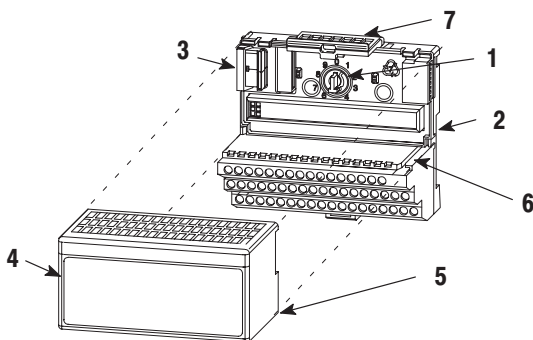




Installation Instructions

24V dc FLEX I/O 2 Input Frequency Module

Cat. No. 1794-IJ2



English

Module Installation

This module mounts on a 1794 terminal base unit.

1. Rotate keyswitch (1) on terminal base unit (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 that the pins on the bottom of the module are straight so they will align properly with the connector in the terminal base unit.
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.



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

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

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

European Union Directive Compliance

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

EMC Directive

This product is tested to meet Council Directive 89/336/EEC Electromagnetic Compatibility (EMC) and the following standards, in whole or in part, documented in a technical construction file:

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

This product is intended for use in an industrial environment.

Low Voltage Directive

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

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

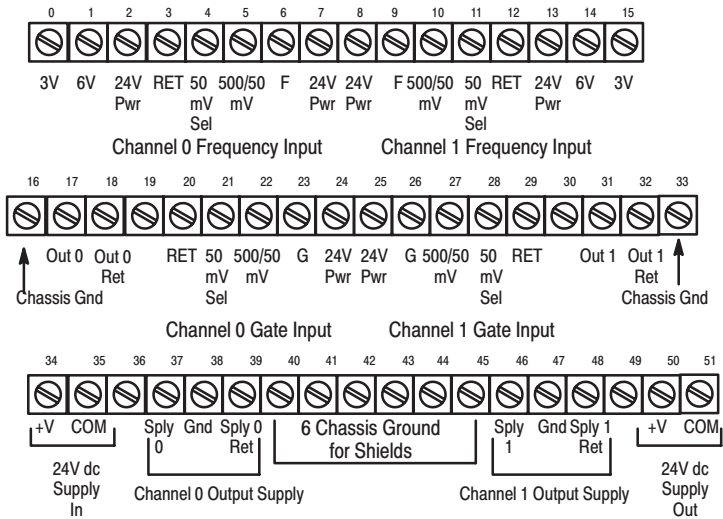
- Industrial Automation Wiring and Grounding Guidelines For Noise Immunity, publication 1770-4.1
- Automation Systems Catalog, publication B111

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

Connecting Wiring to a 1794-TB3G or 1794-TB3GS Terminal Base

Connect wiring to the terminal base as shown below.

Connections for Terminal Base 1794-TB3G shown



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.



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



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

Refer to the table on page 4 for complete wiring connections for various input devices.

Wiring Connections for Various Input Devices

Types of Inputs	Channel 0 Terminals ⁵			Channel 1 Terminals ⁵			GND ⁵
	Power	Input	RET ⁶	Power	Input	RET ⁶	
Frequency							
24V dc IEC1+ Proximity ^{1, 2}	7	6	3	8	9	12	
24V dc Contact Switch ³	7	6	3	8	9	12	
500mV ac Magnetic Pickup	7	5	3	8	10	12	
50mV ac Magnetic Pickup ⁴	7	5	3	8	10	12	
6V ac Vortex	2	1	3	13	14	12	
3V ac Vortex	2	0	3	13	15	12	
Gate							
24V dc IEC1+ Proximity ^{1, 2}	24	23	20	25	26	29	
24V dc Contact Switch ³	24	23	20	25	26	29	
500mV ac Magnetic Pickup	24	22	20	25	27	29	
50mV ac Magnetic Pickup ⁴	24	22	20	25	27	29	

1 As defined by standard IEC 1131-2.

2 RET not used on 2-wire devices

3 Add external resistor from 24V to F or G for wire-off detection (0.4mA)

4 Add a jumper between 50mV and RET (Frequency - channel 0 = 4 to 3; channel 1 = 11 to 12)
(Gate - channel 0 = 21 to 20; channel 1 = 28 to 29)

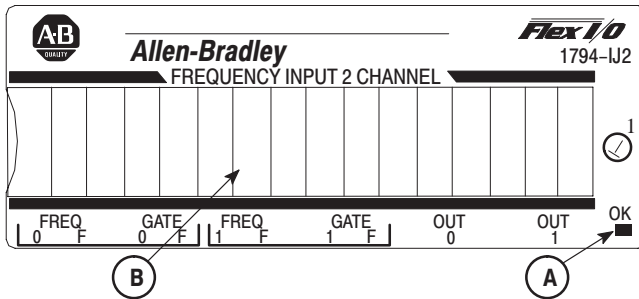
5 Connect cable shields to GND terminals.

6 All 4 RET terminals (ch 0 and 1, Freq, Gate) are internally connected together.

Output Alarm Connections	Channel 0 Terminals ¹				Channel 1 Terminals ¹			
	Sply +	Sply RET	Out +	Out RET	Sply +	Sply RET	Out +	Out RET
Supply Connection	37	39			46	48		
Output Connection			17	18			31	32

1 Connect cable shields to GND connections.

Indicators



A = Power/status indicator – indicates power applied to module and status of module.

B = Insertable label for writing individual I/O assignments.

Indicator	Indication	Description
Input (0 or 1) Frequency or Gate	Off/Dark	Input turned off, input not used, wire disconnected
	On/Yellow	Input turned on
Fault (F) Frequency or Gate	Off/Dark	Wire connected, normal operation
	On/Red flash	Wire disconnected, fault condition (for IEC1+ proximity switch or switch contacts with shunt resistor)
Output Alarm (0 or 1)	Off/Dark	Output turned off
	On/Yellow	Output turned on (logic drive on)
Module Power (OK)	Off/Dark	24V power off, or 5V logic power problem
	Solid Green	Module OK, normal operating mode
	Solid Red	Module fault, outputs disabled

Resolution and Accuracy

$\pm 1\text{Hz}$ or $\pm 0.1\text{Hz}$ (depending on frequency range bit setting), or \pm accuracy specification listed below, whichever is greater.

Resolution percent is defined as:

$$\% \text{ resolution} = \frac{100}{\text{count frequency} \times \text{minimum frequency sample time}}$$

Accuracy percent is defined as:

$$\% \text{ accuracy} = 100 \left[1 - \frac{\frac{\text{minimum frequency sample time}}{2}}{\frac{\text{minimum frequency sample time}}{2} + \frac{1}{\text{count frequency}}} \right]$$

Minimum Freq. Sampling Time in ms	Accuracy					Resolution
	Sampling Accuracy	Time Base Accuracy	Worst Case Total Accuracy	Deviation in Hz Due to Total Accuracy		
				1.0-3276.7 Freq. Range	1-32767 Freq. Range	
2	$\pm 0.02\%$	$\pm 0.0225\%$	$\pm 0.0425\%$	$\pm 0.1-1.4\text{Hz}$	$\pm 1-14\text{Hz}$	0.01%
4	$\pm 0.01\%$	$\pm 0.0225\%$	$\pm 0.0325\%$	$\pm 0.1-1.1\text{Hz}$	$\pm 1-11\text{Hz}$	0.005%
5	$\pm 0.008\%$	$\pm 0.0225\%$	$\pm 0.0305\%$	$\pm 0.1-1.0\text{Hz}$	$\pm 1-10\text{Hz}$	0.004%
10	$\pm 0.004\%$	$\pm 0.0225\%$	$\pm 0.0265\%$	$\pm 0.1-0.9\text{Hz}$	$\pm 1-9\text{Hz}$	0.002%
20	$\pm 0.002\%$	$\pm 0.0225\%$	$\pm 0.0245\%$	$\pm 0.1-0.8\text{Hz}$	$\pm 1-8\text{Hz}$	0.001%
50	$\pm 0.0008\%$	$\pm 0.0225\%$	$\pm 0.0233\%$	$\pm 0.1-0.8\text{Hz}$	$\pm 1-8\text{Hz}$	0.0004%
100	$\pm 0.0004\%$	$\pm 0.0225\%$	$\pm 0.0229\%$	$\pm 0.1-0.8\text{Hz}$	$\pm 1-8\text{Hz}$	0.0002%
200	$\pm 0.0002\%$	$\pm 0.0225\%$	$\pm 0.0227\%$	$\pm 0.1-0.7\text{Hz}$	$\pm 1-7\text{Hz}$	0.0001%
500	$\pm 0.00008\%$	$\pm 0.0225\%$	$\pm 0.02258\%$	$\pm 0.1-0.7\text{Hz}$	$\pm 1-7\text{Hz}$	0.00004%
1000	$\pm 0.00004\%$	$\pm 0.0225\%$	$\pm 0.02254\%$	$\pm 0.1-0.7\text{Hz}$	$\pm 1-7\text{Hz}$	0.00002%

Input Map

Bit→	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Word↓	Read															
0	Frequency 0 – 32,767 – or – 0.0 – 3,276.7 Channel 0															
1	% Full Scale 0.0% to 3,276.7% Channel 0 – or – Acceleration –32,768 to +32,767 Channel 0															
2	Frequency 0 – 32,767 – or – 0.0 – 3,276.7 Channel 1															
3	% Full Scale 0.0% to 3,276.7% Channel 1 – or – Acceleration –32,768 to +32,767 Channel 1															
4	R	R	Direction 0–3 Ch 0	GS Ch 0	F/A Ch 0	WO Ch 0	MP A Ch 0	R	R	Direction 0–3 Ch 1	GS Ch 1	F/A Ch 1	WO Ch 1	MP A Ch 1		
5	Reserved											Diagnostic Status 0 – 15				
6	Reserved															

Where: GS = Gate state
 F/A = Frequency/Accel alarm
 WO = Wire-off alarm
 MPA = Missing pulse alarm
 R = Reserved

Output Map

Bit⇒	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
Word↓	Write																
0	CF	SS M	FR Ch 0	Number Of Pulses To Terminate Sampling 0 - 7 Ch 0			MPM 0 - 3 Ch 0	R	LF	FR Ch 1	Number Of Pulses To Terminate Sampling 0 - 7 Ch 1			MPM 0-3 Ch 1			
1	Maximum Frequency 0 - 32,767 - or - 0.0 - 3,276.7 - or - Absolute Value of Acceleration 0 to 32,767 - Channel 0																
2	Frequency Scaling Divisor 0 - 255 Ch 0								Frequency Scaling Multiplier 0 - 255 Ch 0								
3	W OF G Ch 0	W O FF Ch 0	IGI Ch 0	IFI Ch 0	Minimum Frequency Sample Time 0 - 15 Ch 0			Init St Up Ch 0	ACT 0-3 Ch 0	F/A AS Ch 0	MPDM 0-3 Ch 0	WOFFM 0-3 Ch 0					
4	Maximum Frequency 0 - 32,767 - or - 0.0 - 3,276.7 - or - Absolute Value of Acceleration 0 to 32,767 - Channel 1																
5	Frequency Scaling Divisor 0 - 255 Ch 1								Frequency Scaling Multiplier 0 - 255 Ch 1								
6	W OF G Ch 1	W O FF Ch 1	IGI Ch 1	IFI Ch 1	Minimum Frequency Sample Time 0 - 15 Ch 1			Init St Up Ch 1	ACT 0-3 Ch 1	F/A AS Ch 1	MPDM 0-3 Ch 1	WOFFM 0-3 Ch 1					
7	Reserved																

Where: CF = Communication fault
 SSM = Safe state mode
 FR = Frequency Range
 MPM = Missing Pulse Multiplier
 LF = Local fault mode
 F/AAS = Frequency/Accel alarm select
 WOFF = Wire-off fault frequency
 WOFFG = Wire-off fault gate
 WOFFM = Wire-off fault mode
 IGI = Invert gate input
 IFI = Invert frequency input
 ACT = Acceleration Calculation Time
 MPDM = Missing pulse delay multiplier
 R = Reserved

Specifications – 1794-IJ2 Frequency Input Module

Input Specifications	
Number of Input Channels	2
Number of Inputs per Channel	2 – Frequency and Gate (gate used to establish direction)
Input Frequency (maximum)	1–32KHz w/Sine Wave; 1–32KHz w/Square Wave Input
Frequency Value (maximum)	32,767 or 3,276.7 (dependent on range)
Input Pulse Width (minimum)	20 μ s
Resolution/Accuracy	Refer to Resolution/Accuracy table
On-State Voltage (Minimum)	10V (24V IEC+1 proximity, encoder input or switch inputs)
On-State Voltage (Nominal) (selected by terminal base connections)	50mV ac, 28V ac peak – Extended Magnetic Pickup 500mV ac, 28V ac peak – Magnetic Pickup $\leq 3V$ – Vortex Flowmeter low range $\geq 6V$ – Vortex Flowmeter high range 24V dc IEC1+ Proximity or Encoder input 24V dc Contact Switch input
On-State Voltage (Maximum)	Limited to isolated 24V dc power supply maximum
On-State Current	Minimum Nominal Maximum
	2.0mA 9.0mA 10.0mA
Off-State Current	Minimum
	1.5mA into 24V dc IEC1+ Terminal
Off-State Voltage	Maximum
	5.0V dc on 24V dc IEC1+ Terminal
Wire-Off Detection	0.4mA for proximity, encoder, or contact switch with 50k Ω shunt resistor
Frequency Input Impedance	>5K Ω for 50mV extended magnetic pickup >5K Ω for 500mV magnetic pickup >10K Ω for 3V vortex flowmeter >10K Ω for 6V vortex flowmeter >2.5K Ω for 24V dc IEC1+ proximity or encoder input >2.5K Ω for 24V dc contact switch input

Specifications continued on next page.

Specifications – 1794-IJ2 Frequency Input Module

Gate Input Impedance	>5K Ω for 50mV extended magnetic pickup >5K Ω for 500mV magnetic pickup >2.5K Ω for 24V dc IEC1+ proximity or encoder input >2.5K Ω for 24V dc contact switch input
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Output Specifications (meets IEC 1A 24V dc output specification)

Number of Outputs	2 isolated
Output Voltage Source	Customer supplied
Output Voltage	Minimum Nominal Maximum
	10V dc 24V dc 31.2V dc
Off-State Voltage	Maximum
	31.2V dc
On-State Current	Minimum Maximum
	1.0mA per output minimum 1.0A per channel sourced out of module. Current Limited: All outputs can be on simultaneously without derating
Surge Current	2A for 50ms, repeatable every 2s
Off-State Leakage	Maximum
	Less than 300 μ A @ 31.2V dc
On-State Voltage Drop	Maximum
	0.9V dc @ 1A
Output Control	Outputs individually assignable to: Frequency, % Full Scale, or Acceleration Alarm
Output Switching Time	Triggered by frequency alarm or acceleration alarm Turn On: Less than 0.5ms Turn Off: Less than 1ms

Specifications continued on next page.

Specifications – 1794-IJ2 Frequency Input Module**General Specifications**

Module Location	Cat. No. 1794-TB3G, -TB3GS Terminal Base
External dc Power Supply Voltage Voltage Range Supply Current	(Input for +5V logic and 24V dc/dc converters) 24V dc nominal 19.2 to 31.2V dc (includes 5% ac ripple) 220mA @ 19.2V dc; 180mA @ 24V dc; 140mA @ 31.2V dc
Isolated dc Power Supply Voltage Voltage Range Supply Current Peak ac Ripple	(Output to sensors and encoders) 24V dc nominal 21.6 to 26.4V dc 0–60mA maximum @ 24V dc (4 devices @ 15mA = 60mA) 100mV maximum
Isolation Voltage	1250 Vrms/V ac between user Input (F & G) and System, user Output (0 & 1) and System, and user power and System 100% tested at 2121 Vdc for 1s. 500 Vrms/V ac between 4 user Inputs and 2 user Outputs, user Output 0 and Output 1 100% tested at 850 Vdc for 1s
Processing Time	≤ 4ms
Flexbus Current	30mA @ 5V dc
Power Dissipation	4.6W maximum @ 31.2V dc
Thermal Dissipation	Maximum 15.6 BTU/hr @ 31.2V dc
Indicators (field side driven, logic side indication)	1 green/red power/status indicator Input: 4 yellow status indicators (0, 1) – logic side 4 red wire-off indicators (F) – logic side Output: 2 yellow status indicators (0, 1) – logic side
Keyswitch Position	1

Specifications continued on next page.

Specifications – 1794-IJ2 Frequency Input Module

Dimensions Inches (Millimeters)	1.8H x 3.7W x 2.1D (45.7 x 94.0 x 53.3)
Environmental Conditions	
Operational Temperature	0 to 55°C (32 to 131°F)
Storage Temperature	-40 to 85°C (-40 to 185°F)
Relative Humidity	5 to 95% noncondensing (operating) 5 to 80% noncondensing (nonoperating)
Shock	30 g peak acceleration, 11(±1)ms pulse width
Operating Non-operating	50 g peak acceleration, 11(±1)ms pulse width
Vibration	Tested 5 g @ 10–500Hz per IEC 68-2-6
Input Conductors	
Wire	Belden 8761
Category	2 ¹
Length (max)	1000ft (304.8m)
Output Conductors	
Wire	Belden 8761
Category	2 ¹
Agency Certification (when product is marked)	<ul style="list-style-type: none"> • CSA certified • CSA Class I, Division 2 Groups A, B, C, D certified • UL listed • CE marked for all applicable directives
User Manual	Publication 1794-6.5.11

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



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