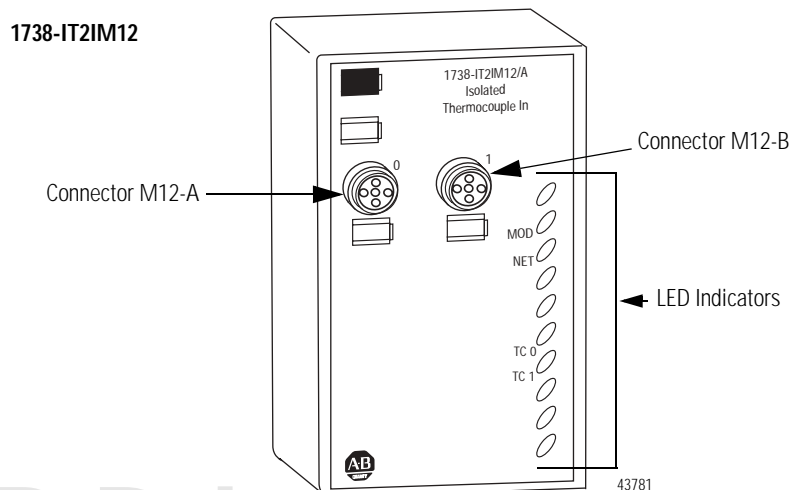
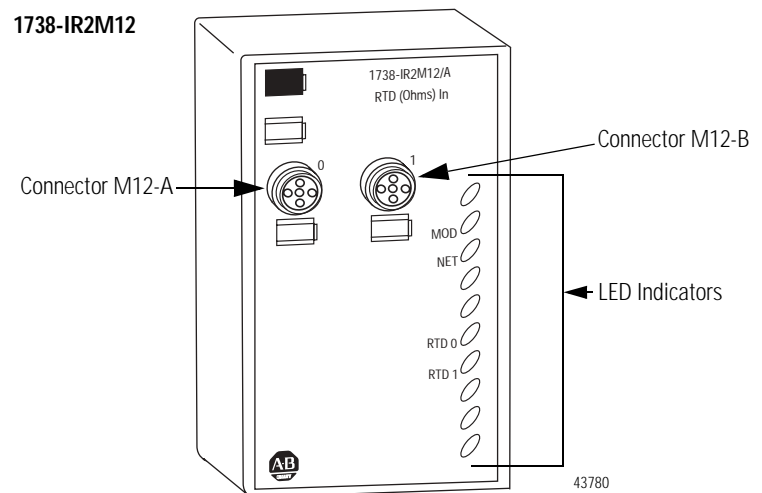




## ArmorPoint RTD and Thermocouple Input Modules, Series A

(Cat. No. 1738-IR2M12 and -IT2IM12)

The ArmorPoint I/O family (Cat. no. 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.) I/O connectors are sealed M12 (micro) styles. The mounting base ships with the module. The 1738-IR2M12 and -IT2IM12 modules are shown below.



AB Drives

**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.ab.com/manuals/gi>) 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.

Reproduction of the contents of this manual, in whole or in part, without written permission of Rockwell Automation, Inc. is prohibited.

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

<p><b>WARNING</b></p> 	<p>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.</p>
<p><b>IMPORTANT</b></p>	<p>Identifies information that is critical for successful application and understanding of the product.</p>
<p><b>ATTENTION</b></p> 	<p>Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you:</p> <ul style="list-style-type: none"> <li>• identify a hazard</li> <li>• avoid a hazard</li> <li>• recognize the consequence</li> </ul>
<p><b>SHOCK HAZARD</b></p> 	<p>Labels may be located on or inside the equipment to alert people that dangerous voltage may be present.</p>
<p><b>BURN HAZARD</b></p> 	<p>Labels may be located on or inside the equipment to alert people that surfaces may be dangerous temperatures.</p>

**ATTENTION****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**



**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**

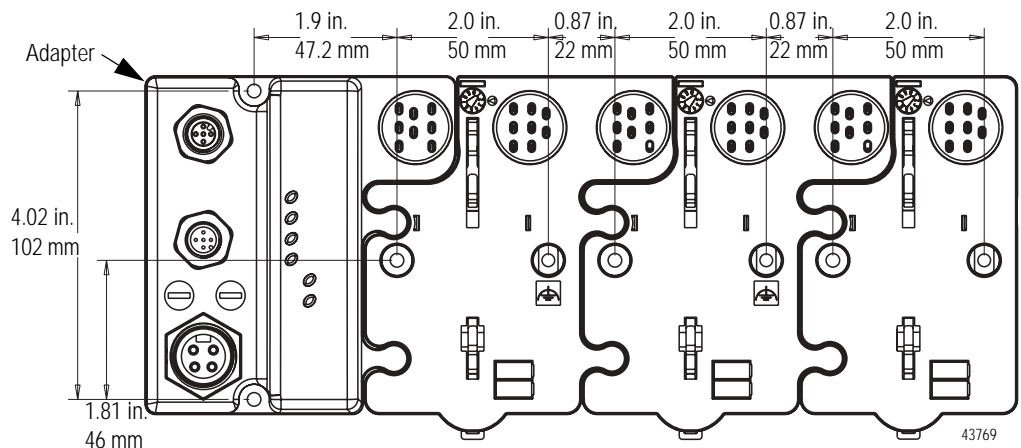
To mount the ArmorPoint I/O base on a wall or panel, use the screw holes provided in the ArmorPoint base.

**ATTENTION**



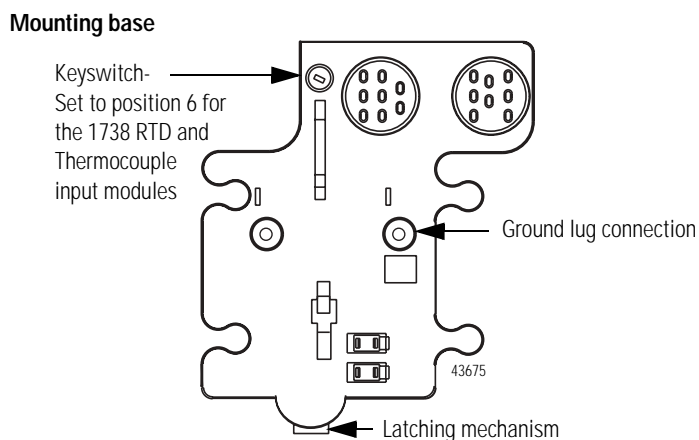
The ArmorPoint I/O module must be mounted on a grounded metal mounting plate or other conductive surface.

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.)

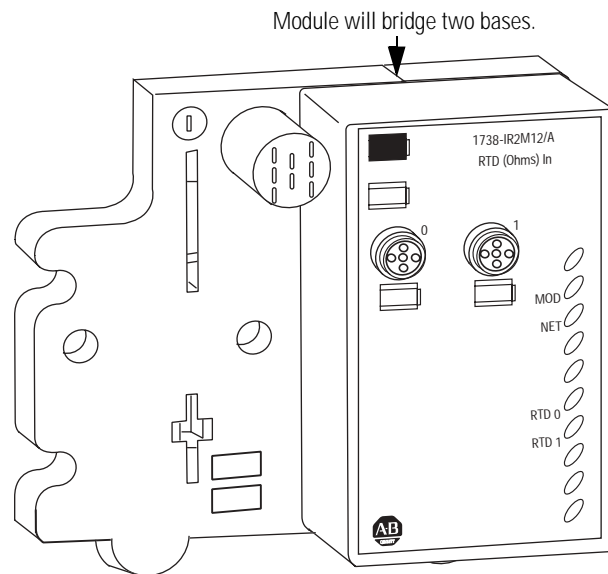


## Install the ArmorPoint RTD and Thermocouple Input Modules

To install the ArmorPoint input module, proceed as follows.

1. Using a bladed screwdriver, rotate the keyswitch on the mounting base clockwise until the number 6 aligns with the notch in the base.
2. Position the module vertically above the mounting base.

The module will bridge two bases.



43782

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 RTD and Thermocouple Input Module From the Mounting Base

To remove the input 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.

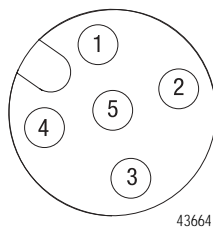
The module will lift up off the base.

3. Pull the module off of the base.

## Wire the Input Modules

Following are wiring instructions for the ArmorPoint input modules.

### 1738-IR2M12



(view into connector)

Pin 1 - No Connect

Pin 2 - Input 0A (M12-A)

Input 1A (M12-B)

Pin 3 - Input 0C (M12-A)

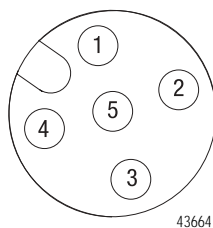
Input 1C (M12-B)

Pin 4 - Input 0B (M12-A)

Input 1B (M12-B)

Pin 5 - No Connect

### 1738-IT2IM12



(view into connector)

Pin 1 - CJC +

Pin 2 - TC 0 + (M12-A)

TC 1 + (M12-B)

Pin 3 - CJC -

Pin 4 - TC 0 - (M12-A)

TC 1 - (M12-B)

Pin 5 - No Connect

#### IMPORTANT

Analog modules have earth grounded metal rings. This should be considered when choosing shielded cables and grounding techniques.

#### 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. The ArmorPoint RTD I/O input module produces 6 bytes of input data (scanner Rx - status) and fault status data. The ArmorPoint Thermocouple I/O input module produces 8 bytes of input data (scanner Rx - status) and fault status data. They do not consume I/O data (scanner Tx).

### Default Data Map for the ArmorPoint RTD Input Module

1738-IR2M12

Message size: 6 Bytes

	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00							
Produces (Scanner Rx)	Input Channel 0 High Byte								Input Channel 0 Low Byte														
	Input Channel 1 High Byte								Input Channel 1 Low Byte														
	Status Byte for Channel 1								Status Byte for Channel 0														
	O	U	H	L	H	L	C	C	O	U	H	L	H	L	C	C	R	R	A	A	A	A	M
Consumes (scanner Tx)	No consumed data																						

Where: CF = Channel Fault Status; 0 = no error, 1 = fault  
 CM = Calibration Mode; 0 = normal, 1 = calibration mode  
 LA = Low Alarm; 0 = no error, 1 = fault  
 HA = High Alarm; 0 = no error, 1 = fault  
 LLA = Low/Low Alarm; 0 = no error, 1 = fault  
 HHA = High/High Alarm; 0 = no error, 1 = fault  
 UR = Underrange; 0 = no error; 1 = fault  
 OR = Overage; 0 = no error; 1 = fault



## Default Data Map for the ArmorPoint Thermocouple Input Module

1738-IT2IM12

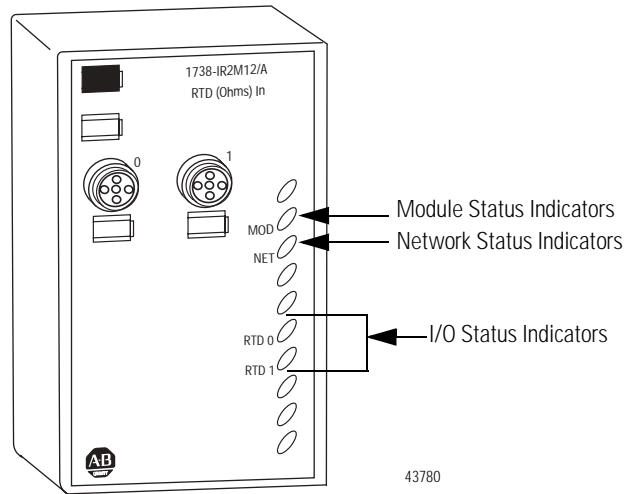
Message size: 8 Bytes

	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Produces (Scanner Rx)	Input Channel 0 High Byte								Input Channel 0 Low Byte							
	Input Channel 1 High Byte								Input Channel 1 Low Byte							
	Status Byte for Channel 1								Status Byte for Channel 0							
	O	U	H	L	H	L	C	C	O	U	H	L	H	L	C	C
	R	R	A	A	A	A	M	F	R	R	A	A	A	A	M	F
	O	U	Cold Junction Temperature (Selectable Channel 0, Channel 1, or Average of both channel 0 and 1)													
	R	R														
Consumes (scanner Tx)	No consumed data															

Where: CF = Channel Fault Status; 0 = no error, 1 = fault  
 CM = Calibration Mode; 0 = normal, 1 = calibration mode  
 LA = Low Alarm; 0 = no error, 1 = fault  
 HA = High Alarm; 0 = no error, 1 = fault  
 LLA = Low/Low Alarm; 0 = no error, 1 = fault  
 HHA = High/High Alarm; 0 = no error, 1 = fault  
 UR = Underrange; 0 = no error; 1 = fault  
 OR = Overage; 0 = no error; 1 = fault

## Troubleshoot with the Indicators

1738-IR2M12



Indication	Probable Cause
<b>Module Status</b>	
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
<b>Network Status</b>	
Off	Device is not on line: - Device has not completed dup_MAC-id test. - Device not powered - check module status indicator.
Flashing Green	Device is on line but has no connections in the established state.
Green	Device is on line 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
<b>I/O Status</b>	
Off	Module in CAL Mode
Solid Green	Normal (channel scanning inputs)
Flashing Green	Channel being calibrated
Solid Red	Major channel fault
Flashing Red	Channel at end of range (over or under)

## Specifications

Following are specifications for the ArmorPoint 1738 RTD and Thermocouple input modules.

<b>ArmorPoint RTD and Thermocouple Input Modules</b>																															
Inputs per Module	1738-IR2 - 2 single ended, nonisolated 1738-IT2I - 2 differential, individually isolated																														
Resolution	1738-IR2 - 16 bits, 9.5mV/cnt, 0.03°C/cnt (Pt385@25°) 1738-IT2I - 15 bits plus sign, 2.5µV/cnt																														
Thermocouple Type (and resolution average over span)	1738-IT2I <table border="1"> <thead> <tr> <th>Sensor</th> <th>Range</th> <th>Resolution (Average Over Span)</th> </tr> </thead> <tbody> <tr> <td>Type B</td> <td>30 to 1820°C</td> <td>3 counts/°C</td> </tr> <tr> <td>Type C</td> <td>0 to 2315°C</td> <td>6 counts/°C</td> </tr> <tr> <td>Type E</td> <td>-270 to 1000°C</td> <td>24 counts/°C</td> </tr> <tr> <td>Type J</td> <td>-210 to 1200°C</td> <td>21 counts/°C</td> </tr> <tr> <td>Type K</td> <td>-270 to 1372°C</td> <td>13 counts/°C</td> </tr> <tr> <td>Type N</td> <td>-270 to 1300°C</td> <td>11 counts/°C</td> </tr> <tr> <td>Type R</td> <td>-50 to 1768.1°C</td> <td>4 counts/°C</td> </tr> <tr> <td>Type S</td> <td>-50 to 1768.1°C</td> <td>4 counts/°C</td> </tr> <tr> <td>Type T</td> <td>-270 to 400°C</td> <td>15 counts/°C</td> </tr> </tbody> </table>	Sensor	Range	Resolution (Average Over Span)	Type B	30 to 1820°C	3 counts/°C	Type C	0 to 2315°C	6 counts/°C	Type E	-270 to 1000°C	24 counts/°C	Type J	-210 to 1200°C	21 counts/°C	Type K	-270 to 1372°C	13 counts/°C	Type N	-270 to 1300°C	11 counts/°C	Type R	-50 to 1768.1°C	4 counts/°C	Type S	-50 to 1768.1°C	4 counts/°C	Type T	-270 to 400°C	15 counts/°C
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RTD Sensors Supported	1738-IR2 100Ω Pt $\alpha = 0.00385$ Euro (-200 to +870°C) 200Ω Pt $\alpha = 0.00385$ Euro (-200 to +630°C) 100Ω Pt $\alpha = 0.003916$ U.S. (-200 to +630°C) 200Ω Pt $\alpha = 0.003916$ U.S. (-200 to +630°C) 10Ω Cu $\alpha = 0.00427$ (-200 to +260°C) 100Ω Ni $\alpha = 0.00618$ (-60 to +250°C) 120Ω Ni $\alpha = 0.00672$ (-60 to +250°C) 120Ω Ni $\alpha = 0.00618$ (-60 to +250°C)																														
Cold Junction Compensation Range	1738-IT2I - 0-70°C																														
Input Range	1738-IR2 - 0-600Ω 1738-IT2I - ±75 mV																														
Absolute Accuracy <sup>1</sup>	0.1% Full Scale @ 25°C																														
Accuracy Drift w/Temp.	30ppm/°C																														

<b>ArmorPoint RTD and Thermocouple Input Modules</b>																					
Input Update Rate (per module)	<table border="0"> <tr> <td>1738-IR2</td> <td>1738-IT2I</td> </tr> <tr> <td>40ms @ Notch = 50Hz</td> <td>20ms @ Notch = 50Hz</td> </tr> <tr> <td>33ms @ Notch = 60Hz (default)</td> <td>17ms @ Notch = 60Hz (default)</td> </tr> <tr> <td>20ms @ Notch = 100Hz</td> <td>10ms @ Notch = 100Hz</td> </tr> <tr> <td>17ms @ Notch = 120Hz</td> <td>8ms @ Notch = 120Hz</td> </tr> <tr> <td>10ms @ Notch = 200Hz</td> <td>5ms @ Notch = 200Hz</td> </tr> <tr> <td>8ms @ Notch = 240Hz</td> <td>4ms @ Notch = 240Hz</td> </tr> <tr> <td>7ms @ Notch = 300Hz</td> <td>3ms @ Notch = 300Hz</td> </tr> <tr> <td>5ms @ Notch = 400Hz</td> <td>3ms @ Notch = 400Hz</td> </tr> <tr> <td>4ms @ Notch = 480Hz</td> <td>2ms @ Notch = 480Hz</td> </tr> </table>	1738-IR2	1738-IT2I	40ms @ Notch = 50Hz	20ms @ Notch = 50Hz	33ms @ Notch = 60Hz (default)	17ms @ Notch = 60Hz (default)	20ms @ Notch = 100Hz	10ms @ Notch = 100Hz	17ms @ Notch = 120Hz	8ms @ Notch = 120Hz	10ms @ Notch = 200Hz	5ms @ Notch = 200Hz	8ms @ Notch = 240Hz	4ms @ Notch = 240Hz	7ms @ Notch = 300Hz	3ms @ Notch = 300Hz	5ms @ Notch = 400Hz	3ms @ Notch = 400Hz	4ms @ Notch = 480Hz	2ms @ Notch = 480Hz
1738-IR2	1738-IT2I																				
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7ms @ Notch = 300Hz	3ms @ Notch = 300Hz																				
5ms @ Notch = 400Hz	3ms @ Notch = 400Hz																				
4ms @ Notch = 480Hz	2ms @ Notch = 480Hz																				
Step Response (per channel)	<table border="0"> <tr> <td>60ms @ Notch = 50Hz</td> </tr> <tr> <td>50ms @ Notch = 60Hz</td> </tr> <tr> <td>30ms @ Notch = 100Hz</td> </tr> <tr> <td>25ms @ Notch = 120Hz</td> </tr> <tr> <td>15ms @ Notch = 200Hz</td> </tr> <tr> <td>13ms @ Notch = 240Hz</td> </tr> <tr> <td>10ms @ Notch = 300Hz</td> </tr> <tr> <td>8ms @ Notch = 400Hz</td> </tr> <tr> <td>6ms @ Notch = 480Hz</td> </tr> </table>	60ms @ Notch = 50Hz	50ms @ Notch = 60Hz	30ms @ Notch = 100Hz	25ms @ Notch = 120Hz	15ms @ Notch = 200Hz	13ms @ Notch = 240Hz	10ms @ Notch = 300Hz	8ms @ Notch = 400Hz	6ms @ Notch = 480Hz											
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Input Resistance	1738-IT2I - 1M $\Omega$																				
Input Impedance	1738-IT2I - 100K $\Omega$																				
Conversion Type	Delta Sigma																				
Common Mode Rejection Ratio	120dB																				
Normal Mode Rejection Ratio	<table border="0"> <tr> <td>100dB</td> </tr> <tr> <td>-3db</td> </tr> <tr> <td>Notch filter</td> </tr> <tr> <td>13.1Hz @ Notch = 50Hz</td> </tr> <tr> <td>15.7Hz @ Notch = 60Hz</td> </tr> <tr> <td>26.2Hz @ Notch = 100Hz</td> </tr> <tr> <td>31.4Hz @ Notch = 120Hz</td> </tr> <tr> <td>52.4Hz @ Notch = 200Hz</td> </tr> <tr> <td>62.9Hz @ Notch = 240Hz</td> </tr> <tr> <td>78.6Hz @ Notch = 300Hz</td> </tr> <tr> <td>104.8Hz @ Notch = 400Hz</td> </tr> <tr> <td>125.7Hz @ Notch = 380Hz</td> </tr> </table>	100dB	-3db	Notch filter	13.1Hz @ Notch = 50Hz	15.7Hz @ Notch = 60Hz	26.2Hz @ Notch = 100Hz	31.4Hz @ Notch = 120Hz	52.4Hz @ Notch = 200Hz	62.9Hz @ Notch = 240Hz	78.6Hz @ Notch = 300Hz	104.8Hz @ Notch = 400Hz	125.7Hz @ Notch = 380Hz								
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125.7Hz @ Notch = 380Hz																					
Data Format	Signed integer																				
Maximum Overload	<table border="0"> <tr> <td>1738-IR2 - No input protection</td> </tr> <tr> <td>1738-IT2I - Input not overvoltage protected</td> </tr> </table>	1738-IR2 - No input protection	1738-IT2I - Input not overvoltage protected																		
1738-IR2 - No input protection																					
1738-IT2I - Input not overvoltage protected																					
Calibration	Factory calibrated																				
Indicators	<table border="0"> <tr> <td>1 green/red module status indicator, logic side</td> </tr> <tr> <td>1 green/red network status indicator, logic side</td> </tr> <tr> <td>2 green/red input status indicators, logic side</td> </tr> </table>	1 green/red module status indicator, logic side	1 green/red network status indicator, logic side	2 green/red input status indicators, logic side																	
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Keyswitch Position	6																				
PointBus Current	<table border="0"> <tr> <td>1738-IR2 - 220mA @ 5V dc</td> </tr> <tr> <td>1738-IT2I - 175mA @ 5V dc</td> </tr> </table>	1738-IR2 - 220mA @ 5V dc	1738-IT2I - 175mA @ 5V dc																		
1738-IR2 - 220mA @ 5V dc																					
1738-IT2I - 175mA @ 5V dc																					
Power Dissipation, Maximum	1.0 W																				
Thermal Dissipation, Maximum	3.3 BTU/hr.																				
Isolation Voltage	Tested at 50V rms (1738-IT2I has isolation between individual channels)																				
Dielectric Test	1000V rms flash for 1s																				

<b>General Specifications</b>	
External dc Power	No external power required
Dimensions Imperial (Metric)	1.25H x 2.63W x 4.25D (31.75H x 66.80W x 107.95D)
Operating Temperature	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 to 60°C (-4 to 140°F)
Storage Temperature	IEC 60068-2-1 (Test Ab, Un-packaged Non-operating Cold), IEC 60068-2-2 (Test Bb, Un-packaged Non-operating Dry Heat), -40 to 85°C (-40 to 185°F)
Relative Humidity	IEC 60068-2-30 (Test Db, Un-packaged Non-operating Damp Heat): 5-95% non-condensing
Shock	IEC60068-2-27 (Test Ea, Unpackaged Shock): Operating 30g Non-operating 50g
Vibration	IEC60068-2-6 (Test Fc, Operating): 5g @ 10-500Hz
ESD Immunity	IEC 61000-4-2: 6kV contact discharges 8kV air discharges
Radiated RF Immunity	IEC 61000-4-3: 10V/m with 1kHz sine-wave 80%AM from 30MHz to 1000MHz 10V/m with 200Hz 50% Pulse 100%AM at 900Mhz
EFT/B Immunity	IEC 61000-4-4: ±3kV at 5kHz on signal ports
Surge Transient Immunity	IEC 61000-4-5: ±2kV line-earth(CM) on shielded ports
Conducted RF Immunity	IEC 61000-4-6: 10Vrms with 1kHz sine-wave 80%AM from 150kHz to 80MHz
Emissions	CISPR 11: Group 1, Class A
Enclosure Type Rating	Meets IP65/66/67 (when marked)
Mounting Base Screw Torque	#8 screw, 7.5 in. lbs. in Aluminum, 16 in. lbs. in Steel
Wiring Category <sup>2</sup>	1 - on signal ports
Weight Imperial (Metric)	0.637 lb. (0.289 kg)
Certifications: (when product is marked)	c-UL-us UL Listed Industrial Control Equipment, certified for US and Canada CE <sup>3</sup> European Union 89/336/EEC EMC Directive, compliant with: EN 61000-6-4; Industrial Emissions EN 50082-2; Industrial Immunity EN 61326; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity C-Tick <sup>3</sup> Australian Radiocommunications Act, compliant with: AS/NZS CISPR 11; Industrial Emissions

1. Includes offset, gain, non-linearity and repeatability error terms.

2. Use this Conductor Category information for planning conductor routing. Refer to Publication 1770-4.1, "Industrial Automation Wiring and Grounding Guidelines".

3. See the Product Certification link at [www.ab.com](http://www.ab.com) for Declarations of Conformity, Certificates, and other certification details.

AB Drives

# Rockwell Automation Support

Rockwell Automation provides technical information on the web to assist you in using our products. At <http://support.rockwellautomation.com>, 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://support.rockwellautomation.com>.

## 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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**[www.rockwellautomation.com](http://www.rockwellautomation.com)**

### Corporate Headquarters

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### Headquarters for Allen-Bradley Products, Rockwell Software Products and Global Manufacturing Solutions

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Asia Pacific: Rockwell Automation, 27/F Citicorp Centre, 18 Whitfield Road, Causeway Bay, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

### Headquarters for Dodge and Reliance Electric Products

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