Installation Instructions

Original Instructions

Allen-Bradley
by ROCKWELL AUTOMATION

FLEX I/O Input, Output, and Input/Output Analog Modules

Catalog Numbers 1794-IE8, 1794-OE4, and 1794-IE4XOE2, Series B

Summary of Changes

This publication contains the following new or updated information. This list includes substantive updates only and is not intended to reflect all changes.

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Updated Certifications	13
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Rockwell Automation

Environment and Enclosure

ATTENTION: This equipment is intended for use in a Pollution Degree 2 industrial environment, in overvoltage Category II applications (as defined in EN/IEC 60664-1), at altitudes up to 2000 m (6562 ft) without derating.
This equipment is not intended for use in residential environments and may not provide adequate protection to radio communication services in such environments.

This equipment is supplied as open-type equipment for indoor use. It must be mounted within an enclosure that is suitably designed for those specific environmental conditions that will be present and appropriately designed to prevent personal injury resulting from accessibility to live parts. The enclosure must have suitable flame-retardant properties to prevent or minimize the spread of flame, complying with a flame spread rating of 5VA or be approved for the application if nonmetallic. The interior of the enclosure must be accessible only by the use of a tool. Subsequent sections of this publication may contain more information regarding specific enclosure type ratings that are required to comply with certain product safety certifications.

In addition to this publication, see the following:

- Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1, for more installation requirements.
- NEMA Standard 250 and EN/IEC 60529, as applicable, for explanations of the degrees of protection provided by enclosures.

Prevent Electrostatic Discharge

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

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

UK and European Hazardous Location Approval

The following modules are UK and European Zone 2 approved: 1794-IE8, 1794-OE4, and 1794-IE4XOE2, series B.

The following applies to products marked Ⓔx II 3 G:

- Are Equipment Group II, Equipment Category 3, and comply with the Essential Health and Safety Requirements relating to the design and construction of such equipment given in Schedule 1 of UKEX and Annex II of EU Directive 2014/34/EU. See the UKEx and EU Declaration of Conformity at rok.auto/certifications for details.
- The type of protection is Ex ec IIC T4 Gc according to EN IEC 60079-0:2018 and EN IEC 60079-7:2015+A1:2018.
- Comply with standards EN IEC 60079-0:2018 and EN IEC 60079-7:2015+A1:2018 reference certificate number DEMKO 14 ATEX 1342501X and UL22UKEX2378X.
- Are intended for use in areas in which explosive atmospheres caused by gases, vapors, mists, or air are unlikely to occur, or are likely to occur only infrequently and for short periods. Such locations correspond to Zone 2 classification according to UKEX regulation 2016 No. 1107 and ATEX directive 2014/34/EU.

IEC Hazardous Location Approval

The following applies to products with IECEx certification:

- Are intended for use in areas in which explosive atmospheres caused by gases, vapors, mists, or air are unlikely to occur, or are likely to occur only infrequently and for short periods. Such locations correspond to Zone 2 classification to IEC 60079-0.
- The type of protection is Ex ec IIC T4 Gc according to IEC 60079-0 and IEC 60079-7.
- Comply with Standards IEC 60079-0, Explosive atmospheres Part 0: Equipment - General requirements, Edition 7, Revision Date 2017, IEC 60079-7, 5.1 Edition revision date 2017, Explosive atmospheres - Part 7: Equipment protection by increased safety “e”, reference IECEx certificate number IECEx UL 14.0066X.

WARNING: Special Conditions for Safe Use:

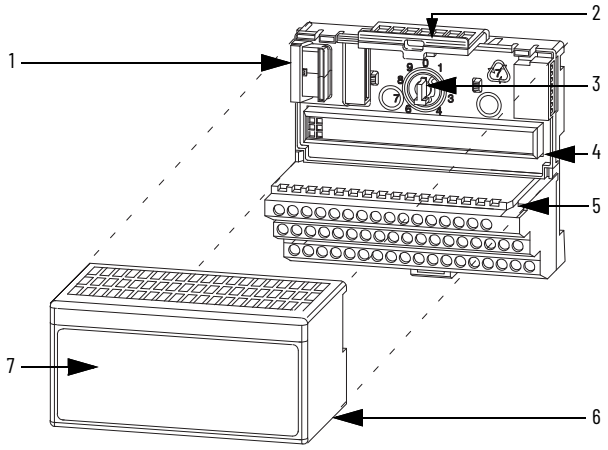
- This equipment shall be mounted in an UKEX/ATEX/IECEx Zone 2 certified enclosure with a minimum ingress protection rating of at least IP54 (in accordance with EN/IEC 60079-0) and used in an environment of not more than Pollution Degree 2 (as defined in EN/IEC 60664-1) when applied in Zone 2 environments. The enclosure must be accessible only by the use of a tool.
- This equipment shall be used within its specified ratings defined by Rockwell Automation.
- Transient protection shall be provided that is set at a level not exceeding 140% of the peak rated voltage value at the supply terminals to the equipment.
- The instructions in the user manual shall be observed.
- This equipment must be used only with UKEX/ATEX/IECEx certified Rockwell Automation backplanes.
- Earthing is accomplished through mounting of modules on rail.

WARNING: Secure any external connections that mate to this equipment by using screws, sliding latches, threaded connectors, or other means provided with this product. Do not disconnect equipment unless power has been removed or the area is known to be nonhazardous.

WARNING: When you insert or remove the module while backplane power is on, an electric 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. Repeated electric arcing causes excessive wear to contacts on both the module and its mating connector. Worn contacts may create electrical resistance that can affect module operation.

Overview

The FLEX™ I/O module mounts on a 1794 terminal base.



	Description		Description
1	Flexbus connectors	5	Groove
2	Latching mechanism	6	Alignment bar
3	Keyswitch	7	Module
4	Terminal base		

Install Your Module

ATTENTION: During mounting of all devices, be sure that all debris (metal chips, wire strands, and so on) is kept from falling into the module. Debris that falls into the module could cause damage on power-up.

1. Rotate the keyswitch (3) on the terminal base (4) clockwise to position 3 (1794-IE8), 4 (1794-OE4) or 5 (1794-IE4XOE2) as required.
2. Make sure 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 align properly with the connector in the terminal base.
4. Position the module (7) with its alignment bar (6) aligned with the groove (5) 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 (2) is locked into the module.

Connect Wiring for the Analog Inputs and Outputs

1. Connect individual input/output wiring to numbered terminals on the 0-15 row (A) for 1794-TB2, 1794-TB3, 1794-TB3S, 1794-TB3T, and 1794-TB3TS, or on row (B) for the 1794-TBN as indicated in Table 1, Table 2, and Table 3.

IMPORTANT Use Belden 8761 cable for signal wiring.

2. Connect channel common/return to the associated terminal on row (A) or row (B) for the 1794-TB2, 1794-TB3, 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.

   For 1794-TB3T or 1794-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.

ATTENTION: To reduce susceptibility to noise, power analog modules and digital modules from separate power supplies. Do not exceed a length of 9.8 ft (3 m) for DC power cabling.

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 terminal base, connect a jumper from terminal 33 (common) on this base unit to terminal 16 on the next base unit.

Figure 2 - Terminal Base Wiring for the 1794-OE4 Module

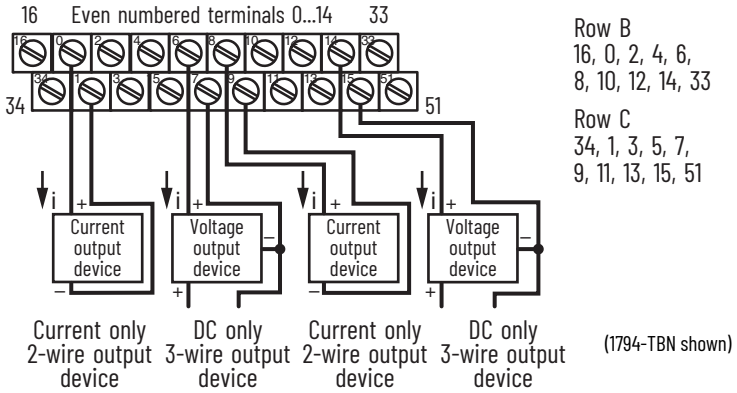


Table 2 - Wiring Connections for the 1794-OE4 Module

Channel	Signal Type	Label Marking	1794-TB2, 1794-TB3, 1794-TB3S, 1794-TB3T, 1794-TB3TS		1794-TBN
			Output Terminal[1]	Shield (1794-TB3T, 1794-TB3TS)	Output Terminal[2]
Output 0	Current	I0	A-0	C-39	B-0
	Current	I0 Ret	A-1		C-1
	Voltage	V0	A-2	C-40	B-2
	Voltage	V0 Ret	A-3		C-3
Output 1	Current	I1	A-4	C-41	B-4
	Current	I1 Ret	A-5		C-5
	Voltage	V1	A-6	C-42	B-6
	Voltage	V1 Ret	A-7		C-7
Output 2	Current	I2	A-8	C-43	B-8
	Current	I2 Ret	A-9		C-9
	Voltage	V2	A-10	C-44	B-10
	Voltage	V2 Ret	A-11		C-11
Output 3	Current	I3	A-12	C-45	B-12
	Current	I3 Ret	A-13		C-13
	Voltage	V3	A-14	C-46	B-14
	Voltage	V3 Ret	A-15		C-15
-V DC Common	1794-TB3 and 1794-TB3S - Terminals 16...33 are internally connected in the terminal base unit. 1794-TB3T and 1794-TB3TS - Terminals 16, 17, 19, 21, 23, 25, 27, 29, 31, and 33 are internally connected in the terminal base unit. 1794-TB2 - Terminals 16 and 33 are internally connected in the terminal base unit				
+V DC Power	1794-TB3 and 1794-TB3S - Terminals 34...51 are internally connected in the terminal base unit. 1794-TB3T and 1794-TB3TS - Terminals 34, 35, 50, and 51 are internally connected in the terminal base unit. 1794-TB2 - Terminals 34 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-1, 3, 5, 7, 9, 11, 13, and 15 are internally connected in the module to 24V DC common.
(2) C-1, 3, 5, 7, 9, 11, 13, and 15 are internally connected in the module to 24V DC common.

Table 8 - Range Selection Bits - 1794-IE8 and 1794-IE4X0E2

1794-IE8	In Ch 0		In Ch 1		In Ch 2		In Ch 3		In Ch 4		In Ch 5		In Ch 6		In Ch 7	
1794-IE4X0E2	In Ch 0		In Ch 1		In Ch 2		In Ch 3		Out Ch 0		Out Ch 1					
	F0	C0	F1	C1	F2	C2	F3	C3	F4	C4	F5	C5	F6	C6	F7	C7
Dec Bits	00	08	01	09	02	10	03	11	04	12	05	13	06	14	07	15
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															

(1) When configured to Off, individual input channels return 0000H; Output channels drive 0V/0 mA.

Table 9 - Input Map (Read) - 1794-OE4

Dec	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Oct	17	16	15	14	13	12	11	10	7	6	5	4	3	2	1	0
Word 0	PU	Not used - set to 0											W3	W2	W1	W0
Where:	PU = Power up bit W0...W3 = Wire off current loop status for output channels															

Table 10 - Output Map (Write) - 1794-OE4

Dec	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Oct	17	16	15	14	13	12	11	10	7	6	5	4	3	2	1	0
Word 0	S	Output Data Channel 0														
Word 1	S	Output Data Channel 1														
Word 2	S	Output Data Channel 2														
Word 3	S	Output Data Channel 3														
Word 4		Not used - set to 0											M3	M2	M1	M0
Word 5	Not used - set to 0				C3	C2	C1	C0	Not used - set to 0				F3	F2	F1	F0
Word 6...9	Not used - set to 0															
Word 10	S	Safe state value for Channel 0														
Word 11	S	Safe state value for Channel 1														
Word 12	S	Safe state value for Channel 2														
Word 13	S	Safe state value for Channel 3														
Where:	S = Sign bit in 2's complement M = Multiplex control bit C = Configure select bit F = Full range bit															

Table 11 - Range Selection Bits - 1794-OE4

Channel Number	In Ch 0		In Ch 1		In Ch 2		In Ch 3	
	F0	C0	F1	C1	F2	C2	F3	C3
Dec Bits	00	08	01	09	02	10	03	11
0...10V DC/ 0...20 mA	1	0	1	0	1	0	1	0
4...20 mA	0	1	0	1	0	1	0	1
-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							

(1) When configured to Off, individual output channels drive 0V/0 mA.

Specifications

Input Specifications

Attribute	Value
Number of inputs, single-ended, nonisolated	8 - **1794-IE8** 4 - **1794-IE4X0E2**
Resolution	12 bits unipolar; 11 bits plus sign bipolar Voltage: 2.56 mV/cnt unipolar; 5.13 mV/cnt bipolar Current: 5.13 µA/cnt
Data format	Left justified, 16 bit 2's complement
Conversion type	Successive approximation
Conversion rate	256 µs all channels
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: 3 dB @ 17 Hz; -20 dB/decade -10 dB @ 50 Hz; -11.4 dB @ 60 Hz Current terminal: -3 dB @ 9 Hz; -20 dB/decade -15.3 dB @ 50 Hz; -16.8 dB @ 60 Hz
Step response to 63%	Voltage terminal: 9.4 ms Current terminal: 18.2 ms
Input impedance	Voltage terminal: 100 kΩ Current terminal: 238 Ω
Input resistance voltage	Voltage terminal: 200 kΩ Current terminal: 238 Ω
Absolute accuracy(1)	0.20% full-scale @ 25 °C (77 °F)
Accuracy drift with temperature	Voltage terminal: 0.00428% full-scale/ °C Current terminal: 0.00407% full-scale/ °C
Calibration required	None required
Maximum overload, one channel at a time	30V continuous or 32 mA continuous
Indicators	1 green power indicator

(1) Includes offset, gain, nonlinearity, and repeatability error terms.

Output Specifications

Attribute	Value
Number of outputs, single-ended, nonisolated	4 - **1794-OE4** 2 - **1794-IE4X0E2**
Resolution	12 bits plus sign Voltage: 0.156 mV/cnt Current: 0.320 µA/cnt
Data format	Left justified, 16 bit 2's complement
Conversion type	Pulse-width modulation
Output current terminal, user configurable	0 mA output until module is configured 4...20 mA 0...20 mA
Output voltage terminal, user configurable	0V output until module is configured ±10V 0...10V
Step response to 63% - voltage or current terminal	24 ms
Current load on voltage output, max	3 mA
Absolute accuracy(1)	Voltage terminal: 0.133% full-scale @ 25 °C (77 °F) Current terminal: 0.425% full-scale @ 25 °C (77 °F)
Accuracy drift with temperature	Voltage terminal: 0.0045% full-scale/ °C Current terminal: 0.0069% full-scale/ °C
Resistive load on mA output	15...750 Ω @ 24V DC

(1) Includes offset, gain, nonlinearity, and repeatability error terms.

General Specifications

Attribute	1794-IE8	1794-OE4	1794-IE4XOE2
Recommended terminal base unit	1794-TB2, 1794-TB3, 1794-TB3S, 1794-TB3T, and 1794-TB3TS terminal base units	1794-TB2, 1794-TB3, 1794-TB3S, 1794-TB3T, 1794-TB3TS, and 1794-TBN terminal base units	1794-TB2, 1794-TB3, 1794-TB3S, 1794-TB3T, and 1794-TB3TS terminal base units
Terminal base screw torque	Determined by the installed terminal base		
Keyswitch position	3	4	5
Isolation voltage	Tested at 850V DC for 1 s between user power to system No isolation between individual channels		
External DC power supply voltage, nom	24V DC		
External DC power supply voltage range	10.5…31.2V DC (includes 5% AC ripple)		
External DC power supply current	60 mA @ 24V DC	150 mA @ 24V DC	165 mA @ 24V DC
Flexbus current	15 mA		
Power dissipation, max	3.0 W @ 31.2V DC	4.5 W @ 31.2V DC	4.0 W @ 31.2V DC
Thermal dissipation, max	10.2 BTU/hr @ 31.2V DC	13.6 BTU/hr @ 31.2V DC	15.3 BTU/hr @ 31.2V DC
Wire category[1]	2		
Wire size	Determined by the installed terminal base		
Dimensions, approx. (H x W x D) (with module installed)	45.7 x 94 x 53.3 mm (1.8 x 3.7 x 2.1 in.)		
Enclosure type rating	None		
North American temp code	T5	T4	T4A
UKEX/ATEX temp code	T4		
IECEx temp code	T4		

(1) You use this category information for planning conductor routing as described in the Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1.

Environmental Specifications

Attribute	Value
Temperature, operating	IEC 60068-2-1 (Test Ad, operating cold), IEC 60068-2-2 (Test Bd, operating dry heat), IEC 60068-2-14 (Test Nb, operating thermal shock): -20…+55 °C (-4…+131 °F)
Temperature, surrounding air, max	55 °C (131 °F)
Temperature, storage	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 nonoperating damp heat): 5…95% noncondensing
Vibration	IEC60068-2-6 (Test Fc, operating): 5 g @ 10…500Hz
Shock, operating	IEC60068-2-27 (Test Ea, unpackaged shock): 30 g
Shock, nonoperating	IEC60068-2-27 (Test Ea, unpackaged shock): 50 g
Emissions	IEC 61000-6-4
ESD immunity	EC 61000-4-2: 4 kV contact discharges 8 kV air discharges
Radiated RF immunity	IEC 61000-4-3: 10V/m with 1 kHz sine-wave 80% AM from 80…6000 MHz
Conducted RF immunity	IEC 61000-4-6: 10V rms with 1 kHz sine-wave 80% AM from 150 kHz…30 MHz
EFT/B immunity	IEC 61000-4-4: ±2 kV at 5 kHz on signal ports
Surge transient immunity	IEC 61000-4-5: ±2 kV line-earth (CM) on shielded ports