



# Installation Instructions

## FLEX I/O 5V dc TTL Digital Input and Output Modules

1794-IG16, 1794-OG16

### 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.literature.rockwellautomation.com>) 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.

No patent liability is assumed by Rockwell Automation, Inc. with respect to use of information, circuits, equipment, or software described in this manual.

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

 <b>WARNING</b>	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.
<b>IMPORTANT</b>	Identifies information that is critical for successful application and understanding of the product.
 <b>ATTENTION</b>	Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you: <ul style="list-style-type: none"> <li>• identify a hazard</li> <li>• avoid a hazard</li> <li>• recognize the consequence</li> </ul>

 <b>ATTENTION</b>	<p><b>Environment and Enclosure</b></p> <p>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 (6562 ft) without derating.</p> <p>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 enclosure must have suitable flame-retardant properties to prevent or minimize the spread of flame, complying with a flame spread rating of 5VA, V2, V1, V0 (or equivalent) if non-metallic. 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.</p> <p>In addition to this publication, see:</p> <ul style="list-style-type: none"> <li>• Industrial Automation Wiring and Grounding Guidelines, for additional installation requirements, Allen-Bradley publication <a href="#">1770-4.1</a>.</li> <li>• NEMA Standards publication 250 and IEC publication 60529, as applicable, for explanations of the degrees of protection provided by different types of enclosure.</li> </ul>
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**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 (for example, aluminum or plastic) that can corrode, oxidize, or are poor conductors, can result in improper or intermittent grounding. Secure DIN rail to mounting surface approximately every 200 mm (7.8 in.) and use end-anchors appropriately.

**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.
- Store the equipment in appropriate static-safe packaging when not in use.

**WARNING**



If 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.

**WARNING**



Do not connect directly to line voltage. Line voltage must be supplied by a suitable, approved isolating transformer or power supply having short circuit capacity not exceeding 100 VA maximum or equivalent.

### North American Hazardous Location Approval

The following modules are North American Hazardous Location approved: 1794-IG16, 1794-OG16.

The following information applies when operating this equipment in hazardous locations:	Informations sur l'utilisation de cet équipement en environnements dangereux :
<p>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.</p>	<p>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.</p>

**WARNING**



**EXPLOSION HAZARD**

- 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.

**AVERTISSEMENT**



**RISQUE D'EXPLOSION**

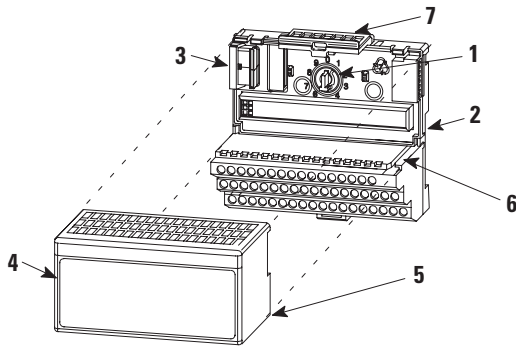
- Couper le courant ou s'assurer que l'environnement est classé non dangereux avant de débrancher l'équipement.
- Couper le courant ou s'assurer que l'environnement est classé non dangereux avant de débrancher les connecteurs. Fixer tous les connecteurs externes reliés à cet équipement à l'aide de vis, loquets coulissants, connecteurs filetés ou autres moyens fournis avec ce produit.
- La substitution de composants peut rendre cet équipement inadapté à une utilisation en environnement de Classe I, Division 2.
- S'assurer que l'environnement est classé non dangereux avant de changer les piles.

**IMPORTANT** To comply with North American restrictions, all connected I/O must be powered from a source compliant with the following:  
Class 2

**WARNING** If you connect or disconnect wiring while the field-side 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.



**Install Your Digital Module**



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

The module mounts on a 1794 terminal base.

**ATTENTION** Do not remove or replace a Terminal Base unit when power is applied. Interruption of the backplane can result in unintentional operation or machine motion.



**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.



1. Rotate the keyswitch (1) on the terminal base (2) clockwise to position 1 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 terminal base/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.
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.

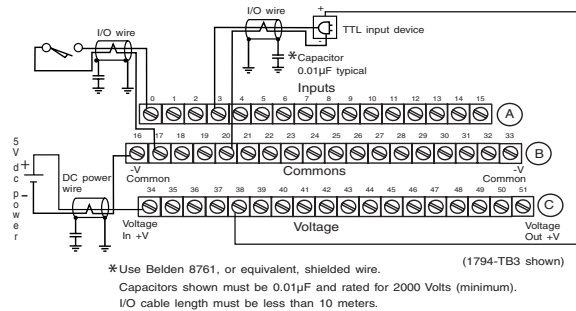
**Connect Wiring for your Module**  
(using a 1794-TB3 or -TB3S Terminal Base)

1. Connect individual input or output wiring to numbered terminals on the 0-15 row (A) as indicated in Table 1.
2. Connect the associated input and output devices as indicated in the wiring diagrams.
3. Connect +V dc power to terminal 34 on the 34-51 row (C).
4. Connect dc common to terminal 16 on the 16-33 row (B).
5. If daisy chaining 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 to the next base unit, connect a jumper from terminal 33 (common) on this base unit to terminal 16 on the next base unit.

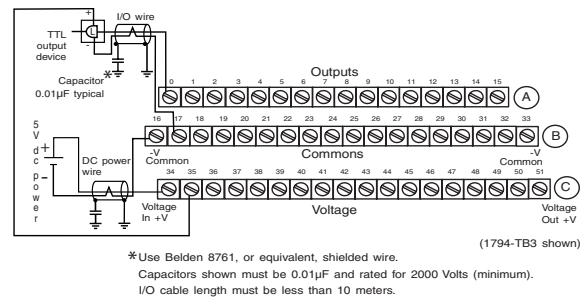
**Table 1 Wiring Connections for 1794-IG16 and 1794-OG16**

Channel	Signal	Power Terminal	Common Terminal
0	A-0	C-35	B-17
1	A-1	C-36	B-18
2	A-2	C-37	B-19
3	A-3	C-38	B-20
4	A-4	C-39	B-21
5	A-5	C-40	B-22
6	A-6	C-41	B-23
7	A-7	C-42	B-24
8	A-8	C-43	B-25
9	A-9	C-44	B-26
10	A-10	C-45	B-27
11	A-11	C-46	B-28
12	A-12	C-47	B-29
13	A-13	C-48	B-30
14	A-14	C-49	B-31
15	A-15	C-50	B-32
+V DC		C-34 thru C-51 are internally connected together.	
Common		B-16 thru B-33 are internally connected together.	

**1794-TB3 and 1794-TB3S Wiring for 1794-IG16**



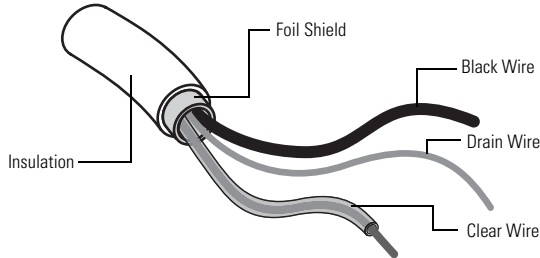
**1794-TB3 and 1794-TB3S Wiring for 1794-OG16**



**IMPORTANT** To comply with the CE Low Voltage Directive (LVD), all connected I/O must be powered from a source compliant with the following: Safety Extra Low Voltage (SELV) or Protected Extra Low Voltage (PELV).

**Ground Your Module**

Use shielded communication cable (Belden #8761). The Belden cable has two signal wires (black and clear), one drain wire, and a foil shield. The drain wire and foil shield must be grounded at one end of the cable.



**IMPORTANT** Do not ground the drain wire and foil shield at both ends of the cable.

**Configure Your Input Module**

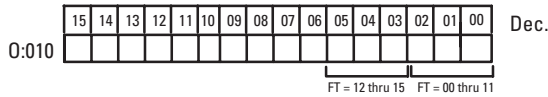
You configure your input module by setting bits in the configuration word (word 3).

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
Read	I15	I14	I13	I12	I11	I10	I9	I8	I7	I6	I5	I4	I3	I2	I1	I0
Write	Not used = Set to 0											Input filter FT1 12-15		Input filter FT0 0-11		

Where I = Input  
 FT0 = Input filter time for inputs 0-11  
 FT1 = Input filter time for inputs 12-15

*Set the Input Filter Time for the 1794-IG16*

To set the input filter time, set the associated bits in the output image (complementary word) for the module.



*Input Filter Times*

Bits	Description	Selected Filter Time
02 01 00	Filter Time for inputs 00..11	
05 04 03	Filter Time for inputs 12..15	
0 0 0	Filter Time 0 (Default)	0.25ms
0 0 1	Filter Time 1	0.50ms
0 1 0	Filter Time 2	1ms
0 1 1	Filter Time 3	2ms
1 0 0	Filter Time 4	4ms
1 0 1	Filter Time 5	8ms
1 1 0	Filter Time 6	16ms
1 1 1	Filter Time 7	32ms

**Configure Your Output Module**

You configure your output module by setting bits in word 1.

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
Read	Not used - Set to 0															
Write	O15	O14	O13	O12	O11	O10	O9	O8	O7	O6	O5	O4	O3	O2	O1	O0

Where O = Output

**Specifications - 1794-IG16 Flex I/O 5V dc TTL Digital Input Module**

Specification	Description
Number of I/O channels	16, nonisolated
Module location	Cat. No. 1794-TB3, -TB3S
On-state voltage	-0.2V dc...0.8V dc typical
Input current	3.7mA nominal @ 5V dc 4.1mA maximum @ 5V dc
Off-state voltage	2.0...5.5V dc typical
Off-state current	4.1mA maximum
Input impedance	1.4K ohms minimum 1.5K ohms typical
Isolation voltage	50V (continuous), Basic Insulation Type, between field side and system Type tested at 707V dc for 60 s, between field side and system No isolation between individual channels
Flexbus current	40mA
Power dissipation	1.4W maximum @ 5.5V dc
Thermal dissipation	4.78 BTU/hr @ 5.5V dc
Indicators (field side indication, customer device driven)	16 yellow status indicators
Input filter time <sup>(1)</sup>	
Off to On	0.25ms, 0.5ms, 1ms, 2ms, 4ms, 8ms, 16ms, 32ms
On to Off	0.25ms, 0.5ms, 1ms, 2ms, 4ms, 8ms, 16ms, 32ms

<sup>(1)</sup> Input off-to-on filter time is the time from a valid input signal to recognition by the module.  
 Input on-to-off filter time is time from the input signal dropping below the valid level to recognition by the module.

**IMPORTANT** TTL inputs are inverted  
 (-0.2...0.8V dc=logic low voltage=1=on  
 2.0...5.5V dc=logic high voltage=0=off).  
 Use a NOT instruction in the ladder program to convert to traditional true=High logic.

**Specifications - 1794-OG16 Flex I/O 5V dc TTL Digital Output Module**

Specification	Description
Number of I/O channels	16, nonisolated
Module location	Cat. No. 1794-TB3, -TB3S
On-state voltage	0V dc...0.4V dc
Output current rating	24mA maximum per channel
Off-state voltage	4.5V...5.5V dc typical
On-state current	0.15mA minimum per channel 24mA maximum per channel
Off-state leakage	0.1mA maximum
Isolation voltage	50V (continuous), Basic Insulation Type, between field side and system Type tested at 707V dc for 60 s, between field side and system No isolation between individual channels
Output signal delay <sup>(1)</sup> (Resistive load)	Off to On - 0.25ms maximum On to Off - 0.5ms maximum
Flexbus current	80mA
Power dissipation	0.8W maximum @ 5.5V dc
Thermal dissipation	3.41 BTU/hr maximum @ 5.5V dc
Pilot duty rating	Not rated
Indicators (field side indication, customer device driven)	16 yellow status indicators

<sup>(1)</sup> The time from the receipt of an on or off command to the output actually turning on or off.

**IMPORTANT** TTL outputs are inverted  
 (On=1=logic low voltage=0...0.4V dc;  
 Off=0=logic high voltage=4.5...5.5V dc).  
 Use a NOT instruction in the ladder program to convert to traditional true=High logic.

## General Specifications - 1794-IG16, 1794-OG16

Specification	Description
Terminal base screw torque	Determined by installed terminal base
Dimensions (with module installed) H x W x D	94 x 94 x 69 mm 3.7 x 3.7 x 2.7 inches
External dc power supply voltage	5V dc nominal
External dc power voltage range	4.5...5.5V dc (includes 50mV p-p ripple)
External dc power supply current	<b>1794-IG16</b> - 210mA max @ 5V dc <b>1794-OG16</b> - 100mA @ 5V dc
North American temp code	T4A
Keyswitch position	1
Enclosure type rating	None (open-style)
Wire type	Shielded (Power and I/O)
Wire size	Determined by installed terminal base
Wiring category <sup>(1)</sup>	3- on signal ports 2- on power ports

<sup>(1)</sup> Use this Conductor Category information for planning conductor routing. Refer to Industrial Automation Wiring and Grounding Guidelines, publication [1770-4.1](#).

## Environmental Specifications

Specification	Description
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...55 °C (32...131 °F)
Storage temperature	IEC 60068-2-1 (Test Ab, Unpackaged Non-operating Cold), IEC 60068-2-2 (Test Bb, Unpackaged Non-operating Dry Heat), IEC 60068-2-14 (Test Na, Unpackaged Non-operating Thermal Shock): -40...85 °C (-40...185 °F)
Relative humidity	IEC 60068-2-30 (Test Db, Unpackaged Damp Heat): 5...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: 6kV contact discharges 8kV air discharges
Radiated RF immunity	IEC 61000-4-3: 10V/m with 1 kHz sine-wave 80% AM from 80...2000 MHz 10V/m with 200 Hz 50% Pulse 100% AM at 900 MHz 10V/m with 200 Hz 50% Pulse 100% AM at 1890 MHz 1V/m with 1 kHz sine-wave 80% AM from 2000...2700 MHz
EFT/B immunity	IEC 61000-4-4: ±2k V at 5kHz on power ports ±2k V at 5kHz on signal ports
Surge transient immunity	IEC 61000-4-5: ±2 kV line-earth(CM) on power ports
Conducted RF immunity	IEC 61000-4-6: 10V rms with 1 kHz sine-wave 80% AM from 150 kHz...80 MHz

## Certifications

Certifications	(when product is marked) <sup>(1)</sup>
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.
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 61131-2; Programmable Controllers (Clause 8, Zone A & B)
C-Tick	Australian Radiocommunications Act, compliant with: AS/NZS CISPR 11; Industrial Emissions

<sup>(1)</sup> See the Product Certification link at [www.ab.com](http://www.ab.com) for Declarations of Conformity, Certificates, and other certification details.

[www.rockwellautomation.com](http://www.rockwellautomation.com)

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