# ArmorPOINT 24V DC Very High Speed Counter Modules, Series A

Catalog number 1738-VHSC24M23

The ArmorPOINT® I/O family (Bulletin 1738) consists of modular I/O modules. The sealed IP67 housing of these modules requires no enclosure. (Note that environmental requirements other than IP67 may require an additional appropriate housing.) The I/O connector is sealed M23 style. The mounting base ships with the module. The 1738-VHSC24M23 module is shown below.

1738-VHSC24M23
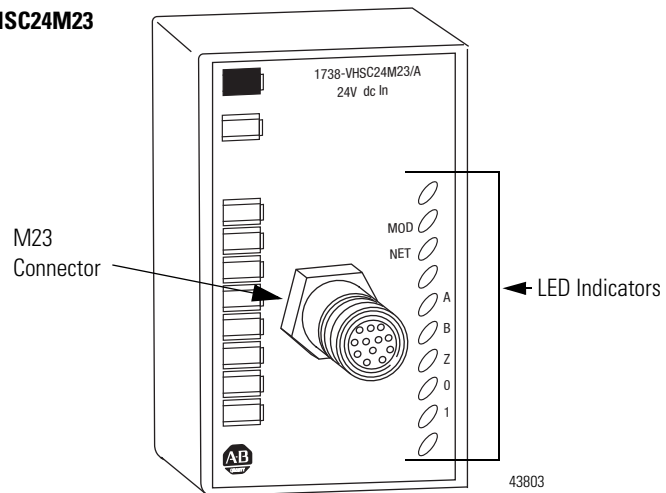
Important User Information

Solid state equipment has operational characteristics differing from those of electromechanical equipment. *Safety Guidelines for the Application, Installation and Maintenance of Solid State Controls* (Publication SGI-1.1 available from your local Rockwell Automation sales office or online at http://www.rockwellautomation.com/literature/) describes some important differences between solid state equipment and hard-wired electromechanical devices. Because of this difference, and also because of the wide variety of uses for solid state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

In no event will Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

No patent liability is assumed by Rockwell Automation, Inc. with respect to use of information, circuits, equipment, or software described in this manual.

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

WARNING	Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.
IMPORTANT	Identifies information that is critical for successful application and understanding of the product.
ATTENTION	Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you: • identify a hazard • avoid a hazard • recognize the consequence
SHOCK HAZARD	Labels may be located on or inside the equipment to alert people that dangerous voltage may be present.
BURN HAZARD	Labels may be located on or inside the equipment to alert people that surfaces may be dangerous temperatures.

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ATTENTION

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Environment and Enclosure

This equipment is intended for use in overvoltage Category II applications (as defined in IEC publication 60664-1), at altitudes up to 2000 meters without derating.

This equipment is considered Group 1, Class A industrial equipment according to IEC/CISPR Publication 11. Without appropriate precautions, there may be potential difficulties ensuring electromagnetic compatibility in other environments due to conducted as well as radiated disturbance.

This equipment is supplied as "enclosed" equipment. It should not require additional system enclosure when used in locations consistent with the enclosure type ratings stated in the Specifications section of this publication. Subsequent sections of this publication may contain additional information regarding specific enclosure type ratings, beyond what this product provides, that are required to comply with certain product safety certifications.

NOTE: See NEMA Standards publication 250 and IEC publication 60529, as applicable, for explanations of the degrees of protection provided by different types of enclosure. Also, see the appropriate sections in this publication, as well as the Allen-Bradley publication 1770-4.1 ("Industrial Automation Wiring and Grounding Guidelines"), for additional installation requirements pertaining to this equipment.

ATTENTION

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Preventing Electrostatic Discharge

This equipment is sensitive to electrostatic discharge, which can cause internal damage and affect normal operation. Follow these guidelines when you handle this equipment:

- Touch a grounded object to discharge potential static.
- Wear an approved grounding wriststrap.
- Do not touch connectors or pins on component boards.
- Do not touch circuit components inside the equipment.
- If available, use a static-safe workstation.
- When not in use, store the equipment in appropriate static-safe packaging.

Mount the I/O Base

To mount the ArmorPOINT I/O base on a wall or panel, use the screw holes provided in the ArmorPOINT base.

> **IMPORTANT**   The ArmorPOINT I/O module must be mounted on a grounded metal mounting plate or other conductive surface.

A mounting illustration for the ArmorPOINT base with an adapter is shown below.
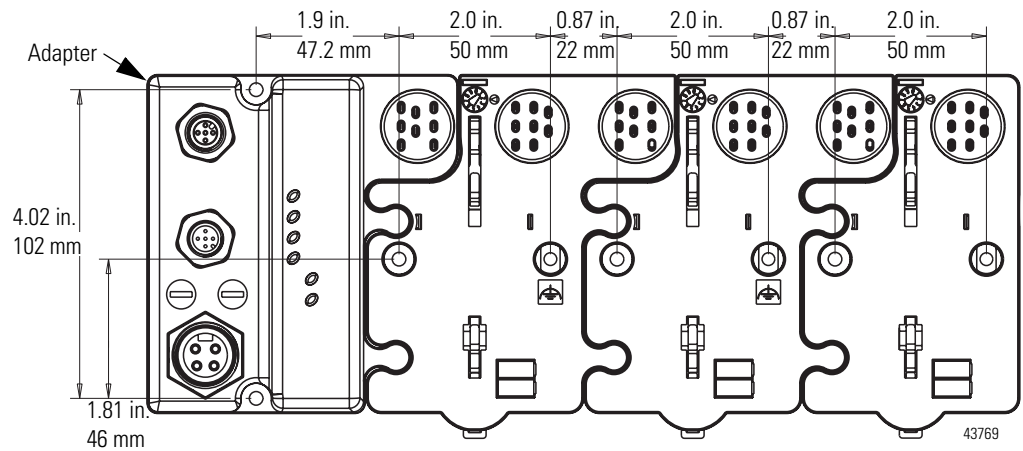
Install the mounting base as follows:

1. Lay out the required points as shown above in the drilling dimension drawing.

2. Drill the necessary holes for #8 (M4) machine or self-tapping screws.

3. Mount the base using #8 (M4) screws.

4. Ground the system using the ground lug connection. (The ground lug connection is also a mounting hole.)

Mounting base
Keyswitch-
Set to position 2 for
the 1738 specialty
modules

Ground lug connection

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Latching mechanism
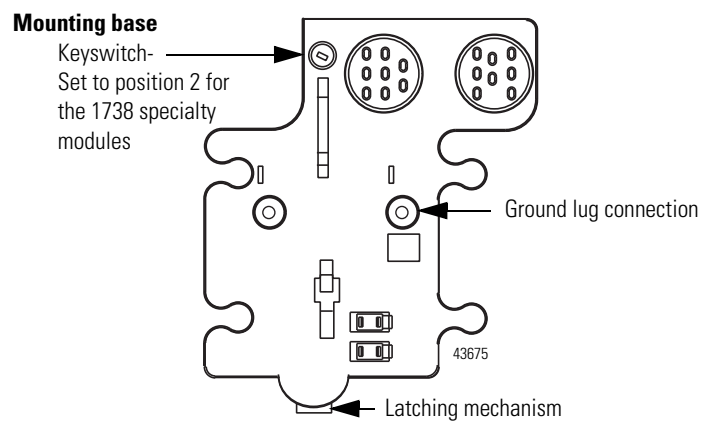
Install the ArmorPOINT Very High Speed Counter Module

To install the ArmorPOINT Very High Speed Counter module, proceed as follows.

1. Using a bladed screwdriver, rotate the keyswitch on the mounting base clockwise until the number 2 aligns with the notch in the base.

2. Position the module vertically above the mounting base. The module will bridge two bases.

Module will bridge two bases.

1738-VHSC24M23/A
24V dc In
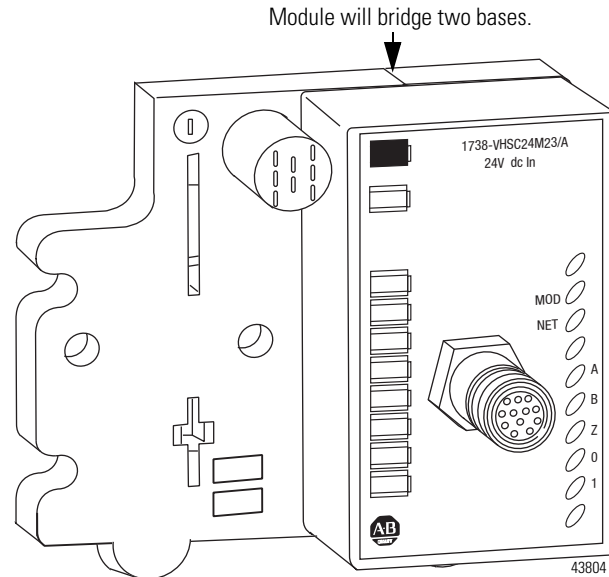
MOD
NET
A
B
Z
0
1

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3. Push the module down until it engages the latching mechanism. You will hear a clicking sound when the module is properly engaged.

    The locking mechanism will lock the module to the base.

Remove the ArmorPOINT Very High Speed Counter Module From the Mounting Base

To remove the module from the mounting base:

1. Put a flat blade screwdriver into the slot of the orange latching mechanism.

2. Push the screwdriver toward the I/O module to disengage the latch.

    The module will lift up off the base.

3. Pull the module off of the base.

Wire the Very High Speed Counter Module

Following are wiring instructions for the ArmorPOINT Very High Speed Counter module.

1738-VHSC24M23
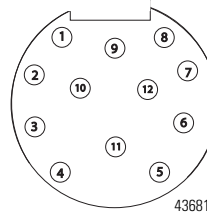
1738-VHSC24M23
(view into connector)
Pin 1 - +A
Pin 2 - ~A
Pin 3 - +B
Pin 4 - ~B
Pin 5 - +Z
Pin 6 - ~Z
Pin 7 - Output 0
Pin 8 - Output 1
Pin 9 - Return (Com)
Pin 10 - Return (Com)
Pin 11 - 24V DC
Pin 12 - Chassis

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IMPORTANT	If shielded cable is used, shield lead can be connected to chassis pin 12 on the connector.

ATTENTION	Make sure all connectors and caps are securely tightened to properly seal the connections against leaks and maintain IP67 requirements.

Communicate With Your Module

I/O messages are sent to (consumed) and received from (produced) the ArmorPOINT I/O modules. These messages are mapped into the processor's memory. This ArmorPOINT I/O input/output module produces 6 or 10 bytes of input data (scanner Rx - status). It consumes 2 or 4 bytes of I/O data (scanner Tx). See the 1738 ArmorPOINT adapter User Manual, publication 1734-UM016, for specific parameter information.

Default Data Map for the ArmorPOINT Very High Speed Counter Module

Message size: 6 or 10 Bytes

	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Produces (Scanner Rx)	Channel 0 value of present counter state (LSW)															
	Channel 0 value of present counter state (MSW)															
	PE	EF	NR	0	FS	FS	OS	OS	0	ZS	BS	AS	C1	C0	ZD	0
	Requested Poll Produce Assembly															
	Requested Change of State Produce Assembly															

Where: PE = Programming error
EF = EEPROM fault status
NR = Not ready status bit
FS = Output fault status bit - bit 10 for output 0, bit 11 for output 1
OS = Output on/off status bit - bit 8 for output 0, bit 9 for output 1
ZS = Z input status
BS = B input status
AS = A input status
C = Stored data count
ZD = Zero frequency detected
LSW = Least significant word
MSW = Most significant word

Note that when a configuration is sent to the module, it is checked for consistency before being applied. If an error is found in the configuration, the PE bit is asserted and the module retains its previous configuration. Monitor this PE bit with your user program to isolate any problems an improperly configured module may have. If the configuration is considered acceptable, the counter ASIC is disabled, counting is suspended, and outputs are shut off while the ASIC is loaded with the new operational parameters.

Message size: 2 or 4 Bytes

	08 - 15	07	06	05	04	03	02	01	00
Consumes (scanner Tx)	0	0	0	0	0	0	VR	CP	CR
	0	DS	ES	OE	FO	DS	ES	OE	FO
	Requested Poll Consume Assembly								
	Where: VR = Value reset of stored/accumulated count CP = Counter preset CR = Counter reset DS = Diagnostic speed ES = Electronic fuse select OE = Output enable FO = Force output								

Configure the Very High Speed Counter Module

Parameter	Set/Get	Description	Bytes
1	Set/Get	Counter Configuration (see page 11)	1
2	Set/Get	Filter Selection (see page 12)	1
3	Set/Get	Decimal Position	1
4	Set/Get	Active Output Assembly	1
5	Set/Get	Time Base Value/PWM Period	2
6	Set/Get	Gate Interval	1
7	Set/Get	Channel Scalar (see page 12)	1
8	Set/Get	Output 0 Ties	1
9	Set/Get	Output 1 Ties	1
10	Set/Get	Channel Rollover Value	4
11	Set/Get	Channel Preset Value	4
12	Set/Get	ON Value 1	4
13	Set/Get	OFF Value 1	4
14	Set/Get	ON Value 2	4
15	Set/Get	OFF Value 2	4
16	Set/Get	ON Value 3	4
17	Set/Get	OFF Value 3	4
18	Set/Get	ON Value 4	4
19	Set/Get	OFF Value 4	4
20	Set/Get	PWM Safe State Value	2
21	Set/Get	Counter Control Safe State	1
22	Set/Get	Output Control Safe State	1
23	Set/Get	Requested Poll Produce Assembly	1
24	Set/Get	Requested COS Produce Assembly	1
25	Set/Get	Requested Poll Consume Assembly	1

Counter Configuration

07	06	05	04	03	02	01	00	
ZI	**MD**				**CF**			**Counter 0**
				0	0	0	0	Counter
				0	0	0	1	Encoder X1
				0	0	1	0	Encoder X2
				0	0	1	1	PWM
				0	1	0	0	Encoder X4
				0	1	0	1	Period/Rate
				0	1	1	0	Continuous/Rate
				0	1	1	1	Rate Measurement
				1	0	0	0	Pulse Generator
	0	0	0					Store Count Disabled
	0	0	1					Mode 1 - store/continue
	0	1	0					Mode 2 - store/wait/resume
	0	1	1					Mode 3 - store, reset/wait/start
	1	0	0					Mode 4 - store, reset/start
	1	0	1					Reserved
	1	1	0					Reserved
	1	1	1					Reserved
0								Z input - 0 = not inverted
1								Z input - 1 = inverted

Filter Selection

07	06	05	04	03	02	01	00	
0	ZF	BF	AF		FS			
				0	0	0	0	No Filter
				0	0	0	1	50kHz (10μs + 0μs/-1.6μs)
				0	0	1	0	5kHz (100μs + 0μs/-13.2μs)
				0	1	0	0	500Hz (1.0ms + 0ms/-125μs)
				1	0	0	0	50Hz (10ms + 0ms/-1.25ms)
			0					A input not filtered
			1					A input filtered
		0						B input not filtered
		1						B input filtered
	0							Z input not filtered
	1							Z input filtered

Scalar Selection

07	06	05	04	03	02	01	00	Scalar[1]
0	0	0	0	0	0	0	1	Z - F_{min} = 0.149Hz
0	0	0	0	0	0	1	0	Z/2 - F_{min} = 0.298Hz
0	0	0	0	0	1	0	0	Z/4 - F_{min} = 0.596Hz
0	0	0	0	1	0	0	0	Z/8 - F_{min} = 1.192Hz
0	0	0	1	0	0	0	0	Z/16 - F_{min} = 2.384Hz
0	0	1	0	0	0	0	0	Z/32 - F_{min} = 4.768Hz
0	1	0	0	0	0	0	0	Z/64 - F_{min} = 9.537Hz
1	0	0	0	0	0	0	0	Z/128 - F_{min} = 19.073Hz

1   Where Fmin indicates the frequency at which the zero frequency detect is asserted due to counter overflow.
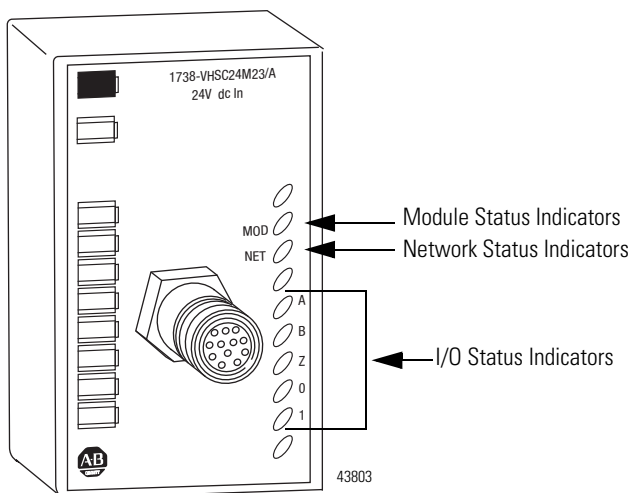
Assemblies

The Very High Speed Counter Module uses several words to communicate real time input and output data as well as non-real time module information (that is, description, revision, and so on) and configuration. The following table shows the words which can be exchanged. Data may be read (get) or written (set) using an explicit message.

Instances (Dec/Hex)	Services	Field	Bytes
#101 (0x65)	Get	Present Channel Data	4
		Status	2
#102 (0x66)	Get	Stored Channel Data	4
		Status	2
#103 (0x67)	Get	Present Channel Data	4
		Stored Channel Data	4
		Status	2
#104 (0x68)	Get	Programming Error Code	2
#105 (0x69)	Set/Get	Counter Control	1
		Output Control	1
#106 (0x6a)	Set/Get	PWM Value	2
#107 (0x6b)	Set/Get	PWM Value	2
		Counter Control	1
		Output Control	1
#108 (0x6c)	Set/Get	Counter Configuration	1
		Filter Selection	1
		Decimal Position	1
		Active Output Assembly	1
		Time Base or PWM Period	2
		Gate Interval	1
		Scalar	1
		Output 0 Ties	1
		Output 1 Ties	1
		Rollover Value	4
		Preset Value	4
		ON Value # 1	4
		OFF Value #1	4
		ON Value # 2	4

Instances (Dec/Hex)	Services	Field	Bytes
		OFF Value #2	4
		ON Value # 3	4
		OFF Value #3	4
		ON Value # 4	4
		OFF Value #4	4
		PWM Safe State Value	2
		Counter Control SSV	1
		Output Control SSV	1
#123 (0x7b)	Set/Get	Counter Configuration	1
		Filter Selection	1
		Decimal Position	1
		Active Output Assembly	1
		Time Base or PWM Period	2
		Gate Interval	1
		Scalar	1
		Output 0 Ties	1
		Output 1 Ties	1
		Alignment (reserved = 0)	2
		Rollover Value	4
		Preset Value	4
		ON Value # 1	4
		OFF Value #1	4
		ON Value # 2	4
		OFF Value #2	4
		ON Value # 3	4
		OFF Value #3	4
		ON Value # 4	4
		OFF Value #4	4
		PWM Safe State Value	2
		Counter Control SSV	1
		Output Control SSV	1

Troubleshoot with the Indicators

1738-VHSC24M23

1738-VHSC24M23/A
24V dc In

MOD — Module Status Indicators
NET — Network Status Indicators

A
B   I/O Status Indicators
Z
0
1

A-B

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Indication	Probable Cause
Module Status	
Off	No power applied to device
Green	Device operating normally
Flashing Green	Device needs commissioning due to missing, incomplete, or incorrect configuration
Flashing Red	Recoverable fault
Red	Unrecoverable fault - may require device replacement
Flashing Red/Green	Device is in self-test

Indication	Probable Cause
Network Status	
Off	Device is not online: – Device has not completed dup_MAC-id test. – Device not powered. Check module status indicator.
Flashing Green	Device is online but has no connections in the established state.
Green	Device is online and has connections in the established state.
Flashing Red	One or more I/O connections in timed-out state.
Red	Critical link failure – failed communication device. Device detected error that prevents it from communicating on the network.
Flashing Red/Green	Communication faulted device – the device has detected a network access error and is in communication faulted state. Device has received and accepted an Identity Communication Faulted Request - long protocol message.

Indication	Probable Cause
I/O Status	
Input Status	
Off	Input inactive
Yellow	Input is active and under control
Flashing Yellow	Input is toggling on and off
Output Status	
Off	Output inactive
Yellow	Output is active and under control
Flashing Yellow	Output is toggling on and off
Flashing Red	Output is faulted (open, short, or no output power)
Flashing Red/Yellow	Output is toggling and faulted (possibly open)

Specifications

Following are specifications for the 1738 ArmorPOINT Very High Speed Counter Module.

| ArmorPOINT 1738-VHSC24M23 Module	
Input Specifications	
Inputs per Module	1 – 1 group of A/A return, B/B return and Z/Z return
Input Voltage	15...24 V DC
Input Current	6.1 mA @ 15V DC 10.2 mA @ 24V DC
Input OFF-State Voltage	≤1.8V DC
Input OFF-State Current, max	≤0.250 mA
Input ON-State Voltage	≥12.5V DC
Input ON-State Current	≥5 mA
Maximum ON-State Voltage	Refer to derating curve below.
Input Filter Selections	Off 10 μs 100 μs 1.0 ms 10.0 ms
Maximum Input Frequency	1.0 MHz counter and encoder X1 configurations 500 kHz encoder X2 configuration (no filter) 250 kHz encoder X4 configuration (no filter)
Output Specifications	
Outputs per Module	1 isolated group of 2 capable of 0.5 A @ 24V DC
Output Control	Outputs can be tied to any of 4 compare windows
Output Supply Voltage Range	10...28.8V DC
OFF-State Leakage Current	≤0.5 mA
ON-State Voltage Drop	≤0.3V DC @ 0.5 A
ON-State Current, max	0.5 A
Short Circuit Current	6A – short circuit detected when the output is turned on. Outputs are short-circuit protected and either cycle until the fault is corrected, or latch off (depending on programming).
Open Wire Detection	Open wire is detected when output is turned off
Delay Time OFF to ON ON to OFF	 25 μs (load-dependent) 150 μs (load-dependent)
Keyswitch Position	2
General Specifications	
LED Indicators	1 yellow input status, logic side 1 yellow/red output status, logic side 1 green/red network status, logic side 1 green/red module status, logic side
PointBus Current, max	180 mA
Power Dissipation, max	1.9 W @ rated load
Thermal Dissipation, max	6.5 BTU/hr @ rated load
Isolation Voltage (continuous-voltage withstand rating)	50V rms Tested @ 1250V AC rms for 60s
External DC Power (does not represent power required to supply outputs)	No additional external power required to power module

General Specifications (continued)

Dimensions (HxWxD)	31.75 x 66.80 x 107.95 mm (1.25 x 2.63 x 4.25 in.)
Temperature, Operating	IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock): -20...60°C (-4...140°F)
Temperature, Nonoperating	IEC 60068-2-1 (Test Ab, Unpackaged Nonoperating Cold), IEC 60068-2-2 (Test Bb, Unpackaged Nonoperating Dry Heat), -40...85°C (-40...185°F)
Relative Humidity	IEC 60068-2-30 (Test Db, Unpackaged Nonoperating Damp Heat): 5...95% noncondensing
Shock, Operating	IEC60068-2-27 (Test Ea, Unpackaged Shock): 30 g
Shock, Nonoperating	IEC60068-2-27 (Test Ea, Unpackaged Shock): 50 g
Vibration	IEC60068-2-6 (Test Fc, Operating): 5 g @ 10...500Hz
ESD Immunity	IEC 61000-4-2: 6 kV contact discharges 8 kV air discharges
Radiated RF Immunity	IEC 61000-4-3: 10V/m with 1 kHz sine-wave 80% AM from 80...2700 MHz 10V/m with 200 Hz 50% Pulse 100% AM from 900...1890 Mhz
EFT/B Immunity	IEC 61000-4-4: ±2 kV @ 5 kHz on signal ports
Surge Transient Immunity	IEC 61000-4-5: ±1 kV line-line (DM) and ±2 kV line-earth (CM) on signal ports
Conducted RF Immunity	IEC 61000-4-6: 10V rms with 1 kHz sine-wave 80% AM from 150 kHz...80MHz
Emissions	CSPR 11: Group 1, Class A
Enclosure Type Rating	Meets IP65/66/67 (when marked)
Mounting Base Screw Torque	#8 screw: 0.847 Nm – Aluminum 1.807 Nm – Steel
Weight (approx.)	0.289 kg (0.637 lb.)
Wiring Category[2]	2 - on signal ports

General Specifications (continued)

Certifications: (when product is marked)	c-UL-us	UL Listed Industrial Control Equipment, certified for US and Canada
	CE[3]	European Union 2004/108/EC EMC Directive, compliant with: EN 61000-6-2; Industrial Immunity EN 61000-6-4; Industrial Emissions EN 61131-2; Programmable Controllers (Clause 8, Zone A & B) EN 61326-1; Meas./Control/Lab., Industrial Requirements
	C-Tick[3]	Australian Radiocommunications Act, compliant with: AS/NZS CISPR 11; Industrial Emissions

1. OFF to ON delay is the time from a valid output "on" signal to output energization. ON to OFF delay is the time from a valid "output" signal to output deenergization.

2. Use this Conductor Category information for planning conductor routing. Refer to Industrial Automation Wiring and Grounding Guidelines, publication 1770-IN041, for additional installation requirements.

3. See the Product Certification link at http://www.rockwellautomation.com/products/certification/ for Declarations of Conformity, Certificates, and other certification details.

Input Derating Curve
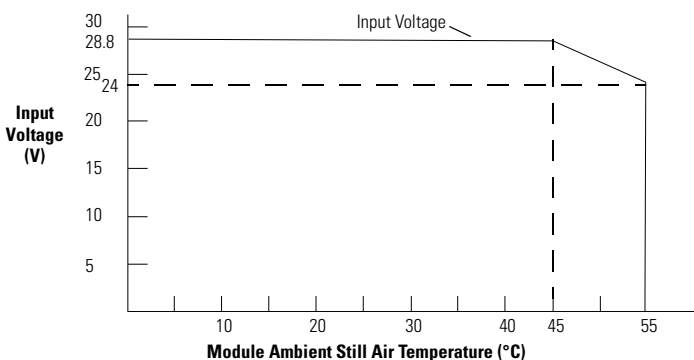
Note: Exceeding the maximum input voltage can cause permanent damage to the input.

Rockwell Automation Support

Rockwell Automation provides technical information on the web to assist you in using our products. At http://www.rockwellautomation.com/support/, you can find technical manuals, a knowledge base of FAQs, technical and application notes, sample code and links to software service packs, and a MySupport feature that you can customize to make the best use of these tools.

For an additional level of technical phone support for installation, configuration and troubleshooting, we offer TechConnect Support programs. For more information, contact your local distributor or Rockwell Automation representative, or visit http://www.rockwellautomation.com/support/.

Installation Assistance

If you experience a problem with a hardware module within the first 24 hours of installation, please review the information that's contained in this manual. You can also contact a special Customer Support number for initial help in getting your module up and running:

United States	1.440.646.3223 Monday – Friday, 8am – 5pm EST
Outside United States	Please contact your local Rockwell Automation representative for any technical support issues.

New Product Satisfaction Return

Rockwell tests all of our products to ensure that they are fully operational when shipped from the manufacturing facility. However, if your product is not functioning and needs to be returned:

United States	Contact your distributor. You must provide a Customer Support case number (see phone number above to obtain one) to your distributor in order to complete the return process.
Outside United States	Please contact your local Rockwell Automation representative for return procedure.

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