Modicon
A120 Series I/O Modules
User Guide
Volume 2

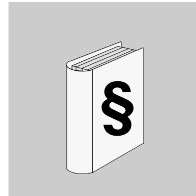
890 USE 109 00 Version 4.0

Schneider Electric

31000401 04

Table of Contents

Safety Information



Important Information

NOTICE

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

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

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

DANGER

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

WARNING

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

CAUTION

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

PLEASE NOTE

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

About the Book

At a Glance

Document Scope

This manual describes the functionality of the Modicon A120 Series I/O Modules.

Validity Note

The data and illustrations found in this book are not binding. We reserve the right to modify our products in line with our policy of continuous product development. The information in this document is subject to change without notice and should not be construed as a commitment by Schneider Electric.

Related Documents

Title of Documentation
IEEE Std 518--1977, Guide for the Installation of Electrical Equipment to Minimize Electrical Noise Inputs to Controllers from External Sources
IEEE Std 142--1982, Recommended Practice for Grounding of Industrial and Commercial Power Systems
Noise Reduction Techniques in Electronic Systems, by Henry W. Ott; published by Wiley--Interscience of New York in 1976

Product Related Warnings

Schneider Electric assumes no responsibility for any errors that may appear in this document. If you have any suggestions for improvements or amendments or have found errors in this publication, please notify us.

User Comments

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

Overview of the DEP 208 Input Module

31

At a Glance

Purpose

The purpose of this chapter is to describe the DEP 208 input module.

What's in this Chapter?

This chapter contains the following topics:

What is the DEP 208 Input Module?

Brief Product Description

The DEP 208 is a discrete input module with eight independent 230 Vac input circuits. It senses input signals from field sensing devices such as pushbuttons, limit or proximity switches, or other ac input sources and converts those signals into voltage signals that can be used by the PLC in a logic scan. Signals are field-wired in one group of eight inputs. Each input is opto-isolated from the I/O bus.

DEP 208 Input Module LEDs

LEDs

The DEP 208 has nine LEDs. One green LED opposite terminal screw 1 indicates the presence of 5 V from the I/O bus. Eight red LEDs opposite terminal screws 3, 5, 7, 9, 14, 16, 18, and 20 indicate that voltage is present at inputs 1 ... 8, respectively.

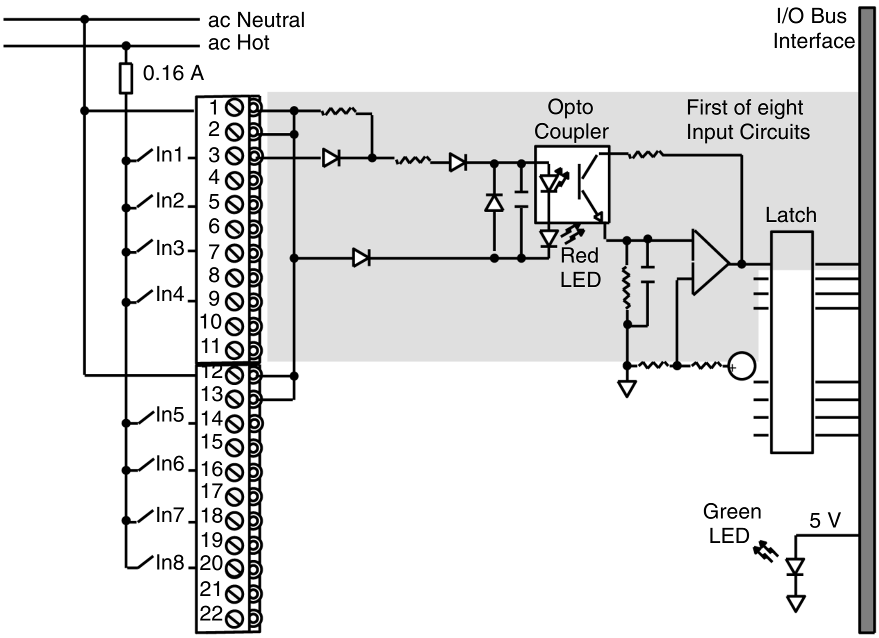
DEP 208 Input Module Field Wiring

Introduction

The DEP 208 is a discrete input module with eight independent 230 Vac input circuits. It senses input signals from field sensing devices such as pushbuttons, limit or proximity switches, or other ac input sources and converts those signals into voltage signals that can be used by the PLC in a logic scan. Signals are field-wired in one group of eight inputs. Each input is opto-isolated from the I/O bus.

Wiring Diagram and Simplified Schematic for DEP 208

A wiring diagram and simplified schematic for the DEP 208 input module is provided below.



Using the DEP 208 Input Module wilth Proximity Switches

Introduction

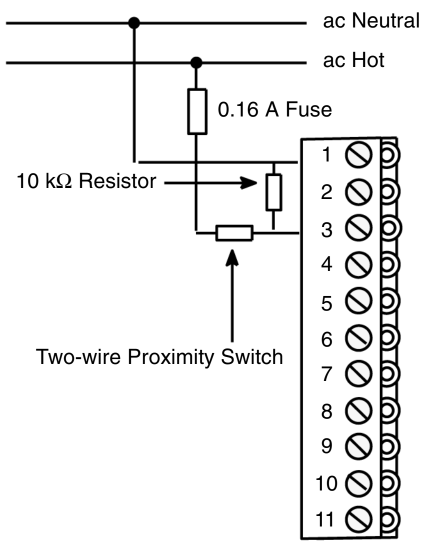
The leakage current of two-wire proximity switches may be as high as 3 mA. Since the OFF current rating of the DEP 208 is .5 mA per input, two-wire proximity switches may trigger false inputs in the module. If you plan to use the DEP 208 in a proximity switch application, consider the following recommendations to prevent false inputs from occurring.

Existing Installations

To eliminate the possibility of false inputs, place a 10 kOhm resistor between neutral and each input terminal on the module to shunt off some of the current. See the diagram below.

New Installations

Keep the above current ratings in mind when selecting proximity switches. Three-wire proximity switches have leakage current levels below .5 mA, and are recommended in order to avoid the need for the 10 kOhm resistor.
The following diagram illustrates wiring the DEP 208 with a 10 kOhm Resistor.



DEP 208 Input Module Specifications

Table of Specifications for DEP 208

The following table contains a list of DEP 208 input module specifications.

Module Topology	Number of Inputs	8
	Number of Groups	1
	Points/group	8
	Isolation	Optocoupler on each input point
Power Supplies	External Source Requirement	230 Vac (+/- 15 percent), 47 ... 63 Hz
	Internally Provided Source	5 V, less than 30 mA from the I/O bus
	Internal Power Dissipation	2 W (typical)
Electrical Characteristics	Working Voltage Range	195 ... 265 Vac
	ON Current Minimum	1 mA/input
	OFF Current Maximum	0.5 mA/input
	0 to 230 V Response Time	25 ms (typical)
	230 to 0 V Response Time	50 ms (typical)
	Operating Mode	True High
	Wire Size/Terminal	One wire: 14 AWG
		Two wires: 20 AWG
I/O Map	Discrete 1x/ox	8 in/0 out
Dimensions	WxHxD	40.3 x 145 x 117.5 mm (1.6 x 5.6 x 4.5 in)
	Weight	220 g (.5 lb)
Agency Approvals	VDE 0160; UL 508; and CSA 22.2 No.142 Standards	

Overview of the DEP 209 Input Module

32

At a Glance

Purpose

The purpose of this chapter is to describe the DEP 209 input module.

What's in this Chapter?

This chapter contains the following topics:

What is the DEP 209 Input Module?

Brief Product Description

The DEP 209 is a discrete input module with eight independent 120 Vac input circuits. It senses input signals from field sensing devices such as pushbuttons, limit or proximity switches, or other ac input sources and converts those signals into voltage signals that can be used by the controller in a logic scan. Signals are field-wired in one group of eight inputs. Each input is opto-isolated from the I/O bus.

DEP 209 Input Module LEDs

LEDs

The DEP 209 has nine LEDs. One green LED opposite terminal screw 1 indicates the presence of 5 V from the I/O bus. Eight red LEDs opposite terminal screws 3, 5, 7, 9, 14, 16, 18, and 20 indicate that voltage is present at inputs 1 ... 8, respectively.

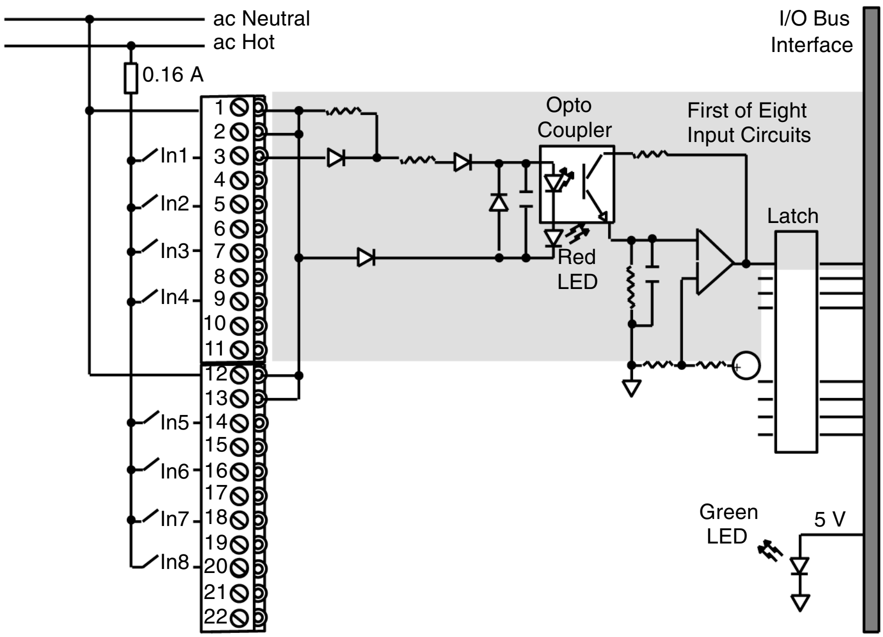
DEP 209 Input Module Field Wiring

Introduction

The DEP 209 is a discrete input module with eight independent 120 Vac input circuits. It senses input signals from field sensing devices such as pushbuttons, limit or proximity switches, or other ac input sources and converts those signals into voltage signals that can be used by the controller in a logic scan. Signals are field-wired in one group of eight inputs. Each input is opto-isolated from the I/O bus.

Wiring Diagram and Simplified Schematic for DEP 209

A wiring diagram and simplified schematic for the DEP 209 input module is provided below.



Using the DEP 209 Input Module with Proximity Switches

Introduction

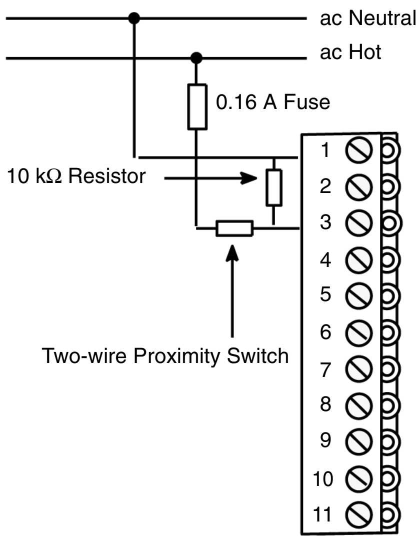
The leakage current of two-wire proximity switches may be as high as 3 mA. Since the OFF current rating of the DEP 209 is .5mA/input, two-wire proximity switches may trigger false inputs in the module. If you plan to use the DEP 209 in a proximity switch application, consider the following recommendations to prevent false inputs from occurring.

Existing Installations

To eliminate the possibility of false inputs, place a 10 kOhms resistor between neutral and each input terminal on the module to shunt some of the current.

New Installations

Keep the above current ratings in mind when selecting proximity switches. Three-wire proximity switches have leakage current levels below .5 mA and are recommended in order to avoid the need for the 10 kOhms resistor.
The following diagram illustrates wiring the DEP 209 with a 10 kOhm resistor.



DEP 209 Input Module Specifications

Table of Specifications

The following table contains a list of DEP 209 input module specifications.

Module Topology	Number of Inputs		8
	Number of Groups		1
	Points/group		8
	Isolation		Optocoupler on each input
Power Supplies	External Source Requirement		120 Vac (+/- 15 percent)
			47 ... 63 Hz
	Internally Provided Source from I/O bus		5 V; less than 30 mA
	Internal Power Dissipation		2 W typical
Electrical Characteristics	Working Voltage Range		85 ... 138 Vac
	ON Current Minimum		1 mA/input
	OFF Current Maximum		0.5 mA/input
	Response Time	0 to 230 V	25 ms typical
		230 to 0 V	50 ms typical
	Operating Mode		True High
	Wire Size/terminal	One wire	14 AWG
		Two wires	20 AWG
I/O Map	Discrete 1x/0x		8 in/0 out
Dimensions	W x H x D		40.3 x 145 x 117.5 mm
			1.6 x 5.6 x 4.5 in
	Weight		220 g
			0.5 lb
Agency Approvals	VDE 0160; UL 508; and CSA 22.2 No.142 Standards		

Overview of the DEP 210 Input Module

33

At a Glance

Purpose

The purpose of this chapter is to describe the DEP 210 input module.

What's in this Chapter?

This chapter contains the following topics:

What is the DEP 210 Input Module?

Brief Product Description

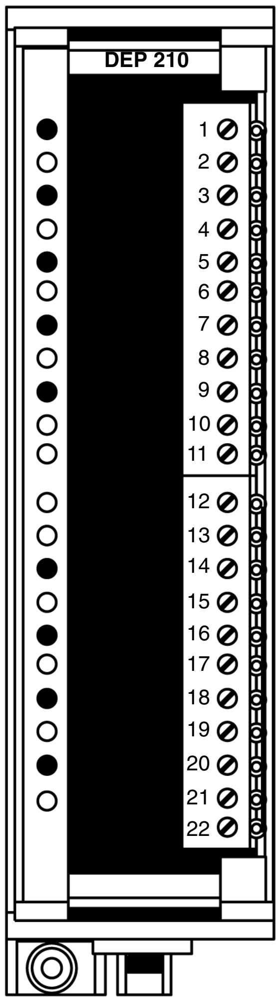
The DEP 210 is a 115 Vac, eight-point input module with 1.8 kV isolation between inputs and the bus. The module senses input signals received from field sensing devices such as pushbuttons, limit and proximity switches, or other 115 Vac input sources and converts those signals into logic voltage levels that can be used by the PLC. Signals are field wired in one group of eight signals. Inputs are opto-isolated from the system bus.

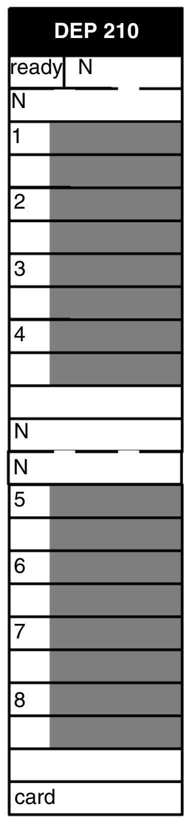
	WARNING
⚠	**Operational Hazard** The DEP 210 module will only operate properly when used with an A984, E984, or Micro 512/612 controller. **Failure to follow this precaution can result in death, serious injury, or equipment damage.**

DEP 210 Input Module LEDs

LEDs

The DEP 210 module has one green LED opposite terminal screw 1. When this LED is ON, it indicates the presence of working voltage from the PLC. The module also has eight red LEDs, opposite terminal screws 3, 5, 7, 9, 14, 16, 18, and 20. When any one of these LEDs is ON, it indicates voltage present at the corresponding input. Location of the LEDs is shown in the figure below.
A front view and fill-in labels of the DEP 210 is provided below.





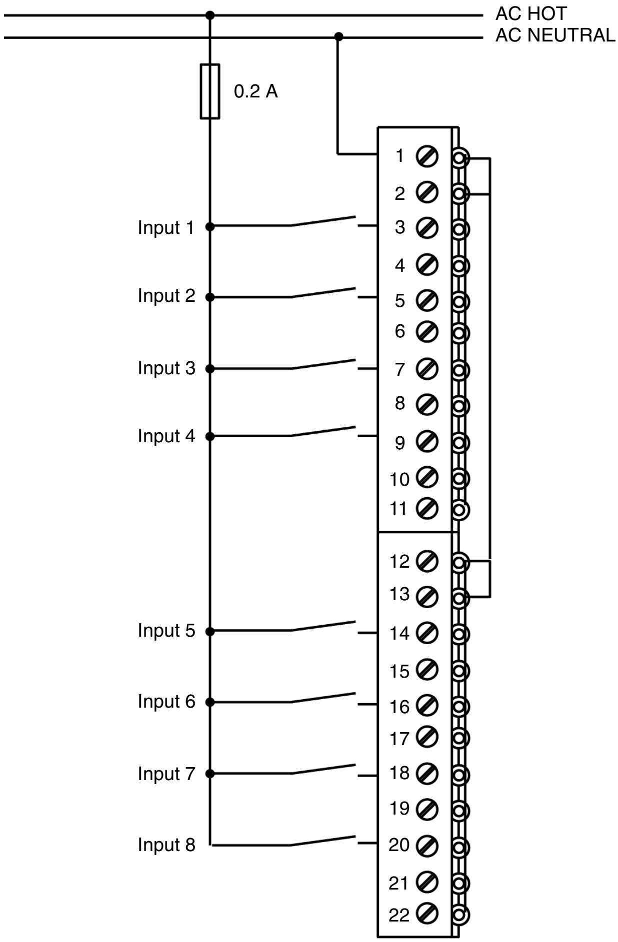
DEP 210 Input Module Field Wiring

Introduction

The DEP 210 is a 115 Vac, eight-point input module with 1.8 kV isolation between inputs and the bus. The module senses input signals received from field sensing devices such as pushbuttons, limit and proximity switches, or other 115 Vac input sources and converts those signals into logic voltage levels that can be used by the PLC. Signals are field wired in one group of eight signals. Inputs are opto-isolated from the system bus.

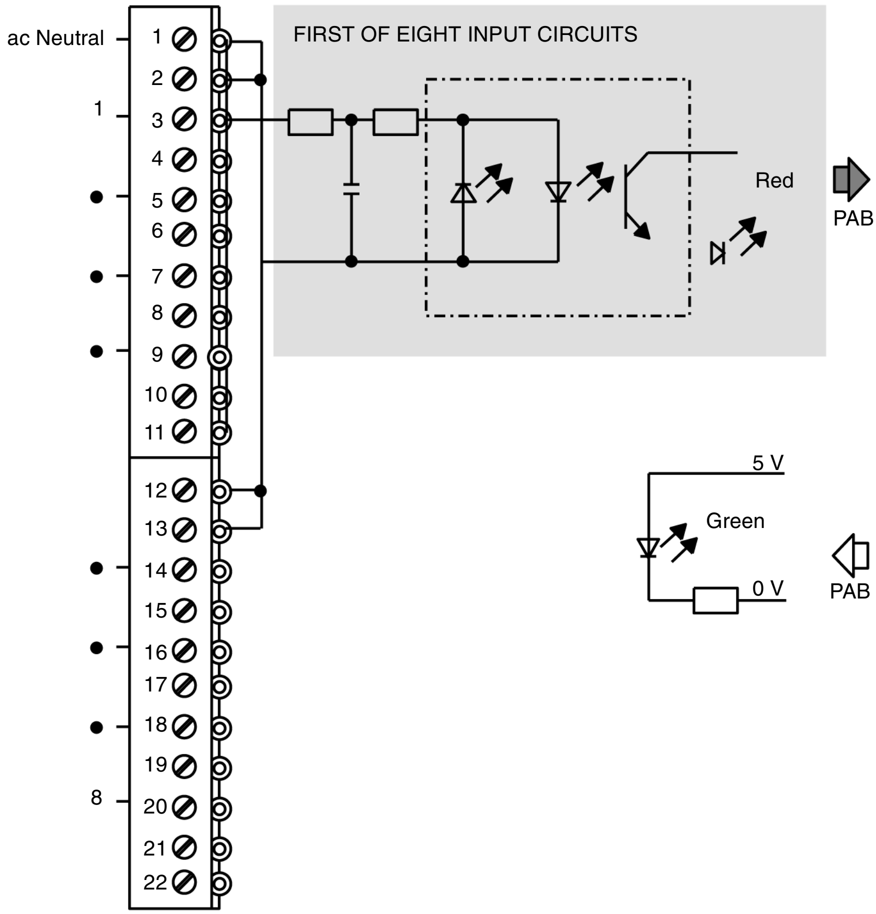
Wiring Diagram for DEP 210

A sample wiring diagram for the DEP 210 input module is provided below.



Simplified Schematic for DEP 210

A simplified schematic for the DEP 210 input module is provided below.



DEP 210 Input Module Specifications

Table of Specifications for DEP 210

The following table contains a list of DEP 210 input module specifications.

Module Topology	Number of Inputs		8
	Number of Groups		1
	Points/group		8
	Isolation		Optocoupler on each input
			1.8 kV field-to-bus
Power Supplies	External Source Requirement		115 Vac
	Rated Signal Value		115 Vac
			47 ... 65 Hz
	Internally Provided Source from I/O bus		5 V
			35 mA maximum
	Internal Power Dissipation		3 W typical
Electrical Characteristics	ON State Signal Level		80 ... 132 Vac
	OFF State Signal Level		0 ... 35 Vac
	ON State Input Current		15.5 mA/input @ 115 Vac
			6 mA @ 80 V, 20 mA @ 132 V
	OFF State Input Current		3 mA maximum
	Response Time	ON	10 ms typical
		OFF	40 ms typical
	Operating Mode		True High
	Wire Size/terminal	One wire	14 AWG
		Two wires	20 AWG
I/O Map	Discrete 1x/0x		8 in/0 out
Dimensions	W x H x D		40.3 x 145 x 117.5 mm
			1.6 x 5.6 x 4.5 in
	Weight		250 g
			0.55 lb
Agency Approvals	VDE 0160; UL 508; and CSA 22.2 No.142 Standards		

Overview of the DEP 211 Input Module

34

At a Glance

Purpose

The purpose of this chapter is to describe the DEP 211 input module.

What's in this Chapter?

This chapter contains the following topics:

What is the DEP 211 Input Module?

Brief Product Description

Note: Some A120 I/O modules (DEP 211/214/215/217, DAP211/217, ADU204/211/214/216, DAU204, VIC2xx, and MOT20x) require a loadable (SW-IODR-001) for proper operation when using certain PLCs (A984-1xx, E984-24x/251/255) with Modsoft.

The DEP 211 is a 115 Vac, eight-point isolated input module. The module senses input signals received from field devices such as pushbuttons, limit and proximity switches, or other 115 Vac sources and converts those signals into logic voltage levels that can be used by the controller. Signals are field wired in one group of eight signals. Inputs are isolated from the system bus and from one another.

WARNING

Operational Hazard

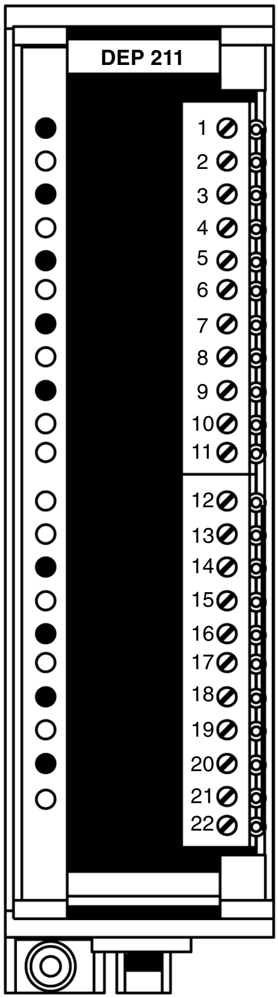
The DEP 211 module will only operate properly when used with an A984, E984, or Micro 512/612 controller.

Failure to follow this precaution can result in death, serious injury, or equipment damage.

DEP 211 Input Module LEDs

LEDs

The DEP 211 module has one green LED opposite terminal screw 1. When this LED is ON, it indicates the presence of working voltage from the controller. The module also has 8 red LEDs, opposite terminal screws 3, 5, 7, 9, 14, 16, 18, and 20. When any one of these LEDs is ON, it indicates voltage present at the corresponding input. Location of the LEDs is shown in the figure below.
A front view of the DEP 211 is provided below.



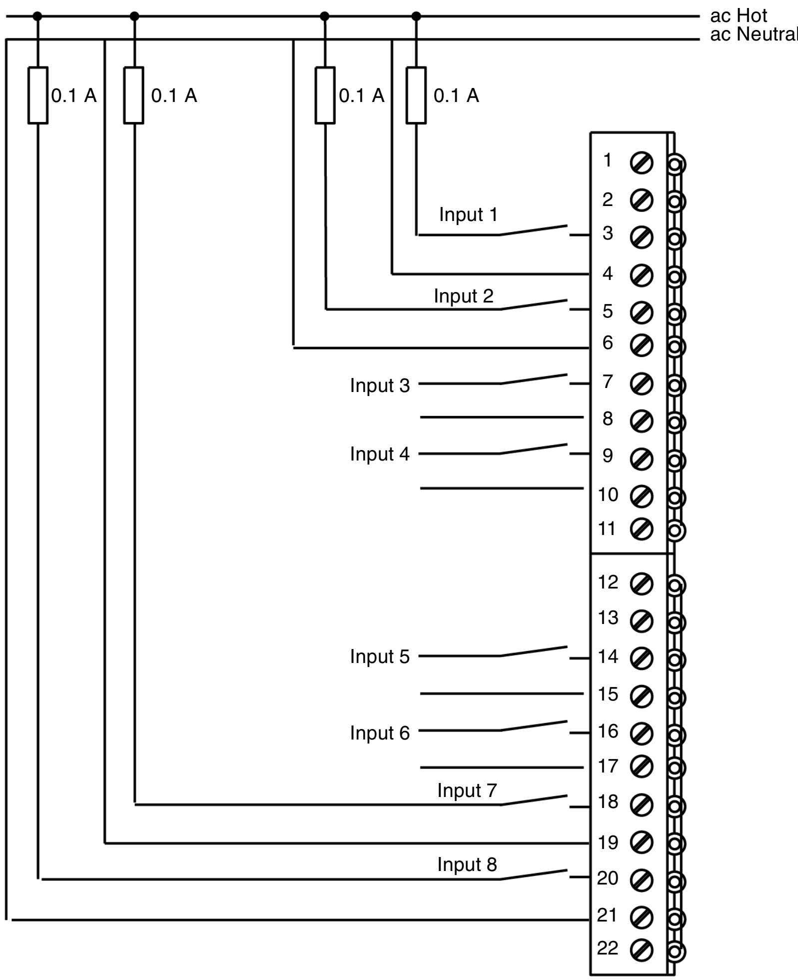
DEP 211 Input Module Field Wiring

Introduction

The DEP 211 is a 115 Vac, eight-point isolated input module. The module senses input signals received from field devices such as pushbuttons, limit and proximity switches, or other 115 Vac sources and converts those signals into logic voltage levels that can be used by the controller. Signals are field wired in one group of eight signals. Inputs are isolated from the system bus and from one another.

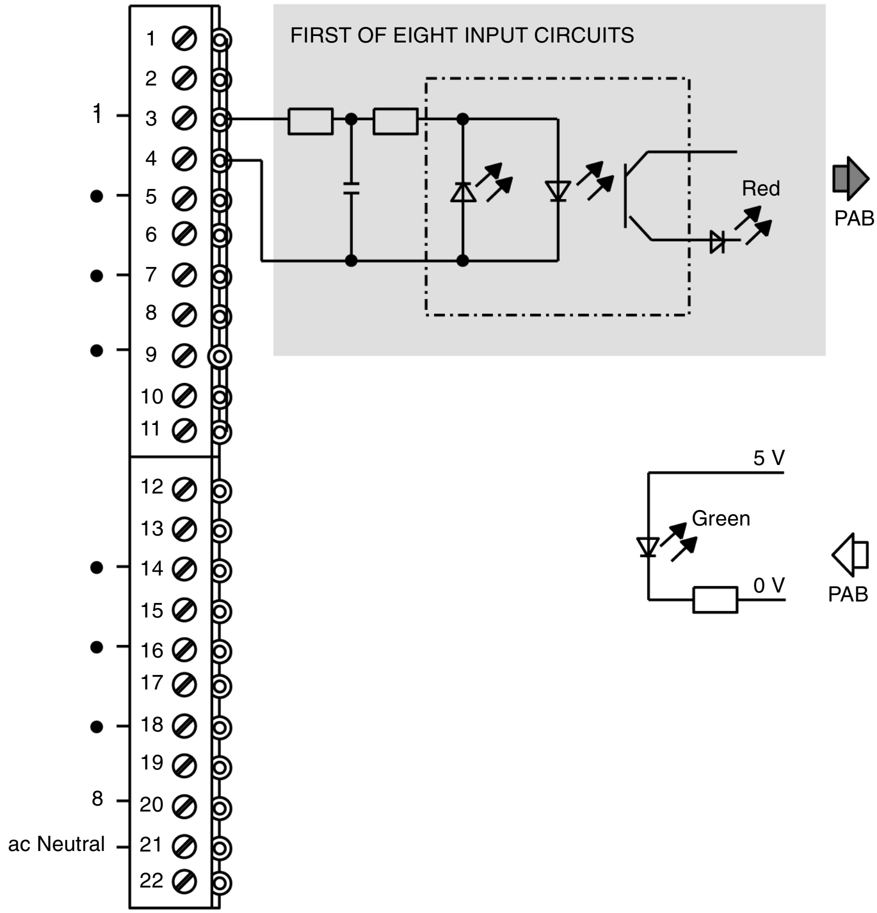
Wiring Diagram for DEP 211

A sample wiring diagram for the DEP 211 input module is provided below.



Simplified Schematic for DEP 211

A simplified schematic for the DEP 211 input module is provided below.



DEP 211 Input Module Specifications

Table of Specifications for DEP 211

The following table contains a list of DEP 211 input module specifications.

Module Topology	Number of Inputs		8
	Number of Groups		8
	Points/group		1
	Isolation		Optocoupler on each input
			1.8 kV between inputs
Power Supplies	External Source Requirement		None
	Rated Signal Value		115 Vac, 47 ... 65 Hz
	Internally Provided Source from I/O bus		5 V
			35 mA maximum
	Internal Power Dissipation		3 W typical
Electrical Characteristics	ON State Signal Level		80 ... 132 Vac
	OFF State Signal Level		0 ... 35 Vac
	ON State Input Current		15.5 mA/input @ 115 Vac
			6 mA @ 80 V; 20 mA @ 132 V
	OFF State Input Current		3 mA maximum
	Response Time	ON	10 ms typical
		OFF	40 ms typical
	Operating Mode		True High
	Wire Size/terminal	One wire	14 AWG
		Two wires	20 AWG
I/O Map	Discrete 1x/0x		8 in/0 out
Dimensions	W x H x D		40.3 x 145 x 117.5 mm
			1.6 x 5.6 x 4.5 in
	Weight		250 g
			0.55 lb
Agency Approvals	VDE 0160; UL 508; and CSA 22.2 No.142 Standards		

Overview of the DEP 214/254 Input Module

35

At a Glance

Purpose

The purpose of this chapter is to describe the DEP 214/254 input module.

What's in this Chapter?

This chapter contains the following topics:

What is the DEP 214/254 Input Module?

Brief Product Description

> **Note:** Some A120 I/O modules (DEP 211/214/215/217, DAP211/217, ADU204/211/214/216, DAU204, VIC2xx, and MOT20x) require a loadable (SW-IODR-001) for proper operation when using certain PLCs (A984-1xx, E984-24x/251/255) with Modsoft.

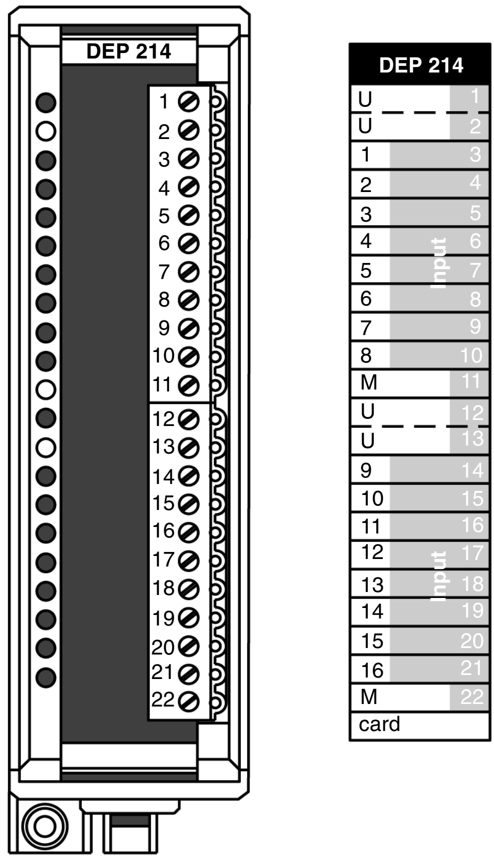
The DEP 214/254 is a 12 ... 60 Vdc 16-point discrete input module. It senses levels provided by field devices such as pushbuttons, limit and proximity switches, or other dc input sources, and converts those signals into logic voltage levels that can be used by the PLC. Signals are field wired in two groups, eight signals/group. Inputs are optically isolated from the system bus. The DEP 254 functions just like the DEP 214 except that the DEP 254 operates at extended temperature.

> **Note:** DEP 254 model is available with conformal coating. The conformal coating model is DEP 254C and it meets Railway standard EN 50 155.

DEP 214/254 Input Module LEDs

LEDs

The DEP 214/254 can be installed in any slot in the A120 subracks (DTA 200, 201, and 202). The module has bus contacts at the rear and peripheral connections on the front. The blank label, which fits in the module cover, can be filled in with relevant information (signal values, etc.) in the spaces provided.
A front view with DEP 214 label is provided below.



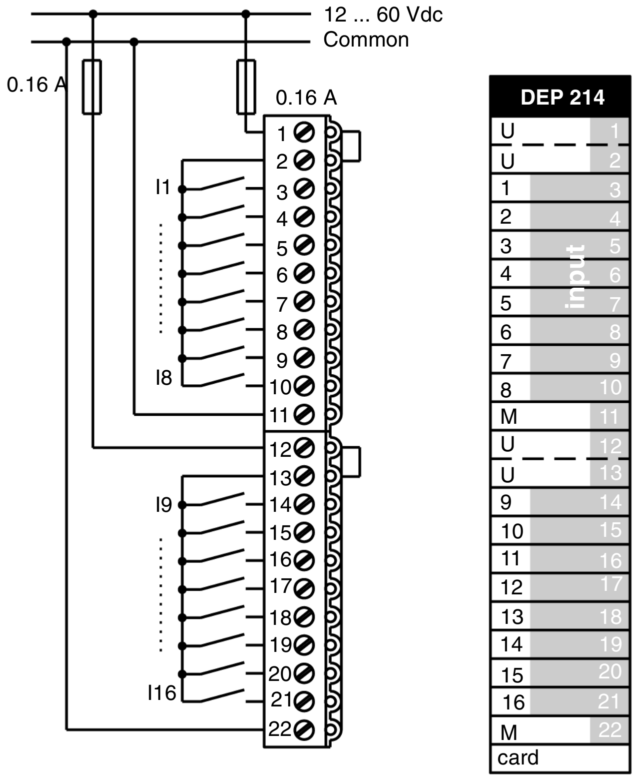
DEP 214/254 Input Module Field Wiring

Introduction

The DEP 214/254 is a 12 ... 60 Vdc 16-point discrete input module. It senses levels provided by field devices such as pushbuttons, limit and proximity switches, or other dc input sources, and converts those signals into logic voltage levels that can be used by the PLC. Signals are field wired in two groups, eight signals/group. Inputs are optically isolated from the system bus. The DEP 254 functions just like the DEP 214 except that the DEP 254 operates at extended temperature.

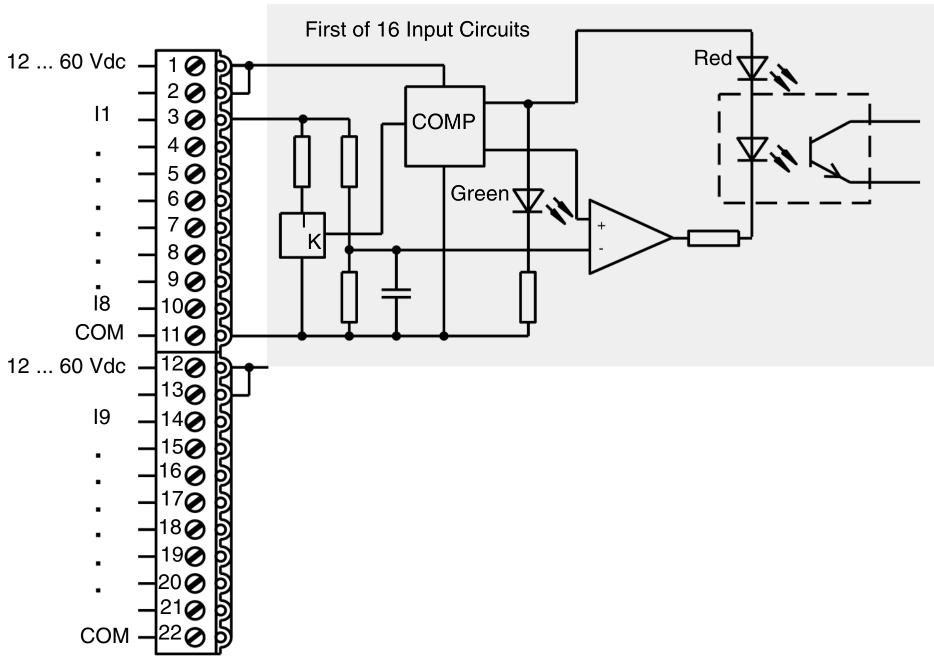
Wiring Diagram for DEP 214/254

A sample wiring diagram for the DEP 214/254 input module is provided below.



Simplified Schematic for DEP 214/254

A simplified schematic for the DEP 214/254 input module is provided below.



DEP 214/254 Input Module Specifications

Table of Specifications for DEP 214/254

The following table contains DEP 214/254 input specifications.

Module Topology	Number of Inputs	16
	Number of Groups	2
	Points/group	8
	Isolation	Optocoupler on each input
Required Loadable	SW-IODR-001	
Power Supplies	External Source Requirement	12 ... 60 Vdc for eight inputs
	Internally Provided Source from I/O bus	5 V; 22 mA maximum

The following table lists DEP 214/254 switching levels.

Signal Input	12 V	24 V	48 V	60 V
Signal Level OFF	-0.6 ... +1.8 V	-3 ... +5 V	-6 ... +10 V	-3 ... +9 V
Signal Level ON	+9 ... +15 V	+11 ... +30 V	+33 ... +60 V	+45 ... +75V
Current OFF	-0.6 ... +1 mA	-1.7 ... +2.9 mA	-3.4 ... +2.5 mA	-1.7 ... + 2.5mA
Current ON	+5.1 ... +7.1 mA	+6.0 ... +7.1 mA	+2.0 ... +2.5 mA	+2.0 ... +2.5mA
Reference Current	less than or equal to 20 mA	less than or equal to 10 mA	less than or equal to 7 mA	less than or equal to 7 mA

DEP 214/254 Specifications (continued)

	ON State Input Current		7 mA @ 24 Vdc
			8.5 mA @ 30 Vdc
	Response Time		4 ms typical
	Operating Mode		True High
	Wire Size/ terminal	One wire	14 AWG
		Two wires	20 AWG
Temperature	Ambient Operating		0 ... 60 degrees C for DEP214 -40 ... +70 degrees C for DEP254
I/O Map	Discrete 1x/0x		16 in/0 out
Dimensions	W x H x D		40.3 x 145 x 117.5 mm
			1.6 x 5.6 x 4.5 in
	Weight		260 g
			0.57 lb
Agency Approvals	DEP214: VDE 0160; UL 508; and CSA 22.2 No.142 Standards.		
	DEP254C: Railway EN 50 155; EMC 89/336/EEC Standards. UL 508; CSA 22.2 No.142; FM Class I, Div 2 pending		

Overview of the DEP 215 Input Module

36

At a Glance

Purpose

The purpose of this chapter is to describe the DEP 215 input module.

What's in this Chapter?

This chapter contains the following topics:

What is the DEP 215 Input Module?

Brief Product Description

> **Note:** Some A120 I/O modules (DEP 211/214/215/217, DAP211/217, ADU204/211/214/216, DAU204, VIC2xx, and MOT20x) require a loadable (SW-IODR-001) for proper operation when using certain PLCs (A984-1xx, E984-24x/251/255) with Modsoft.

The DEP 215 is a TTL, 16-point discrete input module. It senses levels provided by field devices such as pushbuttons, limit and proximity switches, or other TTL input sources, and converts those signals into logic voltage levels that can be used by the PLC. Signals are field wired in two groups, eight signals/group. Inputs are opto-isolated from the system bus.

DEP 215 Input Module LEDs

LEDs

The DEP 215 module has two green LEDs, opposite terminal screws 1 and 12. When one of these LEDs is ON, it indicates that power is available to the group directly below it. The module also has 16 red LEDs, eight opposite terminal screws 3 ... 10 and eight opposite terminal screws 14 ... 21; when any one of these LEDs are ON, it indicates a -1 ... +2 Vdc level present at the corresponding input.

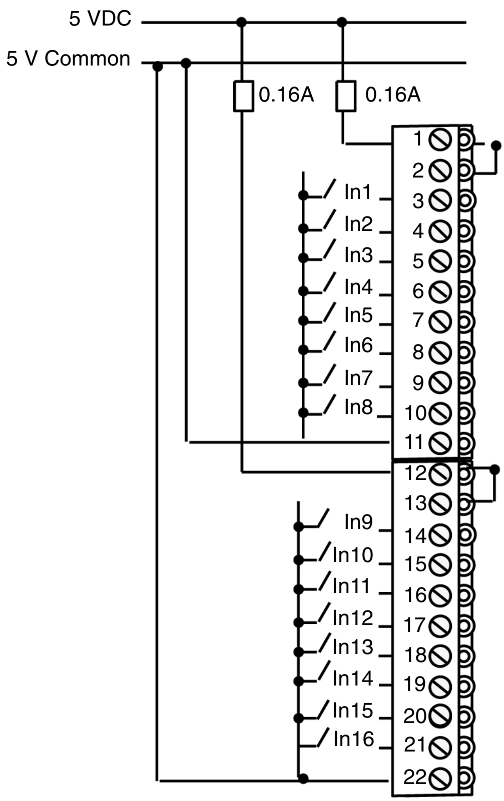
DEP 215 Input Module Field Wiring

Introduction

The DEP 215 is a TTL, 16-point discrete input module. It senses levels provided by field devices such as pushbuttons, limit and proximity switches, or other TTL input sources, and converts those signals into logic voltage levels that can be used by the PLC. Signals are field wired in two groups, eight signals/group. Inputs are opto-isolated from the system bus.

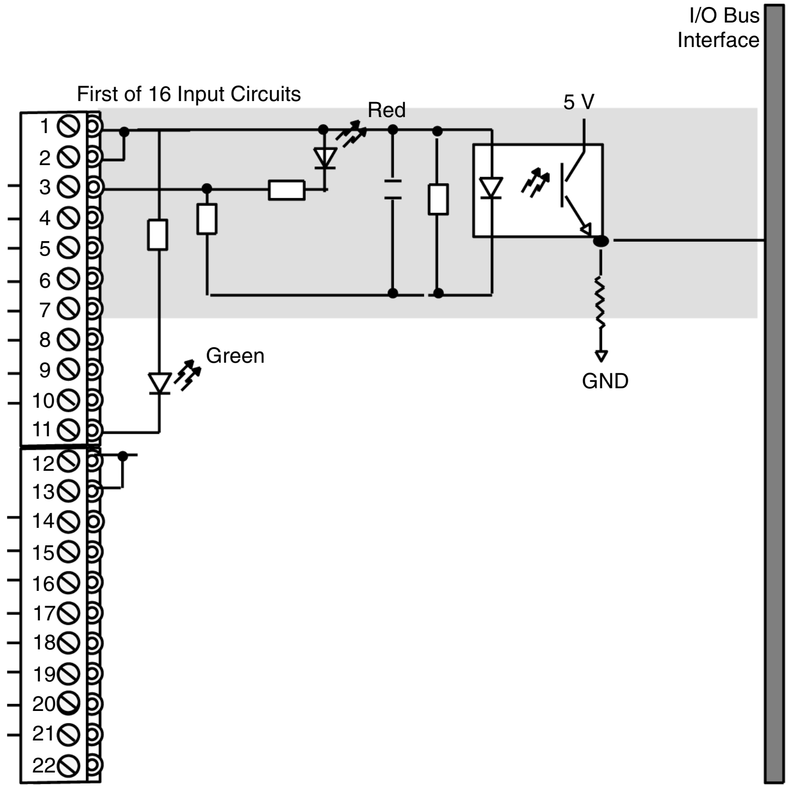
Wiring Diagram for DEP 215

A sample wiring diagram for the DEP 215 input module is provided below.



Simplified Schematic for DEP 215

A simplified schematic for the DEP 215 input module is provided below.



Unique True Low Characteristics of the DEP 215 Input Module

Introduction

This section is intended for DEP 215 16-point TTL input module users who have installed or are otherwise familiar with 200, 500 or 800 Series I/O TTL input modules.

True Low Module

These users should be aware that:

Step	Action
1	The DEP 215 is a True Low module; therefore: ● a HIGH (4 ... 5.5 Vdc) input level to the DEP 215 is read as a logic zero (0) by the system PLC ● a low (-1 ... +2 Vdc) level is read as a logic 1
2	Conversely, other I/O family TTL input modules are traditionally True High; therefore: ● +5 Vdc input levels to other I/O family TTL input modules are read as logic 1 ● low or ground input levels are read as logic 0

DEP 215 Input Module Layout

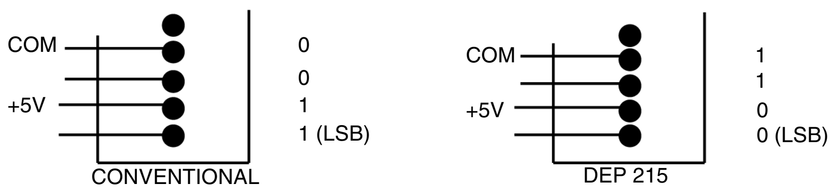
CAUTION

Operational Hazard

Traffic Copping the DEP 215 as BCD and using input devices associated with other series traditional True High modules will cause the controller’s BCD conversion to produce unexpected results.

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

For example, refer to the module input layout in the following illustration.



If the DEP 215 were substituted for an older series TTL input module in a system and I/O Mapped as BCD, the four bottom inputs would be interpreted as an invalid decimal 12 by the PLC. Since this interpretation is a number greater than 9, the internal conversion result would be zero. A conventional module’s conversion value would be decimal 3. In this case, inverting all of the field device inputs to the DEP 215 or changing to a device with complementary outputs results in usable data.

DEP 215 Input Module Specifications

Table of Specifications for DEP 215

The following table contains DEP 215 input module specifications.

Module Topology	Number of Inputs		16
	Number of Groups		2
	Points/group		8
	Isolation		Optocoupler on each input
Required Loadable	SW-IODR-001 (See *Requirements for CE Compliance, p. 779*)		
Power Supplies	External Source Requirement		5 Vdc for eight inputs
	Rated Signal Value		Sinking device
	Internally Provided Source from I/O bus		5 V; 25 mA maximum
	Internal Power Dissipation		2 W typical
Electrical Characteristics	False Condition Signal Level		4 ... 5 Vdc
	True Condition Signal Level		-1 ... +2 Vdc
	True Condition Input Current		3.5 mA @ 0 Vdc
	Response Time		1 ms typical
	Operating Mode		True Low
	Wire Size/terminal	One wire	14 AWG
		Two wires	20 AWG
I/O Map	Discrete 1x/0x		16 in/0 out
Dimensions	W x H x D		40.3 x 145 x 117.5 mm
			1.6 x 5.6 x 4.5 in
	Weight		220 g
			0.5 lb.
Agency Approvals	VDE 0160; UL 508; and CSA 22.2 No.142 Standards		

Overview of the DEP 216/256 Input Module

37

At a Glance

Purpose

The purpose of this chapter is to describe the DEP 216/256 input module.

What's in this Chapter?

This chapter contains the following topics:

What is the DEP 216/256 Input Module?

Brief Product Description

The DEP 216/256 is a 24 Vdc, 16-point discrete input module. It senses input signals received from field sensing devices such as pushbuttons, limit and proximity switches, or other 24 Vdc input sources and converts those signals into logic voltage levels that can be used by the PLC. Signals are field wired in two groups, eight signals per group. Inputs are opto-isolated from the system bus. The DEP 256 functions just like the DEP 216 except that the DEP 256 operates at extended temperature.

Note: The DEP 256 model is available with conformal coating. The conformal coating model is DEP 256C and it meets Railway standard EN 50 155.

DEP 216/256 Input Module LEDs

LEDs

The DEP 216/256 module has two green LEDs, opposite terminal screws 1 and 12. When one of these LEDs is ON, it indicates that power is available to the eight inputs directly below it. The module also has 16 red LEDs, eight opposite terminal screws 3 ... 10 and eight opposite terminal screws 14 ... 21; when any one of these LEDs are ON, it indicates voltage present at the corresponding input.

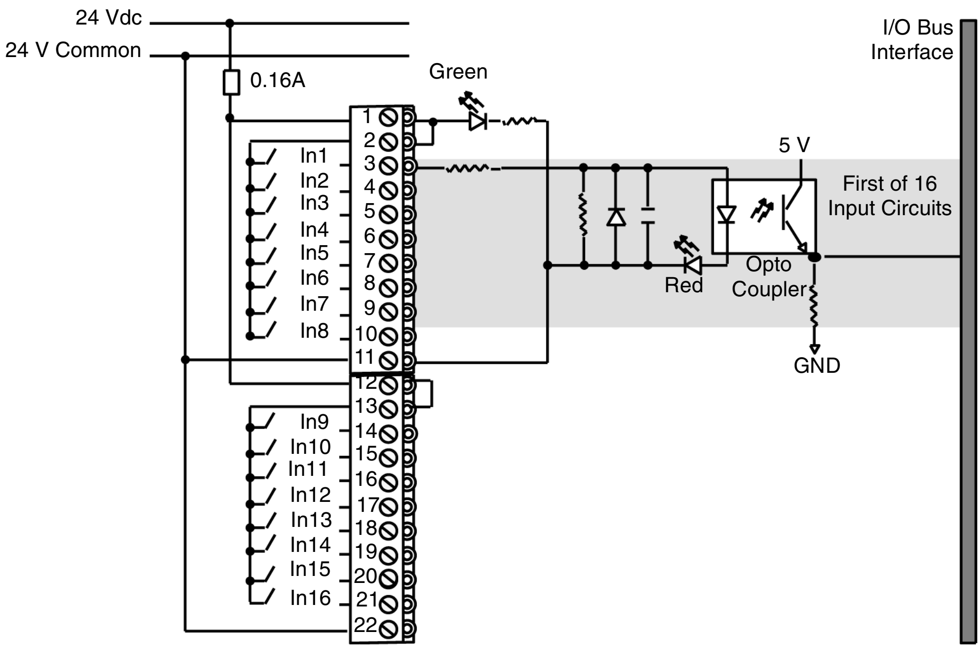
DEP 216/256 Input Module Field Wiring

Introduction

The DEP 216/256 is a 24 Vdc, 16-point discrete input module. It senses input signals received from field sensing devices such as pushbuttons, limit and proximity switches, or other 24 Vdc input sources and converts those signals into logic voltage levels that can be used by the PLC. Signals are field wired in two groups, eight signals per group. Inputs are opto-isolated from the system bus. The DEP 256 functions just like the DEP 216 except that the DEP 256 operates at extended temperature.

Simplified Schematic for DEP 216/256

A simplified schematic for the DEP 216/256 input module is provided below.



DEP 216/256 Input Module Specifications

Table of Specifications for DEP 216/256

The following table contains DEP 216/256 input module specifications.

<table>
<tr><td rowspan="4">Module Topology</td><td colspan="2">Number of Inputs</td><td>16</td></tr>
<tr><td colspan="2">Number of Groups</td><td>2</td></tr>
<tr><td colspan="2">Points/group</td><td>8</td></tr>
<tr><td colspan="2">Isolation</td><td>Optocoupler on each input</td></tr>
<tr><td rowspan="4">Power Supplies</td><td colspan="2">External Source Requirement</td><td>24 Vdc for eight inputs</td></tr>
<tr><td colspan="2">Rated Signal Value</td><td>24 Vdc +25 percent/-15 percent</td></tr>
<tr><td colspan="2">Internally Provided Source from I/O bus</td><td>5 V; 15 mA</td></tr>
<tr><td colspan="2">Internal Power Dissipation</td><td>2 W typical</td></tr>
<tr><td>Electrical Characteristics</td><td colspan="2">ON State Signal Level</td><td>12 ... 30 Vdc</td></tr>
<tr><td rowspan="7"></td><td colspan="2">OFF State Signal Level</td><td>-2 ... +5 Vdc</td></tr>
<tr><td colspan="2" rowspan="2">ON State Input Current</td><td>7 mA @ 24 Vdc</td></tr>
<tr><td>8.5 mA @ 30 Vdc</td></tr>
<tr><td colspan="2">Response Time</td><td>4 ms typical</td></tr>
<tr><td colspan="2">Operating Mode</td><td>True High</td></tr>
<tr><td rowspan="2">Wire Size/terminal</td><td>One wire</td><td>14 AWG</td></tr>
<tr><td>Two wires</td><td>20 AWG</td></tr>
<tr><td>Environmental Characteristics</td><td colspan="2">Operating Temperature</td><td>0 ... 60 degrees C for DEP216
-40 ... +70 degrees C for DEP256</td></tr>
<tr><td>I/O Map</td><td colspan="2">Discrete 1x/0x</td><td>16 in/0 out</td></tr>
<tr><td rowspan="4">Dimensions</td><td colspan="2" rowspan="2">W x H x D</td><td>40.3 x 145 x 117.5 mm</td></tr>
<tr><td>1.6 x 5.6 x 4.5 in</td></tr>
<tr><td colspan="2" rowspan="2">Weight</td><td>220 g</td></tr>
<tr><td>0.5 lb</td></tr>
<tr><td rowspan="2">Agency Approvals</td><td colspan="3">DEP216: VDE 0160; UL 508; CSA 22.2 No.142; and FM Class I, Div 2 Standards.</td></tr>
<tr><td colspan="3">DEP256C: Railway standard EN 50 155; European Directive EMC 89/336/ EEC. UL 508; CSA 22.2 No.142; and FM Class I, Div 2 pending.</td></tr>
</table>

Overview of the DEP 217 Input Module

38

At a Glance

Purpose

The purpose of this chapter is to describe the DEP 217 input module.

What's in this Chapter?

This chapter contains the following topics:

What is the DEP 217 Input Module?

Brief Product Description

> **Note:** Some A120 I/O modules (DEP 211/214/215/217, DAP211/217, ADU204/211/214/216, DAU204, VIC2xx, and MOT20x) require a loadable (SW-IODR-001) for proper operation when using certain PLCs (A984-1xx, E984-24x/251/255) with Modsoft.

The DEP 217 is a 24 Vdc, 16-point discrete true low input module. It senses levels provided by field devices such as pushbuttons, limit and proximity switches, or other 24 Vdc input sources and converts those signals into logic voltage levels that can be used by the PLC. Signals are field wired in two groups, eight signals/group. Inputs are opto-isolated from the system bus.

> **Note:** The DEP 217 is a true low module; therefore, a high (greater than or equal to external source minus 6Vdc) is read by the PLC as a logic 0. Conversely, a low (less than or equal to external source minus 12Vdc) is read by the PLC as a logic 1.

DEP 217 Input Module LEDs

LEDs

The DEP 217 module has two green LEDs, opposite terminal screws 1 and 12. When one of these LEDs is ON, it indicates that power is available to the group directly below it. The module also has 16 red LEDs, eight opposite terminal screws 3 ... 10 and eight opposite terminal screws 14 ... 21; when any one of these LEDs are ON, it indicates 3 external source minus 12 V at the corresponding input.

DEP 217 Input Module Field Wiring

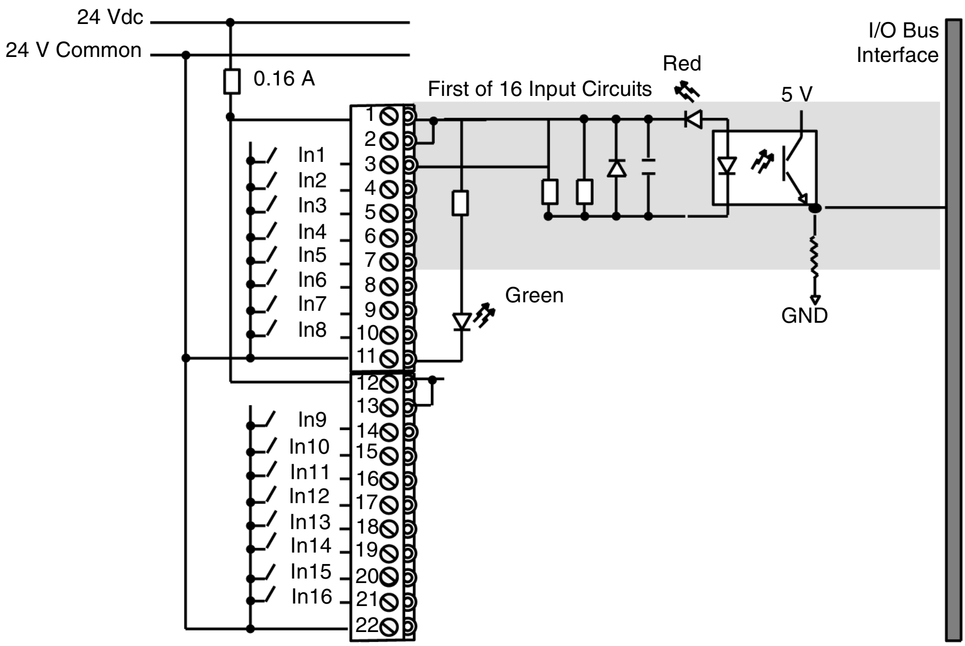
Introduction

The DEP 217 is a 24 Vdc, 16-point discrete true low input module. It senses levels provided by field devices such as pushbuttons, limit and proximity switches, or other 24 Vdc input sources and converts those signals into logic voltage levels that can be used by the PLC. Signals are field wired in two groups, eight signals/group. Inputs are opto-isolated from the system bus.

Note: The DEP 217 is a true low module; therefore, a high (greater than or equal to external source minus 6Vdc) is read by the PLC as a logic 0. Conversely, a low (less than or equal to external source minus 12Vdc) is read by the PLC as a logic 1.

Wiring Diagram and Simplified Schematic for DEP 217

A wiring diagram and simplified schematic for the DEP 217 input module is provided below.



DEP 217 Input Module Specifications

Table of Specifications for DEP 217

The following table contains DEP 217 input module specifications.

Module Topology	Number of Inputs		16
	Number of Groups		2
	Points/group		8
	Isolation		Optocoupler on each input
Required Loadable	SW-IODR-001 (See *Requirements for CE Compliance, p. 779*)		
Power Supplies	External Source Requirement		24 Vdc for eight inputs
	Rated Signal Value		Sinking device
	Internally Provided Source from I/O bus		5 V; 25 mA
	Internal Power Dissipation		3 W typical
Electrical Characteristics	False Condition Signal Level		greater than or equal to external source minus 6 Vdc
	True Condition Signal Level		less than or equal to external source minus 12 Vdc
	True Condition Input Current		7 mA @ 0 Vdc
	Response Time		4 ms typical
	Operating Mode		True Low
	Wire Size/ terminal	One wire	14 AWG
		Two wires	20 AWG
I/O Map	Discrete 1x/0x		16 in/0 out
Dimensions	W x H x D		40.3 x 145 x 117.5 mm
			1.6 x 5.6 x 4.5 in
	Weight		220 g
			0.5 lb.
Agency Approvals	VDE 0160; UL 508; and CSA 22.2 No.142 Standards		

Overview of the DEP 218 Input Module

39

At a Glance

Purpose

The purpose of this chapter is to describe the DEP 218 input module.

What's in this Chapter?

This chapter contains the following topics:

What is the DEP 218 Input Module?

Brief Product Description

	WARNING
⚠	**Operational Hazard** The DEP 218 module will only operate properly when used with an A984, E984, or Micro 512/612 controller. **Failure to follow this precaution can result in death, serious injury, or equipment damage.**

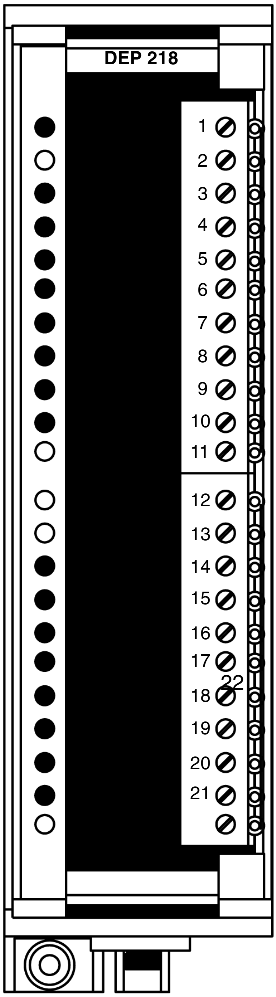
The DEP 218 is a 115 Vac, 16-point input module with 1.8kV isolation between field devices and the bus. It senses input signals received from field sensing devices such as pushbuttons, limit and proximity switches, or other 115 Vac input sources and converts those signals into logic voltage levels that can be used by the controller. Signals are field wired in two groups, eight signals/group. Inputs are opto-isolated from the system bus.

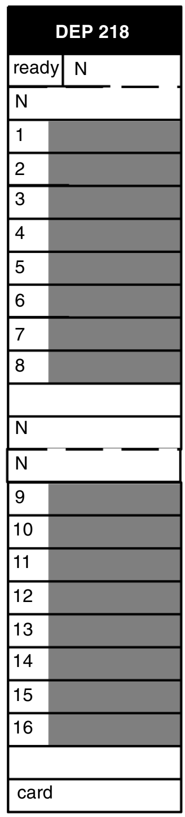
Note: The DEP 218 is designed for capacitive loads. Without any discharge bypass resistor. When using field devices with resistive loads you should use 120K 1/4 Watt resistors (approximately) across the input terminals of the DEP 218. This allows accurate switching of phase firing type solid state sensors by ensuring that the capacitor discharges within the sensor required 50 milliseconds. If your application permits, a DEP 210 may be substituted for the DEP 218. The DEP 210 has an internal input discharge circuit.

DEP 218 Input Module LEDs

LEDs

The DEP 218 module has one green LED opposite terminal screw 1. When this LED is ON, it indicates the presence of working voltage from the power supply. The module also has 16 red LEDs, eight opposite terminal screws 3 ... 10 and eight opposite terminal screws 14 ... 21; when any one of these LEDs is ON, it indicates voltage present at the corresponding input.
A front view and fill-in labels of the DEP 218 module is provided below.

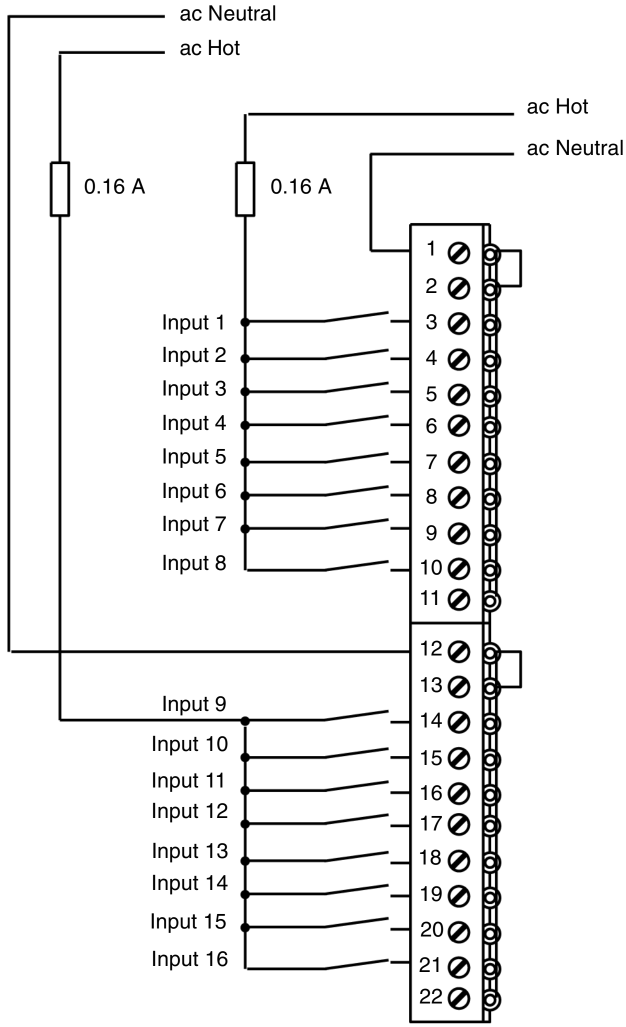




DEP 218 Input Module Field Wiring

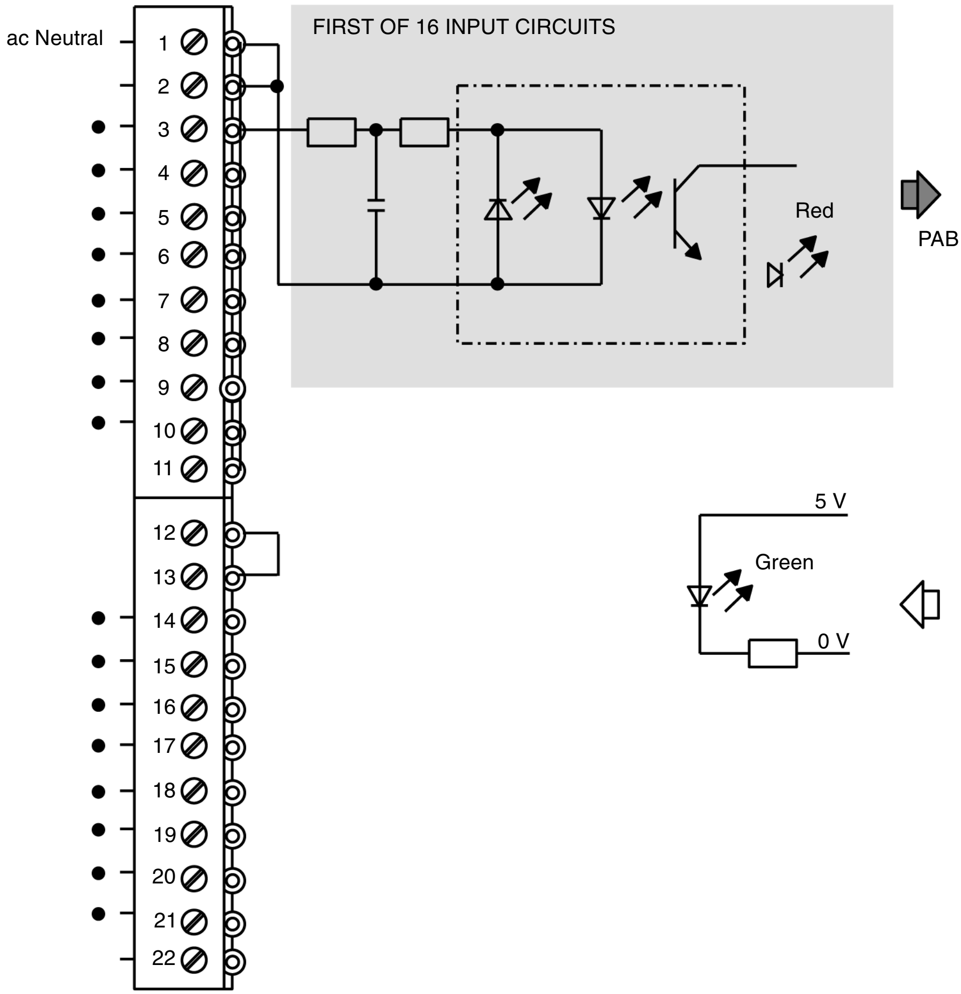
Wiring Diagram for DEP 218

A sample wiring diagram for the DEP 218 input module is provided below.



Simplified Schematic for DEP 218

A simplified schematic for the DEP 218 input module is provided below.



DEP 218 Input Module Specifications

Table of Specifications for DEP 218

The following table contains DEP 218 input module specifications.

Module Topology	Number of Inputs		16
	Number of Groups		2
	Points/group		8
	Isolation		Optocoupler on each input point, 1.8 kV field-to-bus
Power Supplies	External Source Requirement		115 Vac
	Rated Signal Value		115 Vac
			47 ... 65 Hz
	Internally Provided Source from the I/O bus		5 V, less tghan 50 mA
	Internal Power Dissipation		3 W typical
Electrical Characteristics	ON State Signal Level		80 ... 132 Vac
	OFF State Signal Level		0 ... 35 Vac
	ON State Input Current		15.5 mA/input @ 115 Vac
			6 mA @ 80 V, 20 mA @ 132 V
	OFF State Input Current		3 mA maximum
	Response Time	ON	10 ms typical
		OFF	40 ms typical
	Operating Mode		True High
	Wire Size/ terminal	One wire	14 AWG
		Two wires	20 AWG
I/O Map	Discrete 1x/0x		16 in/0 out
Dimensions	W x H x D		40.3 x 145 x 117.5 mm
			1.6 x 5.6 x 4.5 in
	Weight		300 g
			0.66 lb
Agency Approvals	VDE 0160; UL 508; and CSA 22.2 No.142 Standards		

Overview of the DEP 220 Input Module

40

At a Glance

Purpose

The purpose of this chapter is to describe the DEP 220 input module.

What's in this Chapter?

This chapter contains the following topics:

What is the DEP 220 Input Module?

Brief Product Description

The DEP 220 is a 24 Vdc +25 percent/-15 percent, 16-point discrete input module similar to the DEP 216 module, with a much faster response time (0.5 ms). It senses input signals received from field sensing devices such as pushbuttons, limit and proximity switches, or other 24 Vdc input sources and converts those signals into logic voltage levels that can be used by the PLC. Signals are field wired in two groups, eight signals per group. Inputs are opt-isolated from the system bus.

	CAUTION
	Operational Hazard Modicon recommends using two separate power sources with the DEP 220-one for outputs and one for inputs-in order to avoid electrical switching noise. **Failure to follow this precaution can result in injury or equipment damage.**

Note: Inputs do not work if output supply is disconnected.

DEP 220 Input Module LEDs

LEDs

The DEP 220 module has two green LEDs, opposite terminal screws 1 and 12. When one of these LEDs is ON, it indicates that power available to the eight inputs directly below it. The module also has 16 red LEDs, eight opposite terminal screws 3 ... 10 and eight opposite terminal screws 14 ... 21; when any one of these LEDs are ON, it indicates voltage present at the corresponding input.

DEP 220 Input Module Field Wiring

Introduction

The DEP 220 is a 24 Vdc +25 percent/-15 percent, 16-point discrete input module similar to the DEP 216 module, with a much faster response time (0.5 ms). It senses input signals received from field sensing devices such as pushbuttons, limit and proximity switches, or other 24 Vdc input sources and converts those signals into logic voltage levels that can be used by the PLC. Signals are field wired in two groups, eight signals per group. Inputs are opto-isolated from the system bus.

CAUTION

Operational Hazard

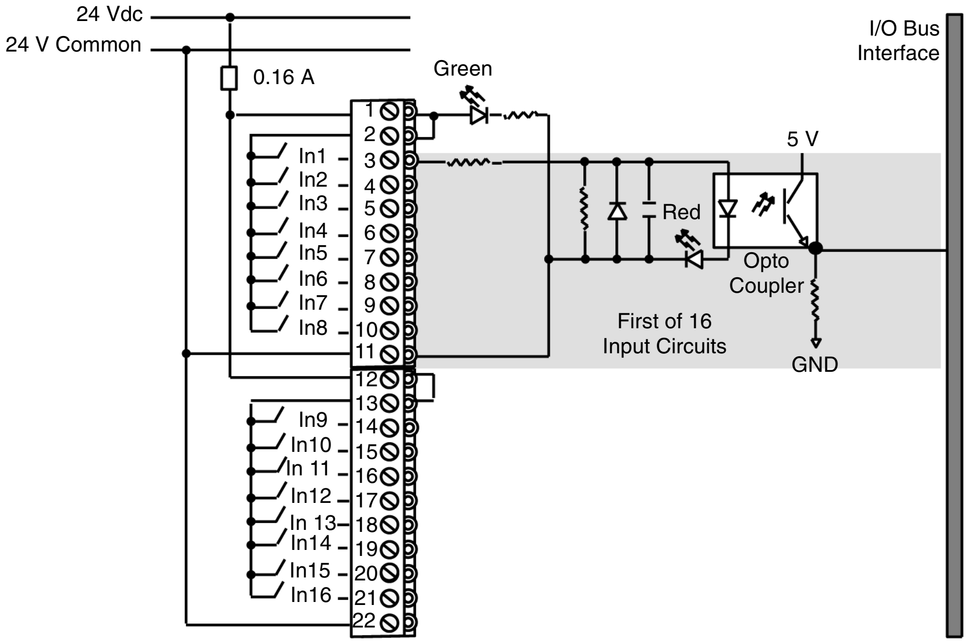
Modicon recommends using two separate power sources with the DEP 220-one for outputs and one for inputs-in order to avoid electrical switching noise.

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

Note: Inputs do not work if output supply is disconnected.

Wiring Diagram and Simplified Schematic

A sample wiring diagram and simplified schematic for the DEP 220 input module is provided below.



DEP 220 Input Module Specifications

Table of Specifications

The following table contains DEP 220 input module specifications.

Module Topology	Number of Inputs		16
	Number of Groups		2
	Points/group		8
	Isolation		Optocoupler on each input
Power Supplies	External Source Requirement		20 ... 30 Vdc for eight inputs
	Rated Signal Value		+24 Vdc
	Internally Provided Source from the I/O bus		5 V; less than 25 mA
	Internal Power Dissipation		2 W typical
Electrical Characteristics	ON State Signal Level		12 ... 30 Vdc
	OFF State Signal Level		-2 ... +5 Vdc
	ON State Input Current		7 mA @ 24 Vdc
			8.5 mA @ 30 Vdc
	Response Time		0.5 ms typical
	Operating Mode		True High
	Wire Size/terminal	One wire	14 AWG
		Two wires	20 AWG
I/O Map	Discrete 1x/0x		16 in/0 out
Dimensions	W x H x D		40.3 x 145 x 117.5 mm
			1.6 x 5.6 x 4.5 in
	Weight		220 g
			0.5 lb
Agency Approvals	VDE 0160; UL 508; and CSA 22.2 No.142 Standards		

Overview of the DEP 257 Input Module

41

At a Glance

Purpose

The purpose of this chapter is to describe the DEP 257 input module.

What's in this Chapter?

This chapter contains the following topics:

What is the DEP 257 Input Module?

Brief Product Description

The DEP 257 is an extended temperature(-40 ... +705 C), 110 Vdc 40%, 16-point discrete input module. The full operational range of this module is 66 ... 154 Vdc. It senses input signals received from field sensing devices such as pushbuttons, limit and proximity switches, or other dc input sources and converts those signals into logic voltage levels that can be used by the PLC. Signals are field wired in two groups, eight signals per group. Inputs are opto-isolated from the system bus.

Note: The DEP 257 model is available with conformal coating. The conformal coating model is DEP 257C.

DEP 257 Input Module LEDs

LEDs

The DEP 257 module has two amber LEDs, opposite terminal screws 1 and 12. When one of these LEDs is ON, it indicates that power is available to the eight inputs directly below it. The module also has 16 red LEDs, eight opposite terminal screws 3 ... 10 and eight opposite terminal screws 14 ... 21; when any one of these LEDs are ON, it indicates voltage present at the corresponding input.

CAUTION

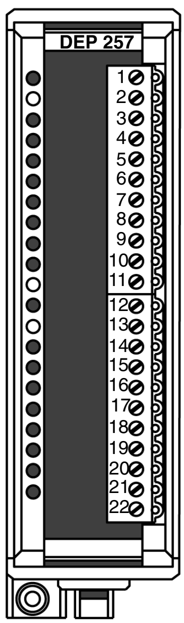
Operational Hazard

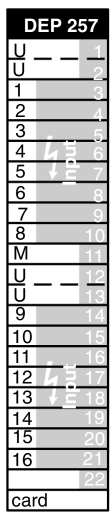
Use of SIM 011 with DEP 257 is not allowed.

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

Note: To I/O Map the DEP 257 module in Modsoft you must select DEP 216. Both modules share a host driver and have similar characteristics.

A front view with DEP 257 label is provided below.





DEP 257 Input Module Field Wiring

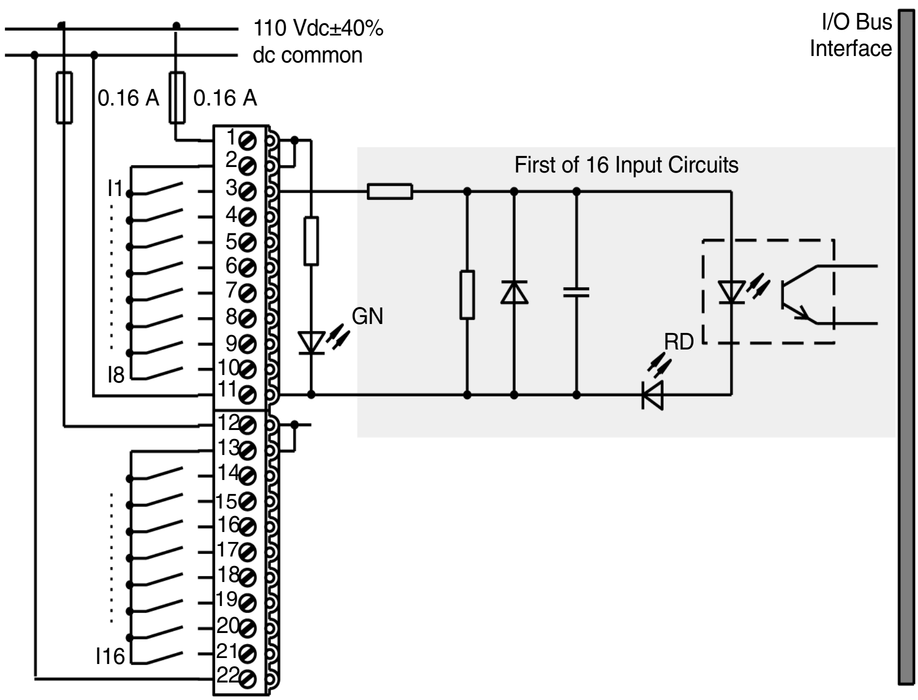
Introduction

The DEP 257 is an extended temperature(-40 ... +70 degrees C), 110 Vdc +/-40 percent, 16-point discrete input module. The full operational range of this module is 66 ... 154 Vdc. It senses input signals received from field sensing devices such as pushbuttons, limit and proximity switches, or other dc input sources and converts those signals into logic voltage levels that can be used by the PLC. Signals are field wired in two groups, eight signals per group. Inputs are opto-isolated from the system bus.

> **Note:** The DEP 257 model is available with conformal coating. The conformal coating model is DEP 257C.

Wiring Diagram and Simplified Schematic

A wiring diagram and simplified schematic for the DEP 257 input module is provided below.



DEP 257 Input Module Specifications

Table of Specifications

The following table contains DEP 257 input module specifications.

Module Topology	Number of Inputs		16
	Number of Groups		2
	Points/group		8
	Isolation		Optocoupler on each input
Power Supplies	External Source Requirement		110 Vdc +/-40 percent for each group of eight inputs
	External Power		40 mA all points on
	Rated Signal Value		66 ... 154 Vdc
	Internally Provided Source from I/O bus		5 Vdc @ 25 mA
	Internal Power Dissipation		3 W typical
Electrical Characteristics	ON State Signal Level		55 ... 170 Vdc
	OFF State Signal Level		-2 ... +10 Vdc
	ON State Input Current		2.2 mA @ 110 Vdc
	Response Time		6 ms typical
	Sensor Supply		110 Vdc +/-40 percent for each group of 8 inputs each residual ripple max 20 percent
	Wire Size/terminal	One wire	14 AWG
		Two wires	20 AWG
I/O Map	Discrete 1x/0x		16 in/0 out
Environmental	Extended Operating Temperature Range		-40 ... +70 degrees C
Dimensions	W x H x D		40.3 x 145 x 117.5 mm
			1.6 x 5.6 x 4.5 in
	Weight		220 g
			0.5 lb
Agency Approvals	DEP257: UL 508; cUL; CSA 22.2 No. 142; and European Directive EMC 89/336/EEC Standards		
	DEP257C: Railway standard EN 50 155; UL 508; cUL; CSA 22.2 No. 142; and European Directive EMC 89/336/EEC Standards		

Overview of the DEP 296 Input Module

42

At a Glance

Purpose

The purpose of this chapter is to describe the DEP 296 input module.

What's in this Chapter?

This chapter contains the following topics:

What is the DEP 296 Input Module?

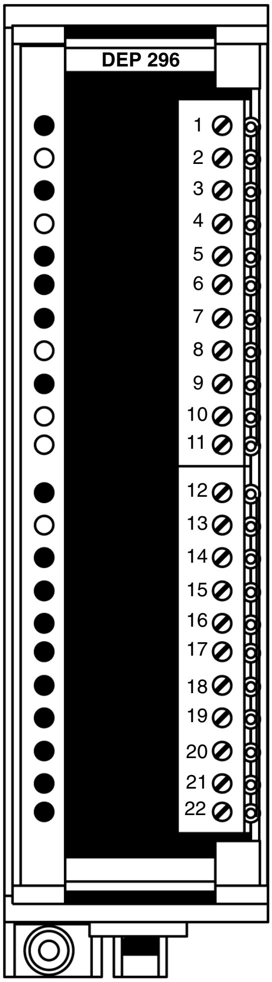
Brief Product Description

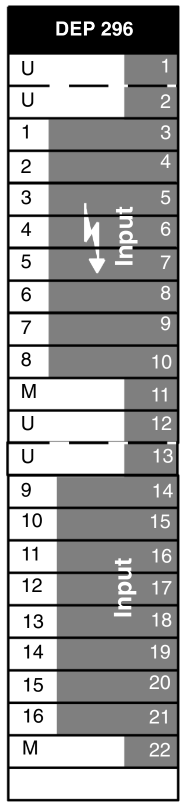
The DEP 296 is a 60 Vdc, 16-point isolated input module. It senses input signals received from field sensing devices such as pushbuttons, limit and proximity switches, or other 60 Vdc input sources and converts those signals into logic voltage levels that can be used by the PLC. Signals are field wired in two groups, eight signals/group. Inputs are opto-isolated from the system bus.

DEP 296 Input Module LEDs

LEDs

The DEP 296 module has two green LEDs, opposite terminal screws 1 and 12. When one of these LEDs is ON, it indicates that power is available to the eight inputs directly below it. The module also has 16 red LEDs, eight opposite terminal screws 3 ... 10 and eight opposite terminal screws 14 ... 21; when any one of these LEDs are ON, it indicates voltage present at the corresponding input.
A front view with DEP 296 label is provided below.





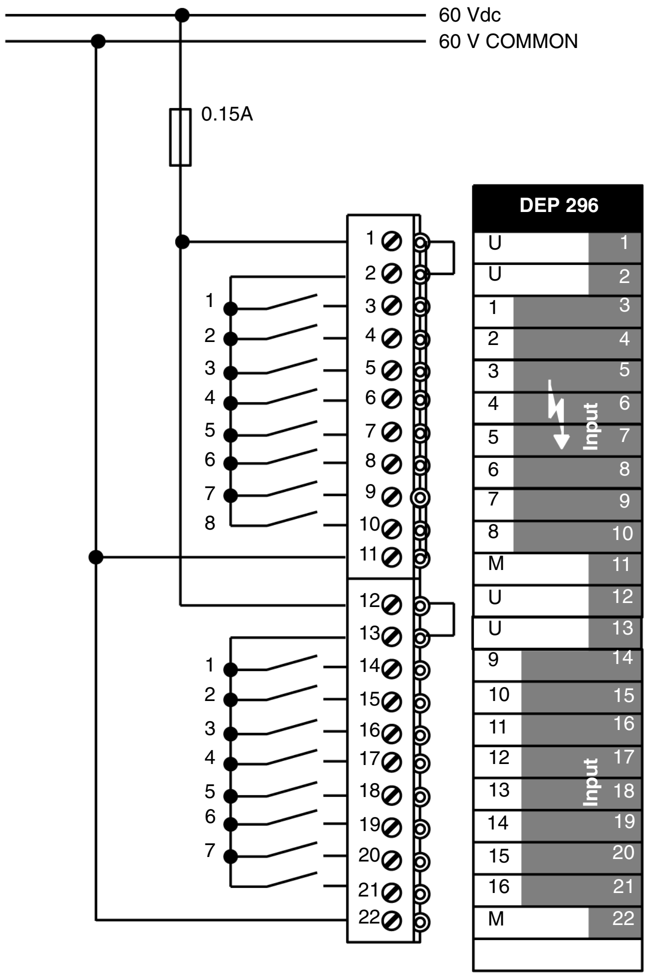
DEP 296 Input Module Field Wiring

Introduction

The DEP 296 is a 60 Vdc, 16-point isolated input module. It senses input signals received from field sensing devices such as pushbuttons, limit and proximity switches, or other 60 Vdc input sources and converts those signals into logic voltage levels that can be used by the PLC. Signals are field wired in two groups, eight signals/group. Inputs are opto-isolated from the system bus.

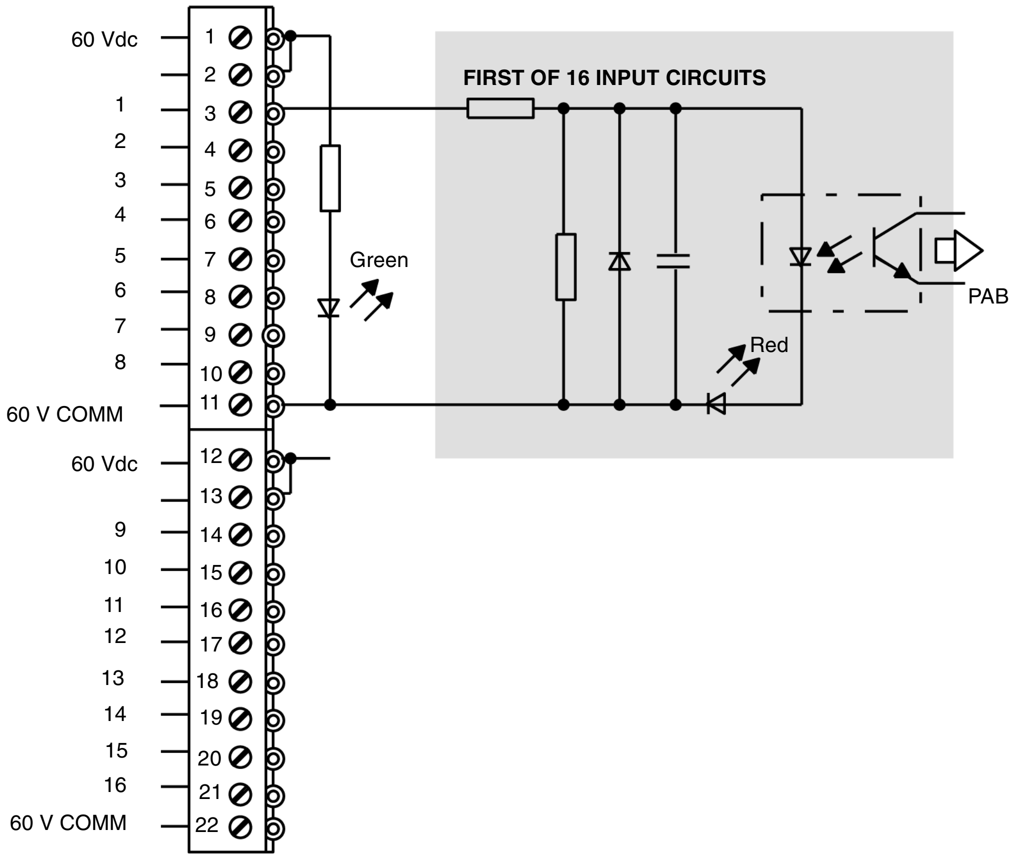
Wiring Diagram

A wiring diagram for the DEP 296 input module is provided below.



Simplified Schematic

A simplified schematic for the DEP 296 input module is provided below.



DEP 296 Input Module Specifications

Table of Specifications

The following table contains DEP 296 input module specifications.

Module Topology	Number of Inputs		16
	Number of Groups		2
	Points/group		8
	Isolation		Optocoupler on each in put
Power Supplies	External Source Requirement		60 Vdc
			125 mA
	Internally Provided Source from I/O bus		5 V
			25 mA maximum
	Internal Power Dissipation		4 W typical
Input Characteristics	Rated Signal Value		+60 Vdc
	ON State Signal Level		35 ... 70 Vdc
	OFF State Signal Level		-4 ... +13 Vdc
	ON State Input Current		7 mA @ 60 Vdc
	Response Time		4 ms typical
	Operating Mode		True High
	Wire Size/terminal	One wire	14 AWG
		Two wires	20 AWG
I/O Map	Discrete 1x/0x		16 in/0 out
Dimensions	W x H x D		40.3 x 145 x 117.5 mm
			1.6 x 5.6 x 4.5 in
	Weight		220 g
			0.5 lb
Agency Approvals	VDE 0160; UL 508; and CSA 22.2 No.142 Standards		

Overview of the DEP 297 Input Module

43

At a Glance

Purpose

The purpose of this chapter is to describe the DEP 297 input module.

What's in this Chapter?

This chapter contains the following topics:

What is the DEP 297 Input Module?

Brief Product Description

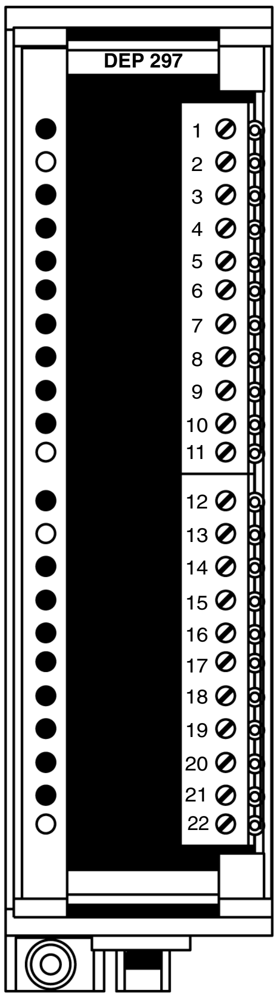
The DEP 297 is a 48 Vdc, 16-point isolated input module. It senses input signals received from field sensing devices such as pushbuttons, limit and proximity switches, or other 48 Vdc input sources and converts those signals into logic voltage levels that can be used by the PLC. Signals are field wired in two groups, eight signals/group. Inputs are opto-isolated from the system bus.

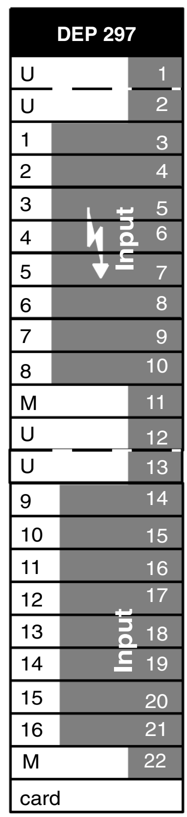
Note: To I/O Map the DEP 297 module in Modsoft you must select DEP 216. Both modules share a host driver and have similar characteristics.

DEP 297 Input Module LEDs

LEDs

The DEP 297 module has two green LEDs, opposite terminal screws 1 and 12. When one of these LEDs is ON, it indicates that power is available to the eight inputs directly below it. The module also has 16 red LEDs, eight opposite terminal screws 3 ... 10 and eight opposite terminal screws 14 ... 21. When any one of these LEDs is ON, it indicates voltage present at the corresponding input.
A front view with DEP 297 label is provided below.





DEP 297 Input Module Field Wiring

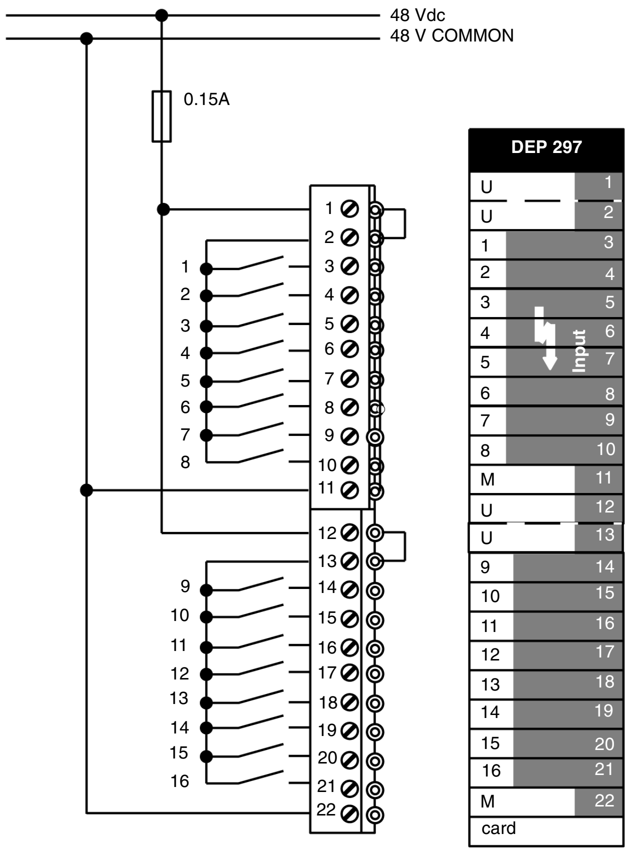
Introduction

The DEP 297 is a 48 Vdc, 16-point isolated input module. It senses input signals received from field sensing devices such as pushbuttons, limit and proximity switches, or other 48 Vdc input sources and converts those signals into logic voltage levels that can be used by the PLC. Signals are field wired in two groups, eight signals/group. Inputs are opto-isolated from the system bus.

Note: To I/O Map the DEP 297 module in Modsoft you must select DEP 216. Both modules share a host driver and have similar characteristics.

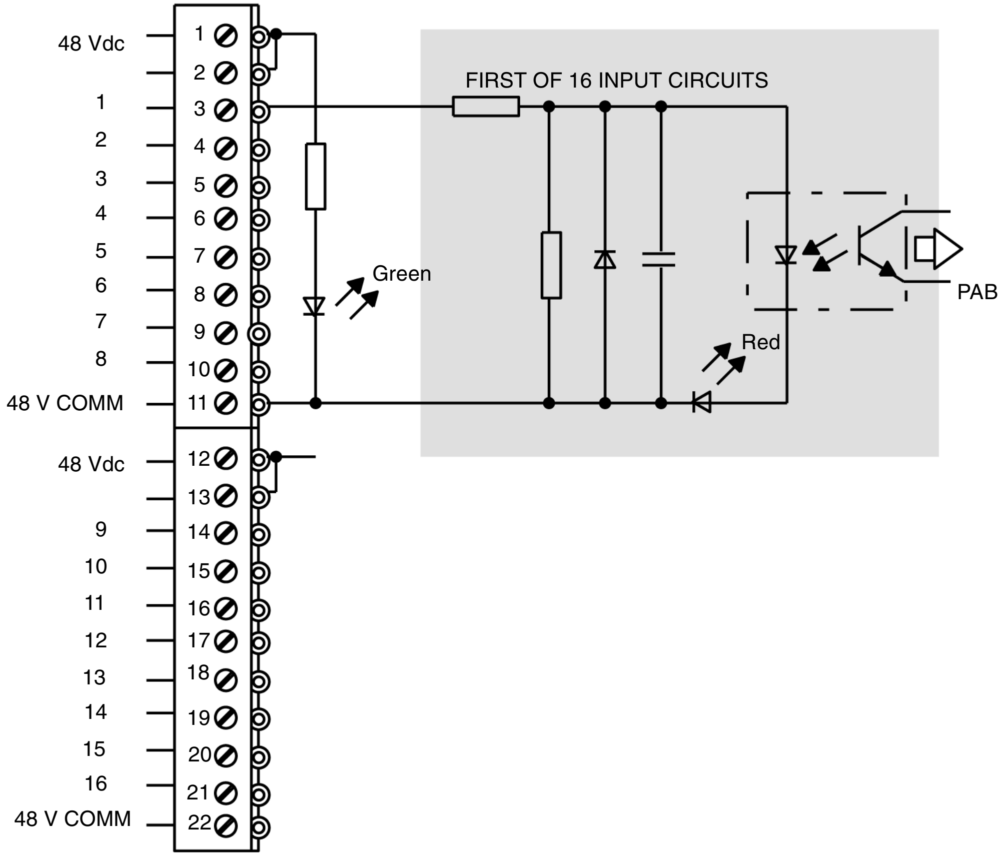
Wiring Diagram

A wiring diagram for the DEP 297 input module is provided below.



Simplified Schematic

A simplified schematic for the DEP 297 input module is provided below.



DEP297 Input Module Specifications

Table of Specifications

The following table contains DEP 297 input module specifications.

Module Topology	Number of Inputs		16
	Number of Groups		2
	Points/group		8
	Isolation		Optocoupler on each input
Power Supplies	External Source Requirement		48 Vdc
			125 mA
	Internally Provided Source from I/O bus		5 V
			25 mA maximum
	Internal Power Dissipation		3 W typical
Input Characteristics	Rated Signal Value		+48 Vdc
	ON State Signal Level		29 ... 56 Vdc
	OFF State Signal Level		-3 ... +10 Vdc
	ON State Input Current		7 mA @ 48 Vdc
	Response Time		4 ms typical
	Operating Mode		True High
	Wire Size/terminal	One wire	14 AWG
		Two wires	20 AWG
I/O Map	Discrete 1x/0x		16 in/0 out
Dimensions	W x H x D		40.3 x 145 x 117.5 mm
			1.6 x 5.6 x 4.5 in
	Weight		220 g
			0.5 lb
Agency Approvals	VDE 0160; UL 508; and CSA 22.2 No.142 Standards		

Overview of the FRQ 204/254 Frequency Module

44

At a Glance

Purpose

The purpose of this chapter is to describe the FRQ 204/254 Frequency Module.

What's in this Chapter?

This chapter contains the following topics:

What is the FRQ 204/254 Frequency Module?

Brief Product Description

The FRQ-204/254 serves the purpose of frequency and speed measurement for the Compact PLCs and has the following features:

- 4Frequency inputs for counting pulse voltages 5 VDC (TTL) or 24 VDC, Counting frequency up to 1 kHz (1 x up to 50 kHz)
- 4fixed assigned semiconductor outputs 24 VDC, 0.5 A for Limit monitoring with:
  - Short–circuit and overload protection
  - Switch–off with value saving
  - Group indication of the overload/ short–circuit switch–off
  - Group short–circuit signal
  - Hardware reset for the acknowledgment of the overload
- 4process inputs 24 VDC for free use
- several LED indicators for function tracking and monitoring

Note: The FRQ 254 functions just like the FRQ 204 except that the FRQ 254 operates at extended temperature.

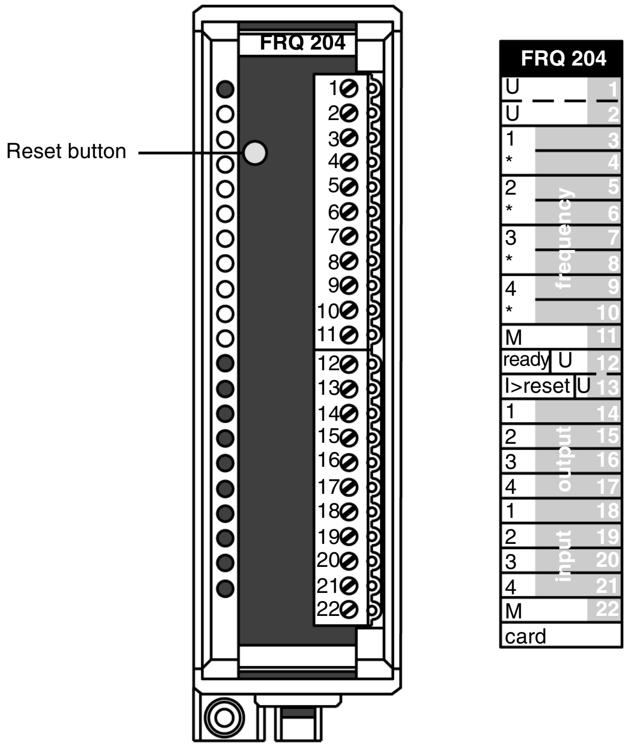
The FRQ-204/254 can be inserted on any I/O slot in the subracks AS-HDTA-200, AS-HDTA-201 and AS-HDTA-202.
The power supply is obtained:

- Internally with 5 VDC via the I/O bus
- Externally with 24 VDC for 24 V counter inputs, outputs and enable inputs
- If required, an addition externally with 5 VDC with 5 V input pulses.

Physical Characteristics of the FRQ 204/254 Frequency Module

Illustration

The module a has bus connection on the rear and peripheral connection via screw/plug–in terminals on the front. One of the enclosed fill–in labels is inserted in the detachable cover of the subrack near the viewing field for the LED indicators. System relevant data should be entered in the provided fields (e.g. signal names).



Operating Modes of the FRQ 204/254 Frequency Module

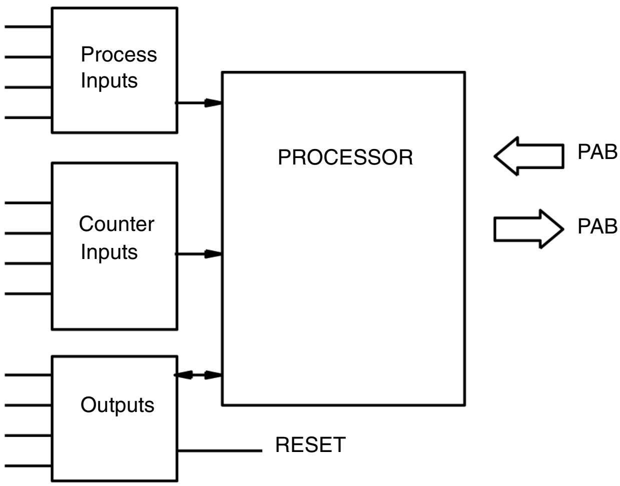
FRQ 204/254 Operating Modes

The module comprises 4 independent hardware counters for the following operating modes:
- Frequency measurement <20 Hz, <1 kHz, <50 kHz
- Speed measurement <1 200 rev/min., <60 000 rev/min., <65 520 rev/min.

The above mentioned operating modes and the required parameters should be defined in the parameters dialog screen of the panel software.
This module is a I/O bus node with isolation to the process peripherals.
In case of overload or short–circuit the corresponding output is switched off. The yellow LED indicates the overload. The reset button provides the acknowledgement.
The outputs can be operated only when 24 V supply is available. When the module is inserted with voltage supply on (24 V and 5 V supply), all the outputs take 0 V position. The 4 discrete inputs (Input 1 ... 4 with LEDs) are available as free process inputs for your use. There is no functional assignment to the counter.

FRQ 204/254 Block Diagram

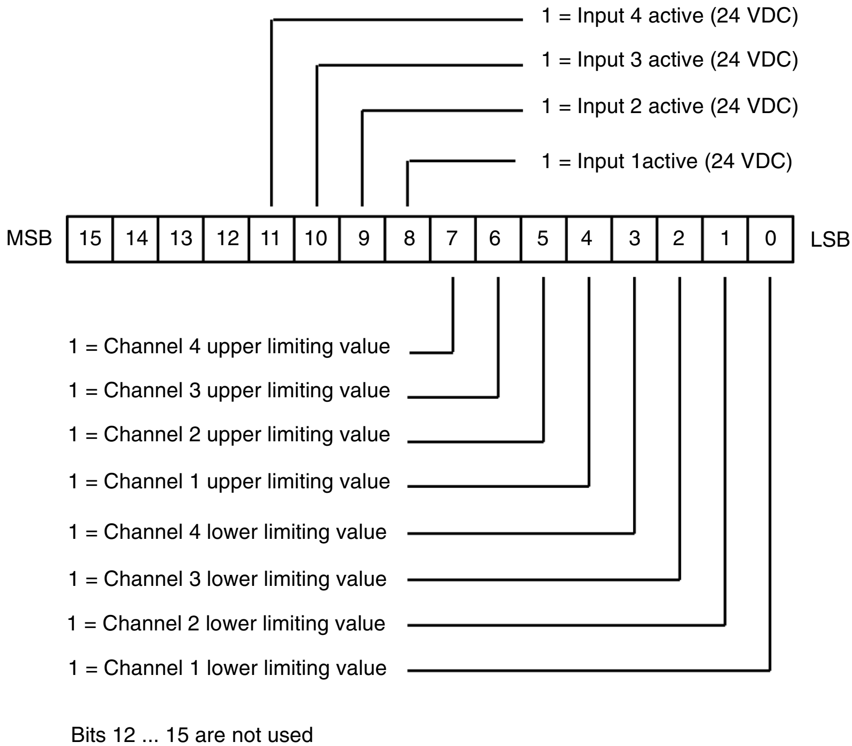
The following diagram describes the architecture of the FRQ 204/205 frequency module.



Configuration of the FRQ 204/254 Frequency Module

I/O Mapping

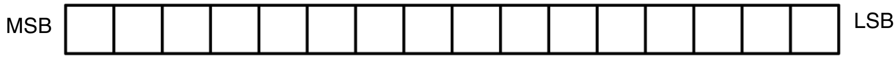
This modules uses 5 3x input registers as detailed here.



Note: Bits 4 ... 7 are high when the value is >= the upper limit. Bits 0 ... 3 are high when the value is <= the lower limit.

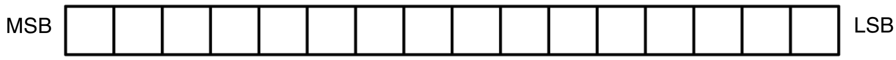
The 3x register is shown below.

3x-register 2 (frequency/revolution data)



...
...
...

3x-register 5 (frequency/revolution data)



I/O Node Number

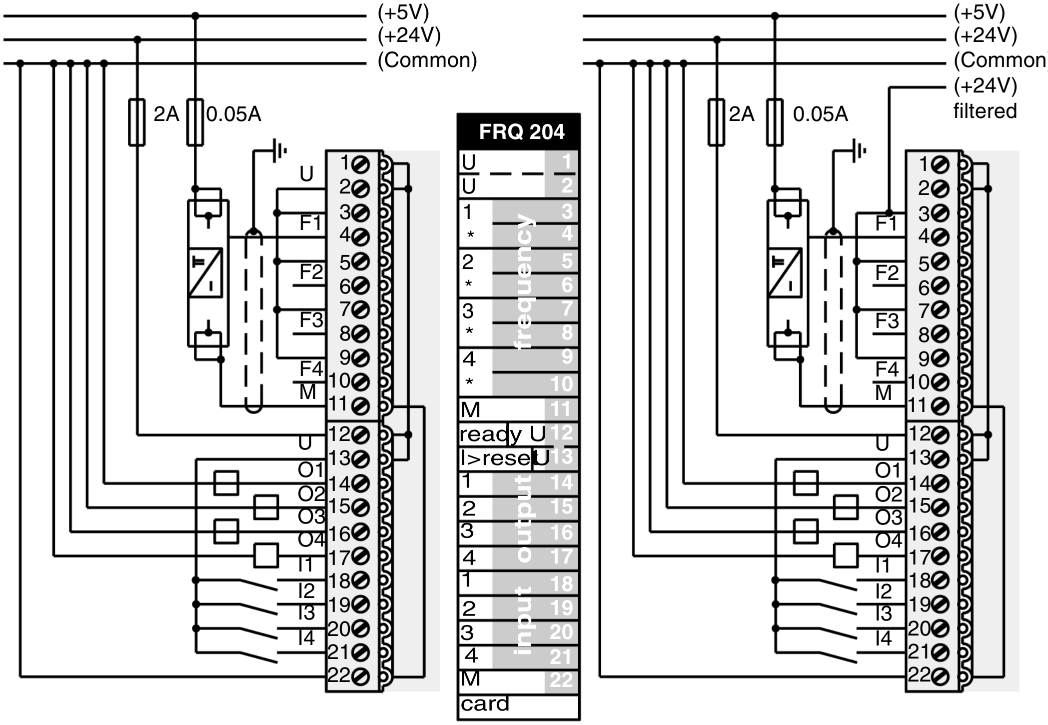
Select the I/O slot number via the I/O map configuration and set the addressing of the 3x registers to be used.

Wiring

- For the counter input connection please use shielded cables, e.g. JE–LiYCY 2 x 2 x 0.5 mm**2** (P/N E–Nr. 424 234 035). All counter inputs can be combined together in one common shielded cable, e.g. LiYrdf(Cgv)Y 5 x 2 x 0.5 mm**2** (P/N E–No. 424 238 059)
- The maximum cable length is 100 m
- The shield should be connected on one side with a short cable (<20 cm) to earth ground. The cable shield should be grounded on both sides when higher noise levels are present.
- The cable should not be combined together with supply lines or similar sources of electrical interference. Distance >0.5 m.

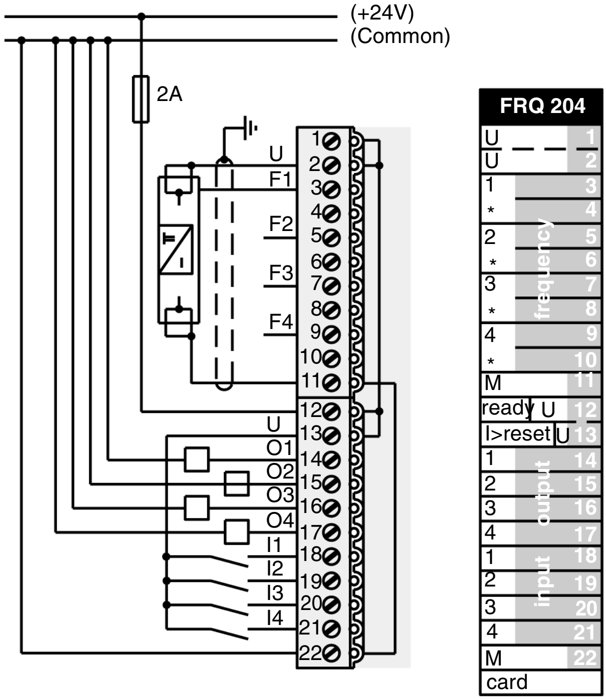
Connection and Signal Address Assignment

The figure below illustrates a connection example for counter input F1 with 5 V input pulses (left) for systems with higher noise level (right).



Note: The example shows a 5 V pulse generator that requires a supply voltage of 24 VDC. Supply it from terminal 1.

The following figure illustrates a connection example for counter input F1 with 24 V input pulses.



Note: The counter input F1 (TTL) is for the connection of 5 V sensor (max. 50 kHz).

Operation and LED Displays of the FRQ 204/254 Frequency Module

Operation and LEDs

The module comes with the following LED indicators:

Color and Name	Use	LED on	LED off
1 x green "U"	supply LED for 24 V counter inputs, outputs and process inputs:	supply is available	supply is not available
1 x green "ready"	LED for function	Firmware initialization is completed, PAB interface enabled (backplane communication)	Module is not ready for operation
1 x yellow "(reset)"	LED for overload or short–circuit of the outputs	short–circuit or overload on one or more outputs	faultless operation
4 x red "output 1 ... 4"	LEDs for outputs	outputs have "1" signal	outputs have "0" signal
4 x red "input 1 ... 4"	LEDs for free process inputs	signal on input	signal on input

The red LED indicators show the level of voltage of input or output signal (1 or 0). Thus, the red LED goes on when the voltage level is high (1).
Reset button:
- switches off the stored overload indication
- removes the reclosing lockout of the switched off (overloaded) outputs, when the overload is no longer present
- switches the group short circuit signal again to 0.

Specifications of the FRQ 204/254 Frequency Module

FRQ 204/254 Power Supply

The following table describes the power supply.

External Power Supply For:	24 Vdc, ca. 1.1 A	Counter Inputs
		Process Inputs
		Outputs
	5 Vdc, 20 mA	Counter Inputs
Internal Power Source via I/O bus	Maximum	5 V, 100 mA
	Typical	75 mA
Power Loss	Typical	1.3 W

FRQ 204/254 I/O Map

The following table describes the I/O map.

Register 3x/4x	5 in / 0 out

FRQ 204/254 Frequency Inputs

The following table describes the frequency inputs.

Quantity		4 for input pulses with 5 Vdc (TTL) or 24 Vdc
Type of Networking		potential free (optical coupler) against I/O bus
Signal Level at 5 V (TTL)	ON signal	>= 2.3 V
	OFF signal	0 ... 1 V
	Input Current	<= 2.5 mA each at 0 V (current sink)
Signal Level at 24 V (TTL)	ON Signal	12 ... 30 V
	OFF signal	-2 ... +5 V
	Input Current	<= 6 mA each at 30 V (current source)
Signal Level at 24 V (TTL)	ON signal	12 ... 30 V
	OFF signal	-2 ... +5 V
Input Current (current source)		< 6 mA each at 30 V
Minimum Pulse Width		0.35 ms
Pulse Duty Factor		7:13 ... 1:1 ... 13:7, (13:7 = 65% : 35%)
Counting range		0 ... 32,767
Counting Frequency		1 kHz maximum (Input 1 with 5 V pulses 50 kHz maximum)
Accuracy (Time = 5) at:		
5 Hz	0.5%	Operating mode < 20 Hz
20 Hz	2%	
25 Hz	4%	Operating mode < 1 Hz
100 Hz	1%	
1 kHz	0.1%	
5 ... 50 kHz	0.05%	Operating mode < 50 kHz
Accuracy (Time =1)		ca. 10 times lower (use only for fast approximate measurements)

FRQ 204/254 Process Inputs

The following table describes the process inputs.

Quantity		4
Type of Networking		potential free (optical coupler) against I/O bus
Rated Signal Value		24 V
Signal Level	HIGH Signal	12 ... 30 V
	LOW signal	-2 ... +5 V
Input Current		7 mA @ 24 V, 8.5 mA at 30 V
Input Delay		4 ms

FRQ 204/254 Semiconductor Outputs

The following table describes the semiconductor outputs.

Quantity	4
Technique	with short–circuit and overload protection, Switch–off with value saving Group indication of the overload/ short–circuit switch–off Group short–circuit signal via I/O map status word, Hardware reset for the overload acknowledgement
Type of Networking	potential free (optical coupler) against I/O bus
Consumer Connection	Between output and reference potential M1
Working Voltage U	U_S = 24 Vdc
Signal Logic	Positive Logic
Signal Output Level	1 signal U = U_S - 0 ... 2 V
	0 signal 0 ... +2 V, < 1 mA
Load Current/Output	500 mA maximum (Current source)
Starting Current for Incandescent Lamp	Iein = 10 x IN, max. 5 W
Load Current for All Outputs	1 A maximum (due to 50% simultaneity factor)
Operating Delay	< 1 ms
Circuit with Inductive Loads	Clamping diode (suppressor diode) locally (parallel to the operating coil), **absolutely necessary** when contact elements are present in the output lines or the lines to the peripherals are very long.
Switching Cycles	1000 / h (0.28 / s) with inductive load and max. permissible current per output 100 / s with ohmic load 8 / s with 1.2 W lamp load

FRQ 204/254 Physical Characteristics

The following table describes the physical characteristics.

Module	Standard Size Case
Format	1 Slot
Weight	300 g

FRQ 204/254 Type of Connection

The following table describes the connection type.

Process	2 Pluggable 11 Pole Screw/Plug-in Terminals
I/O Bus (Internal)	1/3 C30M

FRQ 204/254 Maximum Cable Lengths

The following table describes the maximum cable lengths.

Counter Inputs	max 100 m shielded (longer cables on request)
Outputs and Enable Inputs	max. 400 m unshielded max 1000 m shielded

FRQ 204/254 Environmental Characteristics

The following table describes the environmental characteristics.

Operating Temperature	0 ... 60 C for FRQ204 -40 ... +70 C for FRQ254

FRQ 204/254 Agency Approvals

The following table describes the agency approvals.

VDE 0160, UL 508; CSA 22.2 No.142, European Directive on EMC 89/336/EEC, and Low Voltage Directive 79/23/EEC Standards

Overview of MOT 20X Motion Modules

45

At a Glance

Purpose

The purpose of this chapter is to describe the MOT 20X Motion modules.

	WARNING
⚠	**Compatibility warning** The MOT 20X module will only operate properly when used with an A984, E984, or Micro 512/612 controller. **Failure to follow this precaution can result in death, serious injury, or equipment damage.**

Note: The following A120 I/O modules require a loadable (SW--IODR--001) for proper operation when using certain PLCs (A984--1xx, E984--24x/251/255) with Modsoft:

- DEP 211/214/215/217
- DAP211/217
- ADU204/211/214/216
- DAU204
- VIC2xx
- MOT20x

What's in this Chapter?

This chapter contains the following topics:

What are the MOT 20X Modules?

Brief Description

The MOT 20x modules include the MOT 201 single-width I/O module (encoder only) and the MOT 202 double-width module (resolver and encoder). They are designed to provide single-axis motion control to the 984-A120 Series PLCs.
The MOT 20x motion modules are designed to control a single axis of motion using advanced digital brushless motion control. This capability provides optimal control by eliminating potentiometer adjustments and analog velocity loops. These MOT modules are designed to operate with an A Series Compact 984 PLC-i.e., a Compact A984-120, -130, -131, -141, or -145.

> **Note:** The MOT 20X modules are designed to serve a variety of applications with great accuracy and speed, however certain applications might be outside their scope. Please consult Modicon for applications information if you intend to use the module specifically for precise velocity control.

The primary feedback used by the DNP servo system is position information from either a resolver or an encoder mounted to the motor. Velocity information is derived from the position information, rather than being received from a velocity transducer. This leads to some inaccuracies when using the DNP servo as a velocity controller. Small speed irregularities may result, particularly at slower speeds.

Related Publications

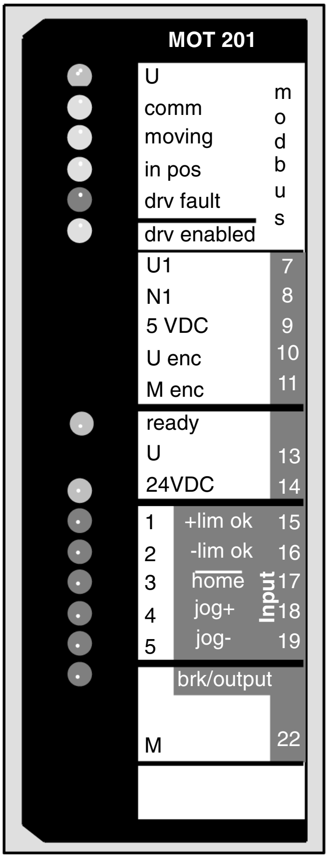
The following publications contain detailed information on the MOT 20X modules:

- Single-Axis Software System (SASS) Motion User Guide (GM-MOTN-001)
- Modicon Motion Development Software (MMDS) User Guide (GM-MMDS-002)

Overview of the MOT 201 Motion Module

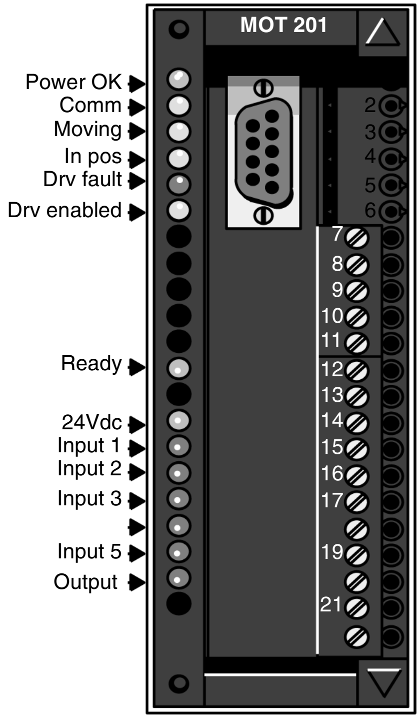
Brief Description

The MOT 201 is an encoder-only module contained in a single-width housing. It works with dc motors that use Cyberline drives and other types of dc and brushless drives from Gettys and other manufacturers. The module contains I/O to interface to the drive and the machine, including drive enable, drive fault, and a variety of user-configurable signals. The MOT 201 is not capable of commutating brushless motors. A front view of the MOT 201 Motion module is provided below.



LEDs

Fourteen LEDs are visible on the front panel to indicate various functions and conditions.
Refer to the following diagram and table for the indicator positions, nomenclature and a brief explanation of their functions.



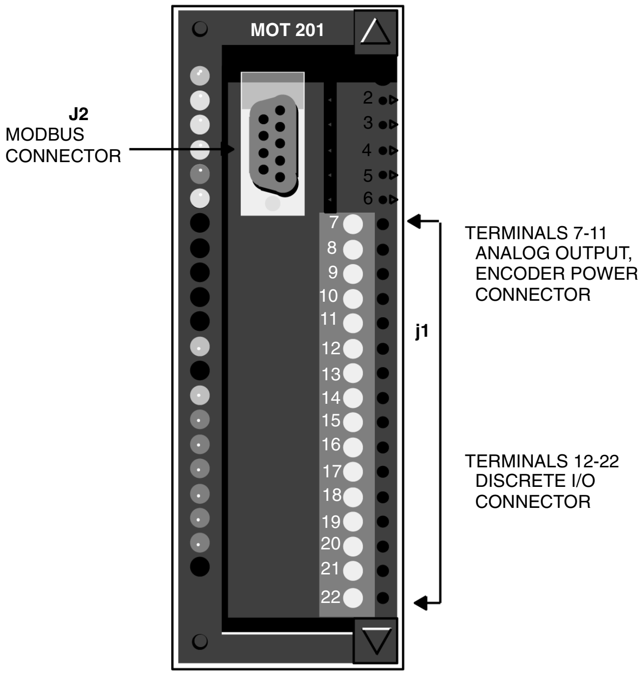
The following table describes the meaning of each front panel indicator.

U (POWER OK)	Green	Backplane power is present
Comm (MODBUS)	Amber	Blinking = RS-232 serial port communication link active
Moving	Amber	MOT is still commanding new positions for the motor
In pos	Amber	Difference between the target position and the actual motor position less than In Position Band parameter value
Drv fault (DRIVE FAULT)	Red	A fault condition exists in the drive controlled by the MOT
Drv enabled (DRIVE ENABLED)	Amber	Drive enable signal to the drive is active
Ready (MODULE OK)	Green	MOT is operational. When not ON, a failure of the module has been detected. When blinking once every 3 s, module is in kernel mode and the executive must be downloaded

24Vdc	Green	24 Vdc for the I/O is present
Input 1 (+LIMIT OK)	Red	Motor has not reached the maximum limit for clockwise motion, or user-configured input 1 is active
Input 2 (- LIMIT OK)	Red	Motor has not reached the maximum limit for counterclockwise motion, or user-configured input 2 is active
Input 3 (HOME LIMIT)	Red	Motor is not at the Home switch, or user-configured input 3 is active
Input 4 (JOG +)	Red	Jog + switch or user-configured input 4 is active
Input 5 (JOG -)	Red	Jog - switch or the user-configured input 5 is active
Output 1 (BRAKE)	Red	Brake control is active(brake released), or user-configured output 1 is active

Connectors

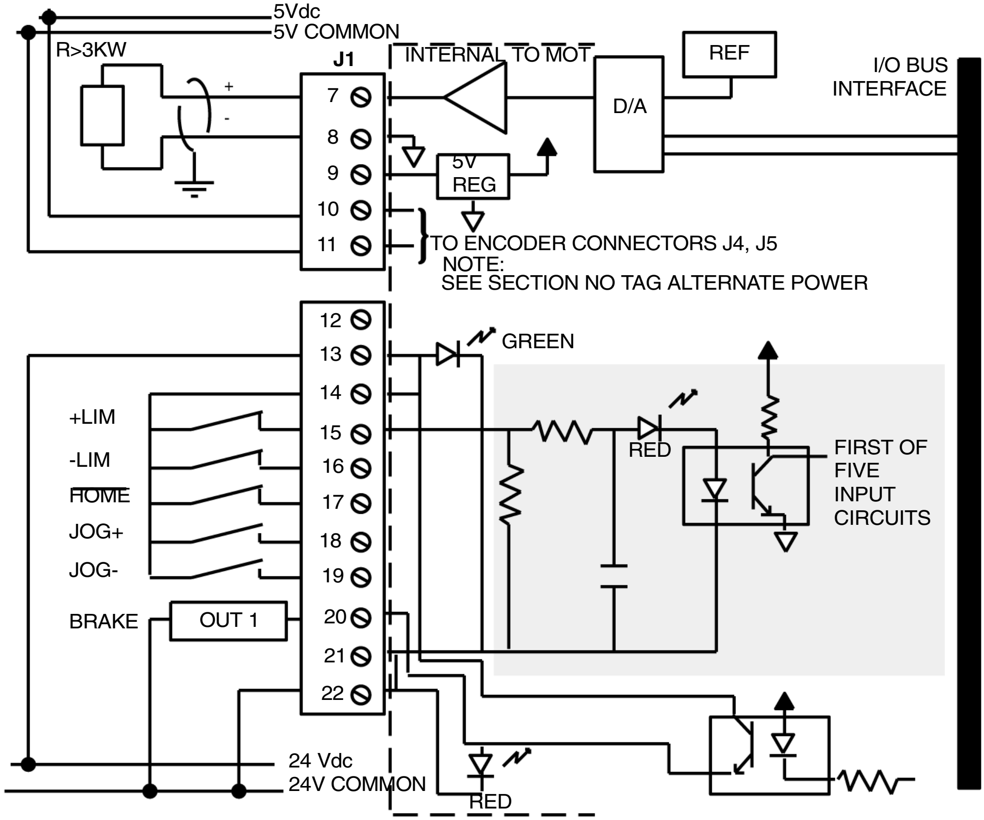
The MOT 201 has five connectors, J1 ... J5. The J1 and J2 connectors are located on the front of the module.



The J2 connector is a standard 9-pin, D-shell RS-232 serial port. Its operating mode and communications parameters are set via a DIP switch on the back of the unit (discussed later in this chapter).

MOT 201 J1 Connector

The J1 connector is a 22-terminal screw I/O connector, as shown in the Discrete I/O, Analog Output, and Encoder Power wiring diagram below.

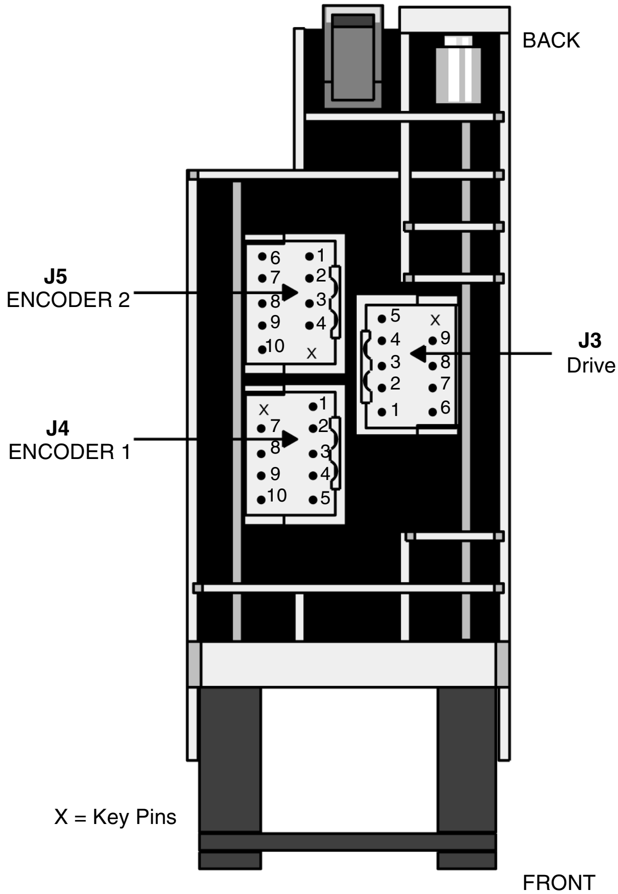


J1 discrete connections are listed in the following table.

Pin #	Function	Pin #	Function
1 ... 6	Not Used	15	+Travel limit/Aux in 1
7	Analog output	16	-Travel limit/Aux in 2
8	Analog output return	17	Home/Aux in 3
9	+5 Vdc	18	Jog+/Aux in 4
10	Encoder Power	19	Jog-/Aux in 5
11	Encoder power return	20	Aux 1 output/Brake
12	Not Used	21	24 Vdc common
13	24 Vdc power	22	24Vdc common
14	24 Vdc power		

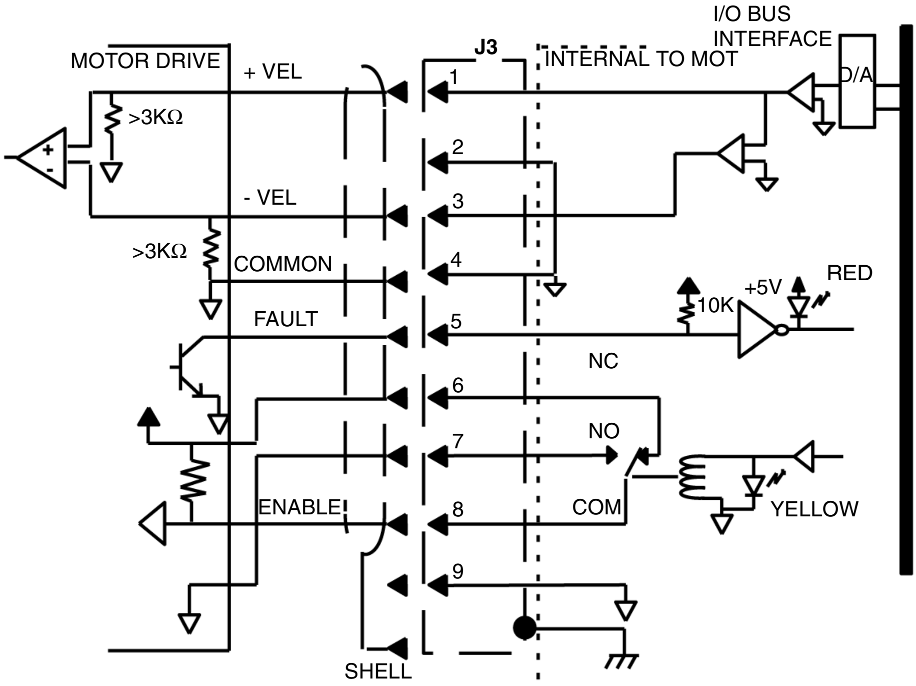
MOT 201 Bottom Connectors

The J3, J4 and J5 connectors are located on the bottom of the module.



MOT 201 J3 Connector

J3 is a 10-pin motor drive connector.

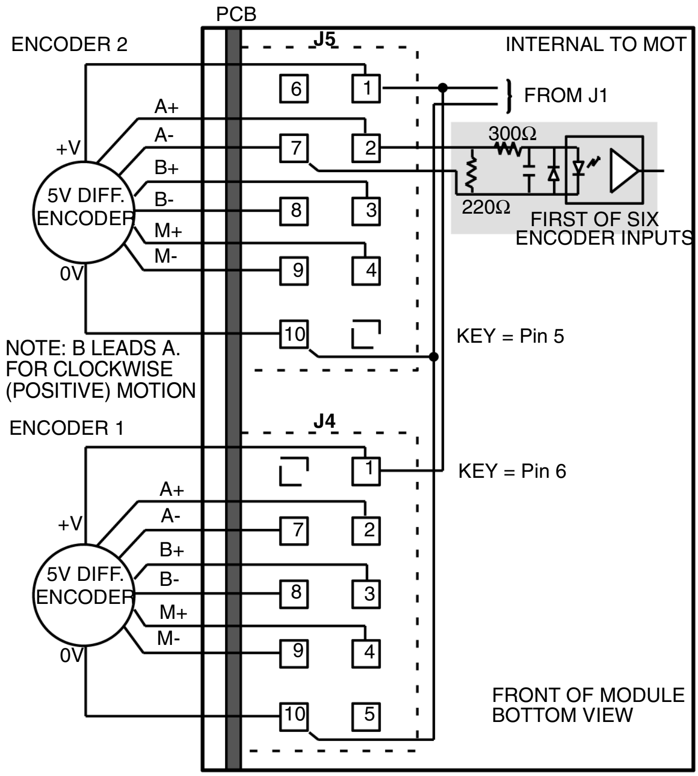


J3 drive connections are listed in the following table.

Pin #	Function	W922 Cable Color
1	+Velocity command	Black
2	Common	White
3	-Velocity command	Blue
4	Common	Orange
5	Drive fault input	Yellow
6	Drive enable contact (N.C.)	Red
7	Drive enable contact (N.O.)	Brown
8	Drive enable common	Green
9	Common	Purple
10	Key	Gray

MOT 201 J4 and J5 Connectors

J4 and J5 are 10-pin encoder feedback connections. The pins on these two connectors have nearly identical functionality (pins 5 and 6 are different).



J4 and J5 encoder feedback connections are listed in the following table.

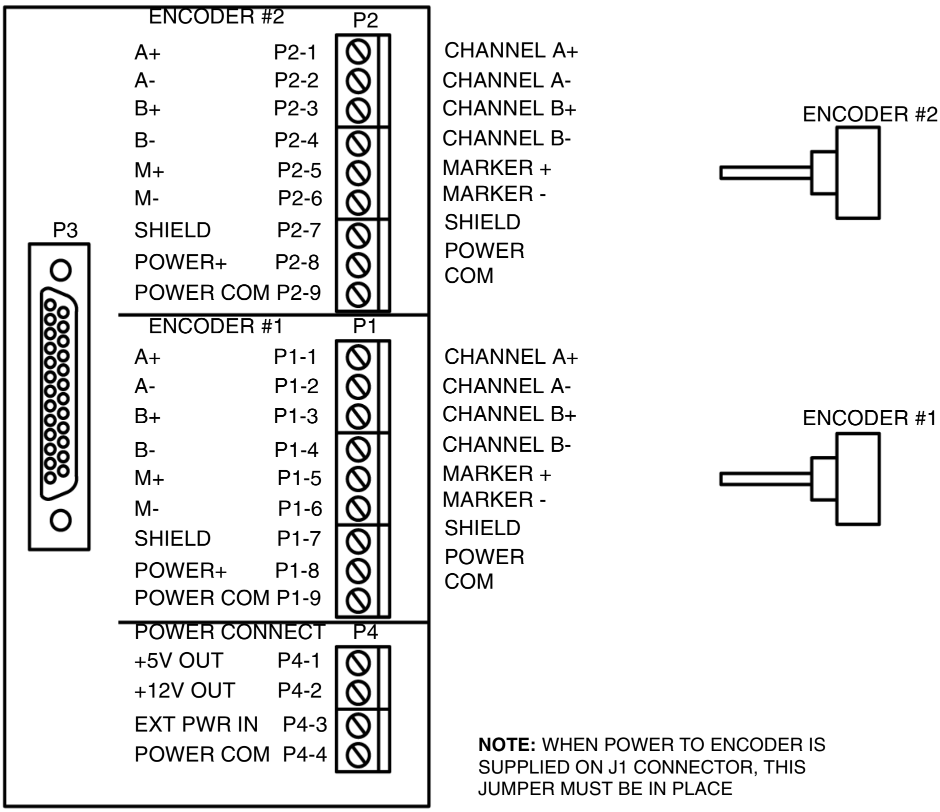
Pin #	Function
1	Encoder power
2	+ Phase A
3	+ Phase B
4	+ Mark
5	Key (J5)
6	Key (J4)
7	- Phase A
8	- Phase B
9	- Mark
10	Encoder Power return

The Encoder Feedback Interface

The MOT 201 accepts feedback from one or two +5 V differential encoders. You may pick between the following two connection options:

- Option 1 uses an AS-W922-008 or AS-W922-015 generic cable, which is terminated at one end and unterminated at the other to plug into either encoder connector on your module
- Option 2 connects to the encoders through a cable and an optional AS-BR85-110 Breakout module.

An AS-W923 encoder breakout cable has a male DB25 connector at one end; the other end has two connectors to attach to the module's two encoder connectors.



Encoder Connection Options

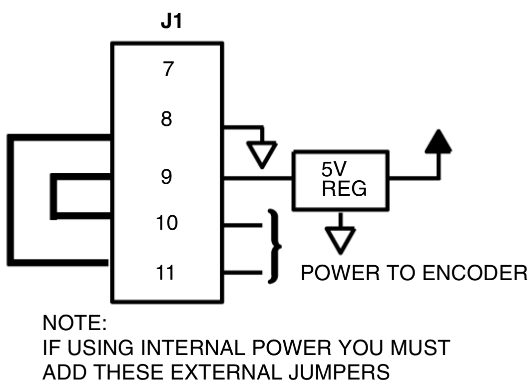
Cables and breakout modules are listed in the following table.

Part Number	Use	Cable Description
AS-W921-XXX	Drive	Cyberline1000 to 10-position AMP Shielded MT Connector (008, 015)
AS-W922-XXX	Generic	10-pin AMP Shielded MT Connector to Wires (008, 015)
AS-W923-XXX	Encoder Break out	Two 10-pin AMP Shielded MT Connectors to DB25 Connector (Y Cable) (003, 006)
AS-W955-XXX	Modbus	DB9 to DB25 (012, 025)
AS-W956-XXX	Modbus	DB9 to DB9 (012, 025)
AS-BR85-110	Breakout Module	For use with AS-W923 cable
XXX stands for the cable length.		

The breakout module is a DIN rail-mountable terminal block PCB assembly and accommodates discrete wiring from the encoder(s). It has a female DB25 connector for the cable attachment and the terminals are clearly marked with the appropriate encoder connections.

Note: When configuring feedback devices, remember that Channel 1 is not used by the MOT 201. Encoder 1 (J4) = Channel 2, and encoder 2 (J5) = Channel 3.

An external power supply is typically used with an encoder (see illustration below). However, when total encoder power (for one or two encoders) requires no more than 75 mA of power, you may use 5 Vdc power from the Compact 984 and thus eliminate the need for the external power supply.



Discrete I/O

The MOT 201 contains five discrete inputs and one discrete output. The inputs can be used as either user-defined discrete inputs or as predefined inputs. The discrete output as well as the inputs are controlled by the I/O command set.
The register bit assignments are shown in the following diagram.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

1 = Drive fault (bit 8)
1 = Jog - (bit 5)
1 = Jog + (bit 4)
1 = not home (bit 3)
1 = - limit OK (bit 2)
1 = + limit OK (bit 1)

> **Note:** Module inputs 1 (+ Limit OK), 2 (- Limit OK) and 3 (NOT HOME) default to 1 (predefined) at power-up while inputs 4 (Jog +) and 5 (Jog -) default to 0 (discrete). Output 1 default condition is user-defined.

Discrete output bit definitions are shown in the following diagram.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

1 = Brake (bit 1)

Refer to the Single-Axis Software (SASS) Motion User Guide (GM-MOTN-001), for details on configuring the I/O.

Analog Output

A +/- 10 V analog output is supplied via connector J1 on the front of the module. This output is configured by you via the analog output setup command; it is available for diagnostic purposes, or it can be placed under user program control.

The Motor Drive Interface

The interface to the motor drive from the MOT 201 consists of several digital and analog I/O signals:
- A drive enable signal
- A drive fault signal
- Velocity or current command signals

A form C relay is provided to enable the drive. A true high drive fault signal is accepted from the drive that must be held at ground to indicate a non-fault condition. A differential +/- 10 V analog signal is provided to control a dc drive. This signal can be software configured to be a velocity or current command. Connection for the motor drive is made to the module through the J3 connector.

Two AS-W922 cables are available. They are terminated to plug into your module at one end and unterminated at the other end.

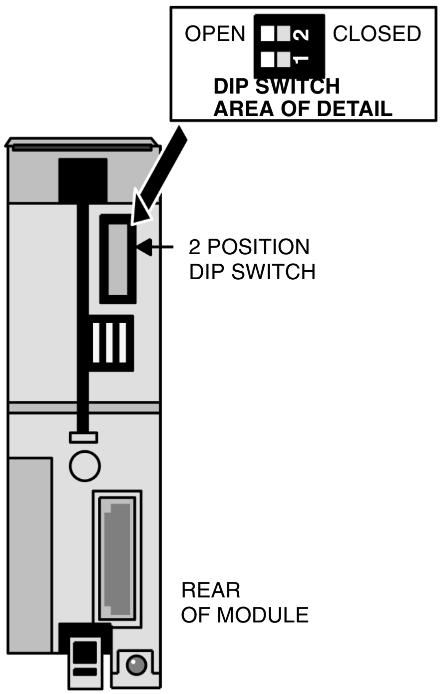
> **Note:** Servo motor thermal overload switches should always be monitored to prevent equipment damage. The MOT 201 does not have a dedicated input for this function. Either a MOT 201 input or some other system input should be used in your system design to monitor this condition.

The DIP Switch

The MOT 201 has an RS-232 serial port to connect the module to an IBM PC (or compatible) running the Modicon Motion Development Software (MMDS). A two-position DIP switch is located on the rear panel of the module. SW1 is used to specify the module's operating mode (984 or MMDS control). SW2 is used to specify the communication characteristics of the Modbus port upon power-up.
The MOT 201 DIP switch settings are listed in the following table.

DIP Switch	Position	Function
SW1	Left/Open (factory set)	Compact 984 Controlled
	Right/Closed	MMDS Controlled
SW2	Left/Open (factory set)	Programmed baud
	Right/Closed	Modbus Default

The MOT 201 DIP switch locations are shown in the following illustration.



Setting the Operating Mode with SW1

The SW1 setting determines which device can write to the MOT 201. The setting is read at power-up and selects either the MMDS or the Compact 984 to control the operation of the module. This mode selection is a safety feature that prevents you from accidentally issuing commands to the module using MMDS while it is being controlled by the Compact 984.

The control priority (SW1) is as follows:

1. When only MMDS is attached to the module, it has write privilege regardless of the setting on SW1.
2. When only the Compact 984 is communicating via Traffic Cop to the module, it has write privilege regardless of the setting of SW1.
3. When the Compact 984 has issued the local lockout command, it has write privileges regardless of the setting of SW1 and whether or not MMDS is attached.
4. When the local lockout command is not issued and both the Compact 984 and MMDS are communicating to the module, the setting of SW1 controls which device has write privilege.

Note: Either device may read (i.e. a GET command) at any time. However, reading the error log (a system command) is not allowed without write privilege because the log is lost once it is read. Refer to Single-Axis Software System (SASS) Motion User Guide (GM-MOTN-001) for details.

Setting the Modbus Communication Characteristics (SW2)

Switch#2 controls the Modbus communication characteristics. When the module is powered up, SW2 is read. When the switch is closed then the default characteristics are used. When the switch is open then the communication characteristics last saved in the module are used.

Once communication characteristics are initialized, they may be changed at any time under software control only if SW2 is in the open position. Refer to Single-Axis Software System (SASS) Motion User Guide (GM-MOTN-001) for details.

When SW2 is closed, the Modbus port default characteristics are as follows:

- 1 start bit
- 7 data bits
- 1 stop bit
- Even parity checking
- 9600 baud rate

Modbus Connections

The 9-pin serial modbus connections are listed in the following table.

Signal	Computer Pin	MOT Pin	Signal	Function
	1NC	1NC		Shield
TXD	2	3	RXD	Serial data
RXD	3	2	TXD	Serial data
GND	5	5	GND	Ground
DTR	4	6	DSR	Control line
DSR	6	4	DTR	Control line
RTS	*7	/ 7*	RTS	Control line
CTS	*8 /	8*	CTS	Control line
	9NC	9NC	+5 V	Future Use
* These pins are jumpered (7 & 8) on both.				

CAUTION

Ensure 5 V power is correct for the application.

Pin 9 supplies 5 V of power (75 mA). Make sure this is the correct pin for your application before wiring.

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

The 25-pin serial modbus connections are listed in the following table.Modbus Connections for 25-Pin Serial.

Signal	MOT Pin	Computer Pin	Signal	Function
	1NC	1NC		Shield
TXD	2	2	RXD	Serial data
RXD	3	3	TXD	Serial data
GND	5	7	GND	Ground
DTR	4	6	DSR	Control line
DSR	6	20	DTR	Control line
RTS	*7	/ 4*	RTS	Control line
CTS	*8 /	5*	CTS	Control line
+5 V	9NC	9NC	+5 Vdc	Future Use
* These pins are jumpered, (7&8 on MOT, 4&5 on computer).				

Overview of the MOT 202 Motion Module

Brief Description

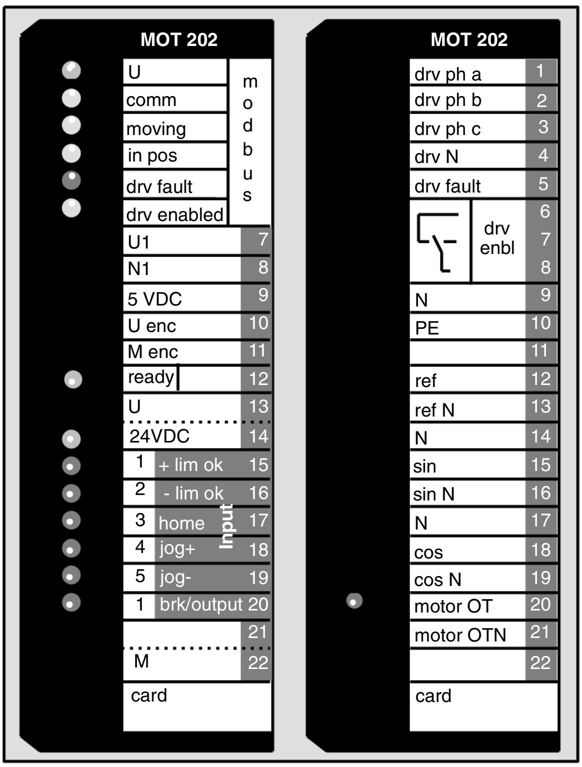
The MOT 202 is a resolver and encoder designed to interface directly to the Modicon Cyberline CL1000 series and M100 series of brushless servo amplifiers and brushless motors in addition to all the MOT 202 capabilities. Control of the MOT 202 can be:

- Through the backplane of the A120 Series I/O system bus interface
- Through the Modbus interface
- By internally stored user programs

The MOT 202 is a double-size module that requires two contiguous slots in an A120 I/O backplane.

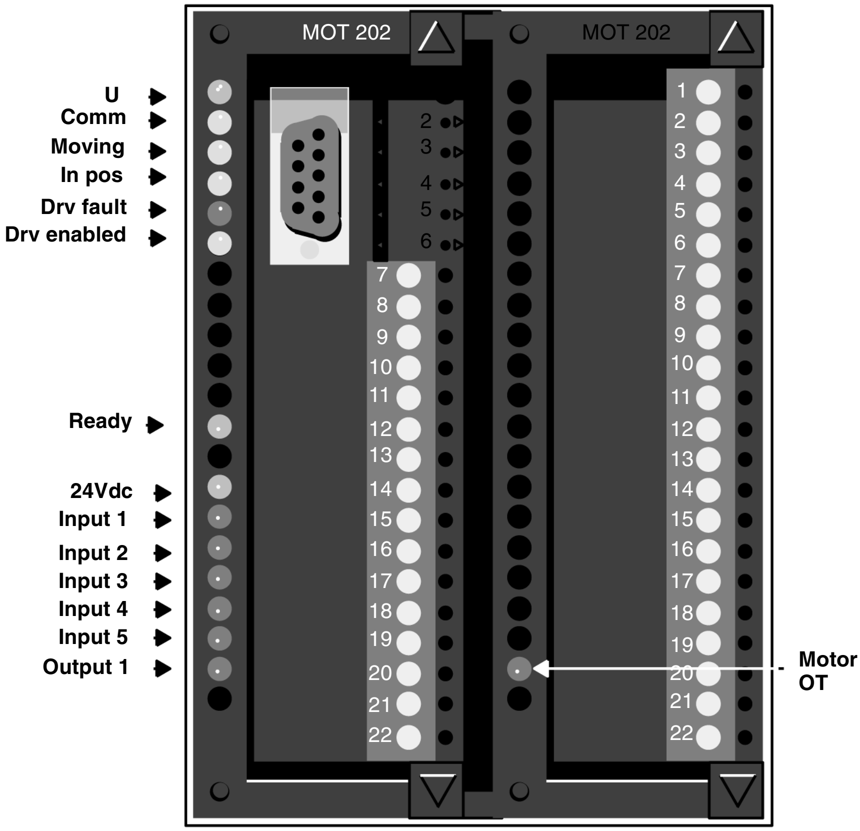
> **Note:** The MOT 202 does not fit in the last two (rightmost) slots of a DTA 200 or DTA 201 backplane.

A front view of the MOT 202 Motion module is provided below.



LEDs

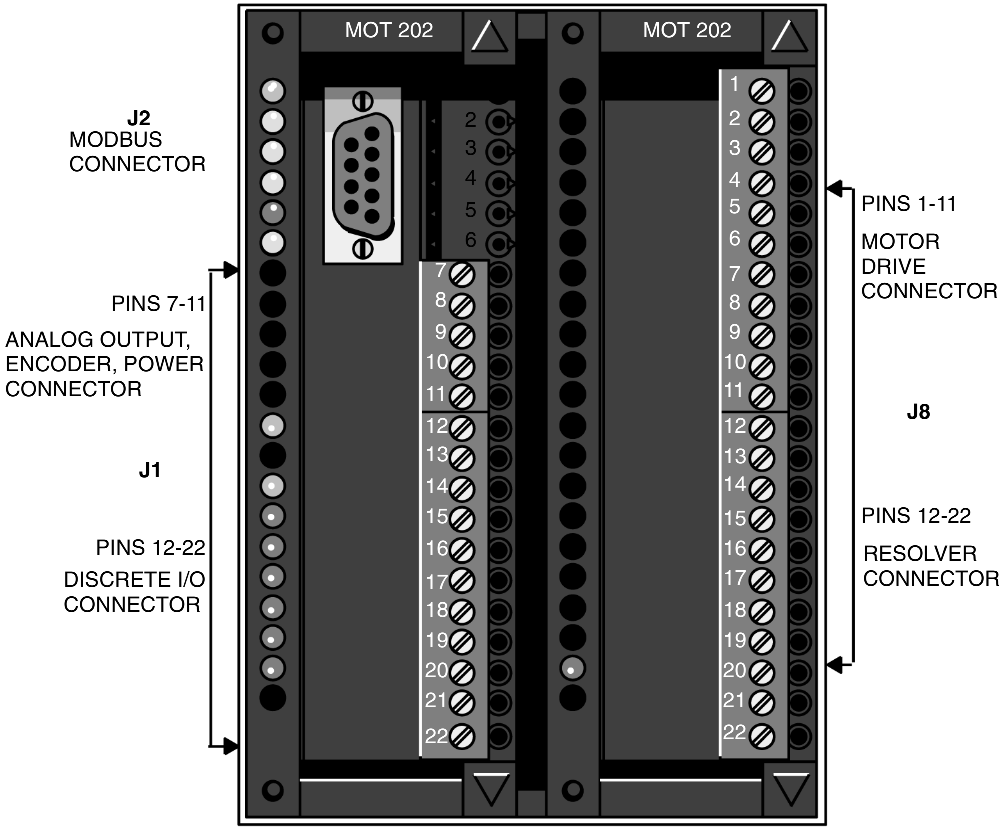
Fifteen LEDs are visible on the front panel to indicate various functions and conditions.
Refer to the following diagram and table for the indicator positions, nomenclature and a brief explanation of their functions.



Indicator	Color	Meaning
U (POWER OK)	Green	Backplane power is present
Comm (MODBUS)	Amber	Blinking = RS-232 serial port communication link active
Moving	Amber	MOT is still commanding new positions for the motor
In pos	Amber	Difference between the target position and the actual motor position less than In Position Band parameter value
Drv fault (DRIVE FAULT)	Red	A fault condition exists in the drive controlled by the MOT
Drv enabled (DRIVE ENABLED)	Amber	Drive enable signal to the drive is active
Ready (MODULE OK)	Green	MOT is operational. When not ON, a failure of the module has been detected. When blinking once every 3 s, module is in kernel mode and the executive must be downloaded
24Vdc	Green	24 Vdc for the I/O is present
Input 1 (+LIMIT OK)	Red	Motor has not reached the maximum limit for clockwise motion, or user-configured input 1 is active
Input 2 (- LIMIT OK)	Red	Motor has not reached the maximum limit for counterclockwise motion, or user-configured input 2 is active
Input 3 (HOME LIMIT)	Red	Motor is not at the Home switch, or user-configured input 3 is active
Input 4 (JOG +)	Red	Jog + switch or user-configured input 4 is active
Input 5 (JOG -)	Red	Jog - switch or the user-configured input 5 is active
Output 1 (BRAKE)	Red	Brake control is active(brake released), or user-configured output 1 is active
Motor O.T.	Red	Motor over temperature condition

Connectors

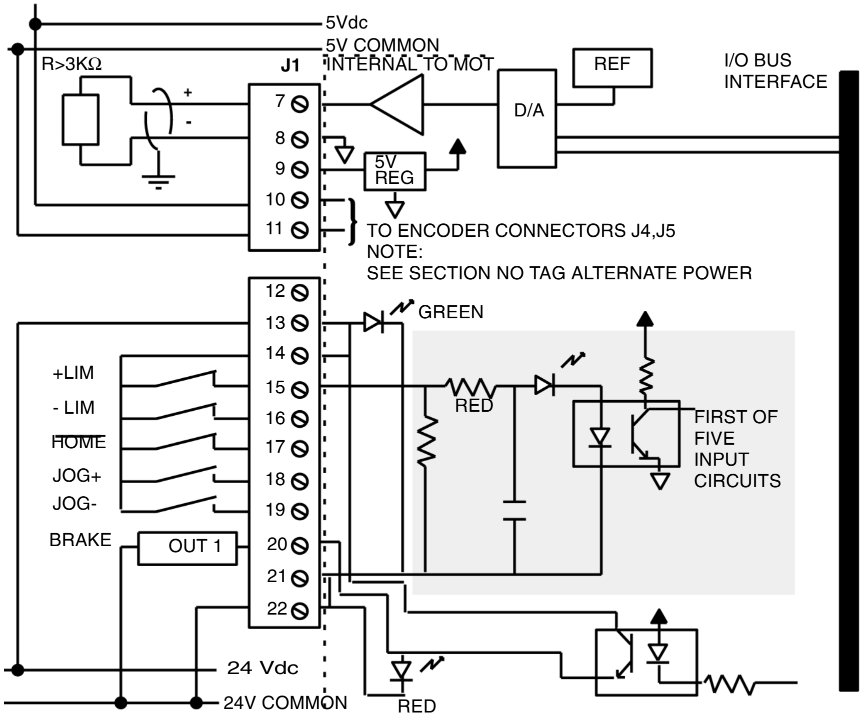
The MOT 202 has 7 connectors (J1, J2, and J8 on the front of module) (J4, J5, J6, and J7 on the bottom of module).



The J2 connector is a standard 9-pin, D-shell RS-232 serial port. Its operating mode and communications parameters are set via a DIP switch on the back of the unit (discussed later in this chapter).

MOT 202 J1 Connector

The J1 connector is a 22-screw terminal I/O connector, as shown in the Discrete I/O, Analog Output, and Encoder Power wiring diagram below.

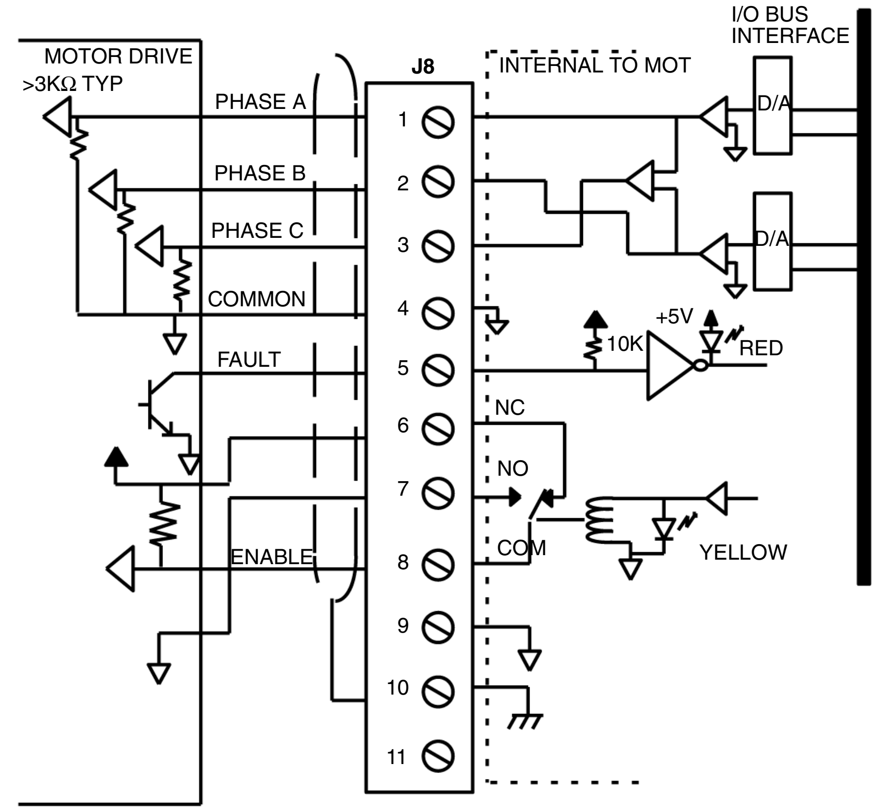


J1 discrete connections are listed in the following table.

Pin #	Function	Pin #	Function
1 ... 6	Not Used	15	+Travel limit/Aux in1
7	Analog output	16	-Travel limit/Aux in 2
8	Analog output return	17	Home/Aux in 3
9	+5 Vdc	18	Jog+/Aux in 4
10	Encoder Power	19	Jog-/Aux in 5
11	Encoder power return	20	Aux 1 output/Brake
12	Not Used	21	24 Vdc common
13	24 Vdc power	22	24Vdc common
14	24 Vdc power		

MOT 202 J8 Connector

J8 is a 22-screw terminal connector that may be for the motor drive and resolver wiring. The top half of J8 (terminals 1 ... 11) is for motor wiring.



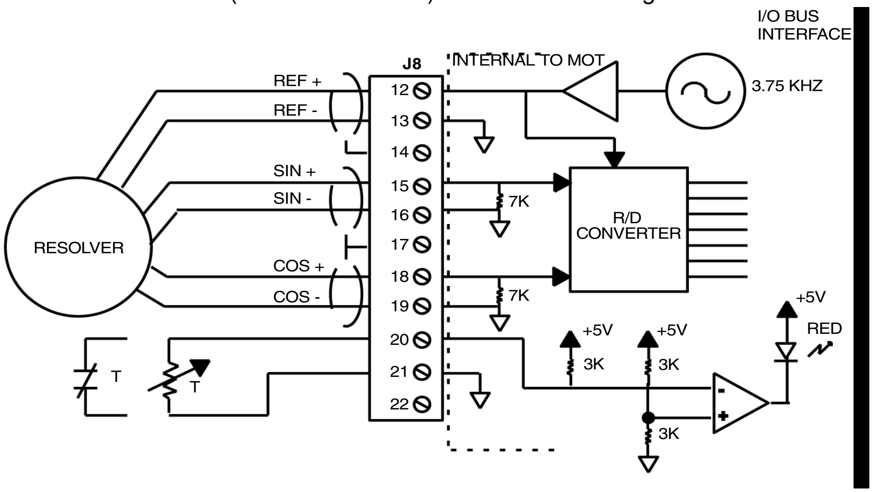
J8 drive connections are listed in the following table.

Pin #	Function	W922 Cable Color
1	+Velocity command	Black
2	Common	White
3	-Velocity command	Blue
4	Common	Orange
5	Drive fault input	Yellow
6	Drive enable contact (N.C.)	Red
7	Drive enable contact (N.O.)	Brown
8	Drive enable common	Green
9	Common	Purple
10	Key	Gray

Note: The J6 connector on the bottom of the module performs the same motor wiring function. If you are using an AS-W922 cable for motor drive wiring, use the J6 connector. If not, you can choose between J8 or J6.

Bottom Half J8 Connector

The bottom half of J8 (terminals 12 ... 22) is for resolver wiring.

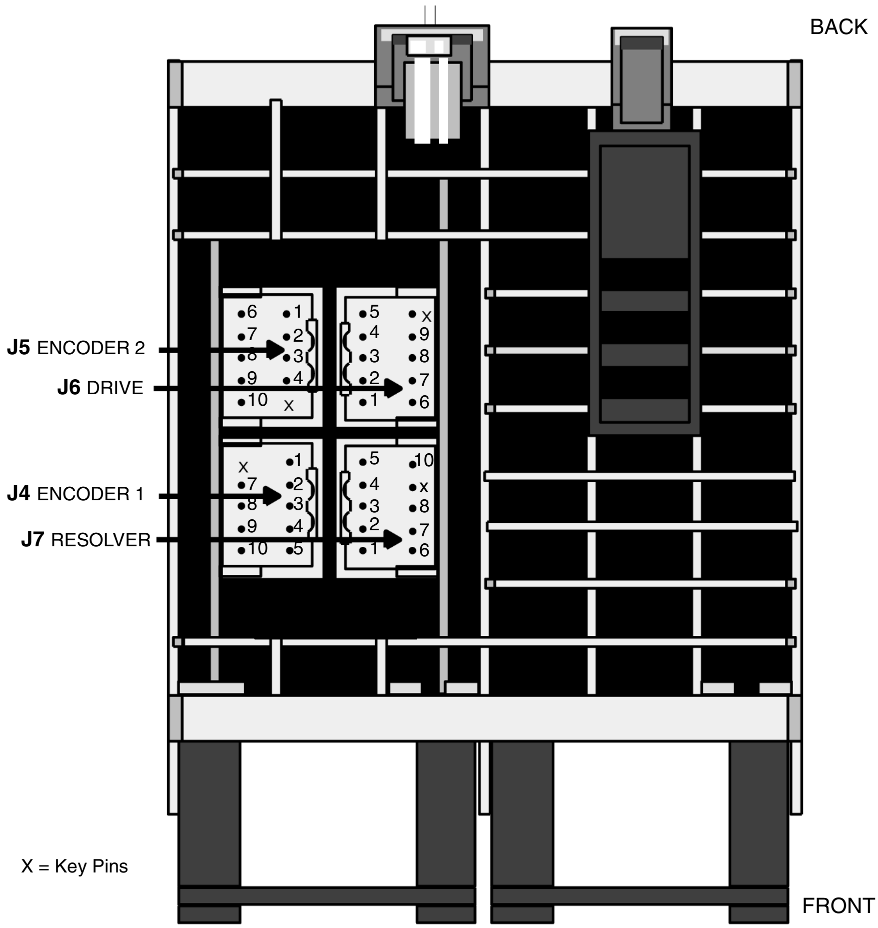


J8 Pin #	J7 Pin #	Function
12	2	Reference output high
13	7	Reference output low
14	4	Shield
15	3	Sine input high
16	8	Sine input low
17		Shield
18	5	Cosine input high
19	10	Cosine input low
20	1	Motor O.T. input high
21	6	Motor O.T. input low
	9	Not Used

MOT 202 Bottom Connectors

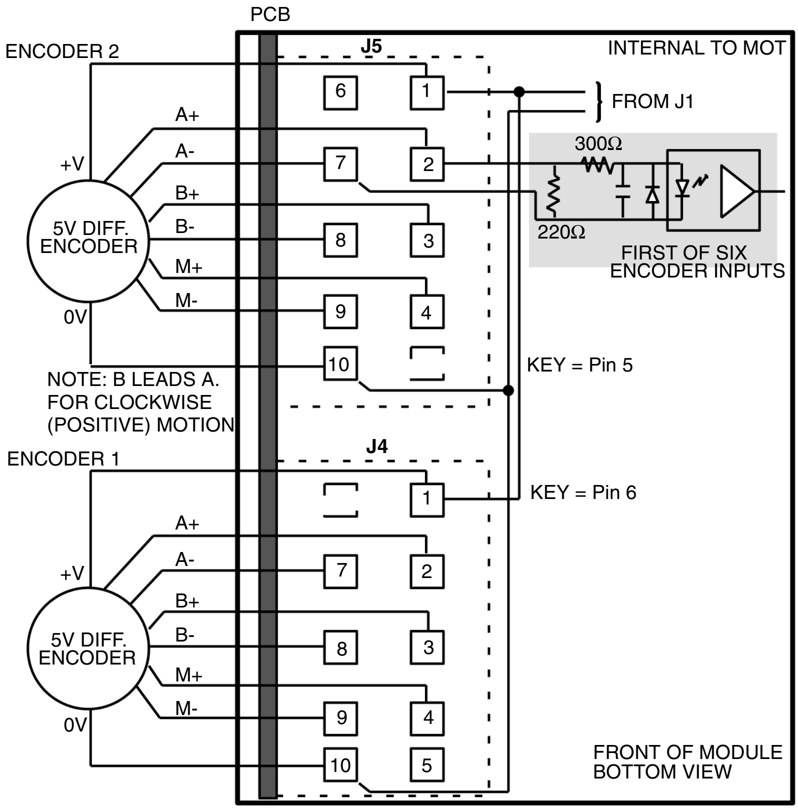
> **Note:** The J7 connector on the bottom of the module performs the same resolver wiring function as terminals 12 ... 22 on J8. If you are using an AS-W922 cable for resolver wiring, use the J7 connector. If not, you can choose between J8 or J7.

The J4 ... J7 connectors are located on the bottom of the module.



MOT 202 J5 Connectors

J4 and J5 are 10-pin encoder feedback connections. The pins on these two connectors have nearly identical functionality (pins 5 and 6 are different).

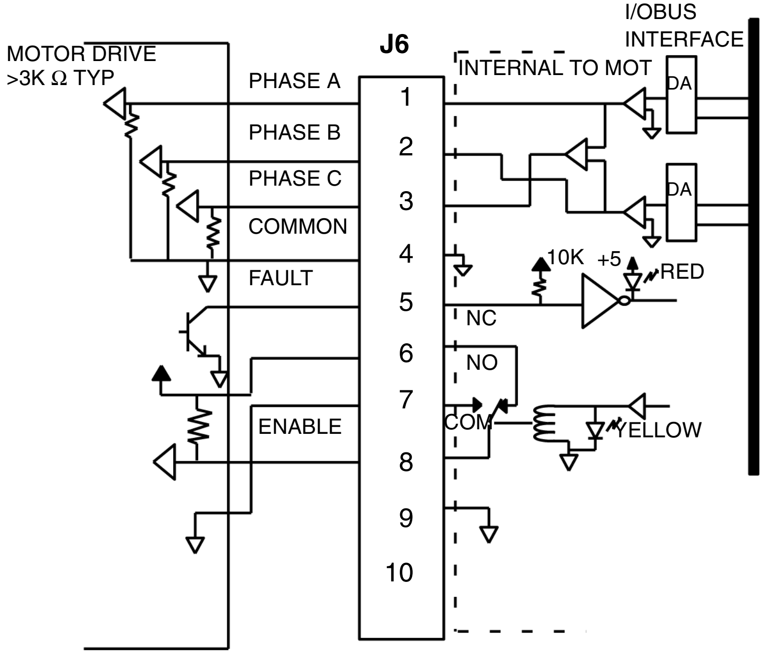


J4 and J5 encoder feedback connections are listed in the following table.

Pin #	Function
1	Encoder power
2	+ Phase A
3	+ Phase B
4	+ Mark
5	Key (J5)
6	Key (J4)
7	- Phase A
8	- Phase B
9	- Mark
10	Encoder Power return

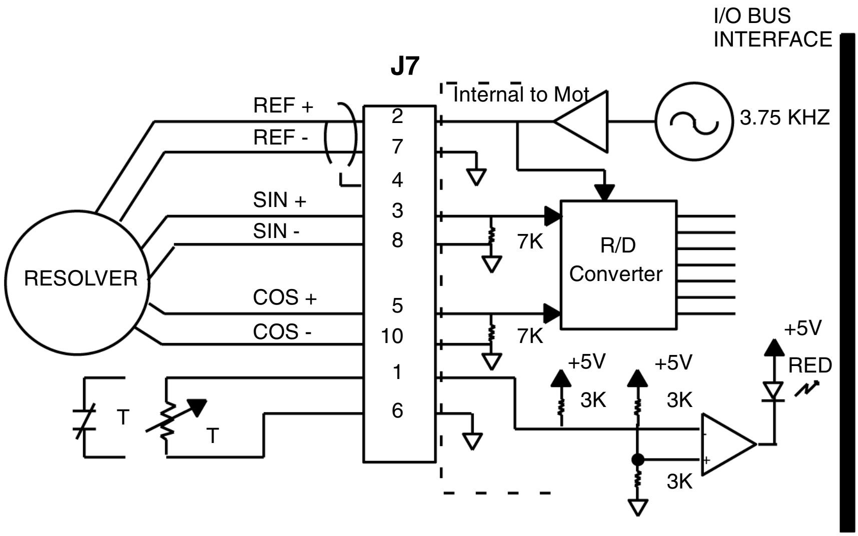
MOT 202 J6 and J7 Connectors

J6 is a 10-pin connector that may be for the motor drive wiring.



Note: The first 11 terminal screws of the J8 connector on the front of the module perform the same motor wiring function. If you are using an AS-W922 cable for motor drive wiring, use the J6 connector. If not, you can choose between J8 or J6.

J7 is a 10-pin connector that may be used for resolver wiring:



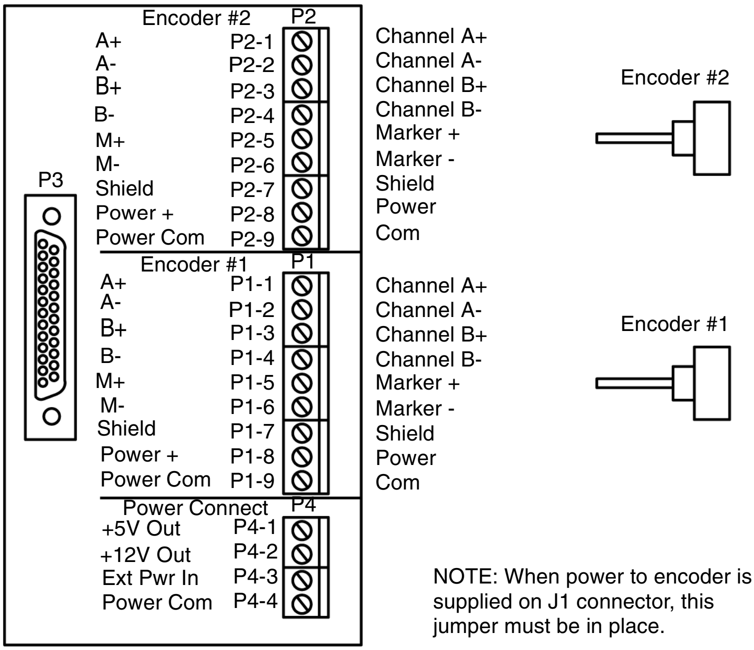
> **Note:** The J7 performs the same resolver wiring function as terminals 12 ... 22 of the J8 connector on the front of the module. If you are using an AS-W922 cable for resolver wiring, use the J7 connector. If not, you can choose between J8 or J7.

The Encoder Feedback Interface

The MOT 202 accepts feedback from one or two +5 V differential encoders. You may pick between the following two connection options:

- Option 1 uses an AS-W922-008 or AS-W922-015 generic cable, which is terminated at one end and unterminated at the other to plug into either encoder connector on your module
- Option 2 connects to the encoders through a cable and an optional AS-BR85-110 Breakout module.

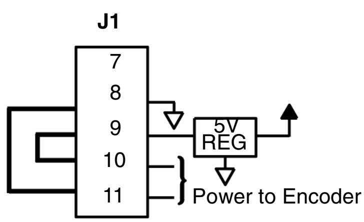
An AS-W923 encoder breakout cable has a male DB25 connector at one end; the other end has two connectors to attach to the module's two encoder connectors.



Cables and breakout modules are listed in the following table.

Part Number	Use	Cable Description
100-338-XXX	Drive	Cyberline1000 to Discrete Wires (008, 015)
AS-W921-XXX	Drive	Cyberline1000 to 10-position AMP Shielded MT Connector (008, 015)
AS-W922-XXX	Generic	10-pin AMP Shielded MT Connector to Wires (008, 015)
AS-W923-XXX	Encoder Breakout	Two 10-pin AMP Shielded MT Connectors to DB25 Connector (Y Cable) (003, 006)
AS-W955-XXX	Modbus	DB9 to DB25 (012, 025)
AS-W956-XXX	Modbus	DB9 to DB (012, 025)
AS-BR85-110	Breakout Module	For use with AS-W923 cable
XXX stands for the cable length.		

The breakout module is a DIN rail-mountable terminal block PCB assembly and accommodates discrete wiring from the encoder(s). It has a female DB25 connector for the cable attachment and the terminals are clearly marked with the appropriate encoder connections.
An external power supply is typically used with an encoder (see illustration below). However, when total encoder power (for one or two encoders) requires no more than 75 mA of power, you may use 5 Vdc power from the Compact 984 and thus eliminate the need for the external power supply.



NOTE:
IF USING INTERNAL POWER YOU MUST
ADD THESE EXTERNAL JUMPERS.

Discrete I/O

The MOT 202 contains five discrete inputs and one discrete output. The inputs can be used as either user-defined discrete inputs or as predefined inputs. The discrete output as well as the inputs are controlled by the I/O command set.
The register bit assignments are shown in the following diagram.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

1 = Drive Fault

1 = Jog -
1 = Jog +
1 = Not Home
1 = - Limit OK
1 = + Limit OK

> **Note:** Module inputs 1 (+ Limit OK), 2 (- Limit OK) and 3 (NOT HOME) default to 1 (predefined) at power-up while inputs 4 (Jog +) and 5 (Jog -) default to 0 (discrete).

Discrete output bit definitions are shown in the following diagram.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

1 = Brake

Refer to the Single-Axis Software (SASS) Motion User Guide (GM-MOTN-001), for details on configuring the I/O.

Analog Output

A +/- 10 V analog output is supplied via connector J1 on the front of the module. This output is configured by you via the analog output setup command; it is available for diagnostic purposes, or it can be placed under user program control.

The Motor Drive Interface

The interface to the motor drive from the MOT 202 consists of several digital and analog I/O signals:

- A drive enable signal
- A drive fault signal
- Three-phase current commands

A form C relay is provided to enable the drive. A true high drive fault signal is accepted from the drive that must be held at ground to indicate a non-fault condition. Three +10 V analog current commands are provided to control a three-phase brushless ac motor. For dc drives, only two of the three phases (phase A and phase C) are used. Connection for the motor drive may be made to the module through the connector on the bottom of the module (J6) or to the discrete wiring points on the front (J8) of the module.

Two AS-W922 cables are available. They are terminated to plug into your module at one end and unterminated at the other end.

Resolver Feedback/ Thermal Interface

The MOT 202 may use a resolver to provide feedback for the position, velocity and commutation of the motor. A resolver is essentially a rotary brushless transformer that provides absolute position information to the MOT. The MOT calculates an absolute position from the continuous signal of the resolver.

The MOT provides a reference output to drive transmit mode resolvers. The drive signal is a 3.75 kHz, self-compensating sine wave. The amplitude of the reference is adjusted by the module (if necessary) at power-up to get returned signal strengths of approximately 2 Vrms at the sine and cosine inputs of the module.

Connection for resolver feedback may be made to the module through the connector on the bottom of the module (use cable AS-W922-XXX) or to the discrete wiring points on the front of the module.

Note: If the cable length between MOT and the resolver is more than 100 ft, please consult with Modicon.

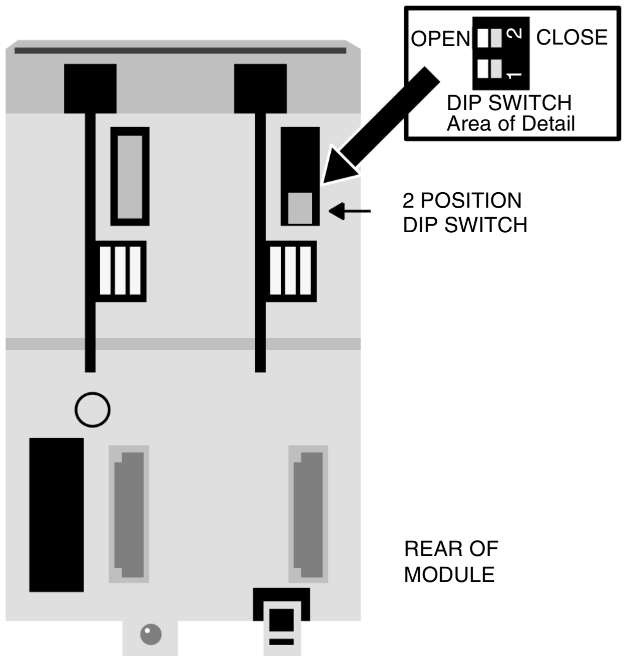
The module can also monitor motor temperature by means of a thermistor or thermostatic switch. The two-wire input recognizes a high impedance (greater than 3072 or open switch) as an over temperature condition. When the input is not used it must be shorted. The over-temperature fault is reported to MMDS or the Compact 984 as a drive fault. The over-temperature fault may be distinguished from a normal drive fault by observing the associated indicator on the front of the module.

DIP Switches

One two-position DIP switch is located on the rear panel of the module. SW1 determines the module's mode of operation (984 or MMDS control). SW2 determines the communication characteristics of the Modbus port upon power up of the module.

DIP Switch	Position	Function
SW1	Left/Open (factory set)	Compact 984 Controlled
SW1	Right/Closed	MMDS Controlled
SW2	Left/Open (factory set)	Programmed baud
	Right/Closed	Modbus Default

The MOT 202 DIP switch locations are shown in the following illustration.



Setting the Operating Mode with SW1

The SW1 setting determines which device can write to the MOT 202. The setting is read at power-up and selects either the MMDS or the Compact 984 to control the operation of the module. This mode selection is a safety feature that prevents you from accidentally issuing commands to the module using MMDS while it is being controlled by the Compact 984.

The control priority (SW1) is as follows:

1. When only MMDS is attached to the module, it has write privilege regardless of the setting on SW1.
2. When only the Compact 984 is communicating via Traffic Cop to the module, it has write privilege regardless of the setting of SW1.
3. When the Compact 984 has issued the local lockout command, it has write privileges regardless of the setting of SW1 and whether or not MMDS is attached.
4. When the local lockout command is not issued and both the Compact 984 and MMDS are communicating to the module, the setting of SW1 controls which device has write privilege.

Note: Either device may read (i.e. a GET command) at any time. However, reading the error log (a system command) is not allowed without write privilege because the log is lost once it is read. Refer to Single-Axis Software System (SASS) Motion User Guide (GM-MOTN-001) for details.

Setting the Modbus Communication Characteristics (SW2)

Switch#2 controls the Modbus communication characteristics. When the module is powered up, SW2 is read. When the switch is closed then the default characteristics are used. When the switch is open then the communication characteristics last saved in the module are used.

Once communication characteristics are initialized, they may be changed at any time under software control only if SW2 is in the open position. Refer to Single-Axis Software System (SASS) Motion User Guide (GM-MOTN-001) for details.

When SW2 is closed, the Modbus port default characteristics are as follows:

- 1 start bit
- 7 data bits
- 1 stop bit
- Even parity checking
- 9600 baud rate

The 9-pin serial modbus connections are listed in the following table.

Signal	Computer Pin	MOT Pin	Signal	Function
	1NC	1NC		Shield
TXD	2	3	RXD	Serial data
RXD	3	2	TXD	Serial data
GND	5	5	GND	Ground
DTR	4	6	DSR	Control line
DSR	6	4	DTR	Control line
RTS	*7	/ 7*	RTS	Control line
CTS	*8 /	8*	CTS	Control line
	9NC	9NC	+5 V	Future Use
* These pins are jumpered (7 & 8) on both.				

CAUTION

Ensure 5 V power is correct for the application.

Pin 9 supplies 5 V of power (75 mA). Make sure this is the correct pin for your application before wiring.

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

The 25-pin serial modbus connections are listed in the following table.Modbus Connections for 25-Pin Serial

Signal	MOT Pin	Computer Pin	Signal	Function
	1NC	1NC		Shield
TXD	2	2	RXD	Serial data
RXD	3	3	TXD	Serial data
GND	5	7	GND	Ground
DTR	4	6	DSR	Control line
DSR	6	20	DTR	Control line
RTS	*7	/ 4*	RTS	Control line
CTS	*8 /	5*	CTS	Control line
+5 V	9NC	9NC	+5 Vdc	Future Use
* These pins are jumpered, (7&8 on MOT, 4&5 on computer).				

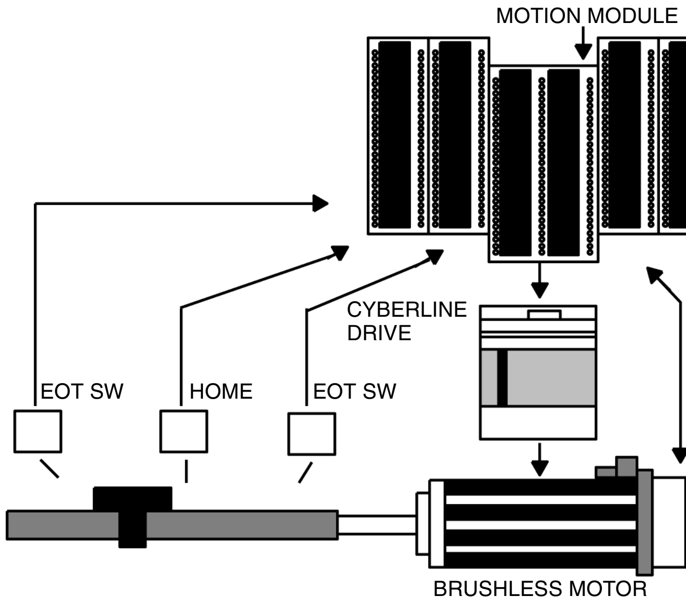
MOT 20X Module System Information

+EOT and -EOT Limits

The +EOT and -EOT normally closed limit switches indicate the Ends Of Travel so the MOT can stop the motor to avoid damage.

	DANGER
⚠	**Mis-wiring Danger** When wiring, ensure that moving positive moves you towards the +, and negative motion moves you towards the -EOT. **Failure to follow this precaution will result in death, serious injury, or equipment damage.**

The following diagram illustrates a typical MOT 20X installation.



If either of these inputs becomes 0 volts (open in the line), the MOT will generate a fatal error.

Note: If you reach the limit switches, the MOT disables the drive and stops the motor. Otherwise system safety may be compromised.

The MOT also has software programmable end-of-travel limits to provide over-travel protection. These programmable limits stop the drive and signal a non-fatal error. The end-of-travel limit switches provide backups for the software limits. The priority should be as follows:
Use software limits as the primary end-of-travel limit. Allow tolerance so you read the software limits before striking the limit switches.

> **Note:** If you don't set the zero position properly, the software end-of-travel limits won't be where expected.

The hardware limit switches should be set outside the software limit switches. This ensures a safe system shut down and thus prevents any over shooting that may result in mechanical damage.
You may use mechanical stops to limit motion and act as a fail-safe stop. These back up the software and hardware limit switches. Plan these as you do your mechanical design.

Home Limit

By using a home limit switch, the MOT can send the machine to its home position. The machine is considered at home when it satisfies two conditions:

- Home limit switch open-this gives the approximate home position
- Encoder or resolver at zero position

> **Note:** In order to ensure that your motor establishes the same home position each time, always home in the same direction. This approach gives you a reliable and consistent homing system. It is not completely dependent on a critical switch setting.

Home works properly even if the machine holds the home switch open for several feedback revolutions. The MOT always finds the same zero. How it chooses the resolver (or encoder) zero depends on its approach. Home is the first feedback zero in the direction of the Home after the switch is open.

Flash Memory

The MOT comes with a flash EEPROM that allows storage of application programs and configuration parameters, such as servo parameters, speed limits, etc. It will also accept firmware updates as firmware enhancements become available.

Communications Protocol

Communications with the MOT is through six pairs of 4x and 3x registers (I/O mapped to the MOT), using a very rigid format. The first register sent is always the control register and the second register is always the command register. The first register returned is always the current status of the MOT, while the second register returned is always an echo of the command register. All remaining registers, data register 1... 4, are reserved for data and are used as necessary. For additional information refer to Single-Axis Software System (SASS) Motion User Guide (GM-MOTN-001).

Note: For I/O Map information refer to the 984-A120 Compact Programmable Controllers User Guide (890 USE 108 00).

On-line/Off-line Development (MMDS)

The Modicon Motion Development Software (MMDS Ver. # 3.00 or higher) is an on-line/off-line software package which runs on a user-supplied IBM PC or compatible computer. [MMDS is purchased separately.] MMDS lets you connect the computer with the MOT (through an RS-232 serial interface) to set parameters, check module diagnostics, and exercise the motor during initial system setup. It also lets you write motion programs and download them to the Compact 984 to be used with the MRTM loadable function block, or you can download into the MOT directly.

System Pre-Check

Do this before you apply power to the MOT system:

Step	Action
1	Check all wiring-compare your wiring to the previous wiring diagrams
2	Make sure the dc power is within the range specified for the MOT.
3	Inspect the motors and loads-Are the motors securely mounted? Is it safe to run the motors? If not, remove keys from motor shafts to disconnect the motors from their mechanical loads.
4	Be sure the Compact 984 is stopped-This prevents an accidental local lockout command issued from the Compact 984 which cannot be changed by the MMDS. The MMDS is not capable of changing this setting.

Releasing the MOT

The only way to release the MOT is to issue the release lockout command from the Compact 984. If a Set or Motion Command is issued while the Modbus is locked out (Compact 984 command), the MOT will reject the command and set a fault bit true.

MOT 20X Motion Module Specifications

Table of Specifications

The following table describes MOT 20X Motion Module Specifications

Module Topology, Required Loadable

The following section describes Module Topology and Required Loadable Specifications.

Module Topology	Number of Discrete Inputs	5
	Number of Discrete Outputs	1
	Number of Analog Outputs	1
Required Loadable	SW-IODR-001	

Power Supplies, DIN Rail Grounding

The following section describes Power Supplies and DIN Rail Grounding Specifications.

Power Supplies	I/O system bus 5 Vdc	MOT 201	300 mA
		MOT 202	600 mA
DIN Rail Grounding	< 0.1 Ω		

Input/Outputs, Drive Interface

The following section describes Input/Outputs and Drive Interface Specifications.

Input/Outputs	Digital	Optically Isolated	to 500 Vdc
		Output drive capability	150 mA (using customer supplied 20 ... 28 Vdc, true high)
		Input impedance	3.5 K Ω (ON @ 15 Vdc minimum, OFF @ 5 Vdc maximum, true high)
	Analog	Drive capability	+/- 10 Vdc, 3 mA
		Resolution	12 bits
		Accuracy	+/- 100 mVdc (without offsets)
			+/- 50 mVdc (with offset)
Drive Interface	Drive fault input		True high, pulled up internally
	Drive enable relay		form C contacts, 30 Vdc @ 0.5 A resistive
	dc motors (201/202)	Command signal	+/- 10 Vdc @ 3 mA differential
		Current or velocity command	Software selectable
		Phasing	Positive voltage for CW motion
	ac motors (202 only)	Three phase current	+/- 10 Vdc @ 3 mA
		Command signal	Summing to 0 +/- 0.1 Vdc

Communications, Resolver Feedback

The following section describes Communications and Resolver Feedback Specifications.

Communications	Modbus		1 RS-232 serial port interface
	Baud rate		300 ... 9600, 9600 default, set by software (for ASCII only)
	5 Vdc supply		75 mA maximum
Resolver Feedback	Resolver reference drive		3.75 +/- 0.05 kHz; 2 +/- 1.0 Vrms
			100 mA RMS drive capability
			200 mW maximum
	Resolver sine/cosine inputs		7 K Ω impedance
	Resolver resolution	14 bits	to 1350 RPM
		12 bits	to 6000 RPM
		with standard transmit style resolver	+/- 10 min of arc typical
	System accuracy		16 bits to 300 RPM
			+/- 15 min of arc maximum
	System Repeatability		+/- 3 min of arc
	Cable length		Consult Customer Service if over 100 ft

Encoder Feedback

The following section describes Encoder Feedback Specifications.

Encoder Feedback	Differential signal	2 V minimum
	Phase	B leads A for CW motion
	Input impedance	145 Ω nominal
	Maximum encoder frequency	500 kHz square wave
		350 ns minimum time be tween edges from phase A and B
	Encoder feedback loss	Detected on phase A and B differential signals. Loss of marker signal is not to be detected; results in failure to home the system
	Resolution	4 times encoder line count
	Marker	Positive pulse for proper homing
	Power for encoder from Compact 984	5 V nominal
		4.4 V minimum
		75 mA maximum
	Power for encoder from external power supply	depends on encoder requirements
	Cable length	Consult Customer Service if over 300 ft

Motion, Thermistor Resistance

The following section describes Motion and Thermistor Resistance Specifications.

Motion	Absolute positioning range	32 bit resolution, convertible to in, mm, or any other user-definable unit
	Speed range	0 ... 6000 RPM
Thermistor Resistance (202 only)	Cold Resistance	1 K Ω maximum
	Hot Resistance	5 K Ω maximum

I/O Map, Dimensions

The following section describes I/O Map and Dimensions Specifications.

<table>
<tr><td>I/O Map</td><td colspan="2">Register 3x/4x</td><td>6 in/6 out</td></tr>
<tr><td rowspan="12">Dimensions</td><td rowspan="2">MOT201</td><td rowspan="2">(W x H x D)</td><td>40.3 x 145 x 117.5 mm</td></tr>
<tr><td>1.6x 5.6x 4.5 in</td></tr>
<tr><td rowspan="2">MOT 202</td><td rowspan="2">(W x H x D)</td><td>86.3 x 145 x 117.5 mm</td></tr>
<tr><td>3.4 x 5.6 x 4.5 in</td></tr>
<tr><td rowspan="2">MOT 201</td><td rowspan="2">Weight</td><td>0.36 kg</td></tr>
<tr><td>0.8 lb</td></tr>
<tr><td rowspan="2">MOT 202</td><td rowspan="2">Weight</td><td>0.61 kg</td></tr>
<tr><td>1.35 lb</td></tr>
<tr><td rowspan="2">Number of slots</td><td>MOT 201</td><td>1</td></tr>
<tr><td>MOT 202</td><td>2</td></tr>
<tr><td colspan="2" rowspan="2">Breakout Module</td><td>7.6 x 13.5 x 11.4 mm</td></tr>
<tr><td>3.0 x 5.31 x 4.5 in*</td></tr>
</table>

Agency Approvals, Environmental Characteristics

The following section describes Agency Approvals and Environmental Specifications.

<table>
<tr><td rowspan="2">Agency Approvals</td><td>MOT 201</td><td colspan="2">VDE 0160; UL 508; and CSA C22.2 No.142; and European Directive EMC 89/336/EEC Standards</td></tr>
<tr><td>MOT 202</td><td colspan="2">VDE 0160; UL 508; and CSA C22.2 No.142 Standards</td></tr>
<tr><td rowspan="6">Environmental Characteristics</td><td rowspan="2">Temperature</td><td>Operating</td><td>0 ... 60 degrees C</td></tr>
<tr><td>Storage</td><td>-40 ... +85 degrees C</td></tr>
<tr><td rowspan="2">Humidity</td><td>Operating</td><td rowspan="2">93 percent Rh at 60 degrees C, noncondensing</td></tr>
<tr><td>Storage</td></tr>
<tr><td rowspan="2">Vibration</td><td>0.075 mm displacement amplitude</td><td>10 ... 57 Hz</td></tr>
<tr><td>1 g</td><td>57 ... 150 Hz</td></tr>
</table>

Note: The double-width MOT 202 module does not fit in the last two (rightmost) slots in the DTA 200 and DTA 201 backplanes. Select alternate slots in the backplane when mounting the MOT 202.

Overview of the VIC/VRC/CTR 2XX Counter Input Module

46

At a Glance

Purpose

The purpose of this chapter is to describe the VIC/VRC/CTR 2XX Counter Input Module.

What's in this Chapter?

This chapter contains the following topics:

What is the VIC/VRC/CTR 2XX Counter Input Module?

Brief Description

Note: The BVIC-200, 205, 212, and 224 modules are now referred to as BVRC-200, BCTR-205, 212 and 224 respectively. The VRC200 is designed for use as a Variable Reluctance Counter to be used with AC signals. The Counter modules (CTR205/212/224) are designed for counting DC input signals at 5, 12 or 24 volts DC. The VRC and CTR modules are functionally the same as the original VIC modules except that they are powered off the 984's power supply instead of an external supply. The VRC and CTR models numbers also tie in the modules' applications more closely with their name.

The VRC/CTR series of counter input modules allows you to directly connect up to four high speed pulse or four VRC inputs (flowmeters, positive displacement meters, ac waveforms, etc.) to a single module. The module uses input metering Device K Factor information, and can modify this value to compensate for wear or application abnormalities.
The four VRC/CTR modules operate identically; each supports a different voltage input level.

VRC-200	VRC inputs (.025 to 36 Vac Peak typical)
CTR-205	5 Vdc
CTR-212	12 Vdc
CTR-224	24 Vdc

VIC/CRC/CTR 2XX Counter Input Module LEDs

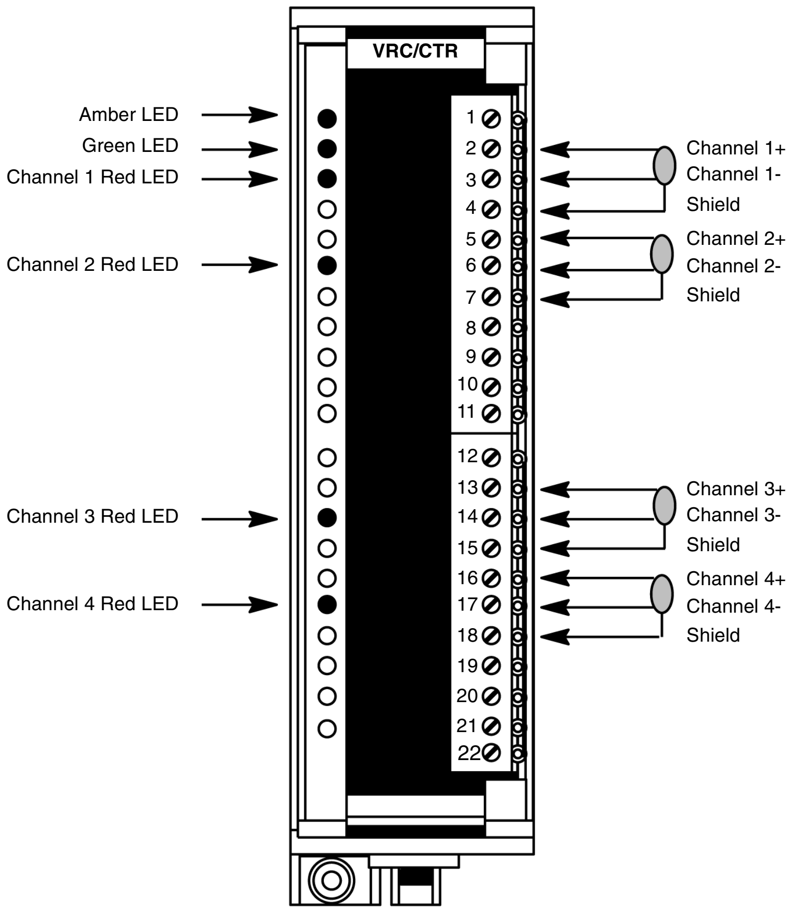
Introduction

The front of the VRC/CTR module has LED indicators that provide operational status, and incoming pulse annunciation.

Amber	Module powered-up and passed power-up diagnostics
Green	Module is configured
Red	Input data present

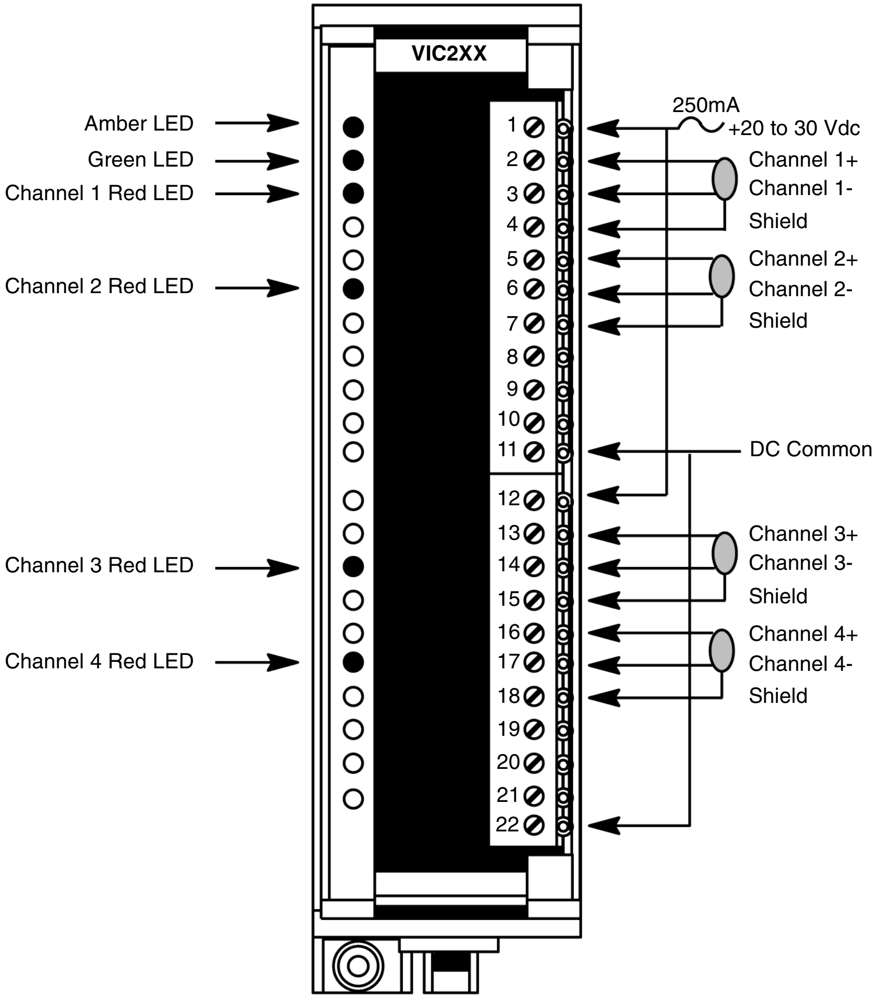
LED Locations and Wiring of the VRC/CTR Module

The following diagram illustrates the LED locations and wiring of the VRC/CTR module.



LED Locations and Wiring of the VIC200, 205, 212, and 212 Modules

The following diagram illustrates the LED locations and wiring ONLY of the VIC200, 205, 212, and 212 modules.



Installation of the VRC/CTR 2XX Module

Overview

Installing Installing the VRC/CTR 2XX modules consists of:
- Field wiring the module for the application selected
- Configuring the module to fit its application

VIC/CRC/CTR 2XX Counter Input Module Field Wiring

Introduction

The VRC/CTR module is capable of detecting extremely low voltage signals. It is very important that you minimize the amount of electrical interference that the module is exposed to. Also, exercise caution with low signal level wiring (turbine meters, pulse transducers etc.). Do not mix signal and power wiring, and ensure that signal wires cross power wiring at 90° angles.

Cables connecting field devices to the VRC/CTR module should be limited to 100 ft (30.6 m) or less. Specifications for the cable should be equal to or exceed those of Belden #8760. Grounding of the shield and instrument wires should occur only at the VRC/CTR module end of the cable. Wiring to the incoming power terminals should be protected by a field-mounted, slow blow fuse rated at 250 mA.

VIC/CRC/CTR 2XX Counter Input Module Configuration for 16-bit Compact Controllers

Output Registers

The VRC/CTR 2XX uses three 4x output registers and three 3x input registers, I/O mapped as BIN data type.

Output Register	Function
4x	Factor Data Word
4x + 1	Control Word 1
4x + 2	Control Word 2

Factor Data Word

This register is used to send into the module K or Meter factor data for each of the four input channels. Control Words 1 and 2 are used to load this factor data into the module.

K Factor Valid Data

Valid K factor values are integer numbers in the range 1 ... 65,535. K factor values are typically located on the meter housing, and should be entered exactly as seen on the housing. If you want data to be counted as engineering units, this is where the value would be entered.

Factor data values loaded into each channel inform the module how many pulses to count before incrementing an on-board counter for each input channel. If a value is loaded into the K factor location, the module will provide information to the PLC based on each channel's K factor.

If a channel's K factor is zero (0), the module will provide raw or unit counts to the PLC. To change this value, simply enter a new K factor value into the factor register and sets the respective bit in output register #2 (bits 13, 14, 15, or 16, respectively, for input channels 1, 2, 3, or 4).

Meter Factor Valid Data

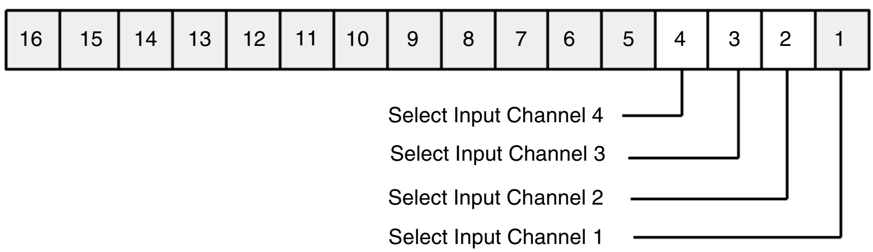
Meter factor values are used to apply a corrective offset or calibration value against a K factor. This feature allows a meter's K factor value to be modified in the field. This is helpful because a meter or field device's characteristics may change as it wears or accumulates material that affects its accuracy.
Typical data used for meter factors are numbers from 0.0001 ... 1.9999, where 1.0000 means no error exists and no correction has been made. To load a Meter factor value, you must enter a five-digit number between 00001 ... 19999 into output register 1 and set the appropriate bit in output register 3 (control word 2). Do not enter a decimal point, since the module assumes a decimal point between the fourth and fifth digits (the meter factor value has an implied decimal to the right of the most significant digit.).
This number is multiplied into the K factor value, with the result being used to form the C factor. Therefore, if you want to calculate the C factor manually,
C factor = (K x M)/10,000
The module as shipped from the factory defaults to a Meter factor of 10000 (unity gain). To change a Meter factor value, simply place the new value into the factor register and set the respective bit in output register 3, bits 1, 2, 3, or 4.

Control Word #1 (4x + 1)

This register is used to:
- Select the input to be read
- Clear input channel data
- Suspend an input channel's counting and hold its value
- Load input channel K factor data

Input Channel Select (Control Word 1, bits 1 ... 4)

The following graphic shows the input channel select.

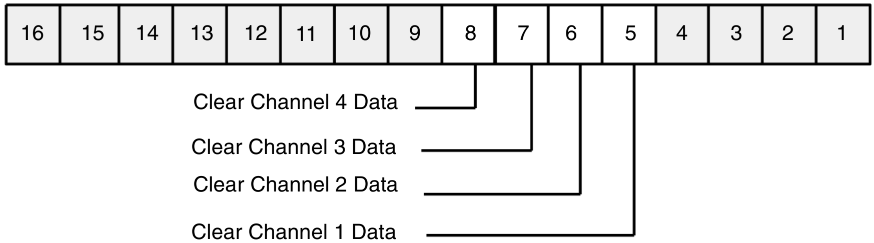


Only one of these bits may be ON at any time. If more than one of these bits is ON, only one channel will be displayed in the input data register. The order of Priority for determining which channel is displayed when multiple bits are ON is 1, 2, 3, and 4.

Note: If auto sequence is enabled, these bits are ignored.

Clear Channel Data (Control Word 1, bits 5 ... 8)

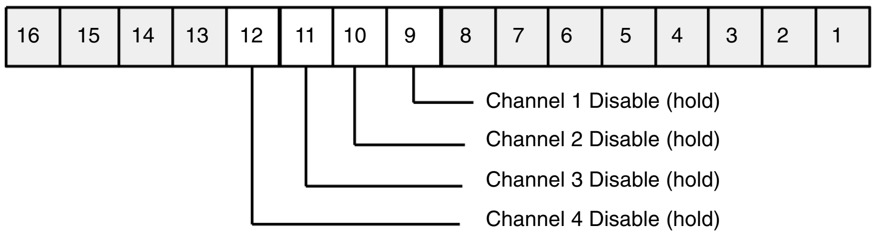
The following graphic shows the clear channel data.



To clear a specific channel’s count data, set the appropriate bit to ON (1). If a bit is set ON, that channel’s data will be reset and held to zero.

Channel Hold (Control Word 1, bits 9 ... 12)

The following graphic shows the channel hold.



To suspend counting and HOLD a channel at a value, set the appropriate bit ON (1). The VRC/CTR will suspend counting that channel and hold the value until the bit is released (0), at which time the channel will again monitor the incoming pulses.

CAUTION

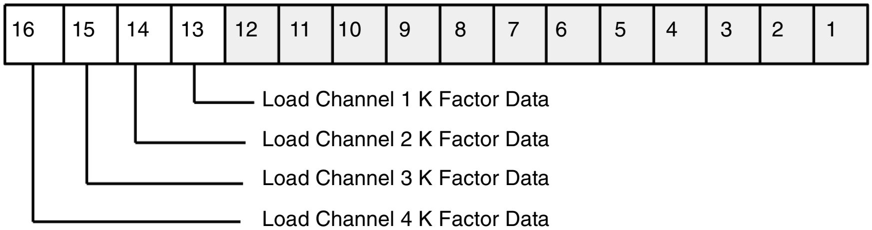
Response speed.

The Channel Hold feature is not intended for immediate or instantaneous control. The ability or speed with which the VRC/CTR module is capable of holding a value depends on a number of factors: PLC scan time, incoming pulse speed, module activity, and the status of other channels. All of these factors may influence how fast the VRC/CTR module can respond to a HOLD request from the PLC.

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

Load K Factor Data (Control Word 1, bits 13 ... 16)

The four bits shown below are used to load K factor data into the VRC/CTR module.

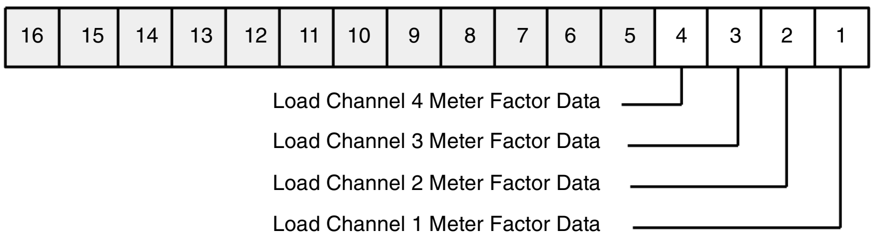


Control Word 2 (4x + 2)

This register is used to:
- Load input channel meter factor data
- Select the channel input data to be accumulated (counts or input frequency)
- Invoke automatic channel sequencing
- Select the factor (K, Meter, or C) to be displayed
- Select raw input frequency display

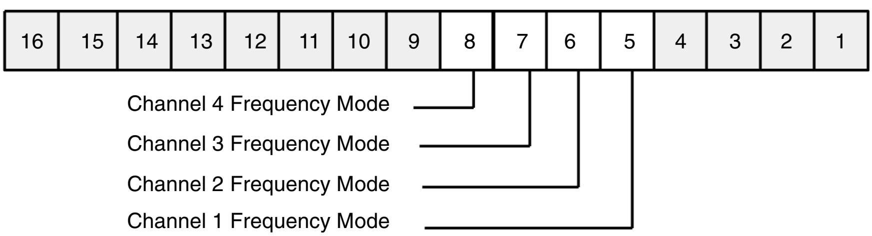
LOAD METER FACTOR DATA (Control Word 2, bits 1 ... 4)

These four bits load the meter factor data into the VRC/CTR module.



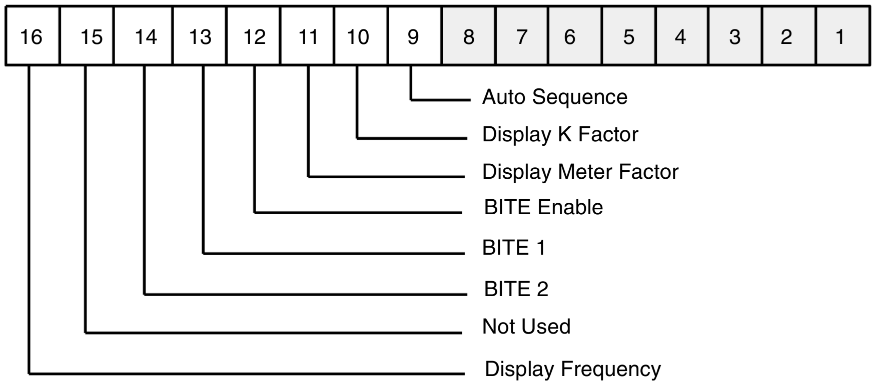
Frequency Mode (Control Word 2, bits 5 ... 8)

The module can display, accumulate, or totalize incoming counts, or it can display the data in rate or frequency. Setting bits 5 ... 8 to a 1 causes data frequency to be displayed.



Auto Scan (Control Word 2, bits 9 ... 16)

The VRC/CTR module has the ability to auto scan its input channels. This feature allows you to easily integrate the VRC/CTR module into the Compact 984 PLC system with minimal ladder programming.



Bit 9—Auto Sequence

By setting bit 9 ON (1), the module sequentially displays each of the four input channels to register 3**x**. The VRC/CTR module will sequence through each of the four channels on a **1/2** s time base (2 s total update of all four channels).

Note: This bit will override the manual channel select bits (output word 2, bits 1 ... 4).

Bit 10—Display K Factor

By setting bit 10 ON (1), the module displays the K factor data for the enabled channel in input word 2. If this bit is OFF (0) and the display Meter factor bit is OFF, the module displays the calculated factor value (C Factor) for each channel in input word 2.

Bit 11—Display Meter Factor

By setting bit 11 ON (1), the module displays the Meter factor data for the enabled channel in input word 2. If this bit is OFF (0) and the display K factor bit is OFF, the module displays the calculated factor value (C Factor) for each channel in input word 2.

Bits 12 ... 14—BITE (Built–in Test Enable)

Refer to *Troubleshooting, p. 546* for BITE test information. Set these bits to 0 for normal information. Set to 1 for diagnostic test.

Note: Bit 15 of control word 2 is unused.

Bits 12 ... 14— Display Frequency

It may be desirable to see the raw frequency being delivered to one of the respective input channels. If bit 16 is set ON (1) and the module is in the rate mode, the data input register 1 will reflect raw frequency (Hz) being read at the respective input channel. The scaled rate and counting will continue in the background.

Input Registers

The read field consists of three 3**x** words that provide data or status information to the Compact 984 processor.

Input Register	Function
3*x*	READ DATA
3*x + 1*	Factor Value
3*x + 2*	Status Word

Input Data (3x)

Count data for all four channels is displayed in this register. Data may be displayed on demand (manually) or can be sequentially (automatically) displayed by the VRC/CTR module.

Factor Value (3x +1)

Register 2 is used to display K, Meter, or the C Factor values used by each channel of the VRC/CTR module. This register provides a means of verifying that the factor value loaded into each channel of the VRC/CTR module is correct. You must monitor the active channel bits to accurately determine each channel's data at any given moment in time.

C Factor Data

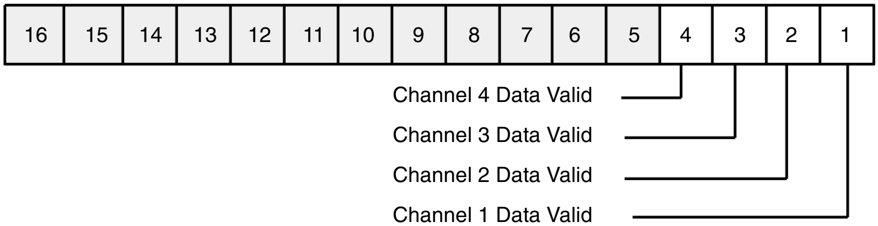
C Factor (Calculated Factor) is the result of the K factor being multiplied by the Meter factor and then being divided by 10,000 prior to being displayed to the PLC. Meter factor default is 10000 (unity) and K factor default is 0. When K and Meter factors are in their default state, the C factor will equal the raw frequency delivered to the VRC/CTR module by the flow meter.

Status Word (3x + 2)

This register is used to indicate:
- When an input channel data is valid
- When a channel count has rolled over
- Excessive signal input frequency to a channel
- Whether auto sequencing is selected
- Module hardware failure

Active Channel Status (Status Word, bits 1 ... 4)

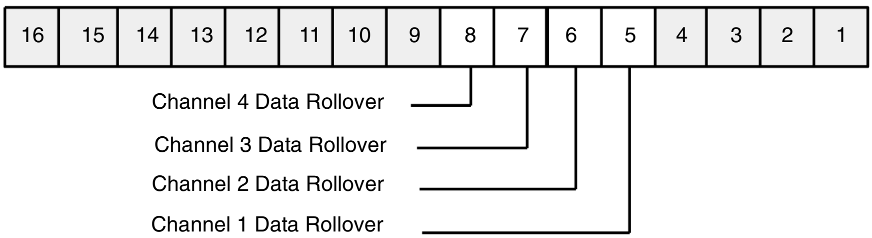
Whenever one of these bits is ON (1), the data in the READ DATA word is valid.



Note: There will only be one bit on at any time.

Channel Rollover (Status Word, bits 5 ... 8)

The following figure shows the channel roll over bit settings.



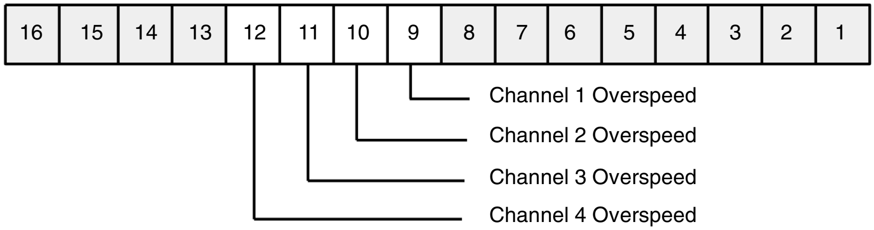
Whenever any of these bits is ON (1), it indicates that the module has incremented the data past the 32,768 count mark for that respective channel. When any of the individual channels (1 ... 4) is at 32,767 and one more pulse is detected, the module will set the appropriate rollover bit ON (1) and clear the accumulated data (00000) for that channel.

Any pulses that are detected after the rollover bit is set will continue to accumulate for that channel starting at (00000). After the rollover bit is set and the count continues, once the count reaches 16,384, the rollover bit will be reset to zero.

The module resets each respective rollover bit to zero (0) whenever the count in a specific channel increments from 16,383 to 16,384.

Channel Overspeed (Status Word, bits 9 ... 12)

The following figure shows the Channel Overspeed bits.

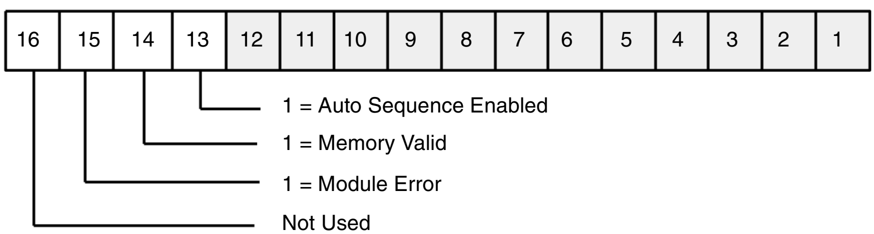


If the module detects pulses that are faster than 12.5 kHz, the module will inform the ladder program by setting individual bits that correspond to each of the four input channels. When the overspeed flag is on, the counter is disabled.
If any of these bits is set ON (1), the data for that channel may be invalid. These bits are only set when the pulse stream exceeds 12.5 kHz. If the signal temporarily exceeds 12.5 kHz, the bit will be set ON only during that period. If the signal returns within the design specification, the bit will turn off. If the module is used in an application that may exceed 12.5 kHz, these bits should be monitored by the ladder logic program.

Note: Overspeed detection was designed to guard against input devices exceeding 10 kHz. The overspeed bits apply to all VRC input modes of the VIC-200, and to the counter input function of the 205, 212, or 224. If the module is configured for dc pulse applications (CTR-205, –212 or –224), the overspeed bits will function as stated above, but the frequency data being read in input register 3x will remain valid until 25 kHz.

Status Word, bits 13 ... 16

The following figure shows the Auto Sequence Mode bits.



All channels are read by the PLC in sequence, every 2 s.

Bit 14—Memory Valid

If bit 14 is detected in an OFF (0) state, the module's data or configuration is in question. If this is the case, you may either initiate a self–test, power cycle the module, or replace the module.

Bit 15—Module Error

Bit 15 is set (1) when a hardware failure is detected within the module. If this bit is set, the module must be power cycled. If the bit does not clear after a power cycle, the module should be replaced.

Note: Bit #16 is not used.

Troubleshooting

Amber LED

Module Status is determined when the PLC goes into run mode. The table below illustrates possible module conditions.

LED Status	Description
Steady ON	Module Ready (operational)
1 blink	Module Watchdog Fault
2 blinks	Module Watchdog Fault at Startup
3 blinks	Module RAM memory failure at Startup
4 blinks	Bus interface failure at Startup
5 blinks	Module ROM memory failure
6 blinks	Module processor Startup Fault
7 blinks	General Module error

When the module detects these conditions, the amber LED blinks the appropriate number of times. After each sequence of pulses, the LED pauses (each pause is a new starting point).

Green LED

When the PLC goes into run mode communication is established with the module. The green LED is on when communication has been established properly. The green LED remains off when communication is not established.

Red LED

Each of the four red LEDs illuminates when data is detected. The LEDs for each of the four channels operate as follows:

LED Status	Description
Steady OFF	No incoming signal
Blinking	Incoming signal detected, < 40 Hz
Steady ON	Incoming signal detected, > 40 Hz

Establishing Communication

If the LEDs on the front of the module are showing, then the module is communicating with the PLC processor.

Amber	ON
Green	ON
Red	Blinking or ON

Steps after Establishing Communication

Refer to table below for steps after establishing communication:

Step	Action
1	Monitor the status of READ Word 3 bits 13 ... 16 to determine what channel the module is displaying.
2	Check the front of the module to determine if the appropriate channel's red LED is pulsing or ON.
3	If the above conditions are true, check to make sure the Clear Channel bit (Write Word 2, bits 8 ... 11) for the appropriate channel is not set.
4	Check that Hold Count bit (Write Word 2, bits 5 ... 8) for the appropriate channel is not set.
5	If these bits are OFF, check to make sure that the module's self–test feature is not enabled (Write Word 3, bit 15 ON).

Invalid Data

The module is capable of measuring frequencies up to 25 kHz, and counting pulses up to 12.5kHz. The counter input mode stops counting inputs if the overspeed bits are set. This occurs at input frequencies over 12.5kHz.
If the incoming cable must pass high voltage cables, make sure the signal cable passes the high voltage cable at 90. If electrical interference is being considered, attempt to locate the VRC/CTR module as far away as possible from the P120 power supply and relay output modules. These products may generate electrical interference during operation. This does not affect the VRC/CTR module but may induce pulses on incoming channel wiring.
If the channel is configured for dc operation, the module is capable of counting up to 25 kHz. If the incoming signal is within specifications and data is still not correct, check that the data values loaded into each channel's K and Meter factor values are correct. The K and Meter factor values are used to scale incoming signals for display purposes. These values are monitored in Read word 2 and are displayed whenever a channel is enabled and either bit 7 or 6 of Write word 3 are ON.

Overspeed VRC Inputs (Flowmeters, Variable Inputs, etc.)

The module is capable of detecting when incoming signals are exceeding the design limits of each channel. The module will detect when incoming signals exceed 12.5kHz and set one of four bits (Read word 3, bits 5 ... 8) for PLC use. These bits operate independently (i.e., if a channel exceeds 12.5 kHz, the remaining channels are not affected). If overspeed is detected, the respective channel will continue to operate, but the data is not guaranteed. If the incoming signal returns to less than 12.5 kHz, the overspeed bit will turn OFF.

Overspeed Pulsed Inputs (Square Wave)

Each channel on the module is capable of being configured for dc operation on the VIC-205, 212, and 224 modules. When configured for dc operation, in the frequency input mode, each channel is capable of measuring frequencies up to 25kHz. In the frequency input mode the overspeed bits turn on at 12.5kHz, but the data is valid up to 25kHz.
When configured for the counter input mode, the count value stops counting when the overspeed bits are turned on. The counter mode continues to count up to a pulse rate of 12.5kHz.

Overspeed Built–in Test Enable (BITE)

The VRC/CTR module has built–in diagnostics that can be enabled to check the module's control electronics. These tests are automatically run each time the module is powered up but can also be run after the module is on–line. By selecting one of three test sequences and then setting this bit ON, the module enters a self–test mode.
To terminate the self-test mode, reset the BITE Enable bit (0). Bits 13 and 14 determine the type of test that will be executed. Available tests and a brief explanation of what they accomplish are shown in the truth table below.

Truth Table for BITE Tests			
Bit 14	Bit 13	Bit 12	Description
OFF	OFF	OFF	Test disabled
OFF	ON	ON	Tests VRC/CTR Microprocessor, RAM, ROM, Ready and Run LEDs, 24 Vdc
ON	OFF	ON	Tests EEPROM, Bus Interface, Internal timers, VRC electronics, Pulse indication, Frequency, and Software products
ON	ON	ON	Overspeed and LED Indicators (requires external input from a calibrated signal generator)

Note: The two bits select the category of test in binary. If the BITE enable bit is ON, the module remains in self–test until the BITE enable bit is turned off. The enable bit and the category bits are currently only read once on entry to the BITE procedure. If you turn the bit OFF, the module will return to on line soon after the applicable test is completed. Allow 100 ms minimum for each test.

Currently, the red LED illuminates steady and the green LED flashes if the test is completed successfully. If a failure is detected, the error bit will illuminate and the red LED will blink.

VIC/CRC/CTR 2XX Counter Input Module Specifications

Table of Specifications

The following table contains a list of VIC/CRC/CTR 2XX counter input module specifications.

VIC/VRC/CTR 2XX High Speed Input Specifications

Electrical Specifications

The following section describes Electrical Specifications.

Electrical	Inputs/module		4
	Isolation		30 Vdc
	Supply Voltage for BVIC 2xx ONLY (24 Vdc power supply)		24 Vdc, +/-2.4Vdc
	Signal Voltage Range	VIC/VRC-200 (VRC inputs)	.025 ... 36 Vac Peak typical
		VIC/CTR-205	5 Vdc, +/-.5Vdc
			Low <= 0.800, High >= 2.000 Vdc typical @ source Z < 10 ohms
		VIC/CTR-212	12 Vdc, +/-1.2Vdc
			Low <= .65 1.920,High >= 4.800 Vdc typical @ source Z < 10 ohms
		VIC/CTR-224	24 Vdc, +/-2.4Vdc
			Logic Low < 3.840, Log ic High > 9.600 Vdc typical @ source Z < 10 W

Frequency Specifications

The following section describes Frequency Specifications.

Frequency	VIC/VRC Inputs	0 ... 10.0 kHz
	VIC/VRC/CTR Vdc Inputs- Counter Mode	0 ... 10.0 kHz
	VIC/VRC/CTR Vdc Inputs- Frequency Mode	0 ... 25.0 kHz
	VIC/VRC/CTR Pulse Width	20 micros minimum
	VIC/VRC/CTR Overspeed	12.5 kHz detection

Data Formats, Required Loadable

The following section describes Data Format and Required Loadable Specifications.

Data Formats	Accumulated, Scaled Accumulated, Rate (Hz) Scaled Rate		
	Accuracy	VIC/ CTR-205, 212, 224	+/- 1 count over full range
		VIC/VRC-200	+/- 0.1 percent of full scale, +/- 1 count
Required Loadable	SW-IODR-001 (See Appendix B, file SVI.DAT)		

Power Required, DIN Rail Grounding

The following section Power Required and DIN Rail Grounding Specifications.

Power Required	VRC/CTR External Power Source	None Required
	VRC/CTR Internal Power Source from the backplane	275 mA @ 5 Vdc maxi mum
	VIC External Power Source, Regulated or Unregulated	20 ... 30VVdc
	VIC External Power Source, Typical	70mA @ 24VVdc
	VIC Internal Power Source from the backplane	None Required
DIN Rail Grounding	< 0.1Ohms	

Environment, I/O Map

The following section describes Environment and I/O Map Specifications.

Environment	Temperature	Operational	0 ... 60 degrees C
			32 ... 140 degrees F
		Storage	-40 ... +85 degrees C
			-40 ... +185 degrees F
	Humidity		0 ... 95 percent @ 60 degrees C, noncondensing
I/O Map	Register 3x/4x		3 in/3 out

Dimensions and Agency Approvals

The following section describes Dimensions and Agency Approvals

Dimensions	W x H x D	40.6 x 142.2 x 114.3 mm
		1.6 x 5.6 x 4.5 in
	Weight	300 g
		0.70 lb
	Power Connections	60/75 copper (Cu)
	Torque on set screws	0.5 in/lb
Agency Approvals	VDE 0160; UL 508; CSA 22.2 No.142; FM Class I, Div 2 and European Directive EMC 89/336/ EEC Standards	

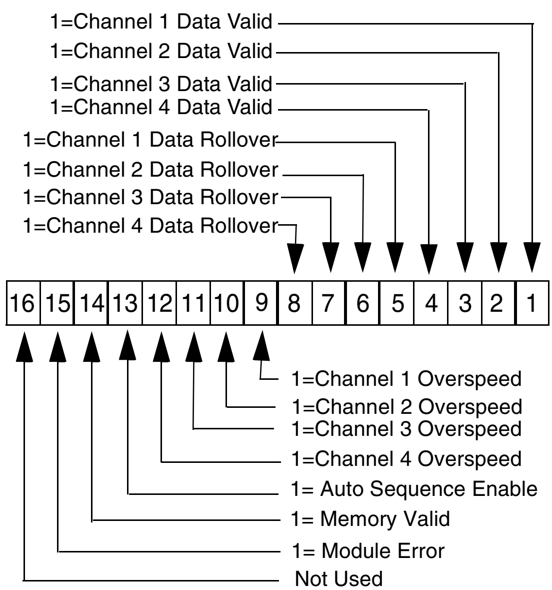
VIC/CRC/CTR 2XX Counter Input Module for Compact 32-bit Controllers

I/O Map Register

In I/O map these modules are configured with nine 3x registers and one 4x register
The 3x register assignements are as follows:

- 3x - Register 1: Input Status Word 3
- 3x - Register 2: Channel 1 Read Data
- 3x - Register 3: Channel 1 Factor Value
- 3x - Register 4: Channel 2 Read Data
- 3x - Register 5: Channel 2 Factor Value
- 3x - Register 6: Channel 3 Read Data
- 3x - Register 7: Channel 3 Factor Value
- 3x - Register 8 : Channel 4 Read Data
- 3x - Register 9 : Channel 4 Factor Value

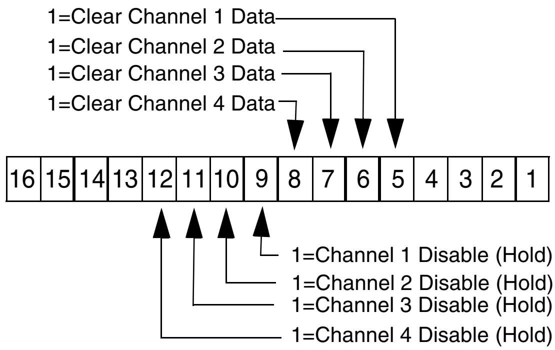
3x Register 1 Input Status Word Bit Assigment



Factor value registers the display either K or M factor as selected in the I/O map parameter screen. The value entered in the parameter screen for the associated channel will be displayed
Real data registers display either count or frequency as selected on the I/O map parameter screen.

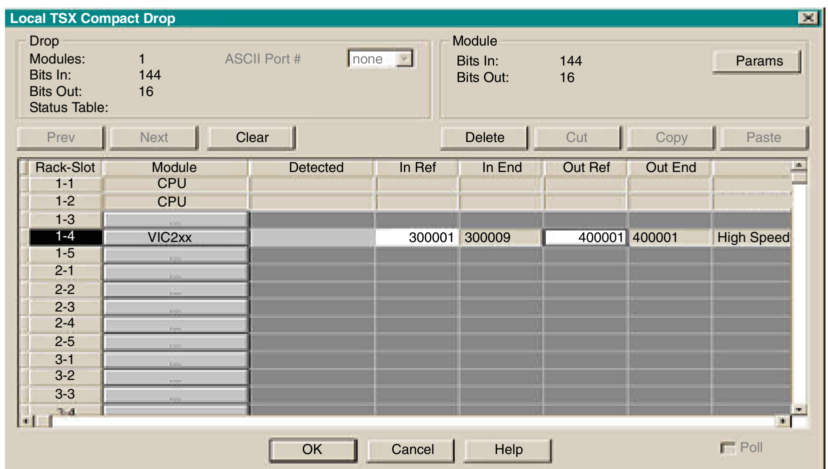
Control Word

4X Register Control Word



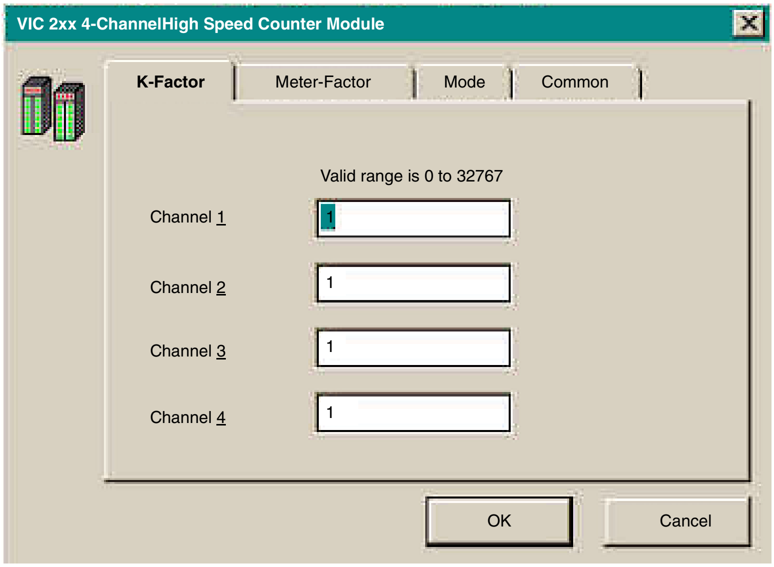
I/O Map Parameter Screen

There is a parameter screen for these modules where the K- Factor, Meter-Factor, Mode and common parameters for the module are entered. The following screen capture illustrates this:



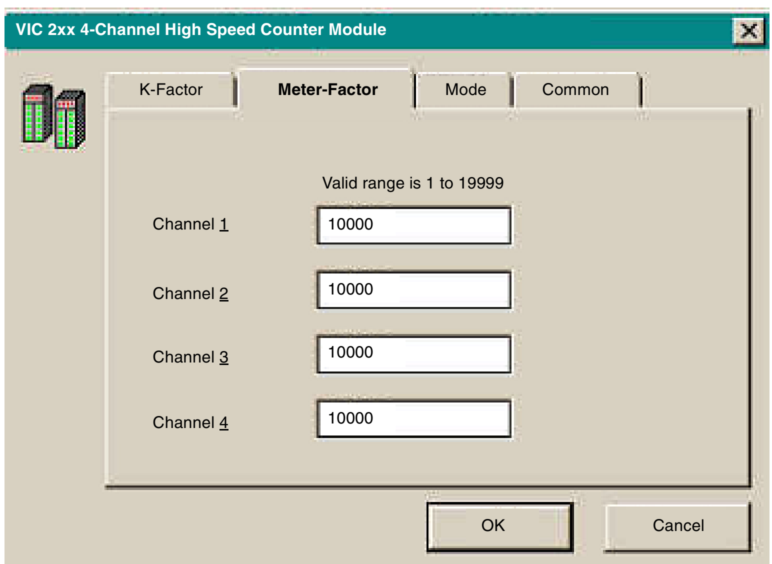
Input Screen for K-Factor

Enter the K-Factor for each channel:



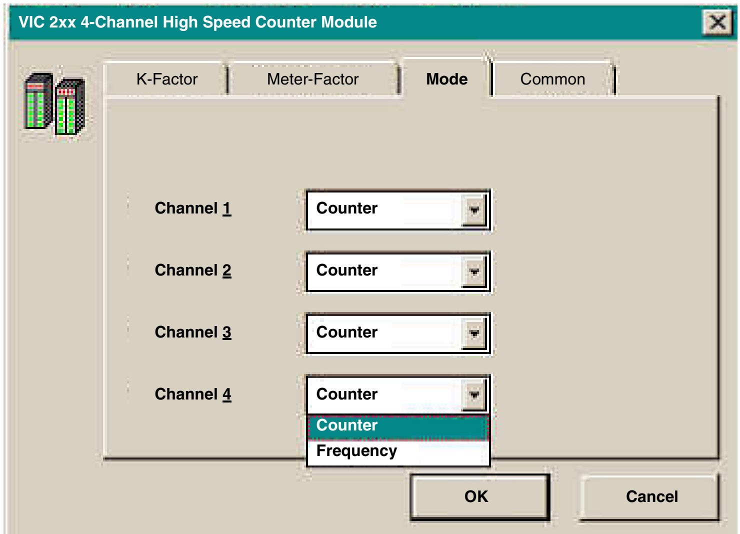
Input Sceen for Meter- Factor

Enter the Meter-Factor for each channel:



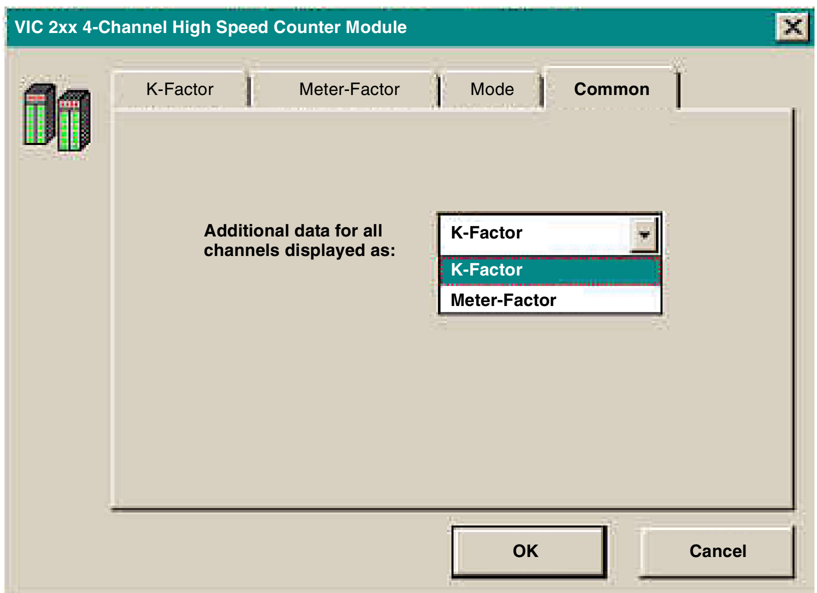
Input Screen Module Mode

For each channel, select either Counter or Frequency in the Real Data register:



Input Screen for Module Common Parameters

Select to display either K or M factor in the Factor Data registers This selection applies to a four channels:



Overview of the ZAE 201 Counter/ Positioner Module

47

At a Glance

Purpose

The purpose of this chapter is to describe the ZAE 201 Counter/Positioner Module.

What's in this Chapter?

This chapter contains the following sections:

47.1 Overview of the ZAE 201 Counter/Positioner Module

At a Glance

Purpose

This section provides an overview of the ZAE 201 Counter/Positioner Module.

What's in this Section?

This section contains the following topics:

What is the ZAE 201 Counter/Positioner Module?

Brief Product Description

The ZAE 201 is a dual-function, user-configurable module that can operate as either a high speed counter or to monitor a simple one–axis positioning application. The ZAE 201 has two output relays, the operation of which are specified when the module is parameterized for either counting or positioning functions. Operational power for the module is 24 Vdc, and position/count signals may be passed to the module as either 5 V (RS422 compatible) or 24 V inputs.

In the counter mode, the unit acts as a high speed counter. Counting is started and stopped by activating and deactivating the count gate input. When counting (count gate activated), two output relays operate based on setup parameters passed to the unit prior to activating the count gate.

In the positioning mode, the unit monitors a single–axis motion. This is accomplished by providing quadrature encoder inputs to the ZAE201. When a motion request is received, the unit will control the state of two output relays based on the current position relative to the commanded position. During motion, the state of two relay outputs are maintained such that speed can be controlled as the target position is approached. The specific operation of these relays is determined by setup parameters passed to the ZAE 201. Direction of motion and absolute speed are determined by other devices controlled through user logic.

LED Indicator Displays of the ZAE 201 Counter/Positioner Module

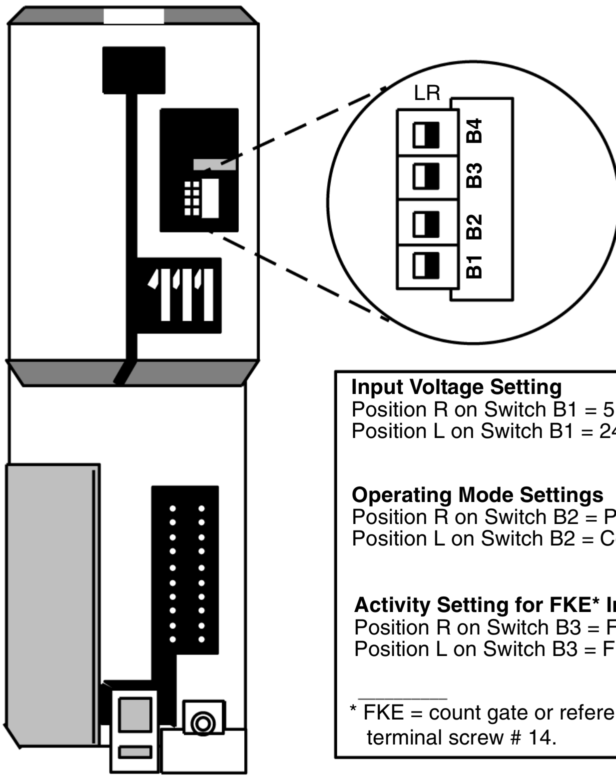
LED Indicators

The ZAE 201 has seven LED indicators displayed on the front panel:
- The green LED opposite terminal screw 1 goes ON to indicate the presence of the 24 V supply voltage
- The amber LED opposite terminal screw 2 may be used as an encoder power monitor if you are using 24 V input signals; if you remove the jumper between terminal screws 1 and 2 and add a wire from the encoder supply, the LED will go ON to indicate a loss of power from the field device. Do not remove the jumper or use this LED with 5 V input signals.
- The green LED opposite terminal screw 12 is the READY LED; its meaning is mode dependent. It goes ON in the positioner mode when the module has been completely parameterized and the reference point trip has been performed. It goes ON in the counter mode when the module has been completely parameterized.
- The amber LED opposite terminal screw 13 is the RUN LED; its meaning is mode dependent. It goes ON in the positioner mode when a motion command is being executed. It goes ON in the counter mode when the module is parameterized and the counter gate is open.
- The red LED opposite terminal screw 14 goes ON to indicate an FKE input active condition.
- The two red LEDs opposite terminal screws 16 and 18 indicate the current condition of relays 1 and 2, respectively. When an LED is ON, its respective relay is closed; when an LED is OFF, its relay is open.

Choosing Operating Mode and Input Voltage Level for the ZAE 201 Counter/ Positioner Module

Switch Location and Settings

The choices of operating mode and input voltage are set via DIP switches on the back of the module. The module can operate in only one mode and at only one input voltage at a time.



Input Voltage Setting
Position R on Switch B1 = 5 V inputs
Position L on Switch B1 = 24 V inputs

Operating Mode Settings
Position R on Switch B2 = Position sensing mode
Position L on Switch B2 = Counter mode

Activity Setting for FKE* Input
Position R on Switch B3 = FKE* input active LOW
Position L on Switch B3 = FKE* input active HIGH

* FKE = count gate or reference trip input, field wired at terminal screw # 14.

Operating States of the ZAE 201 Counter/Positioner Module

Operating States

After a ZAE 201 module has been installed, its two output relays must be parameterized for counting or positioning functions. When the Compact-984 Controller is started and begins solving user logic, the ZAE 201 comes up in an initialized but nonfunctional state called NET IN. In order to bring the module into a READY state where it can function, information must be sent to the module identifying how the two relays are to be used and how the FKE input is to be interpreted. The process of sending this information to the module is called **parameterization**, and the specific parameters are dependent upon the module's operating mode.

At the beginning of each scan, the ZAE 201 places the latest status and counter or positioning data in its input data block. The controller uses this information to determine the next command for the module. Commands are stated in the output data block. If no new command is appropriate based on the current information in the input data block, the command byte in the output data block is set to 0.

The ZAE 201's maximum count cannot exceed 8,388,607.

Typically, the command register in the output data block should be cleared at the start of a scan, allowing the user logic to define a new command as required. The command is passed to the module at the end–of–scan. Commands may be given only when the ZAE 201 is not busy, and a command must be consistent with the current state of the module. If either of these conditions is not met, an error will be returned in the input data block.

The ZAE 201 can be reset to a NET IN state at any time. New information can then be passed to the module, thereby redefining the operating parameters before returning to the READY state.

Representing the ZAE 201 Data Blocks in the I/O Map

Overview

The ZAE 201 is described in the Compact-984 I/O Map as a three-register bidirectional module. Three consecutive 3**x** input registers are used to store the three words in the input data block, and three consecutive 4**x** output registers are used to store the three words in the output data block.

Format of the Input Data Block

The first word in the (3x) input data block contains input data necessary for user logic to efficiently control the ZAE 201; it comprises three parts:

- A one–bit module busy flag
- A set of seven error condition bits
- A set of eight mode–specific module status bits

The following diagram shows the first word in the input data block.

First Word in the Data Input Block

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Module Status Bits

Positioner Mode

0	0	0	0	*	1	0	0 = NET IN
0	0	0	0	*	1	0	1 = parameterized
1	*	1	1	*	1	1	1 = READY
0	0	0	0	*	1	1	1 = RUN fast
0	0	0	1	*	1	1	1 = RUN slow
0	0	1	1	*	1	1	1 = RUN hunting

Counter Mode

0	0	0	0	*	0	0	0 = NET IN
0	0	*	*	0	0	0	1 = READY
0	0	*	*	1	0	1	1 = RUN

Error Condition Bits

0	0	0	0	0	0	1 = module health failure--replace the module
0	0	0	0	0	1	0 = module communication error — stop and restart the controller to clear
0	0	0	0	0	1	1 = module time-out error — stop and restart the controller to clear
0	0	0	0	1	0	0 = invalid request in current mode
0	0	0	0	1	0	1 = invalid request in current state
0	0	0	0	1	1	0 = invalid state RAM pointer
0	0	0	0	1	1	1 = invalid parameter
0	0	0	1	0	0	0 = invalid target value
1	1	1	1	1	1	1 = invalid state error

1 = module is busy
0 = new command may be issued

* indicates that the bit value may be either 1 or 0 when the module is in this state.

The second and third words in the input data block contain the latest count or position value, depending on the operating mode of the module. The second word contains the high order position or count, and the third word contains the low order. The following is an explanation of bits 10 ... 13 in the above illustration:

Bit 10	In position mode, a 1 in this bit indicates whether the motion is within the specified target range
Bit 11	The state of relay 2 at terminal 18
Bit 12	The state of relay 1 at terminal 16
Bit 13	The state of FKE input at terminal 14

Note: When in position mode the counts are 4 times those counts when in counter mode.

Format of the Output Data Block

The first 4x word in the output data block passes commands to the ZAE 201 module. It uses its low byte (bits 9 ... 16) to indicate the command type; the high byte (bits 1 ... 8) is not used. The command types and their output data block implementations are mode dependent.
The following table is an output data block representation of counter/positioner commands:

Operating Mode	Command	Hex Value	Low Byte Bit Values
Counter	parameterize	01	0 0 0 0 0 0 0 1
	reset	02	0 0 0 0 0 0 1 0
	clear current count	03	0 0 0 0 0 0 1 1
Positioner	parameterize	01	0 0 0 0 0 0 0 1
	reset	02	0 0 0 0 0 0 1 0
	run reference	04	0 0 0 0 0 1 0 0
	run reference +	05	0 0 0 0 0 1 0 1
	go to target	06	0 0 0 0 0 1 1 0

These commands initiate a process to be carried out by the module and causes the module to change state, sometimes permanently and sometimes temporarily.
The second and third words in the output data block are command dependent. Sometimes they are used to pass needed information to the ZAE 201; other times they may not be used at all. Some commands require more information than can be stored in two words, and in these cases the second word is used as a pointer into state RAM where the requisite number of registers is accessed.

47.2 Using the ZAE 201 Counter/Positioner Module as a High-Speed Counter

At a Glance

Purpose

This section provides an overview of the using the ZAE 201 Counter/Positioner Module as a high-speed counter.

What's in this Section?

This section contains the following topics:

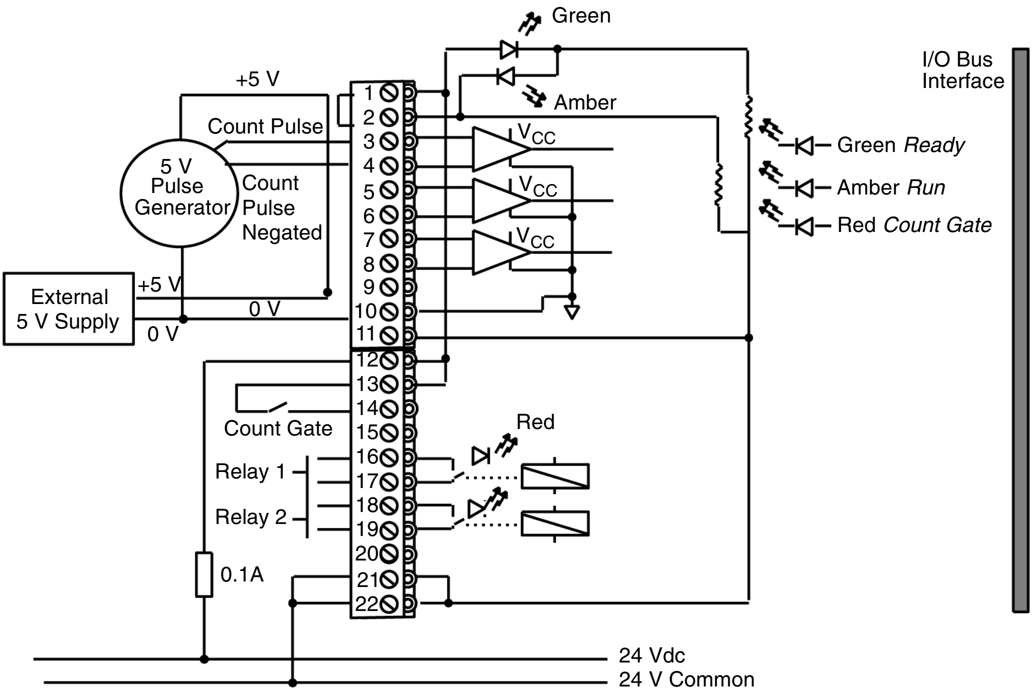
Field Wiring the ZAE 201 for Counting Applications

Field Wiring for Counting Applications

The ZAE 201 module can be field wired for counting applications in three different ways—for 5 V inputs and for 24 V inputs with or without the power monitor jumpered between terminals 1 and 2.

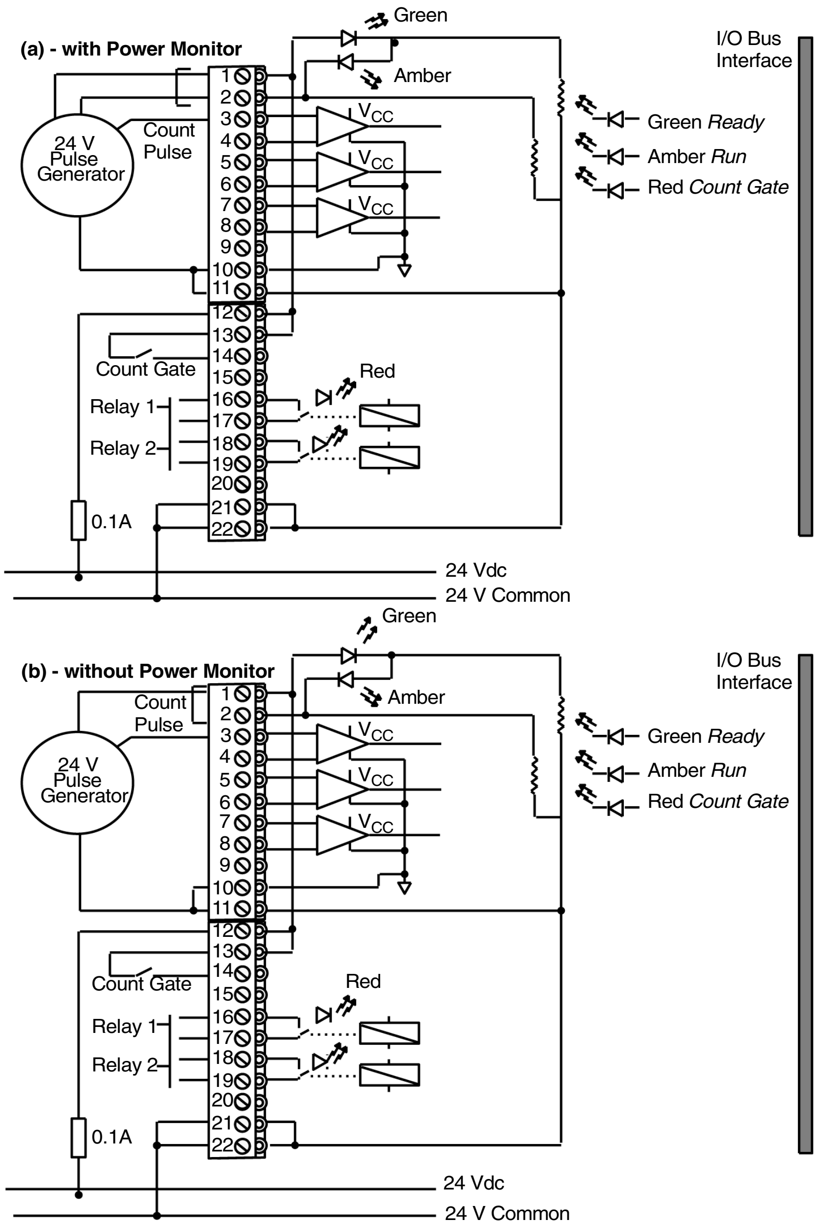
Wiring for Counting with 5 V Inputs

The ZAE 201 can be field wired for counting with 5 V inputs as shown below.



Wiring for Counting with 24 V Inputs

The ZAE 201 can be field wired for counting with 24 V inputs, with or without the power monitor jumpered between terminals 1 and 2 as shown below.



Facts About Field Wiring for Counting Applications

Note: When the jumper between terminals 1 and 2 is removed and when both terminals are field wired, as they are in panel (a) of the previous figure, the amber LED opposite terminal 2 can be used as a power monitor for 24 V input signals. In all other cases, the jumper should be left installed, thus preventing the LED from turning on.

For 24 V operations, a pulse source for the count is field wired to terminal screw 3. For 5 V operations, a differential input is required; pulse source and pulse source must be field wired to terminal screws 3 and 4, respectively. This source is a series of pulses generated by the events being counted.

The counter gate is field wired to terminal screw 14. This gate is used to control the counting operation. When the module is in the READY state and the count gate goes active, the current count held in the data input block is set to 0 and the module starts accumulating a new count.

The two relays that will receive your counter control logic are wired at terminal screws 16 and 18. Counter control logic is very application specific. For example, relay 1 at terminal screw 16 might be connected to an indicator light that is programmed to turn ON when a specified count is reached; at the same time, relay 2 at terminal screw 18 might be used to modify some aspect of the operation being counted when some other count is reached.

Switch Settings for Using the ZAE 201 as a High-Speed Counter

Procedure for Setting Switches

To set a ZAE 201 module up as a high speed counter:

Step	Action
1	Place DIP switch B2 on the back of the module in the left (L) position.
2	Use DIP switch B1 to specify the desired input voltage at the count pulse inputs.
3	Use DIP switch B3 to specify whether the counter gate activity will be HIGH or LOW.

Overview of ZAE 201 Counter Mode Commands and States

Parameterization

When the ZAE 201 has been installed as a counter module and the Compact-984 Controller has been powered up, the ZAE 201 comes up in a NET IN state. In the NET IN state, the module is able to accumulate pulse counts and store current count information in the second and third word of the input data block. The ZAE 201 must be given a set of counter mode parameters before the count gate and relays can operate.

Two parameters—P1 and P2—must be passed to the module. These two parameters are the count values at which relay 1 and relay 2, respectively, are to be either opened or closed. A third bit of information must also be passed to the module defining how the relays are to operate when the count is equal to P1 or P2.

READY and RUN States

Once the module has been parameterized, it goes into a READY state, where it is prepared for normal counting functionality controlled by the counter gate input. When the counter gate is active, the module is in the RUN state where it proceeds with its counting operation.

When the counter gate is not active, the module switches to the READY state where it stops counting and maintains the count that it has accumulated. Activating and deactivating the counter gate switches the module from READY to RUN and back.

RESET

If you need to change the operating parameters without stopping the controller, you can put the module back into a NET IN state at any time by issuing a RESET command.

Single Count and Multiple Count Operations

The relays can operate in either single or multiple count operations.An example of a single count operation might be using the P1 parameter is set to define when relay 1 opens—when the specified count is reached, the relay opens and the count continues.

An example of a multiple count operation might be a relay scheduled to open at a defined count and close when the count reaches 1.25 times the defined count. This operation will continue to open at every multiple of the defined parameter and close at every quarter multiple of that parameter.

ZAE 201Counter Mode Commands

Counter Mode Commands

There are three commands that can be used in the counter mode—parameterize, clear current count, and reset. These commands are implemented in the three-word output data block specified in the I/O Map for the ZAE 201.As described in the following table, not all commands are acceptable at all times to the module:

State	parameterize	clear current counter	reset
NET IN	allowed	allowed	allowed
READY	not allowed	allowed*	allowed
RUN	not allowed	not allowed	allowed
*** Allowed, but has no effect if the module has entered RUN state since being parameterized.**			

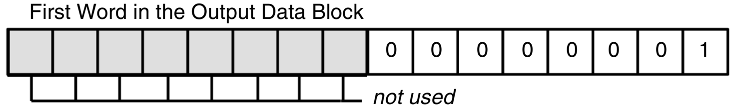
If a command is issued during a state that does not allow that command, an error is reported in the first word of the input data block.

Counter Mode Parameterize Command

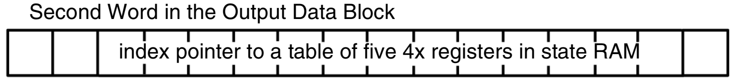
The parameterize command implements the first two words in the output data block.

Output Data Block Format: parameterize Command in Counter Mode

First Word in the Output Data Block



Second Word in the Output Data Block

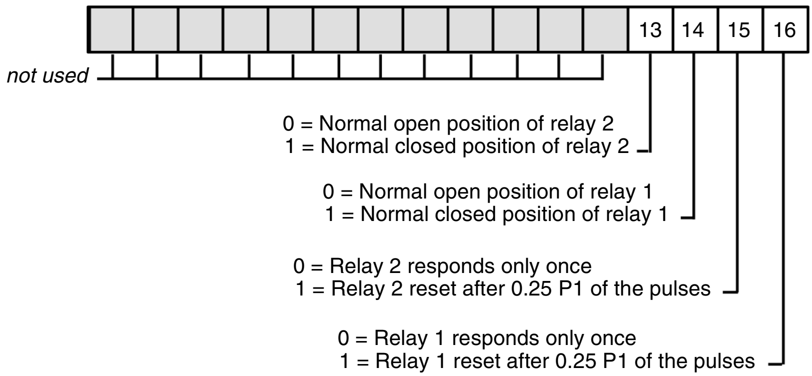


Third Word in the Output Data Block *Not Used*

The second word contains an index into a table of five 4**x** registers in the controller's state RAM. These five registers contain the information necessary to parameterize the module.

The first register in the 4**x** table contains information that defines how the relays will be set and how they will react when the count is met:

The following diagram illustrates how the relays will be set and how they will react when the count is met.

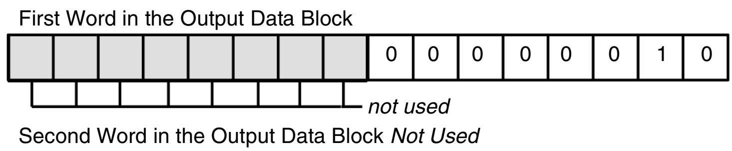


Any values that might appear in bits 1 ... 12 of the register are ignored.
The second and third registers in the 4**x** table contain a hexadecimal representation of P1, the count value controlling relay 1. The value of P1 < 8,388,607. The second register contains the high order part of the hex value, and the third register contains the low order part of the hex value.
The fourth and fifth registers in the 4**x** table contain a hexadecimal representation of P2, the count value controlling relay 2. The value of P2 < 8,388,607. The fourth register contains the high order part of the hex value, and the fifth register contains the low order part of the hex value.
If an error occurs during the issue of the **parameterize** command, the appropriate code will be returned in the first word of the input data block.

Counter Mode reset Command

The reset command implements only the first word in the output data block.

Output Data Block Format: reset Command in Counter mode

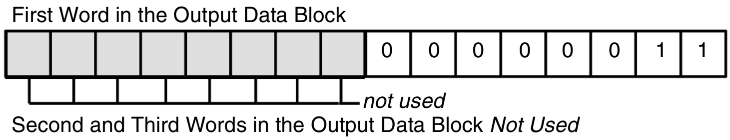


There are no errors associated with this command. If the module is in a RUN or READY state when the reset command is issued, the module will be put into a NET IN state. If the module is already in NET IN when the command is issued, nothing will happen.

Counter Mode clear current count Command

The clear current count command implements only the first word in the output data block, as shown in the graphic below.

Output Data Block Format: clear current count Command in Counter Mode

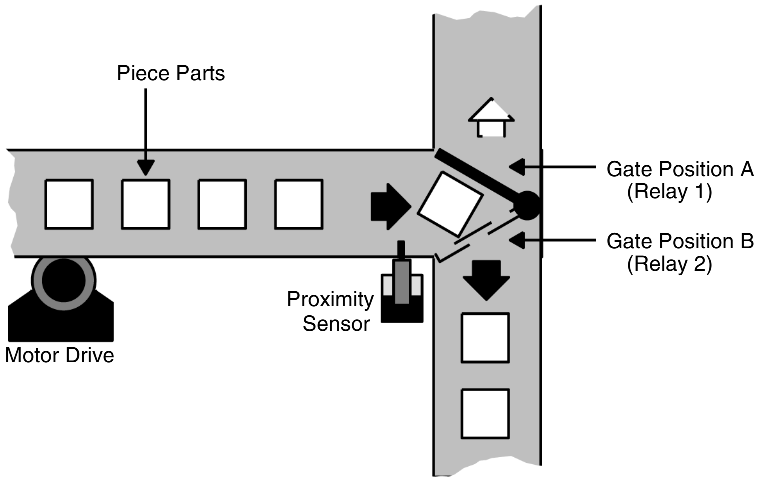


The only potential error associated with this command will be flagged if you issue it while the module is in RUN mode.

Example: Using the ZAE 201 as a High-Speed Counter

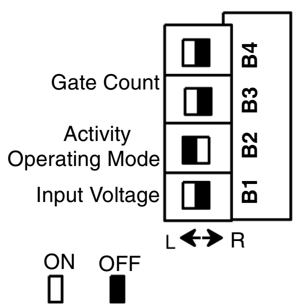
Overview

This system carries piece parts along a motor-driven conveyor line. The line continues to a diverting mechanism that sends parts to either the right (R) or left (L) into separate bins. The ZAE 201 Counter will enable the system to be controlled such that the gate will switch positions after every 4,000 pieces.
The following diagram illustrates a conveyer system application example.



Counter Example DIP Switch Settings

Set the DIP switches on the back of the module for COUNTER mode, 5 V input voltage, and LOW activity on the count gate.
The following diagram illustrates this procedure.



Counter Example Traffic Cop Settings

Traffic cop the drop to support the system with the ZAE 201 high speed counter, a DAP 216 discrete output module, and a DEP 216 discrete input module:

Service ↓Comm DelDrop Quit
F1 F2 F3 F4 F5 F6 F7 F8 OFF F9

TRAFFIC COP
984-128/138/145 CONTROLLERS

Drop : 1 (1) Rack : 1
Number Inputs : 64 Number Outputs : 64

Slot	Module Type	Reference Numbers Input	Output	Data type	Module Description
101	984				PC -145 POWERSUPPLY
102	984				PC -145 POWERSUPPLY
103	ZAE201	30001 - 30003	40001 - 40003	BIN	COUNTER/POSITION
104	DAP216		00001 - 00016		16 - OUT 24VDC
105	DEP216	10001 - 10016			16 - IN 24VDC

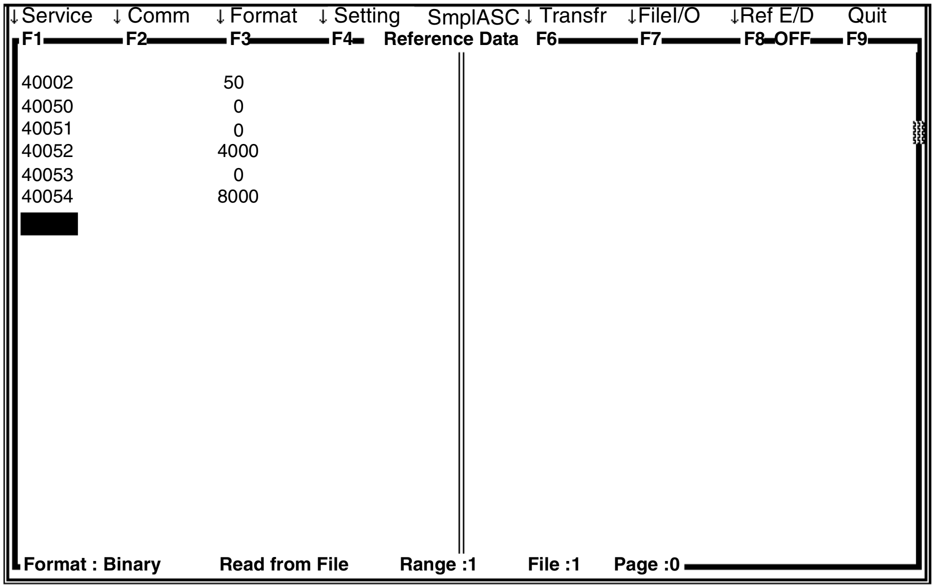
Counter Example Coil Use

The following coils will be implemented in the example counting operation:

Usage	Coil	Function
External (DAP 216)	00001	Control coil for gate position A (at DAP 216 terminal screw 3)
	00002	Control coil for gate position B (at DAP 216 terminal screw 4)
	00007	Control coil for the count gate, the FKE input (at terminal screw 14)
Internal	00017	Logic solve coil—when ON, ladder logic is being solved
External (DEP 216)	10009	State of Relay 1 output from ZAE 201
External (DEP 216)	10011	State of Relay 2 output from ZAE 201

Counter Example Parameterization

Go to the reference editor by pressing <ALT><F2>, and edit register values to parameterize the ZAE 201 high speed counter:



Set register 40002 to a decimal value of 50; this indicates a pointer to a block of five 4**x** registers starting at 40050. (Do not set values in register 40001 manually—this will be done by the user logic.)

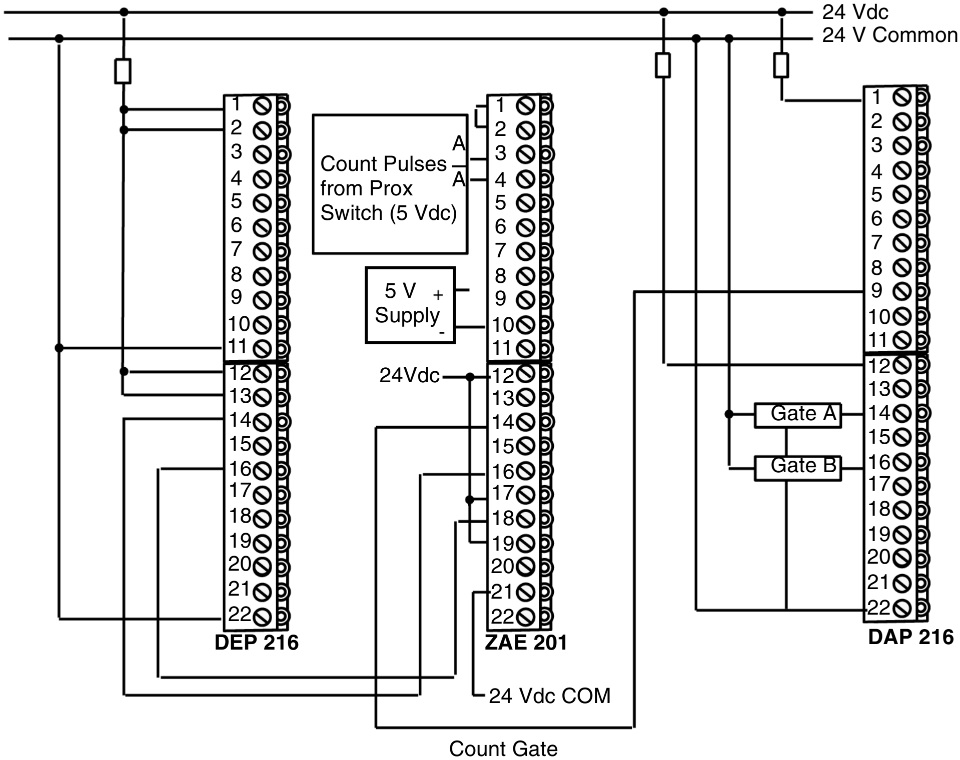
The values you set in the table registers indicate:

- Relays 1 and 2 are normally open and provide one–shot responses, since the four least significant bits in register 40050 are all set to 0
- The high order word value for relay 1, as expressed in register 40051, is 0
- The low order word value for relay 1, as expressed in register 40052, is 4,000 (FA0 in hex)
- The high order word value for relay 2, as expressed in register 40053, is 0
- The low order word value for relay 2, as expressed in register 40054, is 8,000 (1F40 in hex)

These parameterizing values will cause Relays 1 and 2 to close at the count values of 4000 and 8000, respectively.

Counter Example Field Wiring Diagram

The discrete modules will be used to control the mechanics of the switching gate. Field wire the three A120 I/O modules like this:



47.3 Using the ZAE 201 Counter/Positioner Module as a Positioning Controller

At a Glance

Purpose

This section provides an overview of the using the ZAE 201 Counter/Positioner Module as a positioning controller.
The ZAE 201 does not **control** speed, but provides relay outputs that indicate when speed should be changed. The actual control of speed must be provided by the user (ladder or hardware) logic—the module itself does not control the speed. Similarly, the ZAE 201 does not control direction; this is also a function of user-defined logic (ladder or hardware).

What's in this Section?

This section contains the following topics:

Field Wiring for ZAE 201 Positioning Applications

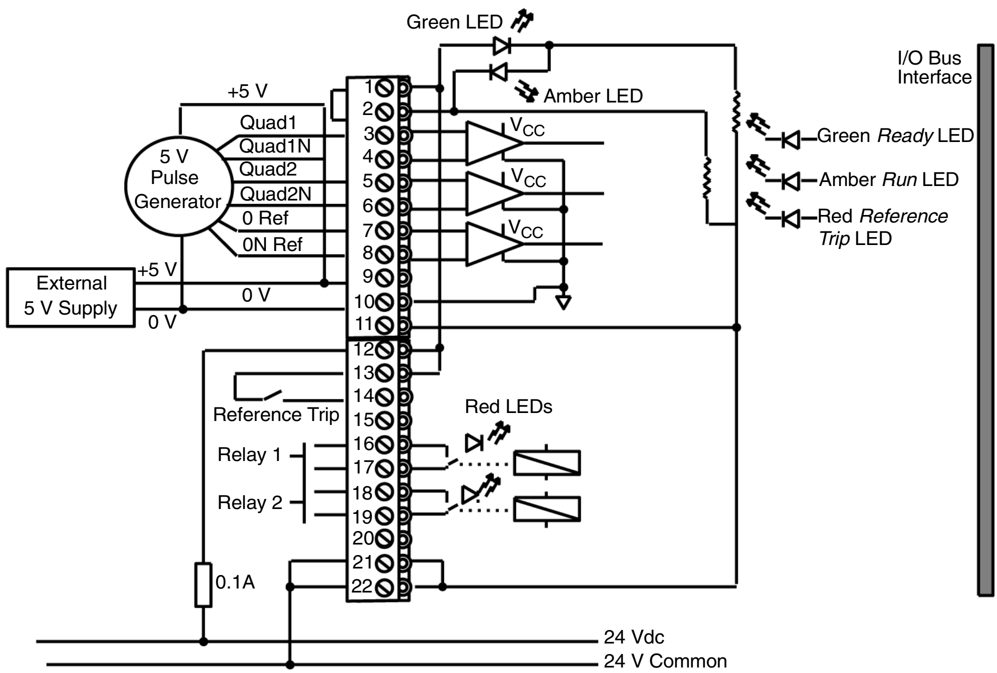
Field Wiring for Positioning Applications

The ZAE 201 module can be field wired for positioning applications in three different ways—for 24 V inputs with or without the power monitor jumpered between terminals 1 and 2, and for 5 V inputs.

> **Note:** When the jumper between terminals 1 and 2 is removed and when both terminals are field wired, as they are in Figure 18 (a), the amber LED opposite terminal 2 can be used as a power monitor for 24 V input signals. In all other cases, the jumper should be left installed.

Wiring a ZAE 201 Module for Positioning with 5 V Inputs

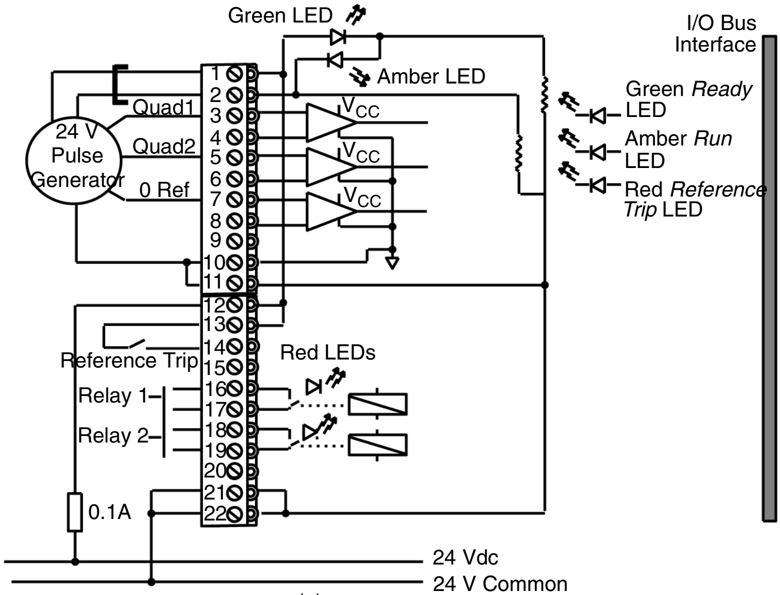
The ZAE 201 can be field wired for positioning applications with 5 V inputs as shown here.



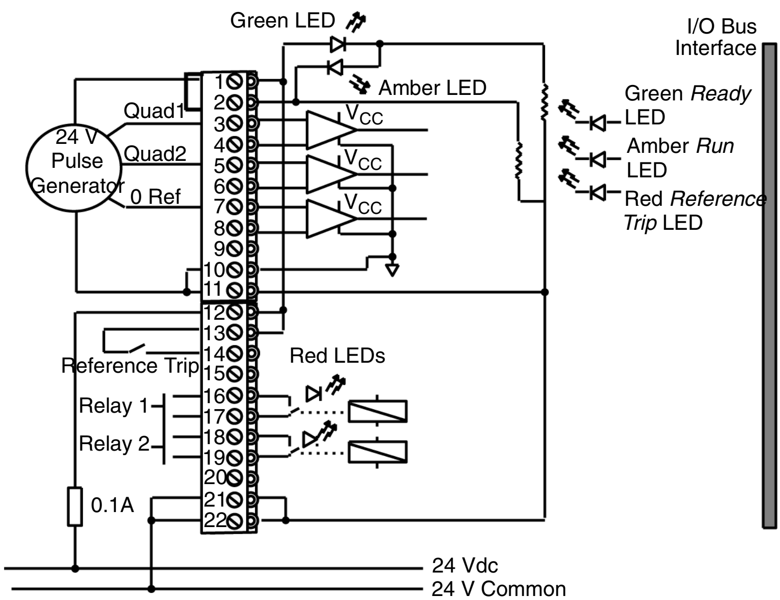
The direction of motion and speed are user defined. The ZAE 201 provides relay outputs that indicate when speed should be changed.

Wiring a ZAE 201 Module for Positioning with 24 V Inputs

The ZAE 201 can be field wired for positioning applications with monitoring as shown in (a), and without (b).



(a)



(b)

Position Control

For 24 V operations, a ZAE 201 positioning module requires three input signals from an incremental encoder to maintain absolute position—two quadrature pulse inputs connected at terminal screws 3 and 5 provide position and direction, and a third signal connected at terminal screw 7 provides a single pulse on every rotation of the encoder.

For 5 V operations, differential inputs are required; a ZAE 201 positioning module must be wired at six terminal screws:

- **Quad pulse 1** and **quad pulse 1** at terminal screws 3 and 4, respectively
- **Quad pulse 2** and **quad pulse 2** at terminal screws 5 and 6, respectively
- The **0 reference** and **0 reference** at terminal screws 7 and 8, respectively

The pulse signal combined with the reference trip input at terminal screw 14 define 0 for the linear travel route being controlled by the module.

The **reference trip input** is derived from the output of some type of proximity sensor placed at a position defined as 0. On command, the object under control is passed by the proximity switch. By logically ANDing the rotational pulse from the encoder with the signal from the proximity switch, you define 0 and maintain the position value of 0 within the module.

Position control is handled by user-defined discrete logic that controls a drive motor based on information provided by the Compact-984 Controller. Relays 1 and 2 on the ZAE 201 module control motor speed in the following manner, depending on whether the **parameterize** command has been set for overlapping mode or alternating mode pulse reception:

Overlapping Mode

- Both relays ON — fast speed
- Relay 1 OFF and relay 2 ON — slow speed
- Both relays OFF — stop drive motor

Alternating Mode

- Relay 1 ON and relay 2 OFF — fast speed
- Relay 1 OFF and relay 2 ON — slow speed
- Both relays OFF — stop drive motor

Motor direction must be controlled by other logic, typically by a discrete output module or ladder logic that drives a D/A converter—e.g., a DAU 202.

Switch Settings for Using the ZAE 201 as a Positioning Controller

Switch Settings

To set a ZAE 201 module up as a one-axis positioning controller, place DIP switch B2 on the back of the module in the right (R) position, use DIP switch B1 to specify the desired input voltage at the encoder inputs, and use DIP switch B3 to specify whether the reference trip activity will be HIGH or LOW.
The ZAE 201's maximum allowable positions are limited to a range between -8,388,607 and +8,388,607.

Note: The ZAE 201 does not control speed, but provides relay outputs that indicate when speed should be changed. The actual control of speed must be provided by the user (ladder or hardware) logic-the module itself does not control the speed. Similarly, the ZAE 201 does not control direction; this is also a function of user-defined logic (ladder or hardware).

Overview of ZAE 201 Positioning Mode Commands and States

Parameterization

When the ZAE 201 has been installed as a positioning module and the Compact-984 Controller has been powered up, the ZAE 201 comes up in a NET IN state. In the NET IN state, the module is unable to conduct any position control operations. It must be given a set of positioner mode parameters before it becomes a functioning module.

The process involves the setting of three positioning parameters—P1, P2, and P3—which describe how the two relays will manage motor speed as the target position is approached, These parameters are unsigned numbers that refer to three different distances from the target position.

For example, in overlapping mode, P1, P2, and P3 are values that must be defined based on the dynamics of the operation being controlled. When the distance from the target position reaches the value defined as P1, relay 1 is opened and the drive motor speed begins to be reduced. When the distance from the target position reaches the value defined as P2, relay 2 is opened and the drive motor is turned OFF; when the motor is turned OFF, the operation coasts to a stop. P3 defines an acceptable region on either side of the target position where you plan to stop the system.

Two additional bits of information must be passed to the module during the parameterization process. The first specifies the relay operation as a function of P1 and P2; the other specifies the speed at which the reference point will be approached.

Running a Reference Point

After the ZAE 201 has been parameterized for positioning mode, the module is not yet able to perform motion control until it has undergone a procedure called **running a reference point**. This procedure defines the 0-point on the axis of travel. It requires the issuing of the **run reference point** command in the output data block in order to drive the system toward the 0-position (defined by a proximity sensor) and set the position value in the module to 0 when that point is reached.

The direction of motion is totally user-controlled.

The READY State

After you have completed running a reference point, the ZAE 201 module enters the READY state for positioning operations. At this point, motion control can be enacted by simply requesting that the module drive the system to a particular coordinate.

RESET

If you need to change the operating parameters, you can put the module back into a NET IN state at any time by issuing a **reset** command.

The ZAE 201 Positioning Mode Commands

Overview

As shown in the following table, there are five commands that can be used in the positioning mode—**parameterize**, **reset**, **run reference point**, **run reference point +**, and **go to target**. These commands are implemented in the three-word output data block specified in the I/O Map for the ZAE 201. Before ordering encoders, ensure they comply with the A, B, and Z pulses shown in the Specifications section. Not all commands are acceptable at all times to the module:
The following table summarizes command and state compatibilities in positioner mode.

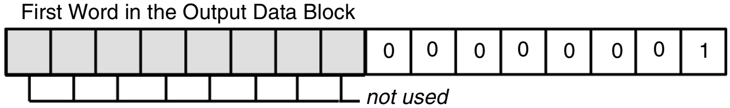
State	**parameterize**	**reset**	**run ref**	**run ref +**	**go to target**
NET IN	allowed	allowed	not allowed	not allowed	not allowed
PARAM	not allowed	allowed	allowed	not allowed	not allowed
READY	not allowed	allowed	not allowed	allowed	allowed
RUN FAST	not allowed	allowed*	not allowed	not allowed	not allowed
RUN SLOW	not allowed	allowed*	not allowed	not allowed	not allowed
RUN HUNT	not allowed	allowed*	not allowed	not allowed	not allowed
* Allowed but can cause current motion to stop by opening both relays.					

If a command is issued during a state that does not allow that command, an error is reported in the first word of the input data block.

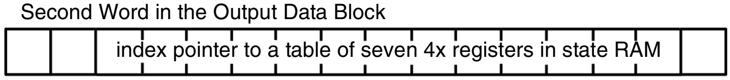
Positioning Mode parameterize Command

The **parameterize** command implements the first two words in the output data block:
Output Data Block Format: parameterize Command in Positioner Mode

First Word in the Output Data Block



Second Word in the Output Data Block

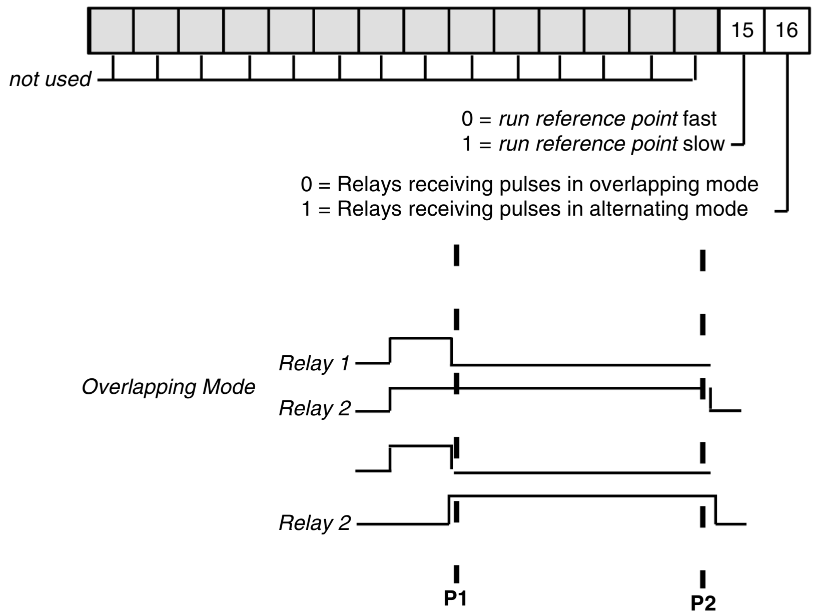


Third Word in the Output Data Block *Not Used*

The second word contains an index into a table of seven 4**x** registers in the controller's state RAM. These seven registers contain the information necessary to parameterize the module.

4[x] Table

The first register in the 4**x** table contains information that defines the operation of the relays during motion to a target position and the speed at which a **run reference point** is executed.
The following diagram illustrates this procedure.



Any values that might appear in bits 1 ... 14 of the register are ignored.
The second and third registers in the 4**x** table contain a hexadecimal number that defines P1—the distance from the target position at which the motor speed should slow down. The value of P1 **<** 8,288,607. The second register contains the high order part of the hex value; the third register contains the low order part of the hex value.
The fourth and fifth registers in the 4**x** table contain a hexadecimal number that defines P2—the distance from the target position at which the motor should turn OFF. The value of P2 **<** 8,288,606. The fourth register contains the high order part of the hex value; the fifth register contains the low order part of the hex value.
The sixth and seventh registers in the 4**x** table contain a hexadecimal number that defines P3—the distance from the target position that is deemed within acceptable tolerance of the desired position. The value of P3 **<** 8,288,605. The sixth register contains the high order part of the hex value; the seventh register contains the low order part of the hex value.

Positioning Mode Motion Completion

CAUTION

Possible need to reset.

If the motion never achieves the target tolerance, the ZAE 201 will never report the motion completed—no further motion commands can be given without resetting the module.

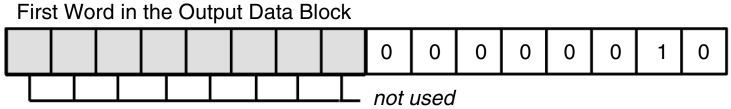
Failure to follow this precaution can result in injury or equipment damage.

Positioning Mode reset Command

The **reset** command implements only the first word in the output data block:

Output Data Block Format: *reset* Command in Positioner Mode

First Word in the Output Data Block



Second and Third Words in the Output Data Block *Not Used*

There are no errors associated with this command. If the module is in a RUN or READY state when the **reset** command is issued, the module will be put into a NET IN state. If the module is already in NET IN when the command is issued, nothing will happen.

Note: The reset can be used as an emergency stop for any motion.

Positioning Mode run reference point Command

The **run reference point** command is used to define a 0-point along the range of motion available to the system being controlled. The system is driven in the direction of a 0-point that has been predefined by a proximity sensor before issuing the command. When the system reaches the 0-point, the module defines its 0 reference location as this point.

The **run reference point** command implements only the first word in the output data block:

Output Data Block Format: *run reference point* Command in Positioner Mode

First Word in the Output Data Block

not used	not used	not used	not used	not used	not used	not used	not used	0		0	0	0	1	0	0

Second and Third Words in the Output Data Block *Not Used*

This command must be issued as part of the parameterization process and is valid only when the module is in a parameterized but not READY state.

Positioning Mode go to target Command

The **go to target** command is the major motion command used in the positioning mode; it implements all three words in the output data block:

Output Data Block Format: *go to target* Command in Positioner Mode

First Word in the Output Data Block

not used	not used	not used	not used	not used	not used	not used	not used	0	0	0	0	0	1	1	0

Second Word in the Output Data Block

signed hex position value (high order)

Third Word in the Output Data Block

signed hex position value (low order)

When you issue the **go to target** command, you tell the ZAE 201 module to drive the system under control to a position specified by a hexadecimal number entered in the second and third words of the output data block. The value of that hex number is in the range -8,388,608 ... +8,388,607. The direction of motion may be positive or negative; anticipated direction must be specified in user logic and transmitted to the position control logic during the same cycle that the **go to target** command is issued.When a **go to target** command is received, bit 1 in the first word of the input data block is set to 1; the bit remains set until the target is reached and the READY state is reached. No further motion commands are permitted while the busy bit is set.

The **go to target** command is valid only while the ZAE 201 is in the READY state.

Positioning Mode run reference point + Command

The **run reference point +** command implements all three words in the output data block:

Output Data Block Format: ***run reference point*** **+ Command in Positioner Mode**

First Word in the Output Data Block

								0	0	0	0	0	1	0	1

Second Word in the Output Data Block

signed hex position value (high order)															

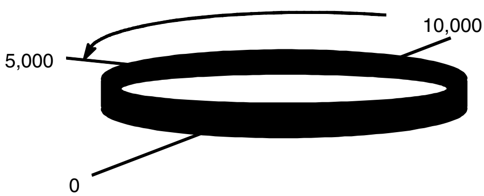
Third Word in the Output Data Block

signed hex position value (low order)															

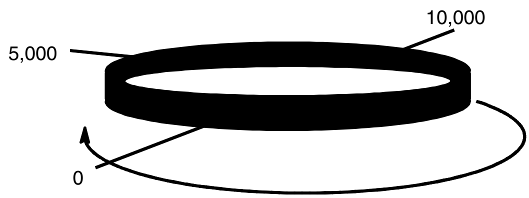
When you issue the **run reference point +** command, you tell the ZAE 201 module to drive the system under control in a positive direction to a position specified by a hexadecimal number entered in the second and third words of the output data block. The value of that hex number is in the range -8,388,608 ... +8,388,607. In order for this command to be satisfied, the system under control must be driven **through** the 0 reference point.

The **run reference point +** command is designed specifically for systems that continually return to the 0 reference point when driven in a positive direction—e.g., a continuous belt-driven machine. In this type of system, where all positions are defined as positive offsets of the predefined 0-point, the command may be used as an alternative to the **go to target** command for sending the system a target. If, for example, you want to move a system currently located at position 10,000 to target position 5,000, you may proceed to the target in either the positive or negative direction:

- To proceed in the negative direction, issue the **go to target** command to target position 5,000:



- To proceed in the positive direction, issue the **run reference point +** command to target position 5,000:



In the second case, the **run reference point +** command moves the system forward to the 0 reference point, resets the count to 0, then continues system movement positively to target position 5,000.

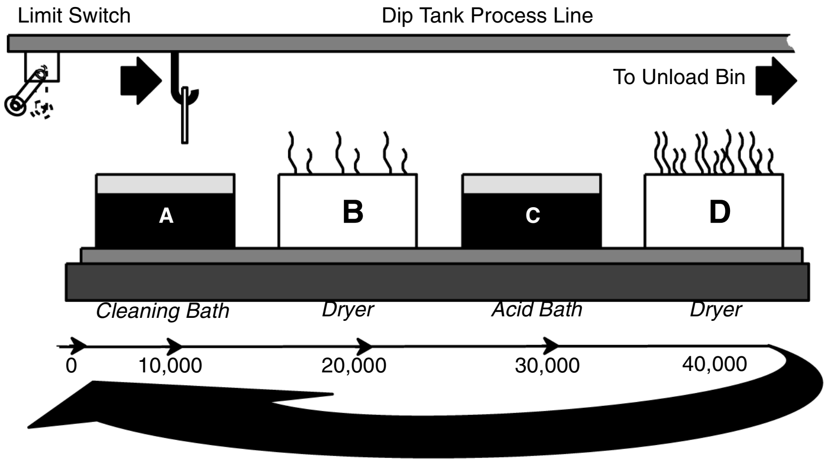
When a **run reference point +** command is received, bit 1 in the first word of the input data block is set to 1; the bit remains set until the target is reached and the READY state is reached. No further motion commands are permitted while the busy bit is set.

The **run reference point +** command is valid only while the ZAE 201 is in the READY state.

Example: Using the ZAE 201 Module as a Positioner

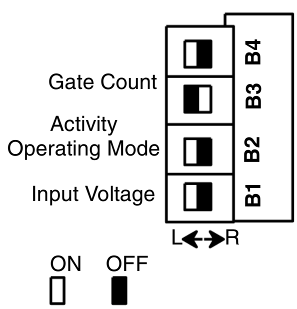
Positioning Example

The ZAE 201 module is used to control horizontal positioning in the following example. The system is a process line where printed circuit boards are dipped into a series of four tanks. In the positioning mode, the ZAE 201 carry the PCBs along the process line, position them over each of the four stations, and move them to the unload position at the end of the line. The example treats only the horizontal movement portion of the application; it does not treat vertical dipping motions.



Positioner Example DIP Switch Settings

Set the DIP switches on the back of the module for POSITION mode, 5 Vdc input voltage, and HIGH activity on the count gate:



Positioner Example Traffic Cop Settings

Traffic cop the drop to support the system with the ZAE 201 positioning module with a DAU 202 analog output module and a DAP 220 24 Vdc combo I/O module:

Service Comm DelDrop Quit
F1 F2 F3 F4 F5 F6 F7 F8 OFF F9

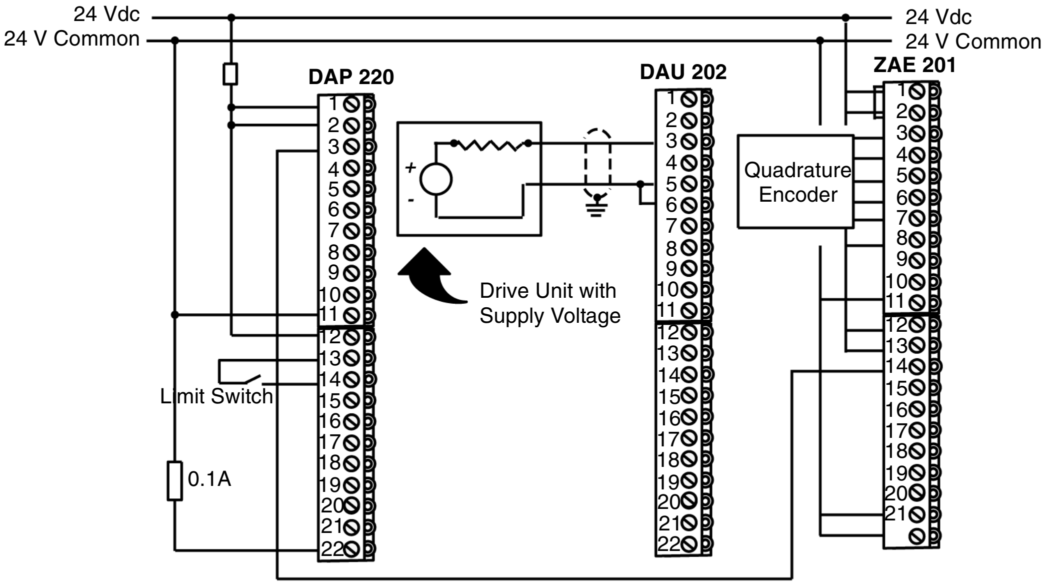
TRAFFIC COP
984-120/130/145 CONTROLLERS

Drop : 1 (1) Rack : 1
Number Inputs: 56 Number Outputs: 88

Slot	Module Type	Reference Numbers Input	Reference Numbers Output	Data Type	Module Description
101	984				PLC-145
102	984				PLC-145
103	DAP220	10001 - 10008	00001 - 00008		8-IN 8-OUT 24V
104	DAU202		40150 - 40151	BIN	2 CHANNEL D/A
105	ZAE201	30001 - 30003	40101 - 40103	BIN	POSITION/HS COUNT

Positioner Example Field Wiring Diagram

Field wire the two A120 I/O modules like this:



Positioning Example Ladder Logic

The following ladder logic program automatically parameterizes the module upon power-up and then repeatedly directs the motion:

- Relays 1 and 2 are normally open and provide one-shot responses, since the four least significant bits in register 40120 are all set to 0
- The high order byte value for P1—the distance from the target location at which the motor drive will begin to slow the process—is expressed in register 40121 as 0
- The low order byte value for P1 is expressed in register 40122 as 1,000
- The high order byte value for P2—the distance from the target location at which the motor drive will stop—is expressed in register 40123 as 0
- The low order byte value for P2 is expressed in register 40124 as 500
- The high order byte value for P3—the acceptable distance from the target location—is expressed in register 40125 as 0
- The low order byte value for P3 is expressed in register 40126 as 250

Positioning Example State RAM Values

The following values, initialized in State RAM, will enable the positioning example to operate using the logic, traffic cop, and module connections as described in the following tables.

Data Blocks

Parameterize Data Blocks

40120	0	Parameterize Data
40121 40122	0 1000 Decimal	P1 Value
40123 40124	0 500 Decimal	P2 Value
40125 40126	0 250 Decimal	P3 Value

Motion Direction Data Block

40130 40131 40132 40133 40134 40135	32 32 32 32 32 64	These registers, when moved to call group 00001 - 00016, set Coil 10 or 11, specifying the direction of motion.
40099	0	Pointer to table of direction bits
40140	0	Pointer to table of motion commands
40100	1	Command data for parameterized command, pointing to a table starting with register 40120. This command will be active at the end of the first scan.
40101	120	
40102	0	

Motor Speed, Direction, Motion Commands

Motor Speed And Direction Values

40160	4096 (+10 V)	One of these values is moved to register 40150, which is I/O mapped to the DAU 202. The output of the DAU 202 will control the motor speed and direction. NOTE: The specific values used here are application-dependent.
40161	3072 (+5 V)	
40162	2048 0	
40163	1024 (-5 V)	
40164	0 (-10 V)	

Motion Command Table

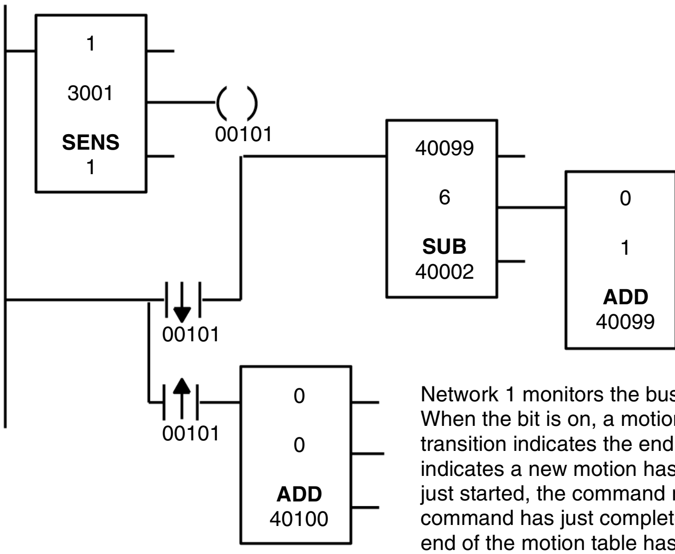
40200	4	Run reference point command data
40201	0	
40202	0	
40203	6	Move to position 10,000 command data
40204	0	
40205	2710 Hex	
40206	6	
40207	0	20,000
40208	4E20 Hex	
40209	6	
40210	0	30,000
40211	7530 Hex	
40212	6	
40213	0	40,000
40214	9C40 Hex	
40215	6	
40216	0	0
40217	0	

Positioning Example Network Diagrams

In the example shown here, the HOME proximity switch is simulated by disabling Coil 00001 and momentarily forcing it ON and then OFF, while the Run Reference Point command is being executed. This toggles the FKE input to the ZAE 201 via the DAP 220.

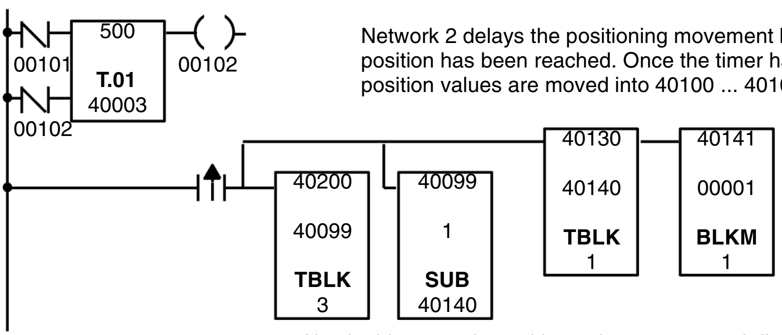
Networks 1 and 2 The following diagram describes Networks 1 and 2.

NETWORK 1



Network 1 monitors the busy bit in status Register 30001. When the bit is on, a motion is in progress. A negative transition indicates the end of a motion; a positive transition indicates a new motion has started. If a new motion has just started, the command register is cleared. If the motion command has just completed, a check is made to see if the end of the motion table has been reached (40099 = 6); if so, the pointer to the motion table is reset to 1.

NETWORK 2

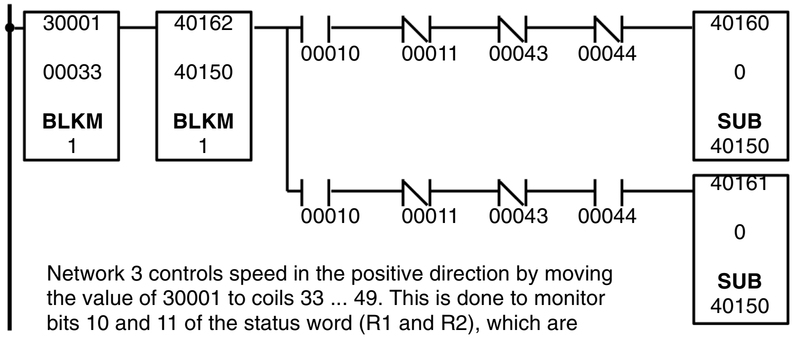


Network 2 delays the positioning movement by 5 s after each new position has been reached. Once the timer has timed out, the new position values are moved into 40100 ... 40102.

Also in this network, position pointer 40099 and direction pointer 40140 are incremented by 1 as part of the TBLK function block.

Networks 3 and 4 The following diagram describes Networks 3 and 4.

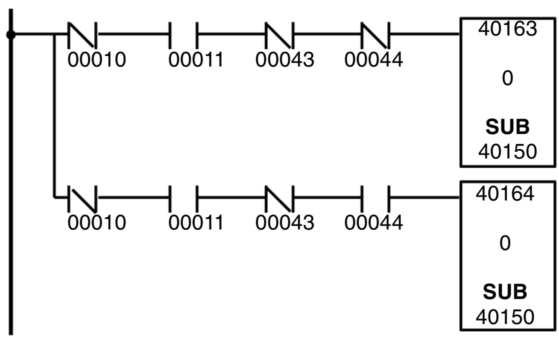
NETWORK 3



Network 3 controls speed in the positive direction by moving the value of 30001 to coils 33 ... 49. This is done to monitor bits 10 and 11 of the status word (R1 and R2), which are placed in coils 43 and 44. When P1 and P2 are reached, the system will change speeds appropriately (normal speed to slow speed, then slow speed to stop). Coils 10 and 11 define the direction of motion.

The BLKM of registers 40162 ... 40150 assumes no motion will occur. Subsequent logic sets up the appropriate speed.

NETWORK 4



Network 4 is similar to Network 3, but controls speed in the negative direction.

47.4 Specifications of the ZAE 201 Counter/Positioner Module

Specifications of the ZAE 201 Counter/Positioner Module

Purpose

The purpose of this section is to list technical specifications of the module.

ZAE 201 Counter/ Positioner Specifications

Module Topology

Number of Relay Outputs	2
Operating Modes	Switch-selectable counter/positioner

Power Supplies

External Power Source (for all operating modes)	24 Vdc, 30 mA
Internal Power Source from I/O Bus	5 V, 100 mA maximum

Electrical Characteristics

<table>
<tr><td colspan="2" rowspan="2">Working Voltage Range of Relays</td><td>24 ... 60 Vdc</td></tr>
<tr><td>24 ... 250 Vac</td></tr>
<tr><td rowspan="6">Contact Current (maximum)</td><td rowspan="3">Load Currents @ 230 Vac</td><td>2 A continuous resistive</td></tr>
<tr><td>4 A instantaneous resistive</td></tr>
<tr><td>1 A continuous (Cos Φ = 0.5)</td></tr>
<tr><td rowspan="3">Load Currents @ 24 Vdc</td><td>2 A continuous resistive</td></tr>
<tr><td>4 A instantaneous resistive</td></tr>
<tr><td>1 A continuous (L/R* = 30 ms)</td></tr>
<tr><td colspan="2">Wetting Current</td><td>5 mA (relay outs)</td></tr>
<tr><td colspan="2">Contact Delay Time</td><td>~10 ms</td></tr>
<tr><td colspan="2">Protective Circuitry</td><td>68 Ω + 15 nF in parallel with the contact
Consumes ~1 mA</td></tr>
<tr><td rowspan="4">Maximum Wire Length</td><td rowspan="2">from 24 V Pulse Generator</td><td>20 m</td></tr>
<tr><td>65 ft</td></tr>
<tr><td rowspan="2">from 5 V Pulse Generator</td><td>50 m</td></tr>
<tr><td>163 ft</td></tr>
<tr><td colspan="3">* L = Load Inductance in H R = Load Resistance in Ω</td></tr>
</table>

Input Characteristics

5 V Input Selection	Differential RS-422	12 V peak-to-peak maximum
		400 mV peak-to-peak minimum
24 V Input Selection	for 1 signal	12 ... 30 V
	for 0 signal	-2 ... +5 V
Maximum Count Frequency	for 5 V input	500 kHz
	for 24 V input	50 kHz
PNP Encoder Quadrature type		Two-track plus marker signal
Count Gate/Reference Trip		1 = 12 Vdc (min)
		0 = 5 Vdc (max)
Encoder Pulse Alignment		See diagram below.
Duration		> 10 ms
Rise Time		N/A

Relay Contact Service Life

Mechanical Switching Cycles		20,000,000
Electric Switching Cycles (Resistive Load)	@ 230 Vac/0.2 A	10,000,000
	@ 230 Vac/0.5 A	7,000,000
	@ 30 Vdc/2 A, clamping diode	8,000,000 (typical)
	@ 60 Vdc/1 A with clamping diode	1,000,000 typical
		3,000,000 maximum
		3000 cycles/hr maximum
Electric Switching Cycles (Inductive Load, Cos Φ = 0.5)	@ 230 Vac/ 0.5 A	5,000,000

I/O Map

Register 3x/4x	3 in/3 out

Dimensions

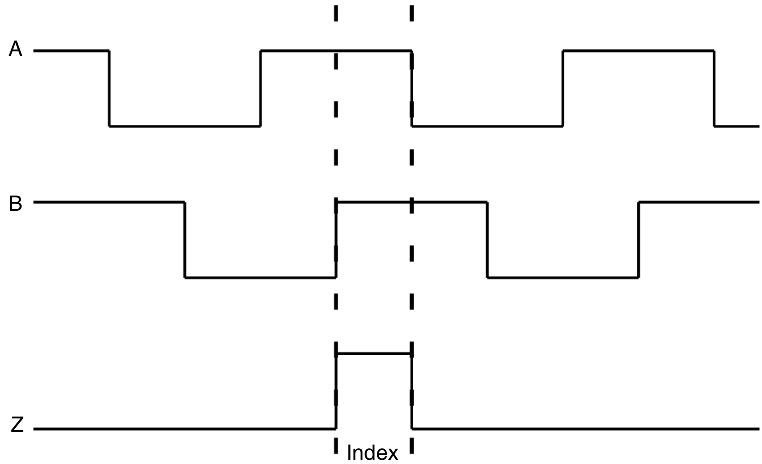
W x H x D	40.3 x 145 x 117.5 mm
	1.6 x 5.6 x 4.5 in
Weight	300 g
	0.7 lb

Agency Approvals

VDE 0160; UL 508; CSA 22.2 No.142; and FM Class I, Div 2 Standards

Pulse Alignment of Encoders Used with the ZAE 201 Module

Encoders used with the ZAE 201 module should be ordered with the alignment of A, B and Z pulses as shown below.



Encoders used with the ZAE-201 module should be ordered with the alignment of A, B + Z pulses as shown above.

Overview of the ZAE 204 High-Speed Counter Module

48

At a Glance

Purpose

The purpose of this chapter is to describe the ZAE 204 High-Speed Counter Module.

	WARNING
⚠	**Compatibility** The ZAE 204 module will only operate properly when used with an A984, E984, or Micro 512/612 controller. **Failure to follow this precaution can result in death, serious injury, or equipment damage.**

What's in this Chapter?

This chapter contains the following topics:

What is the ZAE 204 High-Speed Counter Module?

Brief Product Overview

The ZAE 204 is a high speed counter module with the following characteristics:
- Four counter inputs for counting 5 Vdc (TTL) and 24 Vdc pulses; a counting range of 5 decades; and a counting frequency of up to 1 kHz (channel 1 can operate up to 10 kHz)
- Four 24 Vdc count enable inputs
- Four 24 Vdc semiconductor output switches, 0.5 A each, with short circuit/ overload protection and hardware reset

Power required by the module is:
- 5 Vdc via the internal I/O bus
- 24 Vdc external supply for 24 V counting inputs, outputs, and enable inputs

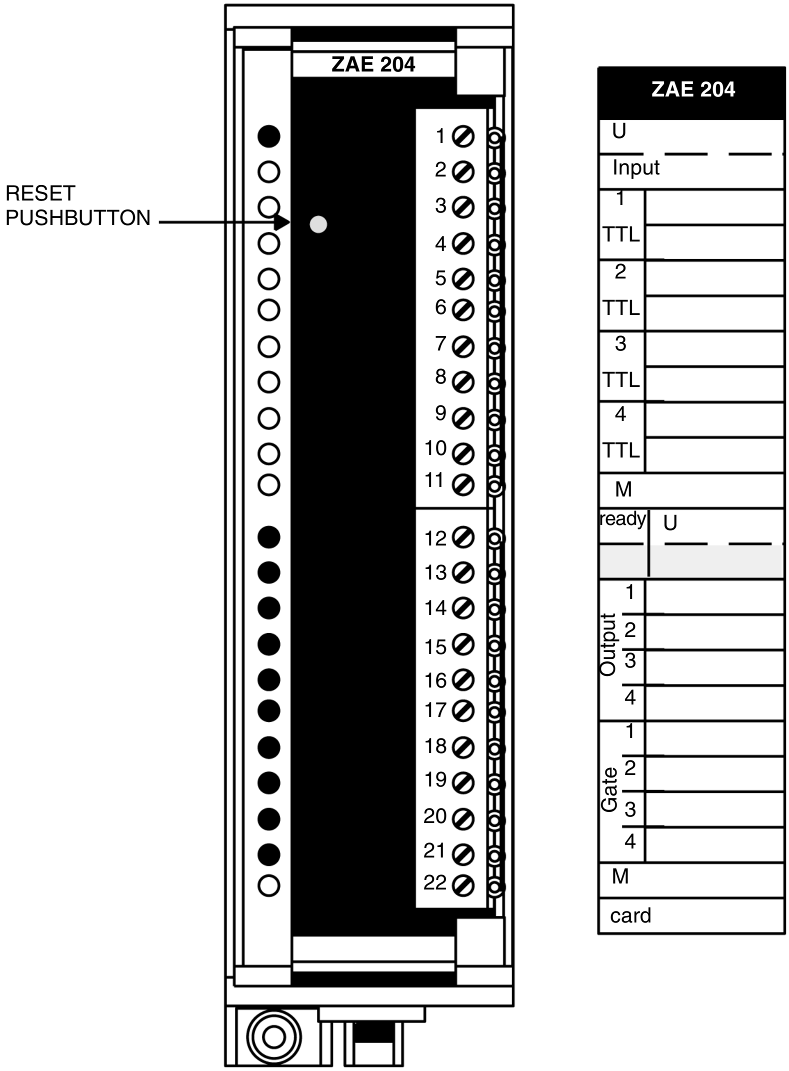
The ZAE 204 can be installed in any slot in the A120 subracks (DTA 200, 201, and 202). The module has bus contacts at the rear and field connections on the front. The blank label, which fits in the module cover, can be filled in with relevant information (signal values, etc.) in the spaces provided. Refer to *ZAE 204 Diagram, p. 601* below.

The ZAE 204 is made up of 4 independent counters for the following modes:
- Event counter
- Repeat counter
- Differential counter

The above operating modes and the parameters required for them are preset by the user program. See *Operation of the ZAE 204 Module, p. 617* for a description of these modes.

ZAE 204 Diagram

Any output that is overloaded or short-circuited is switched OFF, and is indicated by the amber fault LED (see next section (See *Operating and Display Elements of the ZAE 204 High-Speed Counter Module, p. 602*)). Correction is made by use of the RESET button as shown in the front view and label diagram below.



Operating and Display Elements of the ZAE 204 High-Speed Counter Module

ZAE 204 LEDs

The ZAE 204 has eleven LEDs on the front of the module. From top to bottom, they are:

Color	Type	Function
Green	Power	External 24 Vdc—when lit, power ON; when off, power OFF
Green	Ready	When lit, indicates firmware initialization is complete and module is ready for service; when off, indicates start-up functions are not complete and module is not yet ready. **Note**: The PLC must be running for this LED to illuminate.
Amber	Fault	Indicates the presence of an overload or short-circuit at one or several output points. When lit, indicates an overload or short circuit; when off, no faults detected.
Red	Output 1 ... 4	Located opposite terminal screws 14 ... 17. When lit, these LEDs indicate that the outputs are ON.
Red	Gate 1 ...4	Located opposite terminal screws 18 ... 21. When lit, these LEDs indicate that the enable inputs (function gate) have a high signal level voltage applied to them.

The RESET button is used to restore the operation of an output switch after the overload condition has been removed.

Configuration of the ZAE 204 High-Speed Counter Module

ZAE 204 Configuration Overview

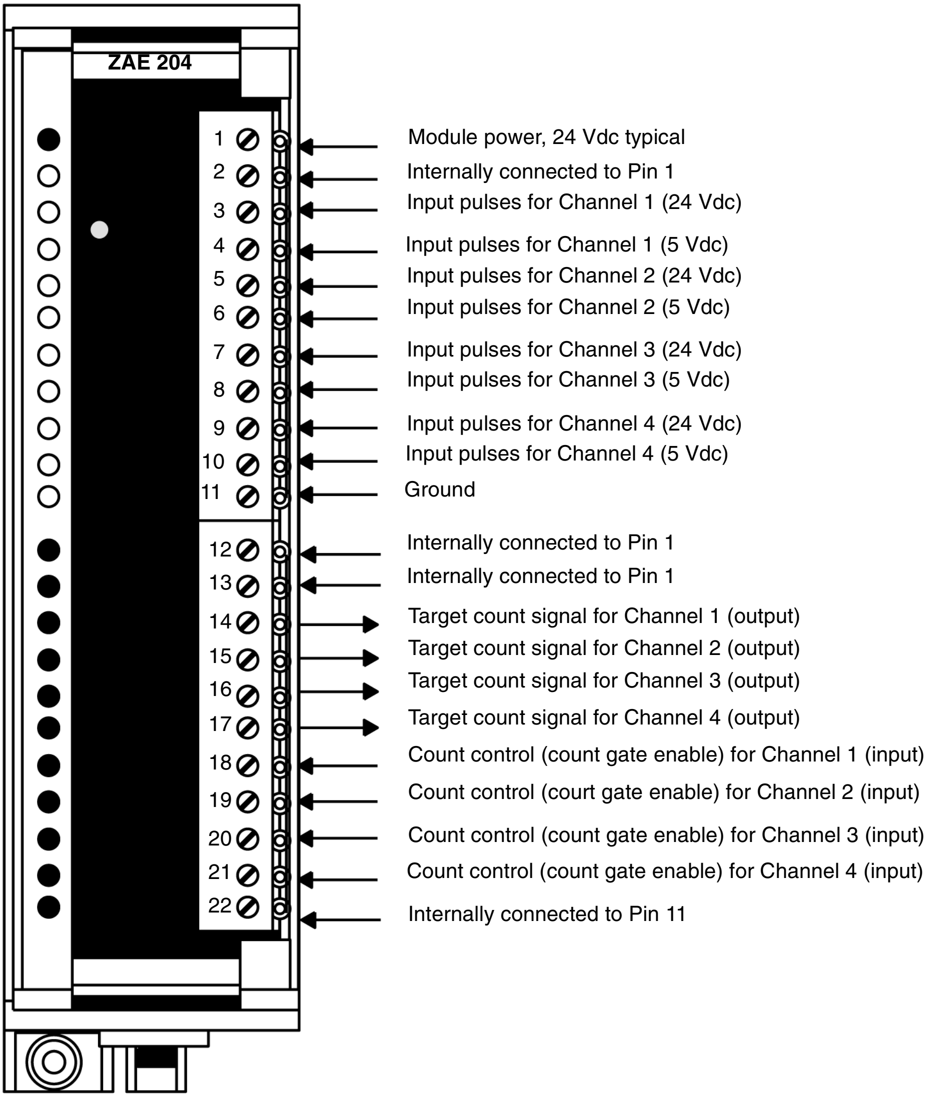
The ZAE2 04 contains four independent 16–bit 1 kHz counters. In addition, channel 1 can be programmed to accept up to 10 kHz inputs. The ZAE 204 has several modes of operation. It can operate as four independent up or down counters, either one time or repetitively. Alternatively, channels 1 and 2 and/or channels 3 and 4 can operate together as differential counters. In this mode, a single count value is maintained for channel pairs.

For the channel 1, 2 pair, input pulses at the channel 1 field connector cause this count value to increase, and input pulses at channel 2 cause the count value to decrease. The differential count value for the channel 1, 2 pair are returned to the location normally associated with channel 1. The channel 3, 4 pair works in a similar manner.

An output is provided for each channel (pins 14 ... 17) to signal when the accumulated count at a particular channel has reached its programmed target, counted up to or counted down from 0. An input signal (pins 18 ... 21) is provided for each channel to enable the counting operation. The accumulation of counts on any channel can be controlled through the state of the enable input to the appropriate pin.

ZAE 204 Field Side Connections

The module must be traffic copped as six 3**x** input registers and one 4**x** output register, as shown in the following field side connections diagram.



ZAE 204 Cabling

- Shielded, twisted pair cable (2 or 4 x 0.5 mm/channel) should be used. All channels can be connected with a common shielded cable. The maximum cable length is 100 m.
- Connect shield to ground (GND) on one side with a short cable (< 8 in).
- Observe a minimum distance of 20 in between the module and power lines or other sources of electrical disturbance.

Example Field Connections and Signal Addresses for the ZAE 204 Module

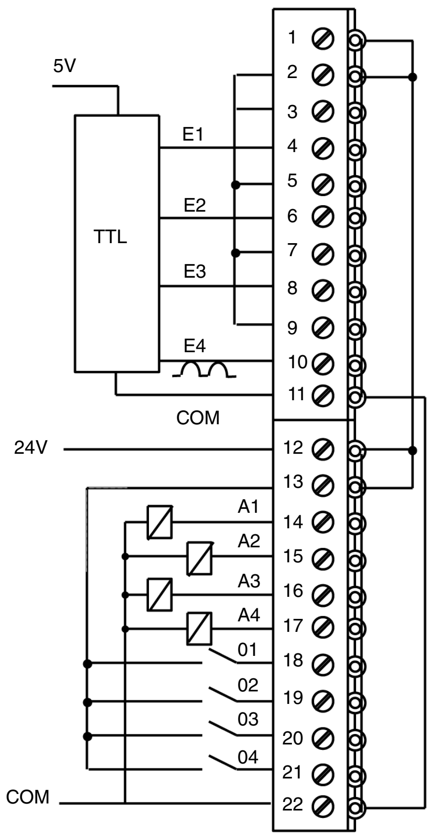
Field Connection Diagrams

Three examples of ZAE 204 connections are provided:
- 5 V inputs (see *5 V Inputs Connection Example, p. 606*);
- 5 V inputs on a noisy system (see *5 V Inputs, High Interference Connection Example, p. 607*);
- 24 V inputs (see *24 V Inputs Connection Example, p. 608*).

Note: Detailed Compact 984 cabling and installation instructions are found in the 984-A120 Compact Programmable Controllers User Guide (GM-A984-PCS).

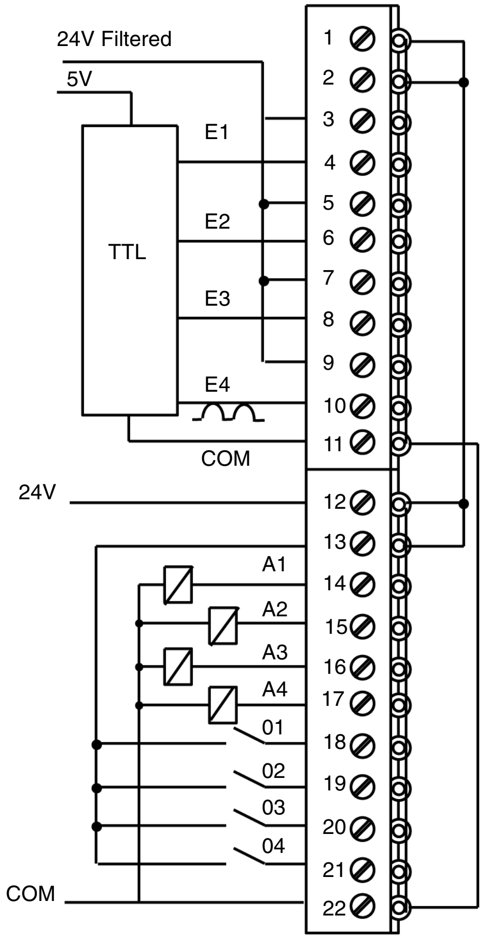
5 V Inputs Connection Example

Example connections for 5 V inputs are shown below.



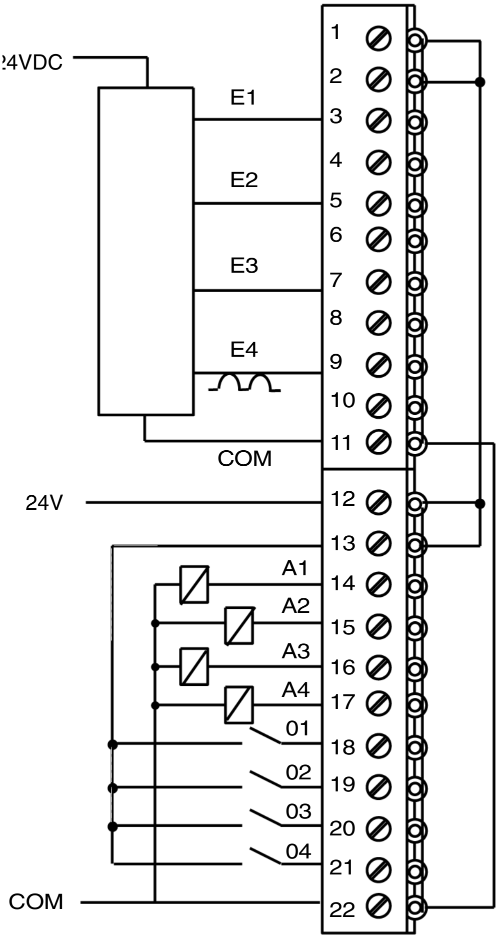
5 V Inputs, High Interference Connection Example

Example connections for 5 V inputs, on a system with a high interference level, are shown below.



24 V Inputs Connection Example

Example connections for 24 V inputs are shown below.

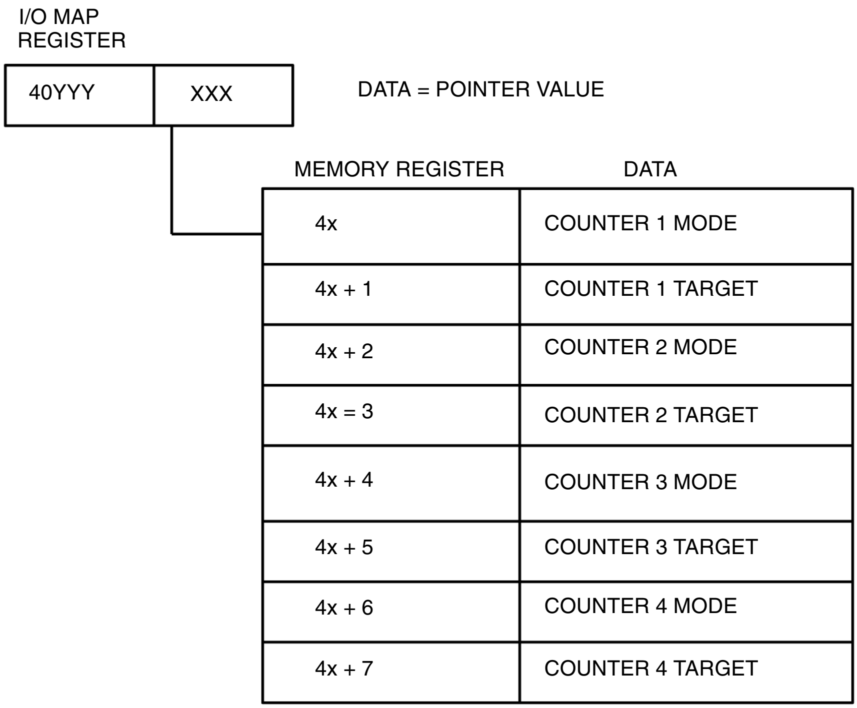


Output Register Formats of the ZAE 204 Module

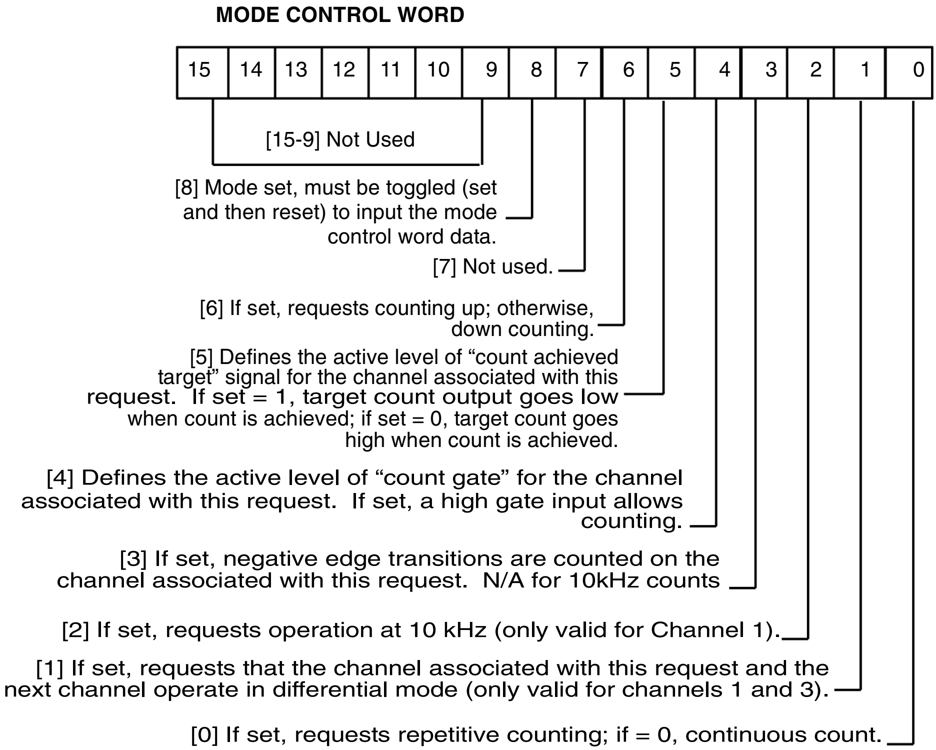
Overview

The ZAE 204 is traffic copped for set up through a single 4YYYY word (BIN register). The content of this word is interpreted as a pointer to the first of eight 4**x** registers that contain the programmable operating parameters for each of the four counter channels.

The format, of the eight words pointed to, appears in the following graphic, which shows the output register format for the ZAE 204 module.



The following figure shows the bits in the ZAE 204 mode control word and their meanings.



The target value is used in several ways. When up counting, the target value is the count at which the target value output for a channel will be on. When down counting, the target value is the value from which the counter counts down to zero. See *Operating and Display Elements of the ZAE 204 High-Speed Counter Module, p. 602* for a more complete description.

Caution

CAUTION

Chance of Incorrect Health Status Indication

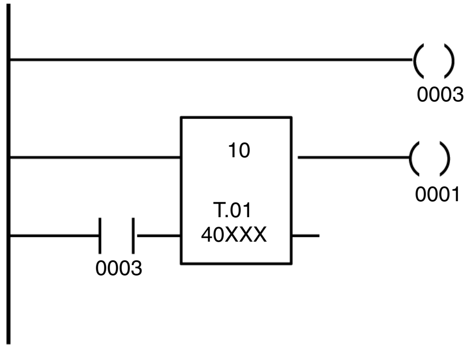
Caution:Modicon 984 PLCs assert IORST, the I/O bus reset, when in STOP mode. This signal halts operation of the ZAE 204 internal microprocessor by forcing it to a reset condition. When I/O Mapping as required in STOP mode, the module will be indicated unhealthy by an asterisk in the I/O module display, and the module description will incorrectly read, "B8   ". This does not affect I/O Mapping, which may proceed as usual. When using a STAT block, module health is properly indicated when Executive Prom Combination #1003 or greater is installed in the 984. Parameters will have to be loaded (or reloaded) after going into RUN from STOP mode, and that 3**x** register data will be zeroed when going from STOP to RUN. Refer to the next figure (See *ZAE 204 RUN/STOP Mode, p. 612*).

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

ZAE 204 RUN/ STOP Mode

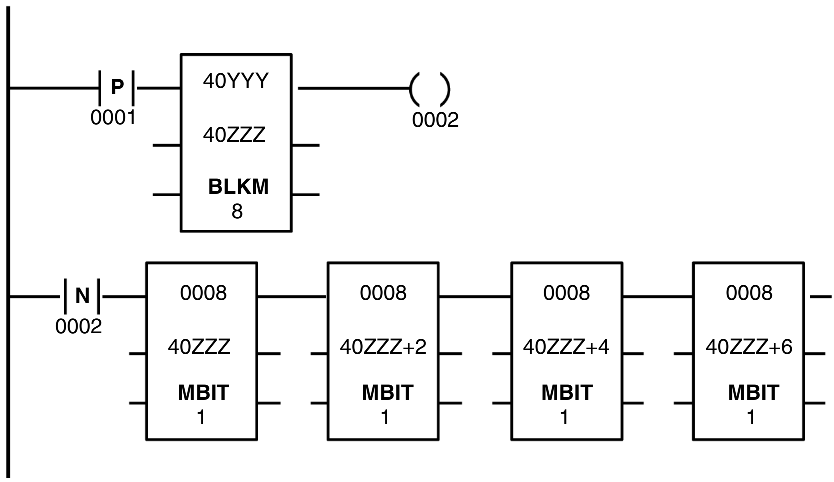
To ensure that the ZAE 204 parameters are loaded after the PLC is set to RUN from STOP mode, the ZAE 204 RUN/STOP mode user logic, shown below, may be used..

NETWORK #1 / SEGMENT #1



40YYY	CTR 1 Mode
40YYY + 1	CTR 1 Target
40YYY + 2	CTR 2 Mode
40YYY + 3	CTR 2 Target
40YYY + 4	CTR 3 Mode
40YYY + 5	CTR 3 Target
40YYY + 6	CTR 4 Mode
40YYY + 7	CTR 4 Target

NETWORK #2 / SEGMENT #1



Operation of Networks in the RUN/STOP Mode User Logic Diagram

On the first scan, the timer in Network 1 is set to zero. The next scan starts the timer, set for 100 ms. When it times out, the output comes on and will activate the BLKM through the positive transition contact referenced to Coil 1. The values of the 8 fixed 40YYY registers are block moved into 8 40ZZZ registers, which is a table pointed to by the contents of the I/O mapped output register. These registers contain the mode and target data for the module. The mode registers in the 40YYY table must have bit 8 set to 1, as required, to load the parameters into the ZAE 204. On the following scan after the BLKM is solved, coil 2 goes OFF. Power is then passed through the negative transitional to the MBIT blocks, which set bit 8 to zero in each mode control register in the 40ZZZ table. When this is done, the module is ready to accept counts from external pulse generators.

Input Register Formats of the ZAE 204 Module

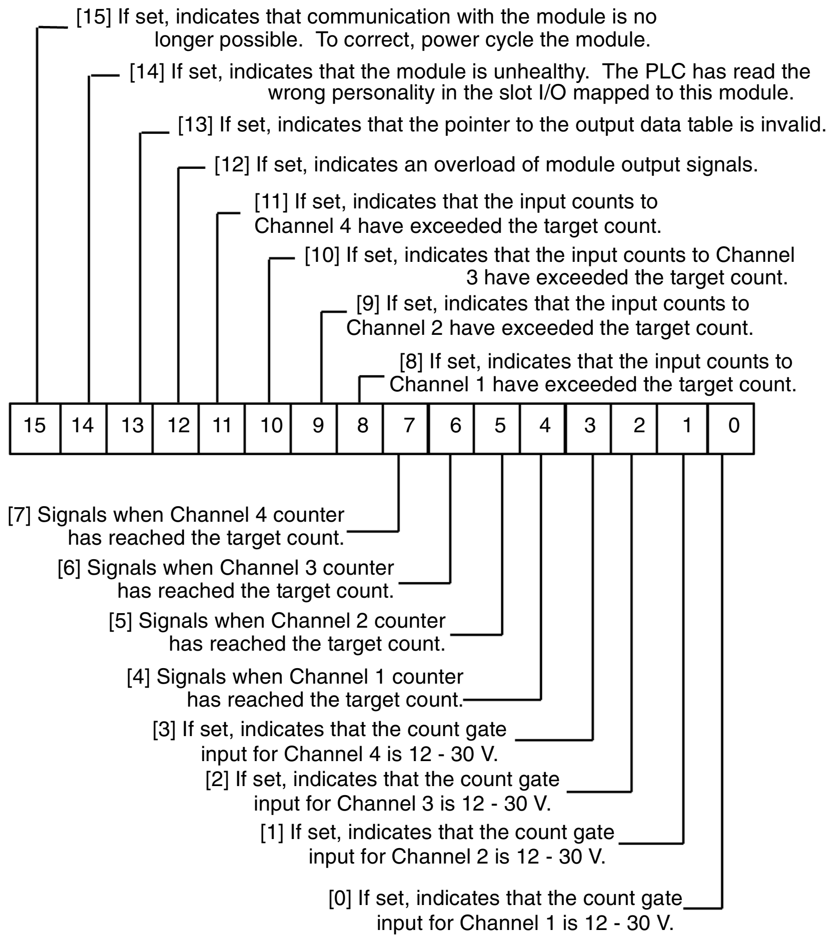
Overview

As described in the following table, the module is I/O mapped to input through six 3**x** words (BIN registers). The first two of the input words contain global and channel–specific status information. The last four input words contain the count associated with each of the four channels.

I/O Map Registers	Description
3x	Module status information
3**x** + 1	Mode–request errors for each channel
3**x** + 2	Current count for channel 1
3**x** + 3	Current count for channel 2
3**x** + 4	Current count for channel 3
3**x** + 5	Current count for channel 4

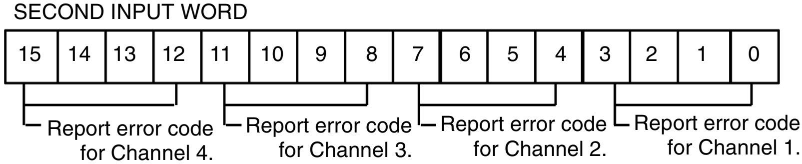
The following figure shows the meanings of the bits in the ZAE 204 RUN/STOP first input word..

FIRST INPUT WORD



The format for the second input word is:

SECOND INPUT WORD



Each nibble of the second word contains a single digit identifying the type of error found while trying to program the module with the user instruction provided for that channel. The meaning of the error codes is as follows:

Error Code	Meaning
0	No error
1	Differential and 10kHz operation requested on channel 1
2	Differential and repetitive mode requested on channels 1 or 3
3	10 kHz operation requested on channels 2, 3, or 4
4	Mode change requested on channels 2 or 4 while channels 1 or 3 (respectively) are set to differential operation
5	Differential operation requested on channels 2 or 4
6	An invalid target value has been specified

Operation of the ZAE 204 Module

Overview

The operation of the ZAE 204 is controlled through the 4**x** register output table (see *Output Register Formats of the ZAE 204 Module, p. 609*. To control the operation of the module through user logic, the logic must be designed to set up the desired operating mode and then toggle the mode change bit (bit 8) in the mode control word for a particular channel for one scan.
If the bit is not cleared after one scan, the driver will continually attempt to change modes and reset the module (and count) based on the selected mode, thus not allowing the module to operate. Having set the desired mode of operation, the actual counting begins when the active level of the count gate for a channel based on bit 4 of the control word is asserted on the input terminal for the channel (pins 18 ... 21). An LED is associated with each of the count gate terminals (described previously) that will illuminate when the count gate has 24 V applied. If the count gate is deasserted, the counting is temporarily suspended until it is once again asserted.
When a count operation is completed (count equals target or 0), the status bit in the first input word for that channel (bits 4 ... 7) is set. In addition, the signal on the output pin for the channel (pin 14 ... 17) is asserted to a level based in the state of bit 5 of the control word for the channel. An LED is associated with the output pin (described previously) that will illuminate. The ZAE 204 will continue to accumulate counts even though the count target has been reached. If this occurs it will be indicated by one of bits 8 ... 11 being set in the first input word depending on the particular channel.
The actual operation of the module depends on the mode of operation chosen. The operating mode is chosen by the state of bits 0 ... 7 of the mode control word. However, all combinations of these bits are not allowed. Invalid combinations are sensed and reported in the second input word. The following describes the operation in each of the allowed modes.

One–time Operation

This is the default operation obtained by clearing all mode bits (0 ... 7) of the control word. In this mode, the module will count up or down (see bit 6 of the control word) once, and when the target value or 0 is reached, the input status and discrete outputs will reflect this. The module will continue to accumulate counts after this occurs. The counting process can be restarted by deasserting and reasserting the count gate input for the channel in question. In this mode, the maximum target value allowed is 32767.

Repetitive Operation

This mode is activated by setting bit 0 of the control word for the channel in question. This mode is similar to one-time operation except that the count process restarts when the target value is reached. The target achieved signal in the status input, the output discrete, and the LED are asserted and remain so for 25% of the next count cycle, or 20 ms minimum. In this mode, the maximum target value allowed is 32767.

Differential Counter

This mode applies to channels 1 and 3 only and is activated by setting bit 1 in the control word. If differential mode is selected for channel 1, channels 1 and 2 operate together, and the accumulated count value is reported in the channel 1 input counter (3**x** + 2). In this mode, the pulses input to the channel 1 input increment the count, while those input to channel 2 decrement the count. This mode is only available to be programmed in channels 1 or 3. When differential mode is selected for Channel 3, Channels 3 and 4 operate together.
The accumulated count value is reported in the Channel 3 input counter (3**x** + 4). Any attempt to use this mode in channels 2 or 4 will result in an error. Additionally, if a mode change to channel 2 or 4 is requested while channels 1 or 3 respectively are set to differential mode, an error will be reported. Selection of up or down counting (bit 6 of the control word) has no effect in this mode. The counting range is from -32767 ... +32768.

10 kHz Count In Channel 1

The default operation of the module is to accept input pulses at a maximum of 1 kHz. For channel 1 only, an option is available to accept up to 10 kHz pulses. This option is chosen by setting bit 2 of the control word for channel 1 to a 1. Choosing this option for any other channel will result in an error. Differential mode is not allowed. Only the 5 V input can be used, and only negative edge transitions are counted.

Note: If set to one–time operation, the counter associated with channel 1 will not continue to accumulate counts after target is reached.

Specifications of the ZAE 204 High-Speed Counting Module

ZAE 204 Module Topology

The following table describes the module topology.

Number of Counting Inputs	4
Number of 24 Vdc Outputs	4
Number of Enable Inputs	4
Operating Mode	High Speed Counter
Isolation	Opto–coupler on each field point

ZAE 204 Power Supplies

Power supply details:

External Power Source Load	24 Vdc	Count Inputs, 25 mA maximum
		Gate Inputs, 30 mA maximum
		Outputs, 1 A maximum
	5 Vdc	Count Inputs, 10 mA maximum
Internal Power Source Load from I/O bus	maximum	5 V, 100 mA
	typical	75 mA

ZAE 204 Counter Inputs

Counter input details

Quantity		4 for input pulses with 5 Vdc (TTL) or 24 Vdc
Signal Level at 5 V (TTL)	ON signal	>= 2.3 V
	OFF signal	0 ... 1 V
Input Current		<= 2.5 mA each at 0 V (current sink)
Signal Level at 24 V (TTL)	ON signal	12 ... 30 V
	OFF signal	-2 ... +5 V
Input Current (current source)		< 6 mA each at 30 V
Minimum 0 Pulse Width		0.35 ms
Allowable Mark-space Ratio		65/35 percent maximum
Counting range		0 ... 32,767 or -32,768 ... 0 ... +32,767, depending on operating mode
Counting Frequency		1 kHz maximum
		Input 1 with 5 V pulses 10 kHz maximum

ZAE 204 Enable Inputs (Gate)

Enable input details:

Quantity		4
Rated Signal Value		24 V
Signal Level	HIGH Signal	12 ... 30 V
	LOW signal	-2 ... +5 V
Input Current		7 mA @ 24 V
Input Delay (contact bounce suppression)		4 ms
Input Rise Time		N/A

ZAE 204 Semiconductor Outputs

Semiconductor output details:

Quantity	4
Working Voltage V	U_S = 24 Vdc
Signal Language	True High
Signal Output Level	ON V_S = 0 ... + 2 V
	OFF 0 ... 2 V, < 1 mA
	U_S = 20 ... 30 Vdc
Load Current/Output	500 mA maximum
Load Current for All Outputs	1 A maximum
Switching Delay	< 1 ms
Power Dissipation	1.25 W
Inrush Current for Lamps	5 W maximum

ZAE 204 Operating Frequency

Operating fequency details:

Resistive Load		100/s
Inductive Load @ 500 mA		1000/hr
Bulb Load	@ 1.2 W	8/s
	@ 5 W	1000/hr

ZAE 204 I/O Map

Register detail:

Registers 3x/4x	6 in/1 out

Dimensions

Dimensions details:

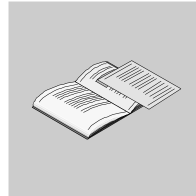
W x H x D	mm	40.3 x 145 x 117.5
	in	1.6 x 5.6 x 4.5
Weight	g	300
	lb	0.7

ZAE 204 Agency Approvals

Agency Approval details:

VDE 0160; UL 508; CSA 22.2 No. 142 and FM Class I, Div 2 Standards.

Appendices



At a Glance

Purpose

The following chapters contain material related to A120 I/O modules.

What's in this Appendix?

The appendix contains the following chapters:

IEC Wiring Diagrams for A120 I/O Modules

A

At a Glance

Introduction

This chapter provides IEC-compliant wiring diagrams for the A120 Series I/O modules.

What's in this Chapter?

This chapter contains the following topics:

IEC Nomenclature Legend

Legend

The following table describes the IEC nomenclature used in the IEC wiring diagrams.

Nomenclature	Description
U	Voltage
I	Current
M	Common
PE	Ground
L	230Vac or hot
US	24Vdc
UB	Supply voltage for modules
US	Working voltage for activating the actuators
N1	Supply 1
N2	Supply 2
E1	Input 1
A1	Output 1
EW1	Input 1 wiring
AW1	Output 1 wiring
F1	Automatic circuit breaker 1 or fuse
C1	Capacitor 1
V1	Isolation diode 1
R1	Resistor 1
G	Gate

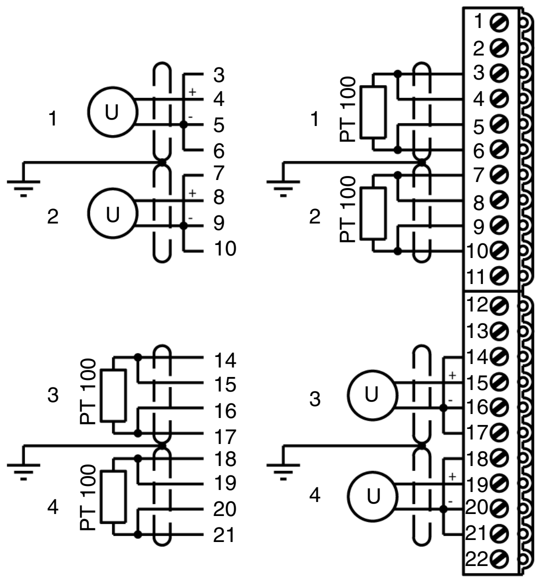
IEC Wiring Diagrams for A120 Modules

Overview

The following diagrams are IEC-compliant versions of the A120 diagrams shown throughout this manual.

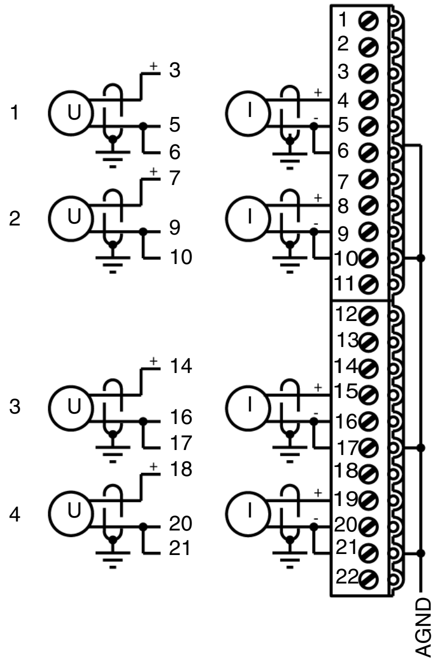
ADU 204 IEC Wiring Diagram

The following figure is the IEC wiring diagram for the ADU 204.



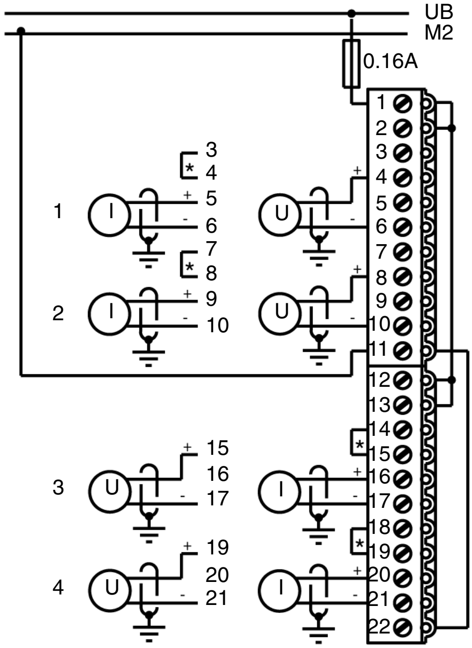
ADU 205 IEC Wiring Diagram

The following figure is the IEC wiring diagram for the ADU 205.



ADU 206 IEC Wiring Diagram

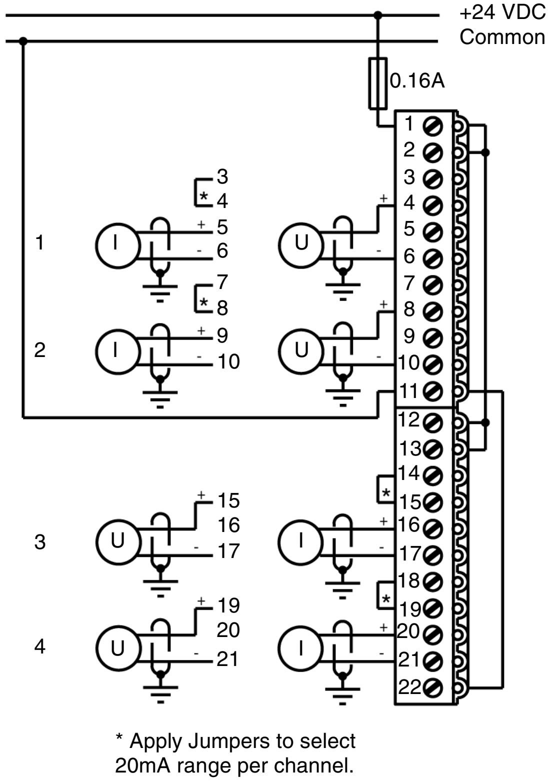
The following figure is the IEC wiring diagram for the ADU 206.



* For current inputs please use the enclosed jumpers

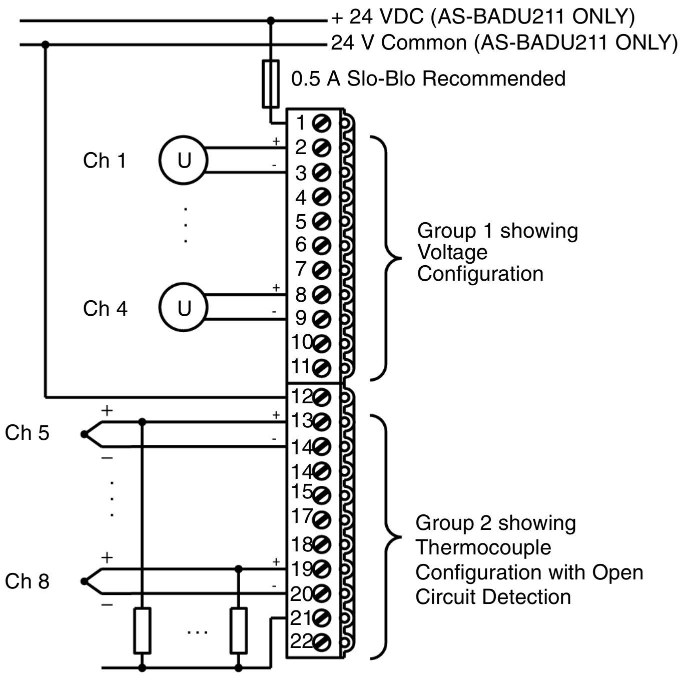
ADU 210 IEC Wiring Diagram

The following figure is the IEC wiring diagram for the ADU 210.

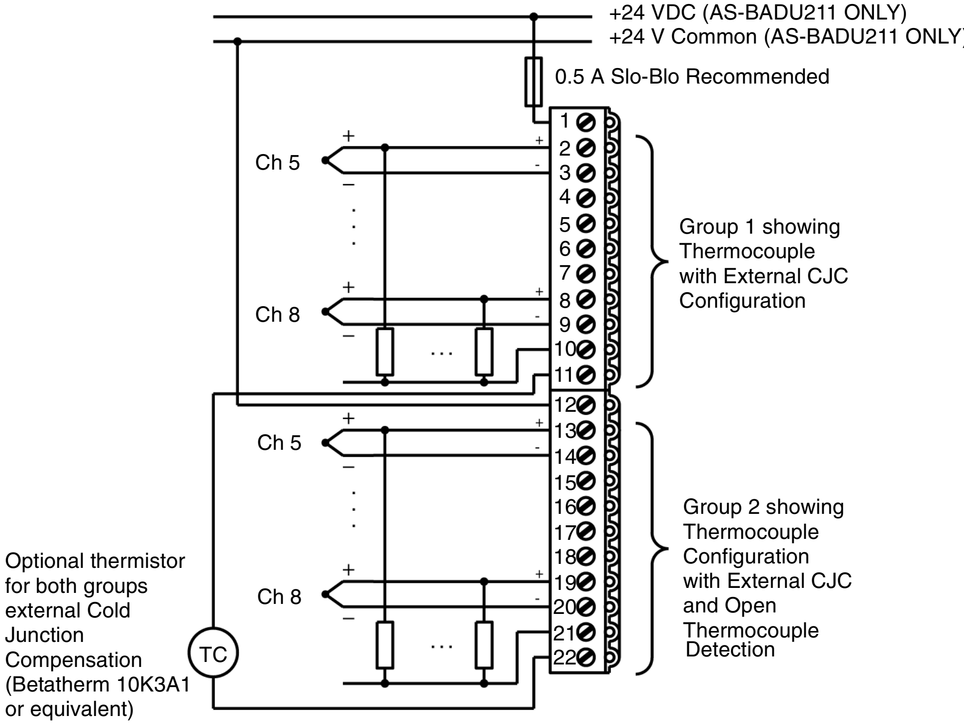


ADU 211/212 IEC Wiring Diagrams

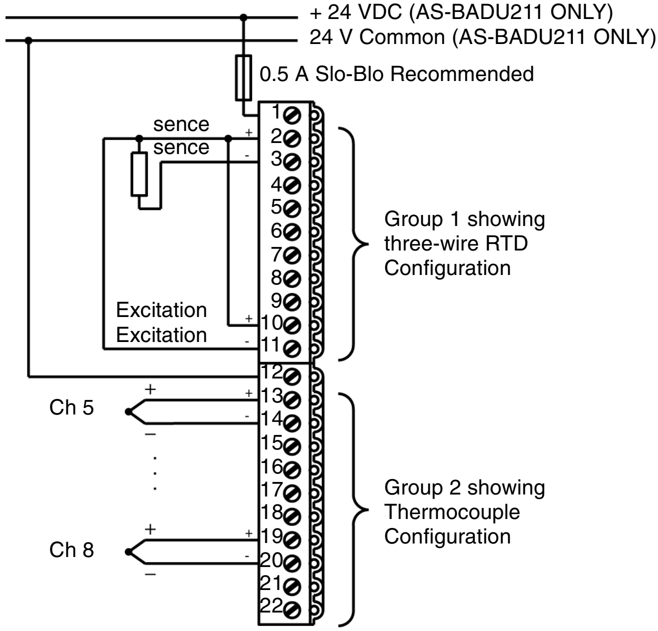
The five figures that follow are all ADU 211/212 IEC wiring diagrams.
The following figure is an ADU 211/212 IEC wiring diagram.



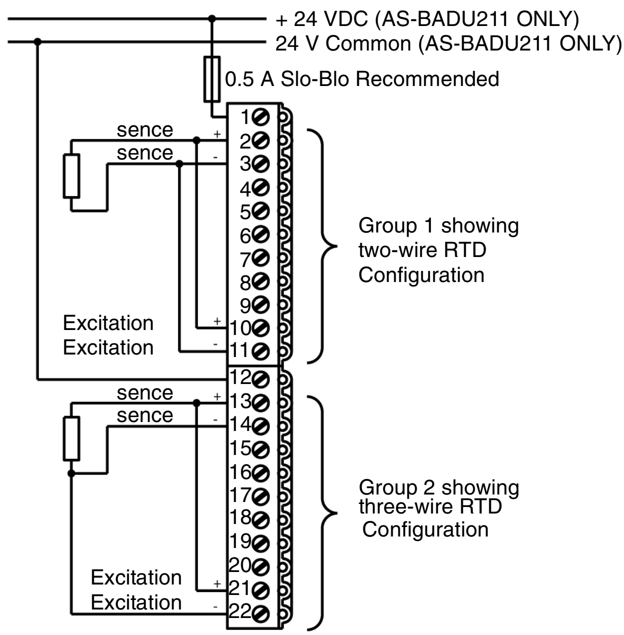
The following figure is an ADU 211/212 IEC wiring diagram.



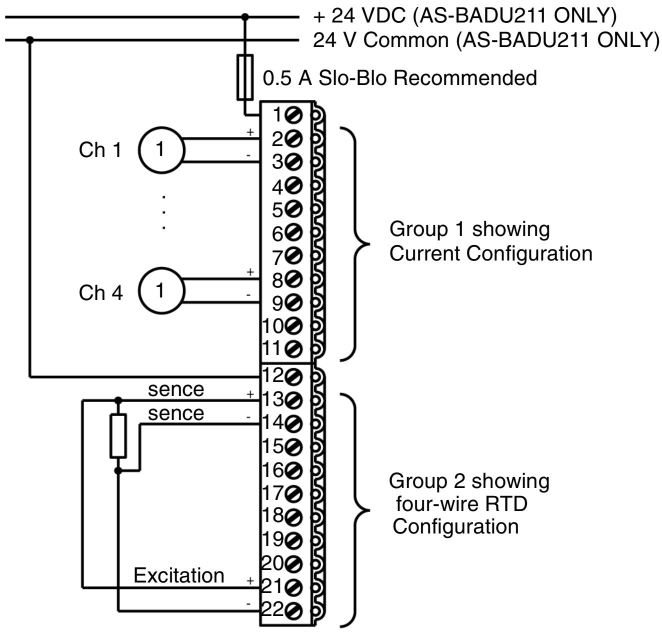
The following figure is an ADU 211/212 IEC wiring diagram.



The following figure is an ADU 211/212 IEC wiring diagram.

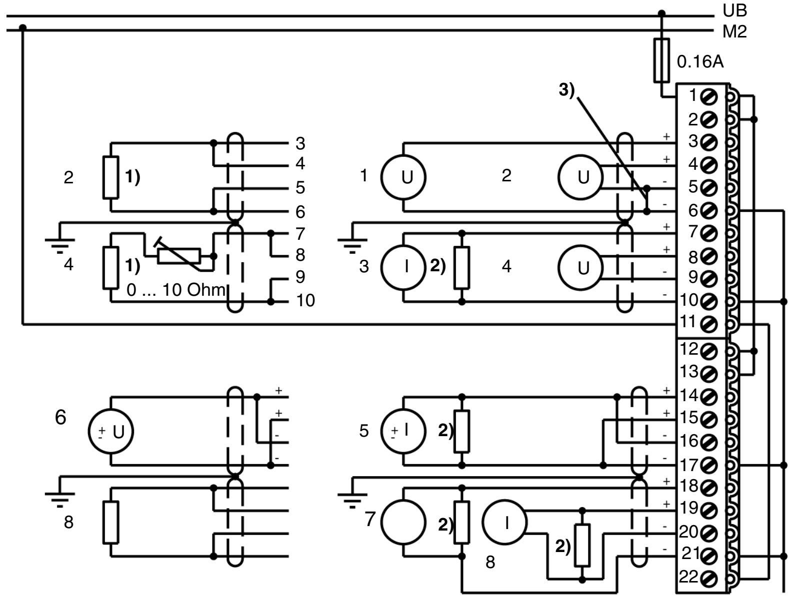


The following figure is an ADU 211/212 IEC wiring diagram.



ADU 214 IEC Wiring Diagram

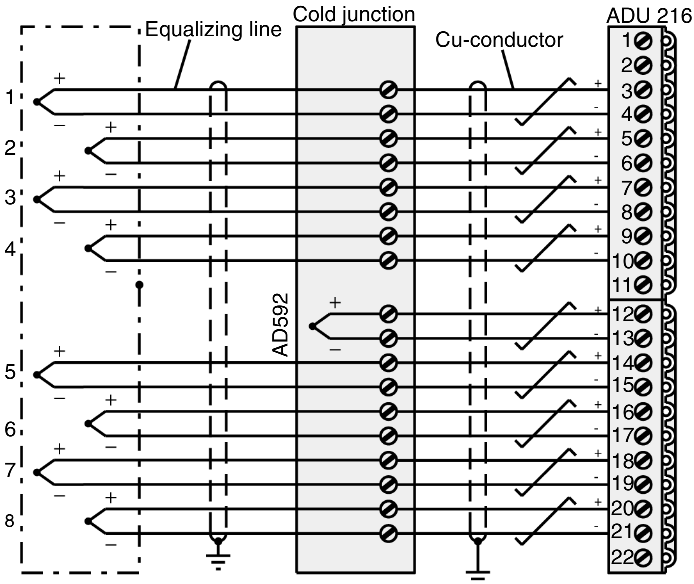
The following figure is the IEC wiring diagram for the ADU 214.



1) Resistance temperature detector Pt 100 ... 1000, Ni 100 ... 1000 or remote resistance detector 0 ... 2000 Ohm
2) External reference resistance 50 or 100 Ohm, 0.1%, 0.125 W, Tk 25
3) See Voltage and Current measuring
4) The common reference point “AGND” is internally connected to 0 V (reference potential of PLC).

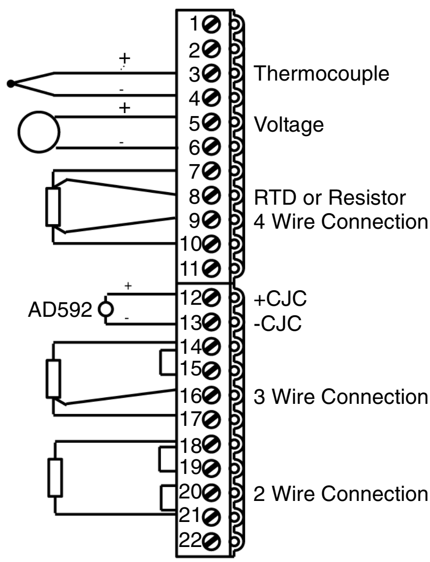
ADU 216 IEC Wiring Diagram

The following figure is the IEC wiring diagram for the ADU 216.



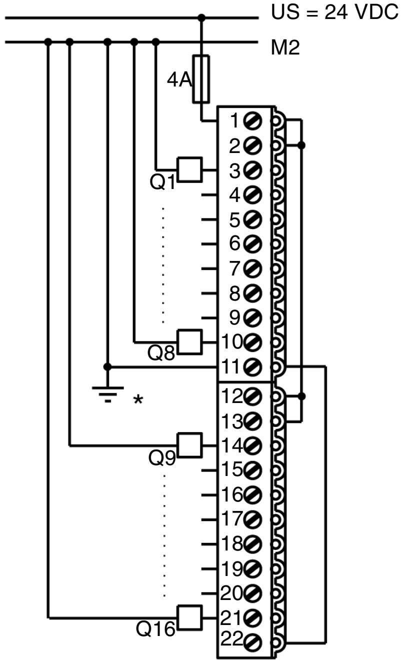
ADU 257 IEC Wiring Diagram

The following figure is the IEC wiring diagram for the ADU 257.



DAO 216 IEC Wiring Diagram

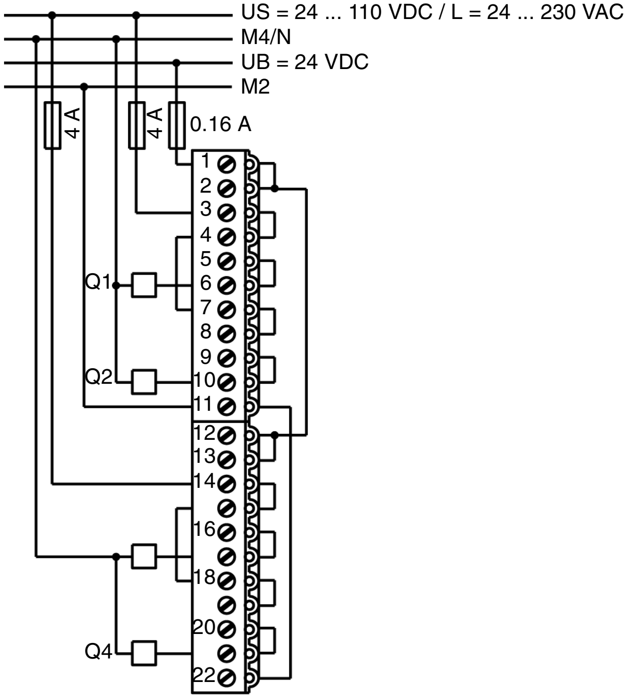
The following figure is the IEC wiring diagram for the DAO 216.



* Terminal 11 should be connected in the shortest possible way to the functional earth (hat rail). In case of connection failure compensating currents can occur via M2→ 0 V path. These lead to the destruction of the protective resistor (R31).

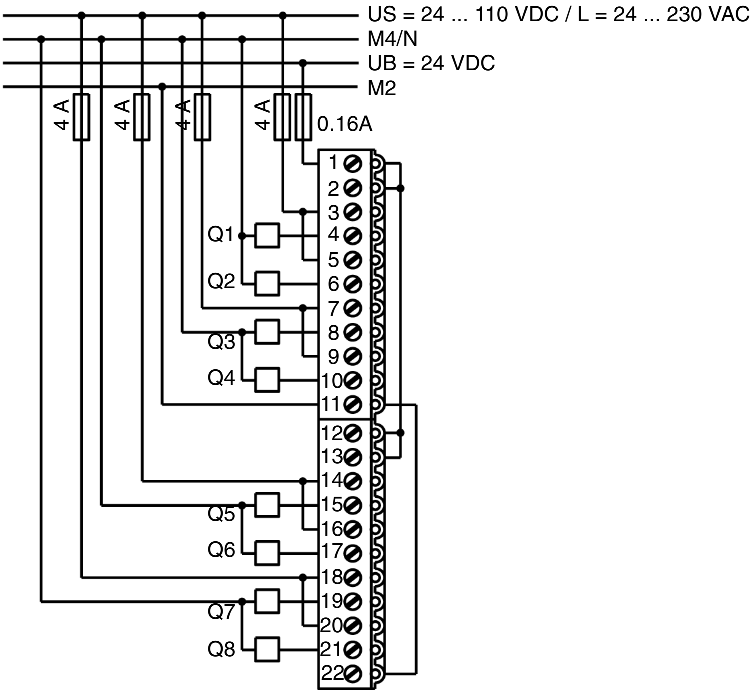
DAP 204 IEC Wiring Diagram

The following figure is the IEC wiring diagram for the DAP 204.



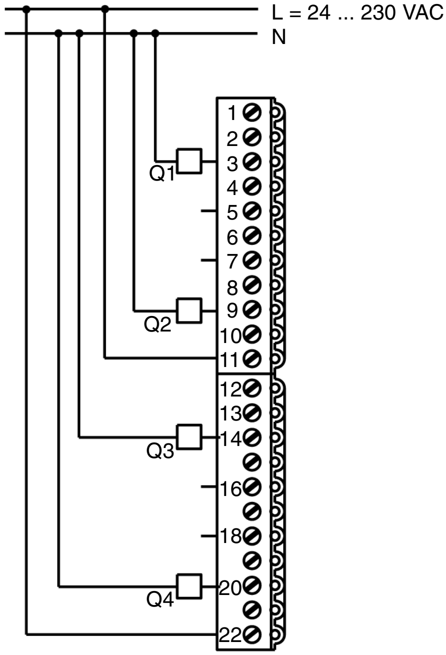
DAP 208 IEC Wiring Diagram

The following figure is IEC wiring diagram for the DAP 208.



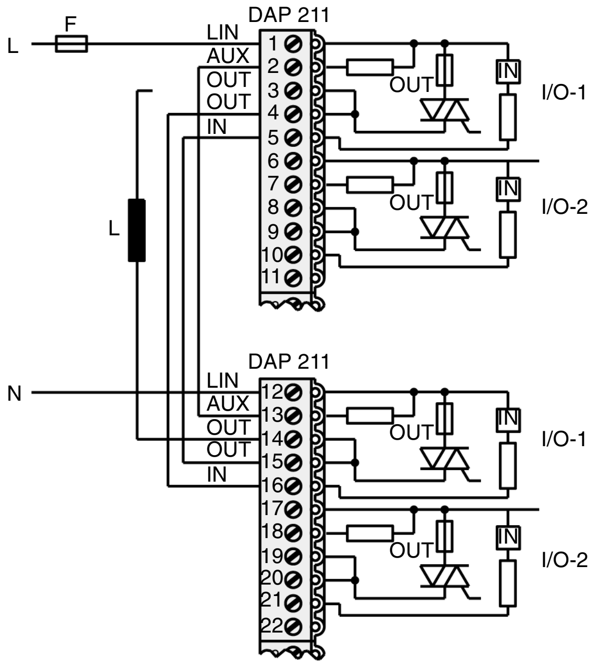
DAP 210 IEC Wiring Diagram

The following figure is IEC wiring diagram for the DAP 210.



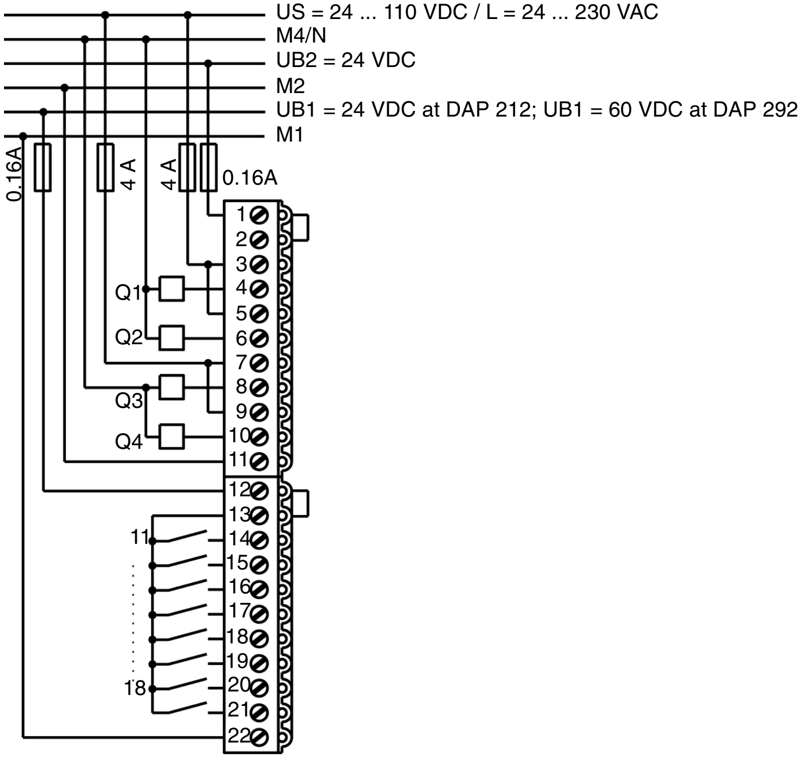
DAP 211 IEC Wiring Diagram

The following figure is the IEC wiring diagram for the DAP 211. Note that this diagram is for Voted (Dual) applications only. See *DAP 211 Combined I/O Module Field Wiring, p. 259*for more information.



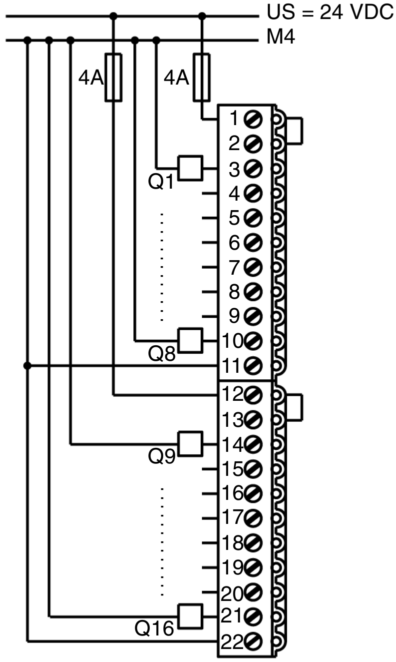
DAP 212 and DAP 292 IEC Wiring Diagram

The following figure is the IEC wiring diagram for the DAP 212 and the DAP 292.



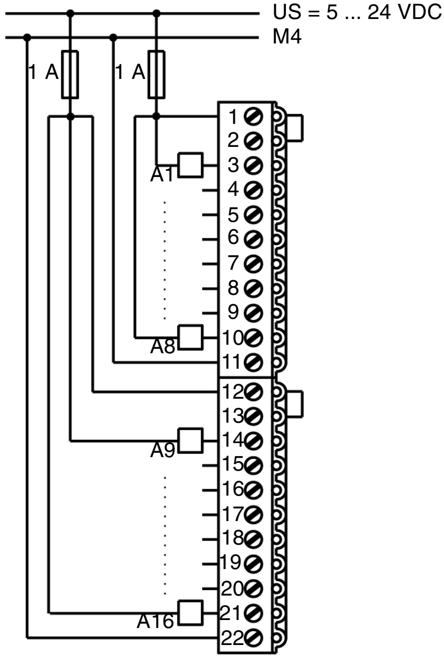
DAP 216/DAP 216N IEC Wiring Diagram

The following figure is the IEC wiring diagram for the DAP 216/DAP216N.



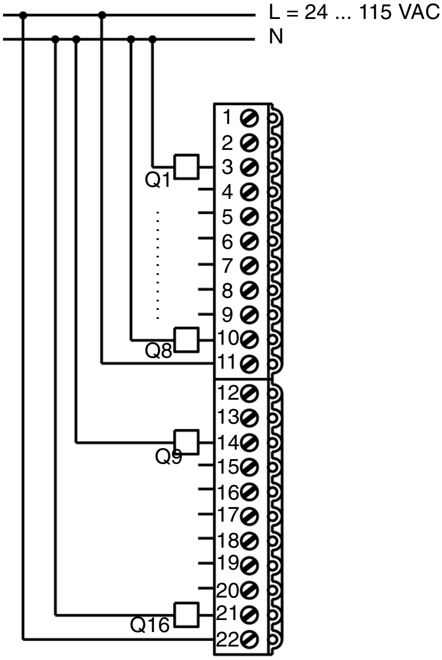
DAP 217 IEC Wiring Diagram

The following figure is the IEC wiring diagram for the DAP 217.



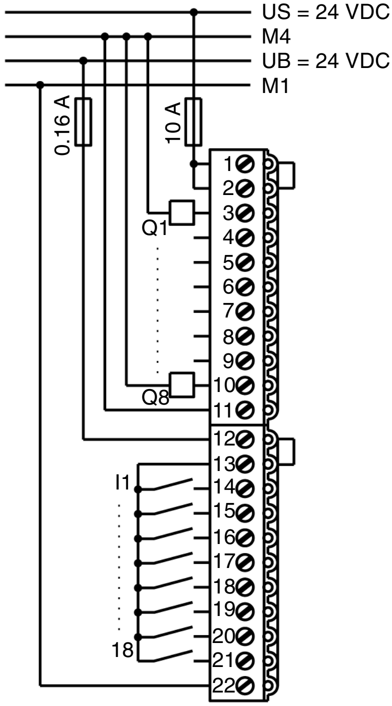
DAP 218 IEC Wiring Diagram

The following figure is the IEC wiring diagram for the DAP 218.



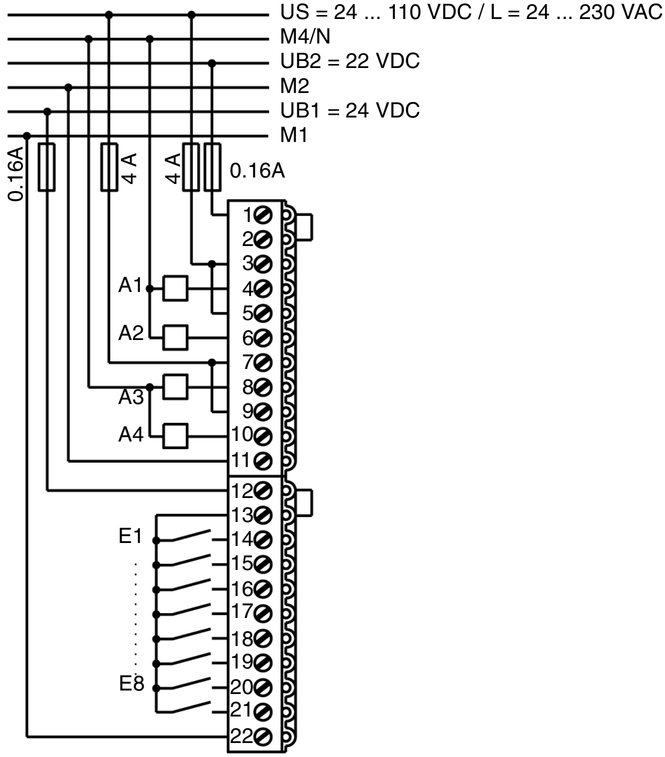
DAP 220 IEC Wiring Diagram

The following figure is the IEC wiring diagram for the DAP 220.



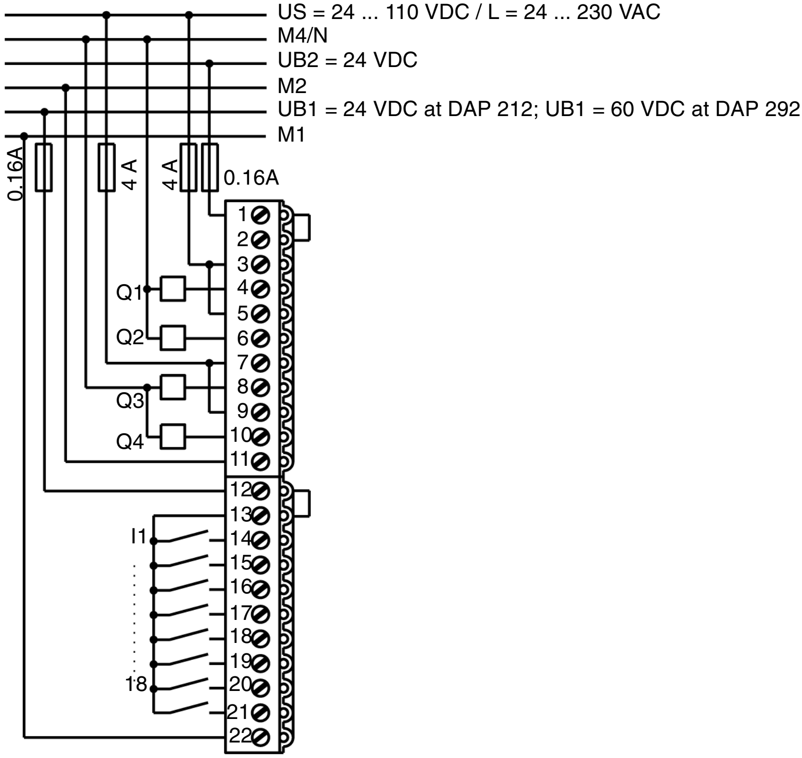
DAP 252 IEC Wiring Diagram

The following figure is the IEC wiring diagram for the DAP 252.



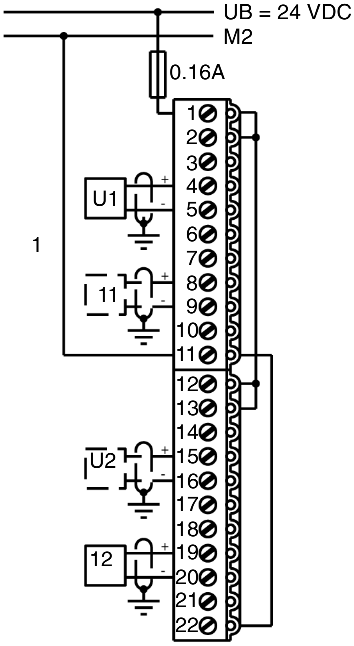
DAP 253 IEC Wiring Diagram

The following figure is the IEC wiring diagram for the DAP 253.



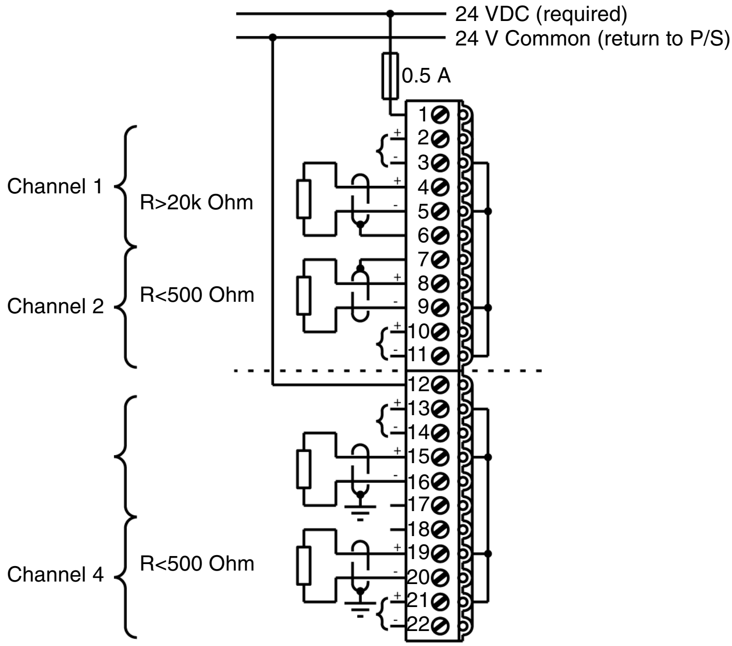
DAU 202 IEC Wiring Diagram

The following figure is the IEC wiring diagram for the DAU 202.



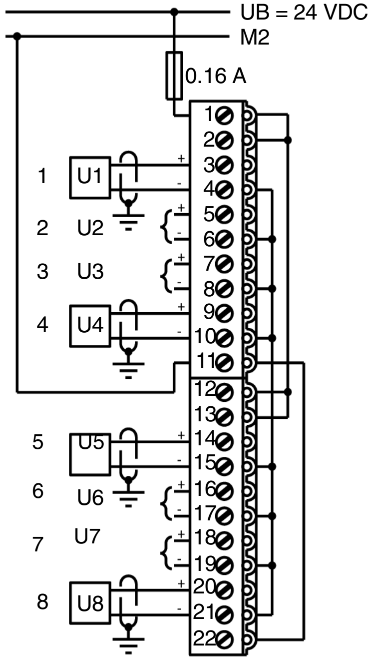
DAU 204 IEC Wiring Diagram

The following figure is the IEC wiring diagram for the DAU 204.



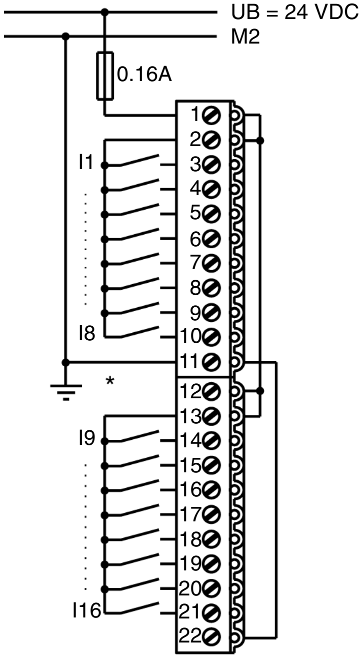
DAU 208 IEC Wiring Diagram

The following figure is the IEC wiring diagram for the DAU 208.



DEO 216 IEC Wiring Diagram

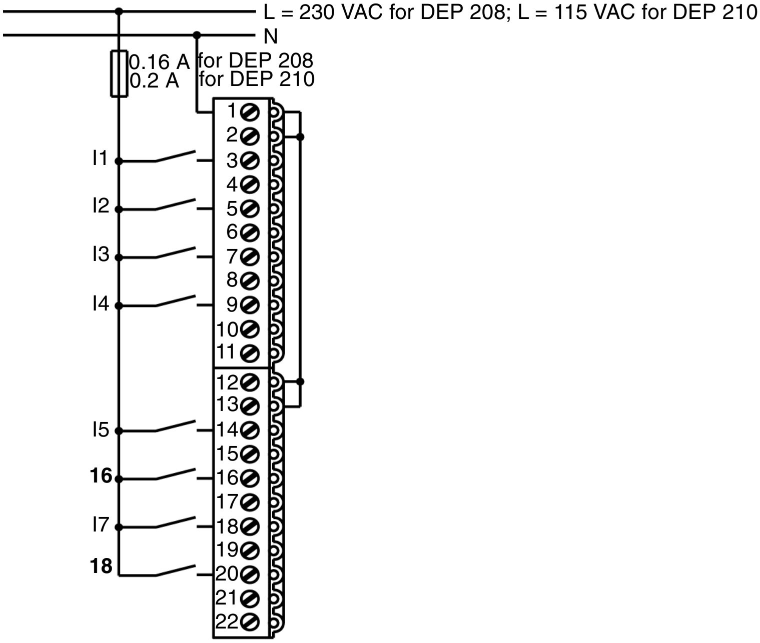
The following figure is the IEC wiring diagram for the DEO 216.



* Terminal 11 should be connected in the shortest possible way to the functional earth (hat rail). In case of connection failure compensating currents can occur via M2→ 0 V path, which lead to the destruction of the protective resistor (R16).

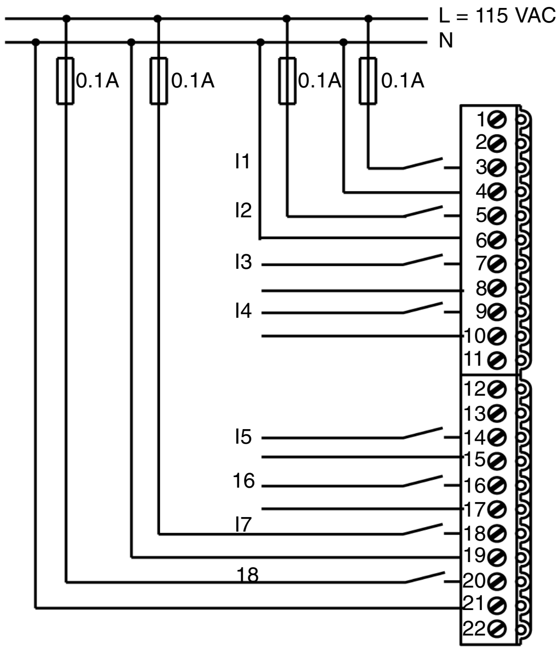
DEP 208 and DEP 210 IEC Wiring Diagram

The following figure is the IEC wiring diagram for both the DEP 208 and the DEP 210.



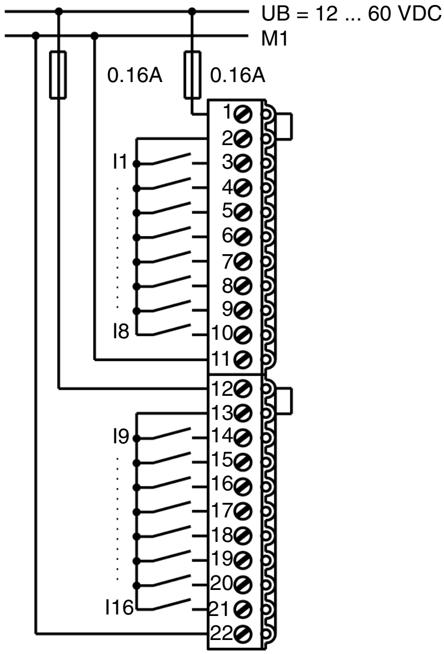
DEP 211 IEC Wiring Diagram

The following figure is the DEP 211 IEC wiring diagram.



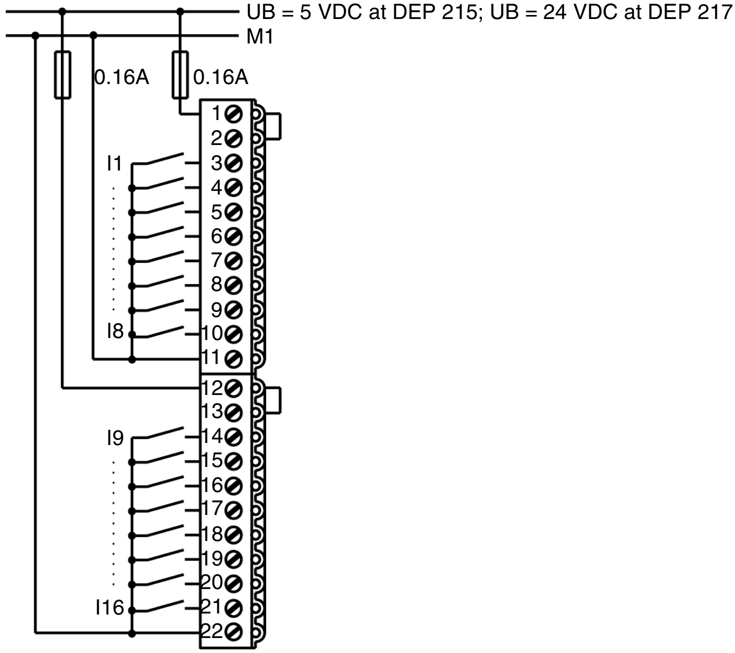
DEP 214 IEC Wiring Diagram

The following figure is the IEC wiring diagram for the DEP 214.



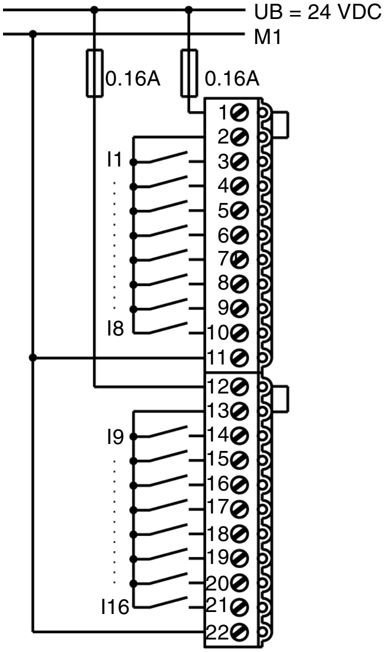
DEP 215 and DEP 217 IEC Wiring Diagram

The following figure is the IEC wiring diagram for both the DEP 215 and the DEP 217.



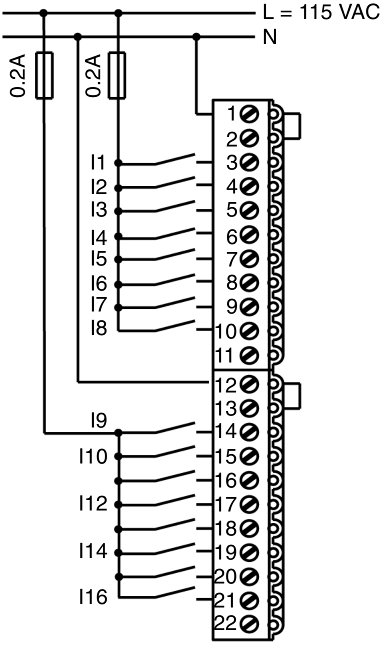
DEP 216 and DEP 220 IEC Wiring Diagram

The following figure is the IEC wiring diagram for both the DEP 216 and the DEP 220.



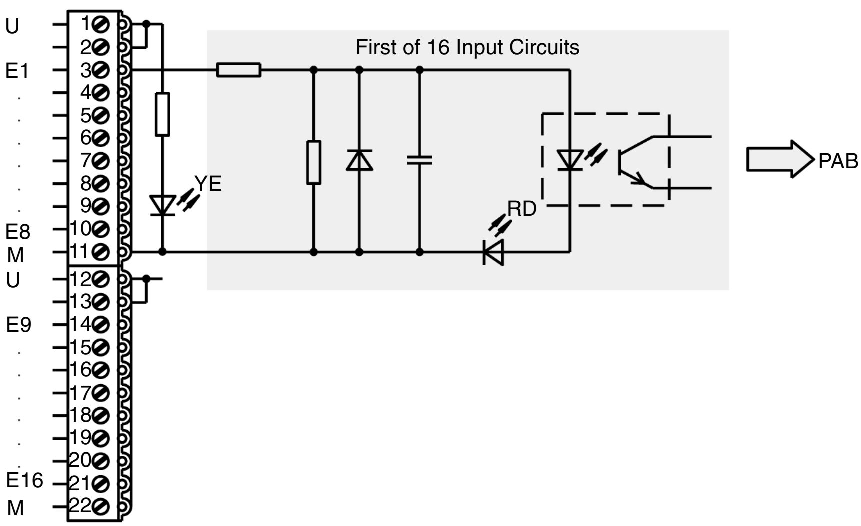
DEP 218 IEC Wiring Diagram

The following figure is the IEC wiring diagram for the DEP 218.



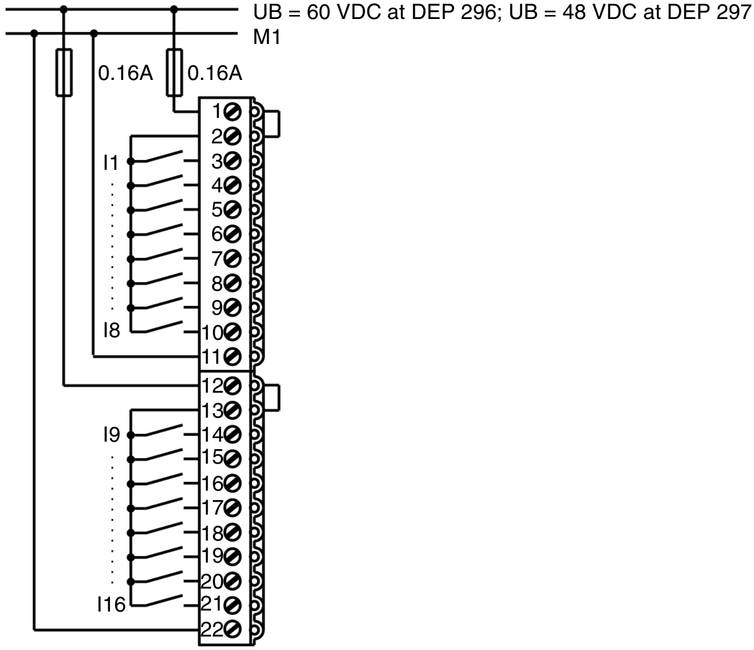
DEP 257 IEC Wiring Diagram

The following figure is the IEC wiring diagram for the DEP 257.



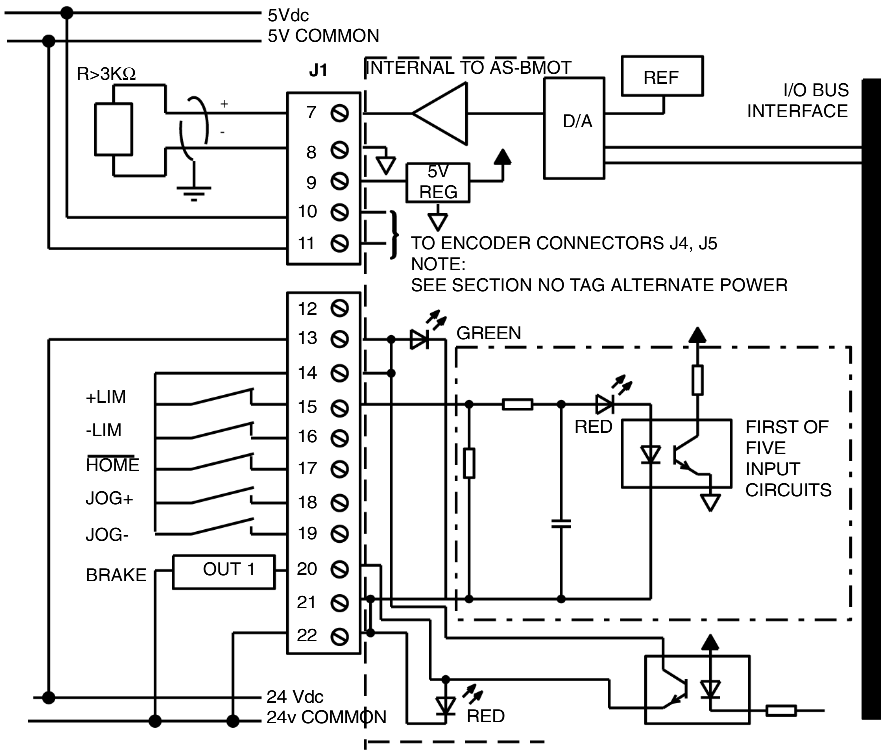
DEP 296 and DEP 297 IEC Wiring Diagram

The following figure is the IEC wiring diagram for both the DEP 296 and the DEP 297.

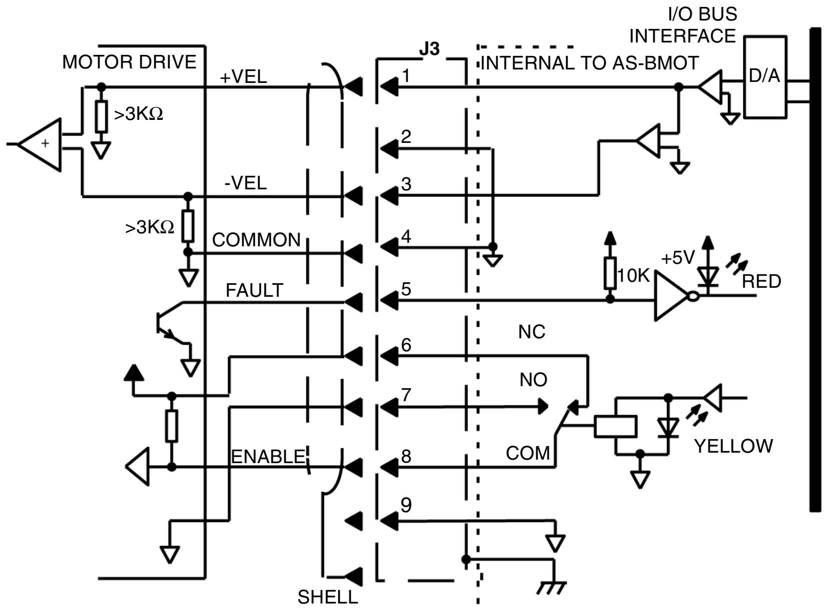


MOT 201/202 IEC Wiring Diagram

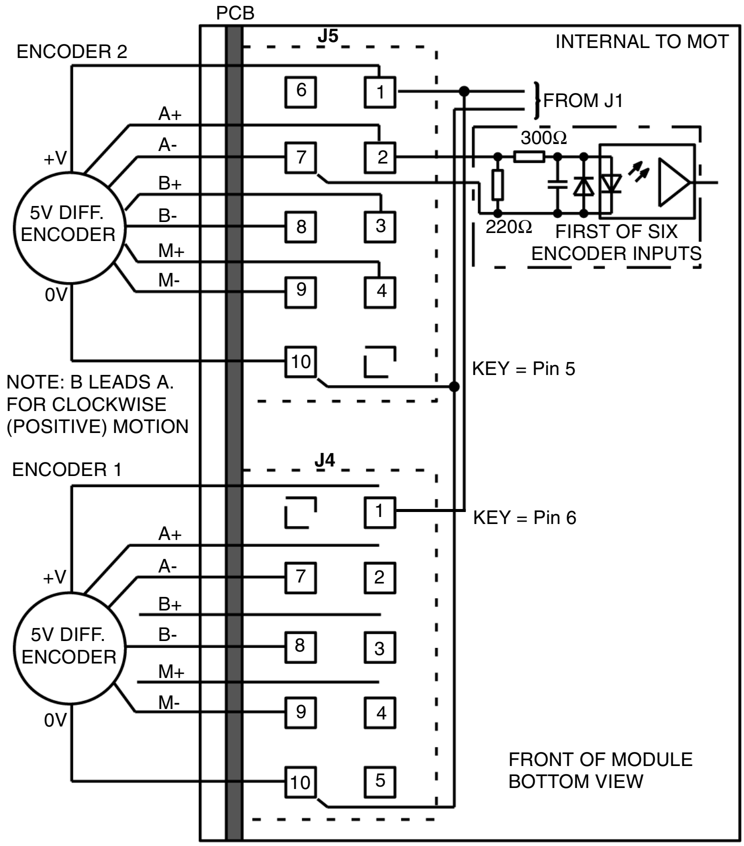
The seven figures that follow are IEC wiring diagrams for the MOT 201, the MOT 202, or both (MOT 201/202), as specified in the introduction to each diagram. The following figure is an MOT 201/202 IEC wiring diagram.



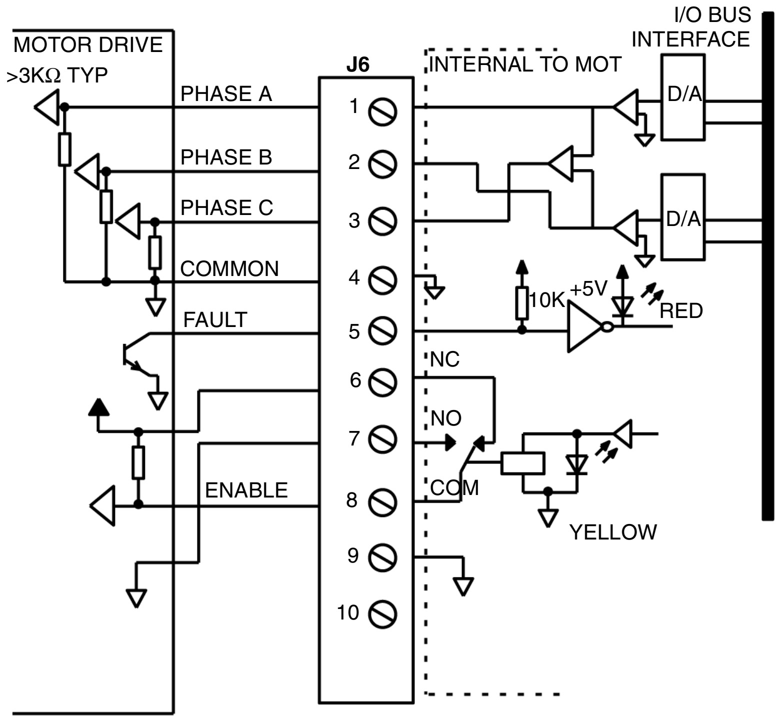
The following figure is an MOT 201 (Motor Drive) IEC wiring diagram.



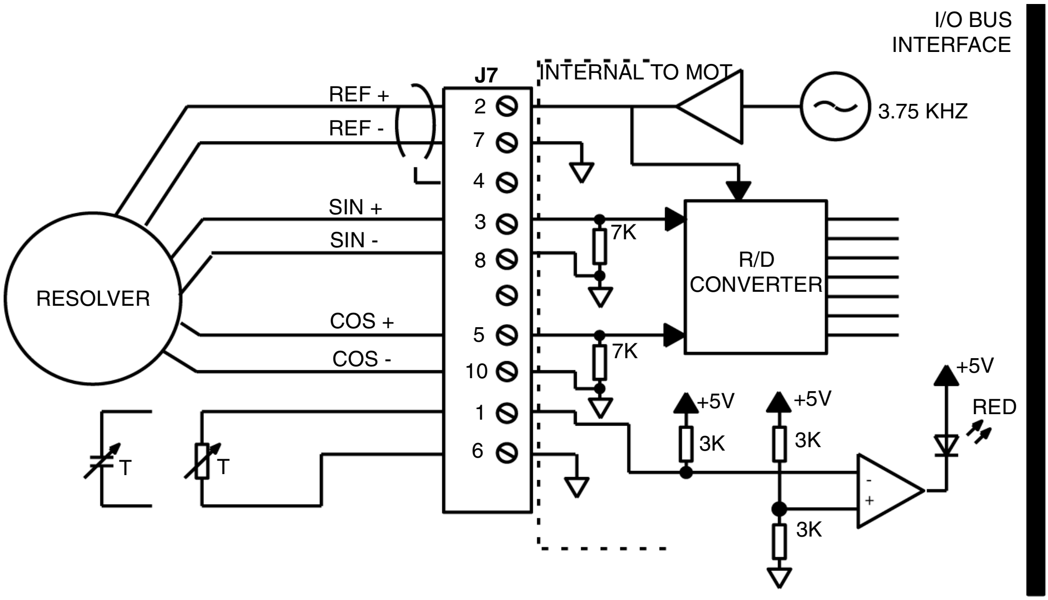
The following figure is an MOT 201/202 (Encoder) IEC wiring diagram.



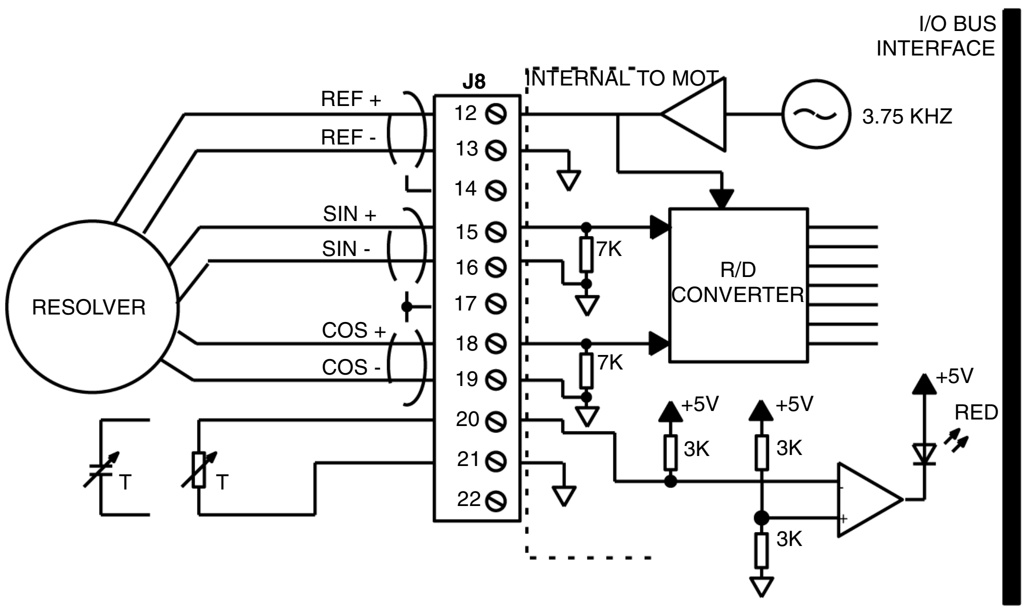
The following figure is an MOT 202 (Motor Drive) IEC wiring diagram.



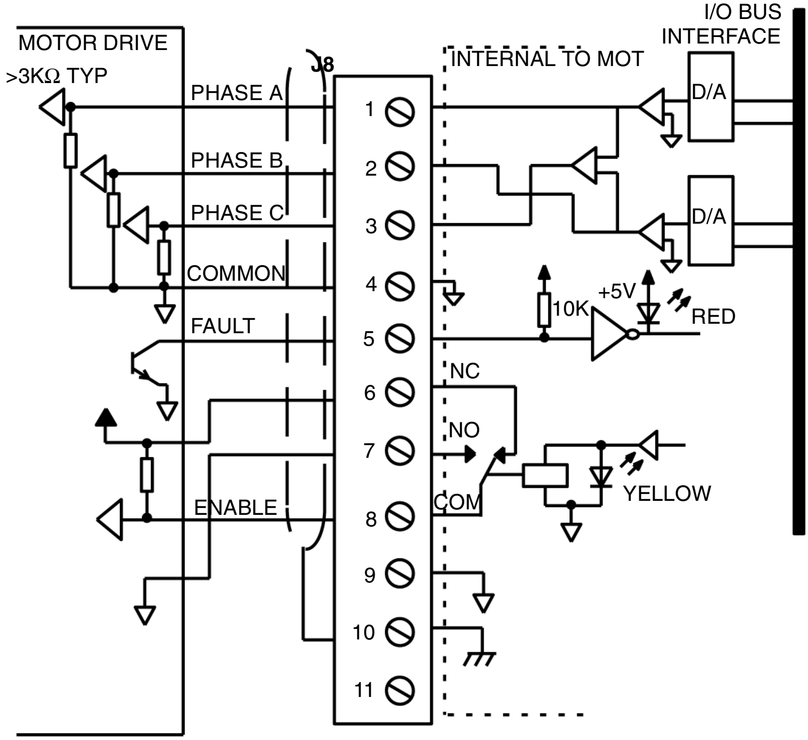
The following figure is an MOT 202 (Resolver) IEC wiring diagram.



The following figure is an MOT 202 (Resolver) IEC wiring diagram.

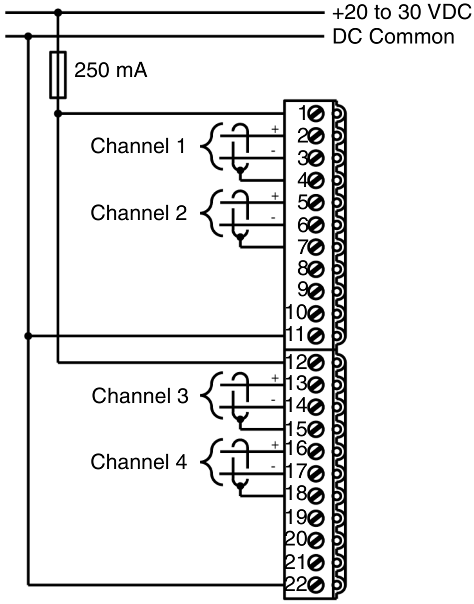


The following figure is an MOT 202 (Motor Driver) IEC wiring diagram.



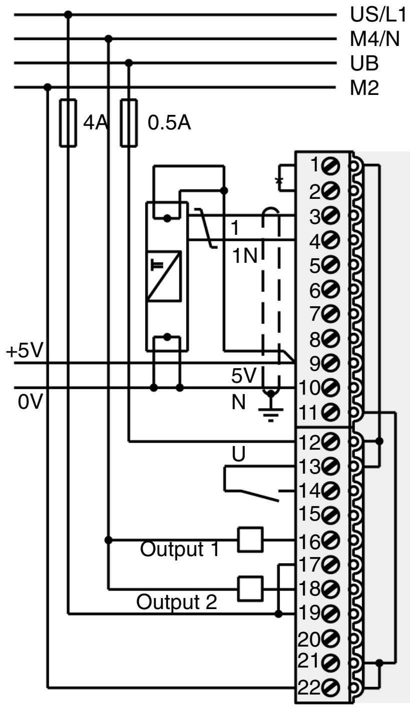
VRC/CTR 2xx IEC Wiring Diagram

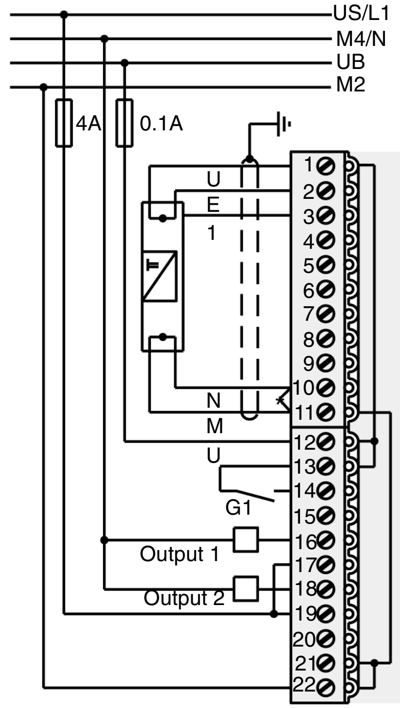
The following figure is the IEC wiring diagram for the VRC/CTR 2xx.



ZAE 201 IEC Wiring Diagram

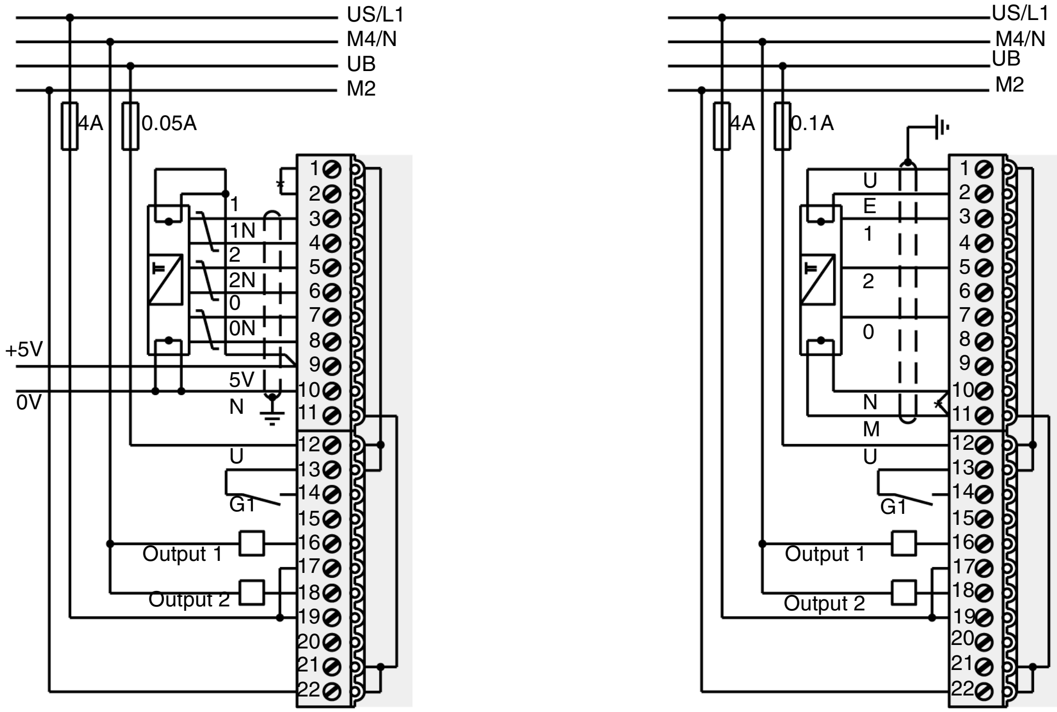
Both of the following figures are IEC wiring diagrams for the ZAE 201. The following figure is a ZAE 201 IEC wiring diagram.





* with Attached Jumpers (as Delivered)

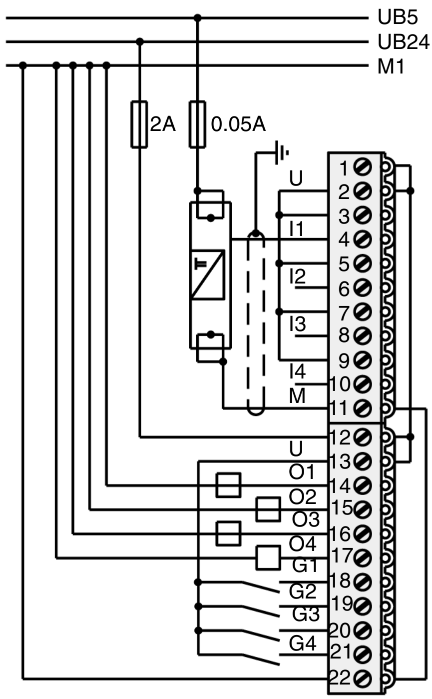
The following figure is a ZAE 201 IEC wiring diagram.

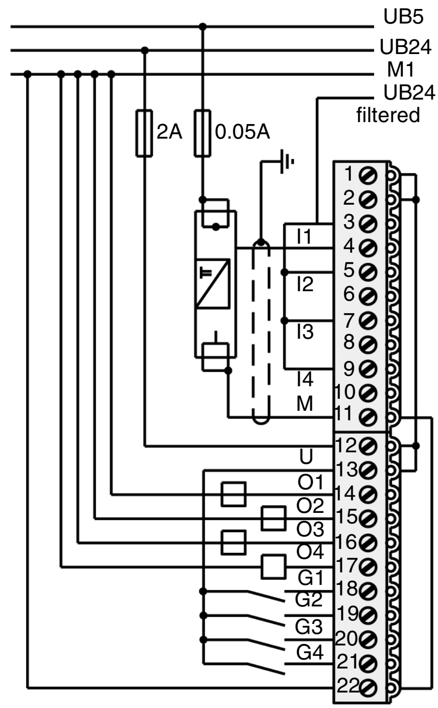


* with Attached Jumpers (as Delivered)

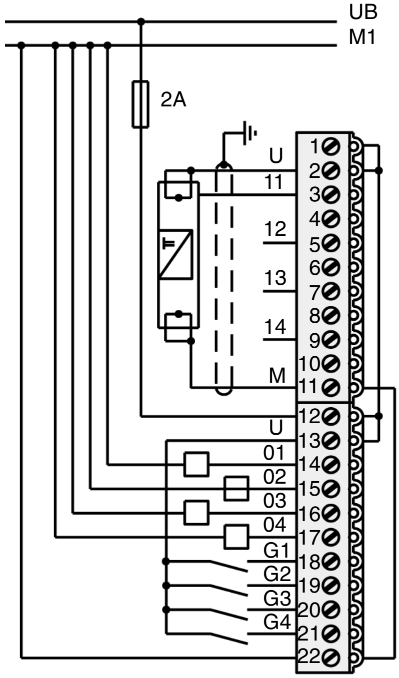
ZAE 204 IEC Wiring Diagram

Both of the following figures are IEC wiring diagrams for the ZAE 204.
The following figure is a ZAE 204 IEC wiring diagram.





The following figure is a ZAE 204 IEC wiring diagram.



I/O Configuration with Concept

B

At a Glance

Introduction

This chapter describes how to configure A120 Series I/O modules with Concept.

> **Note:** When using Modsoft with certain A120 I/O modules you had to build ladder logic to multiplex the data into the PLC. This is no longer required when using Concept programming panel software for these I/O modules: ADU 214/216/211/212, VIC 2xx/VRC 2xx/CTR2xx.

What's in this Chapter?

This chapter contains the following topics:

Multiplexing I/O Data with Concept

Overview

If you use Modsoft to configure certain A120 I/O modules, you must build ladder logic to multiplex the data into the PLC. This is not required if you use Concept programming panel software for the following I/O modules: ADU214/216/211/212, VIC2xx/VRC2xx/CTR2xx.

Configuring A120 Discrete Input Modules with Concept

Discrete Input Modules

This following information describes how to configure these modules:
- DEO 216 16-point 24 Vdc Discrete Input
- DEP 208 8-point 230 Vac Discrete Input
- DEP 209 8-point 120 Vac Discrete Input
- DEP 210 8-point 115 Vac Isolated Discrete Input
- DEP 211 8-point 115 Vac Isolated Discrete Input
- DEP 214/254/254C 16-point 12 ... 60Vdc Discrete Input
- DEP 215 16-point 5 Vdc TTL Discrete Input
- DEP 216/256/256C 16-point 24 Vdc Discrete Input
- DEP 217 16-point 24 Vdc Discrete Input
- DEP 218 16-point 115 Vac Isolated Discrete Input
- DEP 220 16-point 24 Vdc Discrete Input
- DEP 257 16-point 110 Vdc Discrete Input
- DEP 296 16-point 60 Vdc Isolated Discrete Input
- DEP 297 16-point 48 Vdc Isolated Discrete Input
- DEP 284* 8-point 115 Vac Isolated Discrete Input

*The DEP 284 is a "special", and therefore it is not included in this document.

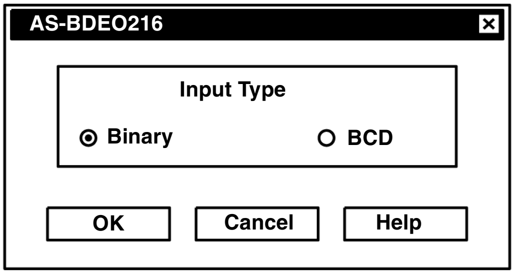
I/O Configuration Using Concept 2.1 or Higher

Use the following procedure to configure the module.

Step	Action
1	Select **Configure** from the menu.
2	Select **I/O Map** from the menu.
3	Click on **Edit...** The Local Common CPU Drop dialog appears.
4	Click on **Module**. The I/O Module Selection dialog appears.
5	Select **DEPxxx** and click on **OK**. A number and description appear.
6	In the In Ref field, enter **1x** or **3x** and press **Enter**. The software completes the **In Ref** and **In End** fields.
7	Click on **Params...** The Input Type dialog appears.
8	Select either **Binary** or **BCD** and click on **OK**.

AS-BDEO-216/ AS-BDEP 214/ 215/ 216/ 217/ 218/ 220/ 254(C)/ 256(C)/ 257(C)/ 296/ 297

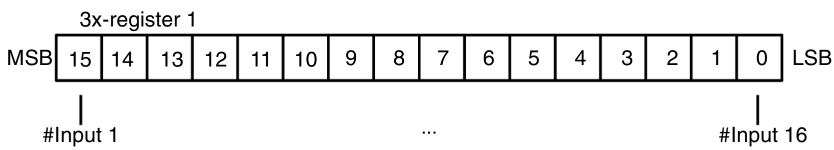
The AS-BDEO-216 dialog box, which follows, is used with these modules: AS-BDEO-216/ AS-BDEP 214/ 215/ 216/ 217/ 218/ 220/ 254(C)/ 256(C)/ 257(C)/ 296/ 297.



Input Type: The **Binary** and **BCD** option buttons in the input type section require corresponding choices between 1x-/3x-references (i.e., in binary or BCD). The 1x-references are shown in binary.

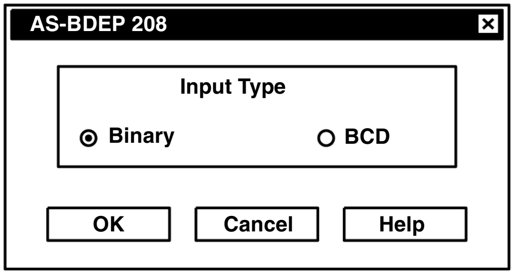
Meanings for the AS-BDEO-216/ AS-BDEP 214/ 215/ 216/ 217/ 218/ 220/ 254(C)/ 256(C)/ 257(C)/ 296/ 297 Module Mapping

These modules require sixteen 1x-discrete inputs. A single 3x-input register can be mapped instead of sixteen 1x-discrete inputs (shown in the following figure).
The following figure shows the 3x-register arrangement for the above-named modules.



AS-BDEP 208/ 210/211

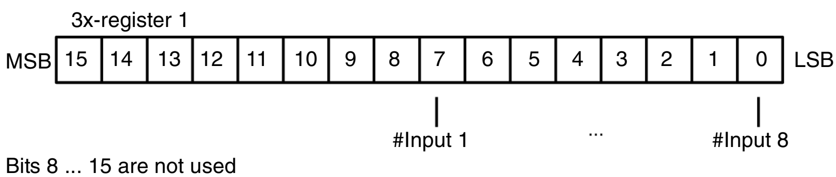
The AS-BDEP-208 dialog, shown in the following figure, is used with these modules: AS-BDEP 208/210/211.



Input Type: The **Input Binary** and **BCD** option buttons require a corresponding choice between 1x-/3x-references (i.e., in binary or BCD).

Meanings for the AS-BDEP 208/ 210/ 211 Module Mapping

These modules require eight 1x-discrete inputs. A single 3x-input register can be mapped instead of eight 1x-discrete inputs.
The following figure shows the 3x-register arrangement for the above-named modules.



> **Note:** Concept provides three ways to display address formats. The default is standard (400001). To change the address format display, use the steps in *Change Address Format Display Procedure, p. 675*. All four formats apply to discrete, analog, and intelligent modules.

Change Address Format Display Procedure

Use the following steps to modify the address format display.

Step	Action
1	From the Main menu, select **Options**, then select **Preferences**.
2	Select **standard (400001)**, **separator (4:00001)**, or **compact (4:1)**; then click **OK**.

Configuring Discrete Output Modules with Concept

Discrete Output Modules

This following information describes how to configure these modules:
- DAO 216 16-point 24 Vdc Discrete Output
- DAP 2x4 4-point 24 ... 110 Vdc/24 ... 250 Vac Relay Discrete Output
- DAP 208/258/258C 8-point 24 ... 110 Vdc/24 ... 250 Vac Relay Discrete Output
- DAP 209 8-point 120 Vac Discrete Output
- DAP 210 8-point 24 ... 240 Vac Discrete Output
- DAP 216(N)16-point 24 Vdc Discrete Output
- DAP 217 16-point 5 ... 24 Vdc Discrete Output
- DAP 218 16-point 24 ... 240 Vac Discrete Output
- DAP 284* 4-point 24 ... 110 Vdc/24 ... 250 Vac Relay Discrete Output (Special, Intrinsically Safe)

*The DAP 284 is a "special", and therefore it is not included in this document.

I/O Configuration Using Concept 2.1 or Higher

Use the following procedure to configure the module.

Step	Action
1	Select **Configure** from the menu.
2	Select **I/O Map** from the menu.
3	Click on **Edit**... The Local Common CPU Drop dialog appears.
4	Click on **Module**. The I/O Module Selection dialog appears.
5	Select **DAPxxx** and click on **OK**. A number and description appear.
6	In the **In Ref** field, enter **0x** or **4x** and press **Enter**. The software fills in the **Out Ref** and **Out End** fields.
7	Click on **Params...** The Output Type and Timeout State dialogs appear.
8	Select either **Binary** or **BCD** for the Output Type, and either **Last Value** or **User Defined** for the **Timeout State**. Click on **OK**.

CAUTION

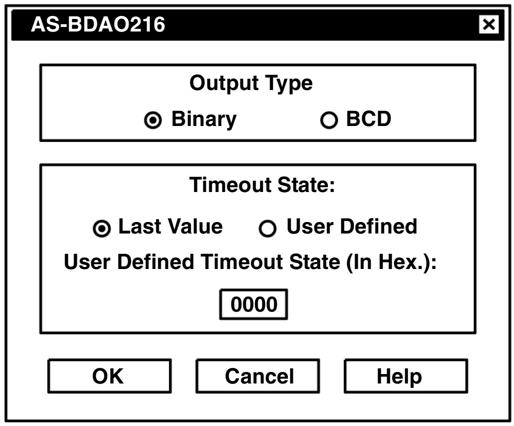
Power-down or kernel mode.

The output module Timeout States are valid only in a normal PLC stop state. Therefore, when the PLC powers down or goes into kernel mode, the outputs default to the module's fail safe state. The Timeout States are defined in the I/O Map module parameter screens.

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

AS-BDAO-216/ AS-DAP-216/N/ 217/218/209

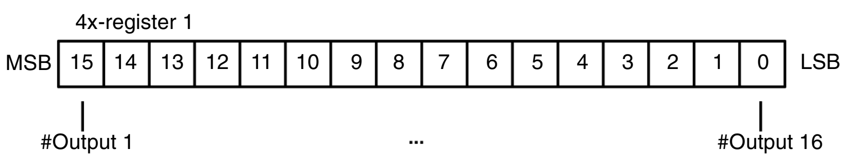
The AS-BDA0-216 dialog box, which follows, isused with the following modules: AS-BDAO-216/ AS-DAP-216/N/ 217/ 218/209.



Output Type: The **Binary** and **BCD** option buttons require corresponding choices between 0x-/4x-references (i.e., in binary or BCD).
Timeout State: The Compact timeout state only reflects a user program in stop mode.
Activation of the **Last Value** option button causes the outputs to retain their last valid value upon user program stop.
Activation of the **User Defined** option button causes the outputs to assume the value defined in the user-defined timeout state text field.
User Defined: If the **User Defined** option button was activated, the corresponding hex value can be entered here.

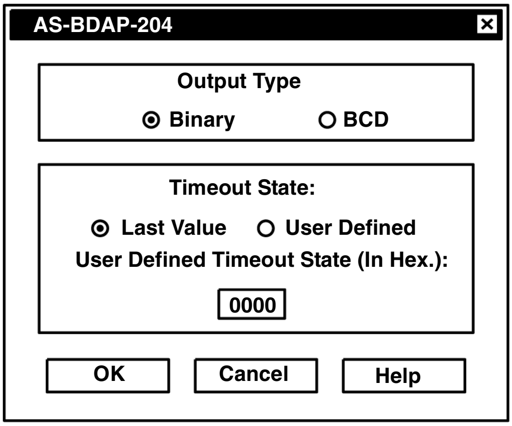
Meanings for the AS-BDAO-216/ AS-DAP-216/N/ 217/218/209 Module Mapping

The AS-BDAO-216/ AS-DAP-216/N/ 217/ 218/209 modules require 16 0x-discrete outputs. The **BCD** button will alternatively require mapping to a 4x-output register. The following figure shows the AS-BDAO-216/ AS-DAP-216/N/ 217/ 218/209 4x register arrangement.



AS-BDAP-204

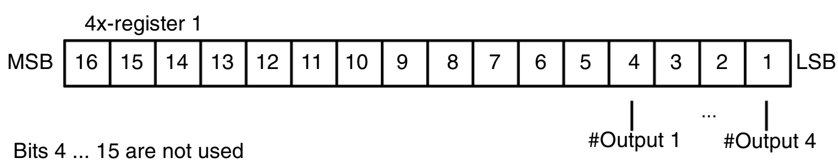
This AS-DBAP-204 dialog, which follows, is used with the following modules: AS-BDAP-204.



Output Type: The **Binary** and **BCD** option buttons require corresponding choices between 0x-/4x-references (i.e., in binary or BCD).
Timeout State: The Compact timeout state only reflects a user program in stop mode.
Activation of the **Last Value** option button causes the outputs to retain their last valid value upon user program stop.
Activation of the **User Defined** option button causes the outputs to take on the value defined in the user-defined timeout state text field.
User Defined: If the **User Defined** option button was activated, the corresponding hex value can be entered here.

Meanings for the AS-BDAP-204 Module Mapping

The AS-BDAP-204 module require four 0x-discrete outputs. The **BCD** option button will alternatively require mapping to a 4x-output register.
The following diagram shows the AS-BDAP-204 4x-register arrangement.



Configuring Discrete Combination Modules with Concept

Discrete Combination Modules

This follwoing information describes how to configure these modules:
- DAP 211 Monitored 4-point in/4-point out 120 Vac Combined I/O
- DAP 212/252/252C 8-point in/4-point out 24 Vdc Combined I/O
- DAP 220/250/250C 8-point in/8-point out 24 Vdc Combined I/O
- DAP 252 8-point in/4-point relay out 24 Vdc LT Combined I/O
- DAP 253 8-point in/4-point relay out 110 Vdc LT Combined I/O
- DAP 292 8-point in/4-point relay out 60 Vdc Combined I/O

I/O Configuration using Concept 2.1 or Higher

Use the following procedure to configure the module.

Step	Action
1	Select **Configure** from the menu.
2	Select **I/O Map** from the menu.
3	Click on **Edit...** The Local Common CPU Drop dialog appears.
4	Click on **Module**. The I/O Module Selection dialog appears.
5	Select **DAPxxx** and click on **OK**. A number and description appear.
6	In the **In Ref** field, enter **1x** or **3x** and press **Enter**. The software completes the **In Ref** and **In End** fields.
7	In the **Out Ref** field, enter **0x** or **4x** and press **Enter**. The software completes the **Out Ref** and **Out End** fields.
8	Click on **Params...** The Output Type and Timeout State dialogs appear.
9	Select either **Binary** or **BCD** for the Output Type and either **Last Value** or **User Defined** for the Timeout State. Click on **OK**.

CAUTION

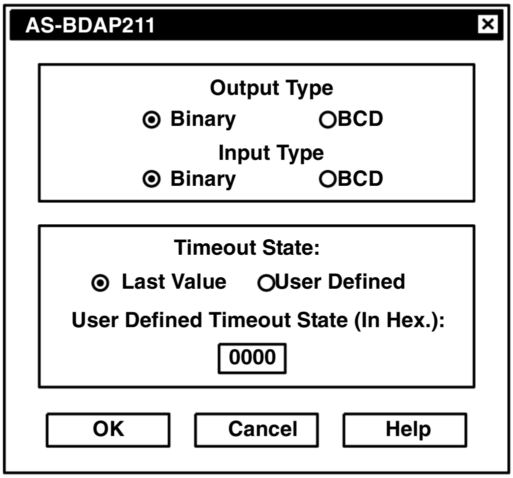
Power-down or kernel mode.

The output module Timeout States is valid only in a normal PLC stop state. Therefore, when the PLC powers down or goes into kernel mode, the outputs default to the module's fail safe state. The Timeout States are defined on the I/O Map module parameter screens.

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

AS-BDAP-211

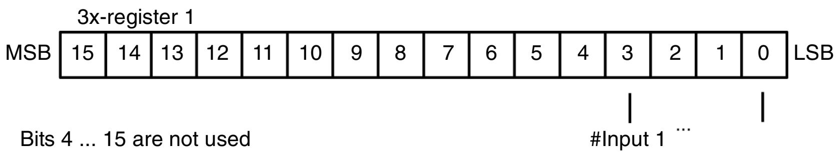
The AS-BDAP-211dialog, which follows, is used with the following module: AS-BDAP-211



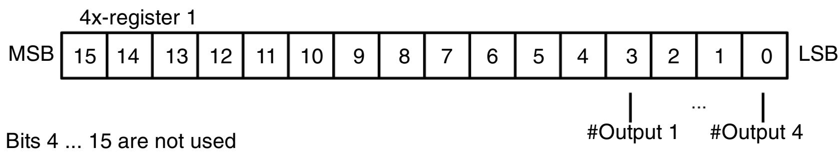
Output Type: The output **Binary** and **BCD** option buttons require corresponding choices between 0x-/4x-references (i.e., in binary or BCD).
Input Type: The input **Binary** and **BCD** option buttons require corresponding choices between 1x-/3x-references (i.e., in binary or BCD).
Timeout State: The Compact Timeout State only reflects a user program in stop mode.
Activation of the **Last Value** option button causes the outputs to retain their last valid valueupon user program stop.
Activation of the **User Defined** option button causes the outputs to take on the value defined in the user-defined timeout state text field.
User Defined: If the **User Defined** option button was activated, the corresponding hex value can be entered here.

Meanings for the AS-BDAP-211 Module Mapping

The AS-BDAP-211 modules require four 1x-discrete inputs and four 0x-discrete outputs. The **BCD** option button will alternatively require mapping to a 4x-output register instead of four 0x–discrete outputs. A single 3x-input register can be mapped, instead of four 1x-discrete inputs (as shown in the following figures).
The following figure shows the AS-BDAP-211 3x-register arrangement.

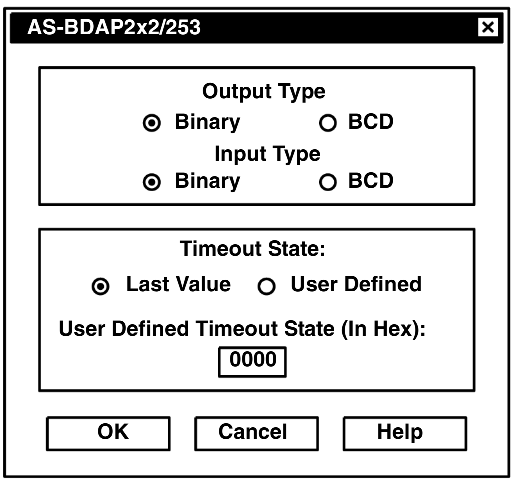


The following figure shows the AS-BDAP-211 4x-register arrangement.



AS-BDAP-212/ 252(C)/ 253/ 292

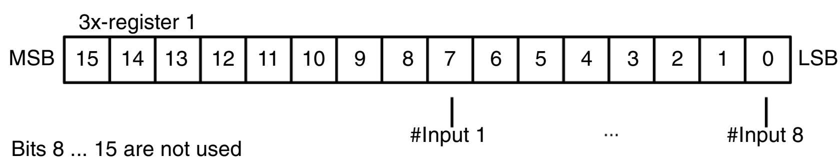
The AS-BDAP-212/252(C)/ 253/ 292 dialog box, which follows, is used with the following modules: AS-BDAP-212/ 252(C)/ 253/ 292.



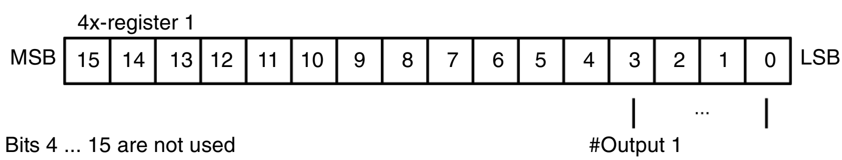
Output Type: The output **Binary** and **BCD** option buttons require corresponding choices between 0x-/4x-references (i.e., in binary or BCD).
Input Type: The input **Binary** and **BCD** option buttons require corresponding choices between 1x-/3x-references (i.e., in binary or BCD).
Timeout State: The Compact Timeout State only reflects a user program in stop mode.
Activation of the **Last Value** option button causes the outputs to retain their last valid value upon user program stop.
Activation of the **User Defined** option button causes the outputs to assume the value defined in the user-defined timeout state text field.
User Defined: If the **User Defined** option button was activated, the corresponding hex value can be entered here.

Meanings for the AS-BDAP-212/ 252(C)/ 253/ 292 Module Mapping

The AS-BDAP-212/ 252(C)/ 253/ 292 modules require eight 1x-discrete inputs and four 0x-discrete outputs. The **BCD** option button will alternatively require mapping to be made to a 4x-output register. A single 3x-input register can be mapped instead of eight 1x-discrete inputs.
The following figure shows the AS-BDAP-212/252(C)/253/292 3x-register arrangement.

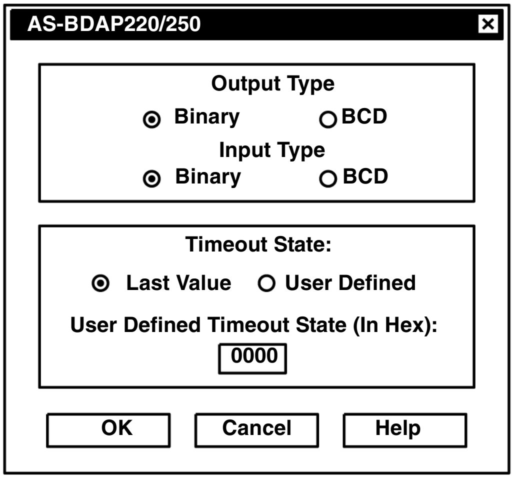


The following figure shows the AS-BDAP-212/ 252(C)/253/292 4x-register arrangement.



AS-BDAP-220/ 252(C)

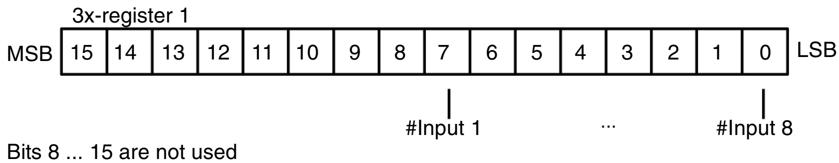
The AS-BDAP220/250(C) dialog, which follows, is used with the following modules: AS-BDAP-220/250(C).



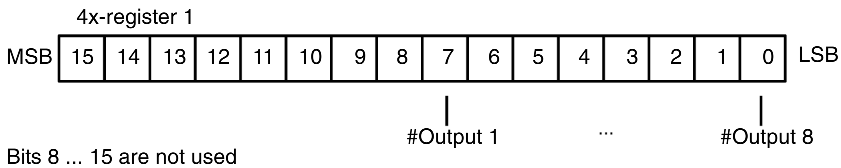
Output Type: The output **Binary** and **BCD** option buttons require corresponding choices between 0x-/4x-references (i.e., in binary or BCD).
Input Type: The input **Binary** and **BCD** option buttons require orresponding choices between 1x-/3x-references (i.e., in binary or BCD).
Timeout State: The Compact Timeout State only reflects a user program in stop mode.
Activation of the **Last Value** option button causes the outputs to retain their last valid value upon user program stop.
Activation of the **User Defined** option button causes the outputs to take on the value defined in the user-defined timeout state text field.
User Defined: If the **User Defined** option button was activated, the corresponding hex value can be entered here.

Meanings for the AS-BDAP-220/ 250(C) Module Mapping

The AS-BDAP-220/ 250(C) modules require eight 1x-discrete inputs and eight 0x-discrete outputs. The output **BCD** option button will alternatively require mapping to a 4x-output register. The input **BCD** option button will require a 3x-input register mapping (as shown in the following two figures).
The following figure shows the AS-BDAP-220/ 250(C) 3x-register arrangement.



The following figure shows the AS-BDAP-220/ 250(C) 4x-register arrangement.



Configuring Analog Input Modules with Concept

Analog Input Modules

The following information describes how to configure these modules:
- ADU 204/254/254C 4–point Voltage/RTD Analog Input
- ADU 205 4–point Voltage/Current Analog Input
- ADU 206/256/256C 4–point Voltage/Current Isolated Analog Input
- ADU 210 4–point Voltage/Current Analog Input (Only supported in Concept 2.2 or higher)
- ADU 214 8–point Voltage/Current Isolated Analog Input (Only supported in Concept 2.2 or higher)
- ADU 216 8–point Thermocouple Isolated Analog Input
- ADU 257/257C 8–point Millivolts/RTD/TC/Resistance Analog Input (Only supported in Concept 2.2 or higher)
- ADU 282/282M* 2–point Analog Input (Special, Intrinsically Safe)
- ADU 284* 2-point Analog Input (Special, Intrinsically Safe)
- ADU 211/212 8–point Universal Isolated Analog Input (Not supported in Concept 2.1 or higher)

*This is a "special", and therefore it is not included in this document.

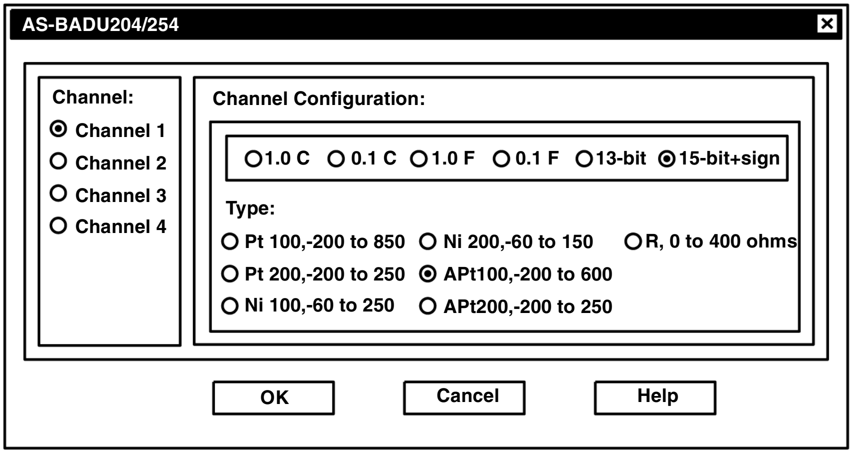
I/O Configuration Using Concept 2.1 or Higher

Use the following procedure to configure the module.

Step	Action
1	Select **Configure** from the menu.
2	Select **I/O Map** from the menu.
3	Click on **Edit...** The Local Common CPU Drop dialog appears.
4	Click on **Module**. The I/O Module Selection dialog appears.
5	Select **ADUxxx** and click on **OK**. A number and description appear.
6	In the **In Ref** field, enter **3x** and press **Enter**. The software completes the **In Ref** and **In End** fields.
7	Click on **Params...** The applicable configuration dialog appears, depending on the selected module. Refer to the specific modules.

Configuring AS-BADU-204/ 254(C) Modules

The following information applies to the AS-BADU-204/254(C) modules.
The AS-BADU-204/ 254(C) parameter dialog, which follows, is used for the analog modules AS–BADU–204/ 254(C).



Channel: The option buttons here allow the selection of individual channels for configuration, as follows:
- Channel 1 = Pins 3 ... 6
- Channel 2 = Pins 7...10
- Channel 3 = Pins 14 ... 17
- Channel 4 = Pins 18 ... 21

Channel–specific option panels are presented for each channel selection. Values entered for a channel are saved automatically when another channel is selected, and therefore are not lost during the definition of another channel.
Channel Configuration: Measuring ranges and data formats for temperature measurement data transfer to the Compact PLC can be determined in this list box. The **1.0 C/F** and **0.1 C/F** option buttons allow a choice of measuring steps of either 1.0 or 0.1 degree (in Centigrade or Fahrenheit). This allows differing displays for the same measurement value, as shown in the following table.

1.0 degree Centigrade	0.1 degree Centigrade
-60	-600
200	2000

The remaining option buttons **13–bit** and **15-**+sign (15–bit value + sign) determine the value range to be transferred.
The tables that follow are present values for all configurable resistive temperature sensors, which are listed here:

- Pt 100, -200 to 850
- Pt 200, -200 to 250
- Ni 100, -60 to 250
- Ni 200, -60 to 150
- APt 100, -200 to 600
- APt 200, -200 to 250
- R, 0 to 400 ohms

Pt 100-200 degrees C to 850 degrees C

Temp. (degrees C)	**1.0 C**	**0.1 C**	**1.0 F**	**0.1 F**	**13-bit**	**15-bit + sign**	**Measuring step/ value range**
<-205	-32768	-32768	-32768	-32768	0	-32768	Under-range
-200	-200	-2000	-328	-3280	3132	-7529	Nominal range
0	0	0	+32	+320	4096	0	
+850	+850	+8500	+1562	+15620	8191	32000	
>+870	+32767	+32767	+32767	+32767	8191	+32767	Overrange

Pt 200-200 degrees C to 250 degrees C

Temp. (degrees C)	**1.0 C**	**0.1 C**	**1.0 F**	**0.1 F**	**13-bit**	**15-bit + sign**	**Measuring step/ value range**
<-205	-32768	-32768	-32768	-32768	0	-32768	Under-range
-200	-200	-2000	-328	-3280	819	-25600	Nominal range
0	0	0	+32	+320	4096	0	
+250	+250	+2500	+482	+4820	8191	32000	
>+256	+32767	+32767	+32767	+32767	8191	+32767	Overrange

Ni 100-60 degrees C to 250 degrees C

Temp. (degrees C)	**1.0 C**	**0.1 C**	**1.0 F**	**0.1 F**	**13-bit**	**15-bit + sign**	**Measuring step/ value range**
<-61	-32768	-32768	-32768	-32768	0	-32768	Under-range
-60	-60	-600	-76	-760	3113	-7680	Nominal range
0	0	0	+32	+320	4096	0	
+250	+250	+2500	+482	+4820	8191	32000	
>+256	+32767	+32767	+32767	+32767	8191	+32767	Overrange

Ni 100-60 degrees C to 150 degrees C

Temp. (degrees C)	1.0 C	0.1 C	1.0 F	0.1 F	13-bit	15-bit + sign	Measuring step/ value range
<-61	-32768	-32768	-32768	-32768	0	-32768	Under-range
-60	-60	-600	-76	-760	2458	-12800	
0	0	0	+32	+320	4096	0	Nominal range
+150	+150	+1500	+302	+3020	8191	32000	
>+151	+32767	+32767	+32767	+32767	8191	+32767	Overrange

APt 100-200 degrees C to 600 degrees C

Temp. (degrees C)	1.0 C	0.1 C	1.0 F	0.1 F	13-bit	15-bit + sign	Measuring step/ value range
<-205	-32768	-32768	-32768	-32768	0	-32768	Under-range
-200	-200	-2000	-328	-3280	2731	-10667	
0	0	0	+32	+320	4096	0	Nominal range
+600	+600	+6000	+1112	+11120	8191	32000	
>+614	+32767	+32767	+32767	+32767	8191	+32767	Overrange

APt 200-200 degrees C to 250 degrees C

Temp. (degrees C)	1.0 C	0.1 C	1.0 F	0.1 F	13-bit	15-bit + sign	Measuring step/ value range
<-205	-32768	-32768	-32768	-32768	0	-32768	Under-range
-200	-200	-2000	-328	-3280	819	-25600	
0	0	0	+32	+320	4096	0	Nominal range
+250	+250	+2500	+482	+4820	8191	32000	
>+256	+32767	+32767	+32767	+32767	8191	+32767	Overrange

R, 0 to 400 ohms

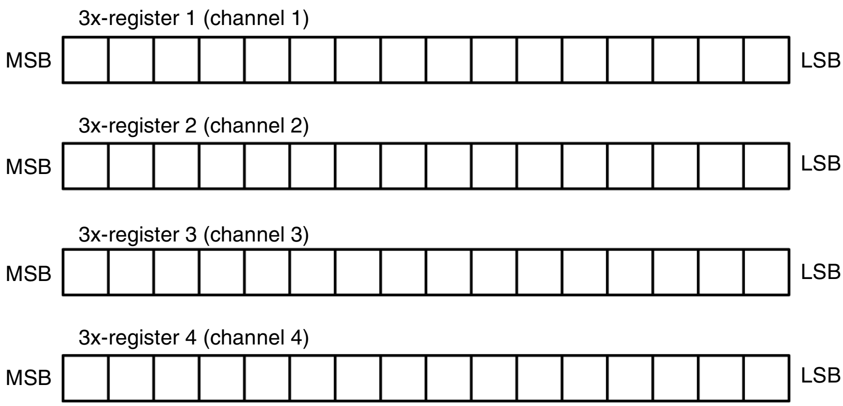
Resistance in W	13-bit	15-bit + sign	Value range
0	0	0	
100	2048	+8000	Recommended nominal range
200	4096	+16000	
399.902	8191	+32000	
>= 400	8191	+32767	Overrange

Type: In this section, an option button can be used to choose a resistive temperature sensor type for the selected channel, or a direct resistance measurement can be performed.

Note: The type R, 0 to 400 ohms button, only selects values whose size has been determined to be either **13–bit** or 1**5–bit + sign** through the appropriate option buttons.

Meanings for the AS-BADU-204/ 254(C) Module Mapping

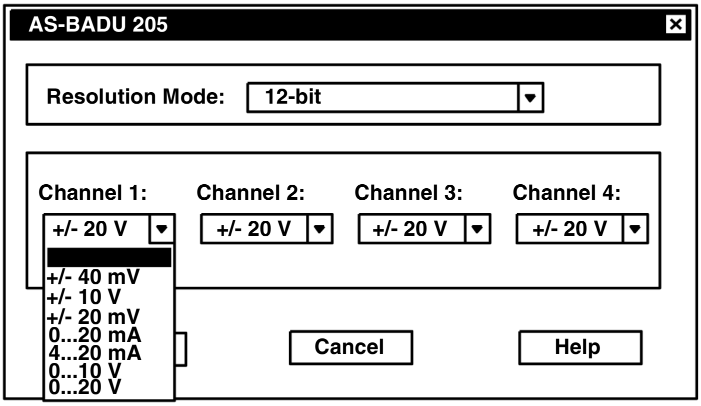
The AS-BADU-204/254(C) modules require four 3x-input registers addressed in sequence, beginning with channel 1 as shown here.



Note: Refer to *Concept I/O Map Status Words, p. 739*.

AS-BADU-205

The following information applies to the AS-BADU-205 module.
The 20AS-BADU-205 parameter dialog, which follows, is valid for the analog module AS-BADU-205.



Resolution Mode: This list box defines the value range for all channels:
- 12-bit
- 12-bit + sign
- 13-bit
- 15-bit + sign
- 16-bit

Channel 1 ... 4: The desired measuring ranges can be chosen in these list boxes.

Note: The combination of current and voltage ranges is not allowed. Pay attention to the switches on the rear of the module.

The measuring ranges can be chosen from the following selections:
- +/- 20 VDC
- +/- 40 mA
- +/- 10 VDC
- +/- 20 mA
- 0 ... 20 mA
- 4 ... 20 mA
- 0 ... 10 VDC
- 0 ... 20 VDC

+/- 20 mA, +/- 40 mA

Input current (mA)	12-bits	13-bits	16-bits	12-bits + sign	15-bits + sign	Range
<-20/-40	0	0	0	-4095	-32768	Under-range
-20/-40	0	0	0	-4095	-32000	Nominal range
0	2048	4096	32768	0	0	
+20/+40	4095	8191	65520	+4095	+32000	
>+20/+40	4095	8191	65520	+4095	+32767	Overrange

+/- 10 VDC, +/- 20 VDC

Input voltage (VDC)	12-bits	13-bits	16-bits	12-bits + sign	15-bits + sign	Range
<-10/-20	0	0	0	-4095	-32768	Under-range
-10/-20	0	0	0	-4095	-32000	Nominal range
0	2048	4096	32768	0	0	
+10/+20	4095	8191	65520	+4095	+32000	
>+10/+20	4095	8191	65520	+4095	+32767	Overrange

0 ... 10 VDC, 0 ... 20 VDC

Input voltage (VDC)	12-bits	13-bits	16-bits	12-bits + sign	15-bits + sign	Range
< 0	0	0	0	-4095	-32768	Under-range
0	0	0	0	0	0	Nominal range
10/20	4095	8191	65520	+4095	+32000	
>10/20	4095	8191	65520	+4095	+32767	Overrange

0 ... 20 mA

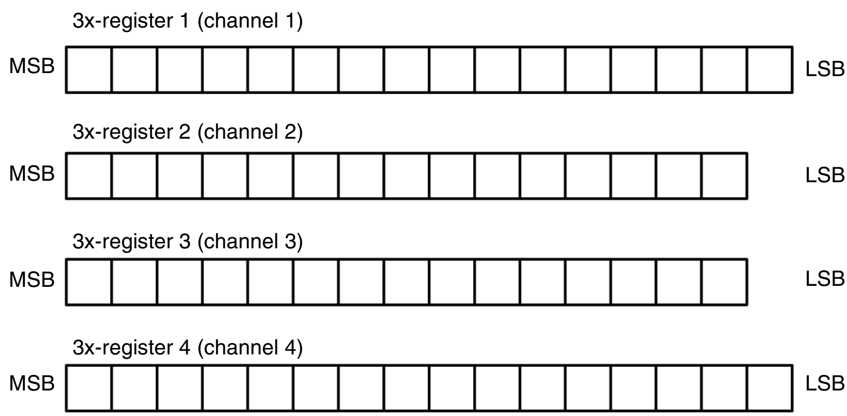
Input current (mA)	12-bits	13-bits	16-bits	12-bits + sign	15-bits + sign	Range
< 0	0	0	0	-4095	-32768	Under-range
0	0	0	0	0	0	Nominal range
20	4095	8191	65520	+4095	+32000	
>20	4095	8191	65520	+4095	+32767	Overrange

4 ... 20 mA

Input current (mA)	12-bits	13-bits	16-bits	12-bits + sign	15-bits + sign	Range
< 0 ... 2	0	0	0	0	0	Wire breakage
2.1 ... 3.61	0	0	0	0	-32768	Under-range
3.62 ... 3.99	0	0	0	0		Tolerable range
4	0	0	0	0	0	Nominal range
20	4095	8191	65520	+4095	+32000	
>20	4095	8191	65520	+4095	+32767	Overrange

Meanings for the AS-BADU-205 Module Mapping

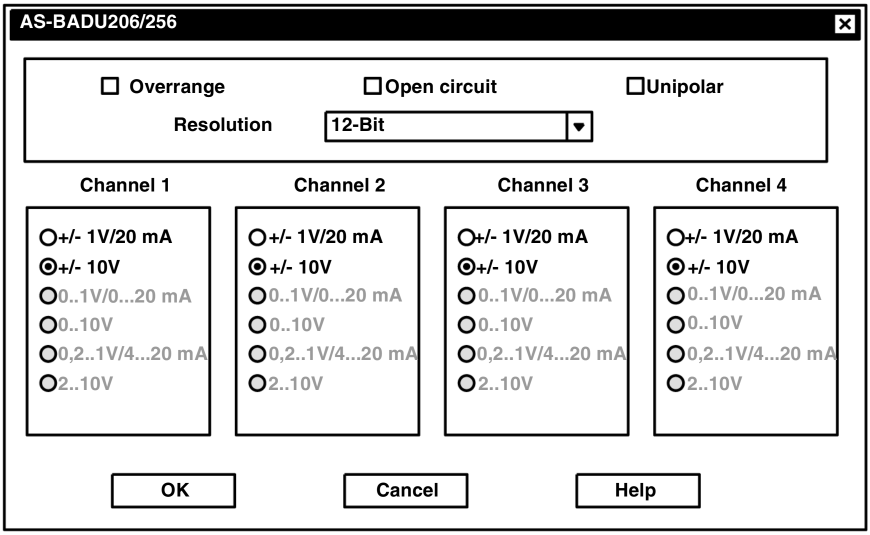
The AS–BADU–205 module requires four 3x–input registers addressed in sequence, beginning with channel 1 (as shown in the following figure).



Note: Refer to *Concept I/O Map Status Words, p. 739.*

AS-BADU-206/ 256(C)

The following information describes the AS-BADU-206/256(C) modules.
The AS-BADU-206/ 256(C) parameter dialog shown below is valid for the analog modules AS–BADU–256/ (C).



Overrange: Activation of the **Overrange** option button enables range exception monitoring. Any range exceptions then trigger a corresponding message within the first input status word (bits 0 ... 3).
Open circuit: Activation of the **Open circuit** (wire breakage) option button enables open-circuit monitoring. Any subsequent error messages are then visible within the first input status word (bits 4 ... 7).
Unipolar: Selection of the **Unipolar** option button restricts choices to the unipolar measuring ranges (e.g. 0 ... 20 mA/ 0 ... 10 V).
Resolution: This list box defines the value range for all channels:

- 11-bit + sign
- 12-bit
- 15-bit + sign
- 16-bit

Channel 1 ... 4: The measuring ranges for channels 1-4 can be chosen from the tables that follow.

Measuring ranges 0 ... 10 VDC/2 ... 10 VDC, 0 ... 20 mA/4 ... 20 mA

Voltage (VDC)	**Current (mA)**	**12-bits**	**16-bits**	**11-bits + sign**	**15-bits + sign**	**Range**
		0	0	0	0	Under-range
		0	0	0	0	Neg. tolerance range
0/2	0/4	0	0	0	0	Nominal range
10	20	4000	64000	+2000	+32000	
10.01 ...	20.02 ...	4001	64016	+2001	+32016	Pos. tolerance range
>= 10.24/ 10.19	>= 20.48/ 20.39	4095	65520	+2047	+32760	Overrange

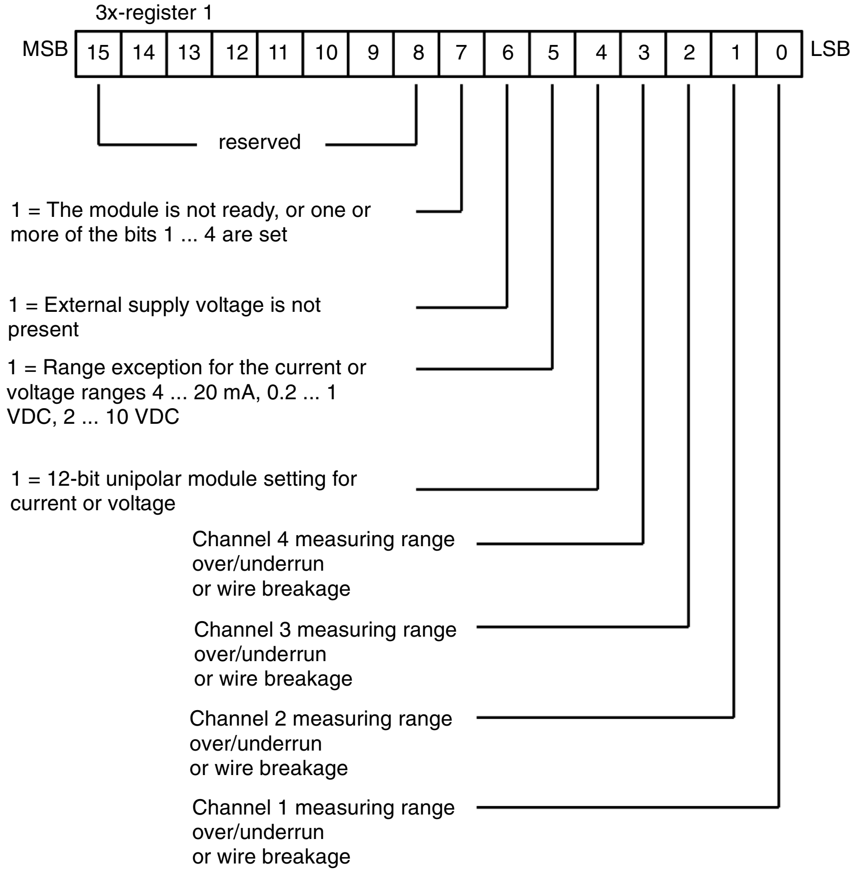
Measuring ranges +/- 10 VDC/ +/- 20 mA

Voltage (VDC)	**Current (mA)**	**12-bits**	**16-bits**	**11-bits + sign**	**15-bits + sign**	**Range**
<=-10.24	<=-20.48	0	0	-2048	-32768	Under-range
-10.01	-20.02	47		-2001	-32016	Neg. tolerance range
-10.00	-20	48	768	-2000	-32000	
0	0	2048	32768	0	0	Nominal range
+10.00	+20	4048	64768	+2000	+32000	
+10.01 ...	+20.02 ...	4049		+2001	+32016	Pos. tolerance range
>=10.24	>=20.48	4095	65520	+2047	+32752	Overrange

AS-BADU-206/ 256(C) Module Input Status Word

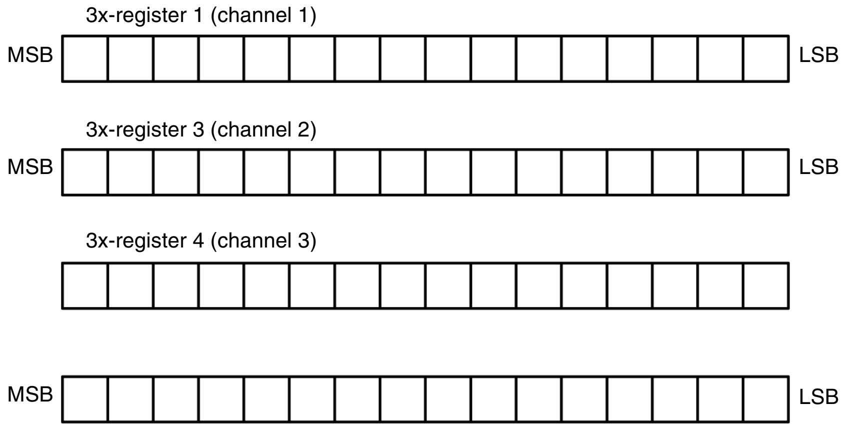
The AS–BADU–206/256 modules require five 3x–input registers addressed in sequence, beginning with the input status word, then channel. (Refer to the following two figures.)

The following figure shows the AS-BADU-206/ 256(C) 3x module status word.



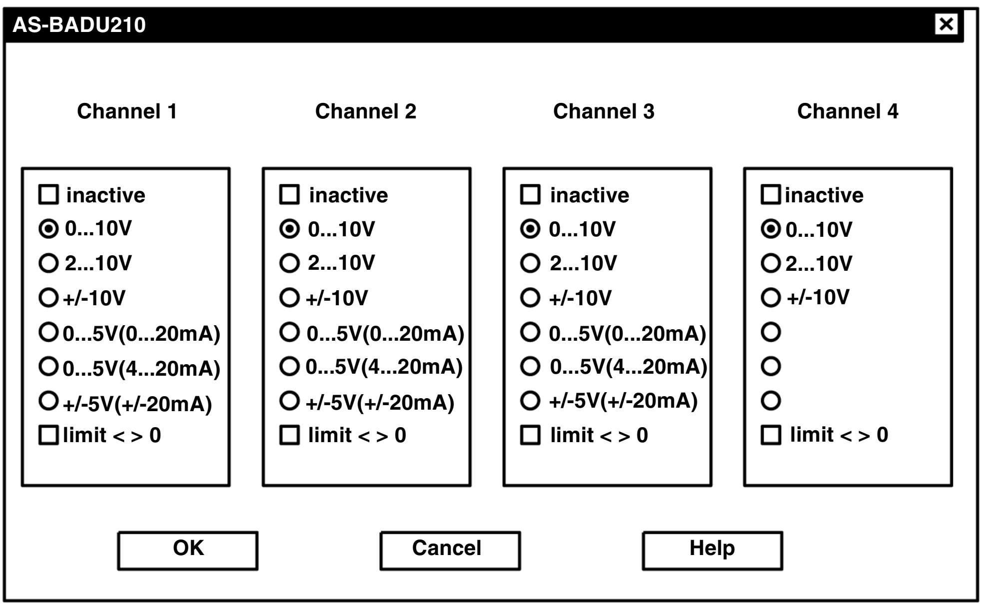
Meanings for the AS-BADU-206/ 256(C)Module Mapping

The following figure shows the AS-BADU-206/ 256(C) 3x-register arrangement.



AS–BADU–210

The following information applies to the AS-BADU-210 module.
The dialog, which follows, works with the analog module AS–BADU–210.



Channel 1 ... 4:

For Chanel ... 4, use the following guidelines:

- Select inactive when channel is not used.
- Select limit < > 0 if you want to use the 1.6% rated value without causing an error for uniplar ranges only.

Use the information in the following tables to choose the measuring ranges for channels 1 to 4.

Conversion Values of Voltage Inputs

Analog value 0 ... 5 V	Analog value 0 ... 10V	Analog value 1 ... 5 V	Analog value 2 ... 10 V	Analog value +/–5 V	Analog value +/– 10 V	Decimal value	Notes
<-0.080	<-0.16	<+0.52	<+1.04	<-5.12	<-10.24	-32 767	underflow error
				-5.119 ... -5.00	-10.239... -10.00	-32 766... -32 001	overload range
-0.08 ... -0.00	-0.16 ... -0.00	+0.52 ... +0.936 ... +0.99	+1.04 .. +1.87 ... +1.99			0 (-3 840) 0 (-512) 0 (-1)	overload range
				-5.00	-10.00	-32 000	linear
				-2.50	-5.00	-16 000	linear
				-0.50	-1.00	-3 200	linear
				-0.25	-0.50	-1 600	linear
				-0.05	-0.10	-320	linear
				-0.005	-0.01	-32	linear
				-0.0025	-0.005	-16	linear
0	0	1	2	0	0	0	linear
0.0025	0.005	1.002	2.004	+0.0025	+0.005	+16	linear
0.005	0.01	1.004	2.008	+0.005	+0.01	+32	linear
0.05	0.10	1.04	2.08	+0.05	+0.10	+320	linear
0.25	0.50	1.20	2.40	+0.25	+0.50	+1 600	linear
0.50	1.00	1.40	2.80	+0.50	+1.00	+3 200	linear
2.50	5.00	3.00	6.00	+2.50	+5.00	+16 000	linear
5.00	10.00	5.00	10.00	+5.00	+10.00	+32 000	rated value
5.000... 5.119	10.000... 10.239	5.00... 5.09	10.00... 10.19	+5.000.. +5.119	+10.00... +10.239	+32 001... +32 766	overload range
>5.12	>10.24	>5.09	>10.19	>+5.20	>+10.24	>+32 767	overflow error

Note: Brackets denote range with limiting value –1.6%. No brackets denotes range with limiting value 0.

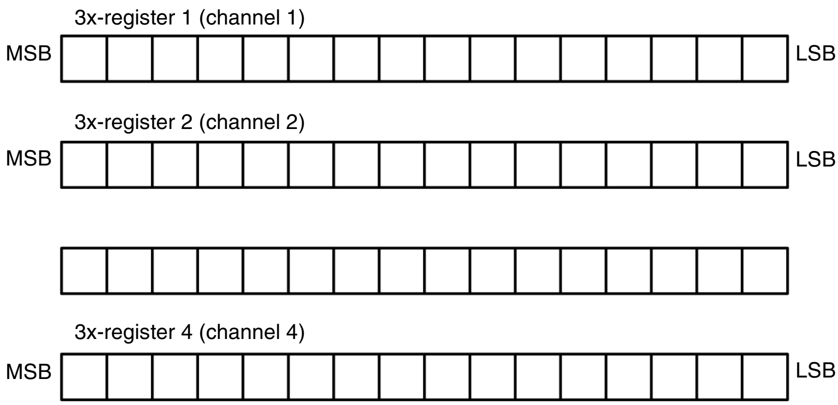
Conversion Values of Current Inputs

Analog value 0 ... 20 mA	Analog value 4 ... 20 mA	Analog value +/ –20 mA	Decimal value	Notes
<-0.32	<+2.08	<-20.479	-32 767	underflow error
		-20.478 ... -20.000	-32 766 ... -32 001	overload range
-0.32 ... -0.00	+2.08 ... +3.74 ... +3.99		0 (-3 840) 0 (-512) 0 (-1)	overload range
		-20.00	-32 000	linear
		-10.00	-16 000	linear
		-2.00	-3 200	linear
		-1.00	-1 600	linear
		-0.20	-320	linear
		-0.02	-32	linear
		-0.01	-16	linear
0	+4	0	0	linear
+0.01	+4.008	+0.01	+16	linear
+0.02	+4.016	+0.02	+32	linear
+0.20	+4.16	+0.20	+320	linear
+1.00	+4.80	+1.00	+1 600	linear
+2.00	+5.60	+2.00	+3 200	linear
+10.00	+12.00	+10.00	+16 000	linear
+20.00	+20.00	+20.00	+32 000	rated value
+20.000 ... +20.478	+20.00 ... +20.38	+20.000 ... +20.478	+32 001 ... +32 766	overload range
>+20.479	>+20.38	>+20.479	>+32 767	overflow error

Note: Brackets denote range with limiting value –1.6%. No brackets denotes range with limiting value 0.

Meanings for the AS–BADU–210 Module Mapping

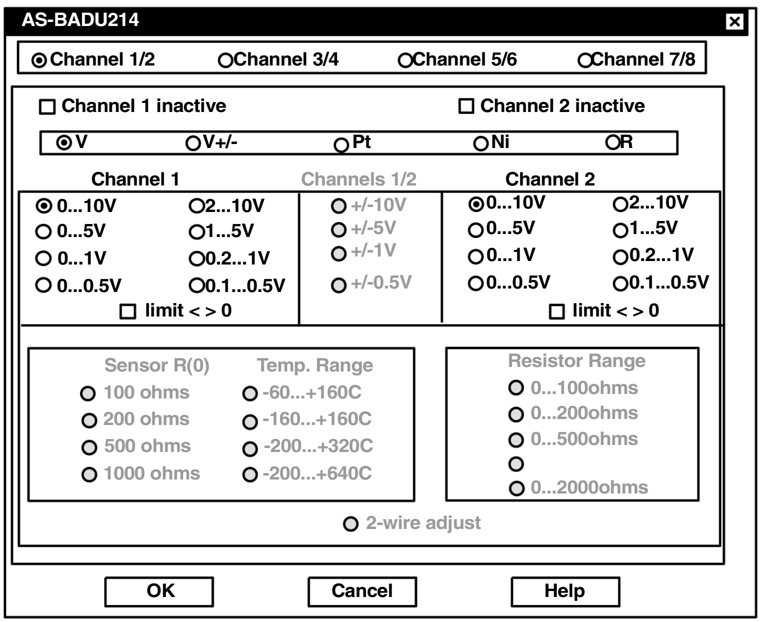
The AS–BADU–210 module requires four 3x–input registers addressed in sequence, beginning with channel 1 as shown below.



Note: Refer to *Concept I/O Map Status Words, p. 739* for Concept I/O Map Status Words.

AS–BADU–214

The following dialog is valid for the analog module AS–BADU–214.



Channel 1 ... 8: Bipolar measurements are configured in pairs. Either channel of the pair may be made inactive. Also, the 2–wire adjust is used for 2 or 3 wire 10 ohm compensation.
The measuring ranges for channels 1 to 8 can be chosen in these sections.
Conversion Values of Unipolar Voltage Inputs

0...0.5 V	**0...1 V**	**0...5 V**	**0...10 V**	**0.1...0.5 V**	**0.2...1 V**	**1...5 V**	**2...10 V**
< –0.008	< –0.016	< –0.08	< –0.16	< +0.052	< +0.104	< +0.52	< +1.04
				+0.052	+0.104	+0.52	+1.04
–0.008 ...	–0.016 ...	–0.08 ..	–0.16 ..	+0.094 ...	+0.187 ...	+0.93 6 ...	+1.87 ...
–0.000	–0.000	–0.00	–0.00	+0.099	+0.199	+0.99	+1.99
0	0	0	0	0.1	0.2	1	2
0.000 02	0.000 03	0.000 16	0.000 31	0.100 0	0.200 0	1.000 1	2.000 3
0.000 25	0.000 5	0.002 5	0.005	0.100 2	0.200 4	1.002	2.004
0.000 5	0.001	0.005	0.01	0.100 4	0.200 8	1.004	2.008
0.005	0.01	0.05	0.10	0.104	0.208	1.04	2.08
0.025	0.05	0.25	0.50	0.12	0.24	1.20	2.40
0.05	0.10	0.50	1.00	0.14	0.28	1.40	2.80
0.25	0.50	2.50	5.00	0.30	0.60	3.00	6.00
0.50	1.00	5.00	10.00	0.50	1.00	5.00	10.00
0.500 0 ...	1.000 0 ...	5.000 ...	10.000 ...	0.500 ...	1.000 ...	5.00 ...	10.00 ...
0.511 9	1.023 9	5.119	10.239	0.509	1.019	5.09	10.19
>=0.512	>=1.024	>=5.12	>=10.24	>0.509	>1.019	>5.09	>10.19
NOTE: Numbers not in parentheses = range with + limit.							

Conversion Values of Unipolar Voltage Inputs (continued)

15-BIT	NOTES
–32,767	underflow error
0 (–3,840) 0 (–512) 0 (–1)	overload range
0 +1 +16 +32 +320 +1 600 +3 200 +16 000 +32 000	rated value Linear Range rated value
+32 001 ... +32 766	 overload range
+32 767	overflow error

Note: Numbers in parentheses = range with + and - limit.

Conversion Values of Bipolar Voltage Inputs

+/-0.5 V	+/-1 V	+/-5 V	+/-10 V
<= –0.512	<= –1.024	<= –5.12	<= –10.24
–0.511 9 ... –0.500 0	–1.023 ... –1.000	–5.119 ... –5.000	–10.239 ... –10.000
–0.50 –0.25 –0.05 –0.025 –0.005 –0.000 5	–1.00 –0.50 –0.10 –0.05 –0.01 –0.001	–5.00 –2.50 –0.50 –0.25 –0.05 –0.005	–10.00 –5.00 –1.00 –0.50 –0.10 –0.01
–0.000 25 0 +0.000 02	–0.000 5 0 +0.000 03	–0.002 5 0 +0.000 16	–0.005 0 +0.000 31

+/-0.5 V	+/-1 V	+/-5 V	+/-10 V
+0.000 25 +0.000 5 +0.005 +0.025 +0.05 +0.25 +0.50	+0.000 5 +0.001 +0.01 +0.05 +0.10 +0.50 +1.00	+0.002 5 +0.005 +0.05 +0.25 +0.50 +2.50 +5.00	+0.005 +0.01 +0.10 +0.50 +1.00 +5.00 +10.00
+0.500 0 ...	+1.000 0 ...	+5.000 ...	+10.000 ...
+0.511 9	+1.023 9	+5.119	+10.239
>= +0.512	>= +1.024	>= +5.12	>= +10.24

Conversion Values of Bipolar Voltage Inputs (continued)

15-BIT	NOTES
–32,767	underflow error
–32 766 –32 001	overload range
–32 000 –16 000 –3 200 –1 600 –320 –32 –16 0 +1 +16 +32 +320 +1 600 +3 200 +16 000 +32 000	rated value linear range rated value
+32 001 ... +32 766	 overload range
+32 767	overflow error

Conversion Values of Current Inputs

0...10 mA	**0...20 mA**	**2...10 mA**	**4...20 mA**	**+20 mA**
< –0.16	< –0.32	< +1.04	< +2.08	<= –20.479
				–20.478 ...
				–20.000
		+1.04 ...	+2.08 ...	
–0.16...	–0.32...	+1.87 ...	+3.74 ...	
–0.00	–0.00	+1.99	+3.99	
				–20.00 –10.00 –2.00 –1.00 –0.20 –0.02 –0.01
0	0	+2	+4	0
+0.005	+0.01	+2.004	+4.008	+0.01
+0.01	+0.02	+2.008	+4.016	+0.02
+0.1	+0.20	+2.08	+4.16	+0.20
+0.5	+1.00	+2.40	+4.80	+1.00
+1	+2.00	+2.80	+5.60	+2.00
+5	+10.00	+6.00	+12.00	+10.00
+10.0	+20.00	+10.00	+20.00	+20.00
+10.000...	+20.000...	+10.00...	+20.00...	+20.000...
+10.239	+20.478	+10.19	+20.38	+20.478
>= +10.24	>= +20.479	> +10.19	> +20.38	>= +20.479

Conversion Values of Current Inputs (continued)

15-BIT	NOTES
–32,767	underflow error
–32 766 –32 001 0 (–3 840) 0 (–512) 0 (–1)	overload range
–32 000	rated value
–16 000	
–3 200	
–1 600	
–320	
–32	
–16	
0	linear range
+1	
+16	
+32	
+320	
+1 600	
+3 200	
+16 000	
+32 000	rated value
+32 001 ... +32 766	overload range
+32 767	overflow error

Note: NOTE: Numbers in parentheses + range with +/– limit

Conversion Values of Temperature Inputs

-60 ... +160oC	**-160 ... +160oC**	**-200 ... +320oC**	**-200 ... +640oC**
< –60	< –160	< –200	< –200
	–160		
	–100	–200	
–60	–60	–120	
–50	–50	–100	–200
–16	–16	–32	–64
0	0	0	0
+0.005	+0.005	+0.01	+0.02
+0.08	+0.08	+0.16	+0.32
+0.16	+0.16	+0.32	+0.64
+8	+8	+16	+32
+16	+16	+32	+64
+80	+80	+160	+320
+160	+160	+320	+640
+160.005 ...	+160.005 ...	+320.01 ...	+640.02 ...
+163.83	+163.83	+327.66	+655.32
>= +163.84	>= +163.84	>= +327.67	>= +655.34

Conversion Values of Temperature Inputs (continued)

15-BIT	**NOTES**
–32,767	measuring range underflow (error)
–32 000	rated value
–22 000	
–12 000	
–10 000	
–3 200	
0	linear range
+1	
+16	
+32	
+320	
+1 600	
+3 200	
+16 000	

15-BIT	NOTES
+32 000	rated value
+32 001 ... +32 766	overload range
+32 767	measuring range overflow error

Conversion Values for Resistance Inputs

0...100 Ω	**0...200 Ω**	**0...500 Ω**	**0...1000 Ω**	**0...2000 W**
< –1.6	< –3.2	< –8	< –16	< –32
0...–1.6	0...–3.2	0...–8	0...–16	0...–32
0	0	0	0	0
0.003	0.006	0.015	0.03	0.06
0.05	0.1	0.25	0.5	1
0.1	0.2	0.5	1	2
1	2	5	10	20
5	10	25	50	100
10	20	50	100	200
50	100	250	500	1000
100	200	500	1000	2000
100.00 ...	200.00 ...	500.01 ...	1000.03 ...	2000.06 ...
102.39	204.78	511.97	1023.94	2047.88
>= 102.40	>= 204.79	>= 511.98	>= 1023.97	>= 2047.94

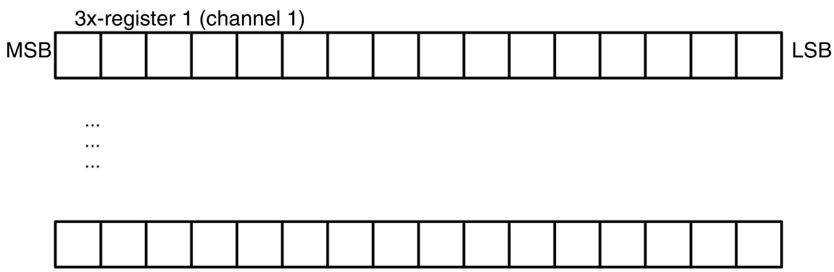
Conversion Values of Resistance Inputs (continued)

15-BIT	NOTES
–32 767	underflow error
0	overload range
0 +1 +16 +32 +320 +1 600 +3 200 +16 000 +32 000	rated value linear range rated value

15-BIT	NOTES
+32 001 ... +32 766	 overload range
+32 767	overflow error

Meanings for the AS–BADU–214 Module Mapping

The AS–BADU–214 module requires eight 3x–input registers addressed in sequence, beginning with channel 1 as shown in the figure below.



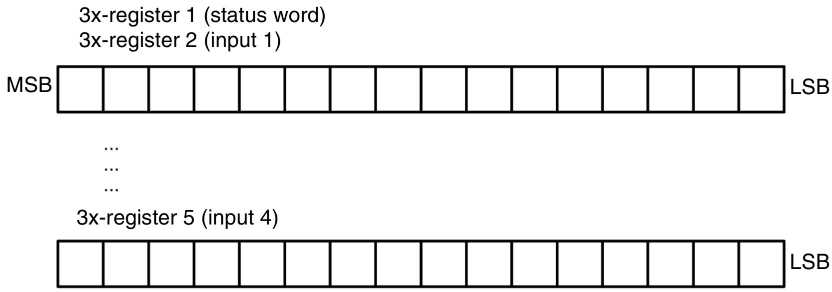
Note: Refer to *Concept I/O Map Status Words, p. 739* for Concept I/O Map Status Words.

AS-BADU 216 8-point Thermocouple Isolated Analog Input

Note: This modules does not require any params... screens.

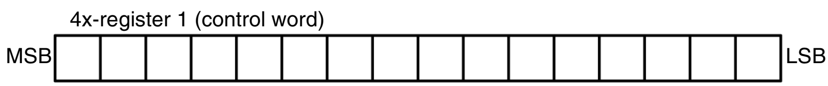
Meanings for the AS-BADU-216 Module Mapping

The AS–BADU–216 module requires five 3x–input registers, addressed in sequence beginning with the first register. Refer to *ADU 216 Analog Input Module, p. 139* for details on the 3x status word for this module (as shown below.



> **Note:** Refer to *Concept I/O Map Status Words, p. 739* for Concept I/O Map Status Words.

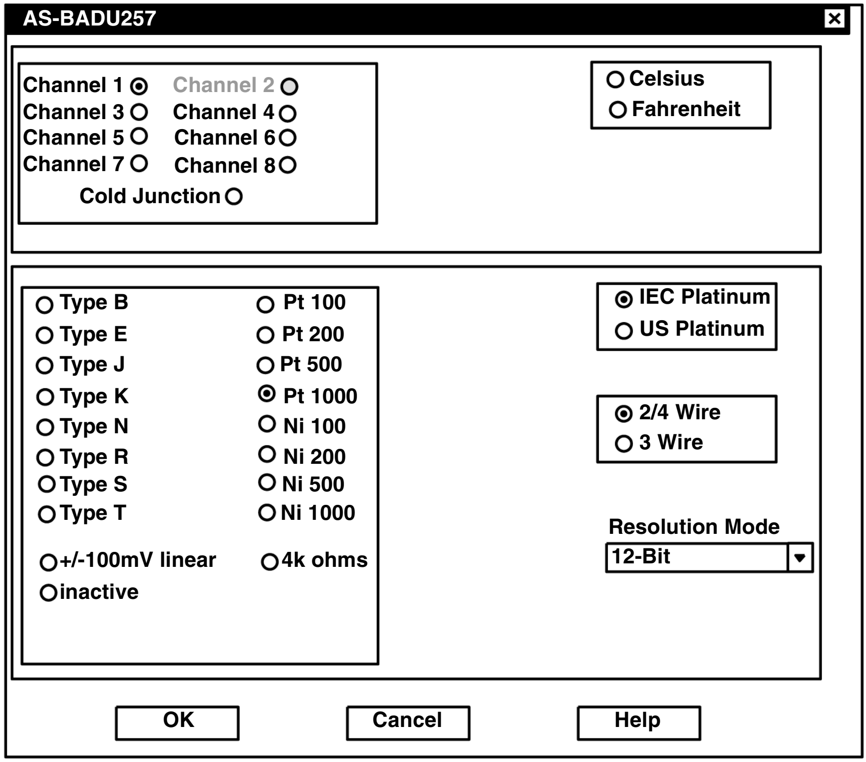
The AS–BADU–216 module requires one 4x–output register, addressed in sequence beginning with the first register. Refer to *ADU 216 Analog Input Module, p. 139* for details on the 4x control word for this module as shown below.



AS–BADU–257/ 257C

> **Note:** The ADU 257 may operate in two different modes: either as a ADU 257 or as an ADU 216. This description ONLY applies the ADU 257 mode. For the ADU 216 description, refer to *ADU 216 Analog Input Module, p. 139* or *I/O Configuration of A120 Series I/O Modules with Modsoft, p. 745*.

The following dialog is valid for the analog module AS–BADU–257.



Channel 1 ... 8: Cold junction compensation is selectable for the module. Eight thermocouple types are supported. Two RTD types with various resistances are supported. Two linear ranges are offered. Two temperature units are available. Either IEC or US platinum RTDs are supported. RTD connections allowed are 2, 3, 4–wire.

Resolution: This list box defines the value range for all channels:
- 12-bit
- 16-bit
- 15-bit + sign
- 32-bit

The measuring ranges for channels 1 to 8 can be chosen in these sections.
+/– 100mV Range and Data Display Format

Millivoltage	12 bit	16 bit	15 bit + sign high resolution	IEEE 754 floating point	Range
<+102.4mV	+4095	+65535	+32767	+1.024 E02	Overrange
>+100mV ... +102.4mV	+4095	+65535	+32001 ... +32766	+1.0 E02 ... +1.024 E02	Pos. tolerance range
+100mV	+4095	+65535	+32000	+1.0 E02	
0mV	+2048	+32768	0	0	Nominal
–100mV	0	0	–32000	–1.0 E02	
<–100mV ... –102.4mV	0	0	–32001 ... –32766	<–1.0 E02 ... –102.4 E02	Neg. tolerance range
<–102.4mV	0	0	–32767	–1.024 E02	Underrange

0 ... 4000W Range and Data Display Format

Resistance	12 bit	16 bit	15 bit + sign high resolution	IEEE 754 floating point	Range
>4095W	+4095	+65535	+32767	+4.096 E03	Overrange
>4000 ... 4095W	+4095	+65535	+32001 ... +32766	>+4.0 E03 ... +4.095 E03	Pos. tolerance range
4000W	+4095	+65535	+32000	+4.0 E03	Nominal
0W	0	0	0	0	
	0	0	–2	–2.0 E00	Broken wire

IEC 751 Pt100,200,500,1000 –200 ... +850 C (–328 ... +1562 F) Range and Data Display Format

RTD	12 bit	16 bit	15 bit + sign 0.1C (0.1F)	IEEE 754 floating point	Range
>+850C (+1562F)	+4095	+65535	+8501 (+15621)	8.501 E02 (1.5621 E03)	Overrange
+850C (+1562F)	+4095	+65535	+8500 (+15620)	8.500 E02 (1.562 E03)	
0 (+32F)	+780	+12483	0 (+320)	0 (3.20 E01)	Nominal
–200C (–328F)	0	0	–2000 (–3280)	–2.00 E02 (–3.28 E02)	
<–200C (–328F)	0	0	–2001 (–3281)	–2.001 E02 (–3.281 E02)	Underrange
	0	0	–2002 (–3282)	–2.002 E02 (–3.282 E02)	Broken wire

SAMA (US) Pt100,200,500,1000 –200 ... +650 C (–328 ... +1112 F) Range and Data Display Format

RTD	12 bit	16 bit	15 bit + sign 0.1C (0.1F)	IEEE 754 floating point	Range
>+600C (+1112F)	+4095	+65535	+6001 (+11121)	6.001 E02 (1.113 E03)	Overrange
+600C (+1112F)	+4095	+65535	+6000 (+11120)	6.000 E02 (1.112 E03)	Nominal
0C (+32F)	+1024	+16384	0 (+320)	0 (3.20 E01)	
–200C (–328F)	0	0	–2000 (–3280)	–2.00 E02 (–3.28 E02)	
<–200C (–328F)	0	0	–2001 (–3281)	–2.001 E02 (–3.281 E02)	Underrange
	0	0	–2002 (–3282)	–2.002 E02 (–3.282 E02)	Broken wire

DIN43760 Ni100,200,500,1000 –60 ... +250 C (–76 ... +482 F) Range and Data Display Format

RTD	12 bit	16 bit	15 bit + sign 0.1C (0.1F)	IEEE 754 floating point	Range
>+250C (+482F)	+4095	+65535	+2501 (+4821)	2.501 E02 (4.821 E02)	Overrange
+250C (+482F)	+4095	+65535	+2500 (+4820)	2.500 E02 (4.820 E02)	Nominal
0C (+32F)	+793	+12684	0 (+320)	0 (3.20 E01)	
–60C (–76F)	0	0	–600 (–760)	–6.00 E01 (–7.6 E01)	
<–60C (–76F)	0	0	–601 (–761)	–6.01 E01 (–7.61 E01)	Underrange
	0	0	–602 (–762)	–6.02 E01 (–7.62 E01)	Broken wire

Thermocouple Type R,S –50 ... +1768 C (–58 ... +3214.4 F) Range and Data Display Format

TC	12 bit	16 bit	15 bit + sign 0.1C (0.1F)	IEEE 754 floating point	Range
>+1768C (+3214.4F)	+4095	+65535	+17681 (+32146)	1.7681 E03 (3.2146 E03)	Overrange
+1768C (+3214.4F)	+4095	+65535	+17680 (+32144)	1.7680 E03 (3.2144 E02)	Nominal
0C (+32F)	+113	+1802	0 (+320)	0 (3.20 E01)	
–50C (–58F)	0	0	–500 (–580)	–5.00 E01 (–5.80 E01)	
<–50C (–58F)	0	0	–501 (–582)	–5.01 E01 (–5.82 E01)	Underrange
	0	0	–502 (–584)	–5.02 E01 (–5.84 E01)	Broken wire

Thermocouple Type B +50 ... +1800 C (+122 ... +3272 F) Range and Data Display Format

TC	12 bit	16 bit	15 bit + sign 0.1C (0.1F)	IEEE 754 floating point	Range
>+1800C (+3272F)	+4095	+65535	+18001 (+32722)	1.8001 E03 (3.2722 E03)	Overrange
+1800C (+3272F)	+4095	+65535	+18000 (+32720)	1.8000 E03 (3.2720 E03)	Nominal
50C (+122F)	0	0	+500 (+1220)	5.00 E01 (1.220 E02)	
<50C (+122F)	0	0	+499 (+1218)	4.99 E01 (1.218 E02)	Underrange
	0	0	+498 (+1216)	4.98 E01 (1.216 E02)	Broken wire

Thermocouple Type J –210 ... +1200 C (–346 ... +2192 F) Range and Data Display Format

TC	12 bit	16 bit	15 bit + sign 0.1C (0.1F)	IEEE 754 floating point	Range
>+1200C (+2192F)	+4095	+65535	+12001 (+21922)	1.2001 E03 (2.1922 E03)	Overrange
+1200C (+2192F)	+4095	+65535	+12000 (+21920)	1.2000 E03 (2.1920 E03)	
0C (+32F)	+610	+9761	0 (+320)	0 (3.20 E01)	Nominal
–210C (–346F)	0	0	–2100 (–3460)	–2.100 E02 (–3.460 E02)	
<–210C (–346F)	0	0	–2101 (–3462)	–2.101 E02 (–3.462 E02)	Underrange
	0	0	–2102 (–3464)	–2.102 E02 (–3.464 E02)	Broken wire

Thermocouple Type T –270 ... +400 C (–454 ... +752 F) Range and Data Display Format

TC	12 bit	16 bit	15 bit + sign 0.1C (0.1F)	IEEE 754 floating point	Range
>+400C (+752F)	+4095	+65535	+4001 (+7522)	4.001 E02 (7.522 E02)	Overrange
+400C (+752F)	+4095	+65535	+4000 (+7520)	4.000 E02 (7.520 E02)	
0C (+32F)	+1650	+26410	0 (+320)	0 (3.20 E01)	Nominal
–270C (–454F)	0	0	–2700 (–4540)	–2.700 E02 (–4.540 E02)	
<–270C (–454F)	0	0	–2701 (–4542)	–2.701 E02 (–4.542 E02)	Underrange
	0	0	–2702 (–4544)	–2.702 E02 (–4.544 E02)	Broken wire

Thermocouple Type E –270 ... +1000 C (–454 ... +1832 F) Range and Data Display Format

TC	12 bit	16 bit	15 bit + sign 0.1C (0.1F)	IEEE 754 floating point	Range
>+1000C (+1832F)	+4095	+65535	+10001 (+18322)	1.0001 E03 (1.8322 E03)	Overrange
+1000C (+1832F)	+4095	+65535	+1000 (+18320)	1.0000 E03 (1.8320 E03)	Nominal
0C (+32F)	+871	+13933	0 (+320)	0 (3.20 E01)	
–270C (–454F)	0	0	–2700 (–4540)	–2.700 E02 (–4.540 E02)	
<–270C (–454F)	0	0	–2701 (–4542)	–2.701 E02 (–4.542 E02)	Underrange
	0	0	–2702 (–4544)	–2.702 E02 (–4.544 E02)	Broken wire

Thermocouple Type K –270 ... +1372 C (–454 ... +2501.6 F) Range and Data Display Format

TC	12 bit	16 bit	15 bit + sign 0.1C (0.1F)	IEEE 754 floating point	Range
>+1372C (+2501.6F)	+4095	+65535	+13721 (+25018)	1.3721 E03 (2.5018 E03)	Overrange
+1372C (+2501.6F)	+4095	+65535	+13720 (+25016)	1.3720 E03 (2.5016 E03)	Nominal
0C (+32F)	+673	+10776	0 (+320)	0 (3.20 E01)	
–270C (–454F)	0	0	–2700 (–4540)	–2.700 E02 (–4.540 E02)	
<–270C (–454F)	0	0	–2701 (–4542)	–2.701 E02 (–4.542 E02)	Underrange
	0	0	–2702 (–4544)	–2.702 E02 (–4.544 E02)	Broken wire

Thermocouple Type N –270 ... +1300 C (–454 ... +2372 F) Range and Data Display Format

TC	**12 bit**	**16 bit**	**15 bit + sign 0.1C (0.1F)**	**IEEE 754 floating point**	**Range**
>+1300C (+2372F)	+4095	+65535	+13001 (+23722)	1.3001 E03 (2.3722 E03)	Overrange
+1300C (+2372F)	+4095	+65535	+13000 (+23720)	1.3000 E03 (2.3720 E03)	
0C (+32F)	+704	+11270	0 (+320)	0 (3.20 E01)	Nominal
–270C (–454F)	0	0	–2700 (–4540)	–2.700 E02 (–4.540 E02)	
<–270C (–454F)	0	0	–2701 (–4542)	–2.701 E02 (–4.542 E02)	Underrange
	0	0	–2702 (–4544)	–2.702 E02 (–4.544 E02)	Broken wire

Cold Junction Sensor AD592 –25 ... +105 C (–13 ... +221 F) Range and Data Display Format

CJC	**12 bit**	**16 bit**	**15 bit + sign 0.1C (0.1F)**	**IEEE 754 floating point**	**Range**
>+125C (+257F)	+4095	+65535	+1051 (+2212)	1.051 E02 (2.212 E02)	Overrange
+125C (+257F)	+4095	+65535	+1050 (+2210)	1.050 E02 (2.210 E02)	
0C (+32F)	+683	+10923	0 (+320)	0 (3.20 E01)	Nominal
–25C (–13F)	0	0	–250 (–130)	–2.50 E01 (–1.30 E01)	
<–25C (–13F)	0	0	–251 (–132)	–2.51 E01 (–1.32 E01)	Underrange
	0	0	–252 (–134)	–2.52 E01 (–1.34 E01)	Broken wire

Meanings for the AS–BADU–257 Module Mapping

The AS–BADU–257 module requires twenty 3x–input registers addressed in sequence, beginning with two module status 3x registers, 16 data channel 3x registers (channels 1 ... 8), and two cold junction sensor 3x registers as shown below.

3x-register 1 (module status word)

MSB	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	LSB
	Ch4				Ch3				Ch2				Ch1				

3x-register 2 (module status word)

MSB	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	LSB
	Ch8				Ch7				Ch6				Ch5				

Ch*n*

The following errors apply to each channel:

Channel OK = 0000

Channel overrange error = 0001

Channel underrange error = 0010

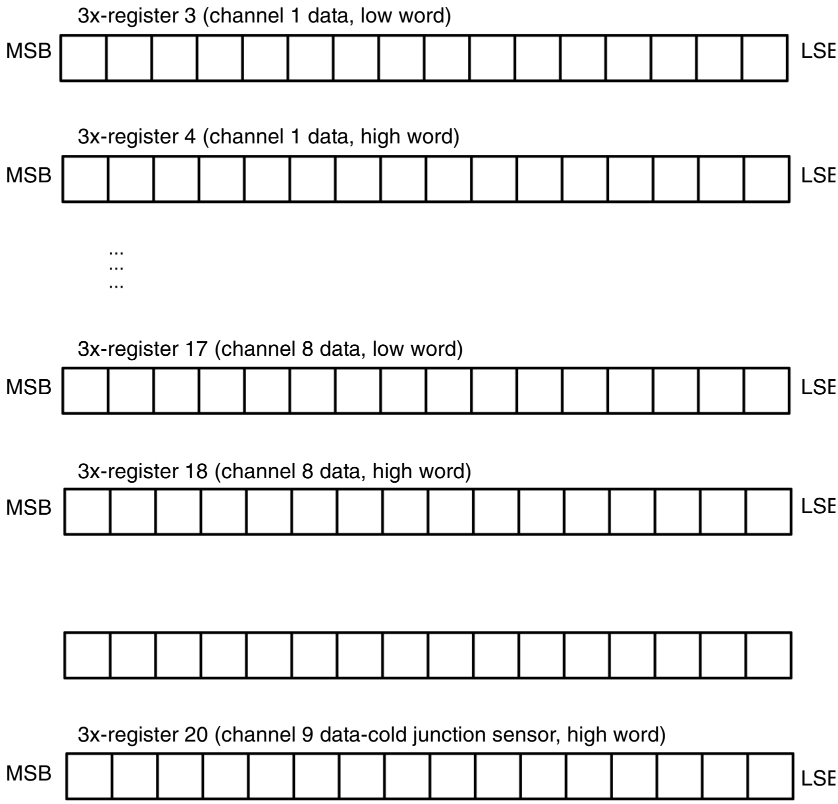
Broken wire error = 0011

Invalid parameter error = 0100

Cold junction error = 0101 (applies to TC parameters ONLY)

(All others are reserved)

The following figure shows the AS-BADU-257 3x-register arrangement.



Analog Output Modules

Analog Output Modules

The following information describes how to configure these modules:
- DAU 202/252/252C 2-point 24 Vdc Voltage/Current Analog Output
- DAU 204 4-point 24 Vdc Voltage/Current Analog Output
- DAU 208 8-point +/-10 Vdc Isolated Analog Output
- DAU 282* 2-point 24 Vdc Voltage/Current Analog Output (Special, Intrinsically Safe)

*The DAU 282 is a "special", and therefore it is not included in this document.

I/O Configuration using Concept 2.1 or Higher

Use the following procedure to configure the module.

Step	Action
1	Select **Configure** from the menu.
2	Select **I/O Map** from the menu.
3	Click on **Edit...** The Local Common CPU Drop dialog appears.
4	Click on **Module**. The I/O Module Selection dialog appears.
5	Select **DAU202/252/252C** or **DAU-208** and click on **OK**. A number and description appear.
6	In the **In Ref** field, enter **0x** or **4x** and press **Enter**. The software completes the **Out Ref** and **Out End** fields.
7	Click on **Params...** The appropriate configuration dialogs appear, depending on the module selected. Refer to the specific modules.

CAUTION

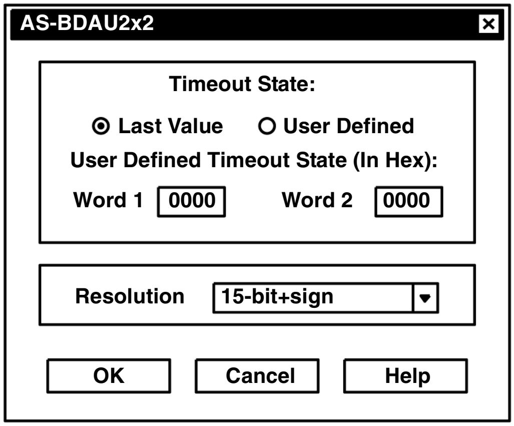
Power-down or kernel mode.

The output module Timeout States is valid only in a normal PLC stop state. Therefore, when the PLC powers down or goes into kernel mode, the outputs default to the module's fail safe state. The Timeout States are defined on the I/O Map module parameter screens.

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

AS-BDAU-202/ 252(C)

The following dialog is valid for the following modules: AS-BDAU-202/ 252(C).



Timeout State:
The Compact Timeout State only reflects a user program in stop mode.
Activation of the User Defined option button causes the outputs to take on the value defined in the user-defined timeout state text field.
Last Value
Activation of the Last Value option button causes the outputs to retain their last valid value upon user program stop.
User Defined:
Activation of the User Defined option button causes the outputs to take on the hex values defined in the user-defined timeout state text fields Word 1/2.
Resolution Mode
This list box defines the value range for all channels:

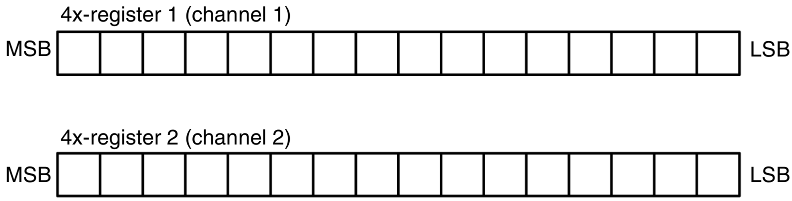
- 12-bit
- 15-bit + sign

Measuring ranges +/- 10 VDC/ +/- 20 mA

Voltage (VDC)	Current (mA)	12-bits	15-bits + sign	Range
-10.24 ... -10.005	-20.48 ... -20.01	0 47	-32768 -32016	Under-range
-10.00 0 +10.00	-20.00 0 +20.00	48 2048 4048	-32000 0 +32000	Nominal range
+10.005 ... +10.24	+20.01 ... +20.48	4049 4095	+32016 +32752	Overrange

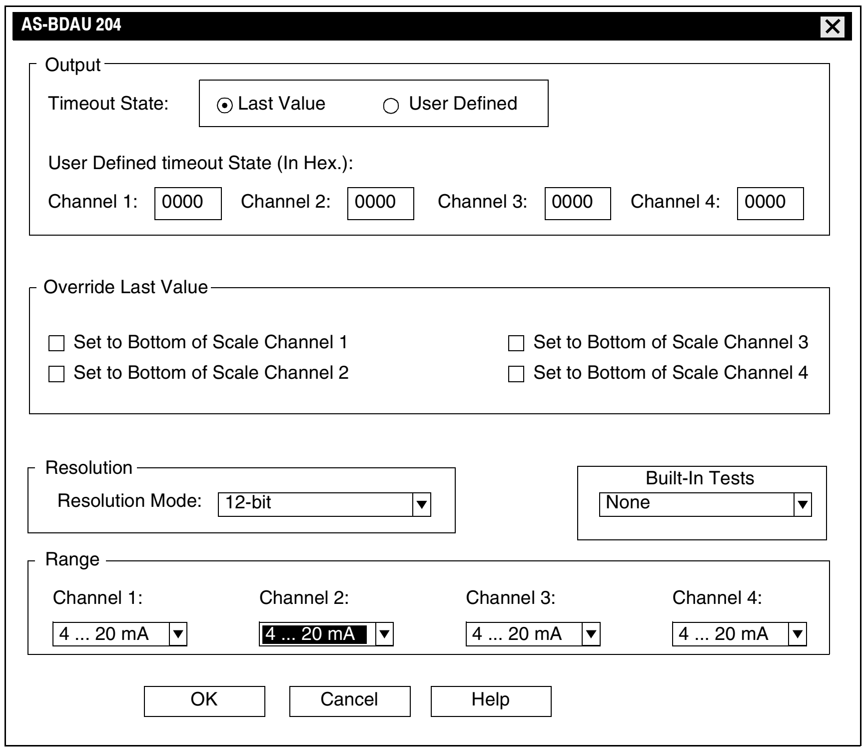
Meanings for the AS-BDAU-202/ 252(C) Module Mapping

The AS-BDAU-202/ 252(C) modules require two 4x-output registers, as shown below.



AS-BDAU-204

This following dialog is valid for the analog module AS-BDAU-204.



Timeout State The Compact Timeout State only reflects a user program in stop mode.
Activation of the Last Value option button causes the outputs to retain their last valid value upon user program stop.
User Defined: Activation of the User Defined option button causes the 4 outputs to take on the hex values defined in the user-defined timeout state text fields Channel 1/4.

Override Last Value: Activation of the Set to Bottom of Scale Channel x option button causes channel x output to be set to the lowest value of the selected measuring range (Range) upon user program stop.
Example: For a selected measuring range of 4 ... 20 mA the output will carry 4 mA upon user program stop, and thus guarantee a defined switch-off behavior.

Note: Activation of the Set to Bottom of Scale option button disables any further alteration of the user-defined timeout state text field for the particular channel.

Resolution Mode: This list box defines the output value range for all channels:
- 11-bit
- 12-bit
- 15-bit + sign
- 16-bit

Built-In Tests: This list box can cause the execution of module built-in tests either automatically at power-up, or during on-line operation. The module's green LED lights as long as no functional fault is determined.
Selection of Category 2 (+/- 10 VDC) restricts the built-in tests exclusively to the +/- 10 VDC measuring range (Range).
Selection of Category 3 (4 ... 20 mA) restricts the built-in tests exclusively to the 4 ... 20 mA measuring range (Range). "None" can be selected if the execution of built-in tests is not desired.
Range: Measuring ranges for the individual channels can be chosen in these list boxes.
- 0 ... 1 VDC
- 0 ... 5 VDC
- 0 ... 10 VDC
- 0 ... 20 mA
- 4 ... 20 mA
- +/- 1 VDC
- +/- 5 VDC
- +/- 10 VDC

0 ... 1 VDC, 0 ... 5 VDC, 0 ... 10 VDC

0 ... 1 VDC	**0 ... 5 VDC**	**0 ... 10 VDC**	**11-bits**	**12-bits**	**15-bits + sign**	**16-bits**	**Range**
0 ... 1 VDC	0 ... 5 VDC	0 ... 10 VDC	11-bits	12-bits	15-bits + sign	16-bits	Range
0	0	0	0	0	0	0	
0.5	2.5	5	1024	2048	16000	32768	Nominal range
1	5	10	2047	4095	32000	65520	

0/4 ... 20 mA

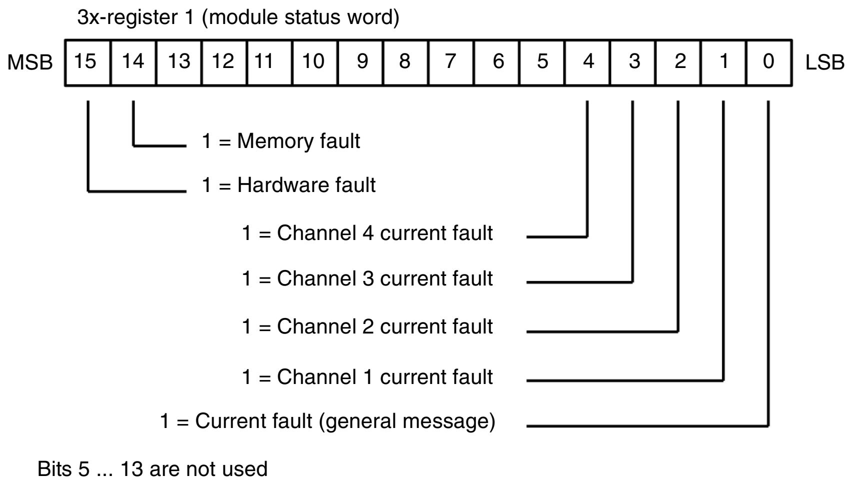
0 ... 20 mA	4 ... 20 mA	11-bits	12-bits	15-bits + sign	16-bits	Range
0	4	0	0	0	0	Nominal range
10	12	1024	2048	16000	32768	
20	20	2047	4095	32000	65520	

+/- 1 VDC, +/- 5 VDC, +/- 10 VDC

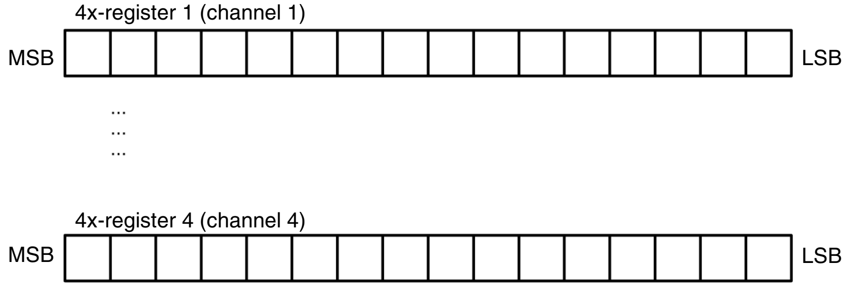
+/- 1 VDC	+/- 5 VDC	+/- 10 VDC	11-bits	12-bits	15-bits + sign	16-bits	Range
-1	-5	-10	0	0	-32000	0	Nominal range
0.5	2.5	0	1024	2048	0	32768	
+1	+5	+10	2047	4095	+32000	65520	

Meanings for the AS-BDAU-204 Module Mapping

The AS-BDAU-204 module requires one 3x-input register and five 4x-output registers. The 4x-output registers are addressed in sequence, beginning with channel 1. See the following figures.
The following figure shows the AS-BDAU-204 3x-register arrangement.

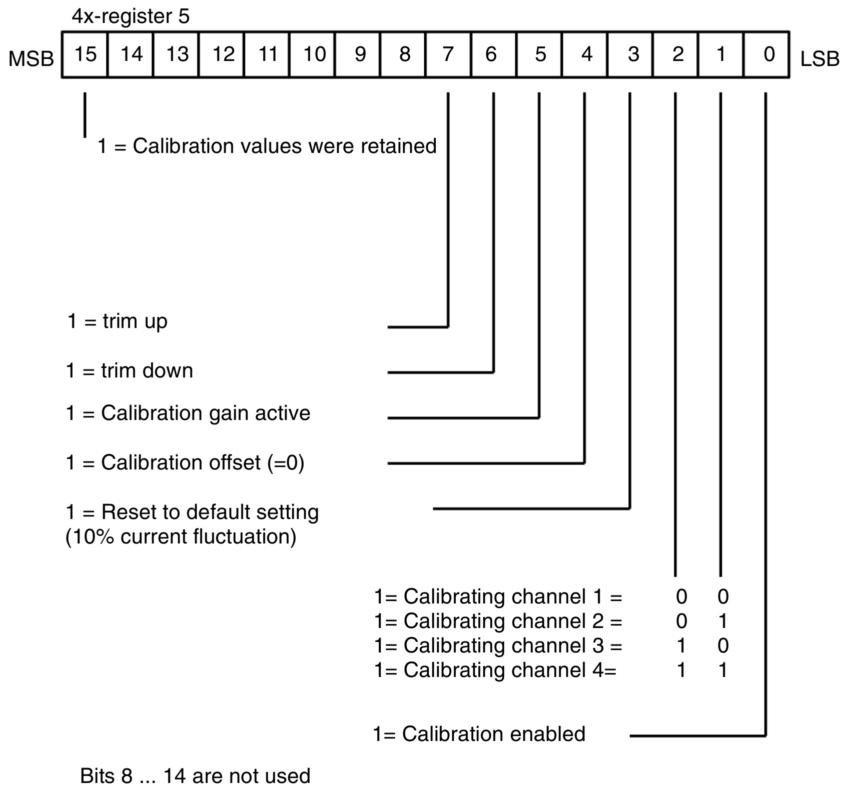


The following figure shows the AS-BDAU-204 4x-register arrangement.

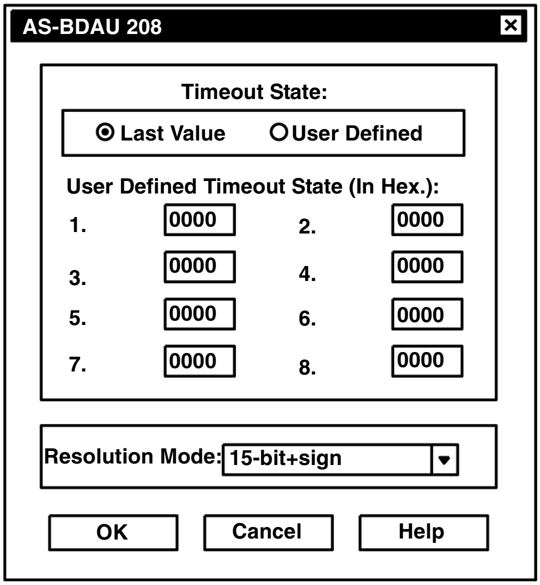


Runtime Control Word

The runtime control word supports the following calibration properties:



AS-BDAU-208 The following dialog is valid for the analog module AS-BDAU-208.



Timeout State
The Compact Timeout State only reflects a user program in stop mode.
Activation of the Last Value option button causes the outputs to retain their last valid value upon user program stop.
If the User Defined option button was activated, the 8 corresponding hex values can be entered here.

User Defined:
If the User Defined option button was activated in the timeout state section, the corresponding hex values can be entered in the text boxes 1/8, determining one value for each of the 8 output registers.

Resolution Mode
This list box defines the output value range for all channels:
- 12-bit
- 15-bit + sign

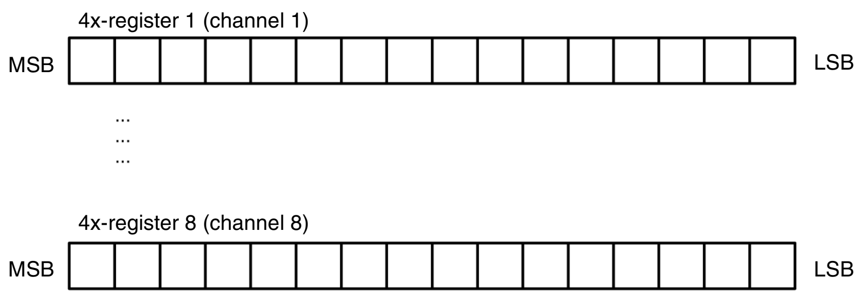
Measuring Range

The +/- 10 VDC measuring range representation can be gathered from the following table:

+/- 10 VDC	12-bits	15-bits + sign	Range
-10.24 ...	0	-32768	Under-range
-10.005	47	-32016	
-10.00	48	-32000	Nominal range
0	2048	0	
+10.00	4048	+32000	
+10.005 ...	4049	+32016	Overrange
+10.24	4095	+32752	

Meanings for the AS-BDAU-208 Module Mapping

The AS-BDAU-208 module requires eight 4x-output registers. The 4x-output registers are addressed in sequence, beginning with channel 1 as shown below.



Intelligent Modules

Intelligent Modules

This section describes how to configure the following modules:
- FRQ-204/254 Frequency
- MOT 201 Motion -Encoder Only
- MOT 202 Motion-Resolver and Encoder
- VIC-2xx (Not supported in Concept 2.1 or higher)
- VRC 200/CTR 205/212/224 (Not supported in Concept 2.1 or higher)
- ZAE 201 Counter/Positioner

I/O Configuration of FRQ Modules using Concept 2.1 or Higher

Use the following procedure to configure the module.

Step	Action
1	Select Configure from the menu.
2	Select I/O Map from the menu.
3	Click on Edit... The Local Common CPU Drop dialog appears.
4	Click on Module. The I/O Module Selection dialog appears.
5	Select FRQ--204/205 and click on OK. A number and description appear.
6	In the In Ref field, enter 3x and press Enter. The software fills in the In Ref and In End fields.
7	Click on Params...

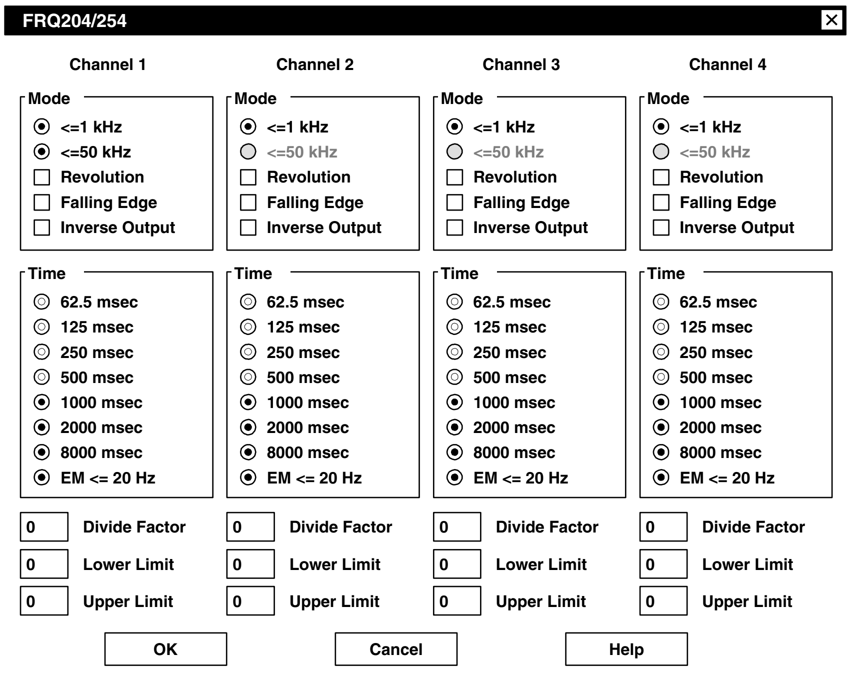
I/O Configuration of Motion and Counter/ Positioner Modules using Concept 2.1 or Higher

Use the following procedure to configure the module.

Step	Action
1	Select Configure from the menu.
2	Select I/O Map from the menu.
3	Click on Edit... The Local Common CPU Drop dialog appears.
4	Click on Module. The I/O Module Selection dialog appears.
5	Select MOT--2X or ZAE--201 and click on OK. A number and description appear.
6	In the In Ref field, enter 3x and press Enter. The software fills in the In Ref and In End fields.
7	In the Out Ref field, enter 4x and press Enter. The software fills in the Out Ref and Out End fields.
8	Click on OK. (No Params are required for these modules.)

AS-BFRQ 204/ 254

The following dialog is valid for the AS-BFRQ 204/ 254 modules (frequency/ revolution counters).



Channel 1 ... 4

The individual channels are configured in the columns Channel 1 ... 4. Enter the desired counting frequency as offered (4 x <=1 kHz, 1 x <=50 kHz)

Mode

The counting frequency can be selected in this section with the <=1 kHz or <=50 kHz option buttons.

> **Note:** Channel 1 can be alternatively driven with counting frequencies of up to 50 kHz.

Revolution counting mode is activated through the Revolution option button. Selecting the Revolution Mode changes the actual value received from Hz to rev/ min.

Activate the Falling Edge option button to trigger on the negative counting edge (1->0). The default setting is positive edge (0->1).

Activation of the Inverse Output option button causes negation of both channel limit signals.

FRQ204 Mode Configuration Example

Mode Selection	Time (Gating Time)	Units of Measure	Actual Input Signal Value	Display Value Received
1kHz	1 ... 7	Hz	247 Hz	247
50kHz	1 ... 7	Hz	26780 Hz	26780
Revolution	1 ... 7	Rev/Min.	14820 Rev/Min.	14820
Revolution/50kHz	1 ... 7	Rev/Min.	29654 Rev/Min.	29654
1kHz	8	Hz	14.286 Hz	14286
Revolution	8	Rev/Min.	857.1 Rev/Min.	8571

Time

Time is the frequency of how often the counts are updated. The gating time for frequency/revolution measurements can be selected in this section.

- 62.5 msec
- 125 msec
- 250 msec
- 500 msec
- 1000 msec
- 2000 msec
- 8000 mesc
- EM <= 20 Hz

The 62.5 to 8000 msec presets open the measurement window a corresponding period for input signal summation, which can then be converted into Hz or RPM units.

The EM <= 20 Hz option button causes the measurement to be derived from the slope time rather than the gate time. This results in higher precision for frequencies up to 20 Hz or below 1200 RPM, which are achieved in a shorter gate-time period.

Divide Factor

The divide factor actually divides your counts by the number you enter. A factor can be entered in this text field. The factor entered here is used for the connection of incremental encoders, sensors, or similar devices with high resolution, i.e. >1 count per revolution. As a value, the number of impulses per revolution has to be given. For example, if you have a 256 pulse/revolution encoder, then you would enter 256. The real frequency response speed is returned from the FRQ 204. The default value is 1. If you enter 0 it will be seen as a 1.

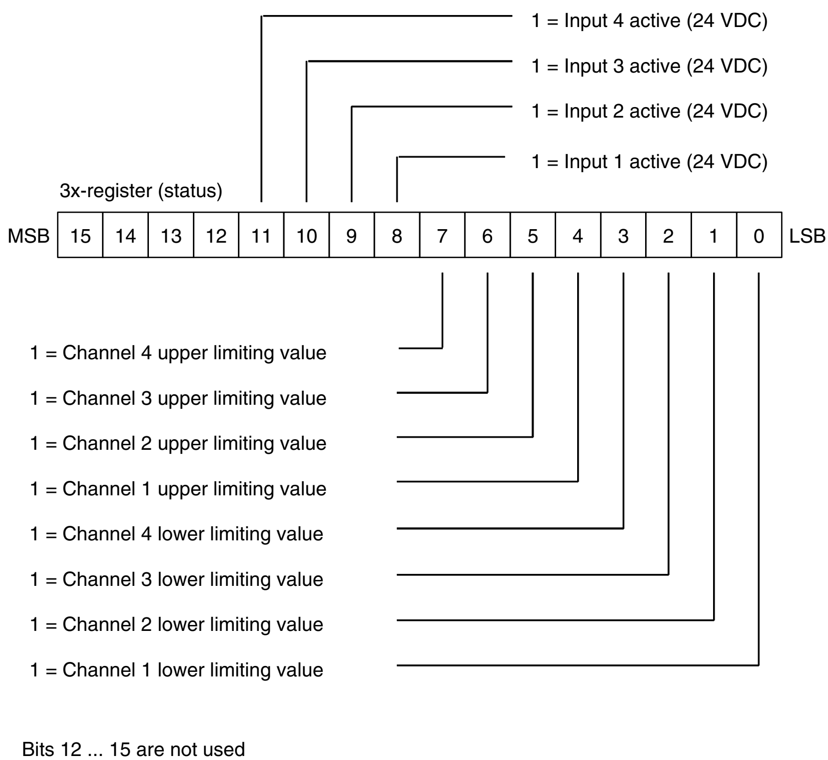
Lower Limit

This establishes the lower limit of your range. The lower limiting threshold for minimum frequency or revolution monitoring (as well as wire breakage), can be entered in this text field. Values falling short of this preset value initiate status bits within the first input register (bits 0 ... 3), and in the status register of the drop station. Measurements continue and remain uninfluenced. When the lower limit is exceeded the corresponding module outputs are set.

Upper Limit
This establishes the upper limit of your range. The upper limiting threshold for maximum permissible frequency or revolution monitoring can be entered in this text field. Values falling short of this preset value initiate status bits within the first input register (bits 4 ... 7), and in the status register of the drop station. Measurements continue and remain uninfluenced. When the upper limit is exceeded the corresponding module outputs are set.

Meanings for the AS-BFRQ 204/ 254 Module Mapping

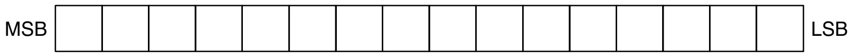
The frequency counting modules require five 3x-input registers, as shown in *AS-BFRQ 204/ 2 Registers, p. 730* and *AS-BFRQ 204/ 2 Registers, p. 730* below.



AS-BFRQ 204/ 2 Registers

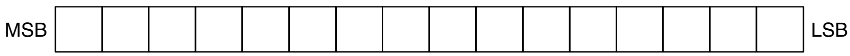
The following figures shows the AS-BRFQ 204/254 3x-status register (top) and the AS-BFRQ 204/ 254 3x +1 ... +4 data register (bottom).

3x-register +1 (frequency/revolution data)



...
...
...

3x-register +4 (frequency/revolution data)



Note: Refer to*Concept I/O Map Status Words, p. 739* for Concept I/O Map Status Words.

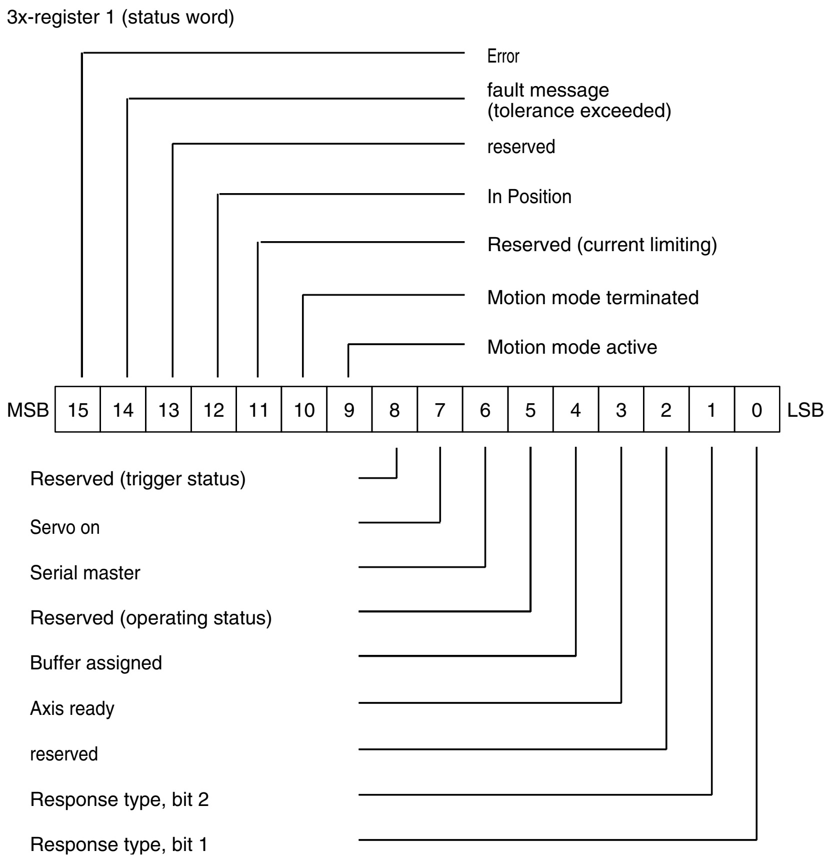
AS-BMOT-201/ 202

Note: These modules do not require any params... screens.

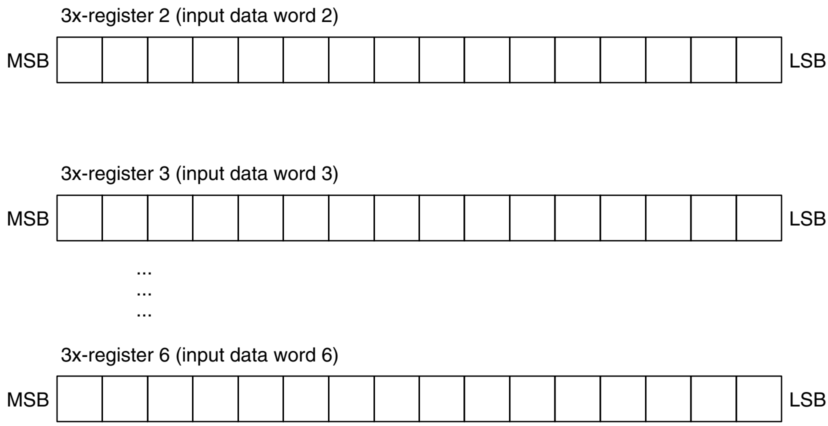
The AS-BMOT-201/ 202 modules require six 3x-input registers and six 4x-output registers.

Meanings for the AS-BMOT-201/ 202 Module Mapping

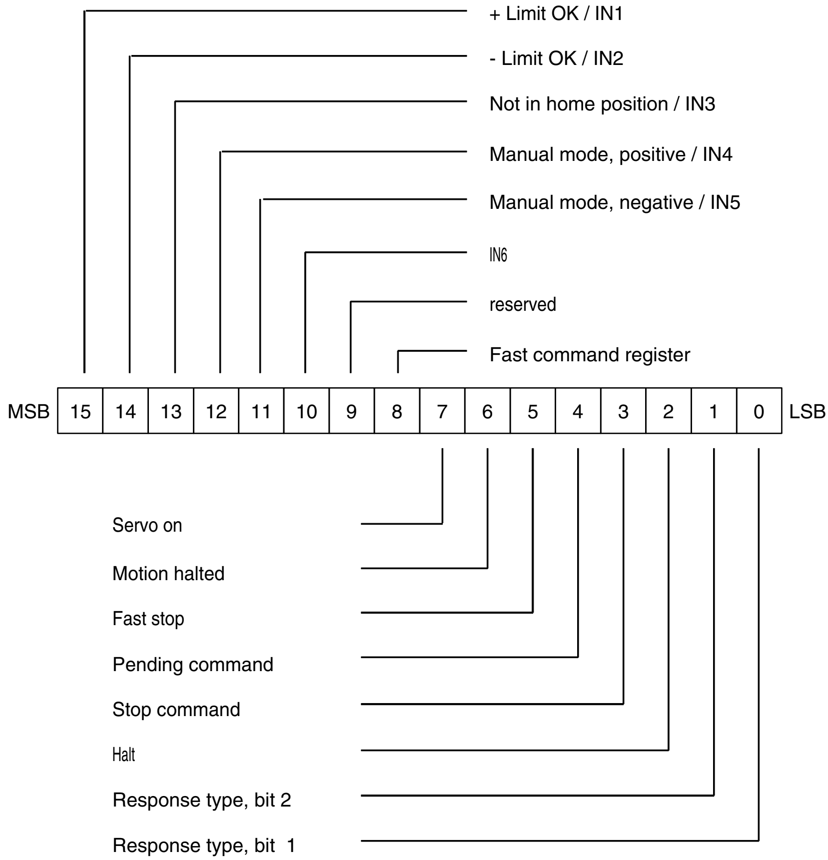
The following figure shows the AS-BMOT-201/ 202 3x-register arrangement.



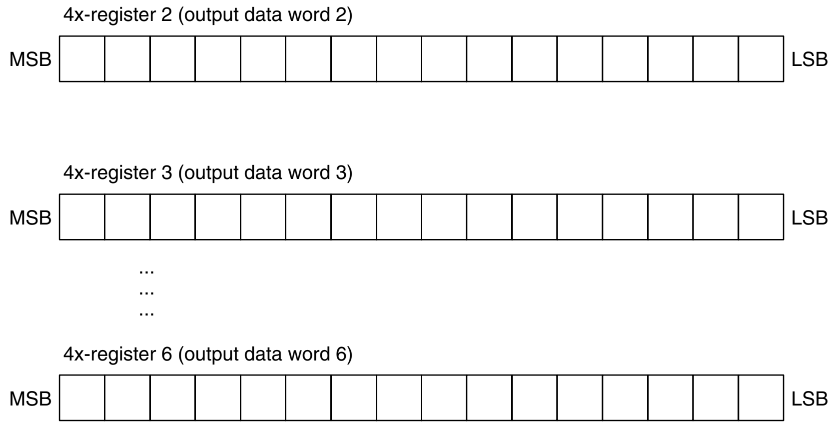
The following figure shows the AS-BMOT-201/ 202 3x-register arrangement.



The following figure shows the AS-BMOT 201/ 202 4x-register arrangement.



The following figure shows the S-BMOT-201/ 202 4x-register arrangement.



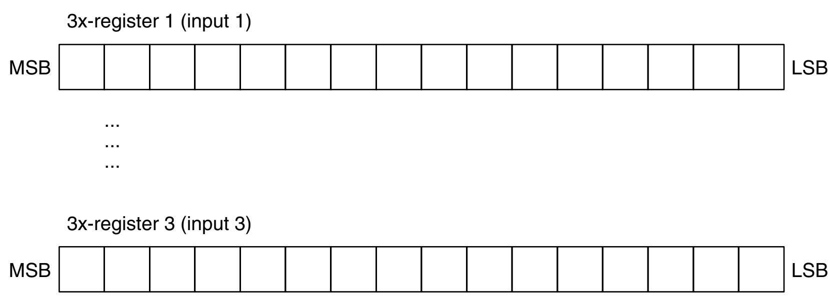
AS-BZAE-201

Note: This module does not require any params... screens.

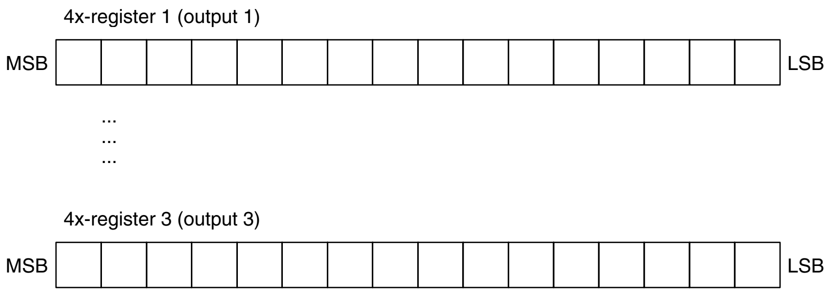
The AS-BZAE-201 module requires three 3x-input registers and three 4x-output registers.

Meanings for the AS-BZAE-201 Module Mapping

The following figure shows the AS-BZAE-201 3x-register arrangement.



The following figure shows the AS-BZAE-201 4x-register arrangement.



Communication Interfaces

Communication Interfaces

This section describes how to configure the following modules:
- BKF-201 (16W)/BKF-201 (64W) Interbus S Master
- BKF-202 Interbus S Slave
- DEA-202 Interbus S Interface (No Mapping required)
- DEA-203253/243C Profibus DP Slave Module (No Mapping required)
- MVB-258/258A*

*The MVB-258/258A is a "special,"and therefore it is not included in this document.

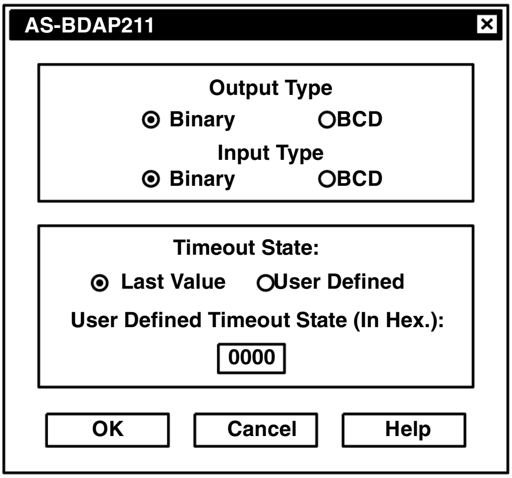
I/O Configuration Using Concept 2.1 or Higher

Instructions for configuring the BKF-201 (16W) and BKF-201(64W) follow.

Step	Action
1	Select **Configure** from the menu.
2	Select **I/O Map** from the menu.
3	Click on **Edit...** The Local Common CPU Drop dialog appears.
4	Click on **Module**. The I/O Module Selection dialog appears.
5	Select **BKF** and click on **OK**. A number and description appear.
6	In the **In Ref** field, enter 3x and press **Enter**. The software completes the **In Ref** and **In End** fields.
7	In the **Out Ref** field, enter **4x** and press **Enter**. The software completes the **Out Ref** and **Out End** fields.
8	Click on **Params...** The Timeout State for Outputs on IBS dialog appears.)
9	Select either **Set to Zero** or Hold Last Value and click on **OK**.

AS-BBKF-201 / 202

The following dialog is used with the communication module AS-BBKF-201 (16 words/64 words). A different dialog box is used for AS–BBKF–202 (16 words); it is very similar.

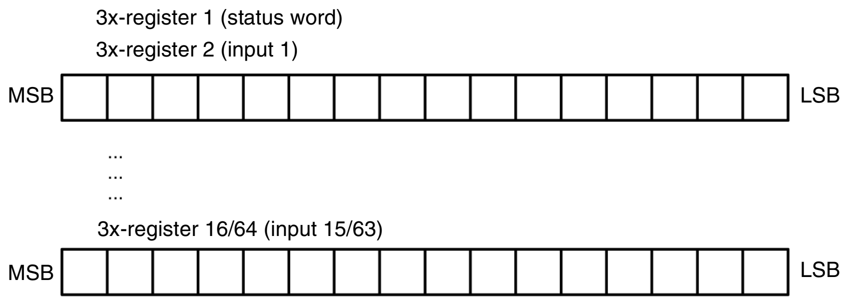


Timeout state for outputs on IBS

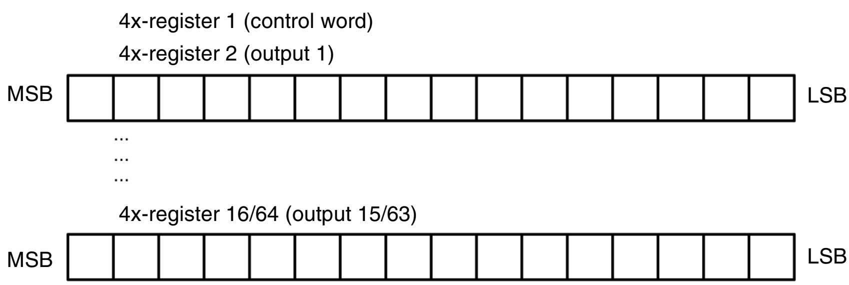
The Compact timeout state only reflects a user program in stop mode.
Activation of the **Set to Zero** option button causes outputs to be set to 0 upon user program stop, and thus guarantee a defined switch-off behavior.
Activation of the **Hold Last Value** option button causes the outputs to retain their last valid value upon user program stop.

Meanings for the AS-BBKF-201/ 202 Module Mapping

The AS-BBKF-201 module requires 16 or 64 4x-output registers; the AS-BBKF-202 module requires 16 4x-output registers addressed in sequence, beginning with the first register (refer to the following figure(s). Refer to *BKF 201 (16W) & (64W) InterBus S Master Module, p. 183* and *BKF 202 InterBus S Slave Module, p. 201* for details about the 4x control word for these modules.
The following figures show the AS-BBKF-201/202 3x-register arrangement.



The AS-BBKF-201 module requires 16 or 64 3x-input registers, the AS-BBKF-202 module requires 16 3x-input registers, addressed in sequence beginning with the first register (refer to the figure below). Refer to *BKF 201 (16W) & (64W) InterBus S Master Module, p. 183* and *BKF 202 InterBus S Slave Module, p. 201* for details on the 3x status word for these modules.



Concept I/O Map Status Words

Status Words

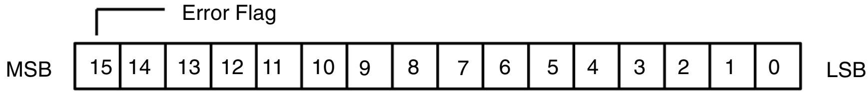
Note: All other modules do not provide status word information.

The following lists the modules that provide Concept I/O Map Status Words. Most provide only an error flag, yet others provide additional error information.
The following table shows I/O Map Status Word Error Flags and Additional Error Information.

I/O Module	Error Flag Meaning (Refer to Figure 54)	Provides Additional Error Information
ADU204/254/254C	Not applicable	Yes. Refer to *ADU 204/254/ 254(C) Status Word, p. 740*.
ADU205	Not applicable	Yes. Refer to *ADU 205 Status Word, p. 740*.
ADU206	1=Group signal when detail status information is available	
ADU210	1=Group signal when detail status information is available	Yes. Refer to *ADU 210 Status Word, p. 741*.
ADU214	1=Group signal when detail status information is available	Yes. Refer to *ADU 214 Status Word, p. 742*.
ADU216	1=Group signal when detail status information is available	
ADU257	1=Group signal when detail status information is available	Yes. Refer to *ADU 257 Status Word, p. 743*.
BKF201/202	1=Module error	
DAP208/210/258/258C	1=Overload on one or more outputs	
DAP220/250/250C	1=Power missing, or overload on one or more outputs	
DAU202/252/252C	1=Error during generation of the internal +/-15V supply	
DAU208/258	1=Error during generation of the internal +/-15V supply	
FRQ204/254	1=Overflow of a counter or overload on one or more outputs	Yes. Refer to *FRQ 204/254 Status Word, p. 743*.

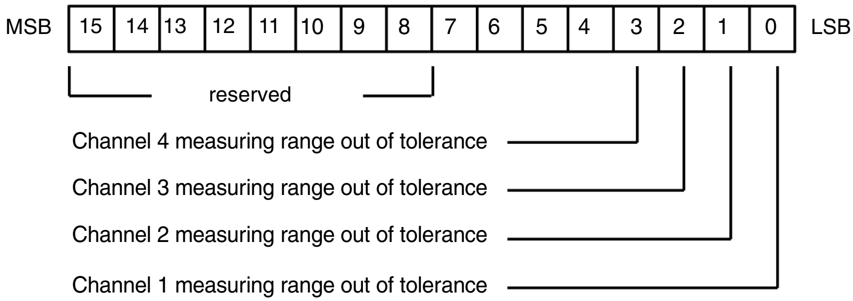
Status Word Error Flag

The following figure shows the Status Word Error Flag.



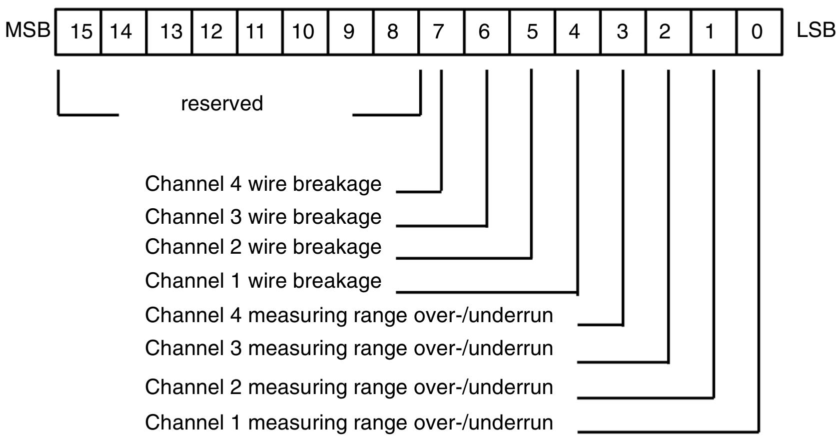
ADU 204/254/ 254(C) Status Word

The following figure shows the ADU 204/254/254(C) Status Word.



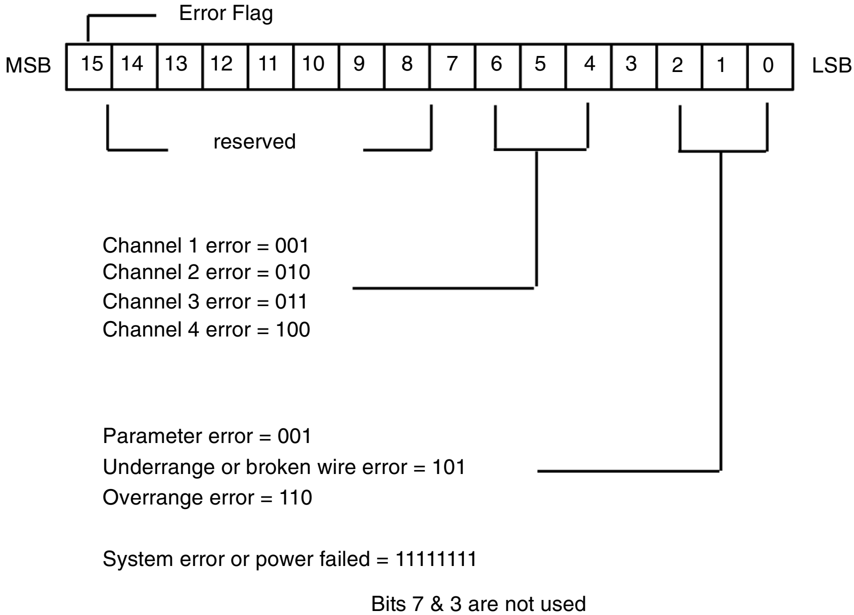
ADU 205 Status Word

The following figure shows the ADU 205 Status Word.



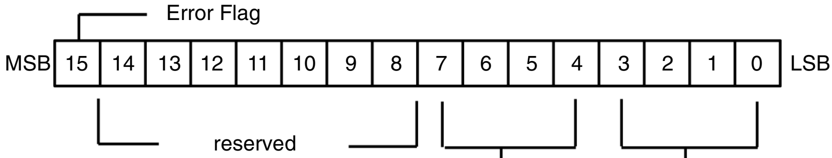
ADU 210 Status Word

The following figure shows the ADU 210 Status Word.



ADU 214 Status Word

The following figure shows the ADU 214 Status Word.



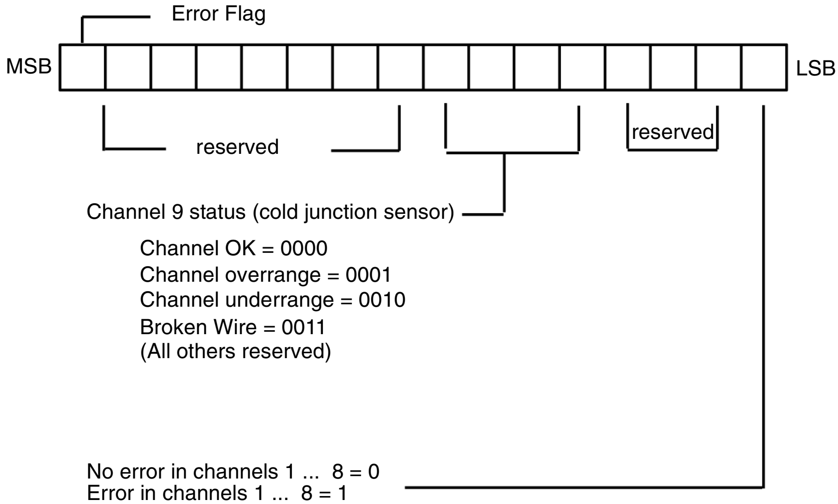
Channel 1 error = 0001
Channel 2 error = 0010
Channel 3 error = 0011
Channel 4 error = 0100
Channel 5 error = 0101
Channel 6 error = 0110
Channel 7 error = 0111
Channel 8 error = 1000

Parameter error = 0001
Channels 1,3,5,7 (for 2-wire voltage or current ONLY) error = 0010
Channels 2,4,7,8 (for voltage or current ONLY)
(channels 1,3,5,7 MUST be inactive) error = 0011
Broken wire (2-wire or 4-wire RTD measurement ONLY) error = 0100
Underrange, sensor short circuit, or broken wire (of any channel) error = 0101
Overrange (of any channel) error = 0110
Bipolar measurement
(both channels MUST be configured as the same-measurement range) error = 0111

System error or power failed = 11111111

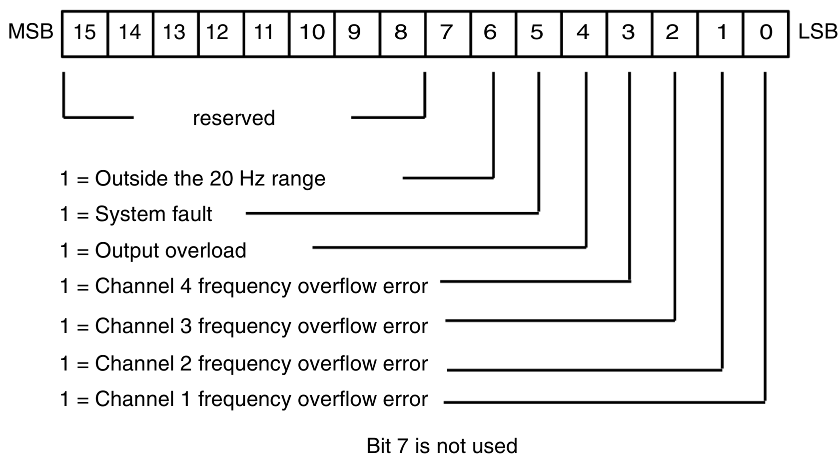
ADU 257 Status Word

The following figure shows the ADU 257 Status Word.



FRQ 204/254 Status Word

The following figure shows the FRQ 204/254 Status Word.



I/O Configuration of A120 Series I/O Modules with Modsoft

C

At a Glance

Purpose

This chapter describes the configuration of A120 Series I/O modules with Modsoft.

What's in this Chapter?

This chapter contains the following topics:

Configuring A120 Discrete Input Modules with Modsoft

Discrete Input Modules

This following information describes how to configure the following modules:
- DEO 216 16-point 24 Vdc Discrete Input
- DEP 208 8-point 230 Vac Discrete Input
- DEP 209 8-point 120 Vac Discrete Input
- DEP 210 8-point 115 Vac Isolated Discrete Input
- DEP 211 8-point 115 Vac Isolated Discrete Input
- DEP 214 16-point 12 ... 60Vdc Discrete Input
- DEP 215 16-point 5 Vdc TTL Discrete Input
- DEP 216 16-point 24 Vdc Discrete Input
- DEP 217 16-point 24 Vdc Discrete Input
- DEP 218 16-point 115 Vac Isolated Discrete Input
- DEP 220 16-point 24 Vdc Discrete Input
- DEP 257 16-point 110 Vdc Discrete Input
- DEP 296 16-point 60 Vdc Isolated Discrete Input
- DEP 297 16-point 48 Vdc Isolated Discrete Input
- DEP 284* 8-point 115 Vac Isolated Discrete Input (Not supported in Modsoft 2.6 or lower)

*The DEP 284 is a "special", and therefore it is not included in this document.

I/O Configuration Using Modsoft 2.6 or Lower

Use the following procedure to configure A120 discrete input modules using Modsoft.

Step	Action
1	Select I/O Map (or press F4). This places you at rack 1, slot position 101...105.
2	Move the cursor to slot 104.
3	Hold the **Shift key** and press the **? key**. This displays a list of possible I/O modules.
4	Select **DEPxxx**.
5	Enter the input reference **10001** and press the **Enter key**. The software automatically fills in the input range. If you are using a 3x register, the cursor automatically moves to Data Type.
6	Select either **Binary** or **BCD** and press the **Enter key**.
7	Choose **Quit** (or press **F9**). Escape to the Modsoft main menu.
8	Refer to individual module chapters for more information.

Configuring A120 Discrete Output Modules with Modsoft

Discrete Output Modules

The following information describes how to configure these modules:
- DAO 216 16-point 24 Vdc Discrete Output
- DAP 204 4-point 24 ... 110 Vdc/24 ... 250 Vac Relay Discrete Output
- DAP 208 8-point 24 ... 110 Vdc/24 ... 250 Vac Relay Discrete Output
- DAP 209 8-point 120 Vac Discrete Output
- DAP 210 8-point 24 ... 240 Vac Discrete Output
- DAP 216(N)16-point 24 Vdc Discrete Output
- DAP 217 16-point 5 ... 24 Vdc Discrete Output
- DAP 218 16-point 24 ... 240 Vac Discrete Output
- DAP 284* 4-point 24 ... 110 Vdc/24 ... 250 Vac Relay Discrete Output (Special, Intrinsically Safe) (Not supported in Modsoft 2.6 or lower)

*This is a "special", and therefore it is not included in this document.

I/O Configuration Using Modsoft 2.6 or Lower

Use the following procedure to configure the A120 discrete output modules using Modsoft.

Step	Action
1	Select **I/O Map** (or press **F4**). This places you at rack 1, slot position 101...105.
2	Move the cursor to slot **104**.
3	Hold the **Shift key** and press the **? key**. This displays a list of possible I/O modules.
4	Select **DAPxxx.**
5	Enter the input reference 10001 and press the **Enter key**. The software automatically fills in the output range. If you are using a 3x register and a 4x register, the cursor automatically moves to Data Type.
6	Select either **Binary** or **BCD** and press the **Enter** key.
7	Choose **Quit** (or press **F9**). Escape to the Modsoft main menu.
8	Refer to individual module chapters for more information.

Configuring A120 Discrete Combination Modules with Modsoft

Discrete Combination Modules

The following information describes how to configure these modules:
- DAP 211 Monitored 4-point in/4-point out 120 Vac Combined I/O (Requires a loadable (SW–IODR–001) for proper operation using certain PLCs (A984–1xx, E984–24x/251/255) with Modsoft. Refer to *Installing the Loadables for A120 Series I/O Modules, p. 791* for details).
- DAP 212 8-point in/4-point out 24 Vdc Combined I/O
- DAP 220 8-point in/8-point out 24 Vdc Combined I/O
- DAP 252 8-point in/4-point relay out 24 Vdc LT Combined I/O
- DAP 253 8-point in/4-point relay out 110 Vdc LT Combined I/O
- DAP 292 8-point in/4-point relay out 60 Vdc Combined I/O

I/O Configuration Using Modsoft 2.6 or Lower

Use the following procedure to configure A120 discrete output modules using Modsoft.

Step	Action
1	Select **I/O Map** (or press **F4**). This places you at rack 1, slot position 101...105.
2	Move the cursor to slot **104**.
3	Hold the **Shift key** and press the **? key**. This displays a list of possible I/O modules.
4	Select **DAPxxx**.
5	Enter the input reference 10001 and press the **Enter key**. The software automatically fills in the input range.
6	Enter the output reference **0001** and press the **Enter key**. The software automatically fills in the input range. If you are using a 3x register and a 4x register, the cursor automatically moves to Data Type.
7	Select either **Binary** or **BCD** and press the **Enter key**.
8	Choose **Quit** (or press **F9**). Escape to the Modsoft main menu.
9	Refer to individual module chapters for more information.

Configuring A120 Analog Input Modules with Modsoft

Analog Input Modules

This section describes how to configure the following modules:
- ADU 204 4-point Voltage/RTD Analog Input
- ADU 205 4-point Voltage/Current Analog Input
- ADU 206 4-point Voltage/Current Isolated Analog Input
- ADU 210 4-point Voltage/Current Analog Input (Not supported in Modsoft)
- ADU 214 8-point Voltage/Current Isolated Analog Input
- ADU 216 8-point Thermocouple Isolated Analog Input
- ADU 257/257C 8-point Voltage/RTD/TC Analog Input (Not supported in Modsoft) NOTE: If the ADU257s DIP switch is set to the ADU216 mode, the ADU257 operates just like an ADU216 module. Refer to *Overview of the ADU 257 Analog Input Module, p. 155*.
- ADU 282/282M* 2-point Analog Input (Special, Intrinsically Safe) (Not supported in Modsoft 2.6 or lower).
- ADU 284* 2-point Analog Input (Special, Intrinsically Safe) (Not supported in Modsoft 2.6 or lower)
- ADU 211/212 8-point Universal Isolated Analog Input

*This is a "special", and therefore it is not included in this document.

I/O Configuration Using Modsoft 2.6 or Lower

Use the following procedure to configure A120 discrete output modules using Modsoft.

Step	Action
1	Select **I/O Map** (or press **F4**). This places you at rack 1, slot position 101...105.
2	Move the cursor to slot **104**.
3	Hold the **Shift key** and press the **? key**. This displays a list of possible I/O modules.
4	Select **ADUxxx.**
5	Enter the input reference **3x** and press the **Enter key**. The software automatically fills in the input range.
6	Enter the output reference **4x** and press the **Enter key**. The software automatically fills in the input range. If you are using a 3x register and a 4x register, the cursor automatically moves to Data Type.
7	Select either **Binary** or **BCD** and press the **Enter key**.
8	Choose **Quit** (or press **F9**). Escape to the Modsoft main menu.
9	Refer to individual module chapters for more information.

Configuring A120 Analog Output Modules with Modsoft

Analog Output Modules

This section describes how to configure the following modules:

- DAU 202 2-point 24 Vdc Voltage/Current Analog Output
- DAU 204 4-point 24 Vdc Voltage/Current Analog Output
- DAU 208 8-point +/-10 Vdc Isolated Analog Output
- DAU 282* 2-point 24 Vdc Voltage/Current Analog Output (Special, Intrinsically Safe) (Not supported in Modsoft 2.6 or lower)

*The DAU 282 is a "special", and therefore it is not included in this document.

I/O Configuration Using Modsoft 2.6 or Lower

Use the following procedure to configure A120 discrete output modules using Modsoft.

Step	Action
1	Select **I/O Map** (or press **F4**). This places you at rack 1, slot position 101...105.
2	Move the cursor to slot **104**.
3	Hold the **Shift key** and press the **? key**. This displays a list of possible I/O modules.
4	Select **DAUxxx**.
5	Enter the output reference **4x** and press the **Enter key**. The software automatically fills in the input range. If you are using a 4x register, the cursor automatically moves to Data Type.
6	Select either **Binary** or **BCD** and press the **Enter key**.
7	Choose **Quit** (or press **F9**). Escape to the Modsoft main menu.
8	Refer to individual module chapters for more information.

Configuring A120 Intelligent Modules with Modsoft

Intelligent Modules

This section describes how to configure the following modules:
- FRQ-204/254 Frequency
- (Not supported in Modsoft 2.6 or lower)
- MOT 201 Motion-Encoder Only
- MOT 202 Motion-Resolver and Encoder
- VIC-2xx High-Speed Input
- VRC 200/CTR 205/212/224 Variable Reluctance Counter/Counter
- ZAE 201 Counter/Positioner
- ZAE 204 High-Speed Counter

I/O Configuration Using Modsoft 2.6 or Lower

Use the following procedure to configure A120 discrete output modules using Modsoft.

Step	Action
1	Select **I/O Map** (or press **F4)**. This places you at rack 1, slot position 101...105.
2	Move the cursor to slot **104**.
3	Hold the **Shift key** and press the **? key**. This displays a list of possible I/O modules.
4	Select **XXXxxx**.
5	Enter the input reference **3x** and press the **Enter key**. The software automatically fills in the input range.
6	Enter the output reference **4x** and press the **Enter key**. The software automatically fills in the input range. If you are using a 3x register and a 4x register, the cursor automatically moves to Data Type.
7	Select either **Binary** or **BCD** and press the **Enter key**.
8	Choose **Quit** (or press **F9**). Escape to the Modsoft main menu.
9	Refer to individual module chapters for more information.

Configuring A120 Communication Interfaces with Modsoft

Communication Interfaces

The following communication interfaces are not supported in Modsoft 2.6 or lower:
- BKF-201 (16W)/BKF-201 (64W) Interbus S Master
- BKF-202 Interbus S Slave (Not supported in Modsoft 2.6 or lower)
- DEA-202 Interbus S Interface (Not supported in Modsoft 2.6 or lower)
- DEA-203/253/243C Profibus DP Slave Module (Not supported in Modsoft 2.6 or lower)
- MVB-258/258A* (Not supported in Modsoft 2.6 or lower)

*The MVB-258/258A is a "special", and therefore it is not included in this document.

I/O Configuration Using Modsoft 2.6 or Lower

Note: The modules are not supported in Modsoft 2.6 or lower.

Modsoft Application Examples for Selected A120 Series I/O Modules

D

At a Glance

Purpose

This chapter provides examples of how to use selected Series A120 I/O modules with Modsoft's Ladder Logic.

What's in this Chapter?

This chapter contains the following topics:

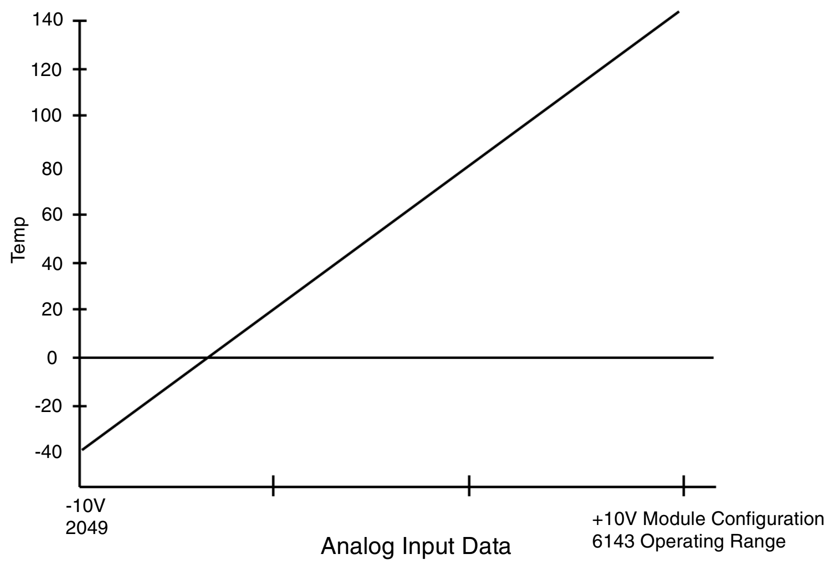
ADU 205 Application Example

Overview

In many applications, analog signals are scaled to engineering units that indicate units such as I/O points,degrees C, gal/min, cm/s, etc. An operator may view the scaled analog input data via LED displays, screen displays on a monitor, or report printouts.

Temperature Example

For example, assume that the -10 ... +10 V signal is being used to represent a temperature between -40 ... +140 F. The following figure shows the **Signal-to-Temperature Relationship**.

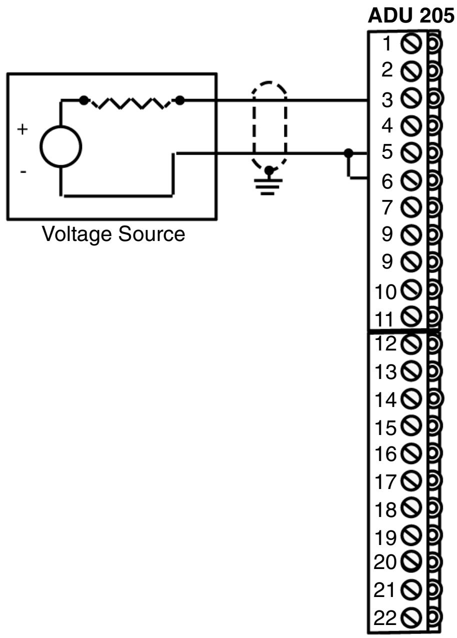


To appropriately display this analog data as a temperature value, you can use an ADU 205 Analog Input module I/O Mapped as follows: 30001-30004 input registers and binary.

Field Wiring Illustration

The following information describes how to field wire the ADU 205. The information consists of a field wiring illustration and a procedure (see *Procedure for Generating Logic, p. 756*.

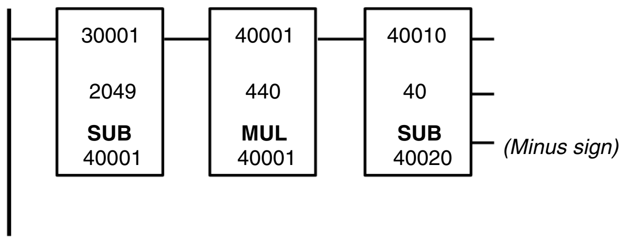
The following figure illustrates how to field wire the ADU 205.



Procedure for Generating Logic

Use the following procedure to generate the ladder logic.

<table>
<tr><th>Step</th><th>Action</th></tr>
<tr><td>1</td><td>Divide the temperature range, 180 degrees, by 4095.
(180 / 4095 = .044)</td></tr>
<tr><td>2</td><td>Obtain the MUL block constant by multiplying the result by 10,000.
(.044 x 10,000 = 440)</td></tr>
<tr><td>3</td><td>Generate the ladder logic to subtract the 2049 offset multiply the analog input by the constant; the high order result register will contain the range. Then subtract the Y-intercept, -40, to obtain the answer, as shown.



This logic generates the scaled value in register 40020 from the analog signal in 30001. Only the high order result of the MUL operation is used, and no compensation for round-off is used in this example.</td></tr>
</table>

DAU 204 Application Example

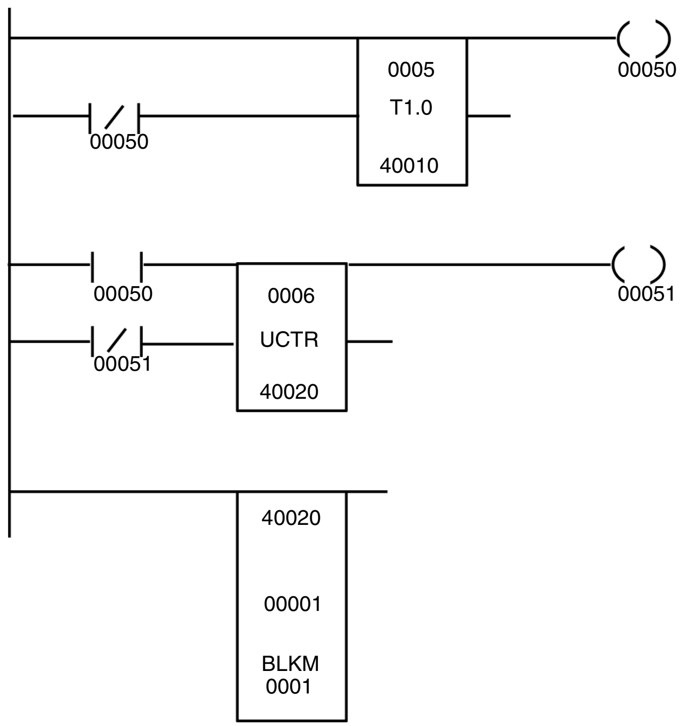
How the Module Ramps Outputs through to the Full Scale

The figures in this map show a ladder logic program that uses 1 timer (register 40010) and 1 upcounter (register 40020) to decrement all 4 output channel registers of the DAU204 (registers 40001 through 40004). This is very easily done using block moves and 5 holding registers (registers 40011 through 40015). With the module configured for 4 ... 20 mA output on all four channels (0 in register 40005), each channel is decremented from the top of the scale (4095) to the bottom of the scale (0) in 5 second intervals. After each interval, the outputs are changed to different values, again for 5 seconds. The counter is then reset, which starts the sequence again.

Note: This is only an example showing how the module operates to ramp the outputs through the full scale. The ladder logic (four networks) are not required to operate the module.

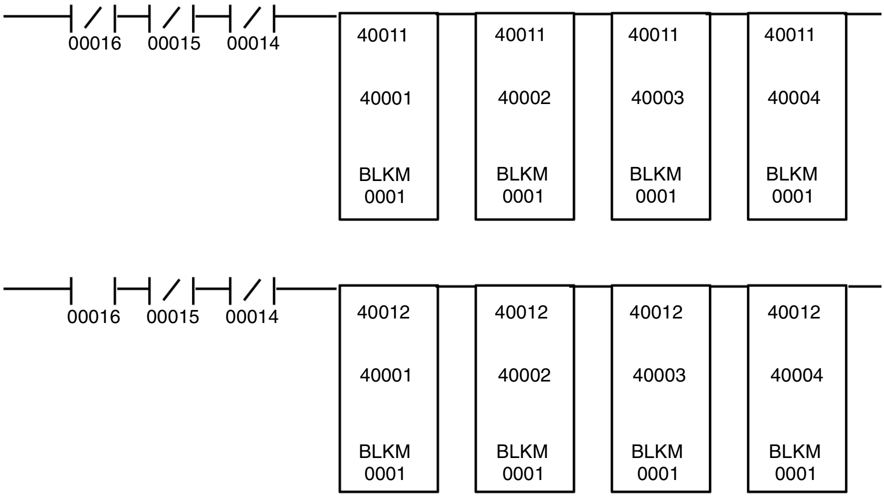
Network 1 Example

The following figure illustrates the logic for Network 1.



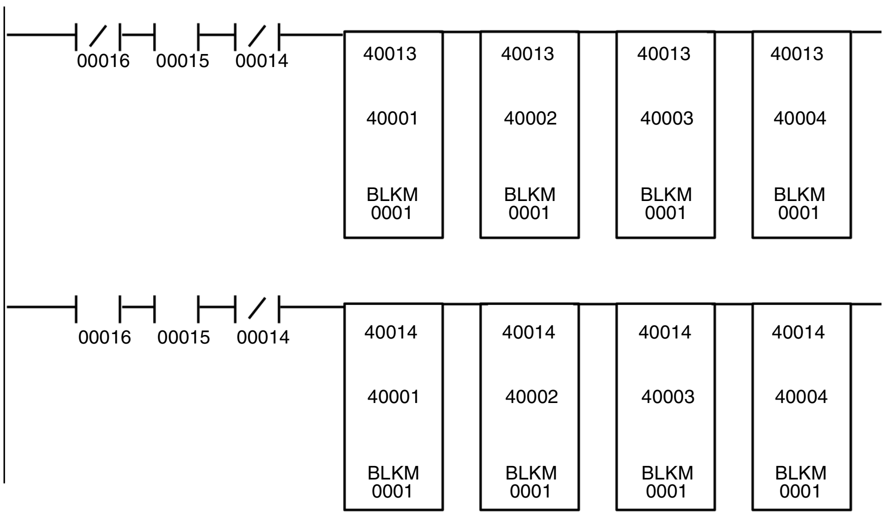
Network 2 Example

The following figure illustrates the logic for Network 2.



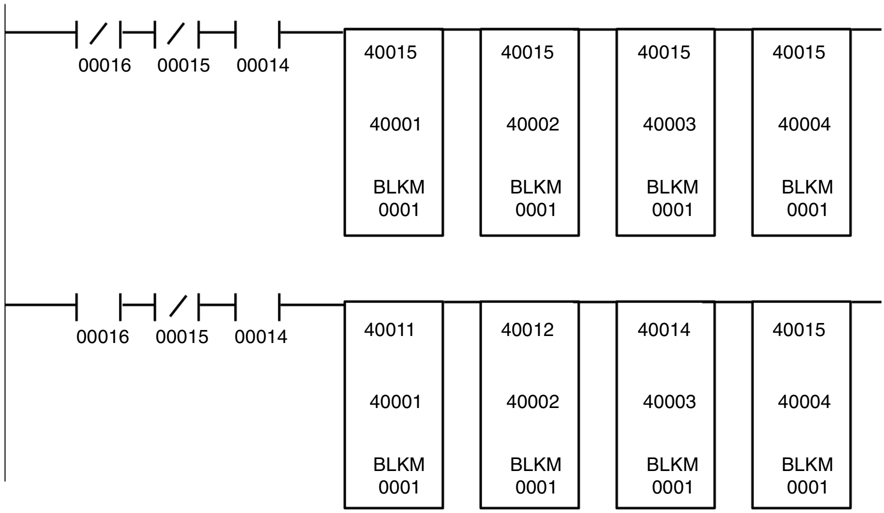
Network 3 Example

The following figure illustrates the logic for Network 3.



Network 4 Example

The following figure illustrates the logic for Network 4.



Reference Data

The following figure shows the reference data for the DAU 204 application example.

REFERENCE DATA

30001	0000000000000000	40010	1 Dec
40001	4095 Dec	40020	5 Dec
40002	3072 Dec		
40003	1027 Dec	40011	4095 Dec
40004	0 Dec	40012	3072Dec
40005	0 Dec	40013	2045 Dec
40006	0 Dec	40014	1027 Dec
		40015	0 Dec

VRC/CTR 2xx (VIC2xx) Application Notes

Controlling the Module

The VRC/CTR module is structured to minimize the amount of I/O resources required to operate the module. A total of six registers, set up as two separate groups of three registers each (three 3**x** input and three 4**x** output registers) is the total amount of resources dedicated to the module. Note that some individual registers are designed for use within the ladder program as contacts or coils.

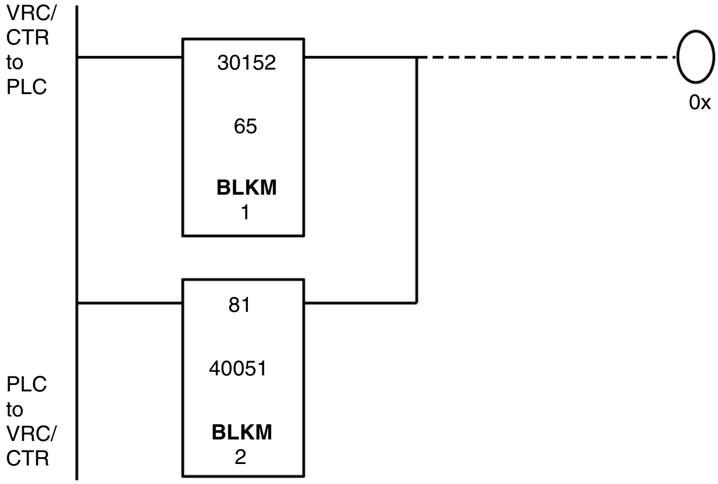
Ladder Logic Example 1, p. 761, which follows, shows how to move data from a word format into a bit location for use as a contact or coil within the ladder program. (This is only one example. You can accomplish the same result differently.)

In this example, the command will copy the data from input register 30152 (16 bits) into sixteen consecutive bit locations starting at output reference 00065. It will also copy 32 bit locations starting at output reference 81 and move the data into two (2) consecutive holding registers starting at 4005. Refer to the figures in *Accompanying Bit Functions, p. 762* to see the bit functions that will be in place with *Ladder Logic Example 1, p. 761*.

Some of the individual registers are designed for use within the ladder program as contacts or coils. With this ladder program, you can easily manipulate coils or simply monitor bits within the ladder program to control or monitor the VRC/CTR module.

Ladder Logic Example 1

The following figure illustrates how to move data from a word format into a bit location for use as a contact or coil within the ladder program. This example assigns registers 30150 ... 30152 and 40050 ... 40052 to the VRC/CTR module.



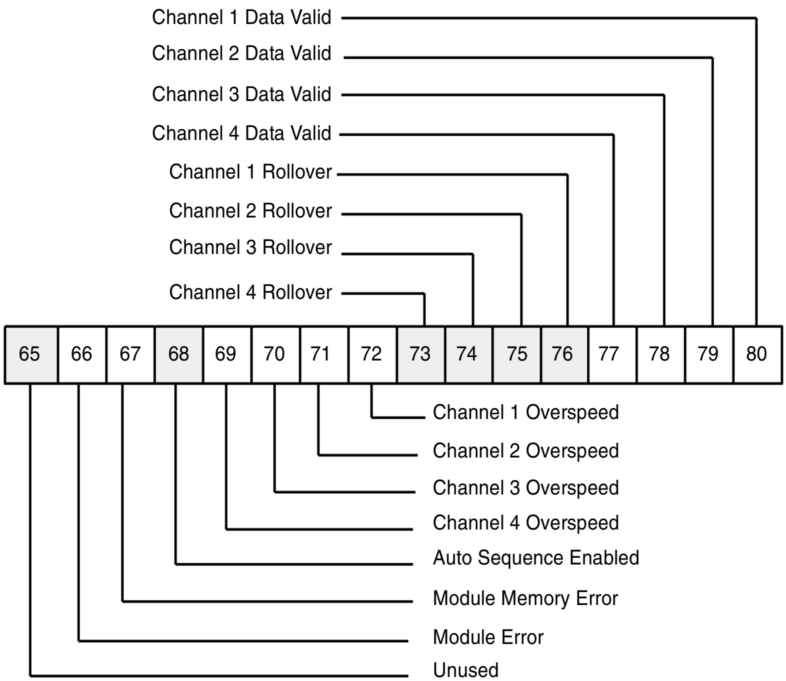
In this figure, the command will copy the data from input register 30152 (16 bits) into sixteen consecutive bit locations starting at output reference 00065. It will also copy 32 bit locations starting at output reference 81 and move the data into two (2) consecutive holding registers starting at 40051.

Note: For consistency, it is recommended that the rung of logic illustrated in this figure be placed after all logic associated with the VRC/CTR module. This does not affect the module, but it may be important for consistent control of the module.

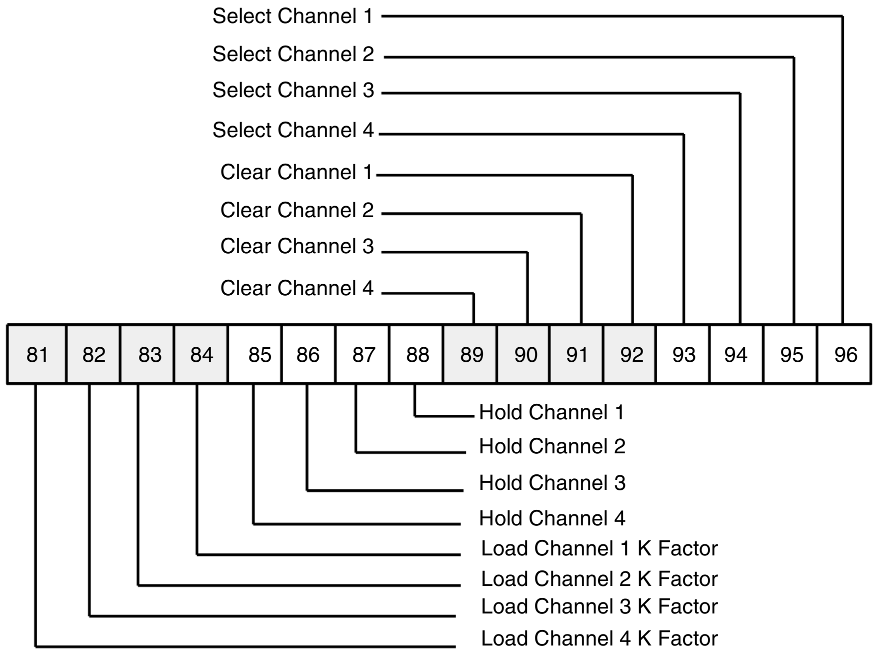
Accompanying Bit Functions

The following figures show the bit functions that will be in place with *Ladder Logic Example 1, p. 761*.

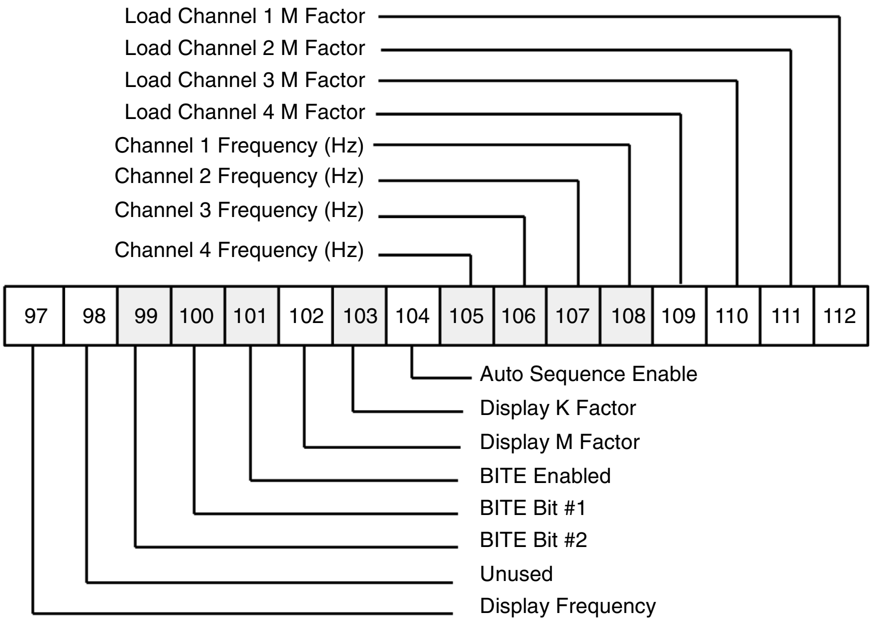
If you were to program as shown in *Ladder Logic Example 1, p. 761*, the output references would allow you to control and monitor the VRC/CTR module, as shown in the following figure.



The following figure depicts **Output Register #2, VRC/CTR Control Word 1** (as it would appear if accompanying *Ladder Logic Example 1, p. 761*).



The following figure depicts **Output Register #3, VRC/CTR Control Word 2** (accompanying (as it would appear if accompanying *Ladder Logic Example 1, p. 761*).



Factor Values

The VRC/CTR module can accept K and Meter factor data to process the incoming pulse information.

K Factor

The VRC/CTR module uses K factor information specific to the field device attached to each channel. K factor values may be any number from 1 ... 65,535, and are used in conjunction with the Meter factor value to calculate the incoming pulse information. Typically, the K factor number is imprinted on the side of the field device or listed in the documentation associated with the device.

Meter Factor

During typical use, sensing device characteristics change due to wear, material accumulation, or other items that impact performance. A meter factor value may be used to adjust the original K factor value to account for these deviations. The value used for a meter factor is multiplied into the K factor, and the result used to modify the incoming information. Meter factor values typically take the form of floating point variables from 0.0001 ... 1.9999.
To accomplish this, the VRC/CTR module assumes a decimal point in a standard integer value, as the information in the follow table shows.

PLC Data	VRtC/CTR Data
5000	0.5000
12550	1.2550

The module's meter factor defaults to a value of unity 1 (or 10000 integer). If a channel's characteristics need to be modified, the user may insert the meter factor value in the appropriate channel, and the module then calculates all incoming data based on the corrected value.The C factor = (K x M)/10,000.
The following table provides some examples.

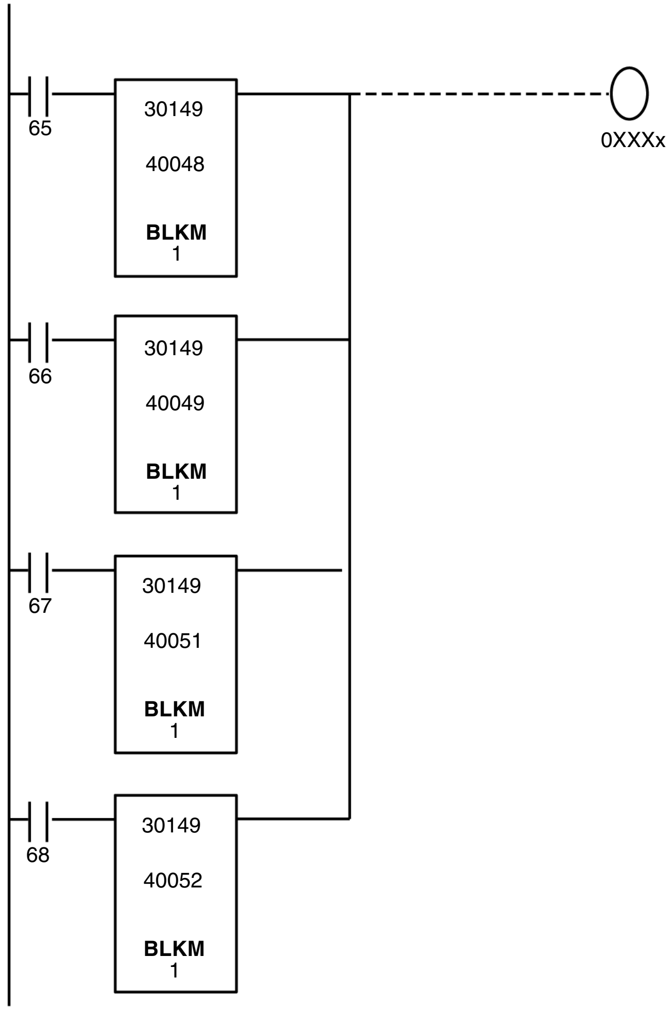
Original K Factor	Meter Factor	C Factor	# Received Pulses	Displayed Data
1000	1.0000	1000	9500	9
1000	0.9875	987.5	10500	10
3800	1.0155	3859	38500	9
1775	0.9725	1726	23471	13

By manipulating bits in Write register 3 (control word 2), you may view the contents of each channel's K Factor, Meter Factor, or C (calculated) factor value.

Auto Sequence

To minimize the amount of ladder programming required to operate the module, the VRC/CTR has the capability to autoscan the four input channels. If enabled, the auto sequence feature scans through channels 1 ... 4 (in order) every **1**/**2** s. (All channels are updated every 2 s.)
The Compact 984 or Micro ladder program simply needs to monitor four status bits assigned to input register 3 (bits 1 ... 4 in the module). These bits turn ON if the data for that channel is valid.

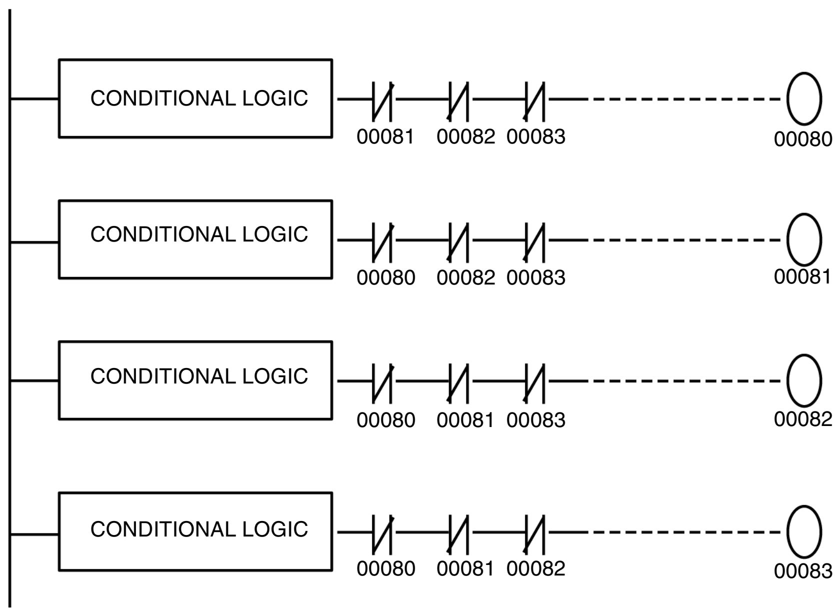
The following ladder logic example, **Ladder Logic Example #2**, shows how to use the data valid bits to move data into a specific holding register for use within the ladder program. Moving data into specific holding registers allows for each channel to be viewed at any time.



[Please review the *Controlling the Module, p. 760* and the *Accompanying Bit Functions, p. 762* for more information about register operation.] By using these four valid data bits, the ladder program distinguishes which channel is displayed at any given moment in time. By moving the data that is displayed for each channel (based on the status of these bits) into specific registers for use by the program, the ladder program can better utilize the information in other sections of the ladder program.

Manual Operation

Manual selection of channels is controlled by four bits located in output word 2, VRC/ CTR control word 1. By setting these bits ON or OFF, you may select a specific channel for monitoring.
Using the above example (see *Auto Sequence, p. 765*), all you would need to do is program four (4) coils in the ladder program, as shown in the following figure.



Overspeed Bits

It is recommended that the user monitor the overspeed bits in the ladder program. For the VRC–200 version of the module, the overspeed bits signal that the data from the module is potentially inaccurate. For these applications, it is recommended that the overspeed bits be monitored in ladder logic and flag an overspeed condition.

A120 Option Modules

E

At a Glance

Introduction

This chapter describes several A120 modules that are options.

What's in this Chapter?

This chapter contains the following topics:

SIM 203 Analog Simulator Module

General

The SIM 203 simulator module is an A120 option that allows you, for instructional purposes, to generate two analog signals - 0 ... 1V or 0 ... 10V (toggle switch selectable) and to display one 10V output signal from a Compact 984 controller output module. The SIM 203 outputs interface to the controller through the ADU 204 and ADU 205 input modules.

Note: The SIM 203 Module is a simulator module used for training purposes only. It is not a functional Compact 984 I/O module.
Note that also for instructional purposes only, the DAU 202 module may be used to output an analog signal to the SIM 203 readout. For more information, see the *Brief Product Description, p. 332*.

Operation

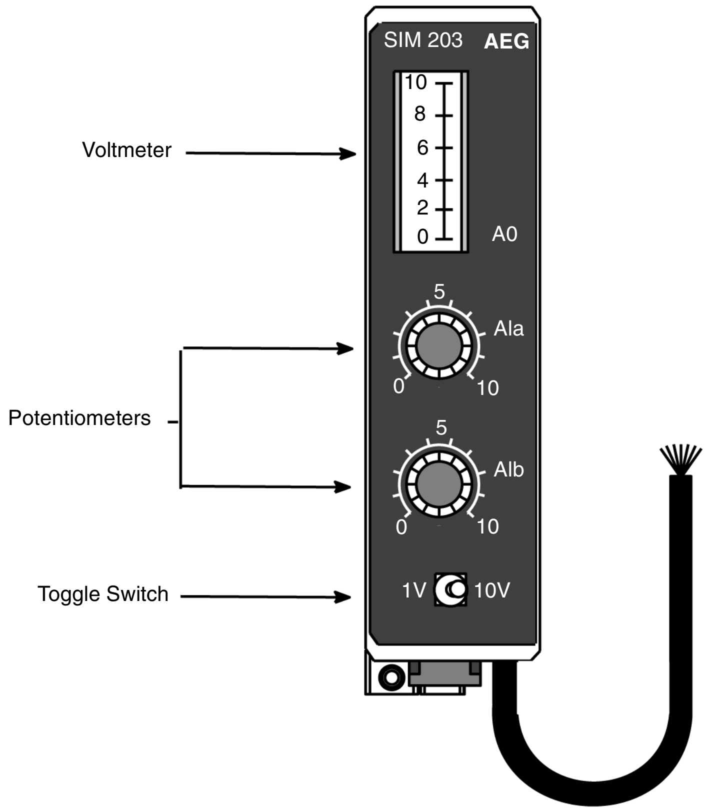
The design of the SIM 203 uses the same form factor as the standard A120 I/O modules do; however, the SIM 203 has no bus connection in back. The SIM 203 fits in any available slot in a DTA housing, and it can be mounted in any available I/O slot (in the same way that a standard A120 I/O module is mounted). The SIM 203 can also be mounted directly on a DIN rail.
The SIM 203 has an interconnection cable that can be brought out either through the top or the bottom of the module cover. The individual cable wires can be connected to the corresponding terminal assignments of the ADU 204, ADU 205, or DAU 202. The module can also be connected to the analog terminals of a Modicon Micro model 612.

Design

The following list and figure describe the structure of the SIM 203.
The SIM 203 has the following principal parts:

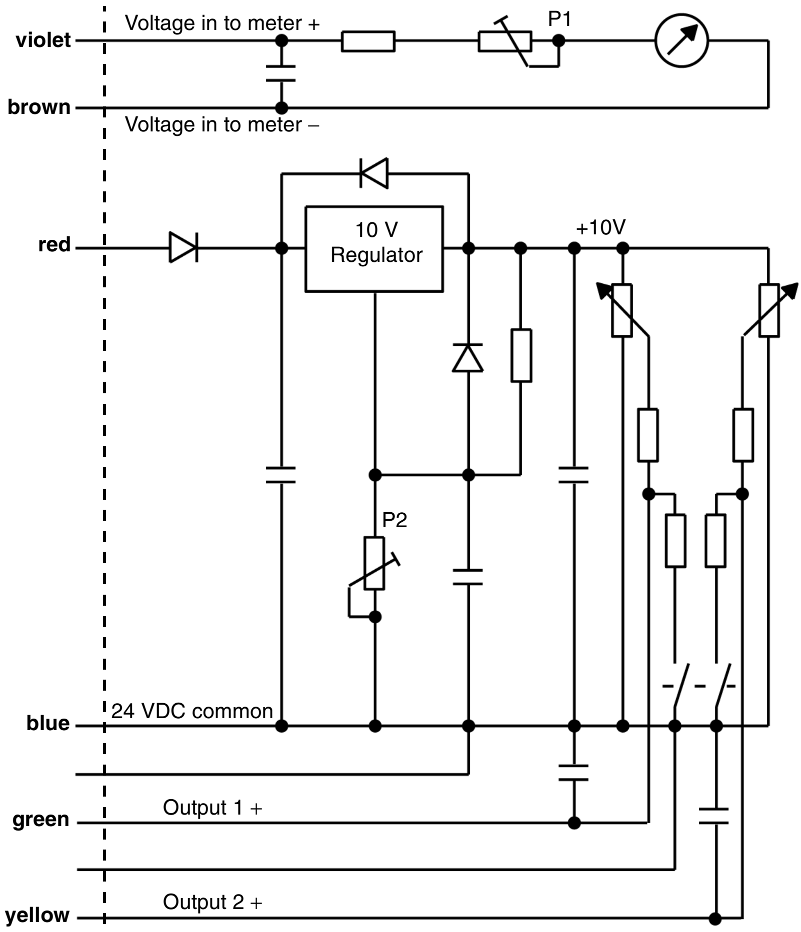
- One output voltmeter (0 V ... +10 V)
- Two input potentiometers
- One toggle switch, which has the following two positions:
  - Toggle switch left position: 0 V ... +1 V (used with ADU 204's PT100 slot)
  - Toggle switch right position: 0 V ... +10 V (used with ADU 205's 10 V slot)

The following figure shows the front view of the SIM 203 Module.



Wiring

The SIM 203 module receives power from the 24 Vdc source on the controller. All of the units in the configuration must be properly grounded.
The wiring diagram, which follows, shows the connections for the SIM 203.



Specifications

The following table lists specifications of the SIM 203 option module.

Electrical Characteristics	
Power Supply Voltage and Current Required	24 Vdc, 50 mA maximum
Signals to Controller	2 analog signals, selectable
Output	0 V ... +1 V
Input	0 V ... +10 V
Input Signal from Controller	1 analog signal: 0 V ... +10 V
Physical Characteristics	
Module	Standard A120 module form factor
Operating and Monitoring Devices	2 potentiometers, 1 toggle switch, 1 voltmeter
Connections	Stripped wires, to be clamped to screw/clamp type terminals of A120 modules
Dimensions	
W x H x D	40.3 x 145 x 117.5 mm (1.6 x 5.6 x 4.5 in)

SIM 216 Binary Simulator Module

General

For instructional purposes, the SIM 216 Binary Simulator module allows you to generate up to 16 binary input signals (24 Vdc) for Compact 984 controller modules. The SIM 216 outputs interface to the controller through the DEO 216 and DEP 216 input modules, and the DAP 212 and DAP 220 combined I/O modules.
The SIM 216 module's power load is 24 Vdc, and it contains a thermally controlled resistor fuse, which adopts high resistance if loads exceed 0.65A. The fuse reassumes low resistance if load is reduced.

Note: The SIM 216 Module is a simulator module used for training purposes only. It is not a functional Compact 984 I/O module.

Operation

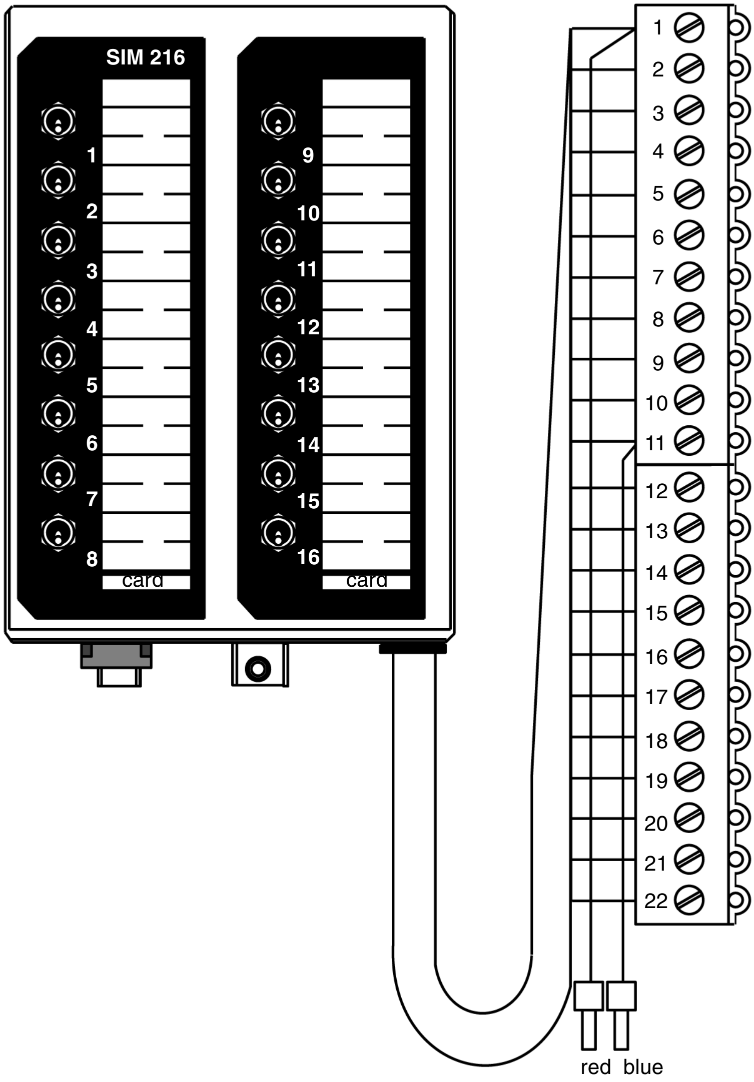
The design of the SIM 216 uses the same form factor as the standard A120 I/O modules do; however, the SIM 216 has no bus connection in back. The SIM 216 fits in any available slot in a DTA housing, and it can be mounted in any available I/O slot (in the same way that a standard A120 I/O module is mounted). The SIM 216 can also be mounted directly on a DIN rail.
The SIM 216 has an interconnection cable that can be brought out either through the top or the bottom of the module cover. The cable terminates into two 11-pole screw/clamp-type terminals, to which the corresponding terminal assignments of the DEO 216, DEP 216, DAP 212, and DAP 220 are connected.

Design

The following list and figure describe the structure of the SIM 216.
The SIM 216 has the following principal parts (which are shown in the figure):
- 16 toggle switches, including 2 latched and 1 jog switch
- Two 11-pole terminal strips, numbered 1-11 and 12-22

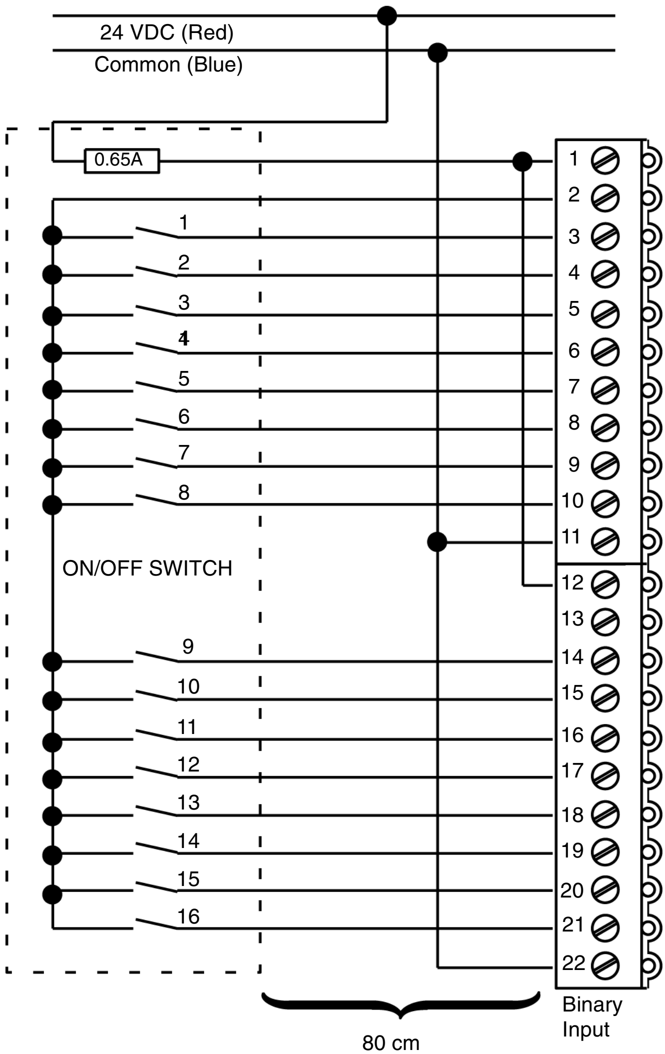
Note the two rows of removable cards alongside the toggle switches (refer to the figure). Use these cards to label the switches by function, voltage, input signal source, and so forth. It is suggested that you photocopy the original cards and use the photocopies to ensure a ready supply of labels.

The following figure shows the SIM 216 front view and wiring terminals.



Wiring

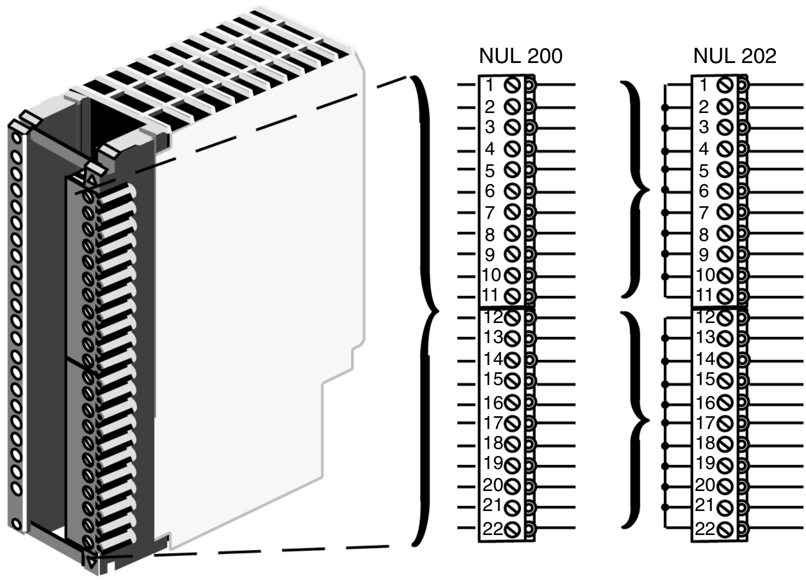
The SIM 216 module can receive power from the 24 Vdc source on the controller. Make sure that all units in the configuration are properly grounded.
The wiring diagram, which follows, shows the connections for the SIM 216.



NUL 200 and 202 Modules

Design

Two types of empty units, the NUL 200 and the NUL 202, are available. The design of these units uses the same form factor as the standard A120 I/O modules do. They fit in any available slot in a DTA housing, and allow you to prewire modules for future use.
The following figure shows the NUL 200 and the NUL 202.



The NUL 200 Unit

The NUL 200 is an empty unit that is used for the following: fixing cables not currently in use, field wiring reserve I/O slots, as a terminator, or as a rest for the snap-in front cover plate. It can be used in a partially configured DTA backplane, and it can be mounted in any available I/O slot, as does a standard A120 I/O module. The terminal screw connectors are all isolated from one another and from the I/O bus.

NUL 200 Specifications

The following table describes the NUL 200 specifications.

Connectors	22 isolated terminal screws for field wire cross-sections; 0.25 ... 2.5 mm2	
Maximum Voltage	Between Adjacent Terminals	< or = 50 V
	Nonadjacent Terminals	< 250 V

The NUL 202 Unit

The NUL 202 is an empty unit that can be used for terminal multiplication. There are two groups of 11 terminal screws to terminate field wiring connections. The two internally combined groups may be used as connection multipliers for two potentials. The unit can be used in a partially configured DTA backplane, and it can be mounted in any available I/O slot as does a standard A120 I/O module.

NUL 202 Specifications

The following table describes the NUL 202 specifications.

Connectors	Two groups of 11 terminal screws for field wire distribution; 0.25 ... 2.5 mm2	
Maximum Voltage	< or = 50 V	
	Sum Current/Connector	10 A (maximum)

Requirements for CE Compliance

F

At a Glance

Introduction

This chapter describes how to ensure your installation of A120 Series I/O modules is in compliance with the European Directive for EMC 89/336/EEC.

Note: The E984--258/265/275/285 PLCs meet EMC requirements by design. Therefore, this chapter does not apply to these four PLC models.

What's in this Chapter?

This chapter contains the following topics:

CE Compliance Requirements for Compact 984 Group 1

Group 1 Requirements

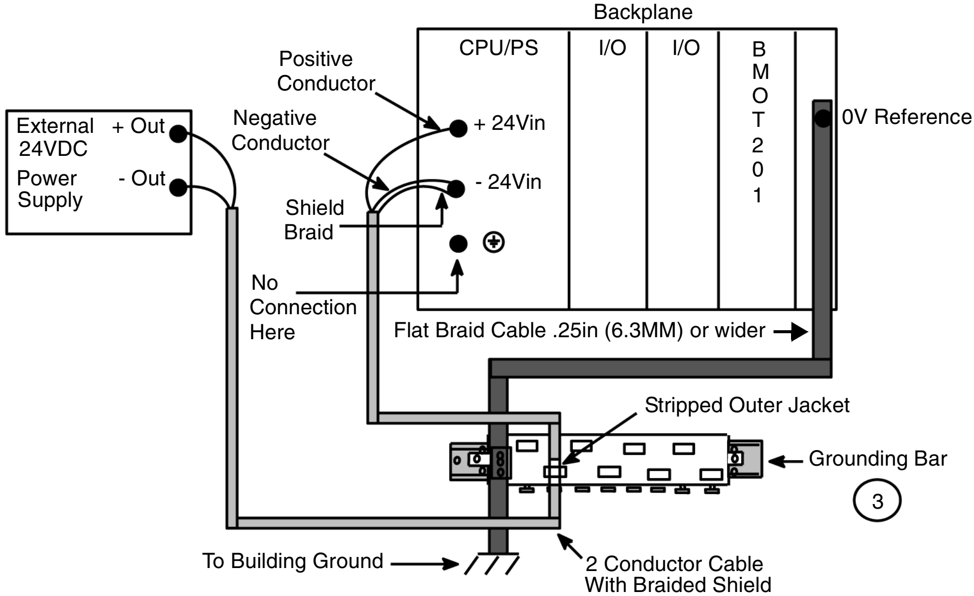
This section covers the installation requirements necessary to maintain compliance with the European Directive for EMC 89/336/EEC for certain (PC-A984-145, PC-E984-241, PC-E984-245, PC-E984-251, PC-E984-255, AS-BDAP-210, AS-BDAP-218, AS-BVIC-200, AS-BVIC-205, AS-BVIC-212, AS-BVIC-224, AS-BVRC-200, AS-BCTR-205,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

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

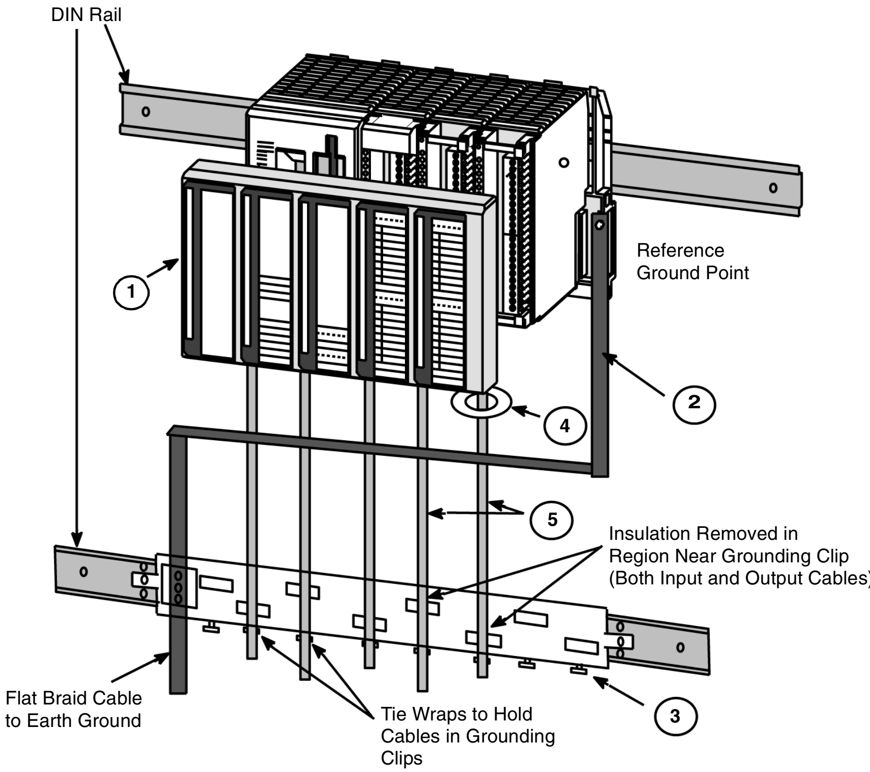
The following requirements should be followed for installations complying with the CE marking:

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

The following figure shows a schematic view of the CE compliance requirements.



The following figure depicts the CE compliance requirements.



The following table is the Parts List for the Callout used in the two previous figures.

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

CE Compliance Requirements for Compact 984 Group 2

Group 2 Requirements

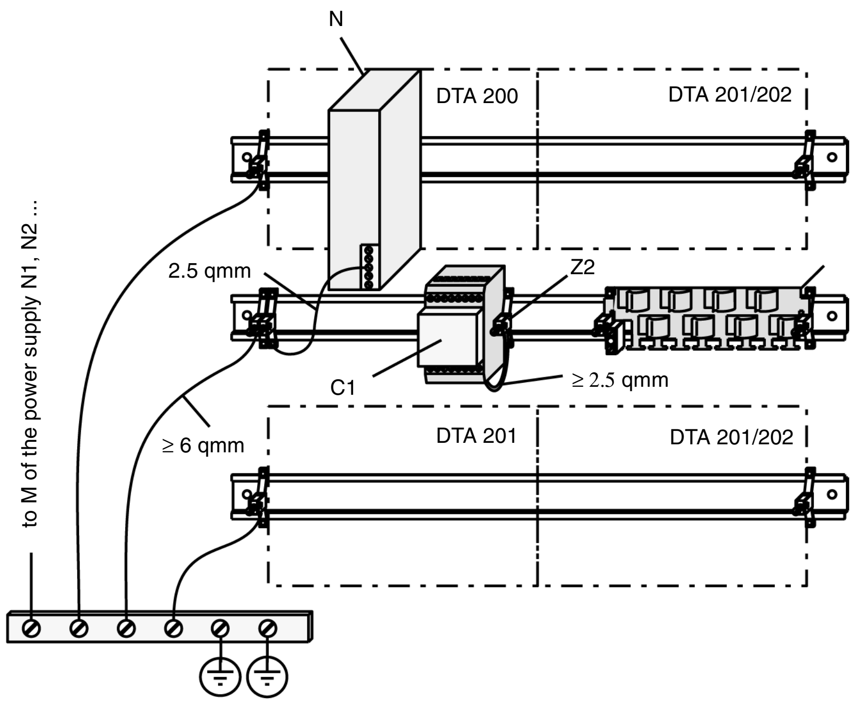
This section covers the installation requirements necessary to maintain compliance with the European Directive for EMC 89/336/EEC for certain (AS-HDTA-200, AS-HDTA-201, AS-HDTA-202, AS-BDAO-216, AS-BDAP-204, AS-BDAP-208, AS-BDAP-211, AS-BDAP-212, AS-BDAP-216, AS-BDAP-216N, AS-BDAP-217, AS-BDAP-220, AS-BDAP-250, AS-BDAP-252, AS-BDAP-292, AS-BDEO-216, AS-BDEP-208, AS-BDEP-210, AS-BDEP-211, AS-BDEP-214, AS-BDEP-215, AS-BDEP-216, AS-BDEP-217, AS-BDEP-218, AS-BDEP-220, AS-BDEP-257, AS-BDEP-254, AS-BDEP-296, AS-BDEP-297, AS-BADU-204, AS-BADU-205, AS-BADU-206, AS-BADU-210, AS–BADU–214, AS-BADU-216, AS-BADU-254, AS-BADU-256, AS-BADU-257, AS-BDAU-202, AS-BDAU-208, AS-BFRQ-204, AS-BBKF-201, AS-BZAE-201, AS-BZAE-204 and AS–BDEA–203) Compact 984 components. These particular modules operating voltages are Ub (24Vdc), working voltages Us (24Vdc/230Vac).

The following requirements should be followed for installations complying with the CE marking:

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

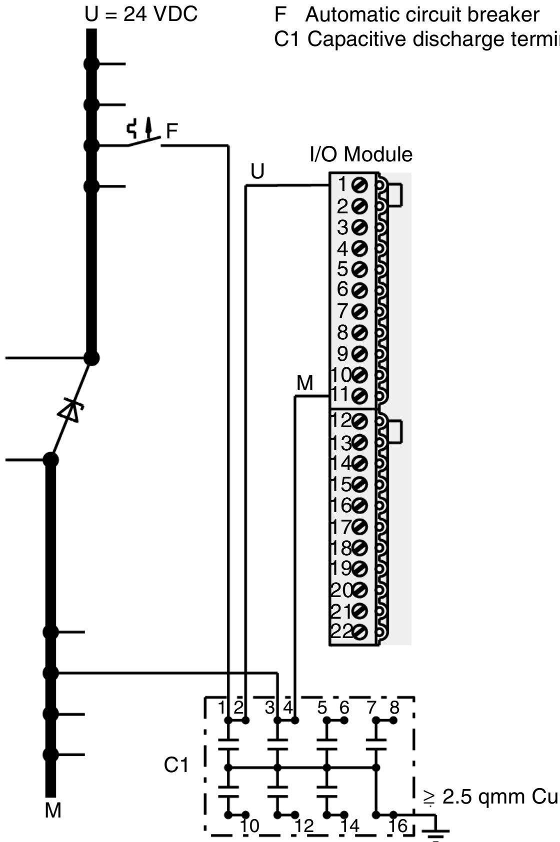
Improvement of the EMC Stability on the Modules

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



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

The following figure shows another view of the capacitive discharge terminal.



Earthing System of the Top Hat Rails and Modules

The earthing system of the 0 V on the rack is already preset when delivered. More details are described in *Earthing System of the Shielded Cable Lines, p. 787* (the following section). To have noise-free operation, perform the following earthing system measures described in that section.

Earthing System of the Shielded Cable Lines

The following table provides an overview of recommended shielded cables.

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

Technical Assistance

G

At a Glance

Purpose

This chapter describes resources that may prove useful in the installation and troubleshooting of A120 series I/O modules.

What's in this Chapter?

This chapter contains the following topics:

Schneider Automation Customer Service Numbers

Schneider Automation Telephone Numbers

Schneider Automation telephone numbers are as follows:

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

When calling the *Schneider Automation* 800 telephone number, you will get a recording asking you to enter a one digit code for the type of service you request provided you use a *touch tone* telephone. The service categories and the extra digit responses for touch tone phones are:
The service categories - and *extra digit* code responses for push-button phones - are:

1	Hardware or software technical support
2	Order entry, buying hardware or software
3	Modfax
4	Training/course registration inquiries
5	General information other than above.

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

Note: BBS (Schneider Automation's Customer Service Bulletin Board): For Modsoft updates, conversion utilities, hardware and software help, field service bulletins, Modbus and Modbus Plus help, software revision levels, FLASH EXEC updates for Modicon equipment, and more. Parameters are up to 56.6k baud, no parity, 8 data, 1 stop, phone 1-(978)-975-9779.

Installing the Loadables for A120 Series I/O Modules

Overview

The following information describes how to install loadables.

General Procedure

The SW-IODR-001 (Rev 1.20 or higher) loadable is available from the Customer Service Bulletin Board Service (978/975-9779). Note that all users of the A984- 1XX, Micro 512, and Micro 612 PLCs may be required to perform the following steps if a particular I/O module is not included in the module table.

Step	Action
1	From the Main Menu, select **F-files to download**.
2	Then select **0-loadables**.

Update the Modsoft GCNFA120.SYS File (If Less Than Ver. 2.1)

The following information must appear in the *GCNFA120.SYS* file in the *Modsoft/ Runtime* directory, if the file version is less than Ver. 2.1. Edit your file accordingly.

- BMOT201,110,0,12,12,1-AXIS MOTN ,1,
- BMOT202,111,0,12,12,1-AXIS MOTN ,1,
- DEP211,17,0,1,0,8-I 110VAC ,0,
- DEP215,46,0,2,0,16-I 5VDC TTL ,0,
- DEP217,45,0,2,0,16-I 24VDC ,0,
- DEP214,20,0,2,0,16-I 10-60VDC ,0,
- DAP217,42,0,0,2,16-O 24VDC ,0,
- VIC2XX,120,0,6,6,COUNTER ,0,
- ADU211,118,0,6,6,8 CHN ANALOG ,0,
- ADU216,59,0,10,2,8 CHN A/D TC ,0,
- ADU214,36,0,6,4,4/8 CHN A/D ,1,
- ADU204,32,0,8,0,4 CHN 0.5V ,1,
- DAU204,117,0,2,12,4 CHN OUTPUT ,1,
- DAP211,10,0,1,1,4 MIXED I/O ROVAC ,0,

Procedure for Installing the SW-IODR-001 Loadable

Use the following steps to install the SW-IODR-001 Loadable.

Step	Action
1	Using Modsoft, from the OFFLINE Mode menu, select **PROGRAM**.
2	Once the program is loaded, select **CONFIG**uration.
3	From the Configuration Overview Screen, select **LOADABLE**.
4	To install the loadable, select **DIR**ectory and enter the applicable file name, for example, *drive:\MODSOFT\PROGRAM\SVI.DAT*. The file names are listed in *Applicable File Names and Modules, p. 792*, immediately following this procedure.
5	Once the file is loaded, select **EDIT**, and then **INSERT**.
6	Select the applicable loadable, for example, *#SVI*. The names of the loadables are listed in *DX Loadable Configuration Files and File Names, p. 792*.
7	To load the program into the PLC, return to the Main Menu and select **TRANSFER**.
8	Select **File to PLC**. The loadable will now be installed in the PLC as part of the configuration and user logic.

Applicable File Names and Modules

The following table lists the file names for the modules to load in *Procedure for Installing the SW-IODR-001 Loadable, p. 792*.l

File Name	Module
BMOT.DAT	BMOT20X
DSC1.DAT	DEP211, 214,215, 217, and DAP217/211
SVI.DAT	ADU211,VIC2XX, and DAU204
ADU216.DAT	ADU216
ADU214.DAT	ADU214

DX Loadable Configuration Files and File Names

The following table lists the configuration file names for the loadables to use in *Procedure for Installing the SW-IODR-001 Loadable, p. 792*.l

DX Loadable Configuration File	File Name
#MOT	BMOT.DAT
#DS1	DSC1.DAT
#SVI	SVI.DAT
#216	ADU216.DAT
#214	ADU214.DAT
Note that the Rev, size, and opcode will vary from file to file.	

A

E

F

G

H

I

L

M

N

O

P

Q

R

S

Z