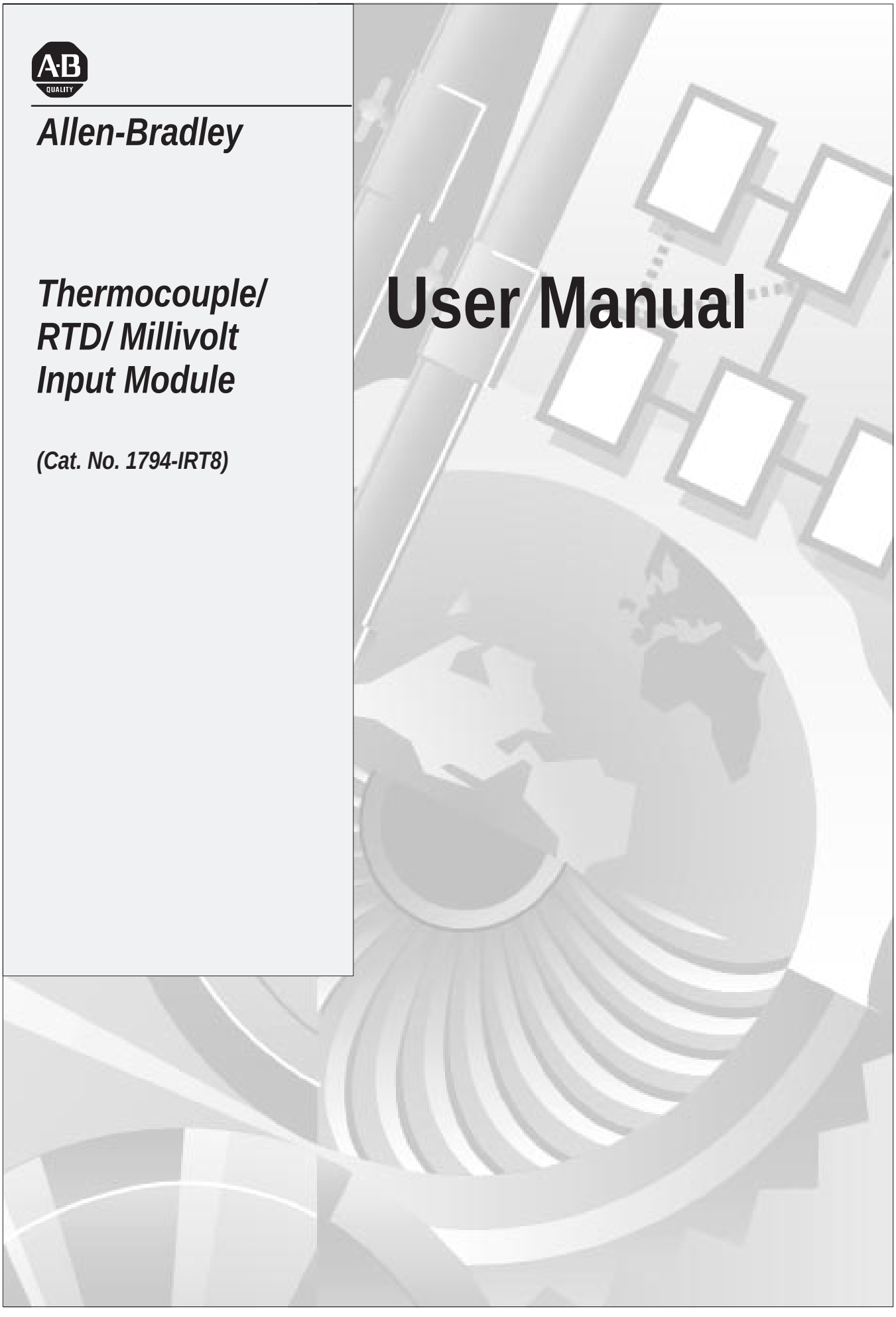


Allen-Bradley

User Manual

Thermocouple/ RTD/ Millivolt Input Module

(Cat. No. 1794-IRT8)

Important User Information

Because of the variety of uses for the products described in this publication, those responsible for the application and use of this control equipment must satisfy themselves that all necessary steps have been taken to assure that each application and use meets all performance and safety requirements, including any applicable laws, regulations, codes and standards.

The illustrations, charts, sample programs and layout examples shown in this guide are intended solely for example. Since there are many variables and requirements associated with any particular installation, Allen-Bradley does not assume responsibility or liability (to include intellectual property liability) for actual use based upon the examples shown in this publication.

Allen-Bradley publication SGI–1.1, “Safety Guidelines For The Application, Installation and Maintenance of Solid State Control” (available from your local Allen-Bradley office) describes some important differences between solid-state equipment and electromechanical devices which should be taken into consideration when applying products such as those described in this publication.

Throughout this manual we make notes to alert you to possible injury to people or damage to equipment under specific circumstances.

ATTENTION: Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss.

Attention helps you:

- identify a hazard
- avoid the hazard
- recognize the consequences

Important: Identifies information that is especially important for successful application and understanding of the product.

Important: We recommend you frequently backup your application programs on appropriate storage medium to avoid possible data loss.

Using This Manual

Preface Objectives

Read this preface to familiarize yourself with this manual and to learn how to use it properly and efficiently.

Audience

We assume that you have previously used an Allen-Bradley programmable controller, that you are familiar with its features, and that you are familiar with the terminology we use. If not, read the user manual for your processor before reading this manual.

In addition, if using this module in a DeviceNet system, you must be familiar with:

- DeviceNetManager™ Software, cat. no. 1787-MGR
- Microsoft Windows™

Vocabulary

In this manual, we refer to:

- the individual Thermocouple/RTD/mV module as the “module,” or “TC/RTD module.”
- the programmable controller as the “controller” or the “processor.”

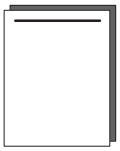
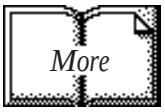
What This Manual Contains

The contents of this manual are as follows:

Chapter	Title	What’s Covered
1	Overview of Flex I/O and Your Thermocouple/RTD/mV Module	Describes features, capabilities, and hardware components
2	How to Install Your TC/RTD/mV Input Module	Installation and connecting wiring
3	Module Programming	Block transfer programming and programming examples
4	Writing Configuration to and Reading Status from Your Module with a Remote I/O Adapter	Describes block transfer write and block transfer read configurations, including complete bit/word descriptions
5	How Communication Takes Place and I/O Image Table Mapping with the DeviceNet Adapter	Describes communication over the I/O backplane between the module and the adapter, and how data is mapped into the image table
6	Calibrating Your Module	Lists the tools needed, and the methods used to calibrate the input module
Appendix		
A	Specifications	Module specifications and accuracy

Conventions

We use these conventions in this manual:

In this manual, we show:	Like this:
that there is more information about a topic in another chapter in this manual	
that there is more information about the topic in another manual	

For Additional Information

For additional information on FLEX I/O systems and modules, refer to the following documents:

Catalog Number	Voltage	Description	Publications	
			Installation Instructions	User Manual
1794		1794 FLEX I/O Product Data	1794-2.1	
1794-ACN	24V dc	ControlNet Adapter	1794-5.8	
1794-ACNR	24V dc	Redundant Media ControlNet Adapter	1794-5.18	
1794-ACN15	24V dc	ControlNet Adapter	1794-5.47	
1794-ACNR15	24V dc	Redundant Media ControlNet Adapter	1794-5.48	
1794-ADN	24V dc	DeviceNet Adapter	1794-5.14	1794-6.5.5
1794-ASB/C	24V dc	Remote I/O Adapter	1794-5.50	1794-6.5.9
1794-ASB2/B	24V dc	2-Slot Remote I/O Adapter	1794-5.44	1794-6.5.13
1794-APB	24V dc	Profibus Adapter	1794-5.40	1794-6.5.6
1794-IB8	24V dc	8 Sink Input Module	1794-5.30	
1794-OB8	24V dc	8 Source Output Module	1794-5.31	
1794-IB16	24V dc	16 Sink Input Module	1794-5.4	
1794-OB16	24V dc	16 Source Output Module	1794-5.3	
1794-IV16	24V dc	16 Source Input Module	1794-5.28	
1794-OV16	24V dc	16 Sink Output Module	1794-5.29	
1794-OB8EP	24V dc	8 Electronically Fused Output Module	1794-5.20	
1794-IB8S	24V dc	Sensor Input Module	1794-5.7	
1794-IB10XOB6	24V dc	10 Input/6 Output Module	1794-5.24	
1794-IE8	24V dc	Selectable Analog 8 Input Module	1794-5.6	
1794-OE4	24V dc	Selectable Analog 4 Output Module	1794-5.5	1794-6.5.2
1794-IE4XOE2	24V dc	4 Input/2 Output Analog Module	1794-5.15	

Table continued on next page

Catalog Number	Voltage	Description	Publications	
			Installation Instructions	User Manual
1794-OF4	24V dc	4 Output Isolated Analog Module	1794-5.37	1794-6.5.8
1794-IF4	24V dc	4 Input Isolated Analog Module	1794-5.38	
1794-IF2XOF2	24V dc	2 Input/2 Output Isolated Analog Module	1794-5.39	
1794-IR8	24V dc	8 RTD Input Analog Module	1794-5.22	1794-6.5.4
1794-IT8	24V dc	8 Thermocouple Input Module	1794-5.21	1794-6.5.7
1794-IRT8	24V dc	8 Thermocouple/RTD Input Module	1794-5.50	1794-6.5.12
1794-IJ2	24V dc	2 Frequency Input Module	1794-5.49	1794-6.5.11
1794-IA8	120V ac	8 Input Module	1794-5.9	
1794-OA8	120V ac	Output Module	1794-5.10	
1794-TB2 1794-TB3		2-wire Terminal Base 3-wire Terminal Base	1794-5.2	
1794-TBN		Terminal Base Unit	1794-5.16	
1794-TBNF		Fused Terminal Base Unit	1794-5.17	
1794-TB3T		Temperature Terminal Base Unit	1794-5.41	
1794-TB3S		Spring Clamp Terminal Base Unit	1794-5.42	
1794-TB3TS		Spring Clamp Temperature Base Unit	1794-5.43	
1794-TB3G		Terminal Base Unit	1794-5.51	
1794-TB3GS		Spring Clamp Terminal Base Unit	1794-5.59	
1794-CE1, -CE3		Extender Cables	1794-5.12	
1794-NM1		Mounting Kit	1794-2.13	
1794-PS1	24V dc	Power Supply	1794-5.35	

Summary

This preface gave you information on how to use this manual efficiently. The next chapter introduces you to the Thermocouple/RTD/mV input module.

Table of Contents

Writing Configuration to and Reading Status from Your Module with a Remote I/O Adapter

Chapter 4

How Communication Takes Place and I/O Image Table Mapping with the DeviceNet Adapter

Chapter 5

Calibrating Your Module

Chapter 6

Specifications

Appendix A

Overview of FLEX I/O and Your Thermocouple/RTD/mV Input Module

What This Chapter Contains

Read this chapter to familiarize yourself with the 1794-IRT8 module.

What the Thermocouple/RTD/mV Input Modules Does

The 1794-IRT8 module accepts up to 8 thermocouple or RTD inputs. The inputs are nonisolated and are selected with analog multiplexers which have a common–mode input range of ±4 volts. The inputs will accept a millivolt or resistive input. Default input spans are –40.00mV to +100.00mV or 0.00 to 500.00 ohms. Fault Indicators are located on the field side.

No switches or jumpers are used on the TC/RTD Input module. The Inputs have both fixed hardware filters and selectable firmware digital filters.

How TC/RTD/mV Modules Communicate with Programmable Controllers

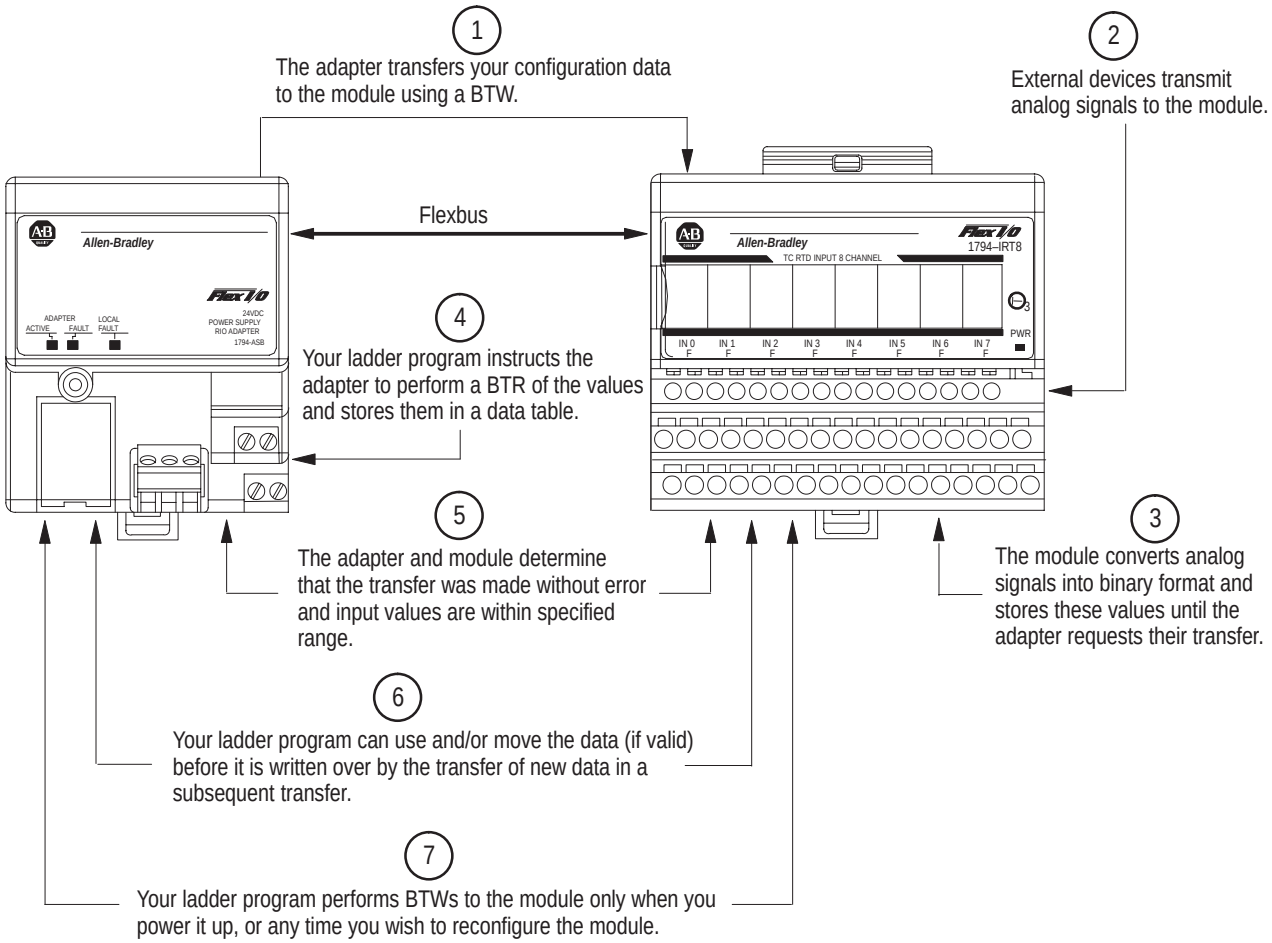
FLEX I/O Thermocouple/RTD/mV modules are block transfer modules that interface analog signals with any Allen-Bradley programmable controllers that have block transfer capability. Block transfer programming moves input or output data words between the module's memory and a designated area in the processor data table. Block transfer programming also moves configuration words from the processor data table to module memory.

The adapter/power supply transfers data to the module (block transfer write) and from the module (block transfer read) using BTW and BTR instructions in your ladder diagram program. These instructions let:

- the adapter obtain input or output values and status from the module
- you establish the module's mode of operation.

The illustration describes the communication process.

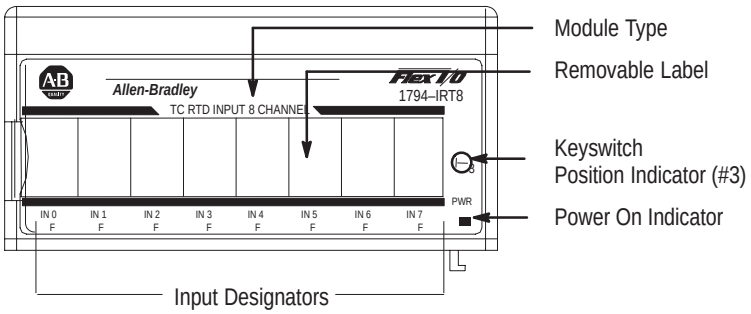
Typical Communication Between an Adapter and a Module



Features of Your Module

The module label identifies the keyswitch position, wiring and module type. A removable label provides space for writing individual designations per your application. Indicators are provided to identify input fault conditions, and to show when power is applied to the module.

1794-IRT8



Chapter Summary

In this chapter, we told you about the FLEX I/O system and the Thermocouple/RTD/mV input module, and how they communicate with programmable controllers.

How to Install Your Thermocouple/RTD/mV Input Module

What This Chapter Contains

In this chapter, we tell you:

Before You Install Your Input Module

Before installing your TC/RTD/mV module:

You need to:	As described under:
Calculate the power requirements of all modules in this FLEX system.	Power Requirements, page 2-2
Position the keyswitch on the terminal base	Installing the Module, page 2–4

ATTENTION: The TC/RTD/mV module does not receive power from the backplane. +24V dc power must be applied to your module before installation. If power is not applied, the module position will appear to the adapter as an empty slot in your chassis.

European Union Directive Compliance

If this product has the CE mark it is approved for installation within the European Union and EEA regions. It has been designed and tested to meet the following directives.

EMC Directive

This product 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:

- EN 50081-2EMC – Generic Emission Standard, Part 2 – Industrial Environment
- EN 50082-2EMC – Generic Immunity Standard, Part 2 – Industrial Environment

This product is intended for use in an industrial environment.

Low Voltage Directive

This product is tested to meet Council Directive 73/23/EEC Low Voltage, by applying the safety requirements of EN 61131–2 Programmable Controllers, Part 2 – Equipment Requirements and Tests.

For specific information required by EN 61131-2, see the appropriate sections in this publication, as well as the following Allen-Bradley publications:

- Industrial Automation Wiring and Grounding Guidelines For Noise Immunity, publication 1770-4.1
- Guidelines for Handling Lithium Batteries, publication AG-5.4
- Automation Systems Catalog, publication B111

This equipment is classified as open equipment and must be mounted in an enclosure during operation to provide safety protection.

Power Requirements

The wiring of the terminal base unit is determined by the current draw through the terminal base. Make certain that the current draw does not exceed 10A.

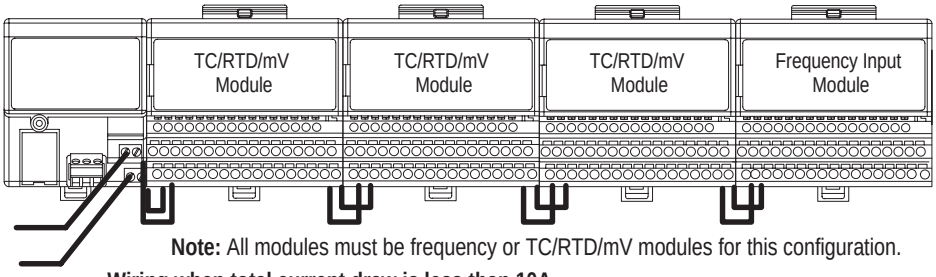
ATTENTION: Total current draw through the terminal base unit is limited to 10A. Separate power connections may be necessary.

Methods of wiring the terminal base units are shown in the illustration below.

Wiring the Terminal Base Units (1794-TB3G shown)

ATTENTION: Do not daisy chain power or ground from the terminal base unit to any ac or dc digital module terminal base unit.

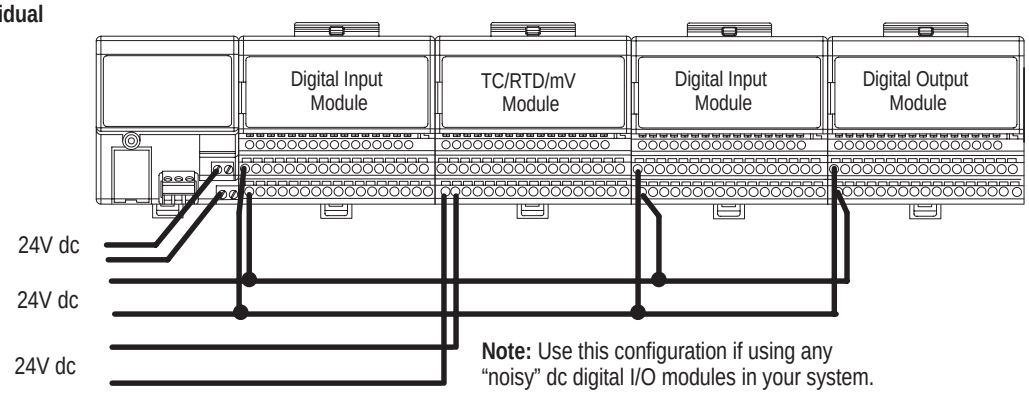
Daisy-chaining



Note: All modules must be frequency or TC/RTD/mV modules for this configuration.

Wiring when total current draw is less than 10A

Individual

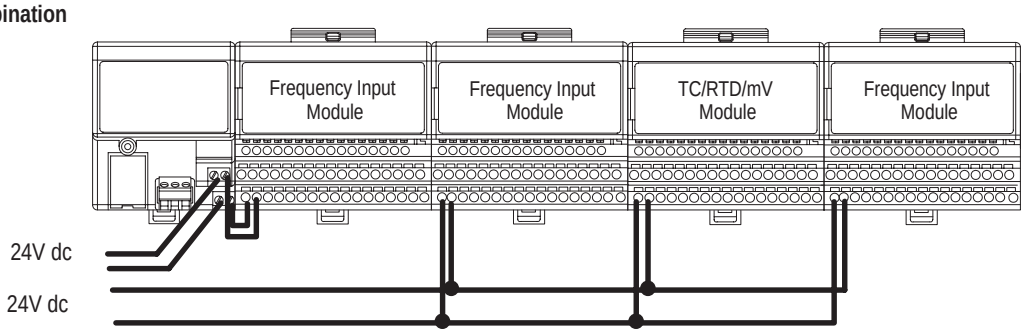


Note: Use this configuration if using any "noisy" dc digital I/O modules in your system.

Thermocouple/RTD/mV Module wiring separate from digital wiring.

Wiring when total current draw is greater than 10A

Combination



Note: All modules powered by the same power supply must be frequency or TC/RTD/mV modules for this configuration.

Total current draw through any base unit must not be greater than 10A

Installing the Module

Installation of the analog module consists of:

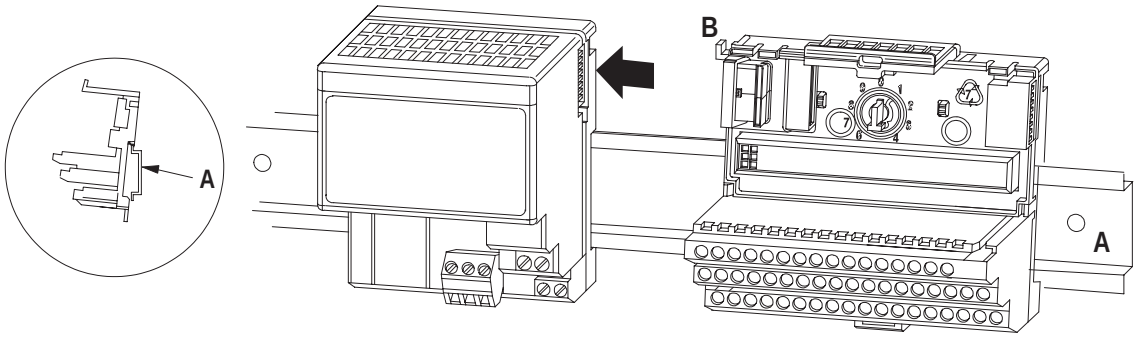
- mounting the terminal base unit
- installing the TC/RTD/mV module into the terminal base unit
- installing the connecting wiring to the terminal base unit

If you are installing your module into a terminal base unit that is already installed, proceed to "Mounting the Thermocouple/RTD/mV Module on the Terminal Base" on page 2–8.

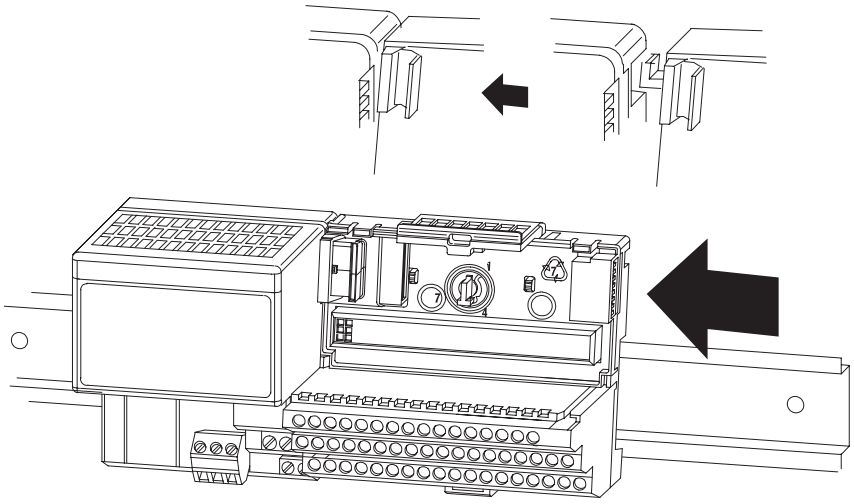
Mounting the Terminal Base Unit on a DIN Rail

ATTENTION: Do not remove or replace a terminal base unit when power is applied. Interruption of the flexbus can result in unintended operation or machine motion.

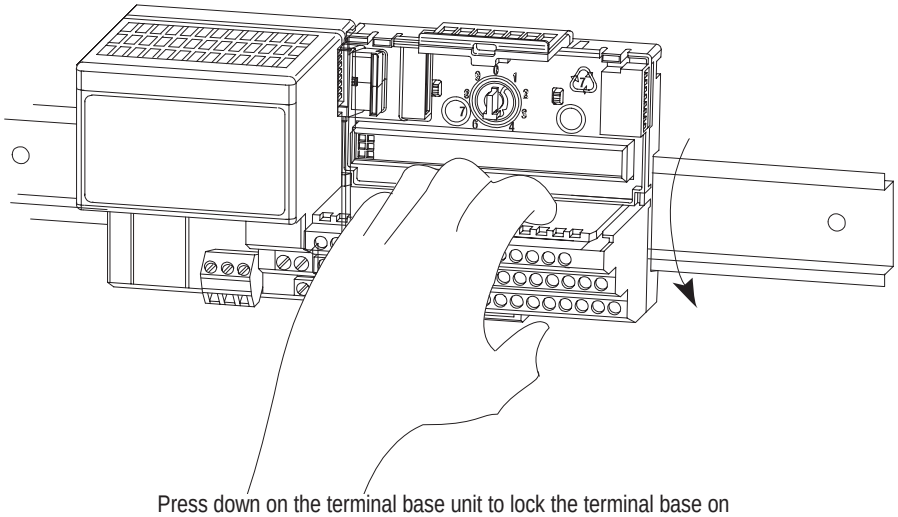
1. Remove the cover plug (if used) in the male connector of the unit to which you are connecting this terminal base unit.
2. Check to make sure that the 16 pins in the male connector on the adjacent device are straight and in line so that the mating female connector on this terminal base unit will mate correctly.
3. Position the terminal base on the 35 x 7.5mm DIN rail **A** (A-B pt. no. 199-DR1; 46277-3) at a slight angle with hook **B** on the left side of the terminal base hooked into the right side of the unit on the left. Proceed as follows:



Position terminal base at a slight angle and hooked over the top of the DIN rail.

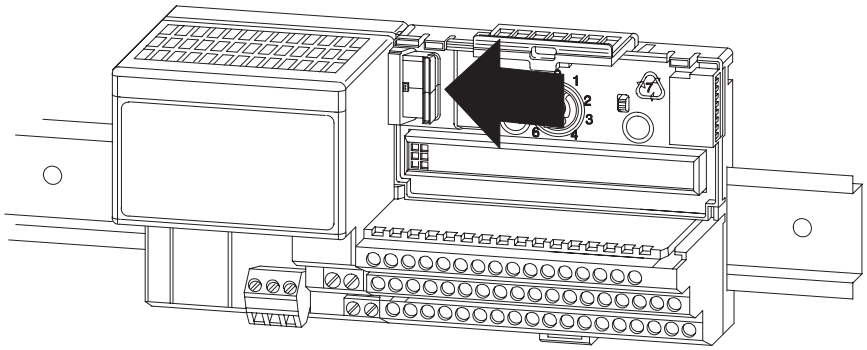


Slide the terminal base unit over tight against the adapter. Make sure the hook on the terminal base slides under the edge of the adapter and the flexbus connector is fully retracted.



Press down on the terminal base unit to lock the terminal base on the DIN rail. If the terminal base does not lock into place, use a screwdriver or similar device to open the locking tab, press down on the terminal base until flush with the DIN rail and release the locking tab to lock the base in place.

30077–M



Gently push the flexbus connector into the side of the adapter to complete the backplane connection.

4. Repeat the above steps to install the next terminal base.

Panel/Wall Mounting

Installation on a wall or panel consists of:

- laying out the drilling points on the wall or panel
- drilling the pilot holes for the mounting screws
- mounting the adapter mounting plate
- installing the terminal base units and securing them to the wall or panel

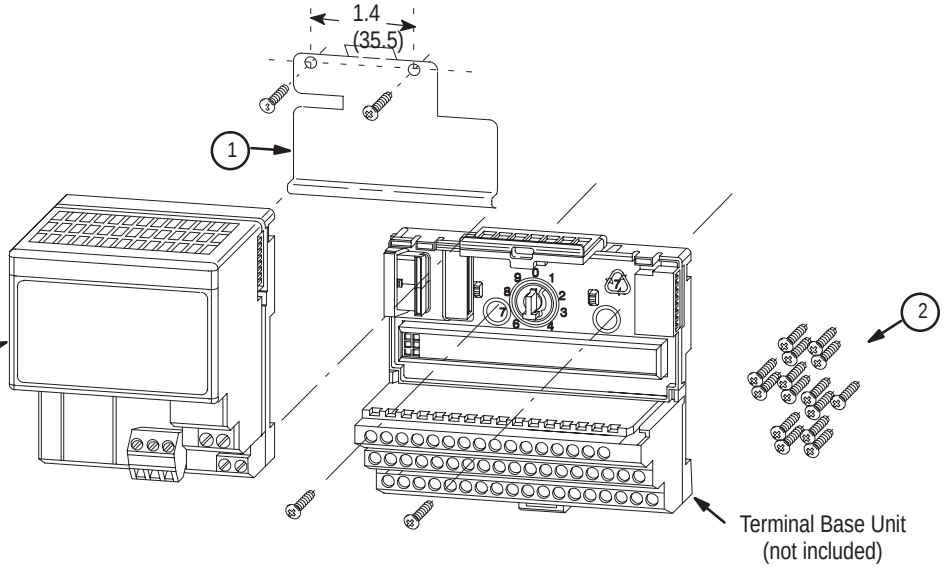
If you are installing your module into a terminal base unit that is already installed, proceed to "Mounting the Thermocouple/RTD/mV Module on the Terminal Base" on page 2–8.

Use the mounting kit Cat. No. 1794-NM1 for panel/wall mounting.

1794-NM1 Mounting Kit

Contents:

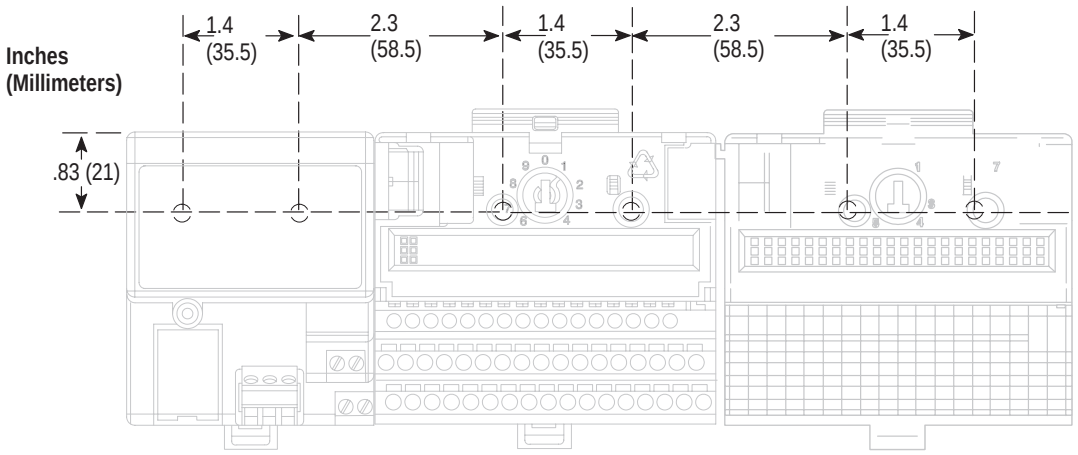
1 – Mounting Plate for Adapter
2 – 18 #6 self-tapping screws
(2 for the adapter, and 2 each for up to 8 modules)



To install the mounting plate on a wall or panel:

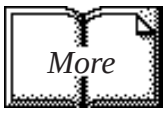
1. Lay out the required points on the wall/panel as shown in the drilling dimension drawing.

Drilling Dimensions for Panel/Wall Mounting of FLEX I/O



2. Drill the necessary holes for the #6 self-tapping mounting screws.
3. Mount the mounting plate (1) for the adapter module using two #6 self-tapping screws (18 included for mounting up to 8 modules and the adapter).

Important: Make certain that the mounting plate is properly grounded to the panel. Refer to "Industrial Automation Wiring and Grounding Guidelines," publication 1770-4.1.



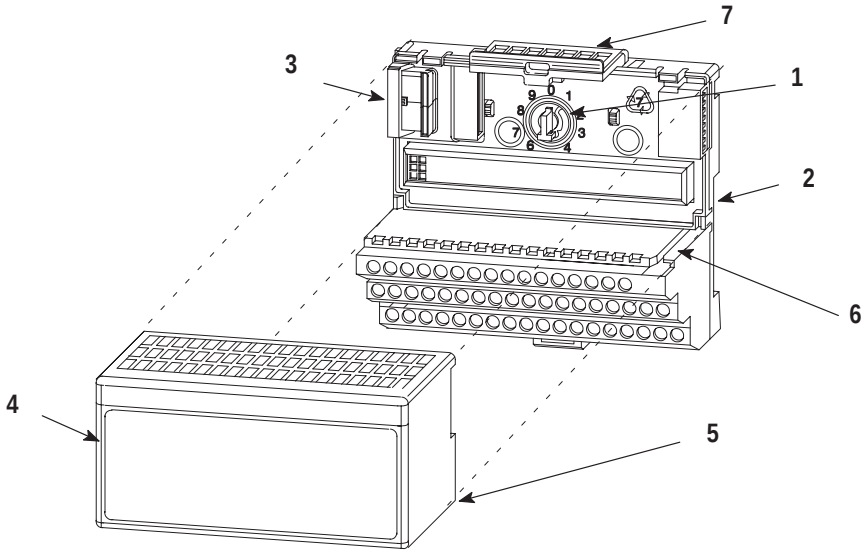
4. Hold the adapter (2) at a slight angle and engage the top of the mounting plate in the indention on the rear of the adapter module.
5. Press the adapter down flush with the panel until the locking lever locks.
6. Position the terminal base unit up against the adapter and push the female bus connector into the adapter.
7. Secure to the wall with two #6 self-tapping screws.
8. Repeat for each remaining terminal base unit.

Note: The adapter is capable of addressing eight modules. Do not exceed a maximum of eight terminal base units in your system.

Mounting the Thermocouple/RTD/mV Module on the Terminal Base Unit

The TC/RTD/mV input module mounts on a 1794-TB3G or TB3GS terminal base unit.

1. Rotate the keyswitch (1) on the terminal base unit (2) clockwise to position 3 as required for the TC/RTD/mV module.



2. Make certain the flexbus connector (3) is pushed all the way to the left to connect with the neighboring terminal base/adapter. **You cannot install the module unless the connector is fully extended.**
3. Make sure that the pins on the bottom of the module are straight so they will align properly with the connector in the terminal base unit.

ATTENTION: Remove field-side power before removing or inserting the module. This module is designed so **you can remove and insert it under backplane power.** When you remove or insert a module with field-side power applied, an electrical arc may occur. An electrical arc can cause personal injury or property damage by:

- sending an erroneous signal to your system's field devices causing unintended machine motion
- causing an explosion in a hazardous environment

Repeated electrical arcing causes excessive wear to contacts on both the module and its mating connector. Worn contacts may create electrical resistance.

4. Position the module (4) with its alignment bar (5) aligned with the groove (6) on the terminal base.

5. Press firmly and evenly to seat the module in the terminal base unit. The module is seated when the latching mechanism (7) is locked into the module.
6. Repeat the above steps to install the next module in its terminal base unit.

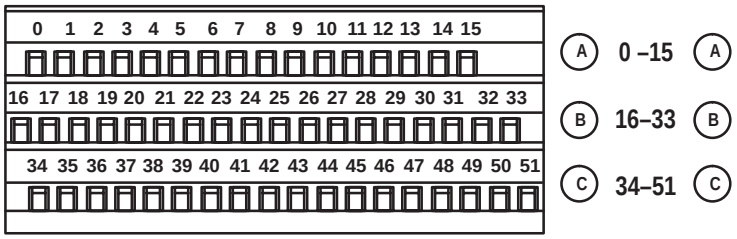
Connecting Wiring for the TC/RTD/mV Module

Wiring to the TC/RTD/mV module is made through the terminal base unit on which the module mounts.

Compatible terminal base units are:

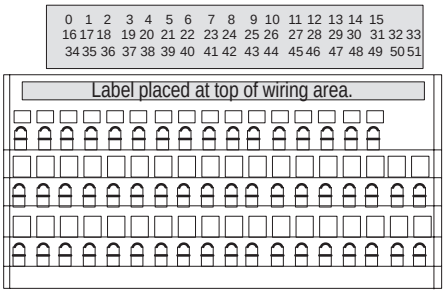
Module	1794-TB3G	1794-TB3GS
1794-IRT8	Yes	Yes

1794-TB3G



34 and 50 = 24V dc
35 and 51 = common
16 and 33 = chassis ground
40 thru 45 = chassis ground

1794-TB3GS



34 and 50 = 24V dc
35 and 51 = common
16 and 33 = chassis ground
40 thru 45 = chassis ground

Connecting Wiring using a 1794-TB3G and -TB3GS Terminal Base Units

1. Connect the individual signal wiring to numbered terminals on the **0–15** row **(A)** and **17–32** row **(B)** on the terminal base unit. Connect the input devices as shown in the wiring table on page 2–11.
2. Terminate shields:to terminals 16 or 33 on row **B**, or 40 through 45 on row **C**.
3. Connect +24V dc to terminal 34 on the **34-51** row (C), and 24V common to terminal 35 on the **34-51** row (C).

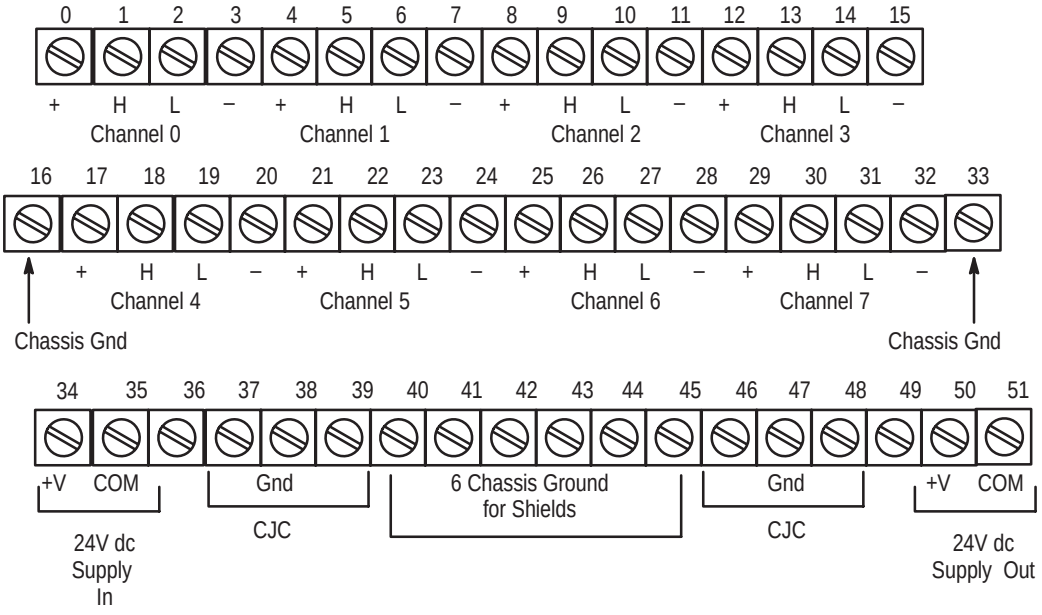
ATTENTION: To reduce susceptibility to noise, power TC/RTD/mV modules and digital modules from separate power supplies. Do not exceed a length of 33 ft (10m) for dc power cabling.

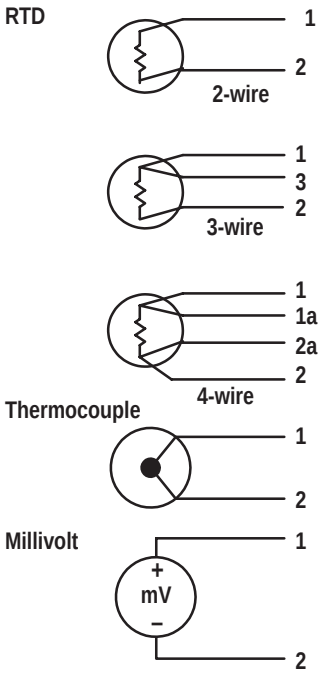
4. If daisy chaining the +24V dc power to the next base unit, connect a jumper from terminal 50 (+24V) on this base unit to terminal 34 and from terminal 51 (24V dc common) to terminal 35 on the next base unit.

ATTENTION: Do not daisy chain power or ground from the TC/RTD/mV terminal base unit to any ac or dc digital module terminal base unit.

ATTENTION: The TC/RTD/mV modules do not receive power from the backplane. +24V dc power must be applied to your module before operation. If power is not applied, the module position will appear to the adapter as an empty slot in your chassis. If the adapter does not recognize your module after installation is completed, cycle power to the adapter.

Connections for Terminal Base 1794-TB3G shown





Wiring connections for the 1794-IRT8 TC/RTD/mV Input Module

Type of Input	Connect the following:				
	H	L	+	–	Shield[1]
RTD – 2-wire			1	2	
RTD – 3-wire		3	1	2	
RTD – 4-wire	1a	2a	1	2	
Thermocouple		1		2	
Millivolt		1		2	

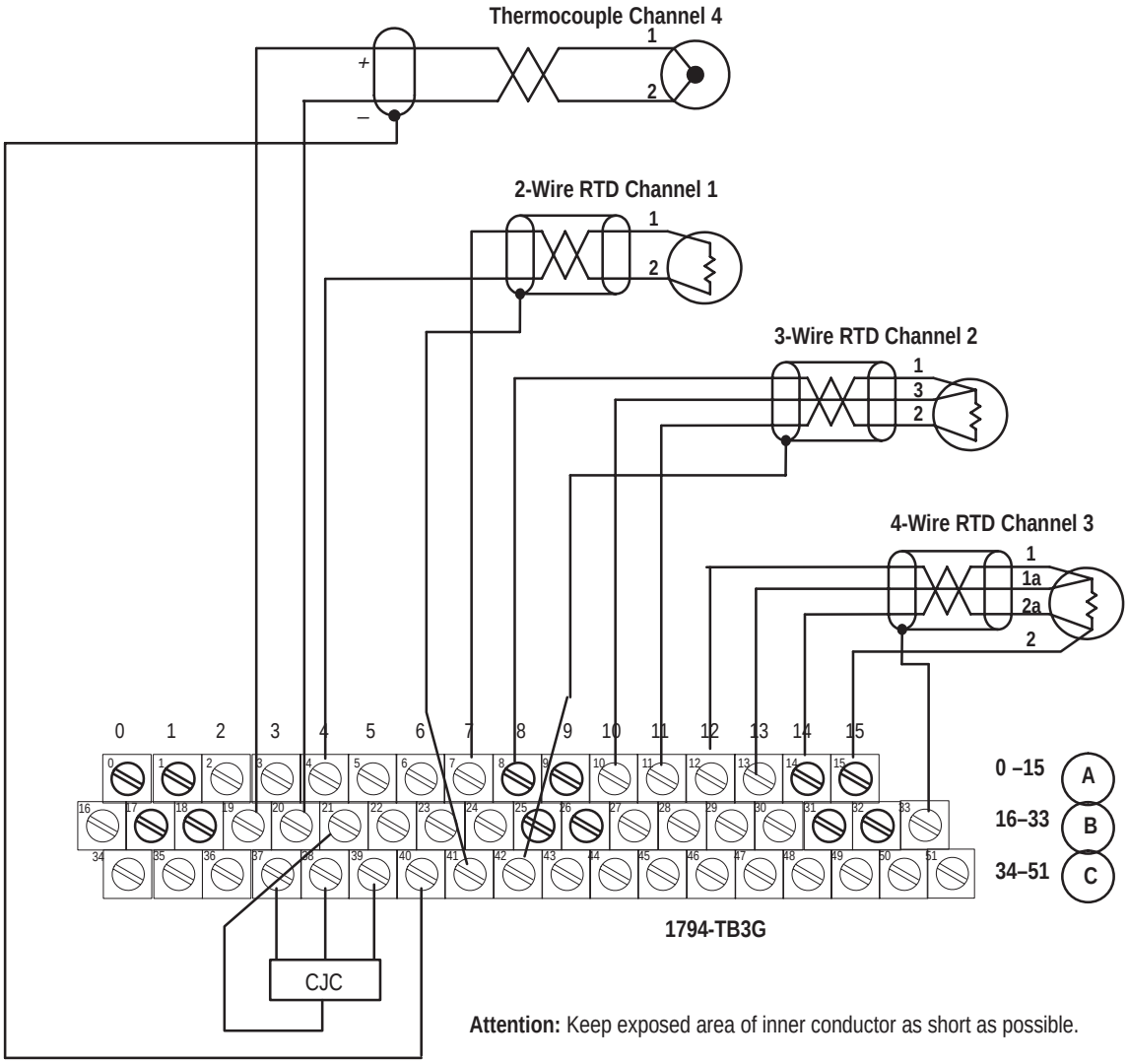
1 Terminals 37, 38 and 39 and 46, 47 and 48 are for cold junction compensation (with 38 and 47 chassis GND).

RTD or Thermocouple Channel	1794-TB3G and -TB3GS Terminal Base Units			
	High Signal Terminal (H)	Low Signal Terminal (L)	RTD Source Current (+)	Signal Return[1] (–)
0	1	2	0	3
1	5	6	4	7
2	9	10	8	11
3	13	14	12	15
4	18	19	17	20
5	22	23	21	24
6	26	27	25	28
7	30	31	29	32
+24V dc Power	34 and 50			
24V dc Common	35 and 51			

1 Terminals 37, 38 and 39 and 46, 47 and 48 are for cold junction compensation (with 38 and 47 chassis GND). Connect CJC1 to terminal 5 or 21; CJC2 to terminal 12 or 29.
2 Terminals 16, 33 and 40 thru 45 are chassis ground.

ATTENTION: Total current draw through the terminal base unit is limited to 10A. Separate power connections to the terminal base unit may be necessary.

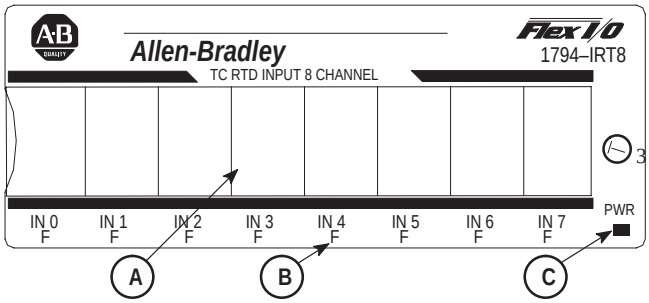
Example of 2-, 3- and 4-wire RTD and Thermocouple Wiring to a 1794-TB3G Terminal Base Unit



Attention: Keep exposed area of inner conductor as short as possible.

Module Indicators

The Thermocouple/RTD/mV module has one status indicator (PWR) that is on when power is applied to the module and one fault indicator (F) for each input.



A = Insertable label for writing individual input designations
B = Fault Indicator – indicates successful power up or noncritical fault
C = Power Indicator – indicates power applied to module

Indicator	Color	State	Meaning
Fault	Red	On	At power up – Channel 0 indicator lights at powerup until all internal diagnostics are checked. After successful powerup, the indicator goes off if no fault is present. After successful powerup – Indicates a critical fault (diagnostic failure, etc.)
		Blinking (when faults are enabled, and bit set)	Indicates a noncritical fault (such as open sensor.) Input data set to maximum, and indicator flashes at 1Hz rate.
Power		Off	Module not powered
	Green	On	Module receiving power.

Chapter Summary

In this chapter, we told you how to install your input module in an existing programmable controller system and how to wire to the terminal base units.

Programming Your Thermocouple/RTD Input Module

What This Chapter Contains

To initiate communication between the Thermocouple/RTD input module and your PLC processor, you must enter block transfer instructions into your ladder logic program. Use this chapter to enter the necessary block transfer instructions into your ladder logic program.

Enter Block Transfer Instructions

The Thermocouple/RTD input module communicates with the PLC processor through bidirectional block transfers. This is the sequential operation of both read and write block transfer instructions.

Before you configure the module, you need to enter block transfer instructions into your ladder logic. The following example programs illustrate the minimum programming required for communication to take place between the module and a PLC processor. These programs can be modified to suit your application requirements.

A configuration block transfer write (BTW) is initiated when the analog module is first powered up, and subsequently only when the programmer wants to enable or disable features of the module. The configuration BTW sets the bits which enable the programmable features of the module, such as filters and signal ranges, etc. Block transfer reads are performed to retrieve information from the module.

Block transfer read (BTR) programming moves status and data from the module to the processor's data table. The processor user program initiates the request to transfer data from the module to the processor. The transferred words contain module status, channel status and input data from the module.

Your program should monitor status bits, block transfer read and block transfer write activity.

PLC-2 Family Processor

The 1794 Thermocouple/RTD/mV modules are not recommended for use with PLC-2 family programmable controllers due to the number of digits needed for high resolution.

Important: The Thermocouple/RTD input module functions with reduced performance in PLC-2 systems. Because the module does not support BCD and the PLC-2 processor is limited to values of 4095 (12 bit binary), many values returned in the BTR file may not provide meaningful data to the PLC-2 processor.

PLC-3 Family Processor

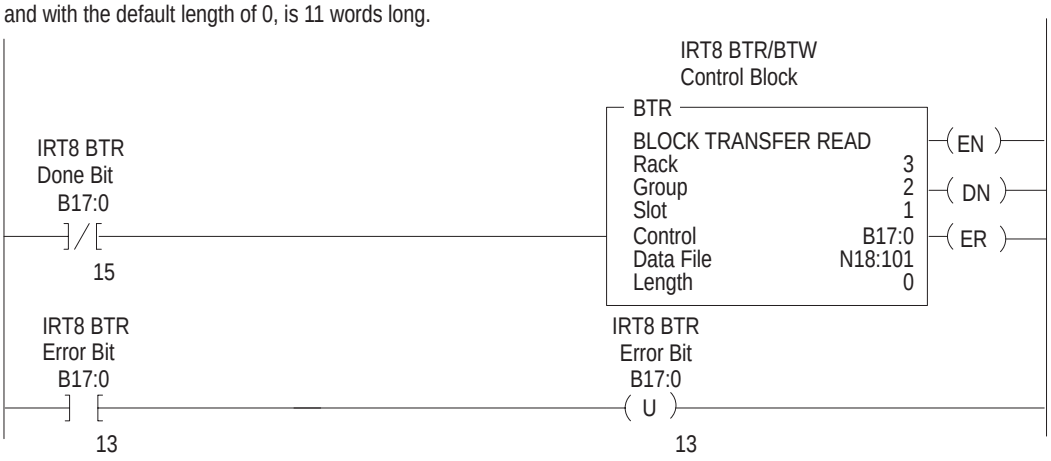
Block transfer instructions with the PLC-3 processor use a control file and a data file. The block transfer control file contains the data table section for module location, the address of the block transfer data file and other related data. The block transfer data file stores data that you want transferred to the module (when programming a BTW) or from the module (when programming a BTR).

The programming terminal prompts you to create a control file when a block transfer instruction is being programmed. **The same block transfer control file is used for both the read and write instructions for your module.** A different block transfer control file is required for every module.

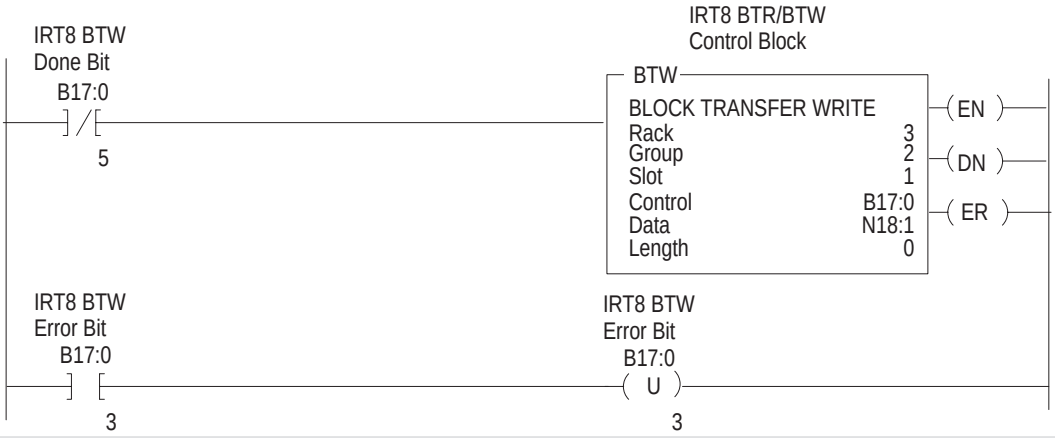
PLC-3 Processor Program Example

Rung M:0

The IRT8 module is located in rack 3, I/O group 2, slot 1. The control file is a 10 word file starting at B17:0 that is shared by the BTR/BTW. The data obtained by the PLC3 processor is placed in memory starting at location N18:101, and with the default length of 0, is 11 words long.



The IRT8 module is located in rack 3, I/O group 2, slot 1. The control file is a 10 word file starting at B17:0 that is shared by the BTR/BTW. The data sent by the PLC-3 processor to the IRT8 module is from PLC memory starting at N18:1, and with the default length of 0, is 4 words long.



PLC-5 Family Processor

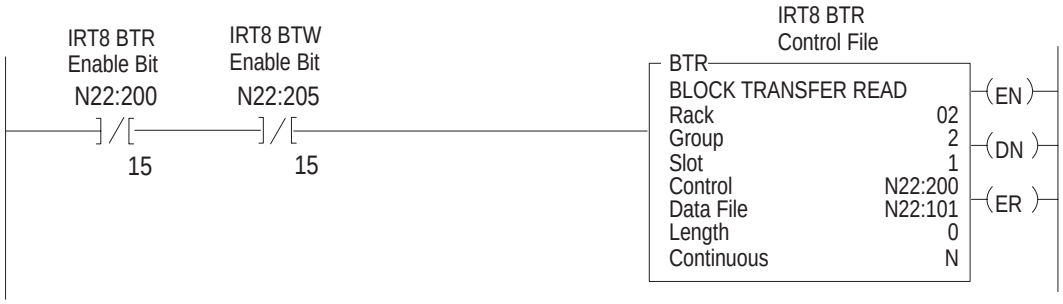
Block transfer instructions with the PLC-5 processor use a control file and a data file. The block transfer control file contains the data table section for module location, the address of the block transfer data file and other related data. The block transfer data file stores data that you want transferred to the module (when programming a BTW) or from the module (when programming a BTR).

The programming terminal prompts you to create a control file when a block transfer instruction is being programmed. **A different block transfer control file is used for the read and write instructions for your module.**

PLC-5 Processor Program Example

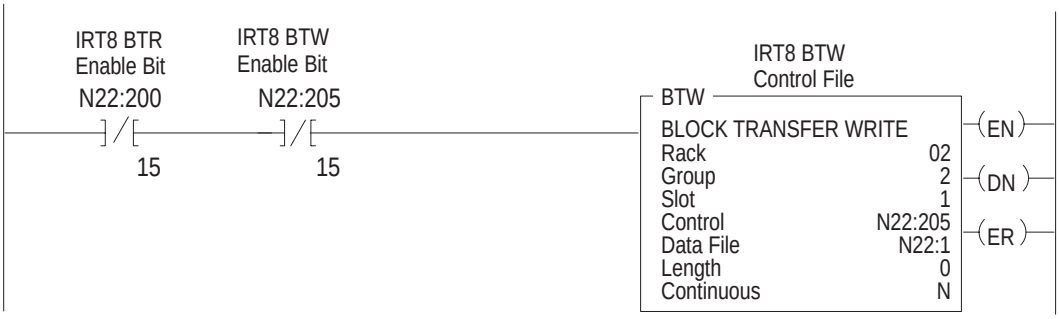
Rung 2:0

The IRT8 module is located in rack 2, I/O group 2, slot 1. The integer control file starts at N22:200, is 5 words long and is compatible with all PLC-5 family members. The data obtained by the PLC-5 processor from the IRT8 module is placed in memory starting at N22:101, and with the default length of 0, is 11 words long. The length can be any number between 0 and 11. In enhanced PLC-5 processors①, the block transfer data type may be used as a control file.



Rung 2:1

The IRT8 module is located in rack 2, group 2, slot 1. The integer control file starts at N22:205, is a 5 words long and is compatible will all PLC-5 family members. The data sent by the PLC-5 processor to the IRT8 module starts at N22:1, and with the default length of 0, is 4 words long. Valid BTW lengths: 0, 1, 2, 3, and 4. In enhanced PLC-5 processors[1], the block transfer data type may be used as a control file.



① Enhanced PLC-5 processors include: PLC-5/11, -5/20, -5/3*x*, -5/4*x*, and -5/6*x*.

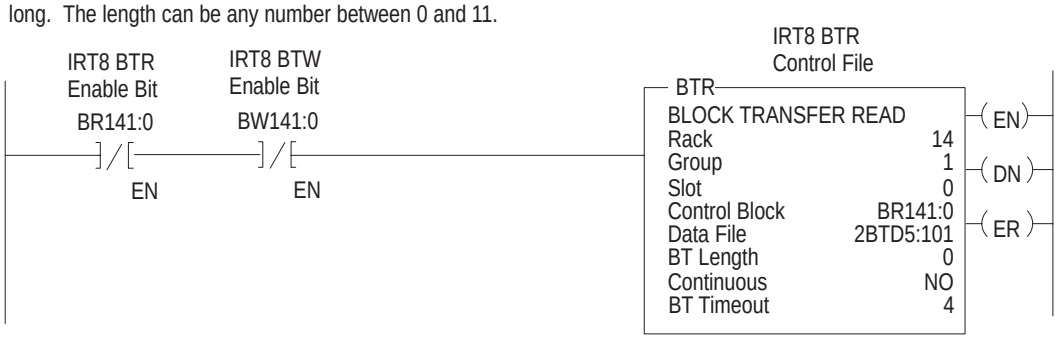
PLC-5/250 Processor

Block transfer instructions with the PLC-5/250 processor use a control file and a data file. The block transfer control file contains the data table section for module location, the address of the block transfer data file and other related data. The block transfer data file stores data that you want transferred to the module (when programming a BTW) or from the module (when programming a BTR).

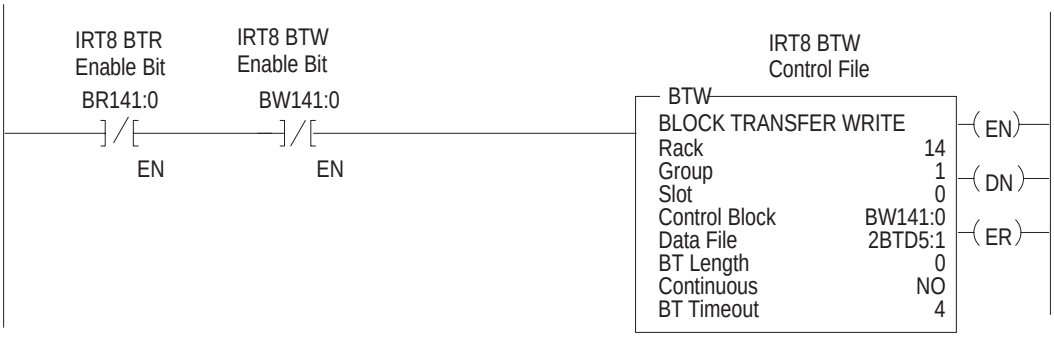
The programming terminal will automatically select the control file based on rack, group and module, and whether it is a read or write. **A different block transfer control file is used for the read and write instructions for your module.** A different block transfer control file is required for every module.

PLC-5/250 Processor Program Example

Rung 1STEPO:1
The IRT8 module is located in rack 14, I/O group 1, slot 0. The data obtained by the PLC-5/250 processor from the IRT8 module is placed in the data table starting at 2BTD5:101, and with the default length of 0, is 11 words long. The length can be any number between 0 and 11.

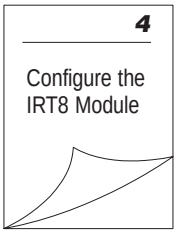


Rung 1STEPO:1
The IRT8 module is located in rack 14, I/O group 1, slot 0. The data sent to the IRT8 module from the PLC-5/250 processor is from the data table starting at 2BTD5:1, and with a default length of 0, is 4 words long.
Valid BTW lengths: 0, 1, 2, 3, and 4.



Chapter Summary

In this chapter, you learned how to program with your IRT8 input module using block transfer instructions and ladder logic. Now, you can configure your module.



Writing Configuration to and Reading Status from Your Module with a Remote I/O Adapter

What This Chapter Contains

In this chapter, we tell you about:

Configuring Your Thermocouple/RTD/mV Input Module

The TC/RTD/mV input module is configured using a group of data table words that are transferred to the module using a block transfer write instruction.

The software configurable features available are:

- input range selection
- selectable single pole low pass filter
- data reported in ^{o}F, ^{o}C, ^{o}K, mV, ohms, unipolar or bipolar count

Note: Programmable controllers that use 6200 software (release 4.2 or higher) programming tools can take advantage of the IOCONFIG Addendum utility to configure this module. IOCONFIG Addendum uses menu–based screens for configuration without having to set individual bits in particular locations. Refer to your 6200 software literature for details.

Important: It is strongly recommended that you use IOCONFIG Addendum to configure this module. The IOCONFIG Addendum utility greatly simplifies configuration. If the IOCONFIG Addendum is not available, you must enter data directly into the data table. Use this chapter as a reference when performing this task.

Sensor Types

Individual input channels are configurable to operate with the following sensor types:

RTD Type		
Sensor type for channels 0 through 3		
Sensor type for channels 4 through 7		
Resistance (default)		
100 ohm Pt α = 0.00385 Euro (–200 to +870^{o}C)		
200 ohm Pt α = 0.00385 Euro (–200 to +400^{o}C)		
100 ohm Pt α = 0.003916 U.S. (–200 to +630^{o}C)		
200 ohm Pt α = 0.003916 U.S. (–200 to +400^{o}C)		
100 ohm Nickel α = 0.00618 (–60 to +250^{o}C)		
200 ohm Nickel α = 0.00618 (–60 to +200^{o}C)		
120 ohm Nickel α = 0.00672 (–80 to +320^{o}C)		
10 ohm Copper α = 0.00427 (–200 to +260^{o}C)		
Thermocouple Type		
Sensor type for channels 0 through 3		
Sensor type for channels 4 through 7		
mV (default)		
B	300 to 1800^{o}C	(572 to 3272^{o}F)
E	–270 to 1000^{o}C	(–454 to 1832^{o}F)
J	–210 to 1200^{o}C	(–346 to 2192^{o}F)
K	–270 to 1372^{o}C	(–454 to 2502^{o}F)
L	-200 to 800^{o}C	(-328 to 1472^{o}F)
N	–270 to 1300^{o}C	(–450 to 2372^{o}F)
R	–50 to 1768^{o}C	(–58 to 3214^{o}F)
S	–50 to 1768^{o}C	(–58 to 3214^{o}F)
T	–270 to 400^{o}C	(–454 to 752^{o}F)

You select individual channel ranges using write word 1 of the block transfer write instruction.

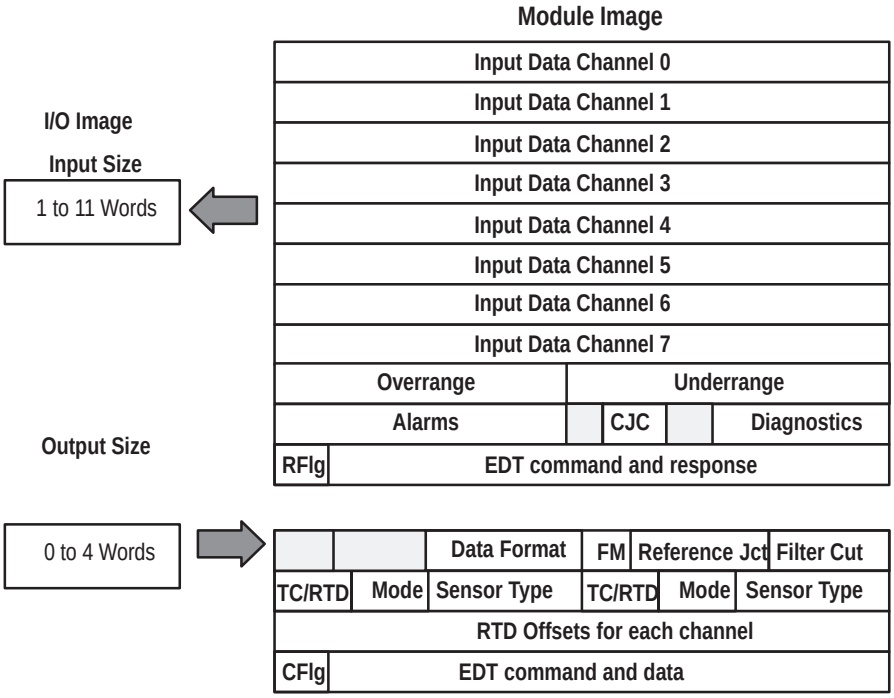
Reading Data From Your Module

Read programming moves status and data from the TC/RTD input module to the processor's data table in one I/O scan. The processor's user program initiates the request to transfer data from the TC/RTD input module to the processor.

Mapping Data for the Thermocouple/RTD/mV Module

The following read and write words and bit/word descriptions describe the information written to and read from the TC/RTD input module. The module uses up to 11 words of input data and up to 4 words of output data. Each word is composed of 16 bits.

Thermocouple/RTD Input Module (1794-IRT8) Image Table Mapping



Thermocouple/RTD/mV Input Module (1794-IRT8) Read Words

Decimal	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Octal	17	16	15	14	13	12	11	10	07	06	05	04	03	02	01	00
Word⇓	Read															
0	Channel 0 Input Data															
1	Channel 1 Input Data															
2	Channel 2 Input Data															
3	Channel 3 Input Data															
4	Channel 4 Input Data															
5	Channel 5 Input Data															
6	Channel 6 Input Data															
7	Channel 7 Input Data															

Decimal	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Octal	**17**	**16**	**15**	**14**	**13**	**12**	**11**	**10**	**07**	**06**	**05**	**04**	**03**	**02**	**01**	**00**
8	Overrange Alarm Bits (channel 0 = bit 08, etc)								Underrange Alarm Bits (channel 0 = bit 00, etc)							
9	Flt Alm Ch7	Flt Alm Ch6	Flt Alm Ch5	Flt Alm Ch4	Flt Alm Ch3	Flt Alm Ch2	Flt Alm Ch1	Flt Alm Ch0	Rsvd	CJC 2 Alm	CJC 1 Alm	Rsvd	Diagnostic Status			
10	Resp Flg	EDT command response							EDT response data							

Bit/Word Descriptions for the Thermocouple/RTD Input Module (1794-IRT8) Block Transfer Read Words

Word	Dec. Bits (Octal Bits)	Description
Read Word 0	00–15 (00–17)	Channel 0 Input data
Read Word 1	00–15 (00–17)	Channel 1 Input data
Read Word 2	00–15 (00–17)	Channel 2 Input data
Read Word 3	00–15 (00–17)	Channel 3 Input data
Read Word 4	00–15 (00–17)	Channel 4 Input data
Read Word 5	00–15 (00–17)	Channel 5 Input data
Read Word 6	00–15 (00–17)	Channel 6 Input data
Read Word 7	00–15 (00–17)	Channel 7 Input data
Read Word 8	00–07	**Underrange bits –** these bits are set if the input signal is below the input channel's minimum range. Bit 00 corresponds to channel 0, bit 01 corresponds to channel 1, etc.
	08–15 (10–17)	**Overrange bits –** these bits are set if 1), the input signal is above the input channel's maximum range, or 2), an open detector is detected. Bit 08 (10) corresponds to channel 0, bit 09 (11) corresponds to channel 1, etc.
Read Word 9	00–03	**Diagnostic bits –** represent module configuration and/or hardware errors.
	04	Not used.
	05–06	**Cold junction compensation alarm bits –** These bits are set (1) when the corresponding cold junction compensator lead is broken, unattached or shorted. Bit 05 corresponds to CJC1, and bit 06 to CJC2.
	07	Not used
	08–15 (10–17)	**Fault alarm bits –** An alarm bit is set (1) when an individual input lead opens (broken, disconnected). If the alarm is enabled, the channel reads maximum value. Bit 08 (10) corresponds to input channel 0, bit 09 (11) to channel 1, etc.
Read Word 10	00–07	**Extended data table command response data bits –** These bits echo the EDT command data written to the module during calibration.
	08–14 (10–16)	**Extended data table command response bits –** These bits echo the EDT command written to the module during calibration.
	15 (17)	Reserved for factory use

Bit	03	02	01	00	
	0	0	0	0	Reserved for factory use
	0	0	1	0	Improper module configuration
	0001 and 0011 thru 1111 Reserved for factory use				

Thermocouple/RTD/mV Input Module (1794-IRT8) Write Words

Output Mapping

Decimal / Octal	15 / 17	14 / 16	13 / 15	12 / 14	11 / 13	10 / 12	09 / 11	08 / 10	07 / 07	06 / 06	05 / 05	04 / 04	03 / 03	02 / 02	01 / 01	00 / 00
Word⇓	Write															
0	Not used				Data Format				Flt Mode Ch 0-3	Flt Mode Ch 4-7	Reference Jct.			Filter Cutoff		
1	TC/RTD Ch. 4-7		Sensor Mode Ch. 4-7		Sensor Mode Ch. 4-7				TC/RTD Ch. 0-3		Sensor Mode Ch. 0-3		Sensor Mode Ch. 0-3			
2	RTD Offset Ch 7		RTD Offset Ch 6		RTD Offset Ch 5		RTD Offset Ch 4		RTD Offset Ch 3		RTD Offset Ch 2		RTD Offset Ch 1		RTD Offset Ch 0	
3	Cmd Flag	EDT command							EDT command data							

Bit/Word Definitions for the Block Transfer Write Words for the TC/RTD/mV Input Module

Word	Dec. Bits (Octal Bits)	Description				
Write Word 0	00–02	**Input Filter Cutoff bits**				
		Bit	02	01	00	Definition
			0	0	0	Hardware filtering only (default filtering)
			0	0	1	40Hz
			0	1	0	10Hz
			0	1	1	4Hz
			1	0	0	2Hz
			1	0	1	1Hz
			1	1	0	0.5Hz
			1	1	1	0.2Hz
	Bits 03–05	**Reference Junction** – used when input type is set to thermocouple and sensor mode is set to internal compensation. Sets a fixed reference junction to compensate all thermocouple channels.				
		Bit	05	04	03	**Reference Junction**
			0	0	0	0°C
			0	0	1	20°C
			0	1	0	25°C
			0	1	1	30°C
			1	0	0	40°C
			1	0	1	50°C
			1	1	0	60°C
			1	1	1	70°C

Word	Dec. Bits (Octal Bits)	Description
Write Word 0	Bits 06–07	**Fault Mode bits –** when a bit is set (1), fault mode is enabled for that channel. Bit 06 corresponds to channels 0–3; bit 07 corresponds to channels 4–7. 0 = disabled 1 = enable wire-off detection
	Bits 08–11 (10–13)	**Data format** – module defaults to –4000 to 10000 in millivolt mode, and 0 to 5000 in ohms mode

Bit	11	10	09	08	Data type for channels 0–7
	0	0	0		^{0}C
	0	0	1		^{0}F
	0	1	0		^{0}K
	0	1	1		–32767 to +32767
	1	0	0		0 to 65535
	0101 through 1111 not used				

	Bits 12–15 (14–17)	Not used
Write Word 1	Bits 00–03	**Sensor Type (Thermocouple or RTD)**
		RTD Type

Bit	03	02	01	00	Sensor type for channels 0 through 3
	0	0	0	0	Resistance (default)
	0	0	0	1	100 ohm Pt α = 0.00385 Euro (–200 to +870^{0}C)
	0	0	1	0	200 ohm Pt α = 0.00385 Euro (–200 to +400^{0}C)
	0	0	1	1	100 ohm Pt α = 0.003916 U.S. (–200 to +630^{0}C)
	0	1	0	0	200 ohm Pt α = 0.003916 U.S. (–200 to +400^{0}C)
	0	1	0	1	100 ohm Nickel (–60 to +250^{0}C)
	0	1	1	0	200 ohm Nickel (–60 to +200^{0}C)
	0	1	1	1	120 ohm Nickel (–80 to +320^{0}C)
	1	0	0	0	10 ohm Copper (–200 to +260^{0}C)
	1001 through 1111 not used				

Word	Dec. Bits (Octal Bits)	Description					
Write Word 1 cont.	Bits 00–03	**Thermocouple Type**					
		Bit	03	02	01	00	Sensor type for channels 0 through 3
			0	0	0	0	mV (default)
			0	0	0	1	B 300 to 1800°C (572 to 3272°F)
			0	0	1	0	E –270 to 1000°C (–454 to 1832°F)
			0	0	1	1	J –210 to 1200°C (–346 to 2192°F)
			0	1	0	0	K –270 to 1372°C (–454 to 2502°F)
			0	1	0	1	L -200 to 800°C (-328 to 1472°F)
			0	1	1	0	N –270 to 1300°C (–450 to 2372°F)
			0	1	1	1	R –50 to 1768°C (–58 to 3214°F)
			1	0	0	0	S –50 to 1768°C (–58 to 3214°F)
			1	0	0	1	T –270 to 400°C (–454 to 752°F)
			1010 through 1111 not used				
	Bits 04–05	**Sensor Mode Select bits**					
		Bit	05	04	Sensor mode select for channels 0–3		
		Thermocouple					
			0	0	External compensation – uses cold junction sensor		
			0	1	Internal compensation – uses the value selected for reference junction		
			1	0	No compensation (Data is referenced to 0°C.)		
			1	1	Differential measurement between 2 channels		
		RTD					
			0	0	2-wire RTD no compensation		
			0	1	2-wire RTD with loop resistance compensation		
			1	0	3-wire RTD		
			1	1	4-wire RTD		
	Bits 06–07	**Input Type Select**					
		Bit	07	06	Input type selection for channels 0–3		
			0	0	Thermocouple		
			0	1	RTD		
			1	0	Not used		
			1	1			

Word	Dec. Bits (Octal Bits)	Description					
Write Word 1	Bits 08–11 (10–13)	**Sensor Type (Thermocouple or RTD)**					
		RTD Type					
		Bit	11	10	09	08	Sensor type for channels 4 through 7
			0	0	0	0	Resistance (default)
			0	0	0	1	100 ohm Pt α = 0.00385 Euro (–200 to +870^{o}C)
			0	0	1	0	200 ohm Pt α = 0.00385 Euro (–200 to +400^{o}C)
			0	0	1	1	100 ohm Pt α = 0.003916 U.S. (–200 to +630^{o}C)
			0	1	0	0	200 ohm Pt α = 0.003916 U.S. (–200 to +400^{o}C)
			0	1	0	1	100 ohm Nickel (–60 to +250^{o}C)
			0	1	1	0	200 ohm Nickel (–60 to +200^{o}C)
			0	1	1	1	120 ohm Nickel (–80 to +320^{o}C)
			1	0	0	0	10 ohm Copper (–200 to +260^{o}C)
			1001 through 1111 not used				
		Thermocouple Type					
		Bit	11	10	09	08	Sensor type for channels 4 through 7
			0	0	0	0	mV (default)
			0	0	0	1	B 300 to 1800^{o}C (572 to 3272^{o}F)
			0	0	1	0	E –270 to 1000^{o}C (–454 to 1832^{o}F)
			0	0	1	1	J –210 to 1200^{o}C (–346 to 2192^{o}F)
			0	1	0	0	K –270 to 1372^{o}C (–454 to 2502^{o}F)
			0	1	0	1	L -200 to 800^{o}C (-328 to 1472^{o}F)
			0	1	1	0	N –270 to 1300^{o}C (–450 to 2372^{o}F)
			0	1	1	1	R –50 to 1768^{o}C (–58 to 3214^{o}F)
			1	0	0	0	S –50 to 1768^{o}C (–58 to 3214^{o}F)
			1	0	0	1	T –270 to 400^{o}C (–454 to 752^{o}F)
			1010 through 1111 not used				
	Bits 12–13 (14–15)	**Sensor Mode Select bits**					
		Bit	13	12	Sensor mode select for channels 4–7		
		Thermocouple					
			0	0	External compensation – uses cold junction sensor		
			0	1	Internal compensation – uses the value selected for reference junction		
			1	0	No compensation (Data is referenced to 0^{o}C.)		
			1	1	Differential measurement between 2 channels		
		RTD					
			0	0	2-wire RTD no compensation		
			0	1	2-wire RTD with loop resistance compensation		
			1	0	3-wire RTD		
			1	1	4-wire RTD		

Word	Dec. Bits (Octal Bits)	Description			
word 1 cont.	Bits 14–15 (16–17)	**Input Type Select**			
		Bit	15	14	Input type selection for channels 4–7
			0	0	Thermocouple
			0	1	RTD
			1	0	Not used
			1	1	
Write Word 2	00–15 (00–17)	**RTD loop resistance offset select bits –** used when input type is set to RTD and sensor mode select is set to 2-wire with loop resistance compensation. Allows you to set the type of RTD loop resistance compensation used for all RTDs or one of three fixed values for all channels. **NOTE:** Not applicable to 10Ω copper RTD, which defaults to 0Ω.			
		Bit	01	00	RTD channel 0
		Bit	03	02	RTD channel 1
		Bit	05	04	RTD channel 2
		Bit	07	06	RTD channel 3
		Bit	09	08	RTD channel 4
		Bit	11	10	RTD channel 5
		Bit	13	12	RTD channel 6
		Bit	15	14	RTD channel 7
			0	0	Use channel loop compensation value stored during calibration procedure for 2-wire RTD (default = 0Ω)
			0	1	5Ω
			1	0	10Ω
			1	1	15Ω
Write Word 3	00–07	**Extended data table command data bits –** These bits are written to the module during calibration. They are used to define offset, gain and general channel calibration.			
	08–14 (10–16)	**Extended data table command bits –** These bits are written to the module during calibration. They are used to select channel calibration action.			
	15 (17)	Reserved for factory use only			

Chapter Summary

In this chapter, you learned how to configure your module's features and enter your data.

How Communication Takes Place and I/O Image Table Mapping with the DeviceNet Adapter

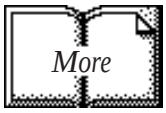
Chapter Objectives

In this chapter, we tell you about:

- DeviceNetManager software
- I/O structure
- image table mapping
- factory defaults

About DeviceNetManager Software

DeviceNetManager software is a tool used to configure your FLEX I/O DeviceNet adapter and its related modules. This software tool can be connected to the adapter via the DeviceNet network.

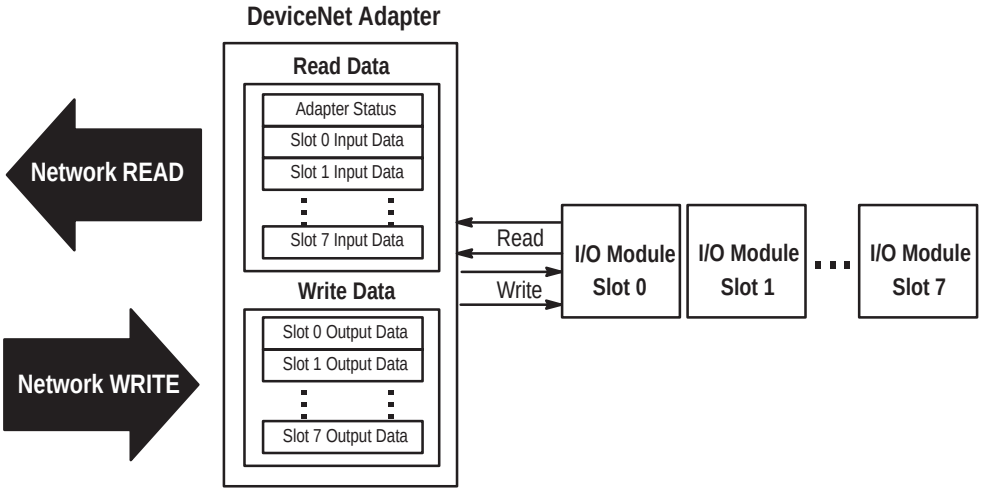


You must understand how DeviceNetManager software works in order to add a device to the network. Refer to the DeviceNetManager Software User Manual, publication 1787-6.5.3.

Polled I/O Structure

Output data is received by the adapter in the order of the installed I/O modules. The Output data for Slot 0 is received first, followed by the Output data for Slot 1, and so on up to slot 7.

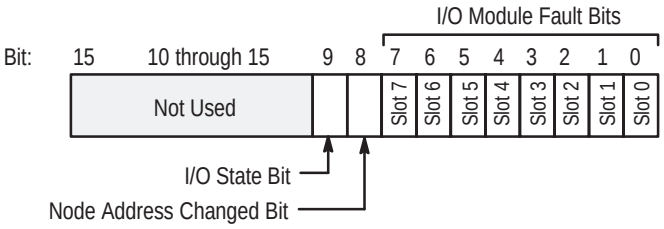
The first word of input data sent by the adapter is the Adapter Status Word. This is followed by the input data from each slot, in the order of the installed I/O modules. The Input data from Slot 0 is first after the status word, followed by Input data from Slot 2, and so on up to slot 7.



Adapter Input Status Word

The input status word consists of:

- I/O module fault bits – 1 status bit for each slot
- node address changed – 1 bit
- I/O status – 1 bit



The adapter input status word bit descriptions are shown in the following table.

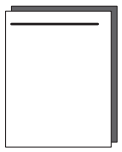
Bit Description	Bit	Explanation
I/O Module Fault	0	This bit is set (1) when an error is detected in slot position 0.
	1	This bit is set (1) when an error is detected in slot position 1.
	2	This bit is set (1) when an error is detected in slot position 2.
	3	This bit is set (1) when an error is detected in slot position 3.
	4	This bit is set (1) when an error is detected in slot position 4.
	5	This bit is set (1) when an error is detected in slot position 5.
	6	This bit is set (1) when an error is detected in slot position 6.
	7	This bit is set (1) when an error is detected in slot position 7.
Node Address Changed	8	This bit is set (1) when the node address switch setting has been changed since power up.
I/O State	9	Bit = 0 – idle Bit = 1 – run
	10 thru 15	Not used – sent as zeroes.

Possible causes for an **I/O Module Fault** are:

- transmission errors on the Flex I/O backplane
- a failed module
- a module removed from its terminal base
- incorrect module inserted in a slot position
- the slot is empty

The **node address changed** bit is set when the node address switch setting has been changed since power up. The new node address does not take affect until the adapter has been powered down and then powered back up.

System Throughput



System throughput, from analog input to backplane, is a function of:

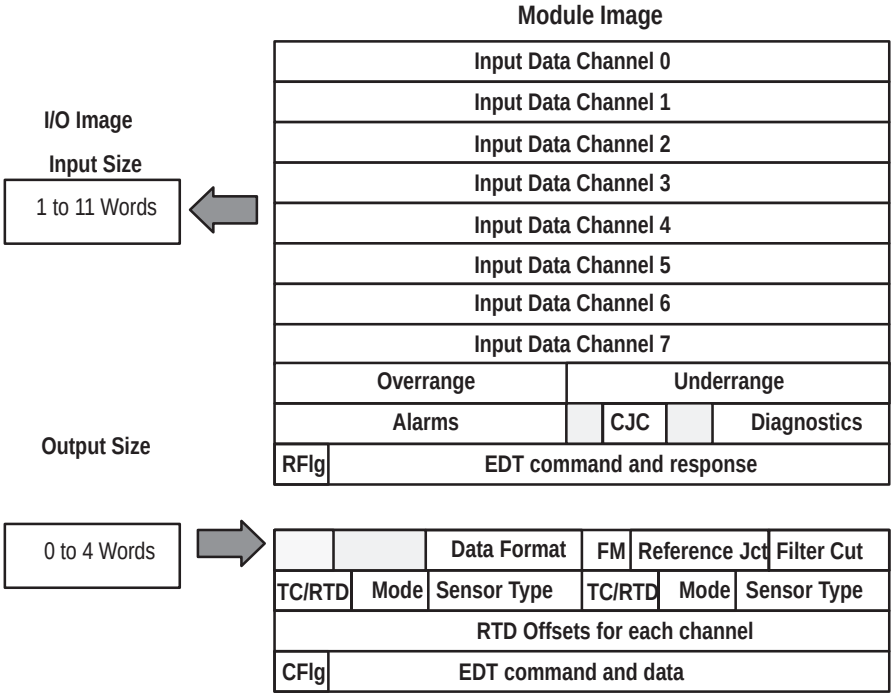
- the data format selected
- the type and mode of sensors selected
- whether filtering is selected

The A/D converter which converts channel 0 through 7 analog data to a digital word provides a programmable single low pass filter. You can set the frequency of this filter during module configuration. The selection influences the A/D output data rate, thus affecting system throughput.

Mapping Data into the Image Table

FLEX I/O Thermocouple/RTD input module data table mapping is shown below.

Thermocouple/RTD Input Module (1794-IRT8) Image Table Mapping



Thermocouple/RTD Input Module (1794-IRT8) Read Words

Decimal	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Octal	17	16	15	14	13	12	11	10	07	06	05	04	03	02	01	00
Word⇓	Read															
1	Channel 0 Input Data															
2	Channel 1 Input Data															
3	Channel 2 Input Data															
4	Channel 3 Input Data															
5	Channel 4 Input Data															
6	Channel 5 Input Data															
7	Channel 6 Input Data															
8	Channel 7 Input Data															
9	Overrange Alarm Bits (channel 0 = bit 08, etc)								Underrange Alarm Bits (channel 0 = bit 00, etc)							
10	Flt Alm Ch7	Flt Alm Ch6	Flt Alm Ch5	Flt Alm Ch4	Flt Alm Ch3	Flt Alm Ch2	Flt Alm Ch1	Flt Alm Ch0		CJC 2 Alm	CJC 1 Alm		Diagnostic Status			
11		EDT command response							EDT response data							

Thermocouple/RTD Input Module (1794-IRT8) Write Words

Decimal	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Octal	17	16	15	14	13	12	11	10	07	06	05	04	03	02	01	00
Word⇓	Write															
1					Data Format				Flt Mode Ch 0-3	Flt Mode Ch 4-7	Reference Jct.			Filter Cutoff		
2	TC/RTD Ch. 4-7		Sensor Mode Ch. 4-7		Sensor Mode Ch. 4-7				TC/RTD Ch. 0-3		Sensor Mode Ch. 0-3		Sensor Mode Ch. 0-3			
3	RTD Offset Ch 7		RTD Offset Ch 6		RTD Offset Ch 5		RTD Offset Ch 4		RTD Offset Ch 3		RTD Offset Ch 2		RTD Offset Ch 1		RTD Offset Ch 0	
4		EDT command							EDT command data							

Bit/Word Descriptions for the Thermocouple/RTD/mV Input Module (1794-IRT8)

Word	Dec. Bits (Octal Bits)	Description
Read Word 1	00–15 (00–17)	Channel 0 Input data
Read Word 2	00–15 (00–17)	Channel 1 Input data
Read Word 3	00–15 (00–17)	Channel 2 Input data
Read Word 4	00–15 (00–17)	Channel 3 Input data
Read Word 5	00–15 (00–17)	Channel 4 Input data
Read Word 6	00–15 (00–17)	Channel 5 Input data
Read Word 7	00–15 (00–17)	Channel 6 Input data
Read Word 8	00–15 (00–17)	Channel 7 Input data
Read Word 9	00–07	**Underrange bits –** these bits are set if the input signal is below the input channel's minimum range. Bit 00 corresponds to channel 0, bit 01 corresponds to channel 1, etc.
	08–15 (10–17)	**Overrange bits –** these bits are set if 1), the input signal is above the input channel's maximum range, or 2), an open detector is detected. Bit 08 (10) corresponds to channel 0, bit 09 (11) corresponds to channel 1, etc.
Read Word 10	00–03	**Diagnostic bits –** represent module configuration and/or hardware errors.
		Bit 03 02 01 00
		0 0 0 0 Reserved for factory use
		0 0 1 0 Improper module configuration
		0001 and 0011 thru 1111 Reserved for factory use
	04	Not used.
	05–06	**Cold junction compensation alarm bits –** These bits are set (1) when the corresponding cold junction compensator lead is broken, unattached or shorted. Bit 05 corresponds to CJC1, and bit 06 to CJC2.
	07	Not used
	08–15 (10–17)	**Fault alarm bits –** An alarm bit is set (1) when an individual input lead opens (broken, disconnected). If the alarm is enabled, the channel reads maximum value. Bit 08 (10) corresponds to input channel 0, bit 09 (11) to channel 1, etc.
Read Word 11	00–07	**Extended data table command response data bits –** These bits echo the EDT command data written to the module during calibration.
	08–14 (10–16)	**Extended data table command response bits –** These bits echo the EDT command written to the module during calibration.
	15 (17)	Reserved for factory use

Word	Dec. Bits (Octal Bits)	Description
Write Word 1	Bits 00–02	**Input Filter Cutoff bits**

Bit	02	01	00	Definition
	0	0	0	Hardware filtering only (default filtering)
	0	0	1	40Hz
	0	1	0	10Hz
	0	1	1	4Hz
	1	0	0	2Hz
	1	0	1	1Hz
	1	1	0	0.5Hz
	1	1	1	0.2Hz

Bits 03–05: **Reference Junction** – used when input type is set to thermocouple and sensor mode is set to internal compensation. Sets a fixed reference junction to compensate all thermocouple channels.

Bit	05	04	03	**Reference Junction**
	0	0	0	$0^{o}C$
	0	0	1	$20^{o}C$
	0	1	0	$25^{o}C$
	0	1	1	$30^{o}C$
	1	0	0	$40^{o}C$
	1	0	1	$50^{o}C$
	1	1	0	$60^{o}C$
	1	1	1	$70^{o}C$

Bits 06–07: **Fault Mode bits –** when a bit is set (1), fault mode is enabled for that channel. Bit 06 corresponds to channels 0–3; bit 07 corresponds to channels 4–7.
0 = disabled
1 = enable wire-off detection

Bits 08–11 (10–13): **Data format** – module defaults to –4000 to 10000 in millivolt mode, and 0 to 5000 in ohms mode

Bit	11	10	09	08	Data type for channels 0–7
	0	0	0		^{o}C
	0	0	1		^{o}F
	0	1	0		^{o}K
	0	1	1		–32767 to +32767
	1	0	0		0 to 65535
	0101 through 1111 not used				

Bits 12–15 (14–17): Not used

Word	Dec. Bits (Octal Bits)	Description					
Write Word 2	Bits 00–03	**Sensor Type (Thermocouple or RTD)**					
		RTD Type					
		Bit	03	02	01	00	Sensor type for channels 0 through 3
			0	0	0	0	Resistance (default)
			0	0	0	1	100 ohm Pt α = 0.00385 Euro (–200 to +870^{o}C)
			0	0	1	0	200 ohm Pt α = 0.00385 Euro (–200 to +400^{o}C)
			0	0	1	1	100 ohm Pt α = 0.003916 U.S. (–200 to +630^{o}C)
			0	1	0	0	200 ohm Pt α = 0.003916 U.S. (–200 to +400^{o}C)
			0	1	0	1	100 ohm Nickel (–60 to +250^{o}C)
			0	1	1	0	200 ohm Nickel (–60 to +200^{o}C)
			0	1	1	1	120 ohm Nickel (–80 to +320^{o}C)
			1	0	0	0	10 ohm Copper (–200 to +260^{o}C)
			1001 through 1111 not used				
	Bits 00–03	**Thermocouple Type**					
		Bit	03	02	01	00	Sensor type for channels 0 through 3
			0	0	0	0	mV (default)
			0	0	0	1	B 300 to 1800^{o}C (572 to 3272^{o}F)
			0	0	1	0	E –270 to 1000^{o}C (–454 to 1832^{o}F)
			0	0	1	1	J –210 to 1200^{o}C (–346 to 2192^{o}F)
			0	1	0	0	K –270 to 1372^{o}C (–454 to 2502^{o}F)
			0	1	0	1	L -200 to 800^{o}C (-328 to 1472^{o}F)
			0	1	1	0	N –270 to 1300^{o}C (–450 to 2372^{o}F)
			0	1	1	1	R –50 to 1768^{o}C (–58 to 3214^{o}F)
			1	0	0	0	S –50 to 1768^{o}C (–58 to 3214^{o}F)
			1	0	0	1	T –270 to 400^{o}C (–454 to 752^{o}F)
			1010 through 1111 not used				

Word	Dec. Bits (Octal Bits)	Description			
Write word 2 cont.	Bits 04–05	**Sensor Mode Select bits**			
		Bit	05	04	Sensor mode select for channels 0–3
		Thermocouple			
			0	0	External compensation – uses cold junction sensor
			0	1	Internal compensation – uses the value selected for reference junction
			1	0	No compensation (Data is referenced to 0ºC.)
			1	1	Differential measurement between 2 channels
		RTD			
			0	0	2-wire RTD no compensation
			0	1	2-wire RTD with loop resistance compensation
			1	0	3-wire RTD
			1	1	4-wire RTD
	Bits 06–07	**Input Type Select**			
		Bit	07	06	Input type selection for channels 0–3
			0	0	Thermocouple
			0	1	RTD
			1	0	Not used
			1	1	

Word	Dec. Bits (Octal Bits)	Description					
Write Word 2 cont.	Bits 08–11 (10–13)	**Sensor Type (Thermocouple or RTD)**					
		RTD Type					
		Bit	11	10	09	08	Sensor type for channels 4 through 7
			0	0	0	0	Resistance (default)
			0	0	0	1	100 ohm Pt α = 0.00385 Euro (–200 to +870^{o}C)
			0	0	1	0	200 ohm Pt α = 0.00385 Euro (–200 to +400^{o}C)
			0	0	1	1	100 ohm Pt α = 0.003916 U.S. (–200 to +630^{o}C)
			0	1	0	0	200 ohm Pt α = 0.003916 U.S. (–200 to +400^{o}C)
			0	1	0	1	100 ohm Nickel (–60 to +250^{o}C)
			0	1	1	0	200 ohm Nickel (–60 to +200^{o}C)
			0	1	1	1	120 ohm Nickel (–80 to +320^{o}C)
			1	0	0	0	10 ohm Copper (–200 to +260^{o}C)
			1001 through 1111 not used				
		Thermocouple Type					
		Bit	11	10	09	08	Sensor type for channels 4 through 7
			0	0	0	0	mV (default)
			0	0	0	1	B 300 to 1800^{o}C (572 to 3272^{o}F)
			0	0	1	0	E –270 to 1000^{o}C (–454 to 1832^{o}F)
			0	0	1	1	J –210 to 1200^{o}C (–346 to 2192^{o}F)
			0	1	0	0	K –270 to 1372^{o}C (–454 to 2502^{o}F)
			0	1	0	1	L -200 to 800^{o}C (-328 to 1472^{o}F)
			0	1	1	0	N –270 to 1300^{o}C (–450 to 2372^{o}F)
			0	1	1	1	R –50 to 1768^{o}C (–58 to 3214^{o}F)
			1	0	0	0	S –50 to 1768^{o}C (–58 to 3214^{o}F)
			1	0	0	1	T –270 to 400^{o}C (–454 to 752^{o}F)
			1010 through 1111 not used				
	Bits 12–13 (14–16)	**Sensor Mode Select bits**					
		Bit	13	12	Sensor mode select for channels 4–7		
		Thermocouple					
			0	0	External compensation – uses cold junction sensor		
			0	1	Internal compensation – uses the value selected for reference junction		
			1	0	No compensation (Data is referenced to 0^{o}C.)		
			1	1	Differential measurement between 2 channels		
		RTD					
			0	0	2-wire RTD no compensation		
			0	1	2-wire RTD with loop resistance compensation		
			1	0	3-wire RTD		
			1	1	4-wire RTD		

Word	Dec. Bits (Octal Bits)	Description			
Write Word 2 cont.	Bits 14–15 (16–17)	**Input Type Select**			
		Bit	15	14	Input type selection for channels 4–7
			0	0	Thermocouple
			0	1	RTD
			1	0	Not used
			1	1	
Write Word 3	00–15 (00–17)	**RTD loop resistance offset select bits –** used input type is set to RTD and sensor mode select is set to 2-wire with loop resistance compensation. Allows you to set the type of RTD loop resistance compensation used for all RTDs or one of three fixed values for all channels. **NOTE:** Not applicable to 10Ω copper RTD, which defaults to 0Ω.			
		Bit	01	00	RTD channel 0
		Bit	03	02	RTD channel 1
		Bit	05	04	RTD channel 2
		Bit	07	06	RTD channel 3
		Bit	09	08	RTD channel 4
		Bit	11	10	RTD channel 5
		Bit	13	12	RTD channel 6
		Bit	15	14	RTD channel 7
			0	0	Use channel loop compensation value stored during calibration procedure for 2-wire RTD (default = 0Ω)
			0	1	5Ω
			1	0	10Ω
			1	1	15Ω
Write Word 4	00–07	**Extended data table command data bits –** These bits are written to the module during calibration. They are used to define offset, gain and general channel calibration.			
	08–14 (10–16)	**Extended data table command bits –** These bits are written to the module during calibration. They are used to select channel calibration action.			
	15 (17)	Reserved for factory use only.			

Defaults

Each I/O module has default values associated with it. At default, each module will generate inputs/status and expect outputs/configuration.

Module Defaults for:		Factory Defaults		Real Time Size	
Catalog Number	Description	Input Default	Output Default	Input Default	Output Default
1794-IRT8	8-Input Thermocouple/RTD Input	11	4	8	0

Factory defaults are the values assigned by the adapter when you:

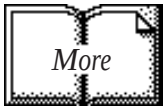
- first power up the system, and
- no previous stored settings have been applied.

For analog modules, the defaults reflect the actual number of input words/output words. For example, for the 8 Thermocouple/RTD input module, you have 11 input words, and 4 output words.

You can change the I/O data size for a module by reducing the number of words mapped into the adapter module, as shown in “real time sizes.”

Real time sizes are the settings that provide optimal real time data to the adapter module.

Analog modules have 15 words assigned to them. This is divided into input words/output words. You can reduce the I/O data size to fewer words to increase data transfer over the backplane.



For information on using DeviceNetManager software to configure your adapter, refer to the DeviceNetManager Software User Manual, publication 1787-6.5.3.

Chapter Summary

In this chapter, you learned how this module communicates over the DeviceNet, and the image table mapping for the module.

Calibrating Your Module

What This Chapter Contains

Use this chapter to calibrate the thermocouple/RTD/mV input module. We tell you about:

When and How to Calibrate Your RTD/Thermocouple/mV Module

Your module is shipped to you already calibrated. If a calibration check is required, the module must be in a FLEX I/O system.

Perform module calibration periodically, based on your application.

Module calibration may also be required to remove module error due to aging of components in your system.

Offset calibration must be done first, followed by gain calibration.

Calibration can be accomplished using any of the following methods:

- manual calibration, as described below.
- 6200 I/O CONFIGURATION software – refer to your 6200 software publications for procedures for calibrating.
- DeviceNetManager Software – refer to your DeviceNet Manager software documentation for the DeviceNet Adapter Module, Cat. No. 1794-ADN.

Important: You must use a 1794-TB3G or -TB3GS terminal base when calibrating this module.

Tools and Equipment

To calibrate your Thermocouple/RTD/mV input module, you will need the following tools and equipment:

Tool or Equipment	Description	
Precision Resistors	High Precision Resistors: 383Ω, 0.01%, 5ppm/°C 100Ω, 0.01%, 5ppm/°C 10 Kohm, 0.5%, 5ppm/°C	
Precision Voltage Source	±320mV, 1µV resolution	Analogic 3100, Data Precision 8200 or equivalent
Industrial Terminal and Interconnect Cable	Programming terminal for A–B family processors	

Manually Calibrating your RTD/Thermocouple/mV Input Module

You must calibrate the module in a FLEX I/O system. The module must communicate with the processor and an industrial terminal. You can calibrate input channels in any order, or all at once.

Before calibrating your module, you must enter ladder logic into the processor memory, so that you can initiate block transfer writes (BTW) to the module, and read inputs from the module (BTR).

Important: To allow the internal module temperature to stabilize, apply power to the module for at least 20 minutes before calibrating.

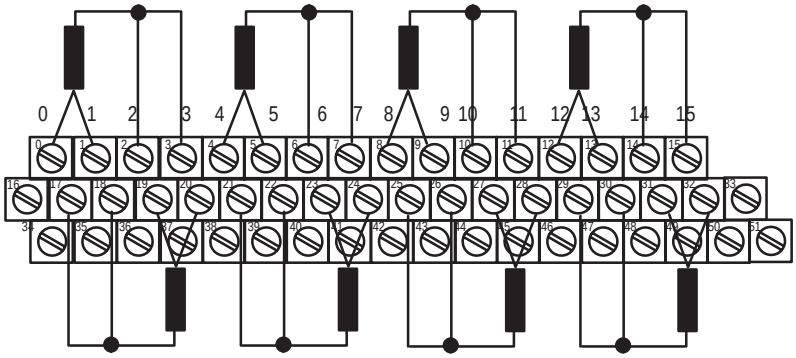
To manually calibrate the module:

1. Apply a reference to the desired input(s).
2. Send a message to the module indicating which inputs to read and what calibration step is being performed (offset).
3. The module will return a BTR which echoes back the message sent in the BTW word.

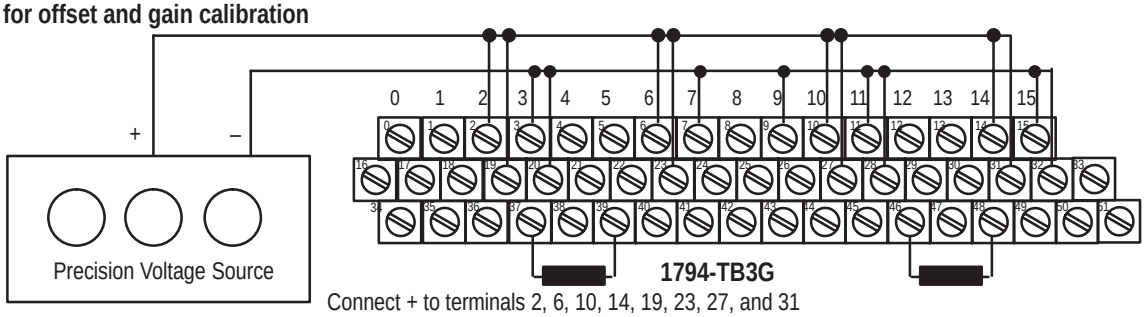
   The module stores this input data.
4. Apply a second reference signal to the module.
5. Send a second message indicating which inputs to read and what calibration step is being performed (gain).
6. The module computes new calibration values for the inputs and returns a BTR which echoes back the message sent in the BTW word. If the calibration is cannot be completed, the module returns a fault message.

Calibration Setups

Using Precision Resistors – for 383Ω and 100Ω calibration



Using Precision Voltage Source – for offset and gain calibration



Connect + to terminals 2, 6, 10, 14, 19, 23, 27, and 31
Connect – to terminals 3, 7, 11, 15, 20, 21, 28 and 32
Connect one 10K ohm, 0.5% resistor across terminals 37 and 39 and another across 46 and 48.

Wiring Connections for Calibrating the TC/RTD/mV Input Module

Type of Input	Connect the following:				
	H	L	+	–	Shield[1]
RTD – 4-wire	1a	2a	1	2	
Millivolt		1		2	

1 Terminals 37, 38 and 39 and 46, 47 and 48 are for cold junction compensation (with 38 and 47 chassis GND).

RTD or Thermocouple Channel	1794-TB3G and -TB3GS Terminal Base Units			
	High Signal Terminal (H)	Low Signal Terminal (L)	RTD Source Current (+)	Signal Return[1] (–)
0	1	2	0	3
1	5	6	4	7
2	9	10	8	11
3	13	14	12	15
4	18	19	17	20
5	22	23	21	24
6	26	27	25	28
7	30	31	29	32
+24V dc Power	34 and 50			
24V dc Common	35 and 51			

1 Terminals 37, 38 and 39 and 46, 47 and 48 are for cold junction compensation (with 38 and 47 chassis GND).
2 Terminals 16, 33 and 40 thru 45 are chassis ground.

Read/Write Words for Calibration

Decimal	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Octal	17	16	15	14	13	12	11	10	07	06	05	04	03	02	01	00
Word⇓	Write															
0					Data Format				Flt Mode Ch 0-3	Flt Mode Ch 4-7	Reference Jct.			Filter Cutoff		
1	TC/RTD Ch. 4-7		Sensor Mode Ch. 4-7		Sensor Mode Ch. 4-7				TC/RTD Ch. 0-3		Sensor Mode Ch. 0-3		Sensor Mode Ch. 0-3			
2	RTD Offset Ch 7		RTD Offset Ch 6		RTD Offset Ch 5		RTD Offset Ch 4		RTD Offset Ch 3		RTD Offset Ch 2		RTD Offset Ch 1		RTD Offset Ch 0	
3		EDT command							EDT command data							

Decimal	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Octal	17	16	15	14	13	12	11	10	07	06	05	04	03	02	01	00
Word⇓	Read															
0	Channel 0 Input Data															
1	Channel 1 Input Data															
2	Channel 2 Input Data															
3	Channel 3 Input Data															
4	Channel 4 Input Data															
5	Channel 5 Input Data															
6	Channel 6 Input Data															
7	Channel 7 Input Data															
8	Overrange Alarm Bits (channel 0 = bit 08, etc)								Underrange Alarm Bits (channel 0 = bit 00, etc)							
9	Flt Alm Ch7	Flt Alm Ch6	Flt Alm Ch5	Flt Alm Ch4	Flt Alm Ch3	Flt Alm Ch2	Flt Alm Ch1	Flt Alm Ch0		CJC 2 Alm	CJC 1 Alm	Not used	Diagnostic Status			
10		EDT command response							EDT response data							

EDT Calibration Command and Command Data

Command	Meaning	Data (up nibble)	Data (low nibble)	Meaning
Dec. (Hex)		channel	command	
4	General Calibration by Channel	0–15	0	zero offset and gain coefficients
		0–15	1	channel internal current source and current sense resistor, with 4-wire external 383Ω inputs
		0–15	2	channel internal current source and current sense resistor with 4-wire external 100Ω inputs
		0–15	3	loop resistance compensation for 2 wire RTD
		0–15	4	CJC calibration
		0–15	5–15	not used
5	Offset Calibration by Channel	0–15	0	gain= 1, input = –320 mV
		0–15	1	gain= 2, input = 0.0 mV
		0–15	2	gain= 4, input = –50 mV
		0–15	3	gain= 8, input = –10.0 mV
		0–15	4	gain= 16, input = –9 mV
		0–15	5	gain= 32, input = 1.0 mV
		0–15	6	gain= 64, input = –4.0 mV
		0–15	7	gain= 128, input = –2.0 mV
		0–15	8–15	not used
6	Gain Calibration by Channel	0–15	0	gain= 1, input = 320 mV
		0–15	1	gain= 2, input = 320 mV
		0–15	2	gain= 4, input = 110 mV
		0–15	3	gain= 8, input = 70 mV
		0–15	4	gain= 16, input = 29 mV
		0–15	5	gain= 32, input = 19 mV
		0–15	6	gain= 64, input = 4.0 mV
		0–15	7	gain= 128, input = 2.0 mV
		0–15	8–15	not used
36 (24)	Calibration all Channels			
	General Calibration all Channels	0	0	zero offset and gain coefficients
		0	1	channel internal current source and current sense resistor, with 4-wire external 383Ω inputs
		0	2	channel internal current source and current sense resistor with 4-wire external 100Ω inputs
		0	3	loop resistance compensation for 2 wire RTD
		0	4	CJC calibration
		0	5–15	not used
	Offset Calibration all Channels	1	0	gain= 1, input = –320 mV
		1	1	gain= 2, input = 0.0 mV
		1	2	gain= 4, input = –50 mV
		1	3	gain= 8, input = –10.0 mV
		1	4	gain= 16, input = –9 mV
		1	5	gain= 32, input = 1.0 mV
		1	6	gain= 64, input = –4.0 mV

Command	Meaning	Data (up nibble)	Data (low nibble)	Meaning
		1	7	gain= 128, input = –2.0 mV
		1	8–15	not used
	Gain Calibration all Channels	2	0	gain= 1, input = 320 mV
		2	1	gain= 2, input = 320 mV
		2	2	gain= 4, input = 110 mV
		2	3	gain= 8, input = 70 mV
		2	4	gain= 16, input = 29 mV
		2	5	gain= 32, input = 19 mV
		2	6	gain= 64, input = 4.0 mV
		2	7	gain= 128, input = 2.0 mV
		2	8–15	not used

Offset Calibration

Inputs can be calibrated one at a time or all at once. To calibrate the offsets for all inputs at once, proceed as follows:

1. Apply power to the module for 20 minutes before calibrating.
2. Connect a precision millivolt source across each input channel. Set the source to –320.00mV for a gain of 1. Connect all (L) signal terminals together and attach to the positive lead from the precision voltage source. Connect all (–) signal terminals together and attach to the negative lead.

Gain Selected	Input (mV)	EDT Command Hex	Decimal
1	–320.00±0.160mV	2410	9232
2	0.000±0.001mV	2411	9233
4	–50.00±0.025mV	2412	9234
8	–10.00±0.005mV	2413	9235
16	–9.00±0.005mV	2414	9236
32	1.000±0.001mV	2415	9237
64	–4.000±0.002mV	2416	9238
128	–2.000±0.001mV	2417	9239

3. Initiate a BTW to the module with the appropriate value in BTW word 3, bits 00–15, as shown above.
4. Monitor the block transfer read word 10 bits 00–15 for an echo of the EDT command.

If the BTR word reads 80FF (hex), repeat the BTW. Make sure that sufficient time is allowed for the module to respond to your request.

5. Set the precision millivolt source to the value required for a gain of 2. Repeat steps 3 and 4 for gain 2. Repeat for each gain setting.
6. When all offset calibrations are successful, proceed to the gain calibration.

Gain Calibration

After completing the offset calibration, proceed with the gain calibration.

1. Connect a precision millivolt source across each input channel. Set the source to 320.00mV for a gain of 1. Connect all (L) signal terminals together and attach to the positive lead from the precision voltage source. Connect all (–) signal terminals together and attach to the negative lead.

Gain Selected	Input (mV)	EDT Command Hex	Decimal
1	320.00±0.160mV	2420	9248
2	320.00±0.160mV	2421	9249
4	110±0.055mV	2422	9250
8	70.00±0.035mV	2423	9251
16	29.00±0.015mV	2424	9252
32	19.00±0.010mV	2425	9253
64	4.000±0.002mV	2426	9254
128	2.000±0.001mV	2427	9255

2. Apply power to the module for 20 minutes before calibrating.
3. After the connections stabilize, send a block transfer write with the corresponding EDT command for your input to the module.
4. Monitor the block transfer read word 10 bits 00–15 for an echo of the EDT command.

If the BTR word reads 80FF (hex), repeat the BTW. Make sure that sufficient time is allowed for the module to respond to your request.

5. Set the precision millivolt source to the value required for a gain of 2. Repeat steps 3 and 4 for gain 2. Repeat for each gain setting.
6. When all gain calibrations are successful, proceed to “current source calibration.”

Current Source Calibration

The current sources can be calibrated one at a time or all at once. To calibrate the current source for all inputs at once, proceed as follows:

1. Connect a 383 ohm, 0.01% resistor across (H, +) and (L, –) of each input channel (8 resistors).
2. Apply power to the module for 20 minutes before calibrating.
3. Initiate a BTW to the module with the2401 (hex) value in BTW word 3, bits 00–15, as shown above.
4. Monitor the block transfer read word 10, bits 00–15 for an echo of the EDT command.

If the BTR word reads 80FF (hex) (indicating a failed calibration), repeat the BTW. Make sure that sufficient time is allowed for the module to respond to your request.

5. Connect a 100 ohm, 0.01% resistor across (H, +) and (L, –) of each input channel (8 resistors). Repeat steps 3 and 4 using a BTW value of 2402 (hex).
6. When all calibrations are successful, proceed to the “cold junction calibration.”

Cold Junction Calibration

Both cold junction compensation inputs must be calibrated together. To calibrate both at once, proceed as follows:

1. Connect a 10 Kohm, 0.5% resistor across terminals 37 and 39 (cjc 1) and terminals 46 and 48 (cjc 2).
2. Apply power to the module for 20 minutes before calibrating.
3. Initiate a BTW to the module with the 2404 (hex) value in BTW word 3, bits 00–15.
4. Monitor the block transfer read word 10, bits 00–15 for an echo of the EDT command.

If the BTR word reads 80FF (hex) (indicating a failed calibration), repeat the BTW. Make sure that sufficient time is allowed for the module to respond to your request.

Specifications

Specifications – 1794-IRT8 Thermocouple/RTD/mV Input Module	
Number of Inputs	8 Channels (2 groups of 4)
Module Location	Cat. No. 1794-TB3G, -TB3GS Terminal Base Unit
Nominal Ranges	–40 to +100mV dc for thermocouples 0 to 500Ω for RTDs
Supported Thermocouple Types	Type B: 300 to 1800°C (572 to 3272°F) Type E: –270 to 1000°C (–454 to 1832°F) Type J: –210 to 1200°C (–346 to 2192°F) Type K: –270 to 1372°C (–454 to 2502°F) Type L –200 to 800°C (–328 to 1472°F) Type N: –270 to 1300°C (–454 to 2372°F) Type R: –50 to 1768°C (–58 to 3214°F) Type S: –50 to 1768°C (–58 to 3214°F) Type T: –270 to 400°C (–454 to 752°F)
Supported RTD Types	Resistance: 100 ohm Pt α = 0.00385 Euro (–200 to +870°C) 100 ohm Pt α = 0.003916 U.S. (–200 to +630°C) 200 ohm Pt α = 0.00385 Euro (–200 to +400°C) 200 ohm Pt α = 0.003916 U.S. (–200 to +400°C) 100 ohm Nickel α = 0.00618 (–60 to +250°C) 120 ohm Nickel α = 0.00672 (–80 to +320°C) 200 ohm Nickel α = 0.00618 (–60 to +200°C) 10 ohm Copper α = 0.00427 (–200 to +260°C)
Resolution	14 bits
Accuracy vs. filter Cutoff	0.2Hz = 0.05% of full range in millivolt mode 0.5Hz = 0.05% of full range in millivolt mode 1.0Hz = 0.05% of full range in millivolt mode 2.0Hz = 0.05% of full range in millivolt mode 4.0Hz = 0.05% of full range in millivolt mode 10.0Hz = 0.05% of full range in millivolt mode 40.0Hz = 0.05% of full range in millivolt mode Hardware only = 0.10% of full range in millivolt mode
Data Format	°C °F °K –32767 to +32767 0–65535 0–5000 (ohms mode) –4000 to +10000 (millivolt mode)
Common Mode Rejection	–80db @ 5V peak-to-peak 50–60Hz
Common Mode Input Range	±4V minimum
Isolation Voltage	1500V ac (rms) or 2550V dc for 1.0s between customer and system
Specifications continued on next page.	

Specifications – 1794-IRT8 Thermocouple/RTD/mV Input Module	
System Throughput (8 channels scanned)	For maximum throughput short circuit all unused channels. 4ms – millivolt 6.0ms – ohms – 2- and 4-wire RTD 10.0ms – ohms – 3-wire RTD 6.4ms – 2- and 4-wire RTD (^{o}F) 6.8ms – 2- and 4-wire RTD (^{o}C), (^{o}K) 10.2ms – 3-wire RTD (^{o}F) 10.6ms – 3-wire RTD (^{o}C), (^{o}K) 5.6ms – Thermocouples (^{o}F) 6.0ms – Thermocouples (^{o}C), (^{o}K)
Open Circuit Detection	Defaults to maximum value
Open Input Detection Time	0 to 6.5s depending on input type and mode selected 1.3s – Thermocouple 3.8s – 2- and 4-wire RTD 6.5s – 3-wire RTD
Overvoltage Capability	7V dc continuous @ 25^{o}C
RFI Immunity	Error of less than 1% of range at 10V/M 27 to 1000MHz
Overall Drift with Temperature	150ppm/^{o}C of span (maximum)
Cold Junction Compensation range	0 to 70^{o}C
Cold Junction Compensator	A-B Part Number 969424–02
Indicators	1 green power status indicator
Flexbus Current	40mA
Power Dissipation	3W maximum @ 31.2V dc
Thermal Dissipation	Maximum 10.2 BTU/hr @ 31.2V dc
Keyswitch Position	3
External dc Power Supply Voltage Voltage Range Supply Current	 24V dc nominal 19.2 to 31.2V dc (includes 5% ac ripple) 85mA @ 24V dc
General Specifications	
Dimensions Inches (Millimeters)	1.8H x 3.7W x 2.1D (45.7 x 94.0 x 53.3)
Environmental Conditions Operational Temperature Storage Temperature Relative Humidity Shock Operating Non-operating Vibration	 0 to 55^{o}C (32 to 131^{o}F) –40 to 85^{o}C (–40 to 185^{o}F) 5 to 95% noncondensing (operating) 5 to 80% noncondensing (nonoperating) 30 g peak acceleration, 11(±1)ms pulse width 50 g peak acceleration, 11(±1)ms pulse width Tested 5 g @ 10–500Hz per IEC 68-2-6
Conductors Thermocouple Millivolt Category	Use appropriate shielded thermocouple wire[1] Belden 8761 2[2]
Agency Certification (when product is marked)	• CSA certified • CSA Class I, Division 2 Groups A, B, C, D certified • UL listed • CE marked for all applicable directives
User Manual	Publication 1794-6.5.12

1 Refer to thermocouple manufacturer for proper thermocouple extension.
2 Use this conductor category information for planning conductor routing. Refer to publication 1770-4.1, "Industrial Automation Wiring and Grounding Guidelines for Noise Immunity."

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