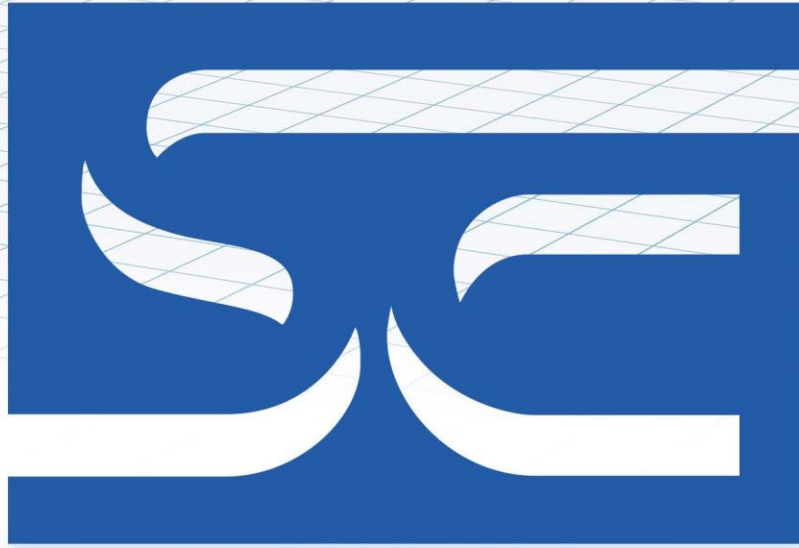


USER MANUAL



User's Manual Pub. 0300243-03 Rev. B

1762 8-Channel Universal Input Module

Catalog Number: 1762sc-IF8U



SPECTRUM
C O N T R O L S

Important Notes

1. Please read all the information in this owner's guide before installing the product.
2. The information in this owner's guide applies to hardware Series A and firmware version 1.00 or later.
3. This guide assumes that the reader has a full working knowledge of the relevant processor.

Notice

The products and services described in this owner's guide are useful in a wide variety of applications. Therefore, the user and others responsible for applying the products and services described herein are responsible for determining their acceptability for each application. While efforts have been made to provide accurate information within this owner's guide, Spectrum Controls, Inc. assumes no responsibility for the accuracy, completeness, or usefulness of the information herein.

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Preface

Read this preface to familiarize yourself with the rest of the manual. This preface covers the following topics:

- Who should use this manual
- How to use this manual
- Related publications
- Conventions used in this manual
- Rockwell Automation support

Who Should Use This Manual

Use this manual if you are responsible for designing, installing, programming, or troubleshooting control systems that use Allen-Bradley I/O and/or compatible controllers, such as MicroLogix 1100 or 1200.

How to Use This Manual

As much as possible, we organized this manual to explain, in a task-by-task manner, how to install, configure, program, operate, and troubleshoot a control system using the 1762sc-IF8u.

Related Documentation

The table below provides a listing of publications that contain important information about Allen-Bradley PLC systems.

Document Title	Document Number
MicroLogix™ 1200 User Manual	1762-UM001
MicroLogix™ 1200 Technical Data	1762-TD001
MicroLogix 1200 and MicroLogix 1500 Programmable Controllers Instruction Set Reference Manual	1762-RM001
Allen-Bradley Programmable Controller Grounding and Wiring Guidelines	1770-4.1

Technical Support

For technical support, please contact your local Rockwell Automation TechConnect Office for all Spectrum products. Contact numbers are as follows:

- USA 440-646-6900
- United Kingdom 01908 635230
- Australia 1800-809-929
- Mexico 001-888-365-8677
- Brazil (55) 11 3618 8800
- Europe +49 211 41553 63

or send an email to support@spectrumcontrols.com




Documentation

If you would like a manual, you can download a free electronic version from the Internet at www.spectrumcontrols.com

Conventions Used in This Manual

The following conventions are used throughout this manual:

- Bulleted lists (like this one) provide information not procedural steps.
- Numbered lists provide sequential steps or hierarchical information.
- *Italic* type is used for emphasis.
- **Bold** type identifies headings and sub-headings:

<p>WARNING</p> 	Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. These messages help you to identify a hazard, avoid a hazard, and recognize the consequences.
<p>ATTENTION</p> 	Actions ou situations risquant d'entraîner des blessures pouvant être mortelles, des dégâts matériels ou des pertes financières. Les messages « Attention » vous aident à identifier un danger, à éviter ce danger et en discerner les conséquences.
<p>NOTE</p> 	Identifies information that is critical for successful application and understanding of the product.

Chapter 1

Module Overview

This chapter describes the 1762sc-IF8u Universal input module and explains how the module reads current, voltage, RTD, resistance, and thermocouple/millivolt analog input data. Included is information about:

- General description
- Input types and ranges
- Data formats and filter frequencies
- Hardware features
- System overview and module operation

Section 1.1 General Description

The universal input module supports current, voltage, RTD, resistance, thermocouple, and millivolt type inputs. The module digitally converts and stores analog data from any combination mentioned above. Each input channel is individually configured via software for a specific input device, data format, filter frequency, and provides open-circuit, over-range, under-range detection, and indication.

NOTE

The IF8u module supports up to 8 channels of voltage, current, or thermocouple, or up to 4 channels of RTD/resistance. Each RTD/resistance input requires two channels. Refer to the table below for possible combinations.

Table 1-1 (Channel Configurations)

8 channels Voltage/Current/Thermocouple + 0 channels RTD/Resistance
6 channels Voltage/Current/Thermocouple + 1 channels RTD/Resistance
4 channels Voltage/Current/Thermocouple + 2 channels RTD/Resistance
2 channels Voltage/Current/Thermocouple + 3 channels RTD/Resistance
0 channels Voltage/Current/Thermocouple + 4 channels RTD/Resistance

Section 1.2 Input Types and Ranges

The tables below list the input types and their associated ranges.

Table 1-2 (Input Types)

Input Type	Range
B Type Thermocouple	300 to 1820 °C (572 to 3308 °F)
C Type Thermocouple	0 to 2315 °C (32 to 4199 °F)
E Type Thermocouple	-270 to 1000 °C (-454 to 1832 °F)
J Type Thermocouple	-210 to 1200 °C (-346 to 2192 °F)
K Type Thermocouple	-270 to 1370 °C (-454 to 2498 °F)
N Type Thermocouple	-210 to 1300 °C (-346 to 2372 °F)
R Type Thermocouple	0 to 1768 °C (32 to 3214 °F)
S Type Thermocouple	0 to 1768 °C (32 to 3214 °F)
T Type Thermocouple	-270 to 400 °C (-270 to 752 °F)
100 Ω Pt α 0.385	-200 to 850 °C (-328 to 1562 °F)
200 Ω Pt α 0.385	-200 to 850 °C (-328 to 1562 °F)
500 Ω Pt α 0.385	-200 to 850 °C (-328 to 1562 °F)
1000 Ω Pt α 0.385	-200 to 850 °C (-328 to 1562 °F)
100 Ω Pt α 0.3916	-200 to 630 °C (-328 to 1166 °F)
200 Ω Pt α 0.3916	-200 to 630 °C (-328 to 1166 °F)
500 Ω Pt α 0.3916	-200 to 630 °C (-328 to 1166 °F)
1000 Ω Pt α 0.3916	-200 to 630 °C (-328 to 1166 °F)
10 Ω Cu α 0.426	-100 to 260 °C (-148 to 500 °F)
100 Ω Ni α 0.618	-100 to 260 °C (-148 to 500 °F)
120 Ω Ni α 0.672	-80 to 260 °C (-112 to 500 °F)
604 Ω NiFe α 0.518	-100 to 200 °C (-148 to 392 °F)
Resistance	0 to 150 Ω
	0 to 1000 Ω
	0 to 3000 Ω
Voltage	±50 mV
	±100 mV
	0 to 5 V
	1 to 5 V
	±10 V
	0 to 10 V

Input Type	Range
Current	4 to 20 mA
	0 to 20 mA

Section 1.3 Data Formats

For each module the data can be configured for:

- Engineering units $\times 1$
- Engineering units $\times 10$
- Scaled-for-PID
- Raw/proportional data

Section 1.4 Filter Frequencies

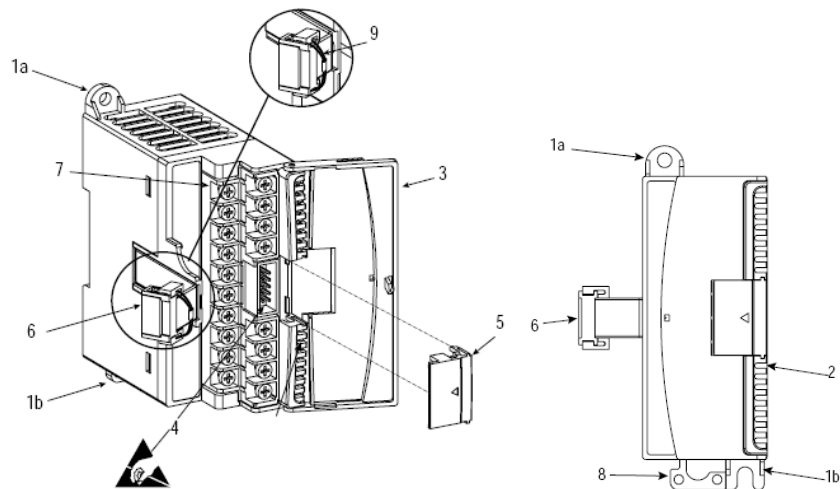
The module uses a digital filter that provides high frequency noise rejection for each input signal. The filter for each channel is programmable allowing you to select from four different filter frequencies:

- 4 Hz
- 17 Hz
- 62 Hz
- 470 Hz

Section 1.5 Hardware Features

Channels are wired as differential inputs, with the exception of RTD and resistance type inputs. One cold junction compensation (CJC) sensor comes installed on the terminal block to enable accurate readings when using thermocouple input types. The CJC sensor compensates for offset voltages introduced into the input signal as a result of the cold-junction where the thermocouple wires come into contact with the terminal block.

Module configuration is done via the controller's programming software and hardware dip switch settings. The module configuration is stored in the memory of the controller. Refer to your controller's user manual for more information. The illustration below shows the module's hardware features.

Figure 1-1

Item	Description
1a	Upper panel mounting tab
1b	Lower panel mounting tab
2	Power diagnostic LED
3	Module door with terminal identification label
4	Bus connector (male)
5	Bus connector cover
6	Flat ribbon cable with bus connector (female)
7	Terminal block
8	DIN rail latch
9	Pull loop

1.5.1 LED Indicator

The 1762 universal module uses a single green LED to show operational status of the module. When startup is completed and all internal tests have passed, the LED will illuminate solid. If the LED remains off, there is an error with the module.

Section 1.6 System Overview

The module communicates to the controller through the bus interface. The module also receives 5 and 24 VDC power through the bus interface.

NOTE

An external power supply is required for all 2-wire transmitters.

1.6.1 Module Power-Up

At power-up, the module performs a check of its internal circuits, memory, and basic functions. During this time, the module status LED remains off. If no faults are found during power-up diagnostics, the module status LED is turned on.

After power-up checks are complete, the module waits for valid channel configuration data. If an invalid configuration is detected, the module generates a configuration error. Once a channel is properly configured and enabled, it continuously converts the input data to a value within the range selected for that channel.

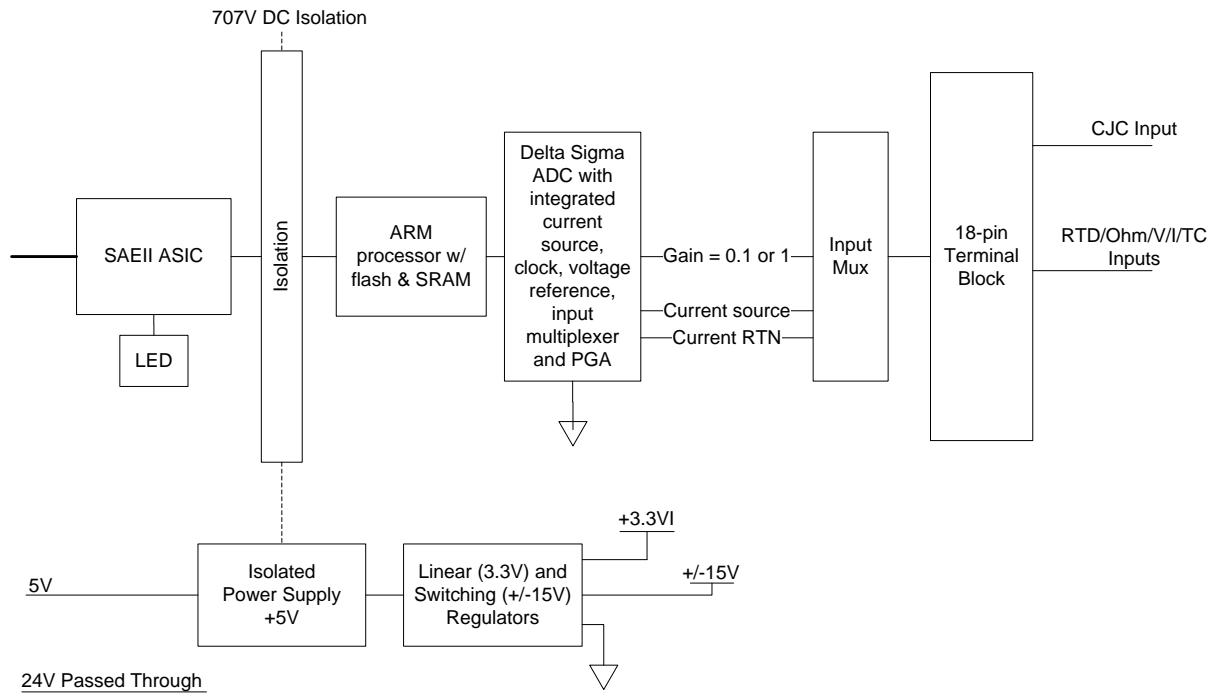
Each time a channel is read by the input module, that data value is tested by the module for an open-circuit, or “input data not valid” condition. If such a condition is detected the channel data value will fail to a user-defined state defined in the module configuration settings. For more details, refer to Chapter 3.

Using the module image table, the controller reads the two’s complement binary converted input data from the module. This typically occurs at the end of the program scan or when commanded by the control program. If the controller and the module determine that the data transfer has been made without error, the data is used in the control program.

1.6.2 Module Operation

When the module receives the input from an analog device, the module’s circuitry multiplexes the input into an A/D converter. The converter reads the signal and converts it as required for the type of input. If thermocouples are being used, the module continuously samples the CJC sensor and compensates for temperature changes at the terminal block cold junction, between the thermocouple wire and the terminal connector.

See the block diagram below.



Chapter 2

Installation and Wiring

This chapter will cover:

- Compliance to European union directives
- Power requirements
- General considerations
- Mounting
- Field wiring connections
- Module indicators

Section 2.1 Compliance to European Union Directives

This product is approved for installation within the European Union and EEA regions. It has been designed and tested to meet the following directive.

2.1.1 EMC Directive

The 1762sc-IF8u module is tested to meet Council Directive 89/336/EEC Electromagnetic Compatibility (EMC) and the following standards, in whole or in part, documented in a technical construction file:

- IEC 61000-6-4 Electromagnetic compatibility (EMC) –Part 6-4: Generic standards - Emission standard for industrial environments
- IEC 61000-6-2 Electromagnetic compatibility (EMC)–Part 6-2: Generic standards – Immunity for industrial environments

This product is intended for use in an industrial environment.

Section 2.2 Power Requirements

The module receives power through the bus interface from the +5 VDC/+24 VDC system power supply. The maximum current drawn by the module is shown in the table below.

5 VDC	24 VDC
175 mA	21 mA

Use the table below to determine the maximum number of IF8U modules that can be installed in a MicroLogix system.

Table 2-1

Controller	Max 5 V Bus Current	Max 24 V Bus Current	Max # of IF8U Modules
ML1100	800	700	4
ML1200 (24 pt.)	400	350	2
ML1200 (40 pt.)	600	500	3
ML1400 (All)	1500	1500	7

Section 2.3 General Considerations

1762 I/O is suitable for use in an industrial environment when installed in accordance with these instructions. Specifically, this equipment is intended for use in clean, dry environments Pollution degree 2¹ and to circuits not exceeding Over Voltage Category II²(IEC 60664-1)³.

2.3.1 Hazardous Location Considerations

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

WARNING



EXPLOSION HAZARD


- Substitution of components may impair suitability for Class I, Division 2. Touch a grounded object to discharge static potential.
- Do not replace components or disconnect equipment unless power has been switched off or the area is known to be non-hazardous. Touch a grounded object to discharge static potential.
- This product must be installed in an enclosure. Touch a grounded object to discharge static potential.
- All wiring must comply with N.E.C. article 501-4(b). Touch a grounded object to discharge static potential.

¹ Pollution Degree 2 is an environment where, normally, only non-conductive pollution occurs except that occasionally a temporary conductivity caused by condensation shall be expected.


² Over Voltage Category II is the load level section of the electrical distribution system. At this level, transient voltages are controlled, and do not exceed the impulse voltage capability of the product's insulation.

³ Pollution Degree 2 and Over Voltage Category II are International Electrotechnical Commission (IEC) designations.

2.3.2 Prevent Electrostatic Discharge

<p>WARNING</p> 	<p>Electrostatic discharge can damage integrated circuits or semiconductors if you touch analog I/O module bus connector pins or the terminal block on the input module. Follow these guidelines when you handle the module:</p> <ul style="list-style-type: none"> • Touch a grounded object to discharge static potential. • Wear an approved wrist-strap grounding device. • Do not touch connectors or pins on component boards. • Do not touch circuit components inside the module. • If available, use a static-safe work station. • When not in use, keep the module in its static-shield box.
---	--

2.3.3 Remove Power

<p>WARNING</p> 	<p>Remove power before removing or inserting this module. When you remove, or insert, a module with power applied, an electrical arc may occur. An electrical arc can cause personal injury or property damage by:</p> <ul style="list-style-type: none"> • Sending an erroneous signal to your system's field devices, causing unintended machine motion. • Causing an explosion in a hazardous environment. • Electric arcing causes excessive wear to contacts on both the module and its mating connector, and may lead to premature failure.
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2.3.4 Selecting a Location


Reducing Noise

Most applications require installation in an industrial enclosure to reduce the effects of electrical interference. Analog inputs are highly susceptible to electrical noise. Electrical noise coupled to the analog inputs will reduce the performance (accuracy) of the module. Group your modules to minimize adverse effects from radiated electrical noise and heat. Consider the following conditions when selecting a location for the analog module. Position the module:

- Away from sources of electrical noise such as hard-contact switches, relays, and AC motor drives.
- Away from modules which generate significant radiated heat. Refer to the module's heat dissipation specification.

In addition, route shielded, twisted-pair analog input wiring away from any high voltage I/O wiring.

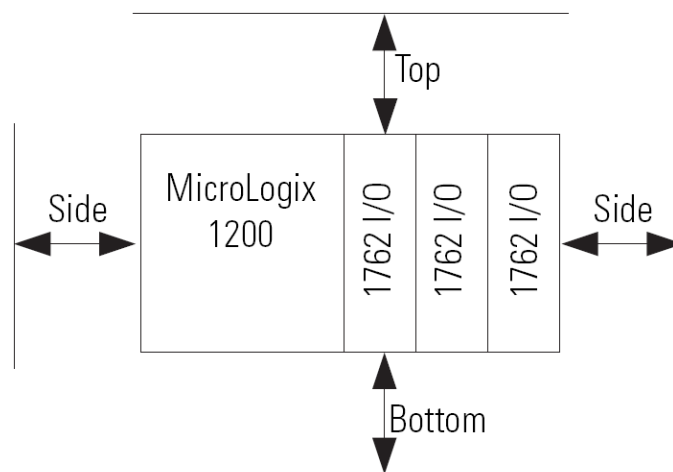
Section 2.4 Mounting


<p>WARNING</p> 	<p>Do not remove protective debris strip until after the module and all other equipment near the module is mounted and wiring is complete. Once wiring is complete, and the module is free of debris, carefully remove protective debris strip. Failure to remove strip before operating can cause overheating.</p>
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2.4.1 Minimum Spacing

Maintain spacing from enclosure walls, wire ways, adjacent equipment, etc. Allow 50.8 mm (2 in.) of space on all sides for adequate ventilation, as shown:

Figure 2-1



<p>NOTE</p> 	<p>1762 expansion I/O may only be mounted horizontally.</p>
--	---

<p>WARNING</p> 	<p>During panel or DIN rail mounting of all devices, be sure that all debris (metal chips, wire strands, etc.) is kept from falling into the module. Debris that falls into the module could cause damage when power is applied to the module.</p>
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2.4.2 DIN Rail Mounting

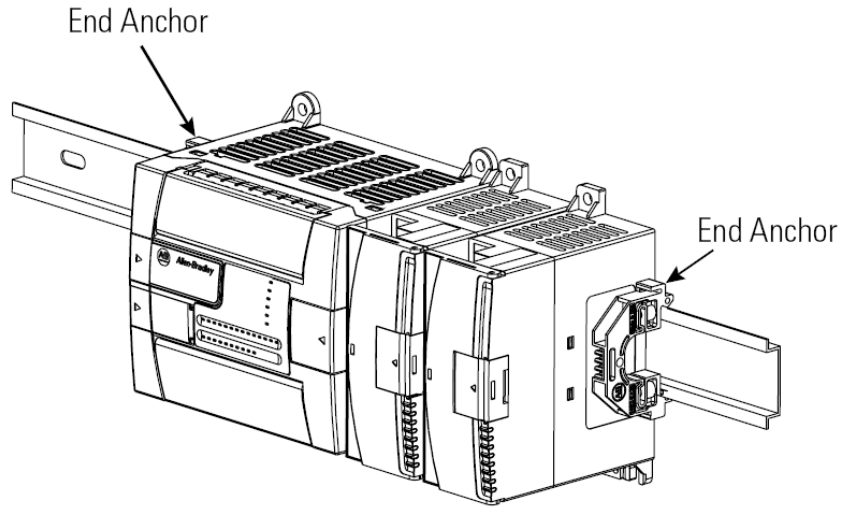
The module can be mounted using the following DIN rails: 35 × 7.5 mm (EN 50 022 - 35 × 7.5) or 35 × 15 mm (EN 50 022 - 35 × 15).

Before mounting the module on a DIN rail, close the DIN rail latch. Press the DIN rail mounting area of the module against the DIN rail. The latch will momentarily open and lock into place.

Use DIN rail end anchors (Allen-Bradley part number 1492-EA35 or 1492-

EAH35) for environments with vibration or shock concerns.

Figure 2-2



NOTE



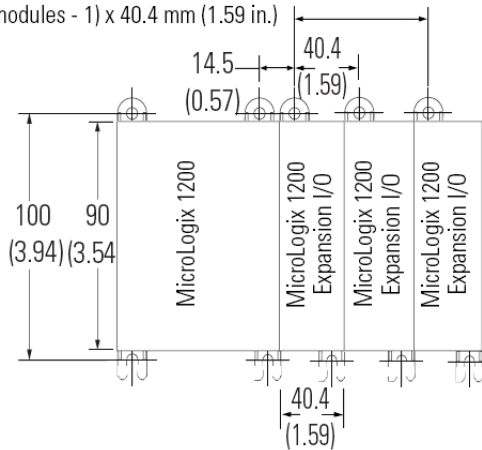
For environments with extreme vibration and shock concerns, use the panel mounting method described below, instead of DIN rail mounting.

2.4.3 Panel Mounting

Use the dimensional template shown below to mount the module. The preferred mounting method is to use two M4 or #8 Pan Head screws per module. M3.5 or #6 Pan Head screws may also be used, but a washer may be needed to ensure a good ground contact. Mounting screws are required on every module.

Figure 2-3

For more than 2 modules: (number of modules - 1) x 40.4 mm (1.59 in.)

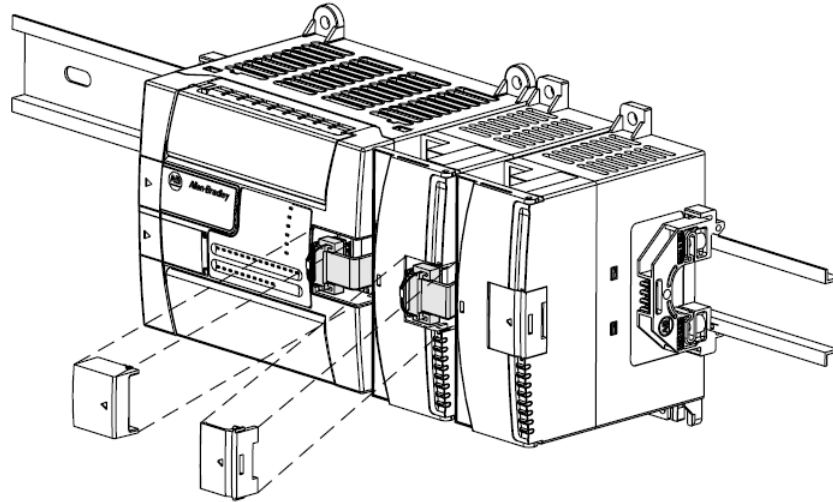




NOTE:
Hole spacing tolerance:
±0.4 mm (0.016 in.).

Section 2.5 System Assembly

The expansion I/O module is attached to the controller or another I/O module by means of a ribbon cable *after* mounting as shown below.

Figure 2-4



<p>NOTE</p> 	<p>Use the pull loop on the connector to disconnect modules. Do not pull on the ribbon cable.</p>
<p>WARNING</p> 	<p>EXPLOSION HAZARD</p> <ul style="list-style-type: none"> • In Class I, Division 2 applications, the bus connector must be fully seated and the bus connector cover must be snapped in place. • In Class I, Division 2 applications, all modules must be mounted in direct contact with each other as shown in the graphic. If DIN rail mounting is used, an end stop must be installed ahead of the controller, and after the last 1762 I/O module.

Section 2.6 Field Wiring Connections

Consider the following when wiring your system:

General




- Power and input wiring must be in accordance with Class 1, Division 2 wiring methods, Article 501-4(b) of the National Electric Code, NFPA 70, and in accordance with the authority having jurisdiction.
- Channels are isolated from one another by ± 10 VDC maximum.

- If multiple power supplies are used with analog millivolt inputs, the power supply commons must be connected.

Terminal Block

- Do not tamper with or remove the CJC sensor on the terminal block. Removal of the sensor reduces accuracy.
- For millivolt sensors, use Belden 8761 shielded, twisted-pair wire (or equivalent) to ensure proper operation and high immunity to electrical noise.
- For a thermocouple, use the shielded, twisted-pair thermocouple extension lead wires specified by the thermocouple manufacturer. Using the incorrect type of thermocouple extension wire or not following the correct polarity will cause invalid readings.
- To ensure optimum accuracy, limit overall cable impedance by keeping a cable as short as possible. Locate the module as close to input devices as the application permits.

Grounding

WARNING 	The possibility exists that a grounded or exposed thermocouple can become shorted to a potential greater than that of the thermocouple itself. Due to possible shock hazard, take care when wiring grounded or exposed thermocouples.
WARNING 	USE SUPPLY WIRES SUITABLE FOR 20 °C ABOVE SURROUNDING AMBIENT TEMPERATURE.
WARNING 	UTILISER DES FILS D'ALIMENTATION QUI CONVIENNENT A UNE TEMPERATURE DE 20 °C AU-DESSUS DE LA TEMPERATURE AMBIANTE.

- This product is intended to be mounted to a well-grounded mounting surface such as a metal panel. Additional grounding connections from the module's mounting tabs or DIN rail (if used) are not required unless the mounting surface cannot be grounded.
- Under normal conditions, the drain wire (shield) should be connected to the metal mounting panel (earth ground). Keep shield connection to earth ground as short as possible.
- Ground the shield drain wire at one end only. The typical location is as follows:
 - For grounded thermocouples or millivolt sensors, this is at the sensor end.
 - For insulated/ungrounded thermocouples, this is at the module end. Contact your sensor manufacturer for additional details.

- If it is necessary to connect the shield drain wire at the module end, connect it to earth ground using a panel or DIN rail mounting screw.
- Refer to Industrial Automation Wiring and Grounding Guidelines, Allen-Bradley publication 1770-4.1, for additional information.

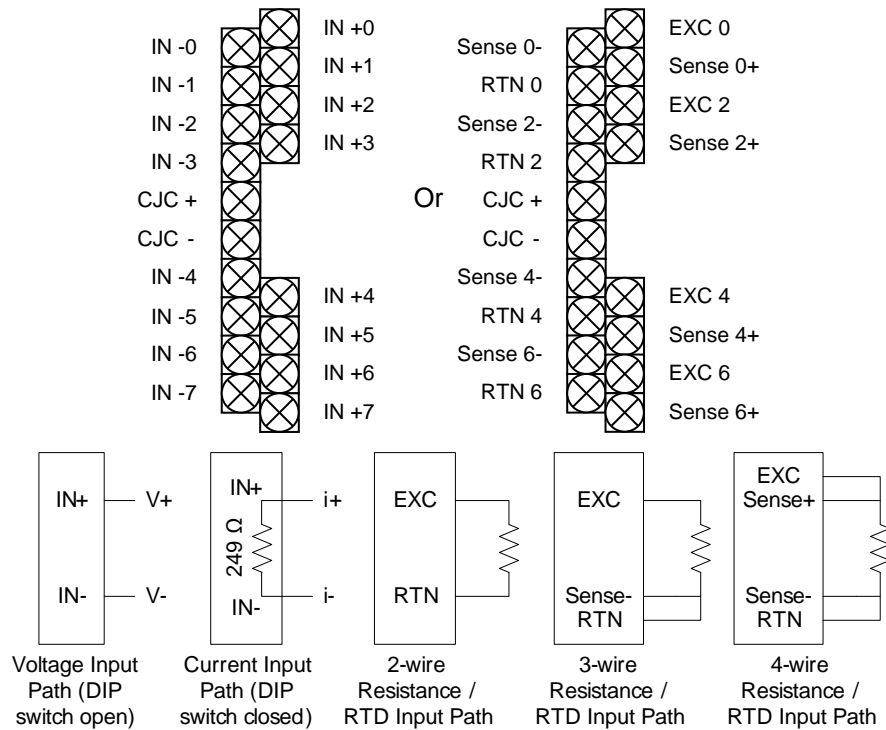
Noise Prevention

- Route field wiring away from any other wiring and as far as possible from sources of electrical noise, such as motors, transformers, contactors, and ac devices. As a general rule, allow at least 15.2 cm (6 in.) of separation for every 120 V of power.
- Routing field wiring in a grounded conduit can reduce electrical noise.
- If field wiring must cross ac or power cables, ensure that they cross at right angles.
- To limit the pickup of electrical noise, keep thermocouple and millivolt signal wires as far as possible from power and load lines.
- If noise persists for a device, try grounding the opposite end of the cable shield or ground both ends of the shield.

2.6.1 Wiring Diagram

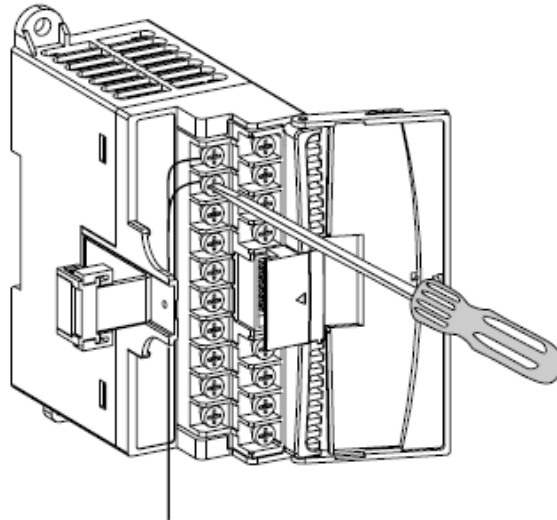
Refer to the following wiring diagrams for field wiring connections.

Figure 2-5 (Wiring Diagram)



2.6.2 Wiring the Finger-Safe Terminal Block

Figure 2-6



WARNING



Be careful when stripping wires. Wire fragments that fall into a module could cause damage when power is applied. Once wiring is complete, ensure the module is free of all metal fragments.

When wiring the terminal block, keep the finger-safe cover in place.

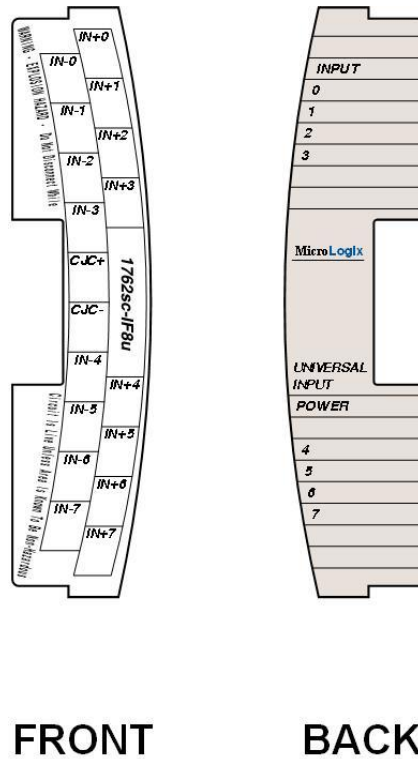
1. Refer to previous section for proper field wiring connections.
2. Route the wire under the terminal pressure plate. You can use the stripped end of the wire or a spade lug. The terminals will accept a 6.35 mm (0.25 in.) spade lug. See Figure 2-5.
3. Tighten the terminal screw making sure the pressure plate secures the wire. Recommended torque when tightening terminal screws is 0.904 Nm (8 in-lbs).
4. After wiring is complete, remove the debris shield.

2.6.3 Terminal Door Label

A removable, write-on label is provided with the module. Remove the label from the door, mark your unique identification of each terminal with permanent ink, and slide the label back into the door. Your markings (ID tag) will be visible when the module door is closed.

See figure below.

Figure 2-7 (Door Label)



FRONT

BACK

Section 2.7 Module Indicators

The 1762 universal module uses a single green LED to show operational status of the module. When startup is completed and all internal tests have passed, the LED will illuminate solid. If the LED remains off, there is an error with the module.

Chapter 3

Configuring the 1762sc-IF8u

Using RSLogix 500

This chapter covers the following subjects:

- Things you should know
- Module memory map
- Add module to Logix 500
- Module configuration
- Reading input data
- Module update time

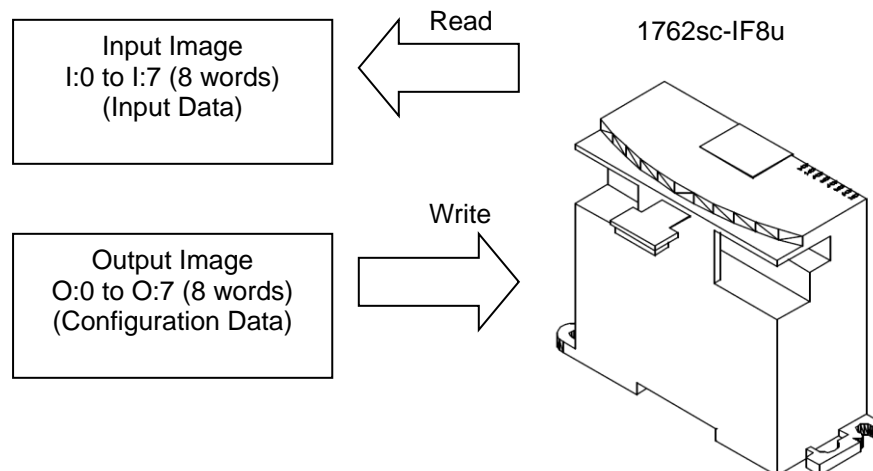
Section 3.1 Things You Should Know

This chapter describes how to configure the IF8u module for the MicroLogix 1100, 1200, and 1400 system using RSLogix 500 programming software.

Section 3.2 Module Memory Map

The module uses 8 input words and 8 output words for input data and configuration. The following figure describes the data mapping for the module.

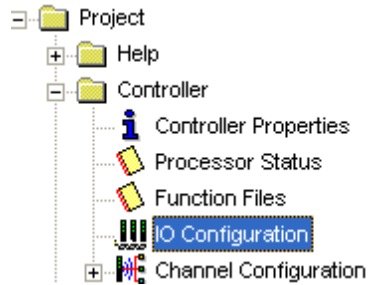
Figure 3-1 (Module Memory Map)



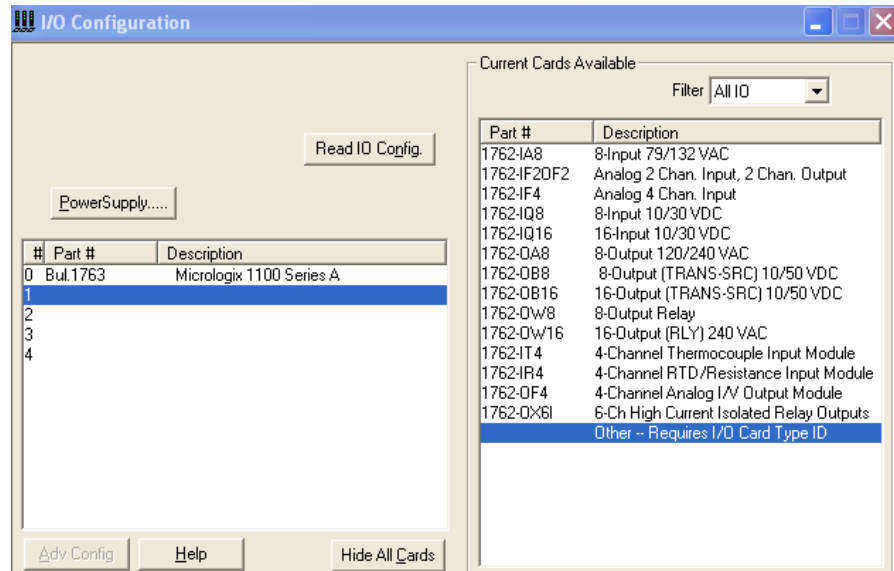
Section 3.3 Add Module to Logix 500

The following procedure describes how to add the IF8u module to the RSLogix 500 programming software.

1. Create a new RSLogix 500 project and select either a Micro 1100, 1200, or 1400 processor.
2. Double-click **I/O Configuration** from the project tree.



3. Select the first empty slot and then double-click the **Other—Requires I/O Card Type ID** option, from the I/O configuration screen.



4. Enter the module profile data as shown in the figure below and click **OK**.

"Other" type IO card

Vendor ID:	<input type="text" value="58"/>	<input type="button" value="OK"/>
Product Type:	<input type="text" value="10"/>	<input type="button" value="Cancel"/>
Product Code:	<input type="text" value="20"/>	
Series/Major Rev/MinorRev:	<input type="text" value="A"/>	
Input Words:	<input type="text" value="8"/>	Input Bits: <input type="text" value="0"/>
Output Words:	<input type="text" value="8"/>	Output Bits: <input type="text" value="0"/>
Extra Data Length:	<input type="text" value="0"/>	
Ignore Configuration Error:	<input type="checkbox"/>	

5. Repeat steps 1 through 4 for additional modules.

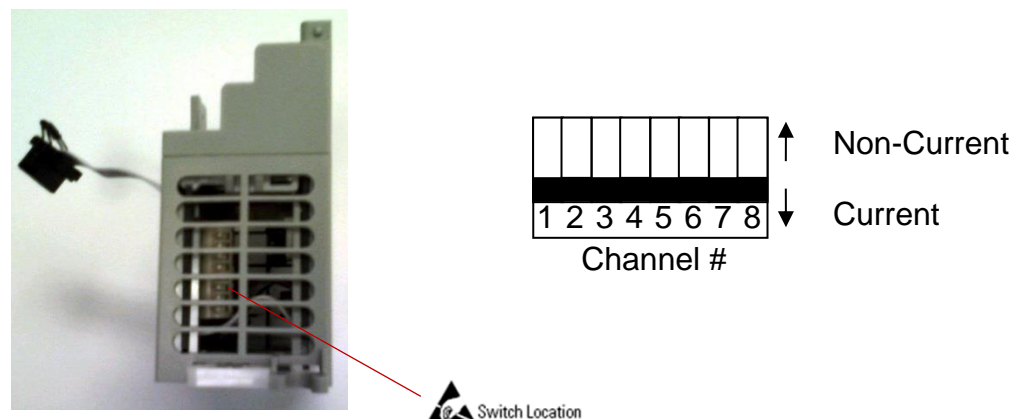
Section 3.4 Module Configuration

The IF8u is configured using the output data table within RSLogix 500 and dip-switch settings located on the circuit board.

3.4.1 Dip-Switch Configuration

There are 8 dip-switches located on the circuit board of the IF8u module. The switches are used to configure the correct input path (i.e. Current or Non-Current). Refer to the diagram below for proper dip-switch settings.

Figure 3-2 (Dip-Switch Settings)

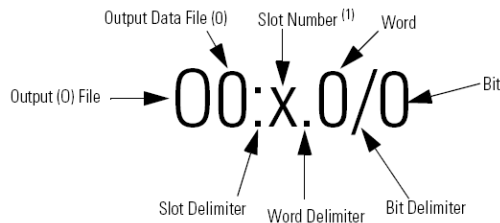


3.4.2 Output Data File (Configuration Data)

The output data file is used to configure the advanced settings of the module including input type, data format, filter settings, etc.

Use the addressing scheme below to locate the 8 output words needed to

configure the module.



1. I/O located on the controller (embedded I/O) is slot 0. I/O added to the controller (expansion I/O) begins with slot 1.

The table below shows the general layout for the 8 output words used for configuration.

Table 3-1 (Output File) Figure 3-3 (Module Memory Map)

Channel	Word	Bits															
		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Ch0	0	Temp Units	CJC and Lead Comp	Data Format ⁴	Input Type				Open Circuit	CJC Display	Filter	Enable Channel					
Ch1	1	Temp Units	CJC and Lead Comp	Data Format ⁴	Input Type				Open Circuit	CJC Display	Filter	Enable Channel					
Ch2	2	Temp Units	CJC and Lead Comp	Data Format ⁴	Input Type				Open Circuit	CJC Display	Filter	Enable Channel					
Ch3	3	Temp Units	CJC and Lead Comp	Data Format ⁴ Error! Bookmark not defined.	Input Type				Open Circuit	CJC Display	Filter	Enable Channel					
Ch4	4	Temp Units	CJC and Lead Comp	Data Format ⁴	Input Type				Open Circuit	CJC Display	Filter	Enable Channel					
Ch5	5	Temp Units	CJC and Lead Comp	Data Format ⁴	Input Type				Open Circuit	CJC Display	Filter	Enable Channel					
Ch6	6	Temp Units	CJC and Lead Comp	Data Format ⁴	Input Type				Open Circuit	CJC Display	Filter	Enable Channel					
Ch7	7	Temp Units	CJC and Lead Comp	Data Format ⁴	Input Type				Open Circuit	CJC Display	Filter	Enable Channel					

Table 3-2 on the following page lists the possible configuration settings for each channel.

⁴ Refer Table 3-3 for data ranges.

Table 3-2 (Module Configuration)

To Select		Make these bit settings																
		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
Channel Enable	Enable																0	
	Disable																1	
Filter Frequency (Ignored if Display CJC)	17 Hz															0	0	
	4 Hz															0	1	
	62 Hz															1	0	
	470 Hz															1	1	
Display CJC ⁵	Disabled															0		
	Enabled															1		
Open Circuit (Ignored if Display CJC)	Upscale															0	0	
	Downscale															0	1	
	Zero															1	0	
	<i>Invalid Setting</i>															1	1	
Input Type (Ignored if Display CJC)	4 to 20 mA							0	0	0	0	0						
	0 to 20 mA							0	0	0	0	1						
	-10 to 10 V							0	0	0	1	0						
	0 to 10 V							0	0	0	1	1						
	1 to 5 V							0	0	1	0	0						
	0 to 5 V							0	0	1	0	1						
	±100 mV							0	0	1	1	0						
	±50 mV							0	0	1	1	1						
	Type J TC							0	1	0	0	0						
	Type K TC							0	1	0	0	1						
	Type T TC							0	1	0	1	0						
	Type E TC							0	1	0	1	1						
	Type R TC							0	1	1	0	0						
	Type S TC							0	1	1	0	1						
	Type B TC							0	1	1	1	0						
	Type N TC							0	1	1	1	1						
	Type C TC							1	0	0	0	0						
100 Pt 385							1	0	0	0	1							

⁵ Depending on the state of bit 13, setting this bit to 1 causes the channel to display either the temperature of the CJC or the adjusted temperature at the associated channel.

To Select	Make these bit settings															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
200 Pt 385						1	0	0	1	0						
500 Pt 385						1	0	0	1	1						
1000 Pt 385						1	0	1	0	0						
100 Pt 3916						1	0	1	0	1						
200 Pt 3916						1	0	1	1	0						
500 Pt 3916						1	0	1	1	1						
1000 Pt 3916						1	1	0	0	0						
10 Cu 426						1	1	0	0	1						
100 Ni 618						1	1	0	1	0						
120 Ni 672						1	1	0	1	1						
604 NiFe 518						1	1	1	0	0						
150 ohm						1	1	1	0	1						
1000 ohm						1	1	1	1	0						
3000 ohm						1	1	1	1	1						
Data Format ⁶	Engineering Units X1				0	0										
	Engineering Units X10				0	1										
	Raw/Proportional Data				1	0										
	Scaled for PID				1	1										
CJC Temp Type ⁷ (Only when bit 3 is set)	Raw CJC Temp		x ⁸	0												
	Adjusted CJC Temp		x8	1												
2/3/4 Wire RTD (Only valid for RTD/R ranges)	2 Wire		0	0												
	3 Wire w/ Comp		0	1												
	3 Wire w/o Comp		1	0												
	4 Wire		1	1												
Temperature	Deg C	0														

⁶ Refer Table 3-3 for data ranges.

⁷ Raw CJC Temp = All 8 channels will display the current CJC sensor temperature.
Adjusted CJC Temp = Each channel will display its adjusted CJC temperature.

⁸ X = don't care

To Select		Make these bit settings															
		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Scale (Only valid for temperature ranges)	Deg F	1															

Table 3-3 lists the number of counts for each of the supported data ranges.


<p>NOTE</p> 	<p>The engineering unit data formats represent real engineering temperature units provided by the module to the controller. The raw/proportional counts, scaled-for-PID and percent of full-scale data formats may yield the highest effective resolutions, but may also require that you convert channel data to real engineering units in your control program.</p>
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Table 3-3 (Data Ranges)

Input Type	Range	Eng. Units	Eng Units ×10	Raw/Prop	PID
B Type Thermocouple	300 to 1820 °C (572 to 3308 °F)	3000 to 18200 (5720 to 32767) ⁹	300 to 1820 (572 to 3308)	-32768 to 32767	0 to 16383
C Type Thermocouple	0 to 2315 °C (32 to 4199 °F)	0 to 23150 (320 to 32767) ⁹	0 to 2315 (32 to 4199)	-32768 to 32767	0 to 16383
E Type Thermocouple	-270 to 1000 °C (-454 to 1832 °F)	-2700 to 10000 (-4540 to 18320)	-270 to 1000 (-454 to 1832)	-32768 to 32767	0 to 16383
J Type Thermocouple	-210 to 1200 °C (-346 to 2192 °F)	-2100 to 12000 (-3460 to 21920)	-210 to 1200 (-346 to 2192)	-32768 to 32767	0 to 16383
K Type Thermocouple	-270 to 1370 °C (-454 to 2498 °F)	-2700 to 13700 (-4540 to 24980)	-270 to 1370 (-454 to 2498)	-32768 to 32767	0 to 16383
N Type Thermocouple	-210 to 1300 °C (-346 to 2372 °F)	-2100 to 13000 (-3460 to 23720)	-210 to 1300 (-346 to 2372)	-32768 to 32767	0 to 16383
R Type Thermocouple	0 to 1768 °C (32 to 3214 °F)	0 to 17680 (320 to 32140)	0 to 1768 (32 to 3214)	-32768 to 32767	0 to 16383
S Type Thermocouple	0 to 1768 °C (32 to 3214 °F)	0 to 17680 (320 to 32140)	0 to 1768 (32 to 3214)	-32768 to 32767	0 to 16383
T Type Thermocouple	-270 to 400 °C (-454 to 752 °F)	-2700 to 4000 (-4828 to 7520)	-270 to 400 (-454 to 752)	-32768 to 32767	0 to 16383
100 Ω Pt α 0.385	-200 to 850 °C (-328 to 1562 °F)	-2000 to 8500 (-3280 to 15620)	-200 to 850 (-328 to 1562)	-32768 to 32767	0 to 16383
200 Ω Pt α 0.385	-200 to 850 °C (-328 to 1562 °F)	-2000 to 8500 (-3280 to 15620)	-200 to 850 (-328 to 1562)	-32768 to 32767	0 to 16383
500 Ω Pt α 0.385	-200 to 850 °C (-328 to 1562 °F)	-2000 to 8500 (-3280 to 15620)	-200 to 850 (-328 to 1562)	-32768 to 32767	0 to 16383
1000 Ω Pt α 0.385	-200 to 850 °C (-328 to 1562 °F)	-2000 to 8500 (-3280 to 15620)	-200 to 850 (-328 to 1562)	-32768 to 32767	0 to 16383
100 Ω Pt α 0.3916	-200 to 630 °C (-328 to 1166 °F)	-2000 to 6300 (-3280 to 11660)	-200 to 630 (-328 to 1166)	-32768 to 32767	0 to 16383
200 Ω Pt α 0.3916	-200 to 630 °C (-328 to 1166 °F)	-2000 to 6300 (-3280 to 11660)	-200 to 630 (-328 to 1166)	-32768 to 32767	0 to 16383

⁹ When configured for Fahrenheit, the maximum temperature that can be displayed by the Engineering X1 data format is 32767 or 3276.7 °F. If you need to read temperatures above 3276.7 °F, use the Engineering ×10 data format.

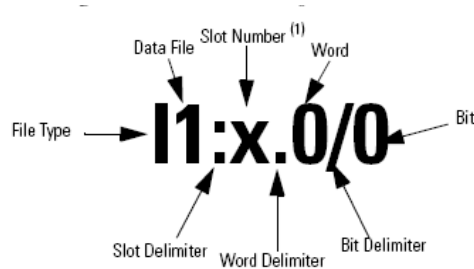
Input Type	Range	Eng. Units	Eng Units ×10	Raw/Prop	PID
500 Ω Pt α 0.3916	-200 to 630 °C (-328 to 1166 °F)	-2000 to 6300 (-3280 to 11660)	-200 to 630 (-328 to 1166)	-32768 to 32767	0 to 16383
1000 Ω Pt α 0.3916	-200 to 630 °C (-328 to 1166 °F)	-2000 to 6300 (-3280 to 11660)	-200 to 630 (-328 to 1166)	-32768 to 32767	0 to 16383
10 Ω Cu α 0.426	-100 to 260 °C (-148 to 500 °F)	-1000 to 2600 (-1480 to 5000)	-100 to 260 (-148 to 500)	-32768 to 32767	0 to 16383
100 Ω Ni α 0.618	-100 to 260 °C (-148 to 500 °F)	-1000 to 2600 (-1480 to 5000)	-100 to 260 (-148 to 500)	-32768 to 32767	0 to 16383
120 Ω Ni α 0.672	-80 to 260 °C (-112 to 500 °F)	-800 to 2600 (-1120 to 5000)	-80 to 260 (-112 to 500)	-32768 to 32767	0 to 16383
604 Ω NiFe α 0.518	-100 to 200 °C (-148 to 392 °F)	-1000 to 2000 (-1480 to 3920)	-100 to 200 (-148 to 392)	-32768 to 32767	0 to 16383
Resistance	0 to 150 Ω	0 to 15000	0 to 1500	-32768 to 32767	0 to 16383
	0 to 1000 Ω	0 to 10000	0 to 1000	-32768 to 32767	0 to 16383
	0 to 3000 Ω	0 to 30000	0 to 3000	-32768 to 32767	0 to 16383
Voltage	±50 mV	-5000 to 5000	-500 to 500	-32768 to 32767	0 to 16383
	±100 mV	-10000 to 10000	-1000 to 1000	-32768 to 32767	0 to 16383
	0 to 5 V	0 to 5000	0 to 500	0 to 31207	0 to 16383
	1 to 5 V	1000 to 5000	100 to 500	6241 to 31207	0 to 16383
	±10 V	-10000 to 10000	-1000 to 1000	-31207 to 31207	0 to 16383
	0 to 10 V	0 to 10000	0 to 1000	0 to 31207	0 to 16383
Current	4 to 20 mA	4000 to 20000	400 to 2000	6241 to 31207	0 to 16383
	0 to 20 mA	0 to 20000	0 to 2000	0 to 31207	0 to 16383
CJC ¹⁰	-25 °C to 85 °C (-13 °F to 185 °F)	-2500 to 8500	-250 to 850	-32768 to 32767	0 to 16383

¹⁰ CJC temperatures are displayed in degrees Celsius only.

Section 3.5

Read Input Data

Input data is read for each channel, converted to a scaled digital value, and stored in the input file. Use the addressing scheme below to locate the 8 input words used for channels 0 through 7, respectively.



1. I/O located on the controller (embedded I/O) is slot 0. I/O added to the controller (expansion I/O) begins with slot 1.

The layout for the input file is shown below.

Table 3-4 (Input Data)

Word	Description
I:e.0	Analog Data Channel 0
I:e.1	Analog Data Channel 1 (0 if Ch 0 RTD/Resistance)
I:e.2	Analog Data Channel 2
I:e.3	Analog Data Channel 3 (0 if Ch 2 RTD/Resistance)
I:e.4	Analog Data Channel 4
I:e.5	Analog Data Channel 5 (0 if Ch 4 RTD/Resistance)
I:e.6	Analog Data Channel 6
I:e.7	Analog Data Channel 7 (0 if Ch 6 RTD/Resistance)

NOTE



Status data is not available for the 1762sc-IF8u module.

Section 3.6 Module Update Time

The module update time is determined by the number of channels enabled and by the filter frequency selected for each channel.

ADC Filter Frequency	Filter Frequency (-3dB point)	Conversion Time	Module update
470 Hz	109 Hz	20 ms	= sum of conversion times for each enabled channel
62 Hz	14 Hz	45 ms	
17 Hz	4 Hz	135 ms	
4Hz	1 Hz	495 ms	

Section 3.7 Module Errors

3.7.1 Mod_Error Field (Bits 11:9)

The purpose of the Mod_Error field is to classify module errors into three distinct groups:

- No Errors (Mod_Error = 0): When Mod_Error field = 0 there is no error present in the module, and there is no need to check the Extended_Error_Info field.
- Hardware Errors (Mod_Error = 1): General and specific error codes may be specified by the Extended_Error_Info field.
- Configuration Errors (Mod_Error = 2): Module-specific error codes specified in the Extended_Error_Info field. These error codes correlate to options that the user can change directly; i.e. things such as Input Range or Input Filter Selection.

3.7.2 Extended_Error_Info Field (Bits 8:0)

The Extended_Error_Info field is checked when a non-zero value is present in the Mod_Error field. Depending on the value of Mod_Error, the Extended_Error_Info field can contain error codes that are either module-specific, or common to all 1762 analog modules.

Below are some guidelines for assigning Extended_Error_Info error codes:

Error Type	Mod_Error (11:9)	Extended_Error_Info(8:0)
No Error	0	always 000
Hardware Error	1	000 = no additional information 001 = Power-up Reset 002-0FF = general common errors 100-1FF = module specific errors
Configuration Error	2	000 = no additional information 001-1FF = module specific errors

3.7.3 General Common Hardware Errors

The other error codes listed in this table are not specific to any particular 1762 module. Note that if no errors are present on the module Mod_Error and Extended_Error_Info will both be set to 0. The user sees the fault code in the Combined column in the following tables:

Mod_Error (11:9)	Extended_Error_Info(8:0)	Combined	Error Description
0	0x000	0x000	No Errors
1	0x016	0x216	Watchdog reset detected.
1	0x021	0x221	Checksum error in NVRAM (bad cal data)

3.7.4 Module Specific Hardware Errors

Mod_Error (11:9)	Extended_Error_Info(8:0)	Combined	Error Description
1	0x102	0x302	A/D Converter Communication Error. This hardware error will be set if the module detects the analog to digital converter is not functioning properly.

3.7.5 Module Specific Configuration Errors

If the user attempts to set the fields in the configuration file to invalid (unsupported) values, the module will 1) ignore the invalid configuration, 2) generate a non-critical error, and 3) keep operating with the previous configuration. Each type of I/O module has different features (number of channels, input or output, etc.), and therefore different error codes associated with it. This section lists the possible module specific configuration error codes defined for the 1762sc-IF8U analog modules.

There are essentially two errors:

- **Bad RTD/R Pair Match.** When the user wants to configure a channel to read resistance or RTD temperature, a pair of contiguous channels (even 1st/odd 2nd) are used. If an odd channel is configured for RTD/R, and

the previous even channel is not configured for RTD/R, this error will be posted.

- Wire type selected for non-RTD/R type. If a channel is not configured for RTD/R and the wire type field is non-zero, this error will be posted indicating the channel.

For multiple configuration errors, the first error detected is posted. The user sees the fault code in the Combined column in the following tables:

Mod_Error (11:9)	Extended_Error_Info(8:0)	Combined	Error Description
2	0x000	0x400	General Error
2	0x011	0x411	Chan 1 Bad RTD/R Pair Match
2	0x013	0x413	Chan 3 Bad RTD/R Pair Match
2	0x015	0x415	Chan 5 Bad RTD/R Pair Match
2	0x017	0x417	Chan 7 Bad RTD/R Pair Match
2	0x020	0x420	Chan 0: Wire type selected for non-RTD/R type.
2	0x021	0x421	Chan 1: Wire type selected for non-RTD/R type.
2	0x022	0x422	Chan 2: Wire type selected for non-RTD/R type.
2	0x023	0x423	Chan 3: Wire type selected for non-RTD/R type.
2	0x024	0x424	Chan 4: Wire type selected for non-RTD/R type.
2	0x025	0x425	Chan 5: Wire type selected for non-RTD/R type.
2	0x026	0x426	Chan 6: Wire type selected for non-RTD/R type.
2	0x027	0x427	Chan 7: Wire type selected for non-RTD/R type.
2	0x030	0x430	Chan 0: Illegal Open Wire Setting
2	0x031	0x431	Chan 1: Illegal Open Wire Setting
2	0x032	0x432	Chan 2: Illegal Open Wire Setting
2	0x033	0x433	Chan 3: Illegal Open Wire Setting
2	0x034	0x434	Chan 4: Illegal Open Wire Setting
2	0x035	0x435	Chan 5: Illegal Open Wire Setting
2	0x036	0x436	Chan 6: Illegal Open Wire Setting
2	0x037	0x437	Chan 7: Illegal Open Wire Setting

Getting Technical Assistance

Note that your module contains electronic components which are susceptible to damage from electrostatic discharge (ESD). An electrostatic charge can accumulate on the surface of ordinary plastic wrapping or cushioning material. **In the unlikely event that the module should need to be returned to Spectrum Controls, please ensure that the unit is enclosed in approved ESD packaging (such as static-shielding / metalized bag or black conductive container).** Spectrum Controls reserves the right to void the warranty on any unit that is improperly packaged for shipment.

RMA (Return Merchandise Authorization) form required for all product returns.

For further information or assistance, please contact your local distributor, or call the Spectrum Controls Technical Support at:

USA - 425-746-9481

Declaration of Conformity

Available upon request

Appendix A

Module Specifications

General Specifications

Specification	Value		
Dimensions	90 mm (height) × 87 mm (depth) × 40 mm (width) height including mounting tabs is 110 mm 3.54 in. (height) × 3.43 in. (depth) × 1.58 in. (width) height including mounting tabs is 4.33 in.		
Approximate Shipping Weight (with carton)	268 g (0.591 lbs.)		
Storage Temperature	-40 °C to +85 °C (-40 °F to +185 °F)		
Operating Temperature	-20 °C to +60 °C (-4 °F to +140 °F)		
Operating Humidity	5% to 95% non-condensing		
Operating Altitude	2000 meters (6561 feet)		
Vibration	Operating: 10 to 500 Hz, 5 G, 0.030 in. max. peak-to-peak		
Shock	Operating: 30 G		
Bus Current Draw (max.)	175 mA at 5 VDC Max 21 mA at 24 VDC Max		
Heat Dissipation	1.4 W Total Max		
Analog Normal Operating Range	Voltage: -10.5 V to +10.5 VDC Current: 0 to +21 mA Resistance: 0 to 3000 Ω		
Resolution	16 bits (Integer Format)		
Channel Update Time	Filter Setting	Conversion Time	Step Response/Module Update ¹¹
	470 Hz	20 ms	= Conversion time * (1+ number of enabled channels)
	62 Hz	45 ms	
	17 Hz	135 ms	
	4 Hz	495 ms	

¹¹ The module update time is purely the sum of conversion times for each enabled channels. The extra addition of 1 is not necessary.

Specification	Value
Input Group to System Isolation	Channel to Rack: 707 VDC for 1 minute Optical and magnetic Channel to Channel: 10 VDC
Module Power LED	On: indicates power is applied and module not faulted.
Recommended Cable	Belden™ 8761 (shielded)
Specification	Value
Vendor I.D.	58
Product Type	10
Product Code	20
Agency Certification	C-UL listed (under CSA C22.2 No. 142) UL 508 listed CE compliant for all applicable directives
Hazardous Environment Class	Class I, Division 2, Hazardous Location, Groups A, B, C, D (ISA 12.12.01, C-UL under CSA C22.2 No. 213) Operating Temperature Code T5
Radiated and Conducted Emissions	EN61131-2
Electrical /EMC:	The module has passed testing at the following levels:
ESD Immunity (IEC61000-4-2)	4 kV contact, 8 kV air, 4 kV indirect
Radiated Immunity (IEC61000-4-3)	10 V/m, 80 to 1000 MHz, 80% amplitude modulation, +900 MHz keyed carrier
Fast Transient Burst (IEC61000-4-4)	2 kV, 5 kHz
Surge Immunity (IEC61000-4-5)	1 kV galvanic gun
Conducted Immunity (IEC61000-4-6)	10 V, 0.15 to 80 MHz ¹²

¹² Conducted Immunity frequency range may be 150 kHz to 30 MHz if the Radiated Immunity frequency range is 30 MHz to 2700 MHz.

Input Specifications

Specification	Value	
Number of Inputs	8 Current/Voltage or 4 Resistance	
A/D Converter Type	Delta Sigma	
Common Mode Rejection	100 dB for 4 Hz and 17 Hz Filters	
Normal Mode Rejection	4 Hz Filter	74 dB minimum at 50 and 60 Hz
	17 Hz Filter	65 dB minimum at 50 and 60 Hz
	62 Hz Filter	First notch at 31 Hz, typically 30 dB
	470 Hz Filter	First notch at 237 Hz, typically 35 dB
Non-linearity (in percent full scale)	±0.1%	
Input Impedance	Current Terminal: 249 Ω	
Current Input Protection	±42 mA	
Voltage Input Protection	±28 V ¹³	
RTD/resistance Excitation Current	Current in mA	
100 Ω Pt α385	0.42	
200 Ω Pt α385	0.42	
500 Ω Pt α385	0.21	
1000 Ω Pt α385	0.21	
100 Ω Pt α3916	1.00	
200 Ω Pt α3916	0.42	
500 Ω Pt α3916	0.21	
1000 Ω Pt α3916	0.21	
10 Ω Cu α426	2.00	
100 Ω Ni α618	1.00	
120 Ω Ni α672	1.00	
604 Ω NiFe α518	0.21	
0 to 150 Ω	0.42	
0 to 1000 Ω	0.21	
0 to 3000 Ω	0.21	

¹³ The maximum allowable voltage difference between any two input pins is 28 V.

Accuracy Specifications

Specification	Value
Thermocouple Inputs (25 °C Ambient)	<p>Linearization per ITS-90</p> <p>System accuracy at 25 °C (4 and 17 Hz filters):</p> <p>Type J (-180 °C to 1200 °C): ±0.6 degrees C maximum</p> <p>Type J (-210 °C to -180 °C): ±0.8 degrees C maximum</p> <p>Type N (-160 °C to 1300 °C): ±1 degrees C maximum</p> <p>Type N (-210 °C to -160 °C): ±1.8 degrees C maximum</p> <p>Type T (-190 °C to 400 °C): ±1 degrees C maximum</p> <p>Type T (-270 °C to -190 °C): ±7 degrees C maximum</p> <p>Type K (-200 °C to 1370 °C): ±1 degrees C maximum</p> <p>Type K (-270 °C to -200 °C): ±10 degrees C maximum</p> <p>Type E (-200 °C to 1000 °C): ±0.6 degrees C maximum</p> <p>Type E (-270 °C to -200 °C): ±5 degrees C maximum</p> <p>Type S and R: ±2.8 degrees C maximum</p> <p>Type C: ±1.8 degrees C maximum</p> <p>Type B: ±3.3 degrees C maximum</p>
Thermocouple Inputs (-20 to 60 °C Ambient)	<p>System accuracy at -20-60° C (4 and 17 Hz filters):</p> <p>Type J (-180 °C to 1200 °C): ±1.2 degrees C maximum</p> <p>Type J (-210 °C to -180 °C): ±1.6 degrees C maximum</p> <p>Type N (-200 °C to 1300 °C): ±2 degrees C maximum</p> <p>Type N (-210 °C to -200 °C): ±3.6 degrees C maximum</p> <p>Type T (-230 °C to 400 °C): ±2 degrees C maximum</p> <p>Type T (-270 °C to -230 °C): ±14 degrees C maximum</p> <p>Type K (-225 °C to 1370 °C): ±2 degrees C maximum</p> <p>Type K (-270 °C to -225 °C): ±20 degrees C maximum</p> <p>Type E (-210 °C to 1000 °C): ±1.2 degrees C maximum</p> <p>Type E (-270 °C to -210 °C): ±10 degrees C maximum</p> <p>Type S and R: ±6 degrees C maximum</p> <p>Type C: ±4 degrees C maximum</p> <p>Type B: ±7 degrees C maximum</p> <p>The above limits do not include the cold junction compensation or sensor error. They must be included (added) to determine overall thermocouple accuracy.</p>
CJC accuracy	±3.0 degrees C maximum correlation between reading and target terminal
CJC Repeatability	±0.2 degrees C max for 0-60 °C, ±0.4 degrees C max for full range
CJC Sensor accuracy	±1.0 degrees C maximum Reading/Conversion of the sensor

Specification	Value
Voltage Inputs	<p>System accuracy at 25° C (4 and 17 Hz filters):</p> <ul style="list-style-type: none"> ±20 uV maximum for ±50 mV inputs ±20 uV maximum for ±100 mV inputs ±3 mV maximum for 0-5 V inputs ±3 mV maximum for 1-5 V inputs ±10 mV maximum for 0-10 V inputs ±10 mV maximum for ±10 V inputs <p>System accuracy at -20-60° C (4 and 17 Hz filters):</p> <ul style="list-style-type: none"> ±40 uV maximum for ±50 mV inputs ±40 uV maximum for ±100 mV inputs ±6 mV maximum for 0-5 V inputs ±6 mV maximum for 1-5 V inputs ±20 mV maximum for 0-10 V inputs ±20 mV maximum for ±10 V inputs
Current Inputs	<p>System accuracy at 25° C (4 and 17 Hz filters):</p> <ul style="list-style-type: none"> ±20 uA maximum for 0-20 mA inputs ±20 uA maximum for 4-20 mA inputs <p>System accuracy at -20-60 °C (4 and 17 Hz filters):</p> <ul style="list-style-type: none"> ±50 uA maximum for 0-20 mA inputs ±50 uA maximum for 4-20 mA inputs
RTD Inputs	<p>System accuracy at 25° C (4 and 17 Hz filters):</p> <ul style="list-style-type: none"> ±0.5 °C for Platinum 385 ±0.5 °C for Platinum 3916 ±0.6 °C for Nickel ±0.3 °C for Nickel-Iron ±1.0 °C for Copper measured in 3-wire mode wire with compensation ±0.6 °C for Copper measured in 4-wire mode <p>System accuracy at -20-60° C (4 and 17 Hz filters):</p> <ul style="list-style-type: none"> ±0.9 °C for Platinum 385 ±0.8 °C for Platinum 3916 ±0.8 °C for Nickel ±0.5 °C for Nickel-Iron ±1.5 °C for Copper measured in 3-wire mode wire with compensation ±1.1 °C for Copper measured in 4-wire mode <p>TOLERANCES DO NOT INCLUDE LEAD WIRE RESISTANCE ERRORS ON 2 AND 3 WIRE.</p>

Specification	Value
Resistance Inputs	System accuracy at 25° C (4 and 17 Hz filters): ±0.5 ohms for 150 Ω range ±1.0 ohms for 1000 Ω range ±3.0 ohms for 3000 Ω range System accuracy at -20-60° C (4 and 17 Hz filters): ±1.0 ohms for 150 Ω range ±1.5 ohms for 1000 Ω range ±4.5 ohms for 3000 Ω range
	Note: The accuracy for the faster filters is equal to the accuracy of the slower filters plus repeatability.

Repeatability Specifications¹⁴

Repeatability (at 25°C)	Slowest Filter (4 Hz)	Middle Filter (17 Hz)	Fastest Filters (62 and 470 Hz) Typical Values ¹⁵
Thermocouples			
Type J	±0.1 °C	±0.2 °C	±3 °C
Type N (-110°C to 1300°C)	±0.1 °C	±0.2 °C	±4 °C
Type N (-210°C to -110°C)	±0.2 °C	±0.3 °C	±7.5 °C
Type T (-170°C to 400°C)	±0.1 °C	±0.1 °C	±3.3 °C
Type T (-270°C to -170°C)	±0.5 °C	±0.6 °C	±20 °C
Type K (-170°C to 1370°C)	±0.1 °C	±0.2 °C	±3.8 °C
Type K (-270°C to -170°C)	±1.5 °C	±2.6 °C	±20 °C
Type E (-220°C to 1000°C)	±0.1 °C	±0.2 °C	±2.4 °C
Type E (-270°C to -220°C)	±0.8 °C	±1.5 °C	±20 °C
Types S & R	±0.3 °C	±0.6 °C	±12 °C
Type B	±0.3 °C	±0.4 °C	±20 °C
Type C	±0.2 °C	±0.3 °C	±6.7 °C
Millivolt Inputs	±20 μV	±20 μV	±60 μV
Voltage Inputs	±1 mV	±2 mV	±2 mV
Current Inputs	±1 μA	±1 μA	±5 μA

¹⁴ Repeatability is the ability of the input module to register the same reading in successive measurements for the same input signal.

¹⁵ These filters do not reject 50/ 60 Hz. Repeatability for these filters is strongly dependent on how much 50/60 Hz noise is in the system.

Repeatability (at 25°C)	Slowest Filter (4 Hz)	Middle Filter (17 Hz)	Fastest Filters (62 and 470 Hz) Typical Values¹⁵
RTD			
Platinum 385	±0.1 °C	±0.2 °C	±1.0 °C
Platinum 3916	±0.1 °C	±0.2 °C	±1.0 °C
Copper	±0.2 °C	±0.3 °C	±2.6 °C
Nickel	±0.1 °C	±0.2 °C	±1.0 °C
Nickel-Iron	±0.1 °C	±0.1 °C	±0.5 °C
Resistance			
0-150 Ω	±0.05 Ω	±0.15 Ω	±1.0 Ω
0-1000 Ω	±0.1 Ω	±0.3 Ω	±2.0 Ω
0-3000 Ω	±0.1 Ω	±0.3 Ω	±2.0 Ω
±50 mV	2.3 μV	3.2 μV	60 μV
±100 mV	4.6 μV	6.4 μV	60 μV
±10 V	0.48 mV	0.48 mV	2 mV
0-20 mA	0.5 μA	0.6 μA	5 μA
Resistance 0-150 Ω	0.007 Ω	0.01 Ω	1.0 Ω
Resistance 0-1000 Ω	0.05 Ω	0.09 Ω	2.0 Ω
Resistance 0-3000 Ω	0.02 Ω	0.13 Ω	2.0 Ω

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