User Manual

Allen-Bradley

FLEX I/O High-Density Analog Modules

Catalog Numbers 1794-IE8, 1794-IE8XT, 1794-OE4, 1794-OE4XT, 1794-IE12, 1794-OE12, 1794-IE4XOE2, 1794-IE4XOE2XT, 1794-IE8XOE4

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Important User Information

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

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

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

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

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

This manual contains new and updated information. Changes throughout this revision are marked by change bars, as shown to the right of this paragraph.

New and Updated Information

This table contains the additions made to this revision.

Topic	Page
Updated Related Documentation table	8
Corrected Terminal Base Unit Wiring	25
Updated Module and Terminal Base Unit Compatibility table	26
Corrected table title for 1794-TB3G and 1794-TB3GS	32
Corrected Range Selection Bits -- 1794-IE4XOE2/B and 1794-IE4XOE2XT Analog Combo Module Data Table	69

Notes:

Read this preface to familiarize yourself with the rest of the manual. It provides information concerning:

- who should use this manual
- the purpose of this manual
- related documentation
- conventions used in this manual

Who Should Use this Manual

You must be able to program and operate an Allen-Bradley® programmable controller to make efficient use of your FLEX™ I/O modules. In particular, you must know how to program block transfers.

We assume that you know how to do this in this manual. If you do not, refer to the appropriate programming and operations manual before you attempt to program your modules.

Purpose of this Manual

This manual shows you how to use your FLEX I/O Analog modules with Allen-Bradley programmable controllers. The manual helps you install, program and troubleshoot your modules.

For Information About	See
Overview of FLEX I/O and Your Analog Module	Chapter 1
Install Your FLEX I/O Module	Chapter 2
Write Configuration to and Read Status from Your Module	Chapter 3
Communicate With Your Module	Chapter 4
Specifications	Appendix A
Differences Between Series	Appendix B
Data Tables	Appendix C
Module Programming	Appendix D

About the Vocabulary

In this manual, we refer to:

- The analog input or analog output module as the "input module" or "output module"
- The Programmable Controller as the “controller”

Related Documentation

The following documents contain additional information concerning Rockwell Automation products. To obtain a copy, contact your local Rockwell Automation office or distributor

Resource	Description
1794 FLEX I/O Product Data, publication 1794-PP019.	Information on FLEX I/O general product specifications, certifications, and list of catalogs and descriptions.
FLEX I/O ControlNet Redundant Media Adapter, publication 1794–IN018.	Information on how to install the FLEX I/O ControlNet® Redundant Media Adapter Catalog No. 1794-ACNR.
FLEX I/O EtherNet/IP Adapter Module Installation Instructions, publication 1794-IN082.	Information on how to install the FLEX I/O EtherNet/IP™ Adapter Module Catalog No. 1794-AENT.
ControlNet Adapter Module Installation Instructions, publication 1794-IN101.	Information on how to install the ControlNet Adapter Modules Catalog No. 1794-ACN15, 1794-ACNR15.
FLEX I/O DeviceNet Adapter Module Installation Instructions, publication 1794-IN099.	Information on how to install the FLEX I/O DeviceNet Adapter Modules Catalog No. 1794-ADN, 1794-ADNK.
Remote I/O Adapter Module User Manual, publication 1794–UM009.	Information on how to use the Remote I/O Adapter Module Catalog No. 1794-ASB.
FLEX I/O PROFIBUS Adapter Module Installation Instructions, publication 1794-IN087.	Information on how to install the FLEX I/O PROFIBUS Adapter Catalog No. 1794-APB.
FLEX I/O PROFIBUS Adapter Module User Manual, publication 1794-UM057.	Information on how to use the FLEX I/O PROFIBUS Adapter Module Catalog No. 1794-APB.
FLEX I/O Terminal Base Units Installation Instructions, publication 1794-IN092.	Information on how to install the FLEX I/O Terminal Base Units Catalog No. 1794-TB2, 1794-TB3, 1794-TB3K, 1794-TB3S, 1794-TB32, 1794-TB3G, 1794-TB3GK, 1794-TB3GS, 1794-TB3T, 1794-TB3TS, 1794-TBN, 1794-TBNK, 1794-TBNF.
FLEX I/O Digital Input Modules Installation Instructions, publication 1794-IN093.	Information on how to install the FLEX I/O Digital Modules Catalog No. 1794-IB8, 1794-IB16, 1794-IB16K, 1794-IB32.
FLEX I/O Digital DC Sourcing Output Modules Installation Instructions, publication 1794-IN094.	Information on how to install the FLEX I/O Digital DC Sourcing Output Modules Catalog No. 1794-OB8, 1794-OB8EP, 1794-OB16, 1794-OB16P, 1794-OB32P.
FLEX I/O Input/ Output Module Installation Instructions, publication 1794-IN083.	Information on how to install the FLEX I/O Input and Output Combo Modules Catalog No. 1794-IB16XOB16P, 1794-IB10XOB6.
FLEX I/O Input and Output Module Installation Instructions, publication 1794-IN100.	Information on how to install FLEX I/O Analog Modules Catalog No. 1794-IE8/B, 1794-IE4XOE2/B, 1794-OE4/B, 1794-IE8K/B, 1794-OE4K/B.
Thermocouple/Millivolt Input Module Installation Instructions, publication 1794-IN050.	Information on how to install the Thermocouple/Millivolt Input Modules Catalog No. 1794-IRT8, 1794-IRT8K, 1794-IRT8XT.
FLEX I/O 8 Input RTD Module User Manual, publication 1794-UM004.	Information on how to use the FLEX I/O 8 Input RTD Module Catalog No. 1794-IR8.
FLEX I/O Thermocouple/Millivolt Input Module User Manual, publication 1794-UM007.	Information on how to use the Thermocouple and Millivolt Input Module Catalog No. 1794-IT8.
FLEX I/O AC Input Modules Installation Instructions, publication 1794-IN102.	Information on how to install the FLEX I/O AC Input Modules Catalog No. 1794-IA8, 1794-IA8I, 1794-IA16.

Resource	Description
FLEX I/O Digital AC Output Modules Installation Instructions, publication 1794-IN103.	Information on how to install the FLEX I/O Digital AC Output Modules Catalog No. 1794-OA8, 1794-OA8K, 1794-OA8I, 1794-OA16.
Interconnect Cable Installation Instructions, publication 1794-IN012.	Information on how to install the Interconnect Cable Catalog No. 1794-CE1, 1794-CE3.
FLEX I/O DC Power Supply Installation Instructions, publication 1794-IN069.	Information on how to install the FLEX I/O DC Power Supply Catalog No. 1794-PS13, 1794-PS3.
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1.	In-depth information on grounding and wiring Allen-Bradley programmable controllers.

Common Techniques Used in this Manual

The following conventions are used throughout this manual:

- Bulleted lists such as this one provide information, not procedural steps.
- Numbered lists provide sequential steps or hierarchical information.
- *Italic* type is used for emphasis.

Notes:

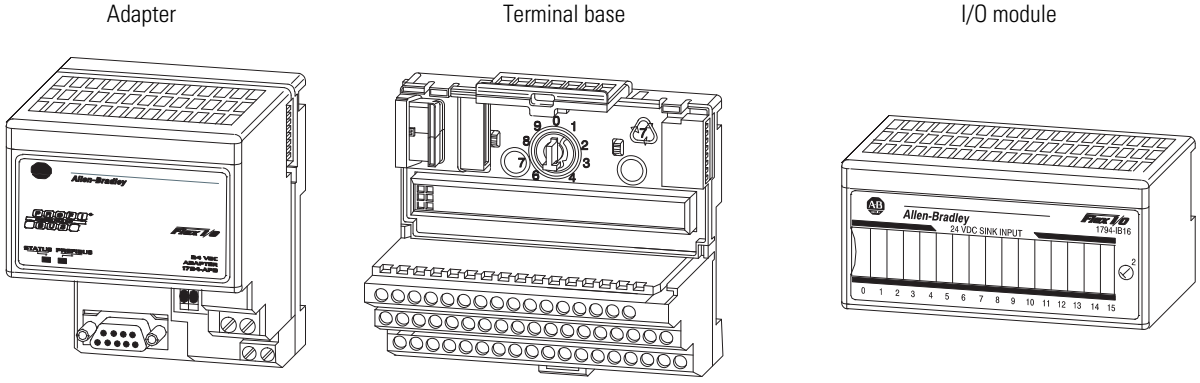
Overview of FLEX I/O and Your Analog Module

Overview

Read this chapter to familiarize yourself with configurable features on the FLEX I/O High Density modules. The following table lists where to find specific information in this chapter.

The FLEX I/O System

FLEX I/O is a small, modular I/O system for distributed applications that performs all of the functions of rack-based I/O. The FLEX I/O system contains the following components shown below:



- adapter/power supply – powers the internal logic for as many as eight I/O modules
- terminal base – contains a terminal strip to terminate wiring for two- or three-wire devices
- I/O module – contains the bus interface and circuitry needed to perform specific functions related to your application

Types of FLEX I/O Modules

The following FLEX I/O analog modules are described in this user manual:

FLEX I/0 Analog Modules

Catalog Number	Voltage	Inputs	Outputs	Description
1794-IE8	24V DC	8	—	analog – 8 input, single-ended, non-isolated
1794-IE8XT[1]				
1794-IE12	24V DC	12	—	analog – 12 input, single-ended, non-isolated
1794-OE4	24V DC	—	4	analog – 4 output, single-ended, non-isolated
1794-OE4XT[1]				
1794-OE12	24V DC	—	12	analog – 12 output, single-ended, non-isolated
1794-IE4XOE2	24V DC	4	2	analog – 4 input, single-ended, non-isolated and 2 output, single-ended, non-isolated
1794-IE4XOE2XT[1]				
1794-IE8XOE4	24V DC	8	4	analog – 8 input, single-ended, non-isolated and 4 output, single-ended, non-isolated

[1] Modules with "XT" indicated in the catalog number signify extended temperature modules.

FLEX I/O analog input, output and combination 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 from the module's memory to a designated area in the processor data table, and output data words from a designated area in the processor data table to the module's memory. Block transfer programming also moves configuration words from the processor data table to module memory.

The analog modules have selectable ranges as shown in the table below:

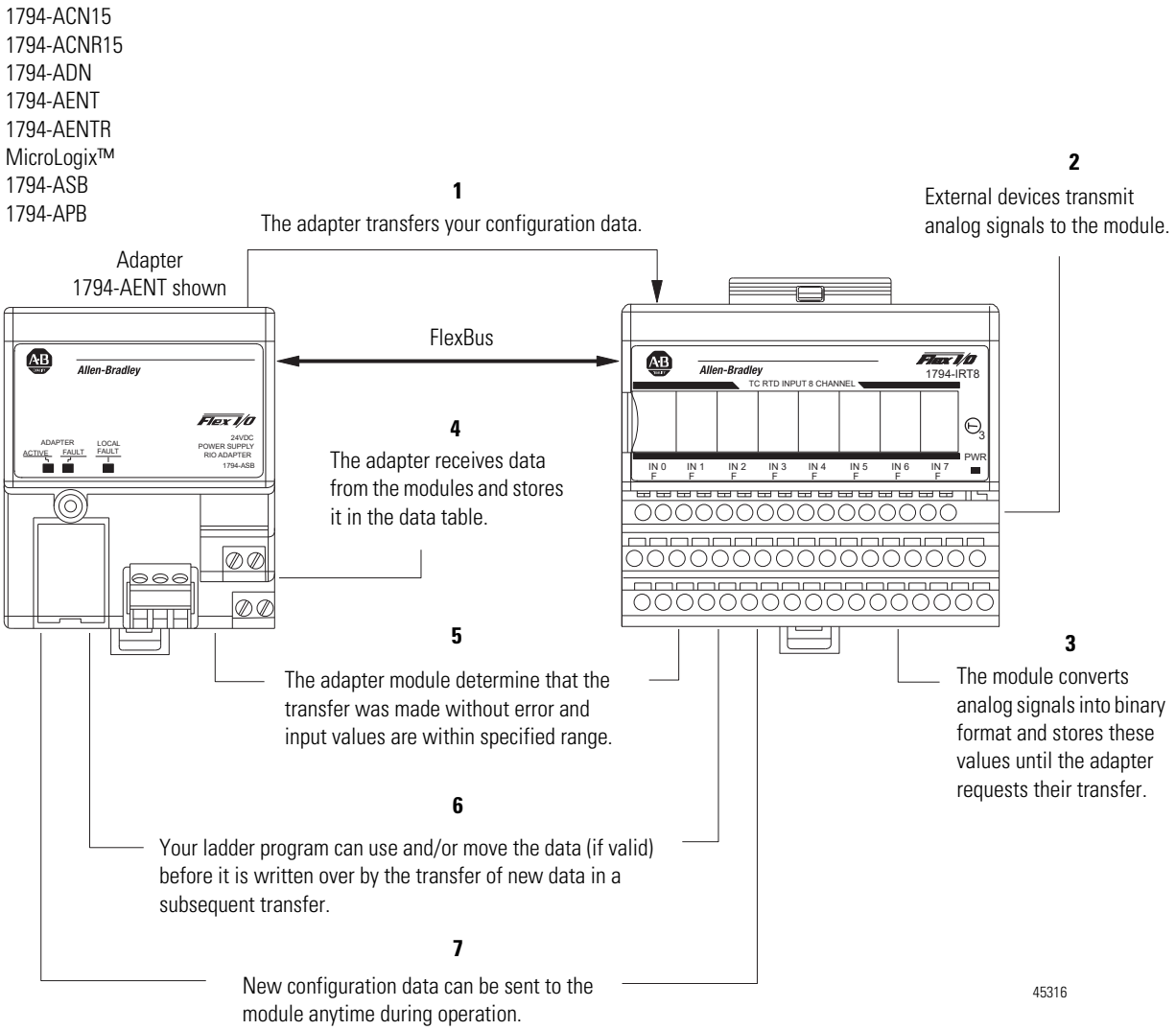
Analog Module Selectable Ranges

Voltage	Current
0…10V DC	0…20 mA
+/- 10V DC	4…20 mA

How FLEX I/O Analog Modules Communicate with Programmable Controllers

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 values and status from the module, and let you send output values and establish the module's mode of operation. The Typical Communication Between the Adapter and a Module figure describes the communication process.

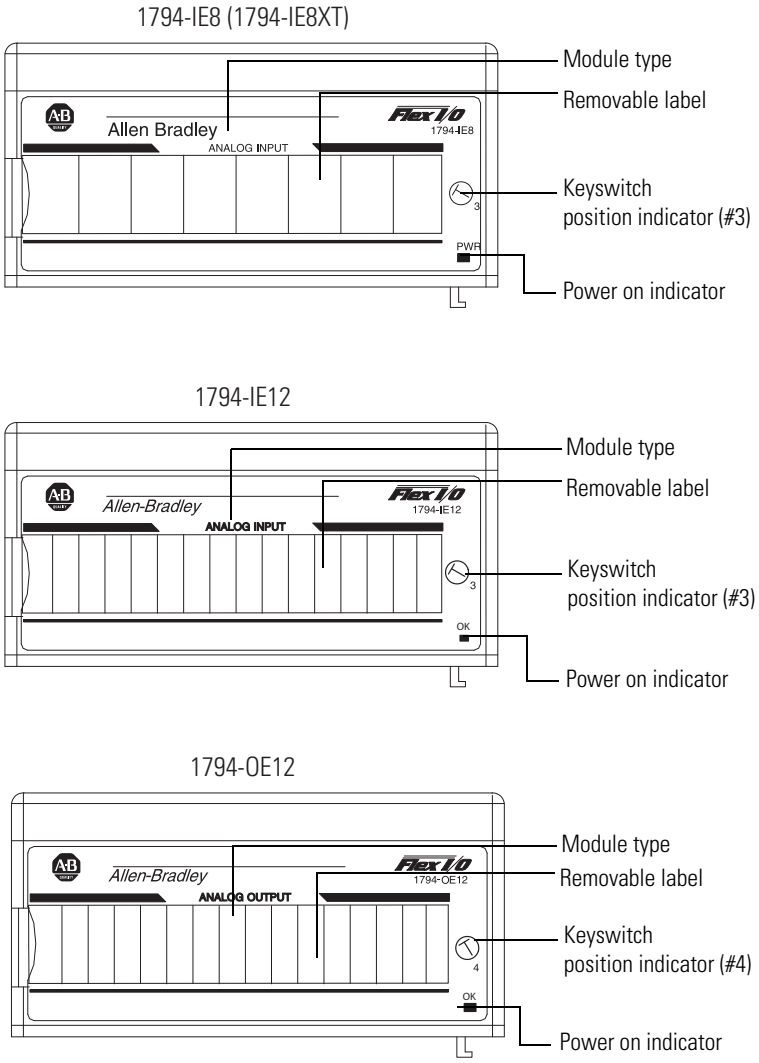
Typical Communication Between the Adapter and a Module



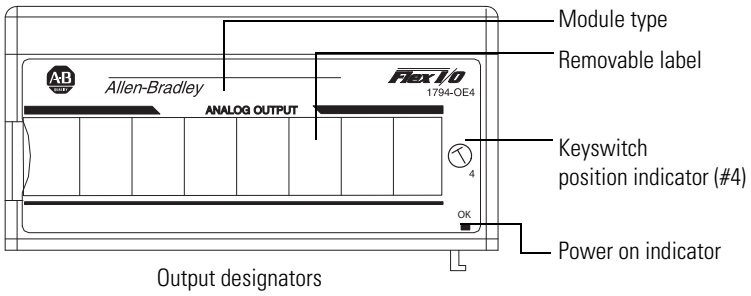
Physical Features of Your Modules

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.

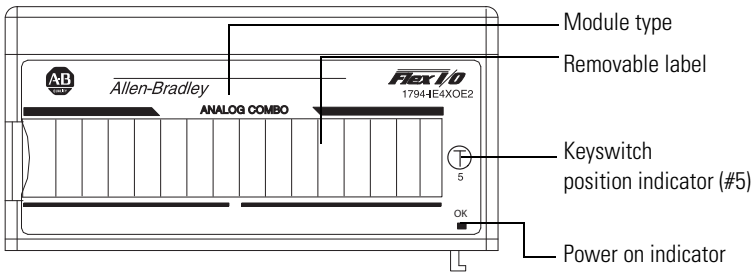
Module Labels and Indicators



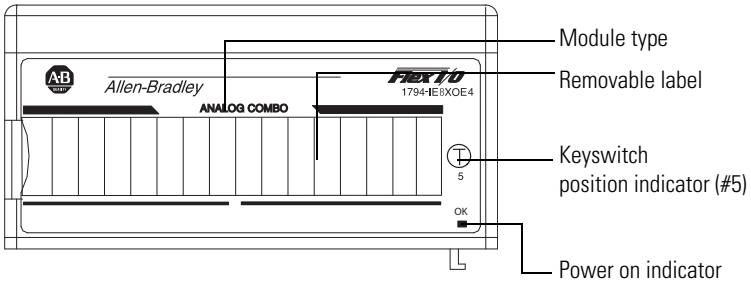
1794-OE4 (1794-OE4XT)



1794-IE4XOE2 (1794-IE4XOE2XT)



1794-IE8XOE4



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Summary

In this chapter, you learned about the FLEX I/O system and the types of analog modules and how they communicate with programmable controllers.

Notes:

Install Your FLEX I/O Module

Overview

This chapter provides you with pre-installation requirements and instructions on how to install your FLEX I/O analog module.

Before You Install Your Module

Before installing your FLEX I/O analog module, you must:

- Calculate the power requirements of all modules in each chassis,
- Verify that a suitable enclosure is available for installation of the module
- Position the keyswitch on the terminal base.

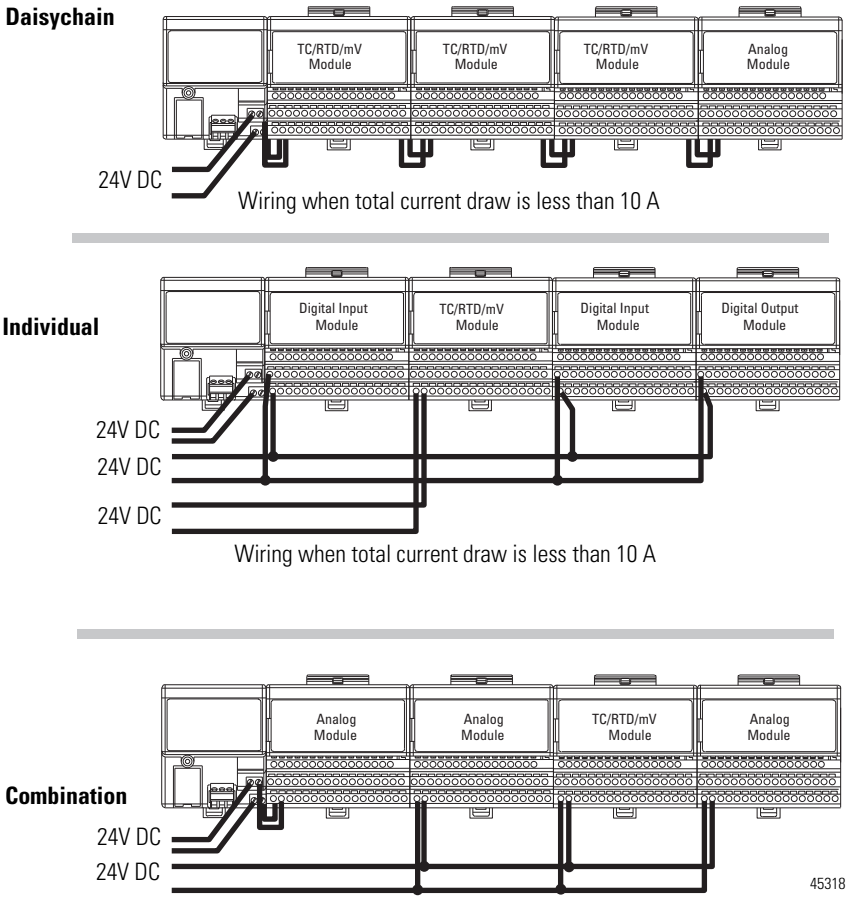
Power Requirements

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 10 A.

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

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

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



ATTENTION: Note the following rules for each type of wiring configuration:

- Daisychain – All modules must be analog or TC/RTD/mV modules for this configuration.
- Individual – Use this type of configuration for any noisy DC digital I/O modules in your system.
- Combination – All modules powered by the same power supply must be analog modules for the combination type of configuration.

Install the Module

Installation of the analog module consists of:

- Mounting the terminal base unit
- Installing the analog 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 the section, Mount the Analog Module on the Terminal Base Unit, on page 23.

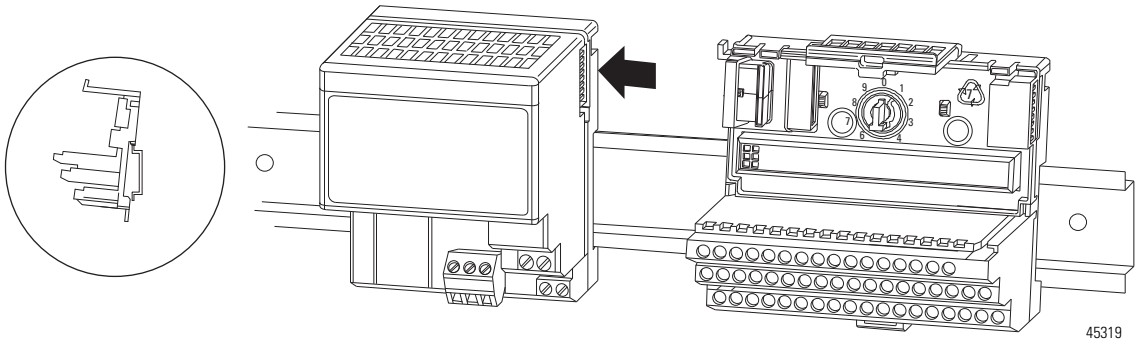
Mount on a DIN Rail

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.

Install the Terminal Base Unit

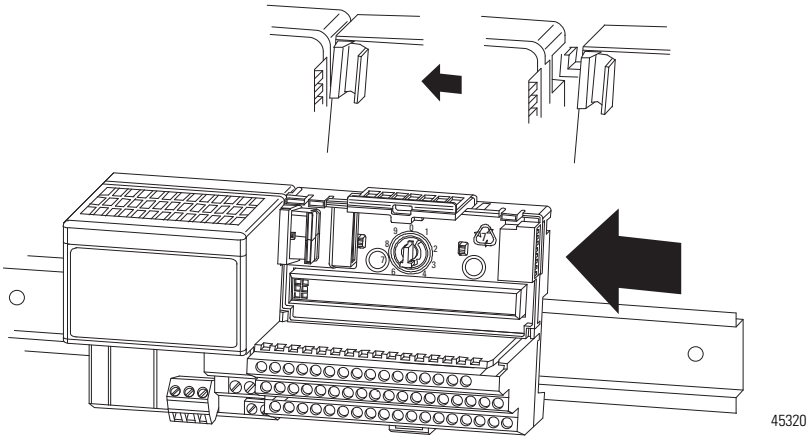
1. Remove the cover plug in the male connector of the unit to which you are connecting this terminal base unit.

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.



Make certain that the female FlexBus connector is fully retracted into the base unit.

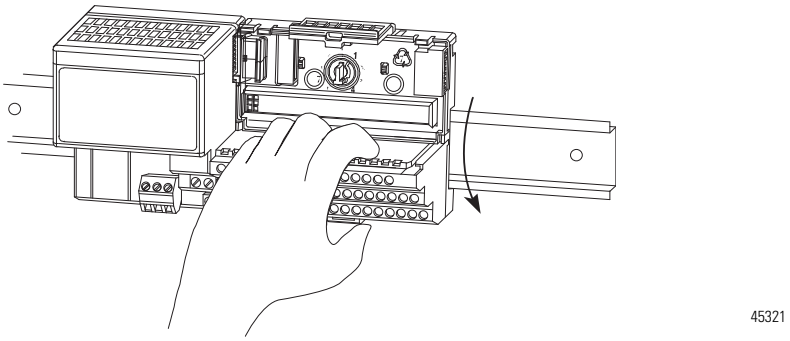
3. Position the terminal base at a slight angle and hooked over the top of the 35 x 7.5 mm DIN rail A (Allen Bradley part number 199-DR1; 46277-3).



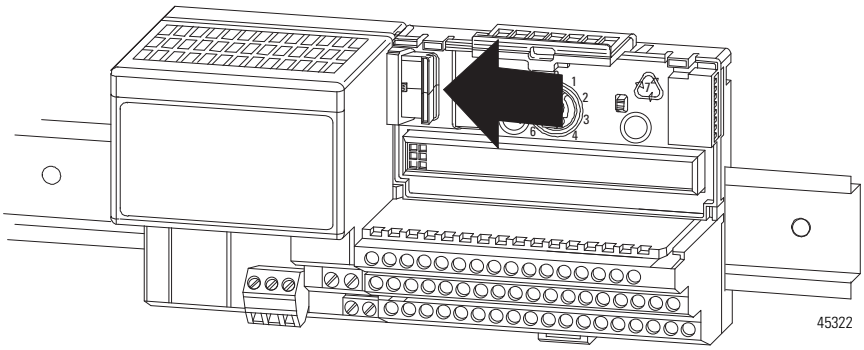
4. Slide the terminal base over tight against the adapter (or proceeding terminal base). Make sure the hook on the terminal base slides under the edge of the adapter (or proceeding terminal base) and the FlexBus connector is fully retracted.

5. Rotate the terminal base onto the DIN rail with the top of the rail hooked under the lip on the rear of the terminal base.
Use caution to make sure that the female FlexBus connector does not strike any of the pins in the mating male connector.

6. 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.



Gently push the FlexBus connector into the side of the adapter (or proceeding terminal base) to complete the backplane connection.



For specific wiring information, see the installation instructions for the module you are installing in this terminal base unit.

7. Repeat the above steps to install the next terminal base unit.
   Ensure that the cover of the FlexBus connector on the last terminal base unit is in place.

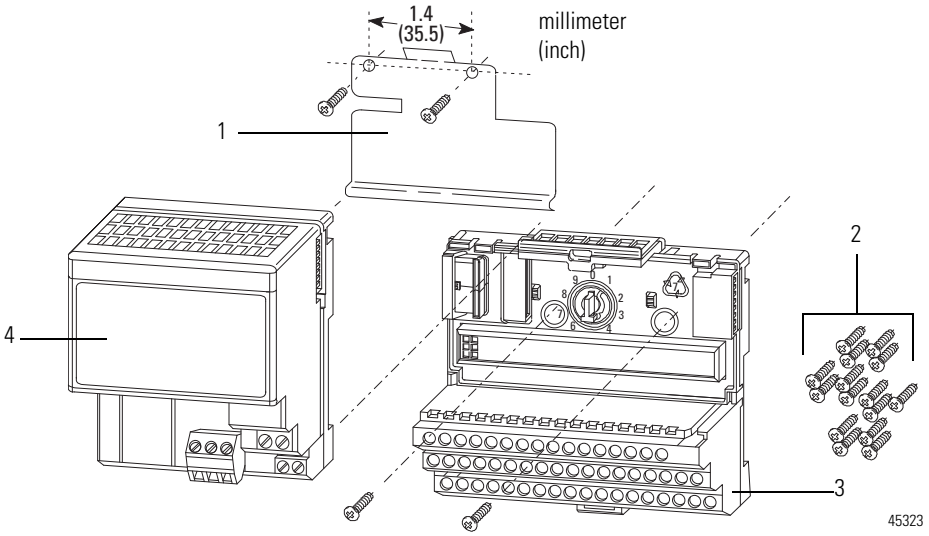
Mount on a Panel or Wall

Installation of a FLEX I/O system 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 the section, Mount the Analog Module on the Terminal Base Unit, on page 23.

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

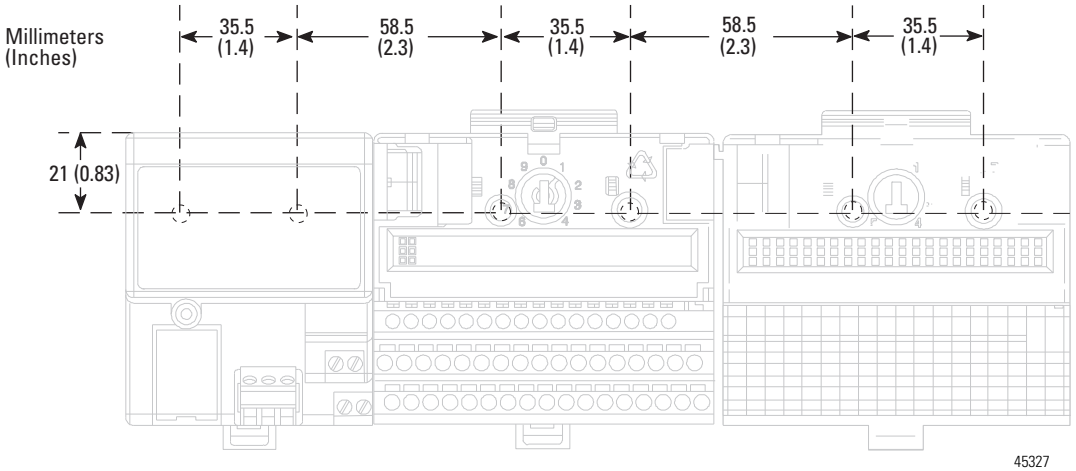


	Description		Description
1	Mounting plate for adapter	3	Terminal base unit (not included)
2	#6 Self-tapping screws	4	Adapter module (not included)

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 or Wall Mounting of FLEX I/O



2. Drill the necessary holes for the #6 self-tapping mounting screws.

3. Mount the mounting plate 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. See Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1.

4. Hold the adapter 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.

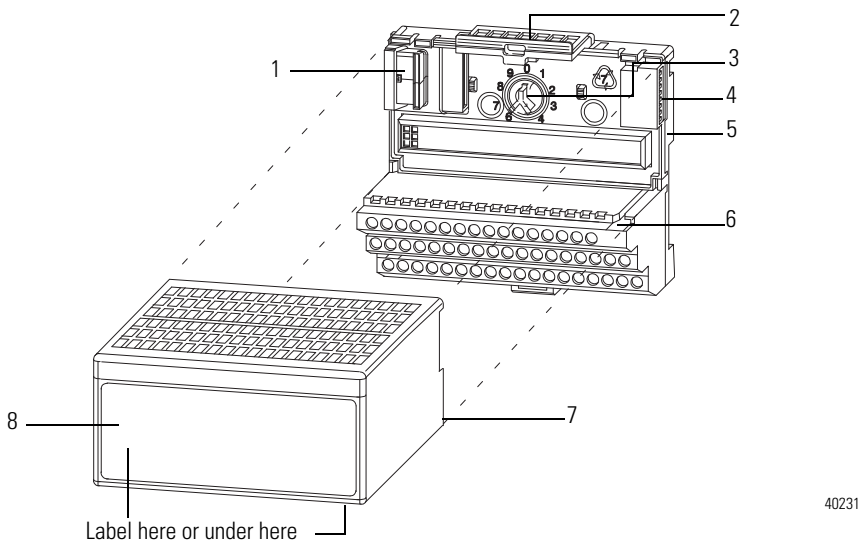
Mount the Analog Module on the Terminal Base Unit

The analog module mounts on a 1794-TBx terminal base unit. More specific terminal bases, see Module and Terminal Base Unit Compatibility on page 26.

1. Rotate keyswitch (3) on terminal base unit (4) clockwise to the position required for your module, see table Keyswitch Positions for Your Module on page 23.
   Do not change the position of the keyswitch after wiring the terminal base unit.

Keyswitch Positions for Your Module

Module	Keyswitch Position
1794-IE8	3
1794-IE8XT	
1794-IE12	
1794-OE12	4
1794-OE4	
1794-OE4XT	
1794-IE4XOE2	5
1794-IE4XOE2XT	
1794-IE8XOE4	



	Description		Description
1	FlexBus connector	5	Base unit
2	Latching mechanism	6	Alignment groove
3	Keyswitch	7	Alignment bar
4	Cap plug	8	Module

2. Make certain the FlexBus connector (1) is pushed all the way to the left to connect with the neighboring terminal base or adapter.
   You cannot install the module unless the connector is fully extended.

3. Make sure the pins on the bottom of the module are straight so they will align properly with the connector in the terminal base unit.

ATTENTION: If you remove or insert the module while the backplane power is on, an electrical arc can occur. This could cause an explosion in hazardous location installations. Be sure that power is removed or the area is nonhazardous before proceeding.

4. Position the module (8) with its alignment bar (7) 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 is locked into the module.

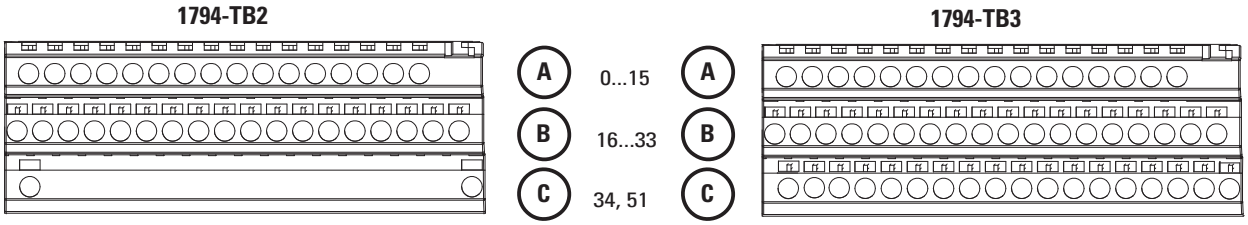
6. Remove cap plug and attach another terminal base unit to the right of this terminal base unit if required.
   Make sure the last terminal base has the cap plug in place.

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

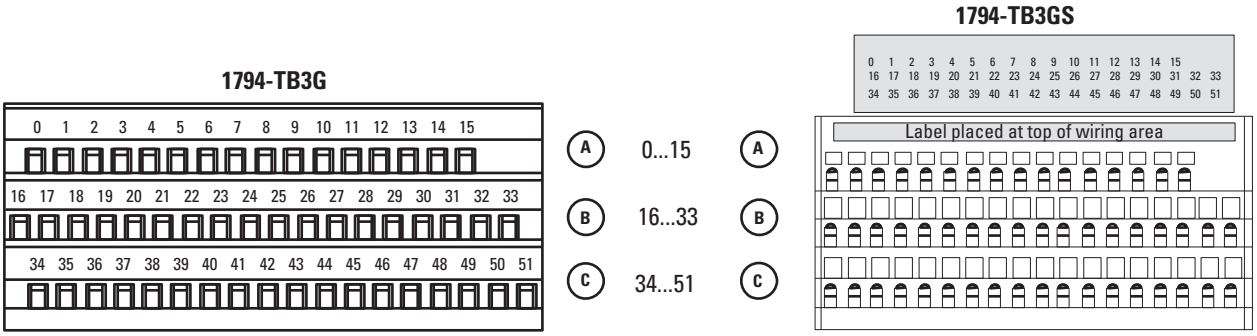
Wire the Terminal Base Unit

Wiring to the analog modules is made through the terminal base unit on which the module mounts.

1794-TB2 and 1794-TB3 Wiring



1794-TB3G and 1794-TB3GS Wiring



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

Connect Wiring to the FLEX I/O Module

Wiring to the analog module is made through the terminal base unit on which the module mounts.

Verify which terminal base units your module is compatible with in table Module and Terminal Base Unit Compatibility on page 26.

Module and Terminal Base Unit Compatibility

Module	1794-TB2	1794-TB3	1794-TB3S	1794-TB3G	1794-TB3GS	1794-TB3T	1794-TB3TS	TBN
1794-IE8	Yes	Yes	Yes	No	No	Yes	Yes	No
1794-IE8XT	Yes	Yes	Yes	No	No	Yes	Yes	No
1794-IE12	No	No	No	Yes	Yes	No	No	No
1794-OE12	No	No	No	Yes	Yes	No	No	No
1794-OE4	Yes	Yes	Yes	No	No	Yes	Yes	Yes
1794-OE4XT	Yes	Yes	Yes	No	No	Yes	Yes	Yes
1794-IE4XOE2	Yes	Yes	Yes	No	No	Yes	Yes	No
1794-IE4XOE2XT	Yes	Yes	Yes	No	No	Yes	Yes	No
1794-IE8XOE4	No	No	No	Yes	Yes	No	No	No

Connect Wiring Using a 1794-TB2 or 1794-TB3 Terminal Base Unit

1. Connect the individual signal wiring to numbered terminals on the 0...15 row (**A**) on the terminal base unit. Use Belden 8761 cable for signal wiring.

ATTENTION: Connect only one current or one voltage signal per channel. Do not connect both current and voltage on one channel.

2. Connect each channel signal return to:
   - 1794-IE8 – the associated terminal on row (**B**).
   - 1794-OE4 – the corresponding terminal on the same row (**A**).
   - 1794-IE4XOE2 – inputs: the associated terminal on row (**B**); outputs: the corresponding terminal on the same row (**A**).
3. Connect +24V DC to designated terminals on the 34...51 row (**C**), and 24V common to designated terminals on the 16...33 row (**B**).

ATTENTION: To reduce susceptibility to noise, power analog modules and discrete modules from separate power supplies. Do not exceed a length of 10 m (33 ft) for power cabling.

If daisy chaining the +24V DC power to the next base unit, connect a jumper from terminal 51 on this base unit to terminal 34 on the next base unit. Connect

the 24V DC common/return from terminal 33 on this base unit to terminal 16 on the next base unit.

Wire Connections for 1794-TB2, and 1794-TB3 using the 1794-IE8 Module

Channel	Signal Type	Label Markings	1794-TB2 and 1794-TB3	
			Input	Common Terminal
Input 0	Current	I	A-0	B-17
	Voltage	V	A-1	B-18
Input 1	Current	I	A-2	B-19
	Voltage	V	A-3	B-20
Input 2	Current	I	A-4	B-21
	Voltage	V	A-5	B-22
Input 3	Current	I	A-6	B-23
	Voltage	V	A-7	B-24
Input 4	Current	I	A-8	B-25
	Voltage	V	A-9	B-26
Input 5	Current	I	A-10	B-27
	Voltage	V	A-11	B-28
Input 6	Current	I	A-12	B-29
	Voltage	V	A-13	B-30
Input 7	Current	I	A-14	B-31
	Voltage	V	A-15	B-32
	24V DC common	B-16…33[1]		
	+24V DC power	1794-TB2 – C-34…51 1794-TB3 – C-34…51		

(1) Terminals 16…33 are internally connected in the terminal base unit.

Wire Connections for 1794-TB2, and 1794-TB3 using the 1794-OE8 Module

Channel	Signal Type	Label Markings	1794-TB2 and 1794-TB3 Output
Output 1	Current signal	I	A-0
	Current common	RET	A-1[1]
	Voltage signal	V	A-2
	Voltage common	RET	A-3[1]
	Current signal	I	A-4
	Current common	RET	A-5[1]
	Voltage signal	V	A-6
	Voltage common	RET	A-7[1]

Wire Connections for 1794-TB2, and 1794-TB3 using the 1794-OE8 Module

Channel	Signal Type	Label Markings	1794-TB2 and 1794-TB3 Output
	Current signal	I	A-8
	Current common	RET	A-9[1]
	Voltage signal	V	A-10
	Voltage common	RET	A-11[1]
	Current signal	I	A-12
	Current common	RET	A-13[1]
	Voltage signal	V	A-14
	Voltage common	RET	A-15[1]
	24V DC common		B-16…33[2]
	+24V	1794-TB2 – C-34…51 1794-TB3 – C-34…51	

(1) Terminals 1, 3, 5, 7, 9, 11, 13 and 15 are connected in the terminal base unit.

(2) Terminals 16…33 are internally connected in the terminal base unit.

Wire Connections for 1794-TB2, and 1794-TB3 using the 1794-IE4XOE2 Module

Channel	Signal Type	Label Markings	1794-TB2 and 1794-TB3	
			Signal	Common Terminal
Input 0	Current	I	0	17
	Voltage	V	1	18
Input 1	Current	I	2	19
	Voltage	V	3	20
Input 2	Current	I	4	21
	Voltage	V	5	22
Input 3	Current	I	6	23
	Voltage	V	7	24
Output 0	Current signal	I	8	
	Current common	RET	9[2]	
	Voltage signal	V	10	
	Voltage common	RET	11[2]	
Output 1	Current signal	I	12	
	Current common	V	13[2]	
	Voltage signal	I	14	
	Voltage common	V	15[2]	
	24V DC Common	16…33[1]		
	+24V DC Power	1794-TB2 – 34…51 1794-TB3 – 34…51		

[1] Terminals 16…33 are internally connected in the terminal base unit.

[2] Terminals 9, 11, 13, and 15 are internally connected in the module to 24V DC common.

Connect Wiring Using a 1794-TB3G or 1794-TB3GS Terminal Base Unit

1. Connect individual signal wiring to numbered terminals on 0...15 row (A), and 17...32 row (B) for 1794-TB3G and 1794-TB3GS as indicated in the following tables.

2. Connect any signal wiring shields to functional ground as near as possible to the module.
   1794-TB3G and 1794-TB3GS only: Connect to earth ground terminals B16, B33, C38, C40...C45 and C47.

3. Connect the -V DC common (return) to terminal 35 on the 34...51 row (C).

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

5. If continuing -V common to the next terminal base unit, connect a jumper from terminal 51 (-VDC common) on this base unit to the common terminal on the next terminal base unit.

Wire Connections for 1794-TB3G, and 1794-TB3GS using the 1794-IE12 Module

Channel	Signal Type	Label Markings	1794-TB3G and 1794-TB3GS	
			Input	Common Terminal
Input 0	Current	I	A-0	B-17
	Voltage	V	A-1	
Input 1	Current	I	A-2	B-18
	Voltage	V	A-3	
Input 2	Current	I	A-4	B-23
	Voltage	V	A-5	
Input 3	Current	I	A-6	B-24
	Voltage	V	A-7	
Input 4	Current	I	A-8	B-25
	Voltage	V	A-9	
Input 5	Current	I	A-10	B-26
	Voltage	V	A-11	
Input 6	Current	I	A-12	B-31
	Voltage	V	A-13	
Input 7	Current	I	A-14	B-32
	Voltage	V	A-15	
Input 8	Current	I	B-19	C-37
	Voltage	V	B-20	
Input 9	Current	I	B-21	C39
	Voltage	V	B-22	
Input 10	Current	I	B-27	C-46
	Voltage	V	B-28	
Input 11	Current	I	B-29	C-48
	Voltage	V	B-30	

Wire Connections for 1794-TB3G, and 1794-TB3GS using the 1794-IE12 Module

Channel	Signal Type	Label Markings	1794-TB3G and 1794-TB3GS	
			Input	Common Terminal
	24V DC common	1794-TB3G – C-35, C-51(1) 1794-TB3GS – C-35, C-51		
	+24V DC power	1794-TB3G – C-34, C-50(2) 1794-TB3GS – C-34, C-50		
	Chassis ground (Shield)	1794-TB3G – B-16, B-33, C-38, C-40…45, C-47(3) 1794-TB3GS – B-16, B-33, C-38, C-40…45, C-47		

(1) Terminals C-35 and C-51 are internally connected in the terminal base unit.

(2) Terminals C-34 and C-50 are internally connected in the terminal base unit.

(3) Terminals B-16, B-33, C-38, C-40 through C- 45, and C-47 are internally connected to chassis ground

Wire Connections for 1794-TB3G, and 1794-TB3GS using the 1794-OE12 Module

Channel	Signal Type	Label Markings	1794-TB3G and 1794-TB3GS	
			Output	Common Terminal
Output 0	Current	I	A-0	B-17
	Voltage	V	A-1	
Output 1	Current	I	A-2	B-18
	Voltage	V	A-3	
Output 2	Current	I	A-4	B-23
	Voltage	V	A-5	
Output 3	Current	I	A-6	B-24
	Voltage	V	A-7	
Output 4	Current	I	A-8	B-25
	Voltage	V	A-9	
Output 5	Current	I	A-10	B-26
	Voltage	V	A-11	
Output 6	Current	I	A-12	B-31
	Voltage	V	A-13	
Output 7	Current	I	A-14	B-32
	Voltage	V	A-15	
Output 8	Current	I	B-19	C-37
	Voltage	V	B-20	
Output 9	Current	I	B-21	C39
	Voltage	V	B-22	

Wire Connections for 1794-TB3G, and 1794-TB3GS using the 1794-OE12 Module

Channel	Signal Type	Label Markings	1794-TB3G and 1794-TB3GS	
			Output	Common Terminal
Output 10	Current	I	B-27	C-46
	Voltage	V	B-28	
Output 11	Current	I	B-29	C-48
	Voltage	V	B-30	
	24V DC common	1794-TB3G – C-35, C-51(1) 1794-TB3GS – C-35, C-51		
	+24V DC power	1794-TB3G – C-34, C-50(2) 1794-TB3GS – C-34, C-50		
	Chassis ground (Shield)	1794-TB3G – B-16, B-33, C-38, C-40…45, C-47(3) 1794-TB3GS – B-16, B-33, C-38, C-40…45, C-47		

(1) Terminals C-35 and C-51 are internally connected in the terminal base unit.

(2) Terminals C-34 and C-50 are internally connected in the terminal base unit.

(3) Terminals B-16, B-33, C-38, C-40 through C- 45, and C-47 are internally connected to chassis ground

Wire Connections for 1794-TB3G, and 1794-TB3GS using the 1794-IE8XOE4 Module

Channel	Signal Type	Label Marking	1794-TB3G or 1794-TB3GS	
			Input/output	Common Terminal
Input 0	Current	I0	A-0	B-17
	Voltage	V0	A-1	
Input 1	Current	I1	A-2	B-18
	Voltage	V1	A-3	
Input 2	Current	I2	A-4	B-23
	Voltage	V2	A-5	
Input 3	Current	I3	A-6	B-24
	Voltage	V3	A-7	
Input 4	Current	I4	A-8	B-25
	Voltage	V4	A-9	
Input 5	Current	I5	A-10	B-26
	Voltage	V5	A-11	
Input 6	Current	I6	A-12	B-31
	Voltage	V6	A-13	
Input 7	Current	I7	A-14	B-32
	Voltage	V7	A-15	
Output 0	Current	I8	B-19	C-37
	Voltage	V8	B-20	
Output 1	Current	I9	B-21	C-39
	Voltage	V9	B-22	
Output 2	Current	I10	B-27	C-46
	Voltage	V10	B-28	
Output 3	Current	I11	B-29	C-48
	Voltage	V11	B-30	

Wire Connections for 1794-TB3G, and 1794-TB3GS using the 1794-IE8XOE4 Module

Channel	Signal Type	Label Marking	1794-TB3G or 1794-TB3GS	
			Input/output	Common Terminal
-V DC Common	**1794-TB3G** and **1794-TB3GS** – Terminals C-35 and C-51 are internally connected in the terminal base unit.			
+V DC Power	**1794-TB3G** and **1794-TB3GS** –Terminals C-34 and C-50 are internally connected in the terminal base unit.			
Chassis Ground (Shield)	**1794-TB3G** and **1794-TB3GS** – Terminals B-16, B-33, C-38, C-40 through C- 45, and C-47 are internally connected to chassis ground.			

Connect Wiring Using a 1794-TB3S, 1794-TB3T, 1794-TB3TS, or 1794-TBN Terminal Base Unit

1. Connect individual input/output wiring to numbered terminals on the 0...15 row (**A**) for 1794-TB3S, 1794-TB3T and 1794-TB3TS, or on row (**B**) for the 1794-TBN as indicated in the following tables.

2. Connect channel common/return to the associated terminal on row (**A**) or row (**B**) for the 1794-TB3S, 1794-TB3T and 1794-TB3TS, or on row (**C**) for the 1794-TBN. For input devices requiring terminal base power, connect the channel power wiring to the associated terminal on row (**C**).

3. Connect any signal wiring shields to functional ground as near as possible to the module.

   1794-TB3T or -TB3TS only: Connect to earth ground terminals C-39...C-46.

4. Connect the +V DC power to terminal 34 on the 34...51 row (**C**) and -V common/return to terminal 16 on the (**B**) row.

5. If daisy chaining +V power to the next terminal base, connect a jumper from terminal 51 (+V DC) on this base unit to terminal 34 on the next base unit.

6. If continuing DC common (-V) to the next base unit, connect a jumper from terminal 33 (common) on this base unit to terminal 16 on the next base unit.

Wire Connections for 1794-TB3S, 1794-TB3T, and 1794-TB3TS using the 1794-IE8XT Module

Channel	Signal Type	Label Markings	1794 -TB3S, -TB3T, -TB3TS Input	1794-TB3S Power(1)	1794-TB3S Common Terminal		1794 -TB3T -TB3TS Shield
Input 0	Current	I	A-0	C-35	B-17	B-17	C-39
	Voltage	V	A-1	C-36	B-18		
Input 1	Current	I	A-2	C-37	B-19	B-18	C-40
	Voltage	V	A-3	C-38	B-20		
Input 2	Current	I	A-4	C-39	B-21	B-21	C-41
	Voltage	V	A-5	C-40	B-22		
Input 3	Current	I	A-6	C-41	B-23	B-23	C-42
	Voltage	V	A-7	C-42	B-24		
Input 4	Current	I	A-8	C-43	B-25	B-25	C-43
	Voltage	V	A-9	C-44	B-26		
Input 5	Current	I	A-10	C-45	B-27	B-27	C-44
	Voltage	V	A-11	C-46	B-28		
Input 6	Current	I	A-12	C-47	B-29	B-29	C-45
	Voltage	V	A-13	C-48	B-30		
Input 7	Current	I	A-14	C-49	B-31	B-31	C-46
	Voltage	V	A-15	C-50	B-32		
24V DC common	1794-TB3S – Terminals 16…33 are internally connected in the terminal base unit. 1794-TB3T, 1794TB3TS- – Terminals 16, 17, 19, 21, 23, 25, 27, 29, 31 and 33 are internally connected in the terminal base unit.						
+24V DC power	1794-TB3S – Terminals 34…51 are internally connected in the terminal base unit. 1794-TB3T, 1794-TB3TS – Terminals 34, 35, 50 and 51 are internally connected in the terminal base unit.						
Chassis ground (Shield)	1794-TB3T, 1794-TB3TS – Terminals 39…46 are internally connected to chassis ground.						

(1) Use when transmitter requires terminal base power.

Wire Connections for 1794-TB3S, 1794-TB3T and 1794-TB3TS using the 1794-OE8XT Module

Channel	Signal Type	Label Markings	1794-TB3S, 1794-TB3T, 1794-TB3TS		1794-TBN
			Output Terminal[1]	Shield 1794-TB3T, 1794-TB3TS	Output Terminal[2]
Output 0	Current	I	A-0	C-39	B-0
	Current	I RET	A-1		C-1
	Voltage	V	A-2	C-40	B-2
	Voltage	V RET	A-3		C-3
Output 1	Current	I	A-4	C-41	B-4
	Current	I RET	A-5		C-5
	Voltage	V	A-6	C-42	B-6
	Voltage	V RET	A-7		C-7
Output 2	Current	I	A-8	C-43	B-8
	Current	I RET	A-9		C-9
	Voltage	V	A-10	C-44	B-10
	Voltage	V RET	A-11		C-11
Output 3	Current	I	A-12	C-45	B-12
	Current	I RET	A-13		C-13
	Voltage	V	A-14	C-46	B-14
	Voltage	V RET	A-15		C-15
24V DC common	1794-TB3S – Terminals 16…33 are internally connected in the terminal base unit. 1794-TB3T, 1794TB3TS- – Terminals 16, 17, 19, 21, 23, 25, 27, 29, 31 and 33 are internally connected in the terminal base unit.				
+24V DC power	1794-TB3S – Terminals 34…51 are internally connected in the terminal base unit. 1794-TB3T, 1794-TB3TS – Terminals 34, 35, 50 and 51 are internally connected in the terminal base unit.				
Chassis ground (Shield)	1794-TB3T, 1794-TB3TS – Terminals 39…46 are internally connected to chassis ground.				

(1) 1A-1, 3, 5, 7, 9, 11, 13 and 15 are internally connected in the module to 24V DC common.

(2) 2C-1, 3, 5, 7, 9, 11, 13 and 15 are internally connected in the module to 24V DC common

Wire Connections for 1794-TB3S, 1794-TB3T and 1794-TB3TS using the 1794-IE4XOE2XT Module

Channel	Signal Type	Label Markings	1794 -TB3S, -TB3T, -TB3TS	1794-TB3S	1794-TB3S	1794-TB3T, 1794-TB3TS	
			Input/output Terminal[1]	Power Terminal[2]	Common Terminal		Shield
Input 0	Current	I	A-0	C-35	B-17	B-17	C-39
	Voltage	V	A-1	C-36	B-18		
Input 1	Current	I	A-2	C-37	B-19	B-18	C-40
	Voltage	V	A-3	C-38	B-20		
Input 2	Current	I	A-4	C-39	B-21	B-21	C-41
	Voltage	V	A-5	C-40	B-22		
Input 3	Current	I	A-6	C-41	B-23	B-23	C-42
	Voltage	V	A-7	C-42	B-24		
Output 0	Current	I	A-8				C-43
	Voltage	RET	A-9				
		V	A-10				C-44
		RET	A-11				
Output 1	Current	I	A-12				C-45
	Voltage	RET	A-13				
		V	A-14				C-46
		RET	A-15				
24V DC common	1794-TB3S – Terminals 16…33 are internally connected in the terminal base unit. 1794-TB3T, 1794TB3TS- – Terminals 16, 17, 19, 21, 23, 25, 27, 29, 31 and 33 are internally connected in the terminal base unit.						
+24V DC power	1794-TB3S – Terminals 34…51 are internally connected in the terminal base unit. 1794-TB3T, 1794-TB3TS – Terminals 34, 35, 50 and 51 are internally connected in the terminal base unit.						
Chassis ground (Shield)	1794-TB3T, 1794-TB3TS – Terminals 39…46 are internally connected to chassis ground.						

(1) A-9, 11, 13 and 15 are internally connected in the module to 24V DC common.

(2) Use when transmitter requires terminal base power.

Chapter Summary

In this chapter you learned how to install the FLEX I/O analog module in an existing programmable controller system and how to wire to a terminal base unit.

Write Configuration to and Read Status from Your Module

Overview

This chapter describes how to configure, read data from, and map data to your FLEX I/O analog module.

Configure Your Analog Module

Because of the many analog devices available and the wide variety of possible configurations, you must configure your module to conform to the analog device and specific application that you have chosen. The 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/output range selection
- safe state operating value (customer selected analog values the module will maintain in the event of a network communication error)

ATTENTION: PLC-5 family programmable controllers that use 6200 software programming tools can take advantage of the IOCONFIG utility to configure these modules. IOCONFIG uses menu-based screens for configuration without having to set individual bits in particular locations. Refer to your 6200 software literature for details.

Range Selection

Individual input channels are configurable to operate with the following voltage or current ranges.

Voltage and Current Ranges

Ranges	Bit Settings	
	Configure Select	Full Range
0…10V DC / 0…20 mA	0	1
4…20 mA	1	0
-10…+10V DC	1	1
Off[1]	0	0

(1) When configured to OFF, individual output channels drive 0V or 0 mA.

ATTENTION: If using Series A modules, do not use configure select and full range bit settings of 0. Individual channels revert to 4…20 mA with bit selections of all zeroes. This could result in unwanted or incorrect action.

You can select individual channel ranges using the designated words of the write block transfer instruction. See the Word/Bit Descriptions for your particular module for word and bit numbers.

Safe State Value Selection

You can select the analog values that your output module maintains in the event of a network communication error. When the multiplex control bits (M) are cleared simultaneously by a communication error, (or by the user), the analog outputs automatically switch to the values set in the safe state analog words. This allows you to define a safe operating state for controlled devices which depend on the analog output from the module.

Data Format

The data returned from the analog-to-digital converter in the module is 12-bit resolute. This value is left-justified into a 16-bit field, reserving the most significant bit for a sign bit. The 4...20 mA mode scales in the module and uses all 16 bits.

For more information on values for various current and voltage modes, and an example of scaling to engineering terms, see Module Programming on page 77.

Read Data From Your Module

Read programming transmits status and data from the analog module to the processor data table in one I/O scan. The processor user program initiates the request to the transfer data from the analog module to the processor.

Map Data for the Module

Read and write words and bit/word descriptions describe the information written to and read from the analog modules. Each word is composed of 16 bits. For a complete list of data for your specific module, see Data Tables on page 53.

Chapter Summary

In this chapter you learned about data and instructions to configure and map your FLEX I/O High-Density Analog Modules.

Notes:

Communicate With Your Module

Overview

Read this chapter to familiarize yourself with configurable features on the input and output analog modules

About DeviceNetManager

DeviceNetManager™ is a software 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.

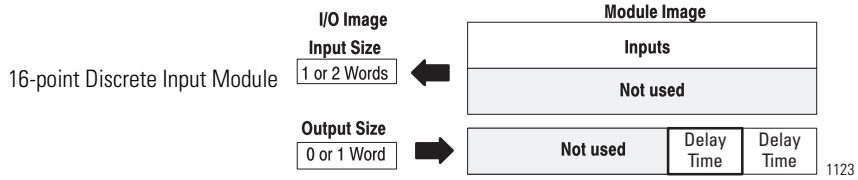
You must know and understand how DeviceNetManager works in order to add a device to the network. Refer to the DeviceNetManager software online help for more information on using DeviceNetManager software.

Communication Over the I/O Backplane

A FLEX I/O adapter communicates to other network system components over the network. The adapter communicates with its I/O modules over the backplane.

The I/O map for a module is divided into read words and write words. Read words consist of input and status words, and write words consist of output and configuration words. The number of read words or write words can be 0 or more. The length of each I/O module's read words and write words vary in size depending on module complexity. Each I/O module will support at least 1 input word or 1 output word. Status and configuration are optional, depending on the module.

For example, a 16 point discrete input module will have up to 2 read words and 1 write word.

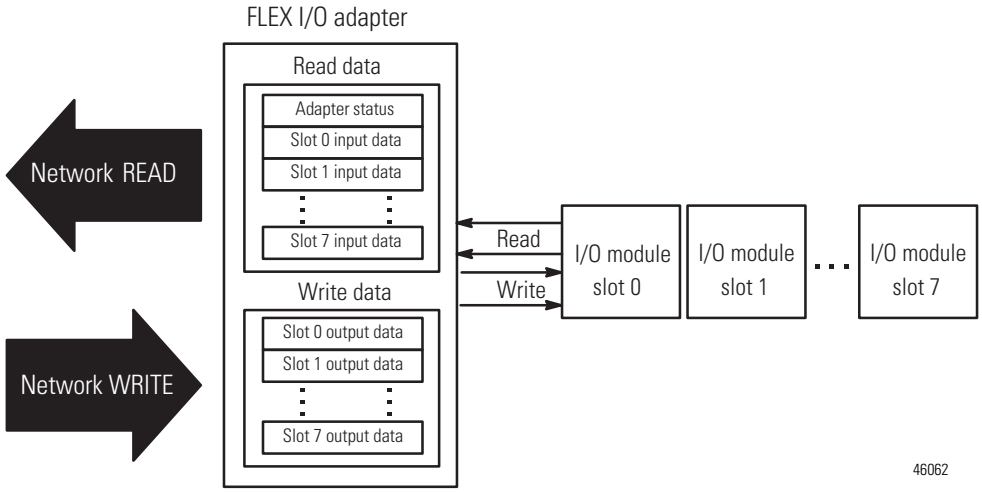


Check the I/O map for each module for the exact mapping.

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.

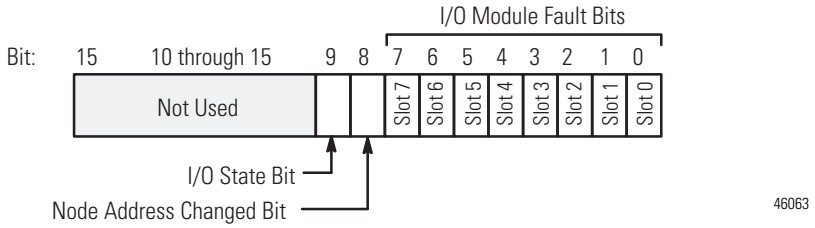
The first word of input data sent by the adapter is the Adapter Status Word. This is followed by the input data from each slot, in the order of installed I/O modules. The Input data from Slot 0 is first after the status word, followed by Input data from Slot 2, and so on to slot 7.



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 table Word Bit Description on page 43.

Word Bit Description

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…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 effect until the adapter has been powered down and then powered back up. Until this power cycling occurs, the node address switches will not match the actual node address.

Defaults

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

Module Default Values

Module Defaults for:		Factory Defaults		Real Time Size	
Catalog Number	Description	Input Default	Output Default	Input Default	Output Default
1794-IE8/B	8-pt Analog Input	9	6	8	0
1794-IE8XT	8-pt Analog Input	9	6	8	0
1794-IE12	12-pt Analog Input	13	2	12	1
1794-OE4/B	4-pt Analog Output	1	14	0	4

Module Default Values

Module Defaults for:		Factory Defaults		Real Time Size	
Catalog Number	Description	Input Default	Output Default	Input Default	Output Default
1794-OE4XT	4-pt Analog Output	1	14	0	4
1794-OE12	12-pt Analog Output	1	14	0	13
1794-IE4XOE2	4 in/2 out Analog Combo	5	10	4	2
1794-IE4XOE2XT	4 in/2 out Analog Combo	5	10	4	2
1794-IE8XOE4	8 in/4 out Analog Combo	9	6	8	5

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 input analog module, you have 9 input words, and 6 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 size.

Real time size is the setting that provides optimal real time data to the adapter module.

Analog modules have 15 words assigned to them. This is divided into inputs words and output words. You can reduce the I/O data size to fewer words to increase data transfer over the backplane. For example, an 8 input analog module has 9 words input and 6 words output with factory default. You can reduce the input words to 8 by not using the underrange settings set in Word 9. Likewise, you can reduce the write words to 0, thus eliminating the configuration setting and unused words.

For information on using DeviceNetManager software, refer to the DeviceNetManager Software help.

Chapter Summary

This chapter explained how to communicate with your module.

Specifications

Overview

This Appendix lists all input, output, general and environment specifications, as well as certifications for the following FLEX I/O Analog Modules: 1794-IE8, 1794-IE8XT, 1794-IE12, 1794-OE4, 1794-OE4XT, 1794-OE12, 1794-IE4XOE2, 1794-IE4XOE2XT, 1794-IE8XOE4.

Input Specifications

The following are input specifications for the FLEX I/O analog input and combination modules.

Input Specifications – 1794-IE8, 1794-IE8XT, 1794-IE12, 1794-IE4XOE2, 1794-IE4XOE2XT, 1794-IE8XOE4 Analog Input Modules

Specification	1794-IE12	1794-IE8XOE4	1794-IE8, 1794-IE8XT	1794-IE4XOE2, 1794-IE4XOE2XT
Number of inputs	12 single-ended, non-isolated	8 single-ended, non-isolated		4 single-ended, non-isolated
Resolution Voltage Current	 320 μV/cnt 0.641 μA/cnt		 2.56 mV/cnt unipolar; 5.13 mV/cnt bipolar 5.13 μA/cnt	
Conversion type	Successive approx			
Conversion rate, all channels	8.0 ms		256 μs	
Input current terminal (user configurable)	4…20 mA 0…20 mA			
Input voltage terminal (user configurable)	±10V 0…10V			
Normal mode rejection ratio voltage terminal current terminal	 -3 db @ 0.05 Hz; -20 db/decade -52 db @ 50 Hz: -54 db @ 60 Hz -3 db @ 1.5 Hz: -20 db/decade -29 db @ 50 H		 -3 db @ 17 Hz; -20 db/decade -10.0 dB @ 50 Hz, -11.4 dB @ 60 Hz -3 db @ 9 Hz; -20 db/decade -15.3 dB @ 50 Hz, -16.8 dB @ 60 Hz	
Step response to 63% voltage terminal current terminal	 1.3 s 0.09 s		 9.4 ms 18.2 ms	

Input Specifications – 1794-IE8, 1794-IE8XT, 1794-IE12, 1794-IE4XOE2, 1794-IE4XOE2XT, 1794-IE8XOE4 Analog Input Modules

Specification	1794-IE12	1794-IE8XOE4	1794-IE8, 1794-IE8XT	1794-IE4XOE2, 1794-IE4XOE2XT
Input Impedance Voltage Terminal Current Terminal	 > 1 MΩ < 100 Ω[1]		 100 kΩ 238 Ω	
Absolute accuracy Voltage Terminal Current Terminal	 0.1% Full scale @ 25 °C 0.1% Full scale @ 25 °C		 0.29% Full scale @ 25 °C 0.29% Full scale @ 25 °C	
Accuracy Drift with Temperature Voltage Terminal Current Terminal	 0.00428% Full scale/°C 0.00407% Full scale/°C			
Max overload	30V continuous or 32 mA continuous, one channel at a time			

[1] If 24V DC is removed from the module, input resistance is <100 Ω. This is also true at 0 mA current input, even if there is 24V DC. If there is an input current applied, input resistance is >1 MΩ.

Output Specifications

The following are output specifications for the FLEX I/O analog output and combination modules.

Output Specifications – 1794-OE4, 1794-OE4XT, 1794-OE12, 1794-IE4XOE2, 1794-IE4XOE2XT, 1794-IE8XOE4

Specification	1794-OE12	1794-IE8XOE4	1794-OE4, 1794-OE4XT	1794-IE4XOE2, 1794-IE4XOE2XT
Number of outputs	12 single-ended, non-isolated	4 single-ended, non-isolated		2 single-ended, non-isolated
Output voltage range, nom	±10V			
Output current, max	0…20 mA			
Voltage output current load, max	3 mA			
Voltage resolution	320 µV/cnt		2.56 µV/cnt	
Current resolution	0.641 µA/cnt		5.13 µA/cnt	
Absolute accuracy Voltage Terminal Current Terminal	 0.1% Full scale @ 25% 0.1% Full scale @ 25%		 0.133% Full scale @ 25% 0.425% Full scale @ 25%	
Accuracy Drift with Temperature Voltage Terminal Current Terminal	 0.004% Full scale/° C 0.004% Full scale/° C		 0.0045% Full scale/° C 0.0069% Full scale/° C	
Resistive load, mA output	0…750 Ω @ 24V DC		15…750 Ω @ 24V DC	

General Specifications

The following are general specifications common to all the FLEX I/O analog modules in this publication.

Output Specifications – 1794-OE4, 1794-OE4XT, 1794-OE12, 1794-IE4XOE2, 1794-IE4XOE2XT, 1794-IE8XOE4

Specification	1794-IE12, 1794-OE12, 1794-IE8XOE4	1794-IE8, 1794-IE8XT, 1794-OE4, 1794-OE4XT,1794-IE4XOE2, 1794-IE4XOE2XT	
Module location	1794-TB3G 1794-TB3GS	1794-TB2 1794-TB3 1794 -TB3S 1794-TB3T 1794-TB3TS **For 1794-OE4, 1794-OE4XT only** 1794-TBN	
Keyswitch position	**1794-IE12** 3 **1794-OE12** 4 **1794-IE8XOE4** 5	**1794-IE8, 1794-IE8XT** 3 **1794-OE4, 1794-OE4XT** 4 **1794-IE4XOE2, 1794-IE4XOE2XT** 5	
Dimensions, approx. (HxWxD)	94.0 x 94.0 x 53.3 mm (3.7 x 3.7 x 2.1 in.)	45.7 x 94.0 x 53.3 mm (1.8 x 3.7 x 2.1 in.)	
Calibration	None required		
Indicators	1 green/red power/status indicator	1 green power indicator	
Data format	16 bit 2's complement, left justified		
External DC power supply, nom	24V DC		
External DC power supply, voltage range	10.0…31.2V DC (includes 5% AC ripple)	19.2…31.2V DC (includes 5% AC ripple)	
External DC power supply, current	**1794-IE12** 30 mA @ 24V DC; 45 mA @ 10V DC **1794-OE12** 320 mA @ 24V DC; 720 mA @ 10V DC **1794-IE8XOE4** 140 mA @ 24V DC; 280 mA @ 10V DC	70 mA @ 24V DC **1794-IE8, 1794-IE8XT** 60 mA @ 24V DC	150 mA @ 12V DC
FlexBus current	80 mA	70 mA 60 mA – **For 1794-IE8, 1794-IE8XT only**	
Isolation voltage	50V continuous Tested at 850V DC for 60 s between user power to system No isolation between individual channels	50V continuous Tested @ 850V DC for 1 s between user power to system No isolation between individual channels	

Output Specifications – 1794-OE4, 1794-OE4XT, 1794-OE12, 1794-IE4XOE2, 1794-IE4XOE2XT, 1794-IE8XOE4

Specification	1794-IE12, 1794-OE12, 1794-IE8XOE4	1794-IE8, 1794-IE8XT, 1794-OE4, 1794-OE4XT,1794-IE4XOE2, 1794-IE4XOE2XT	
Power dissipation, max.	**1794-IE12** 1.2 W @ 31.2V DC **1.1 W @ 24V DC** 0.9 W @ 10.0V DC **1794-OE12** 4.0 W @ 31.2V DC 4.3 W @ 24V DC 4.0 W @ 10.0V DC **1794-IE8XOE4** 3.0 W @ 31.2V DC 2.3 W @ 24V DC 2.0 W @ 10.0V DC	**1794-IE8** 3.0 W @ 31.2V DC **1794-OE8** 4.5 W @ 31.2V DC	4.0 W @ 31.2V DC
Thermal dissipation, max.	**1794-IE12** 4.1 BTU/hr @ 31.2V DC **1794-OE12** 4.7 BTU/hr @ 24V DC **1794-IE8XOE4** 10.3 BTU/hr @ 31.2V DC	**1794-IE8** 10.2 BTU/hr @ 31.2V DC **1794-OE8** 15.3 BTU/hr @ 31.2V DC	13.6 BTU/hr @ 31.2V DC
Wire size – Power	0.34…2.5 mm2 (22…12 AWG) stranded copper wire rated at 75° C 167° F) or higher 4 mm2 (12 gauge) stranded, max – **For 1794-IE8 and 1794-IE8XT only** 1.2 mm (3/64 in.) insulation, max.		
Wire category[1]	2 – on signal port 2 – on power ports		
Terminal base screw torque	**1794-TB3G and 1794-TB3GS** 0379…1.02 N•m (7…9 lb-in.)	0.8 N•m (7 lb-in.) **1794-TBN** 1.0 N•m (9 lb-in.)	
Enclosure type rating	None (open-style)		

(1) Use this Conductor Category information for planning conductor routing. Refer to Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1.

Environmental Specifications

The following are the environmental specifications common to all the FLEX I/O analog modules in this publication.

Environmental Specifications

Specification	Description
Temperature, operating	IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock): 0…55 °C (32…131 °F) -20…+60 °C (-40…+185 °F) – **For 1794-IE12, 1794-OE12 and 1794-IE8XOE4 only**
Temperature, nonoperating	IEC 60068-2-1 (Test Ab, Unpackaged Nonoperating Cold), IEC 60068-2-2 (Test Bb, Unpackaged Nonoperating Dry Heat), IEC 60068-2-14 (Test Na, Unpackaged Nonoperating Thermal Shock): –40…85 °C (–40…185 °F)
Relative humidity	IEC 60068-2-30 (Test Db, Unpackaged Damp Heat): 5…95% noncondensing
Vibration	IEC 60068-2-6 (Test Fc, Operating): 5 g @ 10…500 H
Shock, operating	IEC60068-2-27 (Test Ea, Unpackaged shock): Operating 30 g
Shock, nonoperating	IEC60068-2-27 (Test Ea, Unpackaged shock): Nonoperating 50 g
Emissions	CISPR 11: Group 1, Class A
ESD immunity	IEC 61000-4-2: 6 kV contact discharges 4 kV contact discharges – **For 1794-IE8, 1794-OE4, 1794-IE4XOE2 and 1794-IE4XOE2XT only** 8 kV air discharges
Radiated RF immunity	**1794-IE12, 1794-OE12, 1794-IE8XOE4** IEC 61000-4-3: 10 V/m with 1 kHz sine-wave 80% AM from 30…2000 MHz 10 V/m with 200 Hz 50% pulse 100% AM at 900 MHz 10 V/m with 200 Hz 50% pulse 100% AM at 1890 MHz 3 V/m with 1 kHz sine-wave 80% AM from 2…2.7 GHz
	1794-IE8, 1794-OE4, 1794-IE4XOE2 and 1794-IE4XOE2XT 10V/m with 1 kHz sine-wave 80%AM from 30MHz to 1000MHz
EFT/B immunity	IEC 61000-4-4: ±2 kV at 5 kHz on power ports – **For 1794-IE12, 1794-OE12, 1794-IE8XOE4 only** ±2 kV at 5 kHz on signal ports

Environmental Specifications

Specification	Description
Conducted RF immunity	**1794-IE12, 1794-OE12, 1794-IE8XOE4** IEC 61000-4-6: 10V/m with 1 kHz sine-wave 80%AM from 150 kHz…80 MHz
	1794-IE8, 1794-OE4, 1794-IE4XOE2 and 1794-IE4XOE2XT IEC 61000-4-6: 10V/m with 1 kHz sine-wave 80%AM from 150 kHz…30 MHz
Surge transient immunity	IEC 6100-4-5: ±2 kV line-earth (CM) on shielded ports – **For 1794-IE8, 1794-OE4, 1794-IE4XOE2 and 1794-IE4XOE2XT only**

Certification

The following are the certifications common to all the FLEX I/O analog modules in this publication.

Certifications

Certifications (when product is marked)[1]	Value
c-UL-us	UL Listed Industrial Control Equipment, certified for US and Canada. See UL File E65584 UL Listed for Class I, Division 2 Group A,B,C,D Hazardous Locations, certified for U.S. and Canada. See UL File E194810.
CSA	CSA certified Process Control Equipment CSA certified for Class 1, Division 2, Groups A, B, C and D Hazardous locations
CE	European Union 2004/108/EC EMC Directive, compliant with: EN 61326; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity EN 61000-6-4; Industrial Emissions EN 50082-2; Industrial Immunity
C-Tick	Australian Radiocommunications Act, compliant with: AS/NZS CISPR 11; Industrial Emissions
Ex	European Union 94/9/EC ATEX Directive, compliant with: EN 60079-15; Potentially Explosive Atmospheres, Protection "n" (Zone 2)

(1) 1) See the Product Certification link at www.ab.com for Declarations of Conformity, Certificates, and other certification details.

Differences Between Series

Overview

The following lists major differences between series A and series B of your FLEX I/O analog modules.

Differences Between Series A and Series B

Catalog Number	Description	Series A	Series B
1794-IE8 1794-OE4 1794-IE4XOE2	Power Up bit in Read Word	None	This bit is set when all bits in the configuration register are 0 unconfigured state).
	Change to range selection tables	No off position available. Module produces either 2V or 4 mA, depending on the range selected, until module is configured.	Off position now produces 0V or 0 mA depending on the range selected, until module is configured.
Specifications			
1794-OE4	Output current terminal	4 mA output until module is configured 4…20 mA user configurable 0…20 mA user configurable	0 mA output until module is configured 4…20 mA user configurable 0…20 mA user configurable
	Output voltage terminal	2V output until module is configured ±10V user configurable 0…10V user configurable	0V output until module is configured ±10V user configurable 0…10V user configurable
1794-IE4XOE2	Output current terminal	4 mA output until module is configured 4…20 mA user configurable 0…20 mA user configurable	0 mA output until module is configured 4…20 mA user configurable 0…20 mA user configurable
	Output voltage terminal	2V output until module is configured ±10V user configurable 0…10V user configurable	0V output until module is configured ±10V user configurable 0…10V user configurable
1794-IE8 1794-OE4 1794-IE4XOE2	Agency Certification (when product or packaging is marked)	• CSA certified • CSA Class I, Division 2, Groups A, B, C, D certified • UL listed	• CSA certified • CSA Class I, Division 2, Groups A, B, C, D certified • UL listed • CE marked for all applicable directives

Notes:

Data Tables

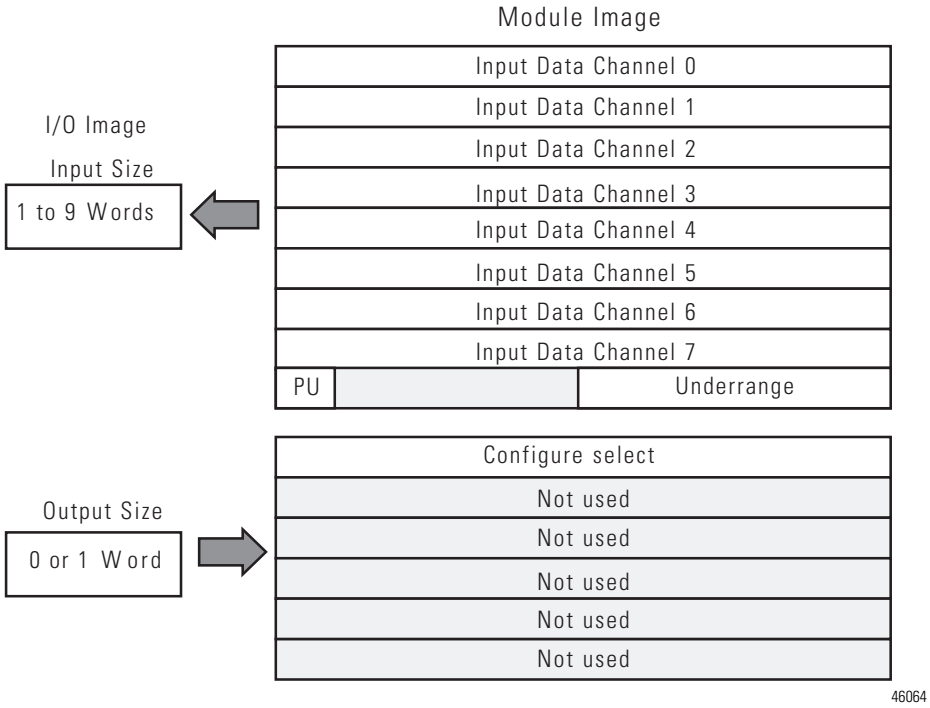
Overview

I/O messages are sent to (consumed) and received from (produced) the FLEX I/O modules. These messages are mapped into the processor memory. This appendix lists the default data maps for 1794 FLEX I/O analog modules.

Block Transfer Read and Write

The following block transfer read and write word bit information is presented for experienced users only.

1794-IE8 Series B and 1794-IE8XT – 8 Input Analog Module Image Table Mapping



Memory Map – 1794-IE8/B and 1794-IE8XT Analog Input Module

Decimal Bit	**15**	**14**	**13**	**12**	**11**	**10**	**09**	**08**	**07**	**06**	**05**	**04**	**03**	**02**	**01**	**00**	**Size**
Octal Bit	**17**	**16**	**15**	**14**	**13**	**12**	**11**	**10**	**07**	**06**	**05**	**04**	**03**	**02**	**01**	**00**	**Read/Write Words**
	S	Analog Value Channel 0															Read Word 0
	S	Analog Value Channel 1															Read Word 1
	S	Analog Value Channel 2															Read Word 2
	S	Analog Value Channel 3															Read Word 3
	S	Analog Value Channel 4															Read Word 4
	S	Analog Value Channel 5															Read Word 5
	S	Analog Value Channel 6															Read Word 6
	S	Analog Value Channel 7															Read Word 7
	PU	Not used – set to zero							U7	U6	U5	U4	U3	U2	U1	U0	Read Word 8
	C7	C6	C5	C4	C3	C2	C1	C0	F7	F6	F5	F4	F3	F2	F1	F0	Write Word 0
	Not used																Write Word 1…5
Where:	PU = Power up bit – included in series B modules only. U = Underrange bits for 4…20 mA inputs C = Configure select bit F = Full range bit S = sign bit (in 2's complement)																

Range Selection Bits – 1794-IE8/B and 1794-IE8XT Analog Input Module

Channel No.	CH 00		CH 01		CH 02		CH 03		CH 04		CH 05		CH 06		CH 07	
	F0	C0	F1	C1	F2	C2	F3	C3	F4	C4	F5	C5	F6	C6	F7	C7
Bit	00	08 (10)	01	09 (11)	02	10 (12)	03	11 (13)	04	12 (14)	05	13 (15)	06	14 (16)	07	15 (17)
0…10V DC /0…20 mA	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0
4…20 mA	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
-10…+10V DC	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Off[1]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Where:	C = Configure select bit F = Full range bit															

(1) When configured to OFF, individual channels will return 000H on Series B modules, and 4…20 mA on Series A modules.

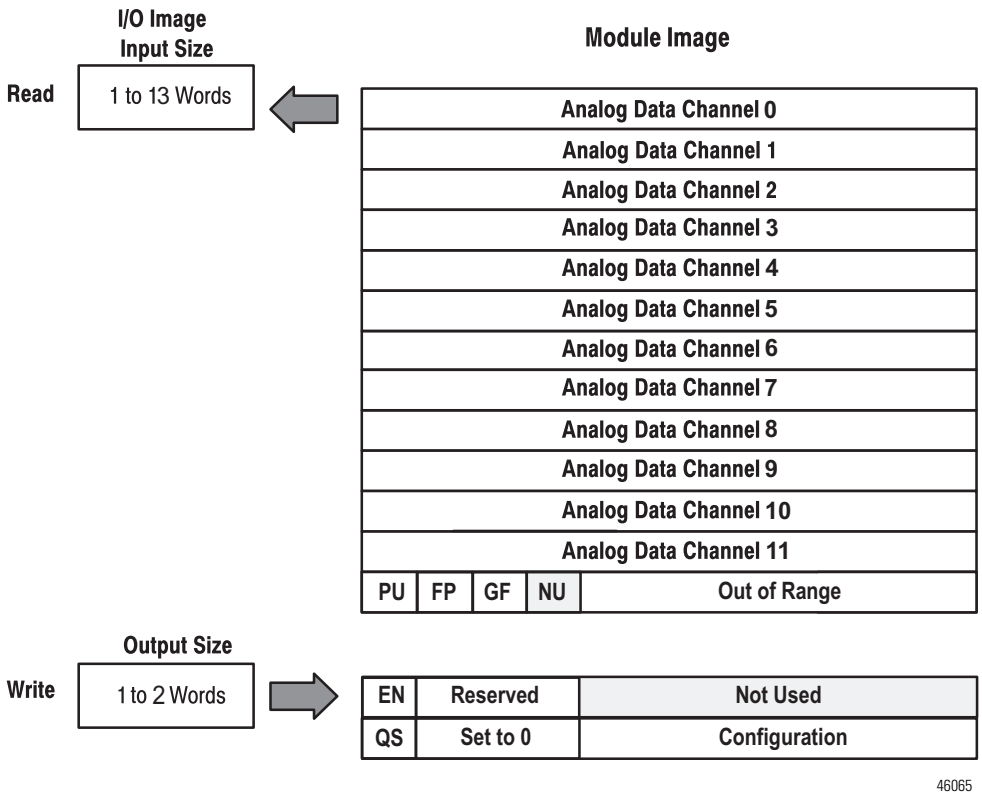
Word/Bit Descriptions – 1794-IE8/B and 1794-IE8XT Analog Input Module

Word	Decimal Bit (Octal Bit)	Definition
Read Word 0	Bits 00…14 (00…16)	**Channel 0 analog data** – 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA uses all 16 bits.
	Bit 15 (17)	**Channel 0 analog data sign bit.**
Read word 1	Bits 00…14 (00…16)	**Channel 1 analog data** – 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA uses all 16 bits.
	Bit 15 (17)	**Channel 1 analog data sign bit.**
Read word 2	Bits 00…14 (00…16)	**Channel 2 analog data** – 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA uses all 16 bits.
	Bit 15 (17)	**Channel 2 analog data sign bit.**
Read word 3	Bits 00…14 (00…16)	**Channel 3 analog data** – 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA uses all 16 bits.
	Bit 15 (17)	**Channel 3 analog data sign bit.**
Read word 4	Bits 00…14 (00…16)	**Channel 4 analog data** – 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA uses all 16 bits.
	Bit 15 (17)	**Channel 4 analog data sign bit.**
Read word 5	Bits 00…14 (00…16)	**Channel 5 analog data** – 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA uses all 16 bits.
	Bit 15 (17)	**Channel 5 analog data sign bit.**

Word/Bit Descriptions – 1794-IE8/B and 1794-IE8XT Analog Input Module

Word	Decimal Bit (Octal Bit)	Definition
Read word 6	Bits 00…14 (00…16)	**Channel 6 analog data** – 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA uses all 16 bits.
	Bit 15 (17)	**Channel 6 analog data sign bit.**
Read word 7	Bits 00…14 (00…16)	**Channel 7 analog data** – 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA uses all 16 bits.
	Bit 15 (17)	**Channel 7 analog data sign bit.**
Read word 8	Bits 00…07	**Underrange bits (U)** for individual channels (4…20 mA current input only) – Bit 00 corresponds to input channel 0, bit 01 corresponds to input channel 1, and so on. When set (1), indicates either a broken or open input wire, or input current at or below 4 mA.
	Bits 08…14 (10…16)	**Not used** – set to 0.
	Bit 15 (17)	**Power Up bit** – included in series B modules only. This bit is always 0 in series A modules. This bit is set to 1 when all bits in the configuration register (write word 0) are 0 (unconfigured state). The configuration register can be cleared by either a reset, or by the user writing all zeroes to it.
Write word 0	Bits 00…07	**Full range bits (F) for individual channels** – Bit 00 corresponds to input channel 0, bit 01 corresponds to input channel 1 and so on.
	Bit 08…15 (10…17)	**Configure select bits (C) for individual channels** – Bit 08 corresponds to input channel 0, bit 09 corresponds to input channel 1 and so on.
Write words 1…5	Bits 00…15 (0…17)	**Not used** – set to 0.

1794-IE12 – 12 Input Analog Module Image Table Mapping



Memory Map – 1794-IE12 Analog Input Module

Decimal Bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00	Size
Octal Bit	**17**	**16**	**15**	**14**	**13**	**12**	**11**	**10**	**07**	**06**	**05**	**04**	**03**	**02**	**01**	**00**	**Read/Write Words**
	S	Analog Value Channel 0															Read word 0
	S	Analog Value Channel 1															Read word 1
	S	Analog Value Channel 2															Read word 2
	S	Analog Value Channel 3															Read word 3
	S	Analog Value Channel 4															Read word 4
	S	Analog Value Channel 5															Read word 5
	S	Analog Value Channel 6															Read word 6
	S	Analog Value Channel 7															Read word 7
	S	Analog Value Channel 8															Read word 8
	S	Analog Value Channel 9															Read word 9
	S	Analog Value Channel 10															Read word 10
	S	Analog Value Channel 11															Read word 11
	PU	FP	GF	NU	R11	R10	R9	R8	R7	R6	R5	R4	R3	R2	R1	R0	Read word 12

Memory Map – 1794-IE12 Analog Input Module

Decimal Bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00	Size
Octal Bit	**17**	**16**	**15**	**14**	**13**	**12**	**11**	**10**	**07**	**06**	**05**	**04**	**03**	**02**	**01**	**00**	**Read/Write Words**
	EN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Write word 0
	QS	0	0	0	CAB		C89		C67		C45		C23		C01		Write word 1

Where:
PU = Power up bit
S = sign bit (in 2's complement)
FP = Field power off
GF = General fault
NU = Not used
Rx = Out of range (x = associated channel)
EN = Enable
QS = Quick step bit – allows input filter to be reduced during rapid signal changes
Cxx = Configuration

Range Selection Bits – 1794-IE12 Analog Input Module

Range	Out of Range	Range Setting	Cxx Channel Configuration
-10…+10V DC	< -10.0V or > 10.0V	Set bits for each channel pair 00 = off 01 = 0…20 mA 10 = 4…20 mA 11 = ±10V	C01 for channels 0 and 1 C23 for channels 2 and 3 C45 for channels 4 and 5 C67 for channels 6 and 7 C89 for channels 8 and 9 CAB for channels 10 and 11
4…20 mA	< 4.0 mA or > 20.0 mA		
0…20 mA	< 0.0 mA or > 20.0 mA		
Where:	Cxx = associated channel pair		

Word/Bit Descriptions – 1794-IE12 Analog Input Module

Word	Decimal Bit (Octal Bit)	Definition
Read Word 0	Bits 00…14 (00…16)	**Channel 0 analog data** – 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA uses all 16 bits.
	Bit 15 (17)	**Channel 0 analog data sign bit.**
Read word 1	Bits 00…14 (00…16)	**Channel 1 analog data** – 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA uses all 16 bits.
	Bit 15 (17)	**Channel 1 analog data sign bit.**
Read word 2	Bits 00…14 (00…16)	**Channel 2 analog data** – 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA uses all 16 bits.
	Bit 15 (17)	**Channel 2 analog data sign bit.**
Read word 3	Bits 00…14 (00…16)	**Channel 3 analog data** – 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA uses all 16 bits.
	Bit 15 (17)	**Channel 3 analog data sign bit.**

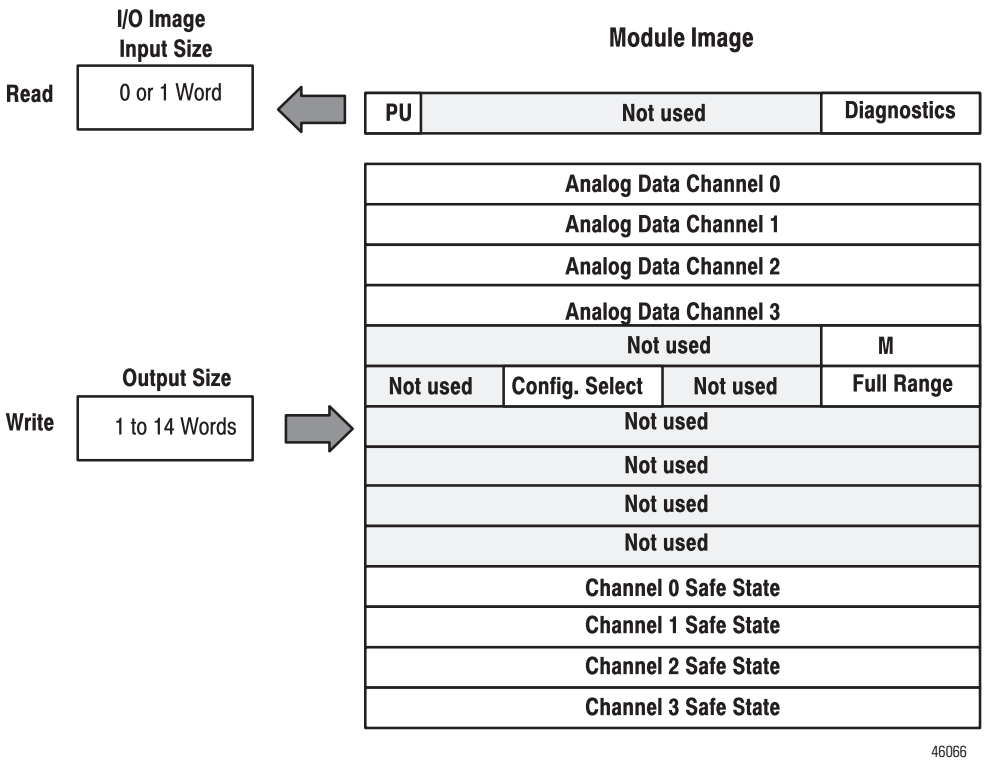
Word/Bit Descriptions – 1794-IE12 Analog Input Module

Word	Decimal Bit (Octal Bit)	Definition
Read word 4	Bits 00…14 (00…16)	**Channel 4 analog data** – 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA uses all 16 bits.
	Bit 15 (17)	**Channel 4 analog data sign bit.**
Read word 5	Bits 00…14 (00…16)	**Channel 5 analog data** – 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA uses all 16 bits.
	Bit 15 (17)	**Channel 5 analog data sign bit.**
Read word 6	Bits 00…14 (00…16)	**Channel 6 analog data** – 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA uses all 16 bits.
	Bit 15 (17)	**Channel 6 analog data sign bit.**
Read word 7	Bits 00…14 (00…16)	**Channel 7 analog data** – 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA uses all 16 bits.
	Bit 15 (17)	**Channel 7 analog data sign bit.**
Read word 8	Bits 00…14 (00…16)	**Channel 8 analog data** – 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA uses all 16 bits.
	Bit 15 (17)	**Channel 8 analog data sign bit.**
Read word 9	Bits 00…14 (00…16)	**Channel 9 analog data** – 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA uses all 16 bits.
	Bit 15 (17)	**Channel 9 analog data sign bit.**
Read word 10	Bits 00…14 (00…16)	**Channel 10 analog data** – 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA uses all 16 bits.
	Bit 15 (17)	**Channel 10 analog data sign bit.**
Read word 11	Bits 00…14 (00…16)	**Channel 11 analog data** – 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA uses all 16 bits.
	Bit 15 (17)	**Channel 11 analog data sign bit.**

Word/Bit Descriptions – 1794-IE12 Analog Input Module

Word	Decimal Bit (Octal Bit)	Definition
Read word 12	Bits 00…11 (00…13)	**Out of range bits (R)** for individual channels – Bit 00 corresponds to input channel 0, bit 01 corresponds to input channel 1, and so on. When set (1), indicates out of range. For more details on out of range, see Table Range Selection Bits – 1794-IE12 Analog Input Module on page 58.
	Bit 12 (14)	**Not used** – set to 0.
	Bit 13 (15)	**General Fault** – Bit set to 1 if a fault has occurred including: RAM test failure, ROM test failure, reserved bits asserted (bits 12…0 of the Reserved word and 15…12 of the Config word) and EEPROM failure.
	Bit 14 (16)	**Field Power Off** – Bit is set to 1 if the field power is off. This is not an indication of field power that is out of tolerance.
	Bit 15 (17)	**Power Up bit** – This bit is set to 1 when all bits in the configuration register (write word 1) are 0 (unconfigured state).
Write word 0	Bits 00…14 (00…16)	**Reserved** – set to 0.
	Bit 15 (17)	**Module Enable bit** – Set the bit to 1 to enable the module. This will turn the OK LED solid green.
Write word 1	Bits 00…11 (00…13)	**Configuration** – Set the 2-bit pattern that configures a pair of channels for Off, 0…20 mA, 4…20 mA, and ±10V. For more information, see Table Range Selection Bits – 1794-IE12 Analog Input Module on page 58.
	Bits 12…14 (14…16)	**Set to 0**.
	Bit 15 (17)	**Quick Step bit** – Set to 1 to allow input filter to be reduced during rapid signal changes. Once the signal change is within 1% of FS (that is, 327 counts), filtering is returned to normal.

1794-OE4 Series B and 1794-OE4XT– 4 Output Analog Module Image Table Mapping



Memory Map – 1794-OE4/B and 1794-OE4XT Analog Output Module

Decimal Bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00	Size
Octal Bit	**17**	**16**	**15**	**14**	**13**	**12**	**11**	**10**	**07**	**06**	**05**	**04**	**03**	**02**	**01**	**00**	**Read/Write Words**
	PU	Not used – set to 0											W3	W2	W1	W0	Read word 0
	S	Analog Value Channel 0															Write word 0
	S	Analog Value Channel 1															Write word 1
	S	Analog Value Channel 2															Write word 2
	S	Analog Value Channel 3															Write word 3
	Not used – set to 0												M3	M2	M1	M0	Write word 4
	Not used – set to 0				C3	C2	C1	C0	Not used – set to 0				F3	F2	F1	F0	Write word 5
	Not used – set to 0																Write words 6…9
	S	Safe State Value – Channel 0															Write word 10
	S	Safe State Value – Channel 1															Write word 11
	S	Safe State Value – Channel 2															Write word 12
	S	Safe State Value – Channel 3															Write word 13

Where:
PU = Power up bit
W = Diagnostic bits for current output wire broken or load resistance high. Not used on voltage outputs.
S = Sign bit (in 2's complement)
M = Multiplex control
C = Configure select bit
F = Full range bit

Range Selection Bits – 1794-OE4/B and 1794-OE4XT Analog Output Module

Channel No.	CH 00		CH 01		CH 02		CH 03	
	F0	C0	F1	C1	F2	C2	F3	C3
	00	08 (10)	01	09 (11)	02	10 (12)	03	11 (13)
4…20 mA	0	1	0	1	0	1	0	1
0…10V DC /0…20 mA	1	0	1	0	1	0	1	0
-10…+10V DC	1	1	1	1	1	1	1	1
Off[1]	0	0	0	0	0	0	0	0
Where:	C = Configure select bit F = Full range bit							

(1) When configured to OFF, individual channels will return 0V or 0 mA on Series B modules, and 2V or 4 mA on Series A modules.

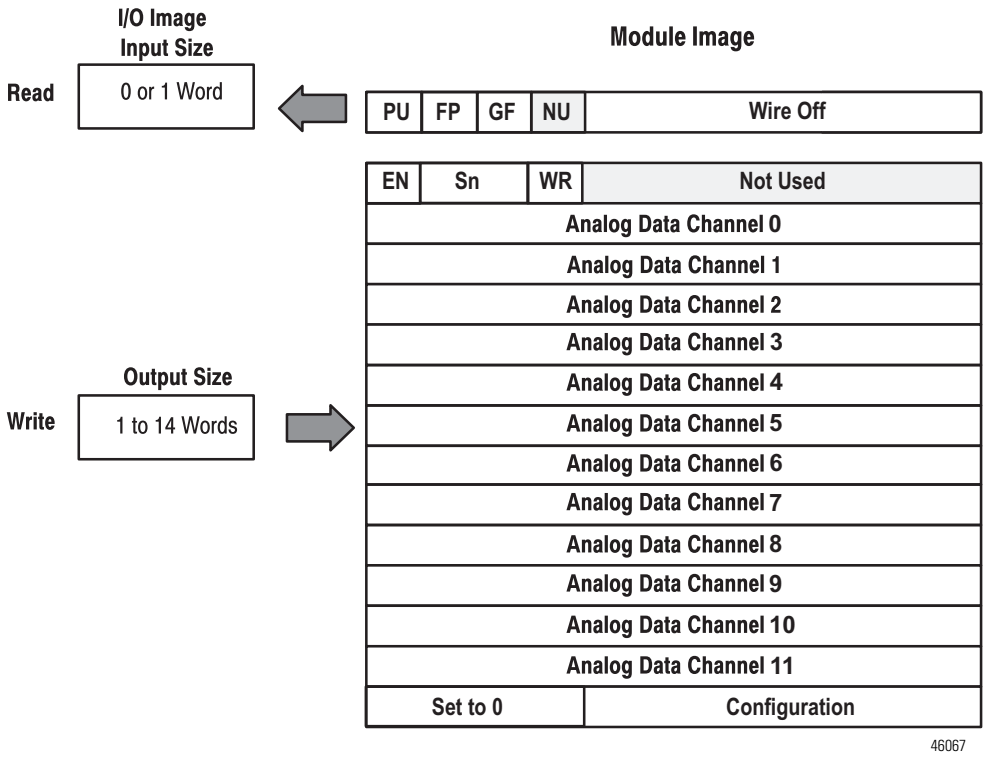
Word/Bit Descriptions – 1794-OE4/B and 1794-OE4XT Analog Output Module

Word	Decimal Bit (Octal Bit)	Definition
Read word 0	Bits 00…03	**Current outputs only** – When set (1), the wire on the output is broken or the load resistance is too high. Bit 00 corresponds to channel 0, bit 01 corresponds to channel 2, and so on.
	Bits 04…14 (04…16)	**Not used** – set to 0.
	Bit 15 (17)	**Power Up bit** – included in series B modules only. This bit is always 0 in series A modules. This bit is set to 1 when all bits in the configuration register (write word 0) are 0 (unconfigured state). The configuration register can be cleared by either a reset, or by the user writing all zeroes to it.
Write Word 0	Bits 00…14 (00…16)	**Channel 0 analog data** – 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA uses all 16 bits.
	Bit 15 (17)	**Channel 0 analog data sign bit**.
Write Word 1	Bits 00…14 (00…16)	**Channel 1 analog data** – 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA uses all 16 bits.
	Bit 15 (17)	**Channel 1 analog data sign bit.**
Write Word 2	Bits 00…14 (00…16)	**Channel 2 analog data** – 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA uses all 16 bits.
	Bit 15 (17)	**Channel 2 analog data sign bit.**
Write Word 3	Bits 00…14 (00…16)	**Channel 3 analog data** – 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA uses all 16 bits.
	Bit 15 (17)	**Channel 3 analog data sign bit.**

Word/Bit Descriptions – 1794-OE4/B and 1794-OE4XT Analog Output Module

Word	Decimal Bit (Octal Bit)	Definition
Write Word 4	Bits 00…03	**Multiplex control bits** – for individual channels. These bits control the safe state analog outputs. – Bit 00 corresponds to output channel 0, bit 01 corresponds to output channel 1, and so on. 1 = use words 0, 1, 2 or 3 as directed by channel number n 0 = use words 10, 11, 12 or 13 as directed by channel number n When bits 00…03 are all cleared (0) simultaneously by a communication error or user choice through the programmable controller program, word 5 full range and configure select bits are preserved at their last setting.
	Bits 04…15 (04…17)	**Not used** – set to 0.
Write word 6…9	Bits 00…03	**Full range bits (F) for individual channels** – Bit 00 corresponds to output channel 0, bit 01 corresponds to output channel 1, and so on. See Range Selection Bits – 1794-OE4/B and 1794-OE4XT Analog Output Module on page 62.
	Bits 04…07 (04…09)	**Not used** – set to 0.
	Bits 08…11 (10…13)	**Configure select bits (C) for individual channels** – Bit 08 corresponds to output channel 0, bit 09 corresponds to output channel 1, and so on. See Range Selection Bits – 1794-OE4/B and 1794-OE4XT Analog Output Module on page 62.
	Bits 12…15 (14…17)	**Not used** – set to 0.
Write words 7…14	Bits 00…15 (00…17)	**Not used** – set to 0.

1794-OE12 – 12 Output Analog Module Image Table Mapping



Memory Map – 1794-OE12 Analog Output Module

Decimal Bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00	Size
Octal Bit	**17**	**16**	**15**	**14**	**13**	**12**	**11**	**10**	**07**	**06**	**05**	**04**	**03**	**02**	**01**	**00**	**Read/Write Words**
	PU	FP	GF	NU	W11	W10	W9	W8	W7	W6	W5	W4	W3	W2	W1	W0	Read word 0 (Reserved)
	EN	S1	S0	WR	0	0	0	0	0	0	0	0	0	0	0	0	Write word 0
	S	Analog Value Channel 0															Write word 1
	S	Analog Value Channel 1															Write word 2
	S	Analog Value Channel 2															Write word 3
	S	Analog Value Channel 3															Write word 4
	S	Analog Value Channel 4															Write word 5
	S	Analog Value Channel 5															Write word 6
	S	Analog Value Channel 6															Write word 7
	S	Analog Value Channel 7															Write word 8
	S	Analog Value Channel 8															Write word 9
	S	Analog Value Channel 9															Write word 10
	S	Analog Value Channel 10															Write word 11

Memory Map – 1794-OE12 Analog Output Module

Decimal Bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00	Size
Octal Bit	**17**	**16**	**15**	**14**	**13**	**12**	**11**	**10**	**07**	**06**	**05**	**04**	**03**	**02**	**01**	**00**	**Read/Write Words**
	S	Analog Value Channel 11															Write word 12
	0	0	0	0	CAB		C89		C67		C45		C23		C01		Write words 13

Where:
PU = Power up bit
FP = Field power bit
GF = General fault
NU = Not used
Wx = Wire off (x = associated channel)
EN = Enable outputs
S1/S0 = Safe state source - When EN = 0, these bits indicate source of safe state output.
WR = Wire-off reset
Cxx = Configuration

Range Selection Bits – 1794-OE12 Analog Output Module

Range	Out of Range	Range Setting	Cxx[1] Channel Configuration
-10…+10V DC	1 <-10.0V or >10.0V	Set bits for each channel pair 00 = off 01 = 0…20 mA 10 = 4…20 mA 11 = ±10V	C01 for channels 0 and 1 C23 for channels 2 and 3 C45 for channels 4 and 5 C67 for channels 6 and 7 C89 for channels 8 and 9 CAB for channels 10 and 11
4…20 mA	<4.0mA or >20.0 mA		
0…20 mA	<0.0 mA or >20.0 mA		

(1) xx = associated channel pair.

Safe State Selection Bits – 1794-OE12 Analog Output Module

S1/S0 Safe State Select Source		Safe State Mode	Safe State Output Behavior
S1	**S0**		
0	0	Safe State value is in the output words	Outputs use Safe State value
0	1	Reserved (Safe State value is in the output words)	Reserved (Outputs use Safe State value)
1	0	Clear/Reset the outputs, based on range selected	+10V range – Output set to 0V 4…20 mA range – Output set to 4 mA 0…20 mA range – Output set to 0 mA
1	1	Hold output at its present level	Outputs Hold Last State

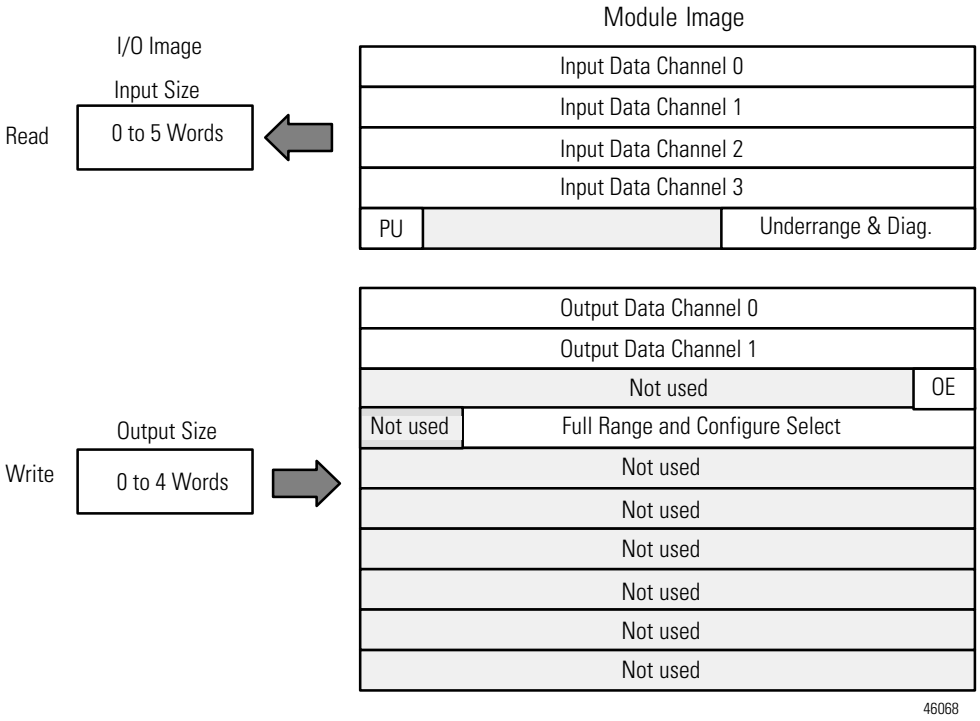
Word/Bit Descriptions – 1794-OE12 Analog Output Module

Word	Decimal Bit (Octal Bit)	Definition
Read Word 0	Bits 00…11 (00…13)	**Wire Off** – Indicates the wire, for the associated output channel configured for current, has become disconnected or that the load resistance is too high.
	Bit 12 (14)	**Not Used**.
	Bit 13 (15)	**General Fault** – Bit is set to 1 if there is a fault to the module.
	Bit 14 (16)	**Field Power Off** – Bit is set to 1 if the field power is off.
	Bit 15 (17)	**Power Up bit** – This bit is set to 1 when all bits in the configuration register (write word 1) are 0 (unconfigured state). The configuration register can be cleared by either a reset, or by the user writing all zeroes to it.
Write word 0	Bits 00…11 (00…13)	**Not Used**.
	Bit 12 (14)	**Wire Off Reset** – when asserted allowes the latched wire-off bits to be cleared.
	Bit 13…14 (15…16)	**Safe State Source** – When EN = 0, these bits indicate source of safe state output, see Table Safe State Selection Bits – 1794-OE12 Analog Output Module on page 65.
	Bit 15 (17)	**Enable Outputs** – instructs the outputs to go to their commanded level. When EN = 0, the outputs go to the level as directed by S1/S0.
Write word 1	Bits 00…14 (00…16)	**Channel 0 analog data** – 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA uses all 16 bits.
	Bit 15 (17)	**Channel 0 analog data sign bit.**
Write word 2	Bits 00…14 (00…16)	**Channel 1 analog data** – 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA uses all 16 bits.
	Bit 15 (17)	**Channel 1 analog data sign bit.**
Write word 3	Bits 00…14 (00…16)	**Channel 2 analog data** – 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA uses all 16 bits.
	Bit 15 (17)	**Channel 2 analog data sign bit.**
Write word 4	Bits 00…14 (00…16)	**Channel 3 analog data** – 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA uses all 16 bits.
	Bit 15 (17)	**Channel 3 analog data sign bit.**
Write word 5	Bits 00…14 (00…16)	**Channel 4 analog data** – 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA uses all 16 bits.
	Bit 15 (17)	**Channel 4 analog data sign bit.**

Word/Bit Descriptions – 1794-OE12 Analog Output Module

Word	Decimal Bit (Octal Bit)	Definition
Write word 6	Bits 00…14 (00…16)	**Channel 5 analog data** – 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA uses all 16 bits.
	Bit 15 (17)	**Channel 5 analog data sign bit.**
Write word 7	Bits 00…14 (00…16)	**Channel 6 analog data** – 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA uses all 16 bits.
	Bit 15 (17)	**Channel 6 analog data sign bit.**
Write word 8	Bits 00…14 (00…16)	**Channel 7 analog data** – 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA uses all 16 bits.
	Bit 15 (17)	**Channel 7 analog data sign bit.**
Write word 9	Bits 00…07	**Channel 8 analog data** – 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA uses all 16 bits.
	Bit 08…15 (10…17)	**Channel 8 analog data sign bit.**
Write word 10	Bits 00…07	**Channel 9 analog data** – 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA uses all 16 bits.
	Bit 08…15 (10…17)	**Channel 9 analog data sign bit.**
Write word 11	Bits 00…07	**Channel 10 analog data** – 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA uses all 16 bits.
	Bit 08…15 (10…17)	**Channel 10 analog data sign bit.**
Write word 12	Bits 00…07	**Channel 11 analog data** – 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA uses all 16 bits.
	Bit 08…15 (10…17)	**Channel 11 analog data sign bit.**
Write word 13	Bits 00…11 (00…13)	**Configuration** – Set range for each channel pair. For more information on range selection bits, see Table Range Selection Bits – 1794-OE12 Analog Output Module on page 65.
	Bits 12…15 (14…17)	**Not Used**.

1794-IE4XOE2 Series B and 1794-IE4XOE2XT – 4 Input 2 Output Analog Combo Module Image Table Mapping



Memory Map – 1794-IE4XOE2/B and 1794-IE4XOE2XT Analog Combo Module

Decimal Bit	**15**	**14**	**13**	**12**	**11**	**10**	**09**	**08**	**07**	**06**	**05**	**04**	**03**	**02**	**01**	**00**	**Size**
Octal Bit	**17**	**16**	**15**	**14**	**13**	**12**	**11**	**10**	**07**	**06**	**05**	**04**	**03**	**02**	**01**	**00**	**Read/Write Words**
	S	Analog Value Channel 0															Read word 1
	S	Analog Value Channel 1															Read word 2
	S	Analog Value Channel 2															Read word 3
	S	Analog Value Channel 3															Read word 4
	PU	Not used – set to 0									W1	W0	U3	U2	U1	U0	Read word 5
	S	Analog Data – Output Channel 0															Write word 1
	S	Analog Data – Output Channel 1															Write word 2
	Not used – set to 0														OE1	OE0	Write word 3
	Not used	C5	C4	C3	C2	C1	C0	0	0	F5	F4	F3	F2	F1	F0		Write word 4
	Not used – set to 0																Write word 5…10

Where:
PU = Power up bit – included in series B modules only.
W = Diagnostic bits for current output wire broken or load resistance high. (Not used on voltage outputs.)
U = Underrange bits for 4…20 mA inputs
S = Sign bit (in 2's complement)
OE = Output enable bits (bit 00 corresponds to output 0, bit 01 corresponds to output 1, and so on.
C = Configure select bit
F = Full range bit

Range Selection Bits – 1794-IE4XOE2/B and 1794-IE4XOE2XT Analog Combo Module

Channel No.	Input Channel 0		Input Channel 1		Input Channel 2		Input Channel 3		Output Channel 0		Output Channel 1	
	F0	C0	F1	C1	F2	C2	F3	C3	F4	C4	F5	C5
Decimal Bits (Octal Bits)	**00**	**08 (10)**	**01**	**09 (11)**	**02**	**10 (12)**	**03**	**11 (13)**	**04**	**12 (14)**	**05**	**13 (15)**
0…10V DC/0…20 mA	1	0	1	0	1	0	1	0	1	0	1	0
4…20 mA	0	1	0	1	0	1	0	1	0	1	0	1
-10…10V DC	1	1	1	1	1	1	1	1	1	1	1	1
Off	0	0	0	0	0	0	0	0	0	0	0	0

Where:
C = Configure select bit
F = Full range bit
Off = When configured to off, individual channels will return 0V.

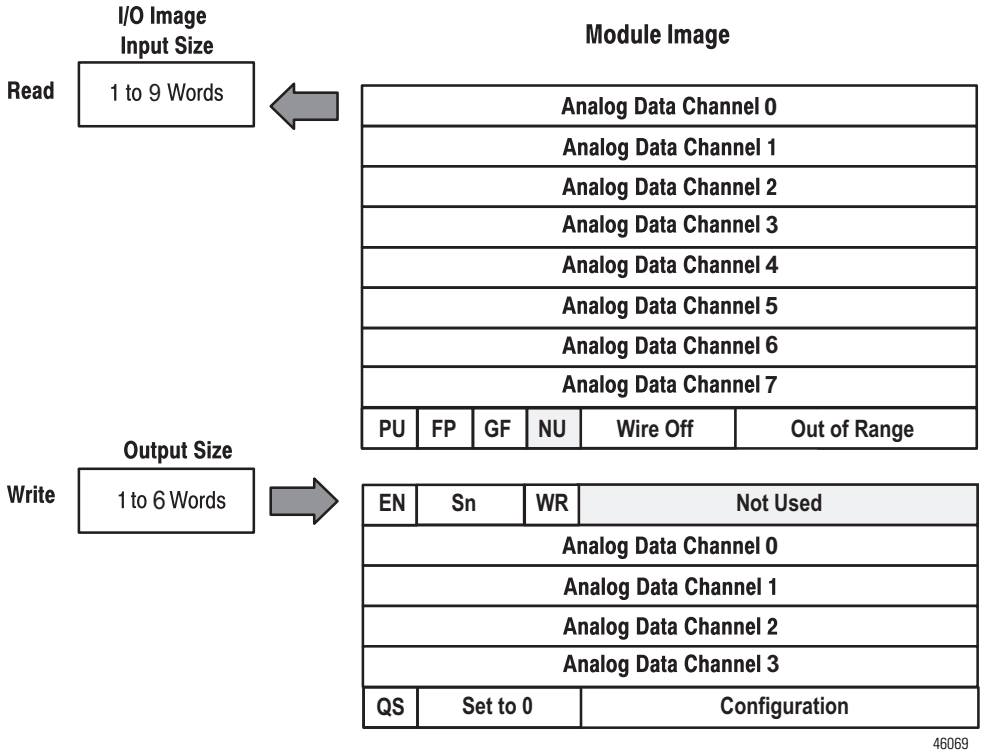
Word/Bit Descriptions – 1794-IE4XOE2/B and 1794-IE4XOE2XT Analog Combo Module

Word	Decimal Bit	Definition
Read word 1	Bits 00…14 (00…16)	**Channel 0 analog data** – 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA uses all 16 bits.
	Bit 15 (17)	Channel 0 analog date sign bit.
Read word 2	Bits 00…14 (00…16)	**Channel 1 analog data** – 12-bit left justified two's complement number; unused lower bits are zero; 4...20 mA uses all 16 bits.
	Bit 15 (17)	Channel 1 analog date sign bit.
Read word 3	Bits 00…14 (00…16)	**Channel 2 analog data –** 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA uses all 16 bits.
	Bit 15 (17)	Channel 2 analog data sign bit.
Read word 4	Bits 00…14 (00…16)	**Channel 3 analog data –** 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA used all 16 bits.
	Bit 15 (17)	Channel 3 analog data sign bit.
Read word 5	Bit 00…03	**Underrange bits (U)-** for individual channels (4...20mA current inputs only) -Bit 00 corresponds to input channel 0, bit 01 corresponds to input channel 1, and so on. When set (1), indicates either a broken or open input wire, or input current is at or below 4 mA.
	Bits 04…05	**Wire Off bits (W)** – Current outputs only – When set (1), the wire on the current output is broken or the load resistance is too high. Bit 00 corresponds to input channel 0, bit 01 corresponds to input channel 1, and so on.
	Bits 06…14 (06…16)	**Not used** – set to 0.
	Bit 15 (17)	**Power Up bit – included in series B modules only. This bit is always 0 in series A modules.** This bit is set to 1 when all bits in the configuration register (write word 3) are 0 (unconfigured state). The configuration register can be cleared by either a reset, or by the user writing all zeroes to it.

Word/Bit Descriptions – 1794-IE4XOE2/B and 1794-IE4XOE2XT Analog Combo Module

Word	Decimal Bit	Definition
Write word 1	Bits 00…14 (00…16)	**Channel 0 analog data** – 12-bit left justified two's complement number; unused lower bits are zero; 4...20mA uses all 16 bits.
	Bit15 (17)	**Channel 0 analog date sign bit.**
Write word 2	Bits 00…14 (00…16)	**Channel 1 analog data** – 12-bit left justified two's complement number; unused lower bits are zero; 4...20mA uses all 16 bits.
	Bit15 (17)	**Channel 1 analog date sign bit.**
Write word 3	Bits 00…01	**Output Enable bits –** Bit 00 corresponds to output 0, bit 01 corresponds to output 1, and so on. **These bits must be set to 1**.
	Bits 02…15 (02…17)	**Not used** – set to 0.
Write word 4	Bits 00…05	**Full range bits (F)** for individual channels – Bit 00 corresponds to input channel 0, bit 01 corresponds to output channel 1, and so on.
	Bits 06…07	**Not used** – set to 0.
	Bit 08…13 (10…15)	**Configure select bits (C)** for individual channels – Bit 08 corresponds to input channel 0, bit 09 (11) corresponds to input channel 1, bit 10 (12) corresponds to input channel 2, bit 11 (13) corresponds to input channel 3, bit 12 (14) corresponds to output channel 0, and bit 13 (15) corresponds to output channel 1. See Range Bit Selections.
	Bits 14…15 (16…17)	**Not used** – set to 0.
Write words 5…10	Bits 00…15	**Not used** – set to 0.

1794-IE8XOE4 – 8 Input 4 Output Analog Combo Module Image Table Mapping



Memory Map – 1794-IE8XOE4 Analog Combo Module

Decimal Bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00	Size
Octal Bit	**17**	**16**	**15**	**14**	**13**	**12**	**11**	**10**	**07**	**06**	**05**	**04**	**03**	**02**	**01**	**00**	**Read/Write Words**
	S	Signed 2's Analog Value Channel 0															Read word 0
	S	Analog Value Channel 1															Read word 1
	S	Analog Value Channel 2															Read word 2
	S	Analog Value Channel 3															Read word 3
	S	Analog Value Channel 4															Read word 4
	S	Analog Value Channel 5															Read word 5
	S	Analog Value Channel 6															Read word 6
	S	Analog Value Channel 7															Read word 7
	PU	FP	GF	NU	W3	W2	W1	W0	R7	R6	R5	R4	R3	R2	R1	R0	Read word 8
	EN	S1	S0	WR	0	0	0	0	0	0	0	0	0	0	0	0	Write word 0 (Reserved)
	S	Analog Data – Output Channel 0															Write word 1
	S	Analog Data – Output Channel 1															Write word 2
	S	Analog Data – Output Channel 2															Write word 3

Memory Map – 1794-IE8XOE4 Analog Combo Module

Decimal Bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00	Size
Octal Bit	**17**	**16**	**15**	**14**	**13**	**12**	**11**	**10**	**07**	**06**	**05**	**04**	**03**	**02**	**01**	**00**	**Read/Write Words**
	S	Analog Data – Output Channel 3															Write word 4
	QS	0	0	0	CAB		C89		C67		C45		C23		C01		Write word 5

Where:
PU = Power up bit
FP = Field power fault
GF = General fault
NU = Not used
Wx = Wire off (x = associated channel)
Rx = Out of range (x = associated channel)
EN = Enable outputs
S1/S0 = Safe state source - When EN = 0, these bits indicate source of safe state output.
WR = Wire-off reset
QS = Quick step bit - allows input filter to be reduced during rapid signal changes.
Cxx = Channel Configuration (xx = associated channel pair)

Range Selection Bits – 1794-IE8XOE4 Analog Combo Module

Range	Out of Range	Range Setting	Cxx Channel Configuration
-10…+10V DC	1< -10.0V or > 10.0V	Set bits for each channel pair 00 = off 01 = 0…20 mA 10 = 4…20 mA 11 = ±10V	C01 for channels 0 and 1 C23 for channels 2 and 3 C45 for channels 4 and 5 C67 for channels 6 and 7 C89 for channels 8 and 9 CAB for channels 10 and 11
4…20 mA	<4.0 mA or >20.0 mA		
0…20 mA	<0.0 mA or >20.0 mA		
Where:	Cxx = associated channel pair.		

Safe State Selection Bits – 1794-IE8XOE4 Analog Combo Module

S1/S0 Safe State Select Source		Safe State Mode	Safe State Output Behavior
S1	**S0**		
0	0	Safe State value is in the output words	Outputs use Safe State value
0	1	Reserved (Safe State value is in the output words)	Reserved (Outputs use Safe State value)
1	0	Clear/Reset the outputs, based on range selected	+10V range – Output set to 0V 4…20 mA range – Output set to 4 mA 0…20 mA range – Output set to 0 mA
1	1	Hold output at its present level	Outputs Hold Last State

Word/Bit Descriptions – 1794-IE8XOE4 Analog Combo Module

Word	Decimal Bit (Octal Bit)	Definition
Read Word 0	Bits 00…14 (00…16)	**Channel 0 analog data** – 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA uses all 16 bits.
	Bit 15 (17)	**Channel 0 analog data sign bit.**
Read word 1	Bits 00…14 (00…16)	**Channel 1 analog data** – 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA uses all 16 bits.
	Bit 15 (17)	**Channel 1 analog data sign bit.**
Read word 2	Bits 00…14 (00…16)	**Channel 2 analog data** – 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA uses all 16 bits.
	Bit 15 (17)	**Channel 2 analog data sign bit.**
Read word 3	Bits 00…14 (00…16)	**Channel 3 analog data** – 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA uses all 16 bits.
	Bit 15 (17)	**Channel 3 analog data sign bit.**
Read word 4	Bits 00…14 (00…16)	**Channel 4 analog data** – 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA uses all 16 bits.
	Bit 15 (17)	**Channel 4 analog data sign bit.**
Read word 5	Bits 00…14 (00…16)	**Channel 5 analog data** – 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA uses all 16 bits.
	Bit 15 (17)	**Channel 5 analog data sign bit.**
Read word 6	Bits 00…14 (00…16)	**Channel 6 analog data** – 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA uses all 16 bits.
	Bit 15 (17)	**Channel 6 analog data sign bit.**
Read word 7	Bits 00…14 (00…16)	**Channel 7 analog data** – 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA uses all 16 bits.
	Bit 15 (17)	**Channel 7 analog data sign bit.**

Word/Bit Descriptions – 1794-IE8XOE4 Analog Combo Module

Word	Decimal Bit (Octal Bit)	Definition
Read word 8	Bits 00…07	**Out of range bits (R)** for individual channels – Bit 00 corresponds to input channel 0, bit 01 corresponds to input channel 1, and so on. When set (1), indicates out of range. For more details on out of range, see Table Range Selection Bits – 1794-IE12 Analog Input Module on page 58.
	Bits 08…11 (10…13)	**Wire Off** – Indicates the wire, for the associated output channel configured for current, has become disconnected or that the load resistance is too high.
	Bit 12 (14)	**Not used** – set to 0.
	Bit 13 (15)	**General Fault** – Bit set to 1 if a fault has occurred including: RAM test failure, ROM test failure, reserved bits asserted (bits 12…0 of the Reserved word and 15…12 of the Config word) and EEPROM failure.
	Bit 14 (16)	**Field Power Off** – Bit is set to 1 if the field power is off. This is not an indication of field power that is out of tolerance.
	Bit 15 (17)	**Power Up bit** – This bit is set to 1 when all bits in the configuration register (write word 1) are 0 (unconfigured state).
Write word 0	Bits 00…11 (00…13)	**Not Used**.
	Bit 12 (14)	**Wire Off Reset** – when asserted allowes the latched wire-off bits to be cleared.
	Bit 13…14 (15…16)	**Safe State Source** – When EN = 0, these bits indicate source of safe state output, see Table Safe State Selection Bits – 1794-IE8XOE4 Analog Combo Module on page 72.
	Bit 15 (17)	**Enable Outputs** – instructs the outputs to go to their commanded level. When EN = 0, the outputs go to the level as directed by S1/S0.
Write word 1	Bits 00…14 (00…16)	**Channel 0 analog data** – 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA uses all 16 bits.
	Bit 15 (17)	**Channel 0 analog data sign bit.**
Write word 2	Bits 00…14 (00…16)	**Channel 1 analog data** – 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA uses all 16 bits.
	Bit 15 (17)	**Channel 1 analog data sign bit.**
Write word 3	Bits 00…14 (00…16)	**Channel 2 analog data** – 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA uses all 16 bits.
	Bit 15 (17)	**Channel 2 analog data sign bit.**

Word/Bit Descriptions – 1794-IE8XOE4 Analog Combo Module

Word	Decimal Bit (Octal Bit)	Definition
Write word 4	Bits 00…14 (00…16)	**Channel 3 analog data** – 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA uses all 16 bits.
	Bit 15 (17)	**Channel 3 analog data sign bit.**
Write word 5	Bits 00…11 (00…13)	**Configuration** – Set the 2-bit pattern that configures a pair of channels for Off, 0…20 mA, 4…20 mA, and ±10V. For more information, see Table Range Selection Bits – 1794-IE8XOE4 Analog Combo Module on page 72.
	Bits 12…14 (14…16)	**Set to 0**.
	Bit 15 (17)	**Quick Step bit** – Set to 1 to allow input filter to be reduced during rapid signal changes. Once the signal change is within 1% of FS (that is, 327 counts), filtering is returned to normal.

Notes:

Module Programming

Overview

This Appendix serves as a reference to users of the PLC Processors to program their modules.

To initiate communication between the analog input and output modules 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.

Block Transfer Programming

Your module communicates with the processor through bidirectional block transfers. This is the sequential operation of both read and write block transfer instructions.

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 scaling, alarms, 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.

ATTENTION: If the analog module is not powered up before the remote I/O adapter, the adapter will not recognize the module. Make certain that the analog module is installed and powered before or simultaneously with the remote I/O adapter. If the adapter does not establish communication with the module, cycle power to the adapter.

The following sample programs are minimum programs; all rungs and conditioning must be included in your application program. You can disable BTRs, or add interlocks to prevent writes if desired. Do not eliminate any storage bits or interlocks included in the sample programs. If interlocks are removed, the program may not work properly.

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

Sample Programs for FLEX I/O Analog Modules

The following sample programs show you how to use your analog module efficiently when operating with a programmable controller.

These programs show you how to:

- configure the module
- read data from the module
- update the module output channels (if used)

These programs illustrate the minimum programming required for communication to take place.

PLC-2 Programming

The 1794 analog I/O modules are not recommended for use with PLC-2® family programmable controllers due to the number of digits needed for high resolution. In addition, the data returned from the analog-to-digital converter in the module is 12-bit resolute. This value is left-justified into a 16-bit field, reserving the most significant bit for a sign bit.

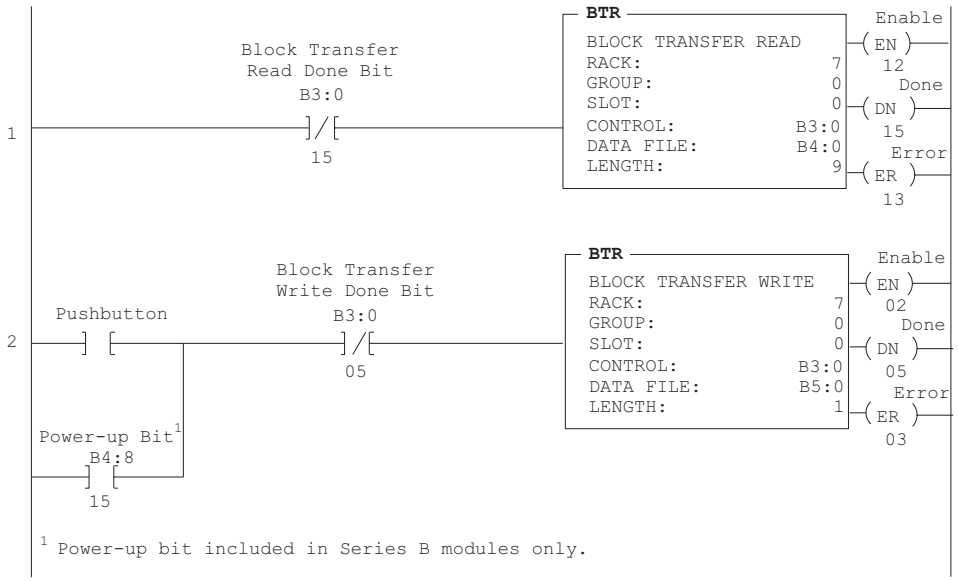
PLC-3 Programming

Block transfer instructions with the PLC-3® processor use one binary file in a data table section for module location and other related data. This is the block transfer control file. The block transfer data file stores data that you want transferred to your module (when programming a block transfer write) or from your module (when programming a block transfer read). The address of the block transfer data files are stored in the block transfer control file.

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.

A sample program segment with block transfer instructions is shown in Figure PLC-3 Family Sample Program Structure for a 1794-IE8 Module.

PLC-3 Family Sample Program Structure for a 1794-IE8 Module



Program Action

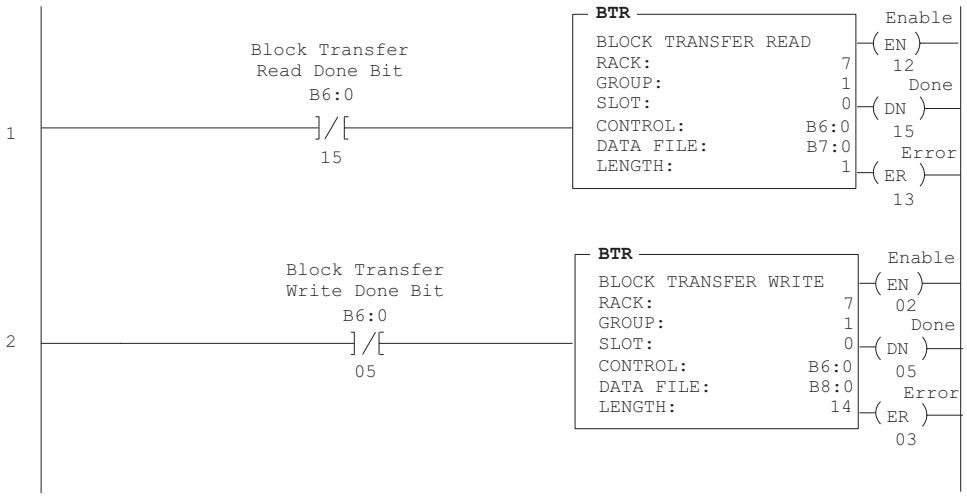
At power-up in RUN mode, or when the processor is switched from PROG to RUN, the user program enables a block transfer read. Then it initiates a block transfer write to configure the module if the power-up bit is set.

Thereafter, the program continuously performs read block transfers.

TIP You must create the data file for the block transfers before you enter the block transfer instructions.

The push button allows the user to manually request a block transfer write to configure the module.

PLC-3 Family Sample Program Structure for a 1794-OE4 Module



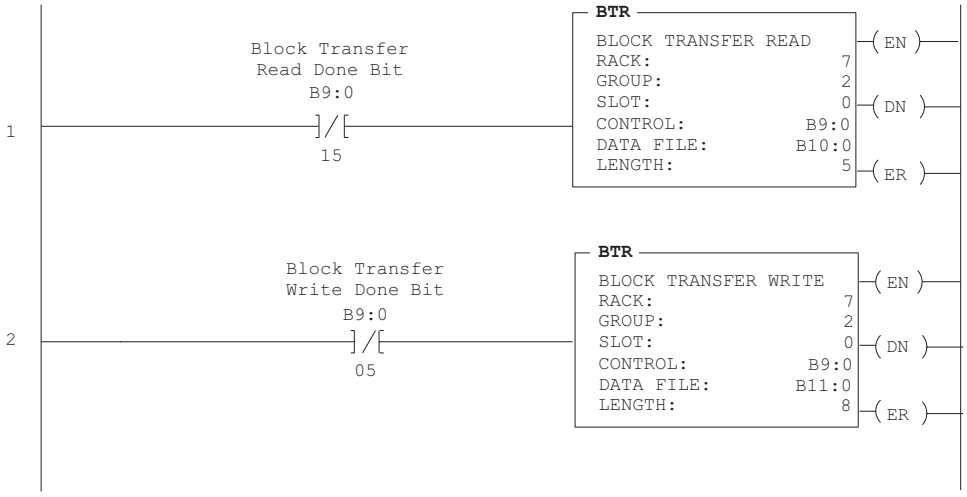
Program Action

At power-up in RUN mode, or when the processor is switched from PROG to RUN, the user program enables a block transfer read. Then it initiates a block transfer write to configure the module and send data values.

Thereafter, the program continuously performs read block transfers and write block transfers.

TIP You must create the data file for the block transfers before you enter the block transfer instructions

PLC-3 Family Sample Program Structure for a 1794-IE4XOE2 Module



Program Action

At power-up in RUN mode, or when the processor is switched from PROG to RUN, the user program enables a block transfer read. Then it initiates a block transfer write to configure the module and send data values.

Thereafter, the program continuously performs read block transfers and write block transfers.

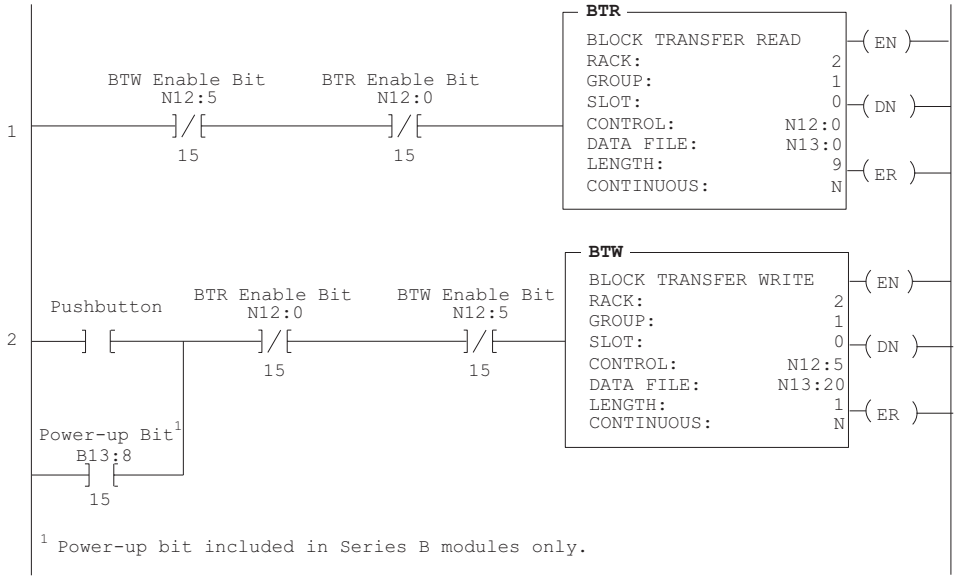
TIP You must create the data file for the block transfers before you enter the block transfer instructions

PLC-5 Programming

The PLC-5® program is very similar to the PLC-3 program with the following exceptions:

- block transfer enable bits are used instead of done bits as the conditions on each rung.
- separate block transfer control files are used for the block transfer instructions.

PLC-5 Family Sample Program Structure for a 1794-IE8 Module



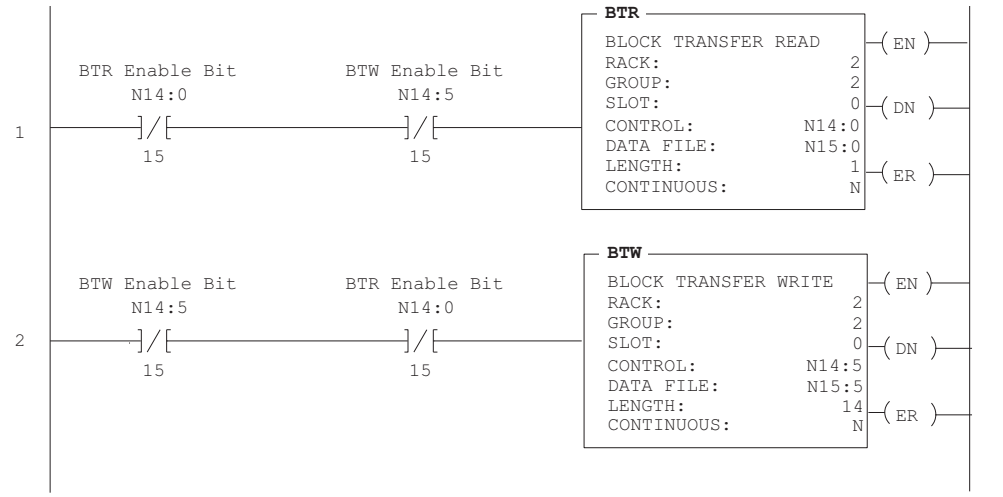
Program Action

At power-up in RUN mode, or when the processor is switched from PROG to RUN, the user program enables a block transfer read. Then it initiates a block transfer write to configure the module if the power-up bit is set.

Thereafter, the program continuously performs read block transfers to configure the module.

The push button allows the user to manually request a block transfer write.

PLC-5 Family Sample Program Structure for a 1794-OE4 Module

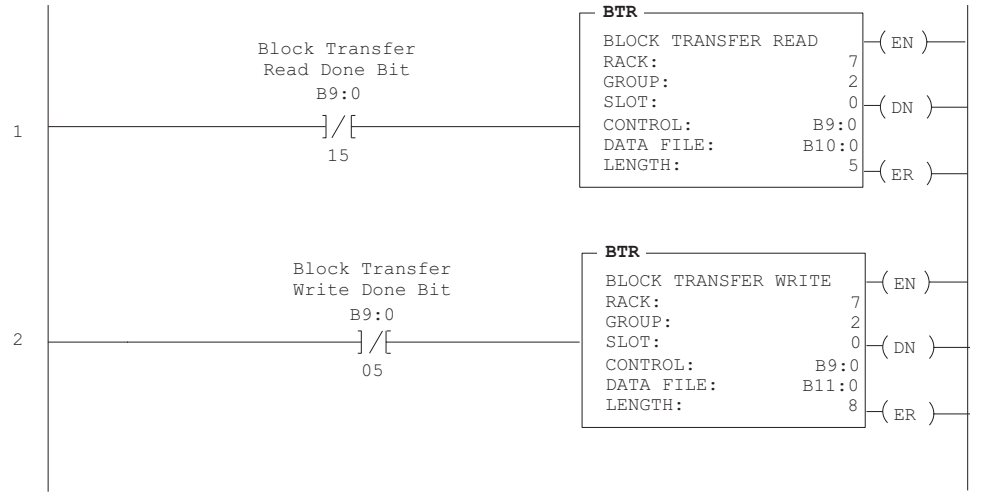


Program Action

At power-up in RUN mode, or when the processor is switched from PROG to RUN, the user program enables a block transfer read. Then it initiates a block transfer write to configure the module and send data values.

Thereafter, the program continuously performs read block transfers and write block transfers.

PLC-5 Family Sample Program Structure for a 1794-IE4XOE2 Module



Program Action

At power-up in RUN mode, or when the processor is switched from PROG to RUN, the user program enables a block transfer read. Then it initiates a block transfer write to configure the module and send data values.

Thereafter, the program continuously performs read block transfers and write block transfers.

TIP You must create the data file for the block transfers before you enter the block transfer instructions

Two's Complement Binary

Two's complement binary is used when performing mathematical calculations internal to the processor. To complement a number means to change it to a negative number. For example, the following binary number is equal to decimal 22.

0 101102 = 2210

First, the two's complement method places an extra bit (sign bit) in the left–most position, and lets this bit determine whether the number is positive or negative. The number is positive if the sign bit is 0 and negative if the sign bit is 1. Using the complement method:

0 10110 = 22

To get the negative using the two's complement method, you must invert each bit from right to left after the first "1" is detected.

In the above example:

0 10110 = +22

Its two's complement would be:

1 01010 = –22

Note that in the above representation for +22, starting from the right, the first digit is a 0 so it is not inverted; the second digit is a 1 so it is not inverted. All digits after this one are inverted.

If a negative number is given in two's complement, its complement (a positive number) is found in the same way:

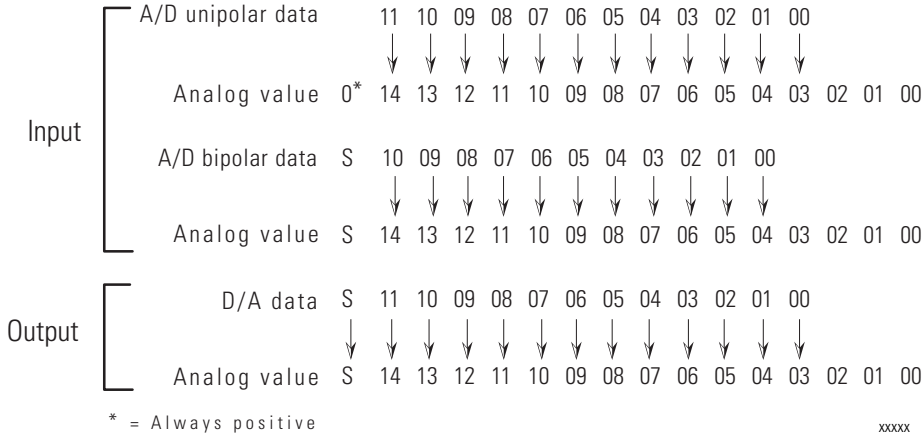
1 10010 = –14 0 01110 = +14

All bits from right to left are inverted after the first "1" is detected.

The two's complement of 0 is not found, since no first "1" is ever encountered in the number. The two's complement of 0 then is still 0.

Analog Data Format

The data returned from the analog-to-digital converter in the module is 12-bit resolute. This value is left-justified into a 16-bit field, reserving the most significant bit for a sign bit.



Current and Voltage Mode Values

Current (mA)	4…20 mA Mode	0…20 mA Mode	Voltage (V)	± 10V Mode		0…10V Mode
				Input	Output	
			-10.50	8000	8000	
0.00		0000	-10.00	8620	8618	
1.00		0618	-9.00	9250	9248	
2.00		0C30	-8.00	9E80	9E78	
3.00		1248	-7.00	AAB0	AAA8	
4.00	0000	1860	-6.00	B6E0	B6D8	
5.00	0787	1E78	-5.00	C310	C310	
6.00	0F0F	2490	-4.00	CF40	CF40	
7.00	1696	2AA8	-3.00	DB70	DB70	
8.00	1E1E	30C0	-2.00	E7A0	E7A0	
9.00	25A5	36D8	-1.00	F3D0	F3D0	
10.00	2D2D	3CF0	0.00	0000	0000	0000
11.00	34B4	4310	1.00	0C30	0C30	0C30
12.00	3C3C	4928	2.00	1860	1860	1860
13.00	43C3	4F40	3.00	2490	2490	2490
14.00	4B4B	5558	4.00	30C0	30C0	30C0
15.00	52D2	5B70	5.00	3CF0	3CF0	3CF0

Current and Voltage Mode Values

Current (mA)	4…20 mA Mode	0…20 mA Mode	Voltage (V)	± 10V Mode		0…10V Mode
				Input	Output	
16.00	5A5A	6188	6.00	4920	4928	4928
17.00	61E1	67A0	7.00	5550	5558	5558
18.00	6969	6DB8	8.00	6180	6188	6188
19.00	70F0	73D0	9.00	6DB0	6DB8	6DB8
20.00	7878	79E8	10.00	79E0	79E8	79E8
21.00	7FFF	7FF8	10.50	7FF0	7FF8	7FF8

Scaling Example

To scale your data to a different range:

- SLC™ 500 – use the scaling instruction.
- PLC-5 – determine a constant (slope) by dividing the desired range by the actual range. Multiply the result by your data, and add or subtract any offset.

EXAMPLE A 4…20 mA input places data at N13:0 (see figure PLC-5 Family Sample Program Structure for a 1794-OE4 Module on page 82), with a range of 0…30,840. (30,840 = 7878 hex – see table Current and Voltage Mode Values on page 84).

You want the 4…20 mA (0…30,840) to be 0…537.7°C (32…1000°F) in the PLC-5. Use the following formula:

Scaled Data (degrees) @ N30:0 = {[(Desired Range)/Actual Range] X Analog Input Data} + O ffset

= {[(1000 - 32)/30,840] X N13:0} + 32

F8:0

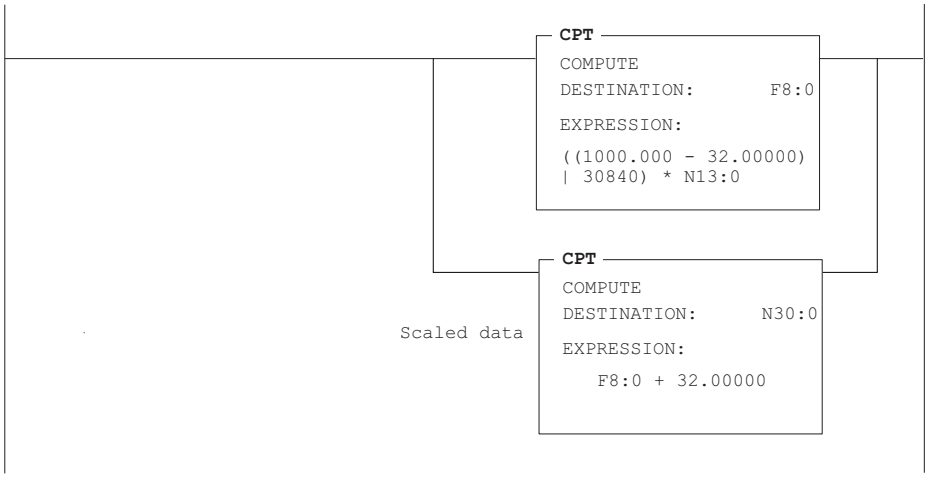
= F8:0 + 32

Scaled Data (degrees) @ N30:0 = F8:0 + 32 (See ladder logic below)

Example using Compute Instructions

This rung scales FLEX I/O analog data to a different range. In this example, we want the 4...20 mA input data to represent 0...537.7°C (32...1000°F) in the PLC-5. N13:0 = 30,840 (7878 in hex). Two compute instructions are needed because of the way the destination value is rounded if we use an integer location

instead of a floating point in the first compute instruction. The second compute instruction has a final destination of an integer location.



Numerics

A

B

C

D

F

I

K

L

M

N

O

P

R

S

T

V

W

Notes:

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Installation Assistance

If you experience a problem within the first 24 hours of installation, review the information that is contained in this manual. You can contact Customer Support for initial help in getting your product up and running.

United States or Canada	1.440.646.3434
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Publication 1794-UM062B-EN-P - March 2020
Supersedes Publication 1794-UM062A-EN-P - September 2012