



FLEX I/O Isolated Output Analog Module, Cat. No. 1794-OF4I

Important User Information

Because of the variety of uses for the products described in this publication, those responsible for the application and use of these products must satisfy themselves that all necessary steps have been taken to assure that each application and use meets all performance and safety requirements, including any applicable laws, regulations, codes and standards. In no event will Rockwell Automation be responsible or liable for indirect or consequential damage resulting from the use or application of these products.

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

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

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

Throughout this publication, notes may be used to make you aware of safety considerations. The following annotations and their accompanying statements help you to identify a potential hazard, avoid a potential hazard, and recognize the consequences of a potential hazard:

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.
IMPORTANT	Identifies information that is critical for successful application and understanding of the product.

ATTENTION **Environment and Enclosure**

This equipment is intended for use in a Pollution Degree 2 industrial environment, in overvoltage Category II applications (as defined in IEC publication 60664-1), at altitudes up to 2000 meters without derating.

This equipment is considered Group 1, Class A industrial equipment according to IEC/CISPR Publication 11. Without appropriate precautions, there may be potential difficulties ensuring electromagnetic compatibility in other environments due to conducted as well as radiated disturbance.

This equipment is supplied as "open type" equipment. 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 interior of the enclosure must be accessible only by the use of a tool. Subsequent sections of this publication may contain additional information regarding specific enclosure type ratings that are required to comply with certain product safety certifications.

See NEMA Standards publication 250 and IEC publication 60529, as applicable, for explanations of the degrees of protection provided by different types of enclosure. Also, see the appropriate sections in this publication, as well as the Allen-Bradley publication 1770-4.1 ("Industrial Automation Wiring and Grounding Guidelines"), for additional installation requirements pertaining to this equipment.

WARNING When you insert or remove the module while 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.

ATTENTION FLEX I/O is grounded through the DIN rail to chassis ground. Use zinc plated yellow-chromate steel DIN rail to assure proper grounding. The use of other DIN rail materials (e.g. aluminum, plastic, etc.) that can corrode, oxidize, or are poor conductors, can result in improper or intermittent grounding.

ATTENTION **Preventing Electrostatic Discharge**

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

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

European Hazardous Location Approval

This analog output module is European Zone 2 approved: 1794-OF4I.

European Zone 2 Certification

This equipment is intended for use in potentially explosive atmospheres as defined by European Union Directive 94/9/EC.

The LCIE (Laboratoire Central des Industries Electriques) certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of Category 3 equipment intended for use in potentially explosive atmospheres, given in Annex II to this Directive. The examination and test results are recorded in confidential report No. 28 682 010.

Compliance with the Essential Health and Safety Requirements has been assured by compliance with EN 50021.

IMPORTANT

Observe the following additional Zone 2 certification requirements.

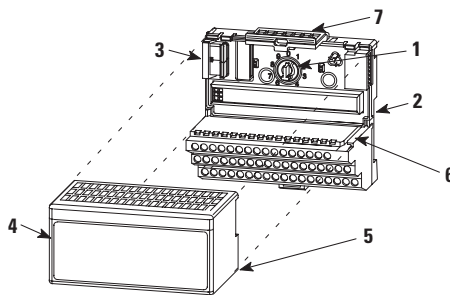
- This equipment is not resistant to sunlight or other sources of UV radiation.
- The secondary of a current transformer shall not be open-circuited when applied in Class I, Zone 2 environments.
- Equipment of lesser Enclosure Type Rating must be installed in an enclosure providing at least IP54 protection when applied in Class I, Zone 2 environments.
- This equipment shall be used within its specified ratings defined by Allen-Bradley.
- Provision shall be made to prevent the rated voltage from being exceeded by transient disturbances of more than 40% when applied in Class I, Zone 2 environments.

North American Hazardous Location Approval

This analog output module is North American Hazardous Location approved: 1794-OF4I.

The following information applies when operating this equipment in hazardous locations:	Informations sur l'utilisation de cet équipement en environnements dangereux :
Products marked "CL I, DIV 2, GP A, B, C, D" are suitable for use in Class I Division 2 Groups A, B, C, D, Hazardous Locations and nonhazardous locations only. Each product is supplied with markings on the rating nameplate indicating the hazardous location temperature code. When combining products within a system, the most adverse temperature code (lowest "T" number) may be used to help determine the overall temperature code of the system. Combinations of equipment in your system are subject to investigation by the local Authority Having Jurisdiction at the time of installation.	Les produits marqués "CL I, DIV 2, GP A, B, C, D" ne conviennent qu'à une utilisation en environnements de Classe I Division 2 Groupes A, B, C, D dangereux et non dangereux. Chaque produit est livré avec des marquages sur sa plaque d'identification qui indiquent le code de température pour les environnements dangereux. Lorsque plusieurs produits sont combinés dans un système, le code de température le plus défavorable (code de température le plus faible) peut être utilisé pour déterminer le code de température global du système. Les combinaisons d'équipements dans le système sont sujettes à inspection par les autorités locales qualifiées au moment de l'installation.
WARNING EXPLOSION HAZARD	AVERTISSEMENT RISQUE D'EXPLOSION
<ul style="list-style-type: none"> • Do not disconnect equipment unless power has been removed or the area is known to be nonhazardous. • Do not disconnect connections to this equipment unless power has been removed or the area is known to be nonhazardous. Secure any external connections that mate to this equipment by using screws, sliding latches, threaded connectors, or other means provided with this product. • Substitution of components may impair suitability for Class I, Division 2. • If this product contains batteries, they must only be changed in an area known to be nonhazardous. 	<ul style="list-style-type: none"> • Couper le courant ou s'assurer que l'environnement est classé non dangereux avant de débrancher l'équipement. • Couper le courant ou s'assurer que l'environnement est classé non dangereux avant de débrancher les connecteurs. Fixer tous les connecteurs externes reliés à cet équipement à l'aide de vis, loquets coulissants, connecteurs filetés ou autres moyens fournis avec ce produit. • La substitution de composants peut rendre cet équipement inadapte à une utilisation en environnement de Classe I, Division 2. • S'assurer que l'environnement est classé non dangereux avant de changer les piles.

Installing Your Analog Output Module



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

The module mounts on a 1794 terminal base.

1. Rotate the keyswitch (1) on the terminal base (2) clockwise to position 2 as required for this type of module.
2. Make certain the flexbus connector (3) is pushed all the way to the left to connect with the neighboring termbase/adaptor. 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.

WARNING 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 (4) with its alignment bar (5) aligned with the groove (6) on the terminal base.
5. Press firmly and evenly to seat the module in the terminal base unit. The module is seated when the latching mechanism (7) is locked into the module.

Connecting Wiring for the 1794-TB2, -TB3, -TB3S, -TB3T, -TB3TS, -TBN and -TBNF

1. Connect individual signal wiring to numbered terminals on the 0-15 row (A) as indicated in the following table. (Use Belden 8761 cable for signal wiring.)

1794-TBN, -TBNF - Connect individual output wiring to the even numbered terminals on row B for each output as indicated in the following table.

2. Connect channel common/return to the associated terminal on row A (1794-TB3, -TB3S, -TB3T)

1794-TBN, -TBNF - Connect the associated common/return to the corresponding odd numbered terminal on row B for each output as indicated in the following table.

ATTENTION



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

3. 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



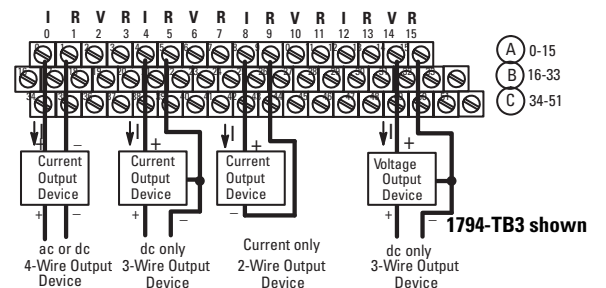
To reduce susceptibility to noise, power analog modules and digital modules from separate power supplies. Do not exceed a length of 33 ft (10m) for dc power cabling.

4. 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.
 5. 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.
 6. Connect the shield to functional earth ground as near as possible to the module.
- 1794-TB3T, -TB3TS only:** connect the shield to terminals 39 thru 46 (earth ground).

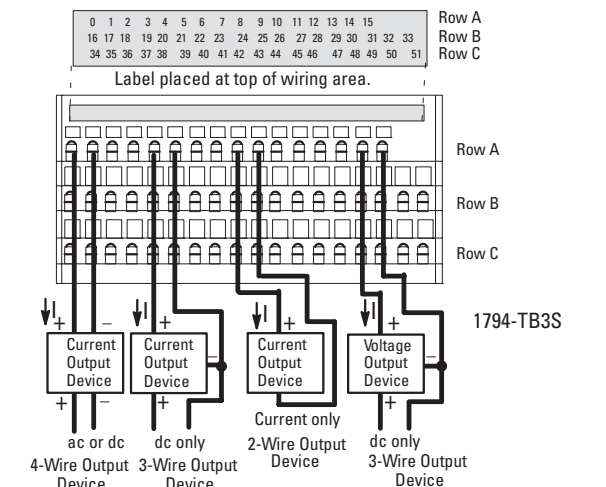
Wiring Connections for the 1794-OF4I Output Module

Channel	Signal Type	Label Markings	1794-TB3, -TB3S, -TB3T, -TB3TS, -TBN, -TBNF		1794-TBN, -TBNF ²
			Terminal	Shield (1794-TB3T, -TB3TS)	Terminal
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
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
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
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-TB2, -TB3, -TB3S, -TBN, -TBNF - Terminals B-16 thru B-33 are internally connected in the terminal base unit. 1794-TB3T, -TB3TS - Terminals 16, 17, 19, 21, 23, 25, 27, 29, 31 and 33 are internally connected in the terminal base unit.		
+V dc Power			1794-TB3, -TB3S - Terminals 34 thru 51 are internally connected in the terminal base unit. 1794-TB3T, -TB3TS - Terminals 34, 35, 50 and 51 are internally connected in the terminal base unit. 1794-TB2, -TBN, -TBNF - Terminals 34 and 51 are internally connected in the terminal base unit.		
Chassis Ground (Shield)			1794-TB3T, -TB3TS - Terminals 39 thru 46 are internally connected to chassis ground.		

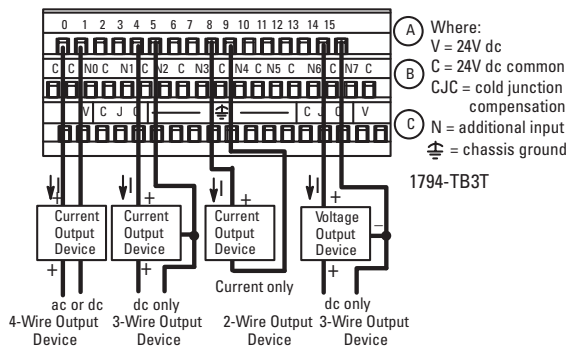
1794-TB2 and -TB3 Terminal Base Wiring



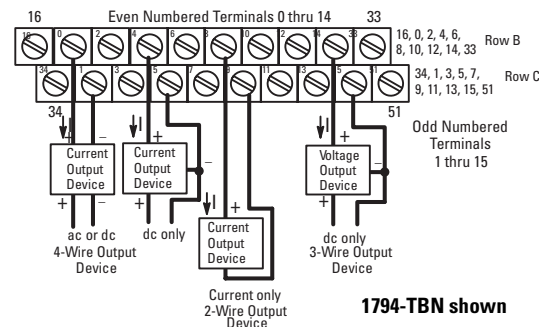
1794-TB3S Terminal Base Wiring



1794-TB3T and -TB3TS Terminal Base Wiring



1794-TBN, and -TBNF Terminal Base Wiring



Input Map

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	Read Back Channel 0															
Word 1	Read Back Channel 1															
Word 2	Read Back Channel 2															
Word 3	Read Back Channel 3															
Word 4	P	U	FP	CF	0	Reserved		0	0	0	0	0	0	B	D	0
Word 5	0	0	0	0	P3	P2	P1	P0	0	0	0	0	W	3	W	2

Where:
 PU = Power up unconfigured
 FP = Field power off
 CF = In configuration mode
 BD = Bad calibration
 DN = Calibration accepted
 P0 thru P3 = Output holding in response to Q0 thru Q3
 W0 thru W3 = Wire off current loop status for channels 0 thru 3 respectively

Output Map

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	E	S	S	0	0	0	0	0	0	0	0	0	0	0	0	0
Word 1	Output Data Channel 0															
Word 2	Output Data Channel 1															
Word 3	Output Data Channel 2															
Word 4	Output Data Channel 3															
Word 5	Ch 0 Configuration				Ch 1 Configuration				Ch 2 Configuration				Ch 3 Configuration			
Word 6	IC	1	T	IT	Q	Q	Q	Q	R	Q	C	G				
			R		3	2	1	0	V	K	K	G				

Where:
 EN = Inable bit (not used on input module)
 S1/S0 = Safe state source
 IC = Initiate Configuration bit
 TR = Transparent bit
 IT = Interrupt toggle bit
 Q0 thru Q3 = Requests for outputs to hold
 RV = Revert to default bit
 QK = Quick calibration
 CK = Calibration clock
 GO = Gain Offset select

Configuring Your Output Channels

Configuration Bits	Nominal Range	Data Type	Output Values	Module Update Rate
MSD 0 0 0 1	4-20mA	2's complement	<0000-7878>	5.0ms
0 0 1 0	±10V		<831F-7CE1>	2.5ms
0 0 1 1	±5V		<8618-79EB>	2.5ms
0 1 0 0	0-20mA	2's complement %	0-10000	5.0ms
0 1 0 1	4-20mA		<0-10000>	5.0ms
0 1 1 0	0-10V		0-10000	5.0ms
0 1 1 1	±10V	<-10000-10000>	5.0ms	
1 0 0 0	0-20mA	binary	0000-F3CF	2.5ms
1 0 0 1	4-20mA		0000-F0F1	5.0ms
1 0 1 0	0-10V		0000-F9C2	2.5ms
1 0 1 1	0-5V		0000-F3CF	2.5ms
1 1 0 0	±20mA		<0618-F9EB>	2.5ms
1 1 0 1	4-20mA		<8000-F87B>	5.0ms
1 1 1 0	±10V		<031F-FCE1>	2.5ms
1 1 1 1	±5V	<0618-F9EB>	2.5ms	

Specifications

Specifications - 4 Isolated Analog Output Module, Cat. No. 1794-OF4I

Number of Outputs	4 isolated
Module Location	Cat. No. 1794-TB2, -TB3, -TB3S, -TB3T, -TB3TS, TBN, -TBNF
Resolution	16 bits - unipolar; 15 bits plus sign - bipolar 0.156mV/cnt unipolar; 0.313mV/cnt bipolar 0.320µA/cnt unipolar; 0.640µA/cnt bipolar
Data Format	2's complement 2's complement % binary offset binary
Conversion Type	Sigma Delta
Update Rate	2.5/5.0/7.5ms all channels (see input update rate table)
Input Current Terminal	4-20mA (user configurable) 0-20mA (user configurable) ±20mA (user configurable)
Input Voltage Terminal	±10V (user configurable) 0-10V (user configurable) ±5V (user configurable) 0-5V (user configurable)
Normal Mode Rejection Ratio - Voltage or Current Terminal	-3dB @ 12Hz (300Hz conversion rate) -80dB @ 50Hz (300Hz conversion rate) -3dB @ 6Hz (150Hz conversion rate) -80dB @ 60Hz (150Hz conversion rate)
Common Mode Rejection Ratio	-120dB @ 50/60Hz
Step Response to 63% - Voltage or Current Terminal	1200Hz conversion rate = 0.6ms 600Hz conversion rate = 0.67ms 300Hz conversion rate = 13.4ms 150Hz conversion rate = 26.7ms
Input Resistance Voltage Terminal	>10 megohms
Input Resistance Current Terminal	<100 ohms ¹
Absolute Accuracy ² Voltage Terminal	0.1% Full Scale @ 25°C
Absolute Accuracy ² Current Terminal	0.1% Full Scale @ 25°C
Accuracy Driftwith Temperature Voltage Terminal	0.0028% Full Scale/°C
Accuracy Driftwith Temperature Current Terminal	0.0038% Full Scale/°C
Calibration Required	Yes
Maximum Overload	30V continuous or 32mA continuous, one channel at a time.
Indicators	1 green power/status indicator
Isolation Voltage	120V ac continuous (when used with 1794-TB3, -TB3S, -TB3T, or -TB3TS) 250V ac continuous (when used with 1794-TBN) Tested to 850V dc for 1s between channel to channel, channel to user, channel to system and user power to system.
Flexbus Current	50mA
Power Dissipation	2.0W maximum @ 31.2V dc
Thermal Dissipation	Maximum 6.8 BTU/hr @ 31.2V dc
Keyswitch Position	3

General Specifications

External dc Power Supply Voltage	24V dc nominal 19.2 to 31.2V dc (includes 5% ac ripple) 80mA @ 24V dc
Dimensions (with module installed)	31.8H x 3.7W x 2.1D inches 45.7H x 94W x 53.3D mm
Environmental Conditions	
Operating Temperature	IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock): 0 to 55°C (32 to 131°F)
Storage Temperature	IEC 60068-2-1 (Test Ab, Un-packaged Non-operating Cold), IEC 60068-2-2 (Test Bb, Un-packaged Non-operating Dry Heat), IEC 60068-2-14 (Test Na, Un-packaged Non-operating Thermal Shock): -40 to 85°C (-40 to 185°F)
Relative Humidity	IEC 60068-2-30 (Test Db, Un-packaged Non-operating Damp Heat): 5 to 95% non-condensing
Vibration	IEC60068-2-6 (Test Fc, Operating): 5g @ 10-500Hz
Shock	IEC60068-2-27 (Test Ea, Unpackaged shock): Operating 30g Non-operating 50g
Emissions	CISPR 11: Group 1, Class A (with appropriate enclosure)
ESD Immunity	IEC 61000-4-2: 4kV contact discharges 8kV air discharges
Radiated RF Immunity	IEC 61000-4-3: 10V/m with 1kHz sine-wave 80%AM from 30MHz to 1000MHz
EFT/B Immunity	IEC 61000-4-4: ±2kV at 5kHz on signal ports
Surge Transient Immunity	IEC 61000-4-5: ±2kV line-earth(CM) on shielded ports
Conducted RF Immunity	IEC 61000-4-6: 10Vrms with 1kHz sine-wave 80%AM from 150kHz to 30MHz
Enclosure Type Rating	None (open-style)
Conductors Wire Size Category ¹	12AWG (4mm ²) stranded copper wire rated at 75°C or higher 3/64 inch (1.2mm) insulation maximum
Certifications (when product is marked) ²	UL UL Listed Industrial Control Equipment CSA CSA certified Process Control Equipment CSA CSA certified for Class I, Division 2, Groups A, B, C and D Hazardous locations EE ² European Union 94/9/EEC ATEX Directive, compliant with: EN 50021: Potentially Explosive Atmospheres, Protection "n" (Zone 2) CE ² European Union 89/336/EEC EMC Directive, compliant with: EN 61000-6-4; Industrial Emissions EN 50082-2; Industrial Immunity EN 61326; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity C-Tick ² - Australian Radiocommunications Act compliant with AS/NZS CISPR 11, Industrial Emissions

¹ You use this category information for planning conductor routing as described in Allen-Bradley publication 1770-4.1, Industrial Automation Wiring and Grounding Guidelines.
² For the latest up-to-date information, see the Product Certification link at www.ab.com for Declarations of Conformity, Certificates and other certification details. For notification of any additional release notes, refer to www.ab.com/manuals/.

www.rockwellautomation.com

Corporate Headquarters

Rockwell Automation, 777 East Wisconsin Avenue, Suite 1400, Milwaukee, WI, 53202-5302 USA, Tel: (1) 414.212.5200, Fax: (1) 414.212.5201

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

Americas: Rockwell Automation, 1201 South Second Street, Milwaukee, WI 53204-2496 USA, Tel: (1) 414.382.2000, Fax: (1) 414.382.4444
 Europe/Middle East/Africa: Rockwell Automation SA/NV, Vorstlaan/Boulevard du Souverain 36, 1170 Brussels, Belgium, Tel: (32) 2 663 0600, Fax: (32) 2 663 0640
 Asia Pacific: Rockwell Automation, 27/F Citicorp Centre, 18 Whitfield Road, Causeway Bay, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

Headquarters for Dodge and Reliance Electric Products

Americas: Rockwell Automation, 6040 Ponders Court, Greenville, SC 29615-4617 USA, Tel: (1) 864.297.4800, Fax: (1) 864.281.2433
 Europe/Middle East/Africa: Rockwell Automation, Brühlstraße 22, D-74834 Elztal-Dallau, Germany, Tel: (49) 6261 9410, Fax: (49) 6261 17741
 Asia Pacific: Rockwell Automation, 55 Newton Road, #11-01/02 Revenue House, Singapore 307987, Tel: (65) 6356-9077, Fax: (65) 6356-9011

Publication 1794-IN037C-EN-P - May 2003

Supersedes publication 1794-IN037B-EN-P - February 2000

PN 957782-32

Copyright © 2003 Rockwell Automation, Inc. All rights reserved. Printed in the U.S.A.