scale (range), as determined by how you have configured the module.

Each output channel can be configured to operate in ramp mode using ladder logic. In ramp mode, changes in %AQ data cause the corresponding output channel to ramp to the new %AQ value. The ramp output consists of steps taken each millisecond until the final value is reached.

High and low alarm limits can be set for all input channels and an *open-wire fault* (current output modes) is reported to the CPU for each output channel. All six analog channels may be updated on every scan, depending on the scan time.

4.8.1. Input Modes and Current/Voltage Ranges

4.8.1.1. Current Operation

In the *4 to 20 mA range*, user data is scaled so that 4 mA corresponds to a count of 0 and 20 mA corresponds to a count of 32767. The other ranges are selected by changing the configuration parameters using the Alspa P8–25/35/05 configurator software or the Hand–Held Programmer. In the *0 to 20 mA range* user data is scaled so that 0 mA corresponds to a count of 0 and 20 mA corresponds to a count of 32767. Full 12-bit resolution is available over the 0 to 20 mA range.

A *4 to 20 mA Enhanced range* can also be selected. When this range is selected, 0 mA corresponds to a count of –8000, 4 mA corresponds to a count of 0 (zero) and 20 mA corresponds to a count of +32767. The Enhanced range uses the same hardware as the 0 to 20 mA range but automatically provides 4 to 20 mA range scaling with the exception that negative digital values are provided to the user for input current levels between 4 mA and 0 mA. This gives you the capability of selecting a low alarm limit that detects when the input current falls from 4 mA to 0 mA, which provides for open-wire fault detection in 4 to 20 mA applications. High and Low alarm limits are available on all ranges. Ranges can be configured on a per channel basis.

User data in the %AI registers is in 16-bit 2's complement format (0 to 20 mA range only). Resolution of the converted signal is 12 bits binary (1 part in 4096) on the 0 to 20 mA range. The placement of the 12 bits from the A/D converter in the %AI data word is shown below.

MSB															LSB
X	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0	X	X	X

X=not applicable to this discussion.

The relationship between the current input and the data from the A/D converter is show below.

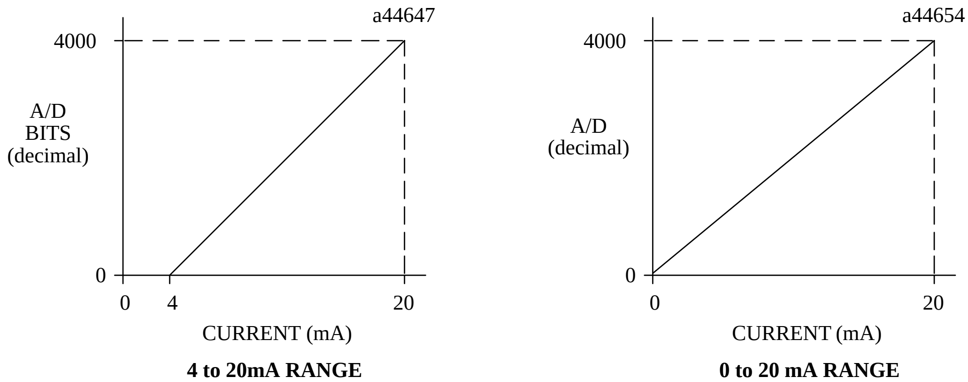


Figure 3.48 – A/D Bits vs. Current Input

If the current source is reversed into the input, or is less than the low end of the current range, then the module will output a data word corresponding to the low end of the current range (0000H in %AI). If an input that is out of range is entered (that is, it is greater than 20 mA), the A/D converter will output up to full scale (corresponding to 7FFFH in %AI).

4.8.1.2. Voltage Operation

In the *0 to +10 V default range,* user data is scaled so that 0 volts corresponds to a count of 0 and +10 volts corresponds to a count of 32767. The –10 to +10 volt range is selected by changing the configuration parameters using the Alspa P8–25/35/05 configurator software or the Hand–Held Programmer. In the *–10 to +10 volt range* user data is scaled so that –10 volts corresponds to a count of –32767 and +10 volts corresponds to a count of +32767. Full 12-bit resolution is available over either range.

Since converters used in the analog input channels are 12-bit converters, not all of the 16 bits in the data tables contain data required for the conversion. A version of the 12 bits is placed within the 16-bit data word corresponding to the analog point (in the %AI table). The Alspa C80–35 PLC system handles the integration differently for the various analog modules.

The CPU does not manipulate the data from the input modules before placing it within the word in the %AI data table. The bits in the %AI data table which were not used in the conversion by the input channels are forced to 0 (zero) by the analog input module. Placement of the 12 data bits from the A/D converter for an analog current input data word for the 16-Channel Analog Voltage Input module in unipolar range is shown below.

MSB															LSB
X	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0	X	X	X

X=not converted bits

Analog values are scaled over the range of the converter. Factory calibration adjusts the analog value per bit (resolution) to a multiple of full scale (that is, 2.5 mV/bit for unipolar; 5 mV/bit for bipolar). This calibration leaves a normal 12-bit converter with 4000 counts (normally 2^{12} = 4096 counts). The data is then scaled with the 4000 counts over the analog range. For example, the data to the A/D converter for the Analog Voltage Input is scaled as shown in Figure 3.49

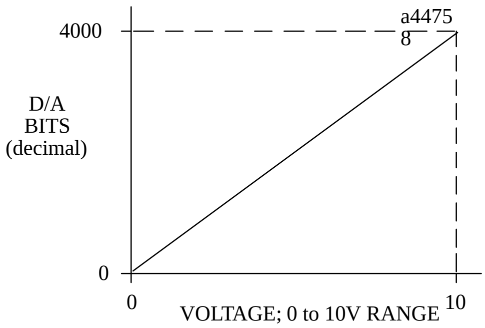


Figure 3.49 – A/D Bits vs. Voltage Input

4.8.2. Output Modes and Current/Voltage Ranges

4.8.2.1. Current Operation

In the 4 to 20 mA range user data is scaled so that 4 mA corresponds to a count of 0 and 20 mA corresponds to a count of 32767. In the 0 to 20 mA range, user data is scaled so that 0 mA corresponds to a count of 0 and 20 mA corresponds to 32000. Note that in the 0 to 20 mA mode, you can enter a value up to 32767 which provides a maximum output of approximately 20.5 mA. Scaling of the current output for both the 4 to 20 mA range and the 0 to 20 mA range is shown below. In current mode the module also provides an open loop fault detect which is reported to the PLC in the %I table.

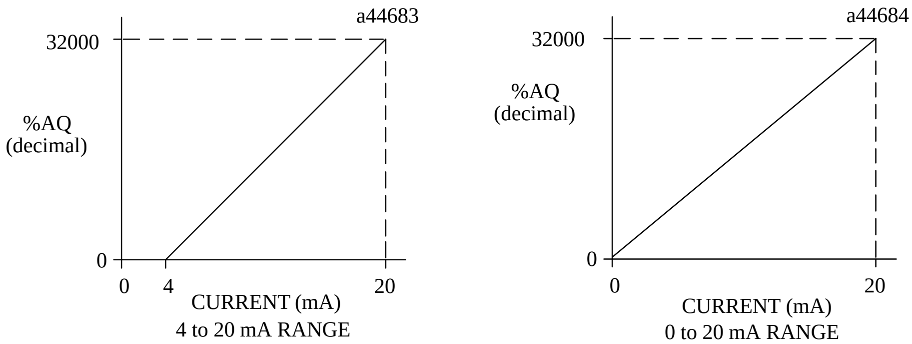


Figure 3.50 – Scaling for Current Output

4.8.2.2. Voltage Operation

For *Voltage Operation* in the default unipolar mode (0 to +10 volts), user data is scaled so that 0 volts corresponds to a count of 0 and +10 volts corresponds to a count of 32000. In this mode, you can enter up to 32767 for an overrange of approximately 10.24 volts output. In the –10 to +10 volt range user data is scaled so that –10 volts corresponds to a count of –32000 and +10 volts corresponds to a count of +32000. In this range, you can enter –32768 to +32767 for an overrange of approximately –10.24 volts to +10.24 volts.

Scaling of the voltage output for both the 0 to +10 volt range and the –10 to +10 volt range is as shown below.

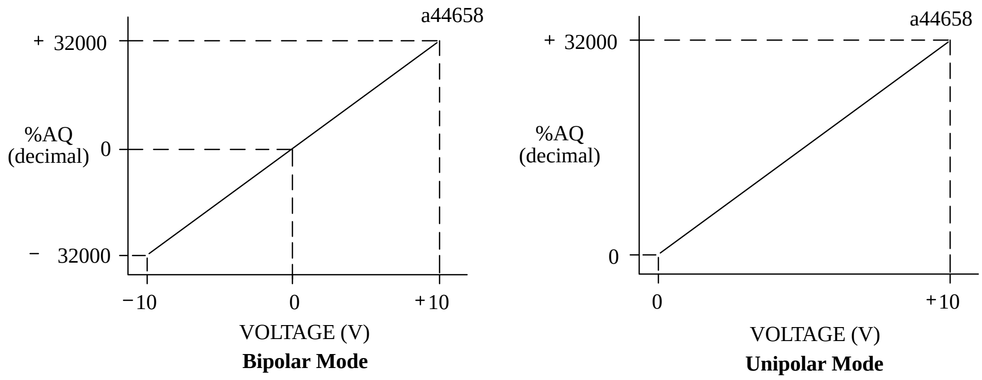


Figure 3.51 – Scaling for Voltage Output

4.8.2.3. CPU Interface to the Analog Combo Module

The Alspa C80–35 PLC uses the data within the %AI and %AQ data table to record analog values for use by the programmable controller. For detailed information on the CPU interface to analog modules, refer to the *Hardware Description of Analog Module* at the beginning of this chapter.

4.8.2.4. Status Reporting

The Analog Combo module module provides status information to the PLC. This status information is updated once each PLC sweep and consists of the following items:

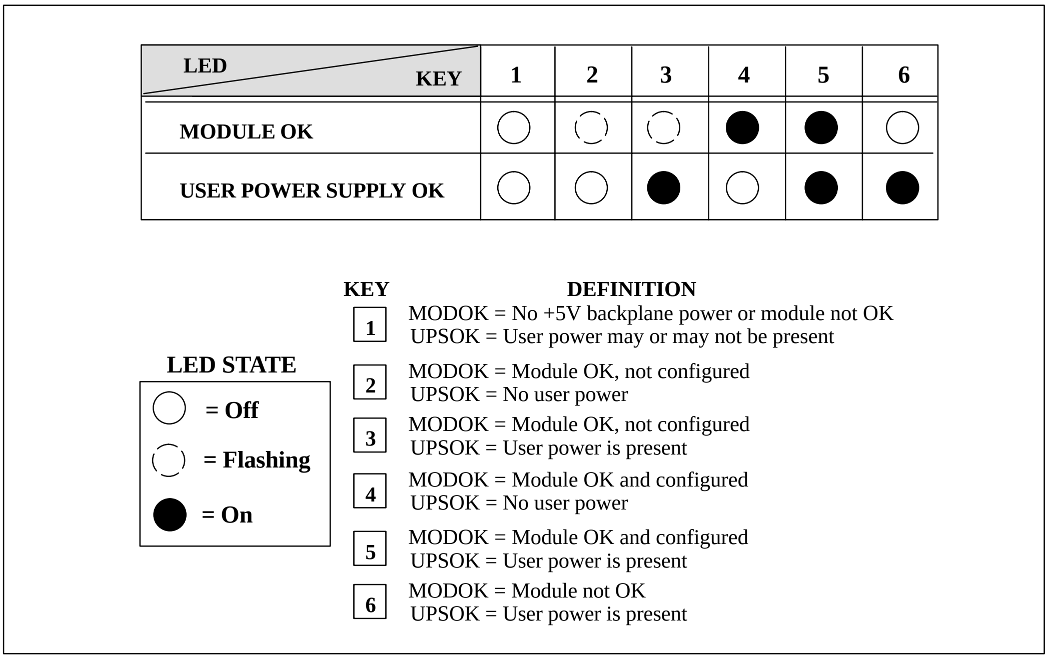
- *health of the module* (all ranges).
- *overload or open wire detect* (current output mode only).
- *alarm low and high status* (input channels).
- *status of the user-supplied power to the module* (all ranges).

4.8.2.5. Power Requirements and LEDs

This module requires a maximum of 95 mA from the 5V bus on the PLC backplane for the logic side. The module's analog power *must be supplied* by a single, user supplied+24 VDC power source. This includes current loop output power and voltage output load power. This user supply requires a maximum current of 129 mA.

There are two green LED indicators on the module which provide module and user supply status. The top LED, **MODULE OK** provides module status information and the bottom LED, **USER POWER SUPPLY OK** indicates that the user supply is present and is above a minimum designated level. Note that both LEDs are powered from the +5V backplane power bus.

The LEDs have three possible states; *off*, *flashing*, or *on*. The definitions for each of these conditions is described below.



4.8.2.6. Location in System

The Analog Combo module can be installed in any I/O slot of a 5 or 10-slot baseplate in an Alspa C80–35 PLC system.

4.8.2.7. References Used

The number of Analog Combo modules which can be installed in a system depends on the amount of %AQ, %AI and %I references available. Each module uses 8 %AQ references and 8 %AI references (depending on the number of channels enabled) and 8, 16 or 24 %I references (depending on alarm status configuration).

There are 32 %AQ and 64 %AI references available in Models 311, 313 and 323 system, 64 %AQ and 128 %AI references available in a Model 331 system, and 256 %AQ and 1024 %AI references available in a Model 341 system, and 512 %AQ and 2048 %AQ references available in Models 351and 352 system.

The maximum number of Analog Combo modules that can be installed in a system are:

- 5 in a Model 311 or 313 system.
- 10 in a Model 323 system.
- 49 in a Model 331 or 341 system.
- 79 in a Model 351 or 352 system.

When planning the module configuration for your application you must also consider the load capacity of the installed power supply and the total load requirements of all modules that are installed in the baseplate. Refer to Chapter 1 in this manual, for details on power supply, baseplate, and module load requirements. Module specifications are provided in the following tables.

Analog Output Specifications	
Number of Output Channels	2, Single-Ended
Update Rate	4 milliseconds (approximate - both channels)
Analog Current Output	
Output Current Ranges	0 to 20 mA 4 to 20 mA
Resolution	
0 to 20 mA	0.625 µA (1 LSB = 0.625 µA)
4 to 20 mA	0.5 µA (1 LSB = 0.5 µA)
Absolute Accuracy*	
All Current Modes	± 0.1% of full scale at 25°C (77°F), typical ± 0.25% of full scale at 25°C (77°F), (maximum) ± 0.5% of full scale over operating temperature range (maximum)
Maximum Compliance Voltage	V_{USER} –3V (minimum) to V_{USER} (maximum)
User Load	0 to 850 Ω (minimum at V_{USER} =20V, maximum 1350Ω at V_{USER} =30V
Output Load Capacitance	2000 pF (maximum)
Output Load Inductance	1 H (maximum)

* In the presence of severe RF interference (IEC 801-3, 10V/m), accuracy may be degraded to ±1% FS.
Refer to data sheet ALS 53002 for product standards and general specifications.

Table 3.23 – Specifications for IC693ALG442

Analog Voltage Output	
Output Ranges	–10 to +10V (bipolar) 0 to +10V (unipolar)
Resolution	
–10 to +10V	0.3125 mV (1 LSB = 0.3125 mV)
0 to +10V	0.3125 mV (1 LSB = 0.3125 mV)
Absolute Accuracy (1)	
Both Voltage Modes	± 0.25% of full scale at 25°C (77°F), typical ± 0.5% of full scale at 25°C (77°F), (maximum) ± 1.0% of full scale over operating temperature range (maximum)
Output Loading	5 mA (2K ohms minimum resistance)
Output Load Capacitance	1 µF (maximum capacitance)
Analog Input Specifications	
Number of Input Channels	4, differential
Update Rate	8 milliseconds approximate for all 4 channes)
Analog Current Input	
Input Ranges	0 to 20 mA 4 to 20 mA 4 to 20 mA Enhanced
Resolution	
0 to 20 mA	5 µA (1 LSB = 5 µA)
4 to 20 mA	5 µA (1 LSB = 5 µA)
4 to 20 mA Enhanced	5 µA (1 LSB = 5 µA)
Absolute Accuracy	
All Current Modes	± 0.25% of full scale at 25°C (77°F) ± 0.5% of full scale over specified operating temperature range
Linearity	<1 LSB
Common Mode Voltage	200V (maximum)
Common Mode Rejection	>70 dB at DC; >70 dB at 60 Hz
Cross Channel Rejection	>80 dB from DC to 1 kHz
Input Impedance	250 Ω
Input Filter Response	29 Hz
Analog Voltage Input	
Input Ranges	0 to +10V (unipolar) –10 to +10V (bipolar)
Resolution	
0 to +10V	2.5 mV (1 LSB = 2.5 mV)
–10 to +10V	5 mV (1 LSB = 5 mV)
Absolute Accuracy(2)	
Both Voltage Ranges	± 0.25% of full scale at 25°C (77°F) ± 0.5% of full scale over specified operating temperature range
Linearity	<1 LSB
Common Mode Voltage	200V (maximum)

(1) In the presence of severe RF interference (IEC 801-3, 10V/m), accuracy may be degraded to ±4% FS.
(2) In the presence of severe RF interference (IEC 801-3, 10V/m), accuracy may be degraded to ±2% FS.

Table 3.23 – Specifications for IC693ALG442 (continued)

Common Mode Rejection	>70 dB at DC; >70 dB at 60 Hz
Cross Channel Rejection	>80 dB from DC to 1 kHz
Input Impedance	800K Ω (typical)
Input Filter Response	29 Hz
Power Requirements	
External Supply Voltage Range	20 to 30 VDC (24 VDC typical)
Power Supply Rejection Ratio (PSRR) *	
Current	5 µA/V (typical), 10µA/V (maximum)
Voltage	25 mV/V (typical), 50mV/V (maximum)
Voltage Ripple	10%
Current Consumption	
From Internal +5V Supply	95 mA from internal +5V supply
From External User Supply	129 mA

* PSSR is measured by varying V_{USER} from 24V to 30V.

Table 3.23 – Specifications for IC693ALG442 (continued)

4.8.3. Configuration

The Analog Combo module can be configured using either the Alspa P8 or Alspa P80 Programming Software configurator function or with the Hand–Held Programmer.

The parameters that can be configured are described in the following table. Configuration procedures using Alspa P8 or Alspa P80 Programming Software and the Hand–Held Programmer are described in the following pages.

Parameter	Description	Values	Defaults	Units
STOP MODE	Output state when module toggled from RUN to STOP mode	HOLD or DEFLOW	HOLD	N/A
%AI ADR	Starting address for the %AI reference type	standard range	%AI0001, or next highest available reference	N/A
%AQ ADR	Starting address for the %AQ reference type.	standard range	%AQ0001, or next highest available reference	N/A
%I ADR	Starting address for the %I reference type	standard range	%I0001, or next highest available reference	N/A
%I SIZE	Number of %I status locations	8, 16, 24	8	bits
RANGE OUTPUT	Type of output range	0,+10 V, –10,+10 V, 4,20 mA, 0, 20mA	0,+10 V	volts (Voltage) mA (Current)
RANGE INPUT	Type of input range	0,+10 V, –10,+10 V, 4,20 mA, 0, 20mA, 4-20 mA Enhanced	0,+10 V	volts (Voltage) mA (Current)
ALARM LO	Low limit alarm value	–32768 to 32759	0	User counts
ALARM HIGH	High limit alarm value	–32767 to 32760	+32000	User counts

Table 3.24 – Configuration Parameters for IC693ALG442

For detailed information on configuration of the Analog Combo module, see

- *Configuration Using Alspa P8–25/35/05 or P80 Programming Software* beginning on page 3–107.
- *Configuration Using the Hand–Held Programmer* beginning on page 3–119.

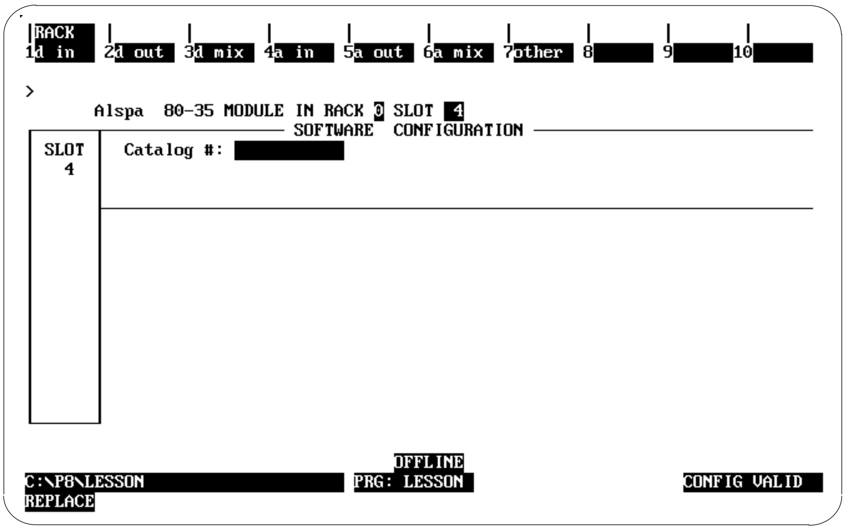
4.8.3.1. Configuration Using Alspa P8–25/35/05 or P80 Software

This paragraph describes how to configure the Analog Combo module using the configurator function in Alspa P8–25/35/05 Programming Software. *Configuration can also be done using Alspa P80 Programming Software. For details refer to the Alspa P80 online help.*

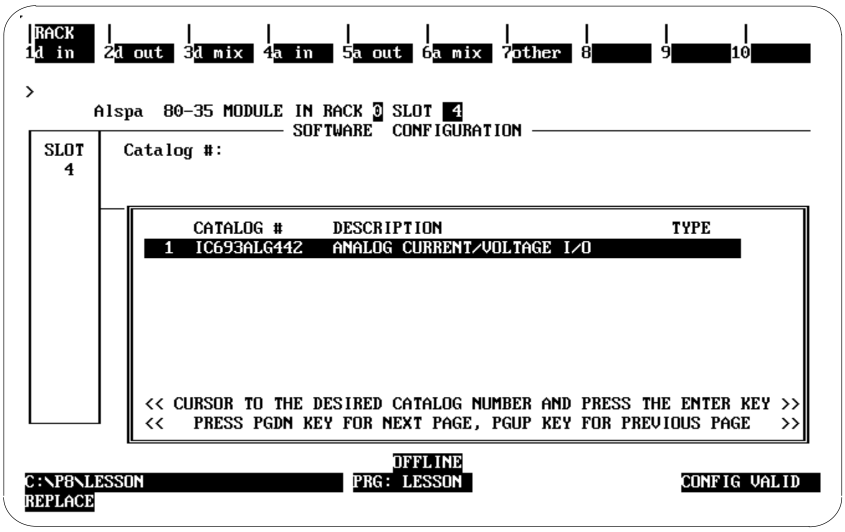
To configure an Analog Combo module on the I/O Configuration Rack screen, follow these steps:

1. Move the cursor to the desired rack and slot location. The slot may be either unconfigured or previously configured.

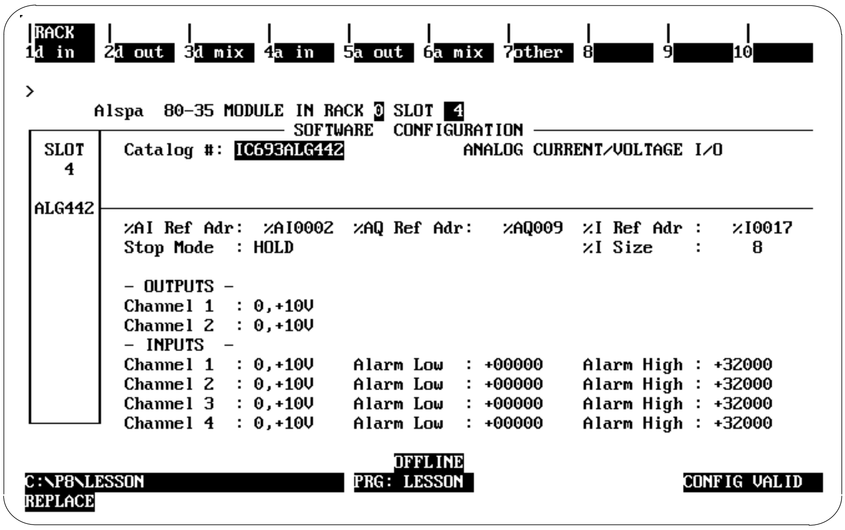
2. Press the **`m35 io`** key (**`F1`**). Your screen will change to one similar to the one shown below.



3. From this screen, press the **`a mix`** key (**`F6`**). Your screen will change to one similar to the one shown below.



4. Currently, there is only one selection. (If more than one selection appears, use your **Cursor Movement** (or **Arrow**) keys to move to Catalog No. IC693ALG442.) Press **Enter** to accept this selection and to move to the screen shown below.



5. All the remaining configuration does not have to be done on this screen. You can move your cursor from field to field by pressing the **Cursor Movement** (or **Arrow**) keys. When you are in the field you want to modify, you can either type in your choice or press the **Tab** key to scroll through the available selections (or **Shift-Tab** to reverse the direction of the scrolling).

Note

The entry in the **Stop Mode** field (**HOLD** or **DEFLOW (DEFault LOW)**) determines how the outputs will behave when the module is toggled from **RUN** to **STOP** mode. When this value is set to **HOLD** (default), the outputs will retain their last state. When you change this value to **DEFLOW**, the output will go to zero.

4.8.3.2. Other Configuration Considerations

The entry in **`%I Size`** will only accept 8, 16 and 24, and will accept only %I addresses. This field denotes the number of bits returned to the user. The only allowable entries for the **`%AI Ref Adr`** are %AI addresses. Similarly, the only allowable entries for the **`%AQ Ref Adr`** are %AQ addresses.

The **`Alarm Low`** limit for each channel must be less than its corresponding **`Alarm High`** limit.

The **`%AI Ref Adr`** field is the reference address for the %AI data and points to the start of the locations in the %AI memory where the input data to the module begins. Each channel provides 16 bits of analog output data as an integer value from 0 to 32767 or –32768 to 32767 depending on the range type selected.

The **`%AQ Ref Adr`** field is the reference address for the %AQ data and points to the start of the locations in the %AQ memory where the output data to the module begins. Each channel provides 16 bits of analog output data as an integer value from 0 to 32767 or –32768 to 32767 depending on the range type selected.

For detailed information of the data format, see the *CPU Interface to Analog Modules* paragraph at the beginning of this chapter.

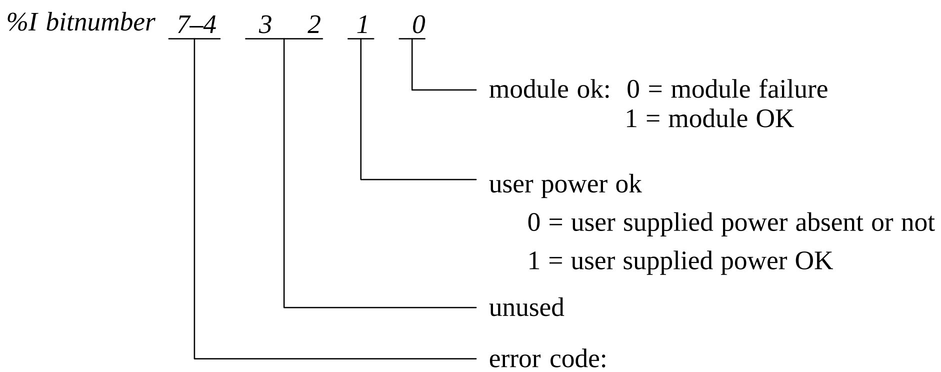
%I Status Information

The **`%I Ref Adr`** is the reference address for the %I data and points to the start of the locations in the %I memory (that is the Input Table) where status information from the module is reported. You can select the number of %I status locations reported to the PLC by editing the value in the **`%I Size`** field. Allowable Values in the %I Size field are 8 or 16 and 24 which refer to the number of %I locations reported to the PLC. For %I SIZE values 8 or greater, the data brought back is in the format described in the following tables.

First eight %I locations – (available for %I SIZE values 8, 16, 24)

%I Locations	Description
%I	Module OK – 0 indicates NOT OK, 1 indicates module OK.
%I+1	User Supply OK – Indicates when user supply is in specified limits; reads a 0 when User supply below specified limit, 1 when User supply OK.
%I+2 & %I+3	Reserved for future modules. Not used in this module.
%I+4 to 7	☞ See definition for these bits below.

☞ %I+4 to 7 (upper 4 bits of first %I byte) hold an error code which is defined as follows:



binary	*hexadecimal*	*error*
0000	0	no errors
0001	1	invalid channel
0010	2	invalid alarm level
0011	3	invalid ramp time or step
1000	8	invalid E2 COMMREQ function

If the you send E2 COMMREQ data that reflects an invalid condition, the module will ignore the COMMREQ command and return an error code in the upper 4 bits of the first %I byte. The module will NOT stop standard operation if an error is detected; these error bits are for the user's information and can be ignored if desired. The error code will remain until you send an E2 COMMREQ to clear the error code or reconfigure the module.

Only the most recent error will be reported; an existing error code will be overwritten if another error occurs. The priorities for errors are:

1. Invalid COMMREQ function (highest priority)

2. Invalid channel.

3. Invalid data (ramp or alarm parameter) (lowest priority).

Thus, if multiple error conditions exist, the one with the highest priority is reported in the error code.

Second eight locations – (available for %I SIZE values 16, 24)

%I Locations	Description
%I+8	Input: Channel No.1 ALARM LO – 0 indicates value above limit; 1 below or =
%I+9	Input Channel No.1 ALARM HI – 0 indicates value below limit; 1 above or =
%I+10	Input Channel No.2 ALARM LO – 0 indicates value above limit; 1 below or =
%I+11	Input Channel No.2 ALARM HI – 0 indicates value below limit; 1 above or =
%I+12	Input Channel No.3 ALARM LO – 0 indicates value above limit; 1 below or =
%I+13	Input Channel No.3 ALARM HI – 0 indicates value below limit; 1 above or =
%I+14	Input Channel No.4 ALARM LO – 0 indicates value above limit; 1 below or =
%I+15	Input Channel No.4 ALARM HI – 0 indicates value below limit; 1 above or =

The third eight locations (available for %I SIZE values 24)

%I Locations	Description
%I+16	Output Channel No.1 BROKEN WIRE 0 = OK, 1 = Wire Broken (Current modes only)
%I+17	Output Channel No.2 BROKEN WIRE 0 = OK, 1 = Wire Broken (Current modes only)
%I+18 to %I+23	Reserved for future modules. Not used in this module

One of four input or output ranges can be selected; two are voltage ranges. The default range is 0 to +10V, where input or output voltage values range from 0 to 10 volts. In input mode they report 0 to 32767 integer values to the CPU and in output mode values between 0 and 32767 are sent to the module. In the –10 to +10V range, values between –32768 to 32767 are sent or received from the CPU over an input voltage range of –10 to +10V.

The two current ranges are 4 to 20 mA, and 0 to 20 mA. In each of the current ranges, values between 0 and 32767 are reported back from the module to sent to the module for the entire range.

Values Sent from CPU to Module for Output Channels

The following tables show values sent from the CPU to the module for the Output channels:

Range	Module Mode	*Allowed Values	Sent values from CPU
0 to 10 V	Voltage	0 to 32767	0 to 32767
–10 to 10 V	Voltage	– 32768 to 32767	–32768 to 32767
4 to 20 mA	Current	0 to 32000*	0 to 32767
0 to 20 mA	Current	0 to 32767	0 to 32767

* *Allowed Values* refers to the values that are valid. If a value outside the specified range is sent, the module clips it to the nearest valid value before sending it to the Digital to Analog Converter. No errors are returned.

The following table shows values sent from the module back to the PLC for the Input channels

Range	Module Mode	Sent values to CPU
0 to 10 V	Voltage	0 to 32767
–10 to 10 V	Voltage	–32768 to 32767
4 to 20 mA	Current	0 to 32767
0 to 20 mA	Current	0 to 32767
0 to 20 mA Enhanced	Current	–8000 to 32767

The ALARM LO and ALARM HI data fields allow you to enter values that cause *alarm* indications to be passed to the PLC. Each channel has a low limit alarm value (ALARM LO) and a high limit alarm value (ALARM HI). These alarm values cause %I points to be set as indicated in the tables above. Values can be entered in all high and low limit fields. Values entered without a sign are assumed to be positive. The allowable values are shown in the following table.

Range	Possible limit values
0 to 20 mA	0...32760
4 to 20 mA	0...32760
4 to 20 mA Enhanced	–8000...32760
0 to 10V	0...32760
–10 to +10V	–32768...32760

4.8.3.3. Ramp Mode Operation

The ramp mode operation represents a separate mode of the module's outputs. When an output channel is not in ramp mode, new values entered in the corresponding %AQ reference cause the output to step to the commanded values as shown in Figure 3.52. When an output channel is in ramp mode, new values entered in the corresponding %AQ reference cause the output to ramp to the given values using ramp variables which have been assigned to the channel using ladder logic. The ramp is composed of output steps taken every 1 millisecond.

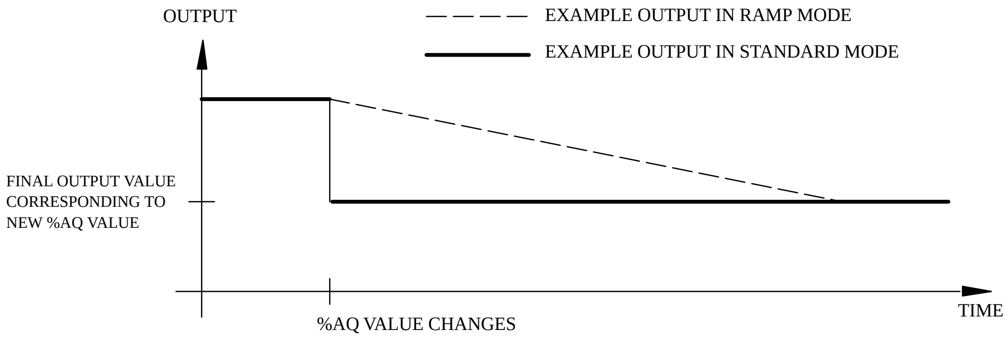


Figure 3.52 – Output Behavior in Ramp Mode and in Standard Mode

The default mode of both outputs is *standard mode*. Ramp mode and ramp variables are set using an E2 COMMREQ in ladder logic as described below. The mode of each output channel is set independent of the mode of the other channel. When an output is in ramp mode, two lower-level modes can be used to specify the ramp slope: ***time* mode**, in which the user provides the total ramp time in milliseconds, and ***step* mode**, in which the user provides the step in %AQ counts that will be taken every 1 millisecond.

Setting the Ramp Mode

An E2 COMMREQ is used to change the ramp mode of an output channel. This is the same COMMREQ that is used to change the input alarm limits of the module and clear the %I error code. When the module receives the COMMREQ, the first word, or *command* word, is checked to determine whether the ramp settings or alarm limits are being changed or whether the %I error code is being cleared.

When step mode is specified, the second COMMREQ data word contains the ramp step in %AQ counts. Valid step values range from 1 to 32000. The direction of the ramp is determined when the value of the corresponding %AQ reference changes. Once the ramp mode and step have been set, changing the corresponding %AQ value causes the output to ramp to the new value.

When time mode is specified, the second COMMREQ data word contains the total time in milliseconds it will take for the output to ramp from the present output value to the final output value. The present and final values are specified by the old and new values of the corresponding %AQ reference. Valid ramp time values range from 1 to 32000, which correspond to ramp times of 1 millisecond to 32 seconds. Once the ramp mode and time have been set, changing the corresponding %AQ value causes the output to ramp to the new value.

If an E2 COMMREQ is issued to the module to change the ramp settings while the indicated output is in the process of ramping, the new ramp settings will take effect as follows:

- If the ramp mode is turned off during a ramp, the output will step completely to the final value (indicated by the corresponding %AQ reference).
- If step mode is turned on during a ramp, the new step is used as soon as the COMMREQ is processed (assuming that the step is valid).
- If time mode is turned on during a ramp, the module will immediately begin a new ramp using the present output as the starting output and the present time as the start time.

In all cases, changing the value of the corresponding %AQ reference will cause the output to begin a new ramp from the present output value.

Error Handling

If the module receives E2 COMMREQ data that indicates an invalid channel or a step height or ramp time that is out of range, the module will ignore the COMMREQ and return an error code in the first byte of %I data assigned to the module. The error code will be cleared when a Clear Errors E2 COMMREQ is sent to the module or when the module is reconfigured. Range checking of %AQ values received by the module is performed before the values are used in ramp computations. %AQ data which is out of range is clipped to the nearest valid value by the module.

4.8.3.4. E2 Commreq

The E2 COMMREQ allows you to modify the input alarm limits, set the output ramp mode and parameters, and clear the %I error code. The E2 COMMREQ uses the standard COMMREQ format. See Chapter 4 of the *ALS 52102 Alspa C80–35, C80–25 and C80–05 PLCs Reference Manual*, and Chapter 8 of the *ALS 52202 Hand–Held Programmer for Alspa C80–35, C80–25 and C80–05 PLCs User's Manual*, for more information on the COMMREQ.

E2 COMMREQ Command Block

The E2 COMMREQ command block consists of 10 words as shown in Table 3.25. Example E2 COMMREQ data in hexadecimal format are included in the figure for clarity.

Address	Data Description	Example Data
Start Address	Always 0004 for this module	0004
+1	Not used	0000
+2	COMMREQ status data type	0008 (%R)
+3	COMMREQ status address (zero-based)	0000 (%R0001)
+4	Not used	0000
+5	Not used	0000
+6	Command type (E2 –> message ID for 6 byte data command to ALG442) and command parameter (1 –> write)	E201
+7	Byte length of data sent to ALG442	0006
+8	Data type	0008 (%R)
+9	Data address (zero based)	0064 (%R0101)

Table 3.25 – E2 COMMREQ Command Block Definitions

The decimal and hexadecimal values which specify COMMREQ data types are shown in Table 3.26. The data format and command word description for the E2 COMMREQ are shown in Table 3.27. The first word holds the command word, the second word holds data for changing alarm or ramp parameters and the third word is unused. The %R addresses correspond to the example command block data in Table 3.27.

For This Data Type		Enter This Number	
		Decimal	Hexadecimal
%I	Discrete Input	28	1C
%Q	Discrete Output	30	1E
%R	Register	8	08
%AI	Analog Input	10	0A
%AQ	Analog Output	12	0C

Table 3.26 – COMMREQ Data Types

E2 COMMREQ Data

word 1	%R0101	command word
word 2	%R0102	alarm or ramp data
word 3	%R0103	unused

Channel Convention *

0 = channel 1
1 = channel 2
2 = channel 3
3 = channel 4

Command Word	Description
000x	Change low alarm of channel x using absolute mode; word 2 holds the new alarm value.
001x	Change high alarm of channel x using absolute mode; word 2 holds the new alarm value.
002x	Change low alarm of channel x using relative mode; word 2 holds the change of the alarm value.
003x	Change high alarm of channel x using relative mode; word 2 holds the change of the alarm value.
004x	Channel x ramp mode off; places channel in standard mode.
005x	Channel x ramp step mode on; word 2 holds the step taken each millisecond.
006x	Channel x ramp time mode on; word 2 holds the total ramp time.
00C0	Clear %I error code; word 2 is ignored.

* 1 to 4 are valid channels for changing alarm levels.
1 and 2 are valid channels for setting ramp modes.

Table 3.27 – E2 COMMREQ Data and Command Word Formats

You can change the high and low alarm limits for any of the four input channels. Two modes are available to modify the alarm data: ***absolute*** mode and ***relative*** mode.

- *When using absolute mode*, the alarm data sent by the COMMREQ specifies the actual new alarm value.
- *When using relative mode*, the alarm data specifies the positive or negative change in the alarm value that is added to the present value.

The module verifies that the new alarm limit requested is not out of range and does not violate the condition HIGH>LOW. If an invalid request is made to change an alarm value, the corresponding error code will be returned in the upper four bits of the first byte of %I references assigned to the module.

E2 COMMREQ Example

The following ladder logic provides an example of setting up E2 COMMREQ data and issuing the COMMREQ. As with all COMMREQs, it is recommended that the ladder verify the completion of the E2 COMMREQ in progress before initiating another. This ensures that the module does not receive COMMREQs faster than it can process them. One way to do this is to zero the contents of the COMMREQ status (%R0001 in this example) as the COMMREQ is enabled. Since the status returned for a completed COMMREQ is never zero, a non-zero status word will then indicate that the COMMREQ has completed.

In this example, the COMMREQ command block begins at %R0002 and is initialized on the first scan. It is assumed that the 6 bytes of COMMREQ data sent to the module are moved into %R0101–%R0103 before the

COMMREQ is enabled. The module is located in rack 0, slot 2 so the SYSID input to the COMMREQ is 0002. Setting %T0001 moves zero into the COMMREQ status word, enables %T0003 for one sweep to initiate the COMMREQ, and sets %T0002 to begin checking the status word. When a non-zero status word is detected, %T0002 is reset to discontinue checking and %T0004 is set to indicate that the module is ready for the next COMMREQ. Reference %M0001 is set if a COMMREQ fault occurs.

```
|
|FST_SCN +------+                 +------+                 +------+
+--] [---+BLKMV+------------------+MOVE_+------------------+MOVE_+
|        | INT |                  | WORD|                  | WORD|
|        |     |                  |     |                  |     |
| CONST -+IN1 Q+-%R0001   CONST -+IN   Q+-%R0008   CONST -+IN Q+-%R0009
| +00000 |     |            E201 | LEN |             0006 | LEN |
|        |     |                 |00001|                  |00001|
| CONST -+IN2  |                 +------+                 +------+
| +00004 |     |
|        |     |
| CONST -+IN3  |
| +00000 |     |
|        |     |
| CONST -+IN4  |
| +00008 |     |
|        |     |
| CONST -+IN5  |
| +00000 |     |
|        |     |
| CONST -+IN6  |
| +00000 |     |
|        |     |
| CONST -+IN7  |
| +00000 +------+
|
|
|
|FST_SCN +------+                 +------+
+--] [---+MOVE_+------------------+MOVE_+
|        | INT |                  | INT |
|        |     |                  |     |
| CONST -+IN  Q+-%R0010   CONST -+IN   Q+-%R0011
| +00008 | LEN |          +00100 | LEN |
|        |00001|                 |00001|
|        +------+                +------+
|
|
| %T0001 +------+                                               %T0002
+--] [---+MOVE_+-----------------------------------------+--------(S)--
|        | INT |                                         |
|        |     |                                         |      %T0003
| CONST -+IN  Q+-%R0001                                  +--------( )--
|  00000 | LEN |                                         |
|        |00001|                                         |      %T0001
|        +------+                                        +--------(R)--
```

```
|
|
|%T0003           +-----+                                         %M0001
+--] [-----------+COMM_| +----------------------------------------(S)--
|                | REQ | |
|                |     | |
|        %R0002 -+IN FT+-+
|                |     |
|         CONST -+SYSID|
|           0002 |     |
|                |     |
|         CONST -+TASK |
|       00000000 +-----+
|
|
| %T0002 +-----+
+--] [---+ NE_ |
|        | INT |
|        |     |                                                  %T0002
| CONST -+    Q+--------------------------------------------+-------(R)--
| +00000 |     |                                            |
|        |     |                                            |     %T0004
| %R0001-+     |                                            +-------(S)--
|        +-----+
|
```

4.8.3.5. Configuration Using the Hand–Held Programmer

You can also configure the 4-Channel Input/2-Channel Output Analog Current/Voltage module using the Alspa C80–35 Hand–Held Programmer. In addition to the information in this paragraph, refer to the *ALS 52202 Hand–Held Programmer for Alspa C80–35, C80–25 and C80–05 PLCs User's Manual* for more information on configuration of Intelligent I/O modules.

Although you can change the number of actively scanned channels with the Alspa P8–25/35/05 configurator function, the Hand–Held Programmer does not support editing the number of actively scanned channels. If the 8-Channel Analog Current/Voltage Output module is initialized by a Hand–Held Programmer, the number of actively scanned channels is 8.

If a module had been previously configured with Alspa P8–25/35/05 software and the number of actively scanned channels has been changed from 8, that number will be displayed on the bottom line of the Hand–Held Programmer display following the **AQ** entry. You can edit data with the Hand–Held Programmer only for the active channels, but you can not change the number of actively scanned channels.

Module Present

If a module is physically present in a system, it can be added to the system's configuration by reading the module into the configuration file. For example, assume that an 4-Channel Input/2–Channel Output Analog Current/Voltage module is installed in slot 3 of a Model 311 PLC system. It can be added to the configuration with the following sequence. Use the ↑ and ↓ arrow cursor keys or the No. key to display the selected slot.

Initial Display

```
R0:03 EMPTY   <S
```

To add the IC693ALG442 module to the configuration, press the **READ/VERIFY, ENT** key sequence. The following screen will be displayed:

```
R0:03 AIO 2.00<S
 I24:I _
```

Selecting %I Reference

At this point the starting %I reference address for the status data returned from the module must be entered. Notice that the length of the status field (**24**) is displayed as the first two digits following the first **I** on the second line of the display.

Note

This field cannot be changed with the Hand-Held Programmer. However, it can be changed using the Alspa P8–25/35/05 Micro software configurator function. The Hand-Held Programmer will always reflect the currently active length of the status field.

Pressing the **ENT** key will allow the PLC to select the starting address of the status data. You can select a specific starting address by pressing the key sequence for the desired address and pressing the **ENT** key. For example, to specify the starting address as I17, press the key sequence **1**, **7, ENT**.

Note

The configured reference addresses will not be displayed until all three reference types (%I, %AI and %AQ) have been assigned starting addresses. Once this is done, the configured addresses can be viewed by scrolling backward using the ← key.

You can press the **CLR** key at any time to abort the configuration you have just selected and return the slot to EMPTY.

After selecting the starting %I address and pressing the **ENT** key, the following screen is displayed.

```
R0:03 AIO 2.00<S
AI04:AI _
```

Selecting %AI Reference

This screen allows you to select the starting address for the %AI reference by specifying the starting reference in the %AI field. Note that the number of references **(04)** is displayed as the first two digits following the first **AI** on the second line of the display.

You can select the next available address or enter a specific address. Pressing the **ENT** key will allow the PLC to select the starting address. You can select a specific starting address by pressing the key sequence for the desired address and pressing the **ENT** key. For example, to specify the starting address as %AI35 press the key sequence **3**, **5**, **ENT**.

Note

The configured reference addresses will not be shown until all three reference types (%I, %AI and %AQ) have been assigned starting addresses. Once this is done, the configured addresses can be viewed by scrolling backward using the ← key.

You can press the **CLR** key while entering the starting address to clear the address field and enter a different address.

After selecting the starting %AI address and pressing the **ENT** key, the following screen is displayed:

```
R0:03 AIO 2.00<S
AQ02:AQ _
```

Selecting %AQ Reference

This screen allows you to select the starting address for the %AQ reference by specifying the starting reference in the %AQ field. Note that the number of references **(02)** is displayed as the first two digits following the first **AQ** on the second line of the display.

You can select the next available address or enter a specific address. Pressing the **ENT** key will allow the PLC to select the starting address. You can select a specific starting address by pressing the key sequence for the desired address and pressing the **ENT** key. For example, to specify the starting address as %AQ35 press the key sequence **3**, **5**, **ENT**. The following screen will be displayed:

```
R0:03 AIO 2.00<S
AQ02:AQ035-0036
```

Once the %AQ starting address has been assigned, the ← key can be used to view the configured %I and %AI reference addresses. For example, if %I17 and %AI35 are used as starting addresses then the following screen will be displayed after pressing the key sequence ←, ←:

```
R0:03 AIO 2.00<S
 I24:I0017-0040
```

Scrolling forward from this screen using the → key causes the following screen to be displayed:

```
R0:03 AIO 2.00<S
AI04:AI0035-0038
```

Removing Module From Configuration

The module can be removed from the current rack configuration at any time during the configuration process by pressing the **DEL**, **ENT** key sequence. The following screen will be displayed:

```
R0:03 EMPTY   <S
```

If the **CLR** key is pressed after the **DEL** key (instead of the **ENT** key), the delete operation will be aborted.

Selecting Module Stop Mode

The STOP mode of the module, either HOLD or DEFAULT LOW (DEFLOW), can be displayed and modified using the following procedure. From the %AQ reference screen, press the → key to scroll to the next screen:

```
R0:03 AIO 2.00 <S
HLS/DEF:HOLD
```

The default STOP mode is HOLD, which indicates that each output will hold its last state when the PLC is placed in STOP mode. You can toggle between the HOLD and DEFLOW modes by pressing the ± key. Pressing this key once causes the following screen to be displayed:

```
R0:03 AIO 2.00 <S
HLS/DEF:DEF LOW
```

In DEFLOW mode, each output will become zero when the PLC is placed in STOP mode. When the desired mode is displayed, it is accepted by pressing the **ENT** key. To return to the previous screen, press the ← key.

Selecting Output Channel Ranges

The range for each of the output and input channels can be displayed and selected or changed as described below. There are two current and two voltage ranges that can be selected for each output channel. From the STOP mode screen, pressing → causes the following screen to be displayed:

```
R0:03 AIO 2.00<S
CH 1–AQ:0,10 V
```

You can toggle through the ranges for each channel by pressing the ± key. Each range will be displayed as shown below.

```
R0:03 AIO 2.00<S
CH 1–AQ:–10,+10
```

```
R0:03 AIO 2.00<S
CH 1–AQ:4,20 MA
```

```
R0:03 AIO 2.00<S
CH 1–AQ:0,20 MA
```

When the desired range is displayed, it is accepted by pressing the **ENT** key. To return to the previous screen, press the ← key. To view the range display for the next channel, press the → key. If the → key is pressed, the following screen will be displayed:

```
R0:03 AIO 2.00<S
CH 2–AQ:0,10 V
```

Edit the range for this channel as you did for the first channel. To view the range display for the first *input* channel, press the → key.

Selecting Input Channel Ranges

There are three current and two voltage ranges that can be selected for each input channel. The following screen is displayed for the first input channel:

```
R0:03 AIO 2.00<S
CH 1–AI:0,10 V
```

You can toggle through the ranges for each input channel by pressing the ± key. Each range will be displayed as shown below.

```
R0:03 AIO 2.00<S
CH 1–AI:–10,+10
```

```
R0:03 AIO 2.00<S
CH 1–AI:4,20 MA
```

```
R0:03 AIO 2.00<S
CH 1–AI:0,20 MA
```

```
R0:03 AIO 2.00<S
CH 1–AI:4–20 MA+
```

When the desired range for the module is displayed, it is accepted by pressing the **ENT** key. To return to the previous screen press the ← key.

Selecting Low and High Alarm limits

The low and high alarm limit screens for each channel are displayed immediately following the channel range screen. The following screen is displayed if the → key is pressed from the range screen for input channel 1:

```
R0:03 AIO 2.00<S
CH 1 LO:     0
```

This display contains the entry field for the *low alarm limit* for this channel. You can enter positive or negative values using the numeric keys (0 through 9) and the ± key. Press the **ENT** key to accept the value you have entered. When an alarm value that is not in the allowed range (–32768 to 32760) is entered, a DATA ERR message will be displayed as shown in the following example:

```
R0:03 DATA ERR<S
CH 1 LO:–33000_
```

The bad data must be corrected before the HHP will allow you to move to another screen. When a valid low alarm has been entered, press the → key to move to the high alarm limit screen for this channel. The following screen will be displayed:

```
R0:03 AIO 2.00<S
CH 1 HI: 32000
```

This screen contains the entry field for the *high alarm limit* for this channel. You can enter positive or negative values using the numeric keys (0 through 9) and the ± key. To view the range screen for the next input channel, press the → key. The following screen will be displayed:

```
R0:03 AIO 2.00<S
CH 2–AI:0,10 V
```

Edit the ranges and alarm limits for this channel and subsequent channels as you did for the first channel.

Freeze Mode

If an alarm value in the allowed range (–32768 to 32760) is entered that results in an invalid condition, such as a low alarm limit greater than an upper alarm limit or a negative alarm for a channel in a unipolar range, the module will enter *freeze* mode. In this mode, you will not be allowed to move beyond the present channel parameters (range, low alarm limit and high alarm limit) until the invalid condition is corrected or removed. Freeze mode is indicated on the HHP screen by an asterisk (*) after the slot number. For example, if a low alarm limit of –1000 is entered for input channel 1 in the 0,10V range the following screen will be displayed:

```
R0:03*AIO 2.00<S
CH 1 LO: –1000
```

If you press either the ↑ key or the ↓ key to change slots, the following message will be displayed:

```
SAVE CHANGES? <S
<ENT>=Y <CLR>=N
```

If you *do not* want to save the changes to the CPU, press the **CLR** key. The following message will be displayed:

```
DISCARD CHGS? <S
<ENT>=Y  <CLR>=N
```

If you *do not* want to discard the changes you have made, press the **CLR** key. This will return you to the last parameter that was being modified with all changes intact.

If you *do* want to discard the changes you have made, press the **ENT** key. The Hand-Held Programmer will then return you to the last parameter that was being modified with the data reset to its previous value.

If you want to save the data to the CPU from the SAVE CHANGES? screen shown above, press the **ENT** key. If the module is in freeze mode, the Hand-Held Programmer will return with a CFG ERR message on the screen as follows:

```
R0:03*CFG ERR <S
CH 1 LO: –1000
```

If all data is valid, the HHP display will move to an adjacent slot when either the ↑ key or ↓ key is pressed.

Saved Configurations

Configurations that contain Analog Combo modules can be saved to an EEPROM or MEM card and read from that device into the CPU at a later time. MEM cards and EEPROMs containing these configurations can be read into any Release 4 or later Alspa C80–35 CPU (cannot be read into an Alspa C80–25 CPU). Refer to Chapter 2 of the *ALS 52202 Hand–Held Programmer for Alspa C80–35, C80–25 and C80–05 PLCs User's Manual* for detailed information on the Save and Restore operations.

4.8.4. Field Wiring Connections

Connections to this module from user devices are made to screw terminals on a removable 20-terminal connector block mounted on the front of the module. The actual terminals used are described in the following table and are shown in the following wiring diagrams.

4.8.4.1. Terminal Assignments

Pin assignments for the 20 terminal I/O connector on the Analog Combo module are as shown in the following table.

Pin Number	Signal Name	Signal Definition
1	24VIN	User Supplied +24 Volt Input
2	JMP1	Jumper terminal for connecting 250Ω sense resistor for CH1
3	JMP2	Jumper terminal for connecting 250Ω sense resistor for CH2
4	+CH1	Positive connection for differential analog input channel 1
5	+CH2	Positive connection for differential analog input channel 2
6	–CH1	Negative connection for differential analog input channel 1
7	–CH2	Negative connection for differential analog input channel 2
8	JMP3	Jumper terminal for connecting 250Ω sense resistor for CH3
9	JMP4	Jumper terminal for connecting 250Ω sense resistor for CH4
10	+CH3	Positive connection for differential analog input channel 3
11	+CH4	Positive connection for differential analog input channel 4
12	–CH3	Negative connection for differential analog input channel 3
13	–CH4	Negative connection for differential analog input channel 4
14	V_{out} CH1	Voltage output for channel 1
15	I_{out} CH1	Current output for channel 1
16	V_{out} CH2	Voltage output for channel 2
17	I_{out} CH2	Current output for channel 2
18	V COM	Common return for voltage outputs
19	I RET	Common return for User supplied +24 V and current outputs
20	GND	Frame ground connections for cable shields

Table 3.28 – Terminal Pin Assignments for IC693ALG442

4.8.4.2. Analog Combo Module Block Diagram

The following figure is a block diagram of the Analog Combo module.

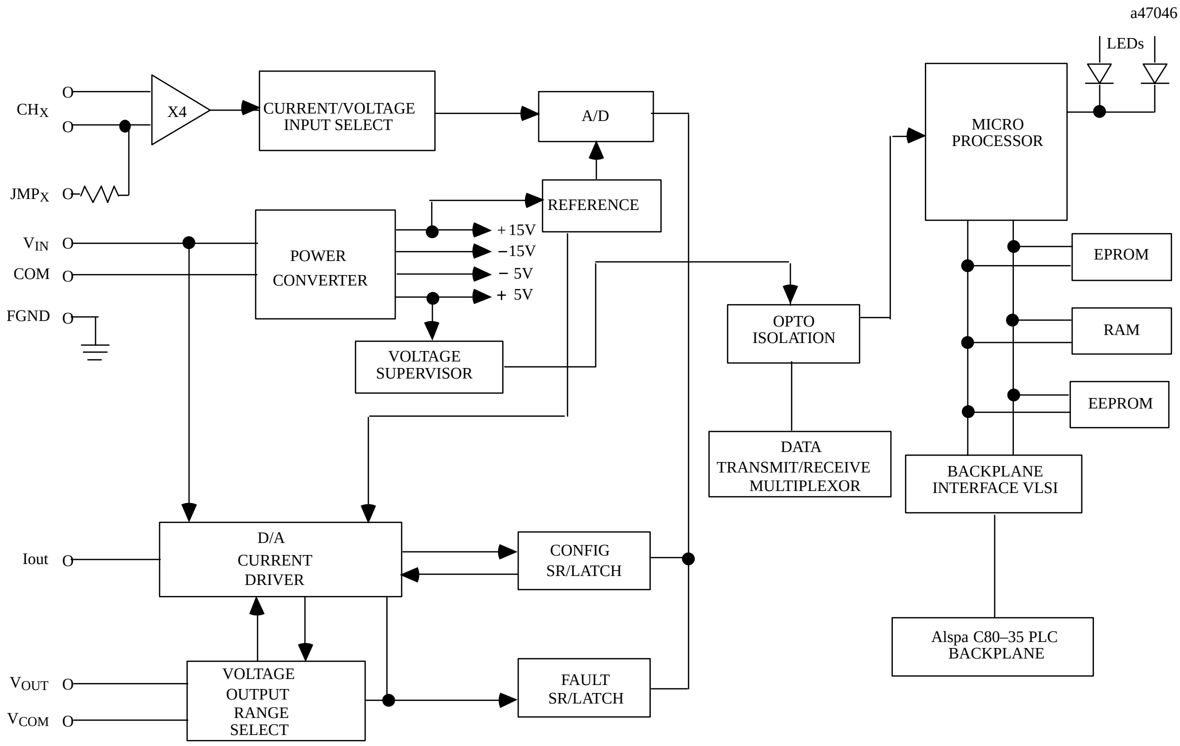


Figure 3.53 – Analog Combo Module Block Diagram - IC693ALG442

4.8.4.3. Field Wiring Information

The following figure provide information for connecting field wiring to the user terminal board on the analog combo Module.

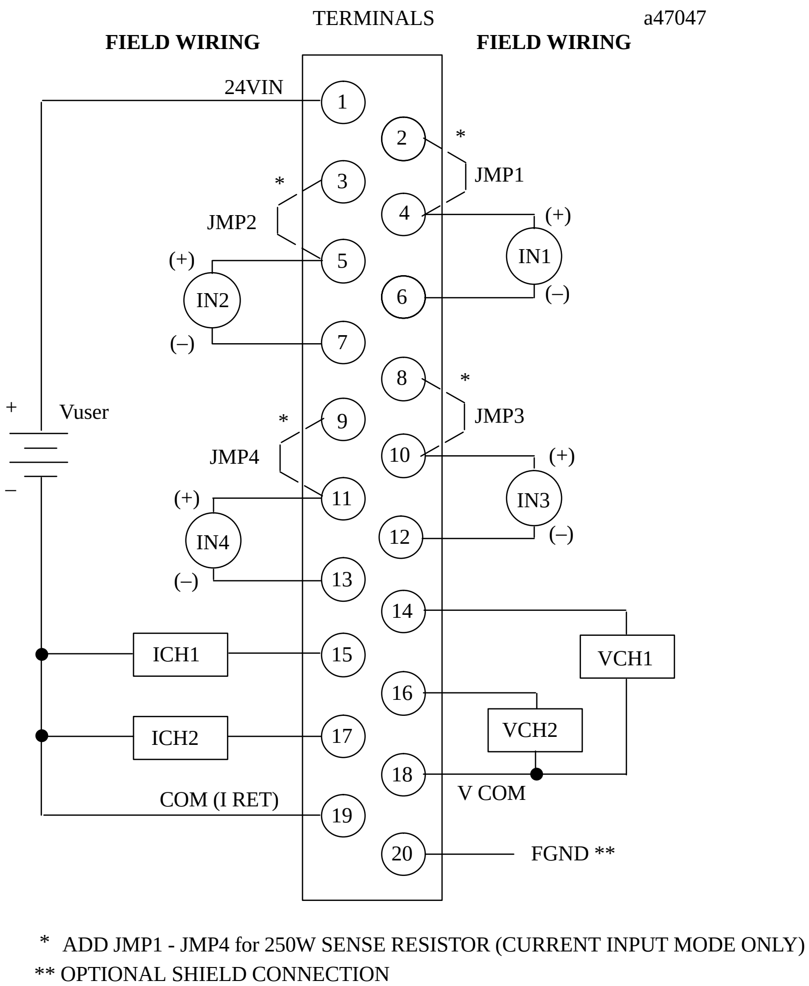


Figure 3.54 – Field Wiring for Analog Combo Module - IC693ALG442

Note

1. Each Input channel can be configured independent of other Input channels to operate as a voltage input ***or*** a current input – *not both simultaneously.*
2. Each Output channel can be configured independent of other Output channels to operate as a voltage output ***or*** a current output – *not both simultaneously*.

Appendix A

Product Certification, Standards and General Specifications

1. INTRODUCTION

This information applies to Alspa C80–35 and Alspa C80–75 PLC products; Alspa CE80–15 I/O products; and Alspa CE80–20/CE80–35 Distributed I/O and Control Products.

The Alspa 8000 products supplied by **ALSTOM** are global products which are designed and manufactured with ISO9001 quality assurance for application in industrial environments throughout the world. They should be installed and used in conformance with product specific guidelines as well as the following product certification, standards and general specifications.

The list of applicable certifications and standards for each module is available on request.

2. CERTIFICATION

Quality Assurance in Design/Development, Production, Installation and Servicing	ISO9001	Certification by Underwriters Laboratories and BSI Quality Assurance
European EMC and Low Voltage Directives	CE Mark	Certification by Competent Body for EMC Directive for selected modules
Safety for Industrial Control Equipment	UL508	Certification by Underwriters Laboratories
	C-UL[3] or CSA22.2, 142-M1987	Certification by Underwriters Laboratories [C-UL[3]] or Canadian Standards Association for selected C80–35, C80–75, CE80–35, CE80–15 and CE80–20 modules
Safety for Hazardous Locations Class I, Div. II, A, B, C, D	UL1604 with C–UL[3]	Certification by Underwriters Laboratories for selected modules Alspa C80–35, C80–75, CE80–35 and CE80–20.
	FM3611	Certification by Factory Mutual for selected modules Alspa C80–75 and CE80–15
	CSA22,2 213–M1987	Certification by Canadian Standards Association for selected Alspa CE80–15 modules.

3. STANDARDS OVERVIEW (1)

Environmental		
Vibration	IEC68–2–6, ISC0911	1 g at 40–150 Hz, 5 µm (0.012 in) p–p at 10–40 Hz
Shock	IEC68–2–27, JISC0912	15 g, 11 ms
Operating Temperature (2)		0 to 60 °C: Alspa C80–35, C80–75, CE80–35 (inlet) Alspa CE80–15 (ambient). 0 to 55 °C: Alspa CE80–20 (ambient).
Storage Temperature		– 40°C to + 85 °C (–40°F to +185°F)
Humidity		5 to 95 % non condensing
Enclosure Protection	IEC 529	Steel cabinet per IP54: protection from dust and splashing water

EMC Emissions		
Radiated, Conducted	CISPR11, EN55011 FCC	Class A (applies to CE Marked modules) part 15, subpart J, class A

EMC Immunity		(applies to CE Marked modules)
Electrostatic Discharge	IEC 1000–4–2	8 kV Air Discharge, 4 kV Contact
Radiated RF	IEC 1000–4–3	10 V_{rms}/m, 80 to 1000 MHz, 80% AM
Fast Transient Burst	IEC 1000–4–4	2 kV: power supplies, 1KV:I/O communications
Surge Withstand	ANSI/IEEE C37.90a IEC 255–4	Ring Wave, 2.5 kV Power supplies, I/O (12 V–240 V) Ring Wave, class II Power supplies, I/O (12 V–240 V)
Conducted RF	IEC 1000–4–6	10V_{rms}, 150 kHz to 80 MHz, 80% AM: communication cables >30 m

Isolation		
Dielectric Withstand	IEC 664 UL508, UL840	1.5 kV for modules rated from 51V to 250 V

Power Supply		
Input Dips, Variations	IEC 1000–4–11	During Operation: Dips to 30% and 100%, variation for AC= ±10%, Variation for DC= ±20%.

Notes 1 : Refer to module specific data sheets and installation guidelines in the related publications listed in Preface.
2 : Selected modules may be derated.
3 : Modules comply with applicable CSA Standards as evaluated by UL. The C-UL mark is accepted throughout Canada.

Appendix B Data Sheets for I/O Cables

This appendix provides data sheets describing each of the Alspa C80–35 cable types that can be used in an I/O system. The information in these data sheets applies to I/O systems controlled by either an Alspa C80–35 PLC or by a PC with a Personal Computer Interface card installed in the PC. These data sheets allow all cable information to be found in one convenient location. Each data sheet contains the following information:

- Cable name and function,
- Applicable catalog numbers,
- Hardware description of cable: connector types, cable type, other relevant hardware,
- Wiring diagram of cable.

Information on these cables is included in this appendix:

- *IC693CBL300* I/O Expansion cable, 1 meter (3 feet), continuous shield,
- *IC693CBL301* I/O Expansion cable, 2 meters (6 feet), continuous shield,
- *IC693CBL302* I/O Expansion cable, 15 meters (50 feet), continuous shield,
- *IC693CBL312* I/O Expansion cable, 0.15 meter (0.5 feet), continuous shield,
- *IC693CBL313* I/O Expansion cable, 8 meters (26 feet), continuous shield,
- *IC693CBL315* I/O Interface cable (24-pin) for high-density I/O modules, 3 meters (10 ft.),
- *IC693CBL321* I/O Faceplate to Terminal Block, 24-pin, 1 meter (3 ft.),
- *IC693CBL322* I/O Faceplate to Terminal Block, 24-pin, 2 meters (6 ft),
- *IC693CBL323* I/O Faceplate to Terminal Block, 24-pin, 0.5 meter (1.5 ft.).

4. IC693CBL300/301/302/312/313 I/O BUS EXPANSION CABLES

4.1. Function of cable

The I/O Bus expansion cables are used to extend the I/O bus to local expansion or remote baseplates in an Alspa C80–35 I/O system when additional I/O slots are needed or baseplates are required some distance from the CPU baseplate. The prewired I/O bus expansion cables can be used in a local expansion system with the last baseplate no more than 15 meters (50 feet) from the CPU baseplate. They can also be used in a remote expansion system within 15 meters (50 feet) of the CPU baseplate. For cable distances beyond 15 meters (50 feet) and up to 213 meters (700 feet), you must build cables of the required length (see Chapter 1 for detailed instructions).

All of the I/O Bus Expansion cables are made with a *continuous* or 100 % shield. Also, the cable with catalog number IC693CBL300 can be used for ”Y” connections in a remote expansion system.

4.2. Cable Lengths

- IC693CBL300 1 meter (3 feet), *continuous shield,*
- IC693CBL301 2 meters (6 feet), *continuous shield,*
- IC693CBL302 15 meters (50 feet), *continuous shield,*
- IC693CBL312 0.15 meter (0.5 feet), *continuous shield,*
- IC693CBL313 8 meters (26 feet), *continuous shield.*

4.3. Cable Specifications (for Remote Expansion System)

Item	Description
Cable:	Belden 8107: Computer cable, overall braid over foil shield, twisted-pair 30 volt/80°C (176°F) 0.22 mm^2 (AWG 24) tinned copper, 7 x 32 stranding Velocity of propagation = 70% (1.) Nominal impedance = 100 Ω
25 Pin Male Connector:	Crimp Plug = Amp 207464-1; Pin = Amp 66506-9 Solder Plug = Amp 747912-2
25 Pin Female Connector:	Crimp Receptacle = Amp 207463-2; Pin = Amp 66504-9 Solder Receptacle = Amp 747913-2
Connector Shell:	Kit - Amp 745833-5: Metal-plated plastic (plastic with nickel over copper) (1.) Crimp ring - Amp 745508-1, split ring ferrule

1. Critical Information

4.4. Expansion Port Pin Assignments

The following table lists the expansion port pin assignments you will need when building remote cables. All connections between cables are point-to point, that is, pin 2 of one end to pin 2 of the opposite end, pin 3 to pin 3, etc.

Pin Number	Signal Name	Function
16	DIODT	I/O Serial Data Positive
17	DIODT/	I/O Serial Data Negative
24	DIOCLK	I/O Serial Clock Positive
25	DIOCLK/	I/O Serial Clock Negative
20	DRSEL	Remote Select Positive
21	DRSEL/	Remote Select Negative
12	DRPERR	Parity Error Positive
13	DRPERR/	Parity Error Negative
8	DRMRUN	Remote Run Positive
9	DRMRUN/	Remote Run Negative
2	DFRAME	Cycle Frame Positive
3	DFRAME/	Cycle Frame Negative
1	FGND	Frame Ground for Cable Shield
7	0V	Logic Ground

Table B.1 – Expansion Port Pin Assignments

4.5. I/O Expansion Bus Termination

When two or more baseplates are cabled together in an expansion system, the I/O expansion bus must be properly terminated. The I/O bus *must be terminated* at the last baseplate in an expansion system. Each signal pair is terminated with 120 ohm, 1/4 watt resistors wired between the appropriate pins, as follows (also see Table B.1):

pins 16 - 17; 24 - 25; 20 - 21; 12 - 13; 8 - 9; 2 - 3

The I/O bus termination can be done one of the following ways:

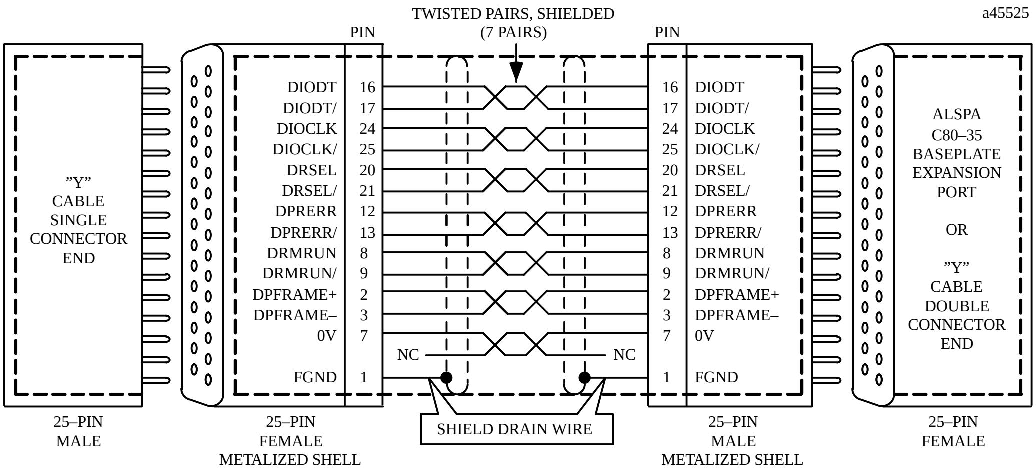
- By installing an *I/O Bus Terminator Plug,* catalog number IC693ACC307, on the last expansion baseplate (local expansion baseplate or remote baseplate) in the system. The Terminator Plug has a resistor pack physically mounted inside of a connector. The I/O Bus Terminator Plug is shipped with each baseplate; only the last baseplate in the expansion chain can have the I/O Bus Terminator Plug installed. Unused I/O Bus Terminator Plugs can be discarded or saved as spares.

- If an expansion system has only one expansion baseplate, the I/O bus can be terminated by installing as the last cable, the 15 meters (50 foot) I/O Expansion cable, catalog number IC693CBL302. This cable has the termination resistors installed in the end that connects to the expansion baseplate connector.

- You can also build a custom cable with termination resistors wired to the appropriate pins for installation at the end of the bus.

4.6. Wiring Diagrams

The following wiring diagrams show the wiring configuration for I/O expansion system cables. Wiring diagrams are provided for both point-to-point cables and ”Y” cables. For detailed information on building custom length cables, see Chapter 1.



NOTE:
Bold dashed line shows continuous (100%) shielding when metallized shell connectors are plugged together.

Figure B.1 – Point-To-Point Cable Wiring Diagram for Custom Length Cables

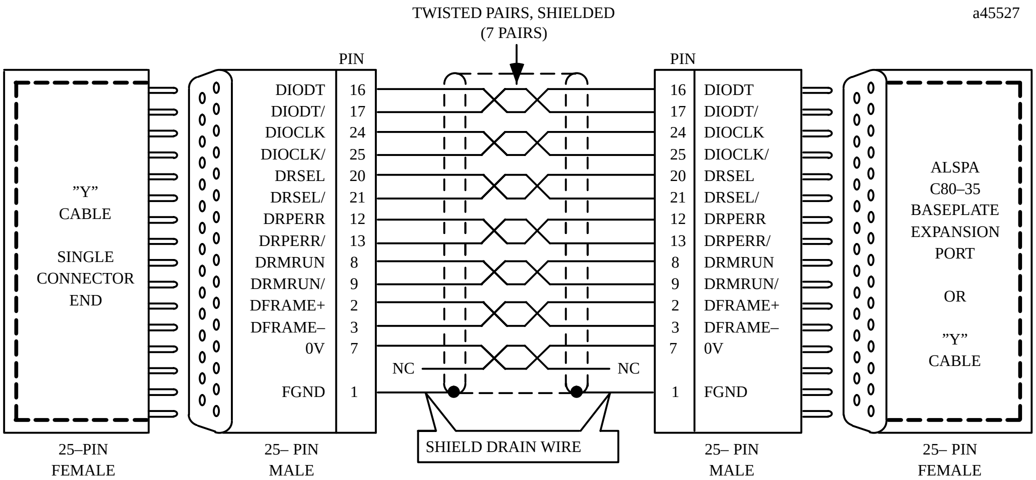
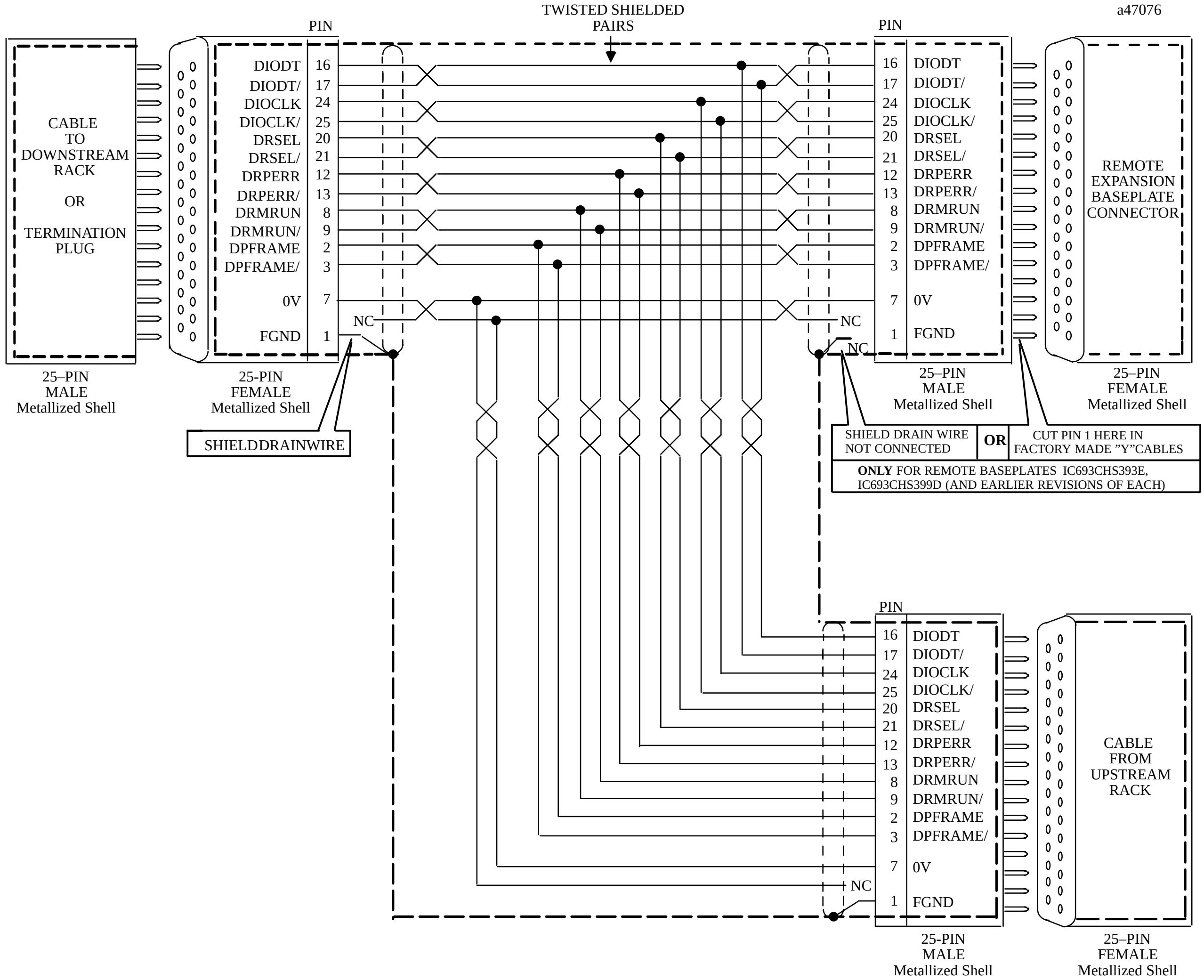


Figure B.2 – Point-To-Point Cable Wiring Diagram for Applications Requiring Less Noise Immunity

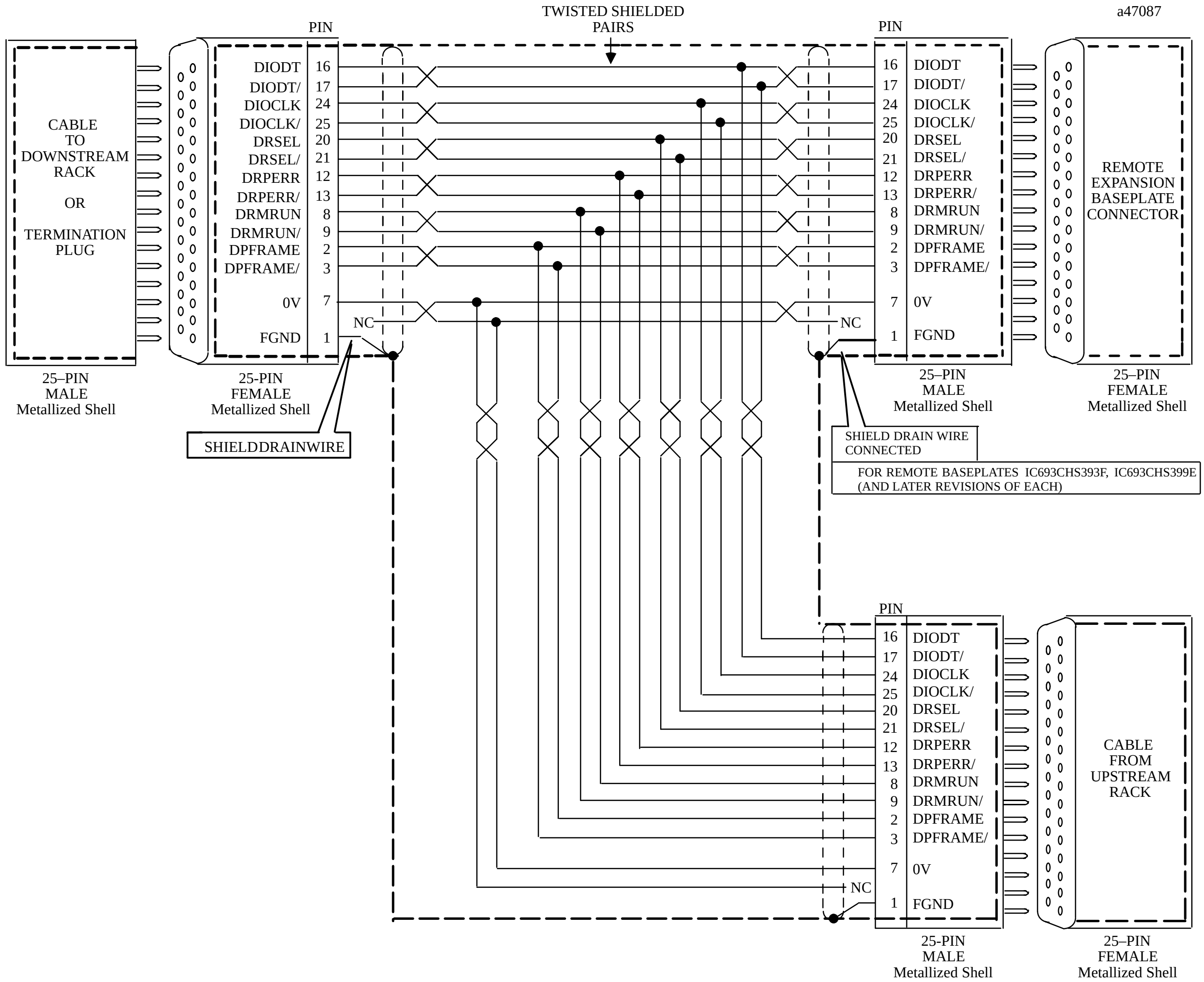
In remote baseplates, IC693CHS393E (and earlier) and IC693CHS399D (and earlier), it is necessary to remove pin 1 of the mating cable where the cable plugs into the baseplate. This means that when using a factory made ”Y” cable, IC693CBL300, you must break pin 1 out of the male end where it plugs into the remote baseplate before using it with one of these baseplates. *Custom built ”Y” cables for these baseplates should be built using Figure B.3.*



NOTE:
Bold dashed line shows continuous (100%) shielding when metallized shell connectors are plugged together.

Figure B.3 – Earlier Versions of Remote Baseplate Custom ”Y” Cable Wiring Diagram

Remote baseplates IC693CHS393F (and later) and IC693CHS399E (and later) have a change inside the baseplate which alleviates the need to remove pin 1 from the mating cable. When using factory made ”Y” cable with these baseplates, it is ***not*** necessary to remove pin 1 from the cable. Custom built ”Y” cables for these baseplates can be made using either Figure B.3 or Figure B.4. Figure B.4 shows how the factory made ”Y” cable are made.



NOTE:
Bold dashed line shows continuous (100%) shielding when metallized shell connectors are plugged together.

Figure B.4 – Current Remote baseplate Custom ”Y” Cable Wiring Diagram

5. IC693CBL315 I/O INTERFACE CABLE (24-PIN) FOR 32 POINT MODULES

5.1. Function of cable

This prewired cable is available for use with all Alspa C80–35 high-density (32 point) I/O modules that use the Fujitsu 24-pin user I/O connector. Each of these modules has two of these connectors mounted side-by-side. I/O Interface cables have a 24-pin connector on one end for connection to the module, and stripped and tinned wires on the other end. Catalog numbers for 32 point modules having two 24-pin connectors are: IC693MDL654, IC693MDL655, IC693MDL752 and IC693MDL753.

Connections to input circuits are made from the user's input devices to two male (pin-type) 24-pin connectors (Fujitsu FCN-365P024-AU) mounted on the front of the module. The connector mounted on the right of the module (front view) interfaces with groups A and B; the connector on the left side of the module interfaces with groups C and D. If a different length cable is required for connections to these modules, you can build your own cable.

5.2. Specifications

Cable Length	3 meters (10 feet)
Connector	Fujitsu FCN-365S024-AU or equivalent

5.2.1. Building Cables for 24-Pin Connectors

Cables connecting the module to field devices can be built to length as required for individual applications. You must purchase the mating female (socket type) 24-pin connectors. The 24-pin connector kit can be ordered as an accessory kit from ALSTOM. Catalog numbers for these connectors and their associated parts are listed in the following table. The list includes catalog numbers for three types of connectors: solder pin, crimp pin and ribbon cable. *Each accessory kit contains enough components (D-connectors, backshells, contact pins, etc.) to assemble ten single-ended cables of the type specified for each kit.*

ALSTOM Catalog Number	Vendor Catalog Number	Description
IC693ACC316	FCN-361J024-AU	Solder eyelet receptacle
(Solder Eyelet Type)	FCN-360C024-B	Backshell (for above)
IC693ACC317	FCN-363J024	Crimp wire receptacle
(Crimp Type)	FCN-363J-AU	Crimp pin (for above, 24 needed)
	FCN-360C024-B	Backshell (for above)
IC693ACC318	FCN-367J024-AUF	IDC (ribbon) receptacle, closed cover
(Ribbon or IDC Type)	FCN-367J024-AUH	IDC (ribbon) receptacle, open cover

Table B.2 – Catalog Numbers for 24-Pin Connector Kits

Additional tools from Fujitsu are required to properly assemble the crimped contact and ribbon cable type connectors. *The solder eyelet connectors (as provided in IC693ACC316) do not require any special tooling.*

Crimped Contact Connectors (as provided in IC693ACC317) require :

Hand Crimping Tool	FCN-363T-T005/H
Contact Extraction Tool	FCN-360T-T001/H

Ribbon Cable Connectors (as provided in IC693ACC318) require :

Cable Cutter	FCN-707T-T001/H
Hand Press	FCN-707T-T101/H
Locator Plate	FCN-367T-T012/H

These tools need to be ordered from an authorized Fujitsu distributor.

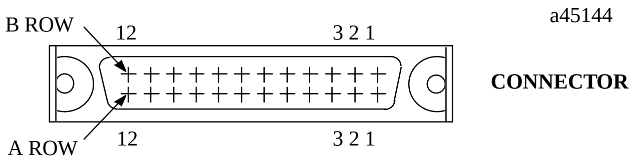
It is recommended that you order any necessary connector tooling with sufficient lead time to meet your assembly requirements for these connectors. These tools are generally not stock items and can have significant lead times from distribution. If you have any further questions about this issue, please feel free to contact the ALSTOM PLC Hotline.

Pin connections with color codes are shown in the following table. Cables are made of 12 twisted pairs; wire size is 0.22mm^2 (AWG 24).

Pin Number	Pair No.	Wire Color Code
A1	1	BROWN
A2	1	BROWN/BLACK
A3	2	RED
A4	2	RED/BLACK
A5	3	ORANGE
A6	3	ORANGE/BLACK
A7	4	YELLOW
A8	4	YELLOW/BLACK
A9	5	DARK GREEN
A10	5	DARK GREEN/BLACK
A11	6	DARK BLUE
A12	6	DARK BLUE/BLACK

Pin Number	Pair No.	Wire Color Code
B1	7	VIOLET
B2	7	VIOLET/BLACK
B3	8	WHITE
B4	8	WHITE/BLACK
B5	9	GRAY
B6	9	GRAY/BLACK
B7	10	PINK
B8	10	PINK/BLACK
B9	11	LIGHT BLUE
B10	11	LIGHT BLUE/BLACK
B11	12	LIGHT GREEN
B12	12	LIGHT GREEN/BLACK

Table B.3 – Wire List for 24-Pin Connectors



Note

Each wire pair has a solid color wire and that same color wire with a black tracer. For example, Pair 1 has a solid brown wire paired with a brown wire with a black tracer.

5.2.2. Connector Depth

The following illustration shows the depth of the connector on this cable. The depth of the cabinet that the PLC is mounted in should allow for the depth added by this connector.

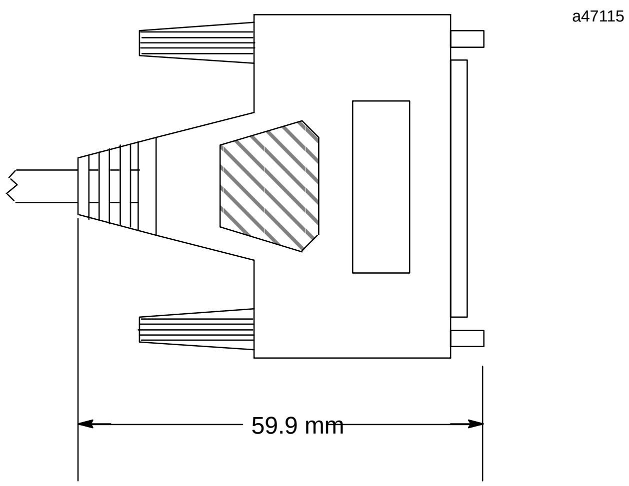


Figure B.5 – Dimension for Depth of Connector

6. IC693CBL321/322/323 I/O FACEPLATE TO TERMINAL BLOCK, 24-PIN

6.1. Function of cable

These cables are used with I/O modules that have a 20-pin terminal block on the module to allow easier and faster wiring to interposing terminal blocks. Each cable has a 24-pin female connector on both ends. Each cable provides a connection from the module to a connector mounted on a terminal block assembly. These cables are wired pin-to-pin (that is, pin A1 to pin A1, pin A2 to pin A2, etc.). An I/O faceplate assembly (catalog number IC693ACC334) is required which snaps onto the module in place of the 20-pin terminal block assembly. Five different terminal blocks are available to allow a variety of I/O modules to use this accessory (see Appendix C).

6.2. Cable Specifications

Item	Description
Cable Length (1.) **IC693CBL321** **IC693CBL322** **IC693CBL323**	 1 meter (3 feet), 2 meters (6 feet) 0.5 metert (1.5 feet)
Cable Type:	12 twisted pairs with overall aluminum polyester shield and AWG 24 drain wire.
24 Pin Female Connectors:	Equivalent to Fujitsu FCN-363J024 or equivalent.

1.Length of cable is measured from backs of connector shells as shown in figure on next page.

The connector on the I/O faceplate is oriented as shown below, with the rows labeled A1-A12 and B1-B12. A1 and B1 are towards top of module faceplate.

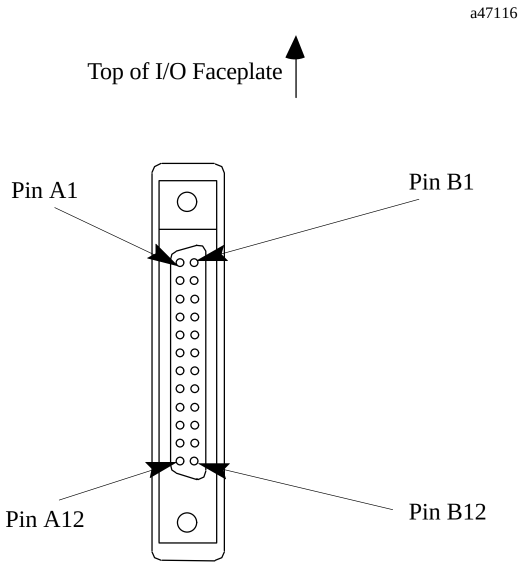
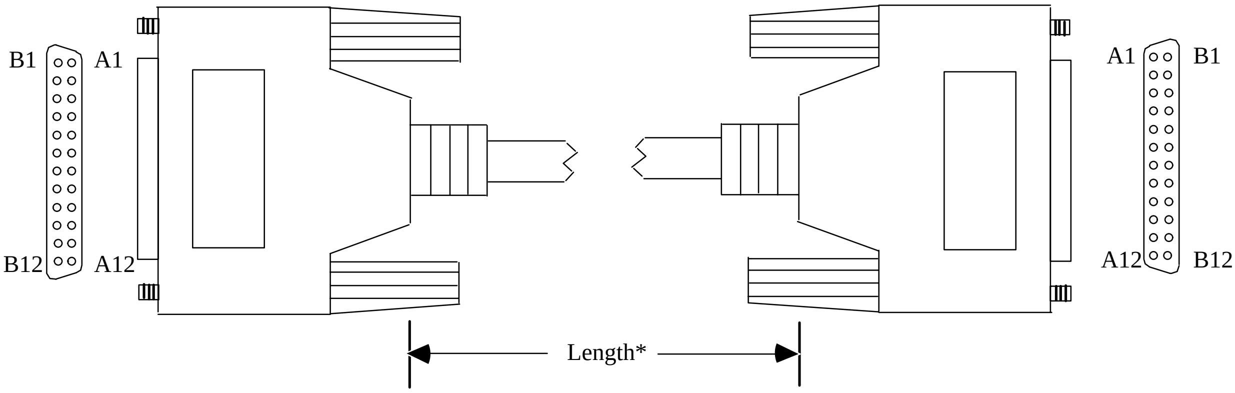


Figure B.6 – Connector Orientation on I/O Faceplate

a47117



IC693CBL321	1 meter (3 feet)
IC693CBL322	2 meters (6 feet)
IC693CBL323	0.5 meter (1.5 feet)

* Length is measured from backs of connector shells as shown above

Figure B.7 – I/O Faceplate to Terminal Block Cable

Appendix C Terminal Block Quick Connect Assembly

This appendix describes the Alspa C80–35 interposing terminal block assemblies for Alspa C80–35 discrete I/O modules. This terminal block assembly is referred to as Terminal Block Quick Connect or simply TBQC. This system allows the listed 16-point discrete modules to be quickly connected to interposing terminal blocks. Installing a 16 point module typically takes 2 1/2 hours to wire from a PLC to interposing terminal blocks. With the TBQC, you simply snap in the interposing terminal block, remove the I/O module's terminal assembly, snap in the I/O faceplate and connect the cable. This reduces wiring time to about two minutes and no additional wiring is required, thereby reducing wiring costs and errors. Complete assemblies consist of a terminal block, an I/O Face Plate and a cable.

1. TERMINAL BLOCK QUICK CONNECT COMPONENTS

1.1. Terminal Blocks

Catalog numbers for the terminal blocks and the modules they can be used with are listed below.

Catalog Number	Use With These Modules	Module Description
IC693ACC329*	IC693MDL240 IC693MDL645 IC693MDL646	Input, 120 VAC – 16 points Input, 24 VDC Pos./Neg Logic– 16 points Input, 24 VDC Pos./Neg, Logic, FAST – 16 points
IC693ACC330	IC693MDL740 IC693MDL742	Output, 12/24 VDC Pos Logic, 0.5A – 16 points Output, 12/24 VDC Pos Logic ESCP, 1A– 16 points
IC693ACC331	IC693MDL741	Output, 12/24 VDC Neg Logic, 0.5A– 16 points
IC693ACC332	IC693MDL940	Output, Relay, N.O. – 16 points
IC693ACC333	IC693MDL340	Output, 120 VAC, 0.5A – 16 points

* This Terminal Block may be used with most I/O modules that have up to 16 I/O points (can not be used with 32 point modules). Jumpers may have to be added; for details of required wiring connections, refer to module specifications in this manual.

1.2. Cables

Three cables are available for the connection between the module's faceplate connector and the connector on the interposing terminal block. Each cable has a 24-pin connector wired pin-to-pin on each end.

- **IC693CBL321** 1 meter (3.3 feet),
- **IC693CBL322** 2 meters (6.5 feet),
- **IC693CBL323** 0.5 meter (1.6 feet).

1.3. I/O Face Plate

The I/O Face Plate (catalog number IC693ACC334) has a 24-pin connector, which provides the connection to the applicable terminal block through a 0.5, 1 or 2 meter cable. This face plate replaces the 20-terminal connector on the listed modules.

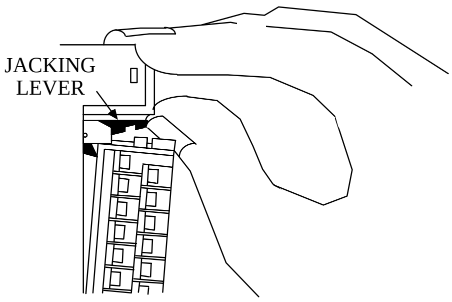
1.4. Installation

1. Install terminal block assembly on DIN rail.

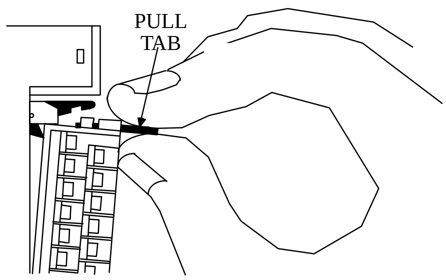
   Place the terminal block over the desired location on the DIN rail and snap into place.

2. Remove 20-pin terminal assembly from module.

a43061



a43715

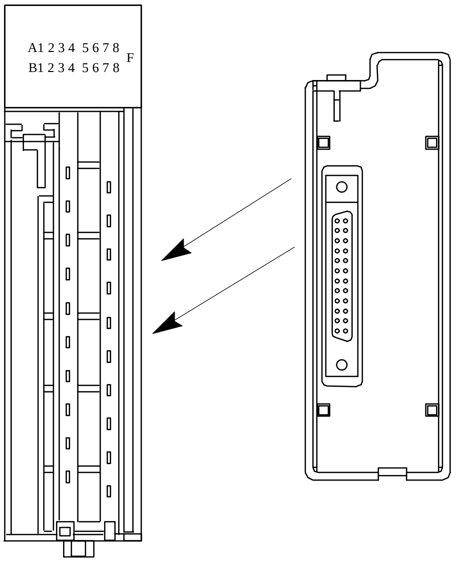


1 Open the plastic terminal board cover.

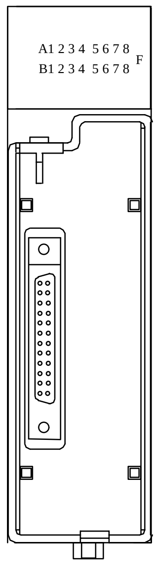
2 Push up on the jacking lever to release the terminal block.

3 Grasp pull-tab towards you until contacts have separated from module housing and hook has disengaged for full removal.

3. Snap I/O Face Plate assembly on module.



Installing the I/O Face Plate



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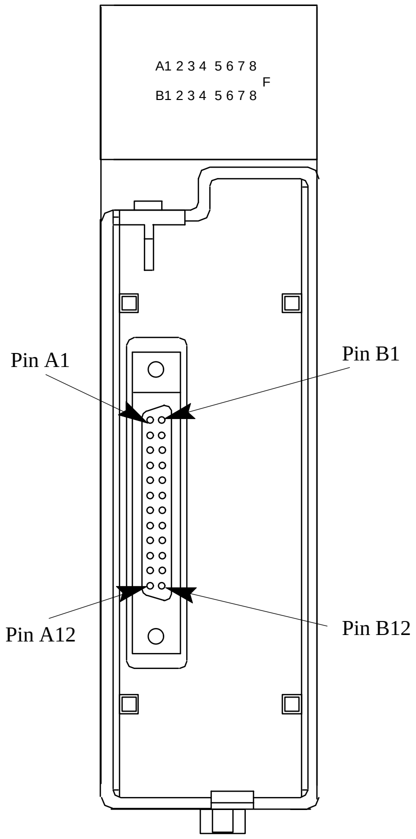
Module with I/O Face Plate Installed

4. Connect cable to connector on terminal block.

   Finally, connect the selected length cable from the connector on the I/O Face Plate to the connector on the interposing terminal block.

1.5. Connector Pin Orientation and Connection to Module Terminal



Connector Pin Orientation

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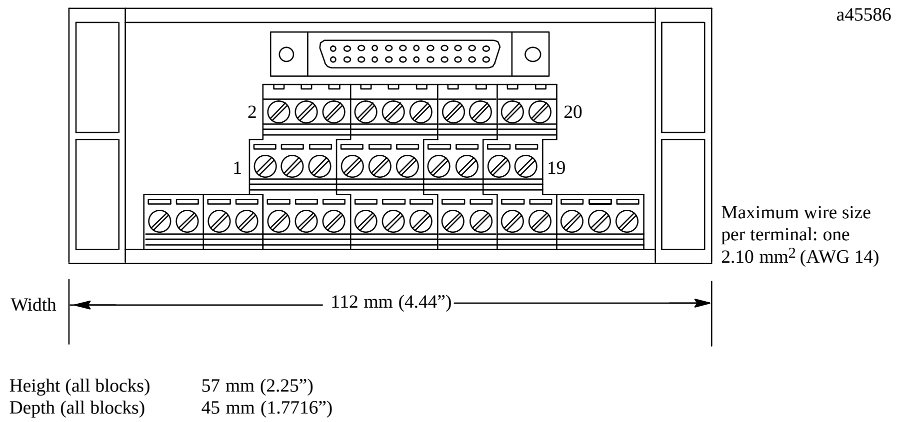
Module Terminal No.	Connector Pin No.
1	B1
2	A1
3	B2
4	A2
5	B3
6	A3
7	B4
8	A4
9	B5
10	A5
	B6 (N.C.)
	A6 (N.C.)
	B7 (N.C.)
	A7 (N.C.)
11	B8
12	A8
13	B9
14	A9
15	B10
16	A10
17	B11
18	A11
19	B12
20	A12

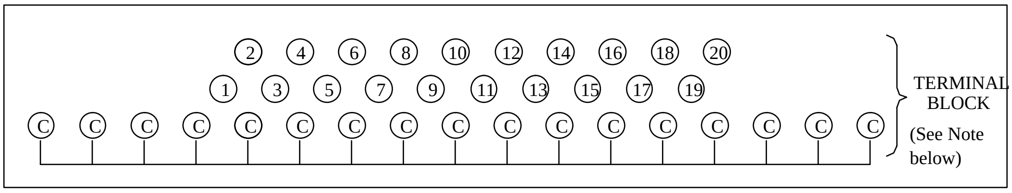
Refer to Chapter 2 for each module.

Each of the Terminal Block Quick Connector assemblies are detailed on the following pages.

1.6. IC693ACC329

Use with: **IC693MDL240**
IC693MDL645
IC693MDL646



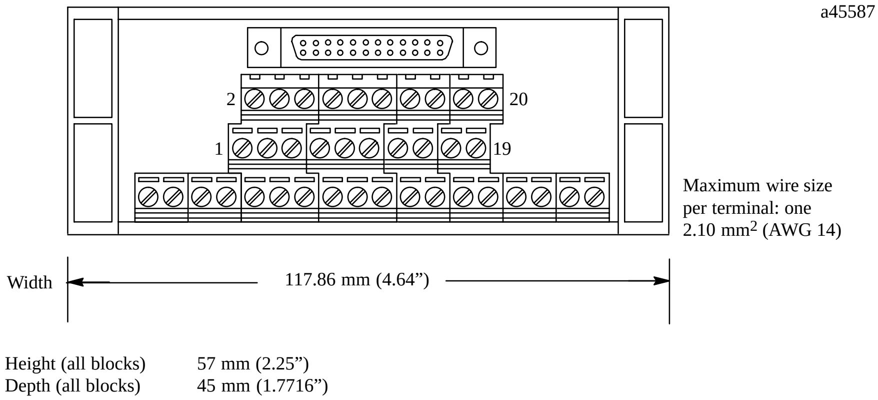


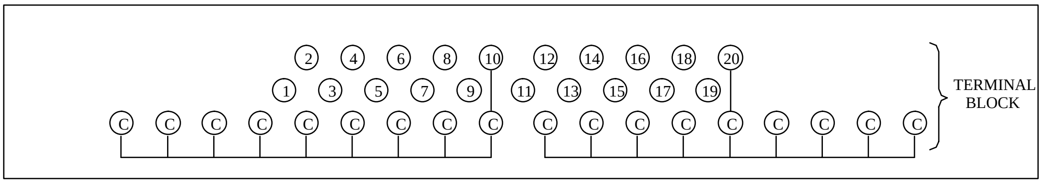
Note

The terminal block provides a second wire connection point. The common row is electrically isolated from the other connection points. If used for common connection, a jumper must be added between the common row and the module common. Refer to Chapter 2 for required wiring connections.

1.7. IC693ACC330

Use with: **IC693MDL740**
IC693MDL742



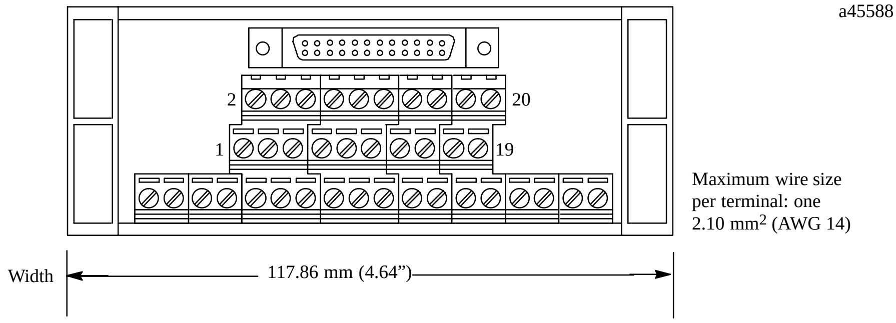


Note

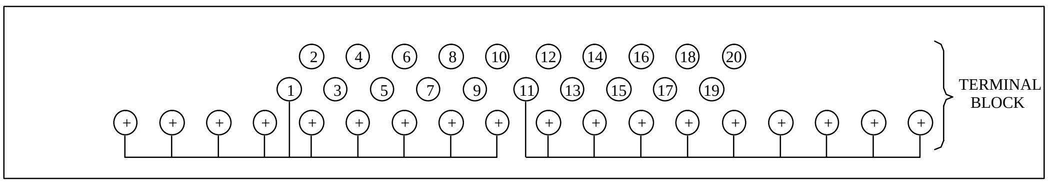
Refer to Chapter 2 for required wiring connections.

1.8. IC693ACC331

Use with: IC693MDL741



Height (all blocks) 57 mm (2.25”)
Depth (all blocks) 45 mm (1.7716”)

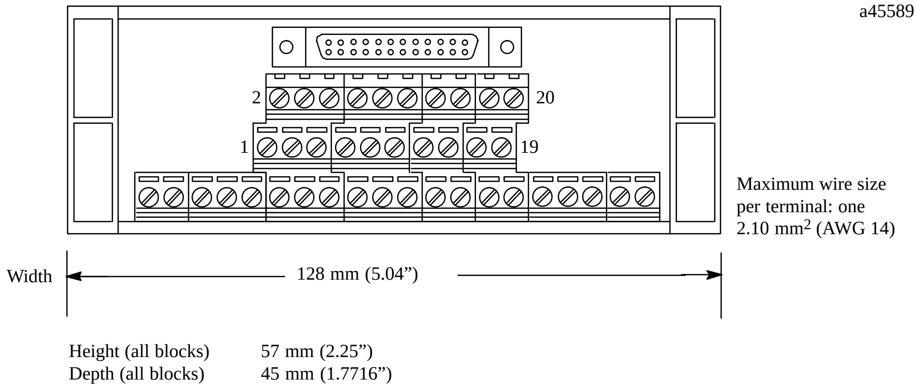


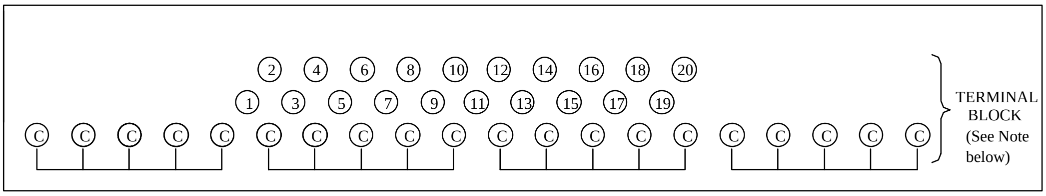
Note

Refer to Chapter 2 for required wiring connections.

1.9. IC693ACC332

Use with: **IC693MDL940**



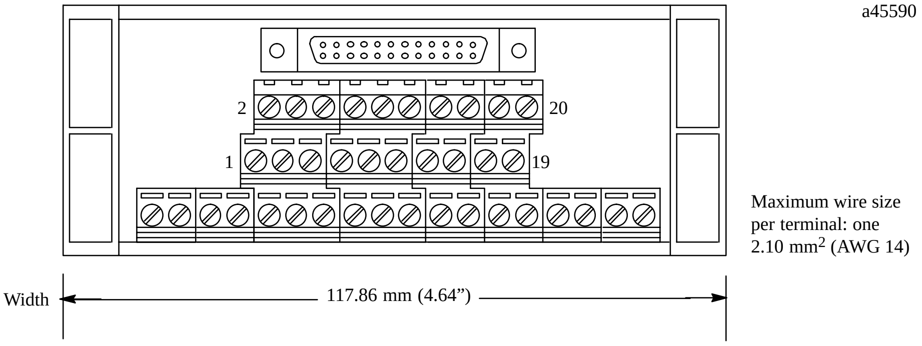


Note

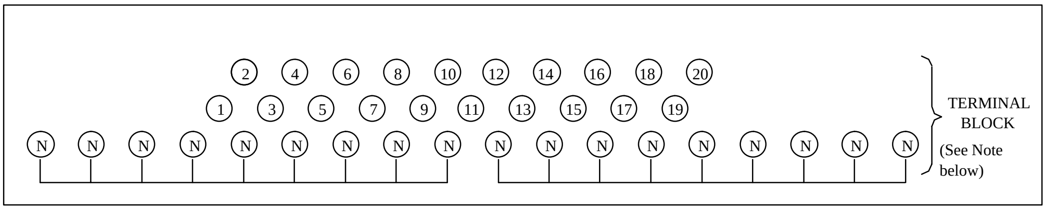
The terminal block provides a second wire connection point. The common row is electrically isolated from the other connection points. If used for common connection, a jumper must be added between the common row and the module common. Refer to Chapter 2 for required wiring connections.

1.10. IC693ACC333

Use with: **IC693MDL340**



Height (all blocks) 57 mm (2.25")
Depth (all blocks) 45 mm (1.7716")



Note

The terminal block provides a second wire connection point. The common row is electrically isolated from the other connection points. If used for common connection, a jumper must be added between the common row and the module common. Refer to Chapter 2 for required wiring connections.

This glossary explains some general terms relating to measurements at analog I/O terminals.

Bipolar Bipolar signals can reverse polarity in operation. Reversed signal connections to a bipolar input will produce data of opposite sign.

Common Mode This is the voltage between the analog signal wires and the common point of the power supply of a differential signal or to ground in the case of an isolated signal. It is desirable that all common mode signals are ignored by the circuit, but in practice there is some error introduced in the data. This is specified as Common Mode Rejection Ratio (CMRR), usually expressed in decibels (db). Differential circuits also have a maximum common mode voltage specification, usually stated as a maximum voltage with respect to circuit common. Exceeding the common mode voltage rating of differential signals causes large errors in the data conversion and may affect several points.

Current Loop This is a standard analog interface defined by the Instrument Society of America (ISA) in ANSI/ISA-S50-1. The signal level is 4 mA to 20 mA. Three types of signal sources are defined, Types 2, 3 and 4. These correspond to the number of wires used. Transmitter outputs may have various isolation among loop power source, input sensor and 4-20 mA output current. The isolation of the transmitter may impact the type of PLC input required. The Standard covers only isolated or common (single-ended) inputs. Differential inputs often used in PLCs, and connecting several current loops together, as often occurs with PLCs, are not covered well in the Standard, and often introduce additional complication regarding location of commons and grounds.

Differential Differential signals are measured on two wires which are separate but not isolated from the power supply. Differential inputs allow a greater degree of freedom in wiring commons and grounds without affecting accuracy. There is a limited voltage rating (see Common Mode) between the signal level wires and the power supply wires. This limitation also applies to voltage differences among additional I/O on the same supply. Differential inputs usually come in groups sharing the supply common tie point. Some voltage outputs may have an external return or remote sense which allows the load common or ground to be different than the supply of the output module by a small voltage. Current loop signals are less susceptible to differences in voltage between circuit components (see compliance). Differential inputs permit series inputs with current loops, since the signal can be offset from common. Do not confuse differential inputs with isolated inputs; differential requires the common tie point reference for all inputs of the group, usually either ground or the supply common.

Ground Loop

When a conductor is grounded in more than one place, differences between grounds can induce currents producing voltage drops in the wire. If the conductor is also used to carry an analog signal, these voltage drops produce an accuracy error or noisy values. If a single point ground is used, the voltage difference between locations may still appear in series with the desired signal. This is overcome by using differential or isolated inputs and running a separate return from the remote source. This preserves the integrity of the signal and the ground voltages appear as common mode voltage at the receiving end.

Isolated

Isolated inputs are usually two-wire and are dialectically insulated from supplies and ground. Sometimes additional connections are provided for excitation of transducers such as RTDs, but these signals are not shared with other I/O points. Isolated modules allow high voltages to exist between I/O devices and the PLC. Do not confuse isolated inputs with the isolation between groups of analog circuits or isolation from other components of the system, such as logic or power supplies.

Normal Mode

This is the actual signal across the signal wires of differential or isolated I/O. This may also include unwanted noise such as power line frequency pickup.

Single-ended

Single-ended circuits have the signal measured relative to a common connection, usually the power supply. Other analog I/O signals typically share this common. Single-ended circuits require fewest terminal points, giving the highest density and lowest price, but at the cost of more restrictive wiring and errors due to voltage drops and currents in the common connections. Single-ended circuit connections are most similar to the wiring of discrete modules.

Unipolar

Unipolar signals or ranges do not change polarity during normal operation; for example 0 to 10 volts, or 4 mA to 20 mA. Reversed connection to a unipolar input will produce minimum value and, if diagnostics are available, underrange or open wire faults.

Symbols

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