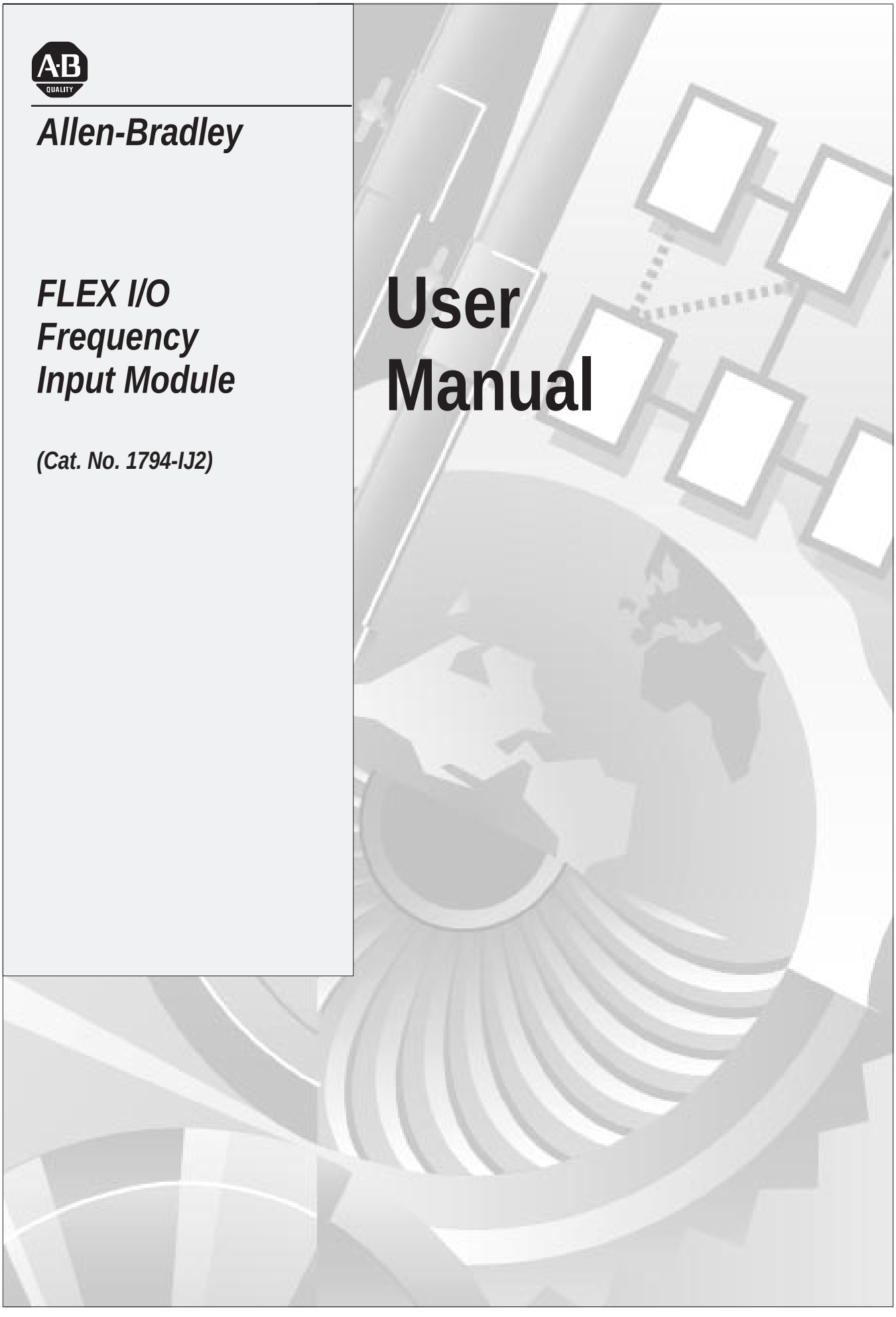


Allen-Bradley

FLEX I/O Frequency Input Module

(Cat. No. 1794-IJ2)

User Manual

Important User Information

Because of the variety of uses for the products described in this publication, those responsible for the application and use of this control equipment 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.

The illustrations, charts, sample programs and layout examples shown in this guide are intended solely for example. Since there are many variables and requirements associated with any particular installation, Allen-Bradley 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 Allen-Bradley office) describes some important differences between solid-state equipment and electromechanical devices which should be taken into consideration when applying products such as those described in this publication.

Throughout this manual we make notes to alert you to possible injury to people or damage to equipment under specific circumstances.

ATTENTION: Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss.

Attention helps you:

- identify a hazard
- avoid the hazard
- recognize the consequences

Important: Identifies information that is especially important for successful application and understanding of the product.

Important: We recommend you frequently backup your application programs on appropriate storage medium to avoid possible data loss.

Using This Manual

Purpose of this Manual

This manual shows you how to use your FLEX I/O 2 input frequency module with Allen-Bradley programmable controllers. The manual helps you install, program and troubleshoot your module.

Audience

You must be able to program and operate an Allen-Bradley programmable controller to make efficient use of your FLEX I/O module. 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.

Vocabulary

In this manual, we refer to:

- the frequency input module as the “input module”
- the Programmable Controller as the “controller”

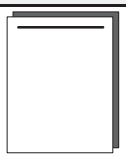
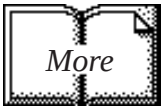
Manual Organization

This manual is divided into five chapters. The following chart lists each chapter with its corresponding title and a brief overview of the topics covered in that chapter.

Chapter	Title	Contents
1	Overview of FLEX I/O and Frequency Input modules	Describes FLEX I/O frequency input modules, features, and how they function
2	How to Install Your Frequency Input Module	How to install and wire the module
3	Module Programming	Explains block transfer programming, sample programs
4	Writing Configuration to and Reading Status From with a Remote I/O Adapter	Explains how to configure your modules and read status information from your modules when using a remote I/O adapter
5	How Communication Takes Place and I/O Image Table Mapping with the DeviceNet Adapter	Explains how you communicate with your modules, and how the I/O image is mapped when using a DeviceNet adapter
Appendix	**Title**	**Contents**
A	Specifications	Specifications for the frequency module
B	Schematics	Simplified schematics of frequency input module

Conventions

We use these conventions in this manual:

In this manual, we show:	Like this:
that there is more information about a topic in another chapter in this manual	
that there is more information about the topic in another manual	

For Additional Information

For additional information on FLEX I/O systems and modules, refer to the following documents:

Catalog Number	Voltage	Description	Publications	
			Installation Instructions	User Manual
1794		1794 FLEX I/O Product Data	1794-2.1	
1794-ACN	24V dc	ControlNet Adapter	1794-5.8	
1794-ACNR	24V dc	Redundant Media ControlNet Adapter	1794-5.18	
1794-ACN15	24V dc	ControlNet Adapter	1794-5.47	
1794-ACNR15	24V dc	Redundant Media ControlNet Adapter	1794-5.48	
1794-ADN	24V dc	DeviceNet Adapter	1794-5.14	1794-6.5.5
1794-ASB/C	24V dc	Remote I/O Adapter	1794-5.50	1794-6.5.9
1794-ASB2/B	24V dc	2-Slot Remote I/O Adapter	1794-5.44	1794-6.5.13
1794-APB	24V dc	Profibus Adapter	1794-5.40	1794-6.5.6
1794-IB8	24V dc	8 Sink Input Module	1794-5.30	
1794-OB8	24V dc	8 Source Output Module	1794-5.31	
1794-IB16	24V dc	16 Sink Input Module	1794-5.4	
1794-OB16	24V dc	16 Source Output Module	1794-5.3	
1794-IV16	24V dc	16 Source Input Module	1794-5.28	
1794-OV16	24V dc	16 Sink Output Module	1794-5.29	
1794-OB8EP	24V dc	8 Electronically Fused Output Module	1794-5.20	
1794-IB8S	24V dc	Sensor Input Module	1794-5.7	
1794-IB10XOB6	24V dc	10 Input/6 Output Module	1794-5.24	
1794-IE8	24V dc	Selectable Analog 8 Input Module	1794-5.6	
1794-OE4	24V dc	Selectable Analog 4 Output Module	1794-5.5	1794-6.5.2
1794-IE4XOE2	24V dc	4 Input/2 Output Analog Module	1794-5.15	

Table continued on next page

Catalog Number	Voltage	Description	Publications	
			Installation Instructions	User Manual
1794-OF4	24V dc	4 Output Isolated Analog Module	1794-5.37	1794-6.5.8
1794-IF4	24V dc	4 Input Isolated Analog Module	1794-5.38	
1794-IF2XOF2	24V dc	2 Input/2 Output Isolated Analog Module	1794-5.39	
1794-IR8	24V dc	8 RTD Input Analog Module	1794-5.22	1794-6.5.4
1794-IT8	24V dc	8 Thermocouple Input Module	1794-5.21	1794-6.5.7
1794-IRT8	24V dc	8 Thermocouple/RTD Input Module	1794-5.50	1794-6.5.12
1794-IJ2	24V dc	2 Frequency Input Module	1794-5.49	1794-6.5.11
1794-IA8	120V ac	8 Input Module	1794-5.9	
1794-OA8	120V ac	Output Module	1794-5.10	
1794-TB2 1794-TB3		2-wire Terminal Base 3-wire Terminal Base	1794-5.2	
1794-TBN		Terminal Base Unit	1794-5.16	
1794-TBNF		Fused Terminal Base Unit	1794-5.17	
1794-TB3T		Temperature Terminal Base Unit	1794-5.41	
1794-TB3S		Spring Clamp Terminal Base Unit	1794-5.42	
1794-TB3TS		Spring Clamp Temperature Base Unit	1794-5.43	
1794-TB3G		Terminal Base Unit	1794-5.51	
1794-TB3GS		Spring Clamp Terminal Base Unit	1794-5.59	
1794-CE1, -CE3		Extender Cables	1794-5.12	
1794-NM1		Mounting Kit	1794-2.13	
1794-PS1	24V dc	Power Supply	1794-5.35	

Summary

This preface gave you information on how to use this manual efficiently. The next chapter introduces you to the frequency module.

Table of Contents

Overview of the Frequency Input Module

Chapter 1

How to Install Your Frequency Input Module

Chapter 2

Programming Your Frequency Input Module

Chapter 3

Writing Configuration to and Reading Status from Your Module with a Remote I/O Adapter

Chapter 4

How Communication Takes Place and I/O Image Table Mapping with the DeviceNet Adapter

Chapter 5

Overview of the Frequency Input Module

What This Chapter Contains

Read this chapter to familiarize yourself with the 1794-IJ2 module.

How You Use the Frequency Input Module

The 1794-IJ2 module is an intelligent I/O module designed to perform high-speed frequency algorithms. The module provides:

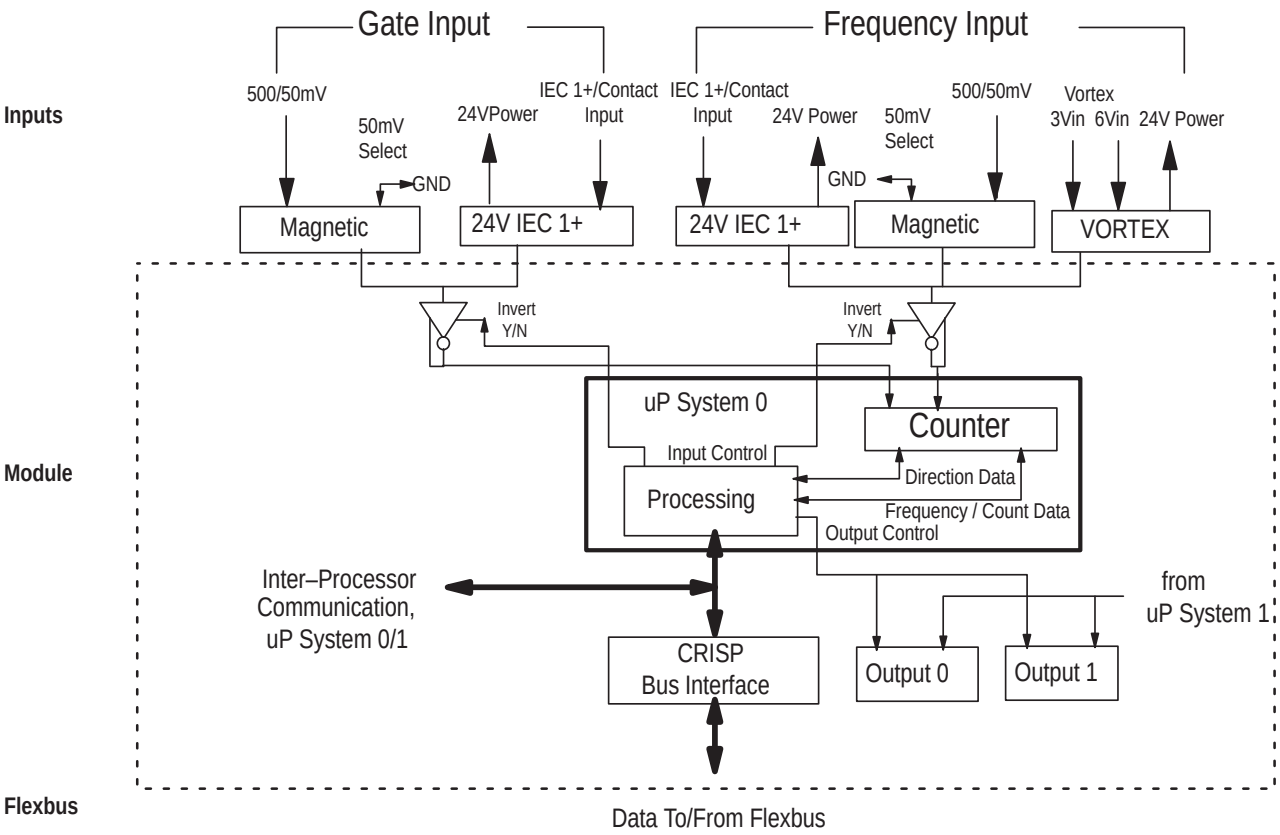
- 2 Frequency Inputs,
- 2 Gate Inputs and
- 2 Outputs.

The Frequency Inputs can accept frequencies up to 32,767 Hz. The module accepts and returns binary data.

The module measures frequency over a user-specified time interval. A frequency calculation can start before the time interval has elapsed, if a user-specified number of frequency input pulses have occurred.

The module's primary use is accurate, high-speed frequency measurement. A high-speed internal clock is synchronized with the frequency input to count over a user-selected sampling time or a user-defined number of frequency input pulses.

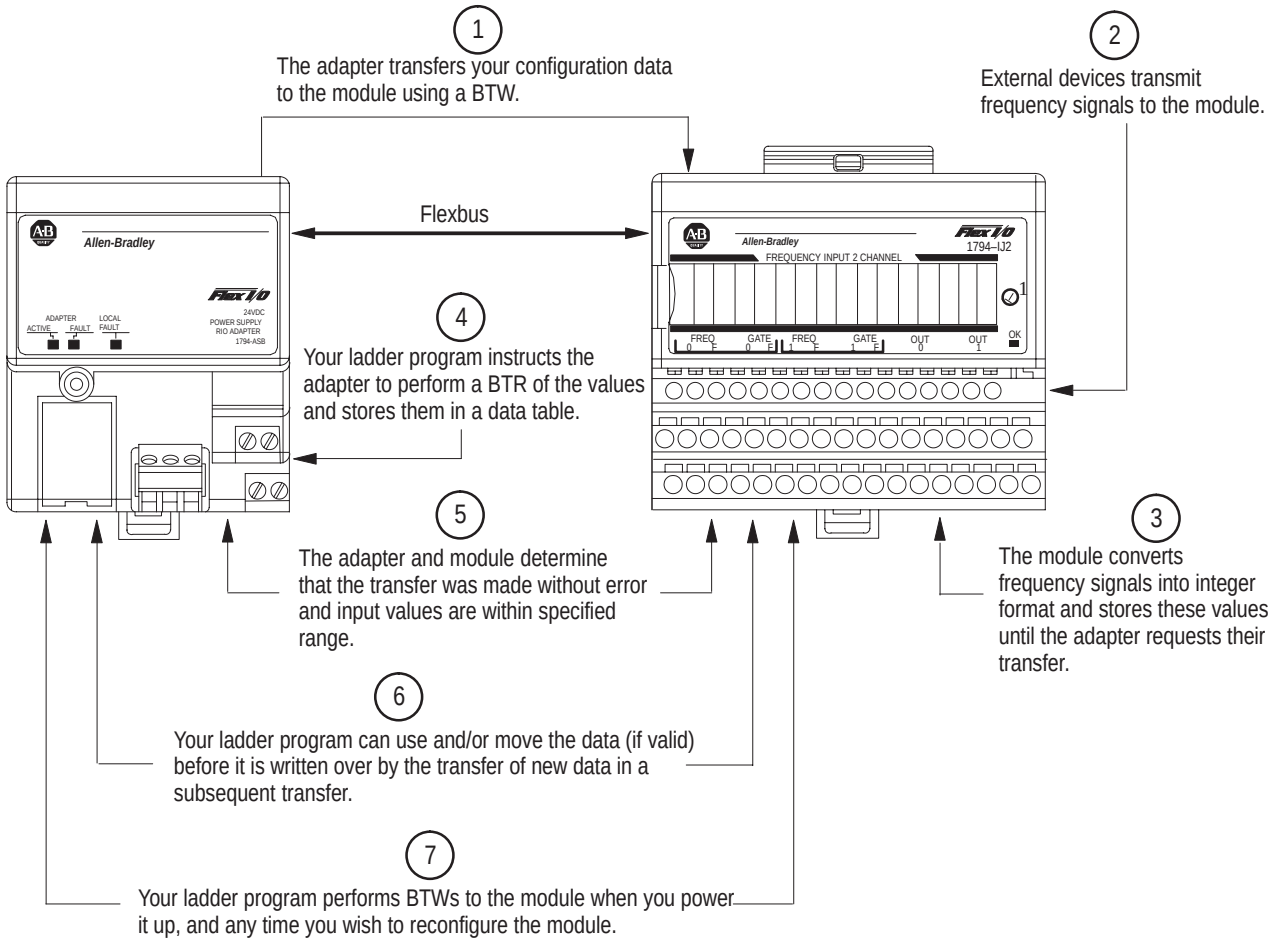
All power for input devices (4 devices, 24 Vdc @ 15 mA max) is supplied by the I/O module.



What the Frequency Input Module Does

The frequency input module performs high-speed frequency and/or scaling calculation operations for various industrial applications. The module interfaces with a FLEX family adapter which then communicates with a programmable controller processor that has block-transfer capability and external I/O devices.

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 read input values and status from the module, and let you write output values and configure the module's mode of operation. The following illustration describes the communication process.



Typical Applications

You can use the 1794-IJ2 module in the power management, automotive, food and beverage, and oil and gas industries for various flow and/or turbine metering applications. Some sample applications include:

- turbine shaft speed monitoring
- automotive paint booths
- brewery flow monitoring
- petrochemical flow and custody transfer

Input Capabilities

The frequency module has 2 input channels (mode dependent). Each of the 2 input channels may accept these input signals:

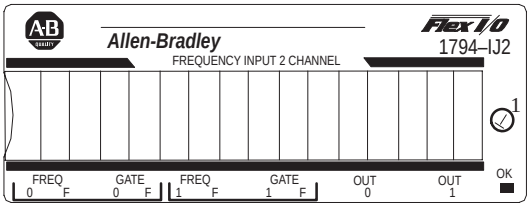
- magnetic pickup — 500mV to 28V ac peak (optional 50mV to 28V ac peak for increased signal sensitivity)
- proximity probe inputs
  - compatible with Bently Nevada 3300 (5mm and 8mm) proximity transducer systems
  - provides 1 isolated 24V dc power supply (2 channels rated at 30mA each) to power external devices
  - vortex flowmeter – 6V and 3V

You configure the module's 2 input channels for your specific application(s). Each input channel has two input selections:

frequency input (F0-F1) — you connect your input device to this input (ac, proximity sensors switch, magnetic, vortex)

gate input (G0-G1) — you connect your input device to this input (ac, proximity sensors switch, magnetic, vortex)

- used to determine direction – CW or CCW



2 input channels

frequency input (F0) gate input (G0)	Channel 0
frequency input (F1) gate input (G1)	Channel 1

Selecting the Mode(s) of Operation

You configure the 1794-IJ2 module for these modes of operation:

Mode	Use this mode to:	Indicators/ Alarms	Scaler values
Frequency and % Full Scale	• monitor the frequency of an input with high accuracy (e.g. shaft)		
	• monitor the percent of full scale frequency		
	• operate frequency alarm (% full scale)	√	
	• scale the frequency		
	• monitor the direction of shaft rotation		√
	• wire-off alarm with dc devices	√	
	• missing pulse alarm	√	
Frequency and Acceleration	• monitor the frequency of an input with high accuracy (e.g. shaft)		
	• monitor the acceleration (rate of speed change)		
	• operate acceleration alarm (rate of change)	√	
	• scale the frequency		√
	• monitor the direction of shaft rotation		
	• wire-off alarm with dc devices	√	
	• missing pulse alarm	√	

Output Capabilities

The 1794-IJ2 module has 2 assignable outputs. These outputs are designed for applications that require fast response. The outputs:

- are current sourcing at 10–31.2V dc (1A maximum per output)
- are electrically fused/current limited to 3A
- can be assigned to the associated input channel with user-selectable frequency and acceleration values
- are isolated — this lets you use two separate external power supplies if desired (one for output 0 and one for output 1)

Implementing Application Features

You can use the module to implement programmable application features that are usually initiated by your PLC processor. This frees the PLC processor to do other tasks and helps increase the overall throughput of your PLC system.

This feature	Is used in these modes	To	Alarm is ON when
frequency alarm	frequency alarm selected	activate alarm when calculated or scaled frequency is higher than user-specified frequency value.	frequency > user-specified value
acceleration alarm	acceleration alarm selected	activate acceleration alarm when acceleration is greater than user-specified acceleration value.	|acceleration| > user-specified value
scaling	% full scale and acceleration	multiply and/or divide frequency by scalar	frequency > user-specified scaled frequency value

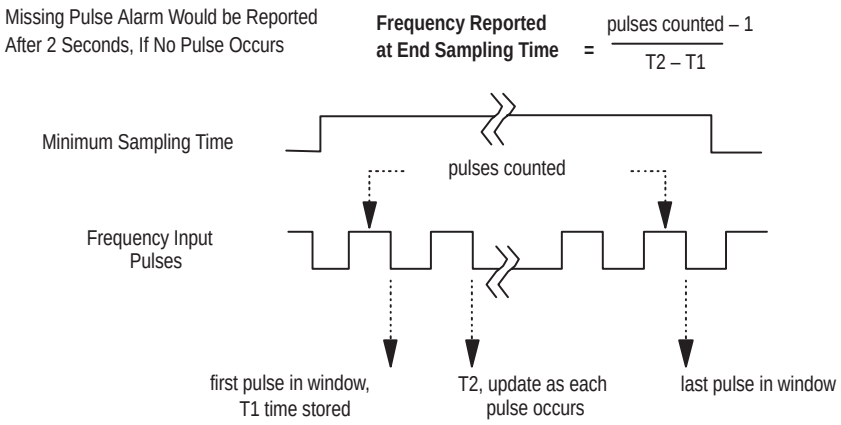
How Frequency is Calculated

The following paragraphs detail operation of the frequency input module algorithm and its modifying parameters.

Frequency Calculation

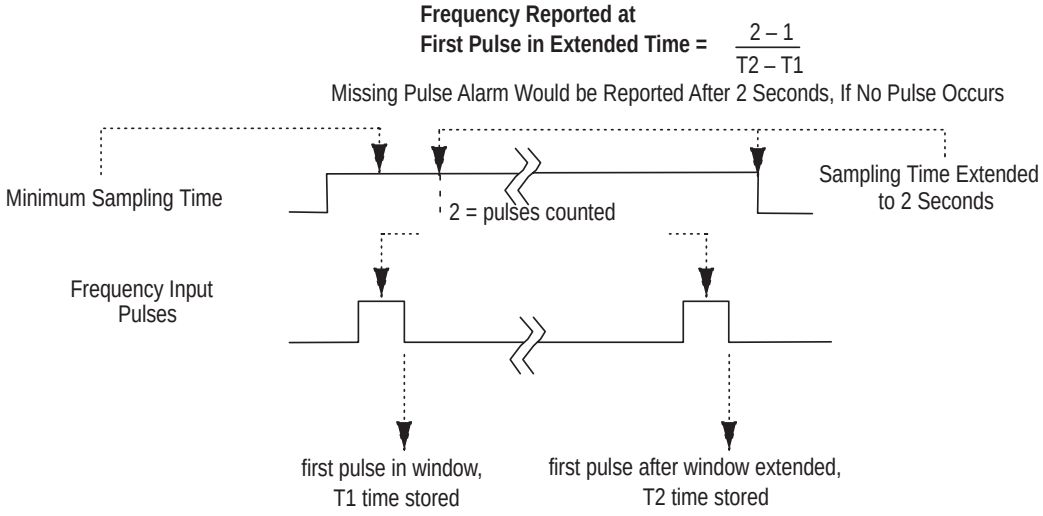
Frequency is determined by a general algorithm which can be modified by user defined parameters. In its simplest form, the algorithm employs the user defined Minimum Sampling Time to set a window in which to count pulses to determine the frequency. At least two pulses are required within the sample window. Frequency is determined by storing the time the first pulse occurred and then continually storing and updating the time of subsequent pulses, along with the number of pulses encountered. When the window expires, the frequency is calculated and the procedure repeats. The sequence and formula for determining frequency are shown below.

Normal Mode Frequency Determination, at Least Two Pulses in Sampling Time



If only one pulse occurs within the sampling window, when the sample time has expired, the window is extended to 2 seconds to allow for a second pulse to occur. As soon as a second pulse occurs, the frequency is calculated and the procedures starts over. If no second pulse is detected, zero frequency is reported and a Missing Pulse Alarm is generated. The following figure depicts this situation.

Normal Mode, Only One Pulse inSampling Time, Sampling Time Extended



Termination on Number of Pulses

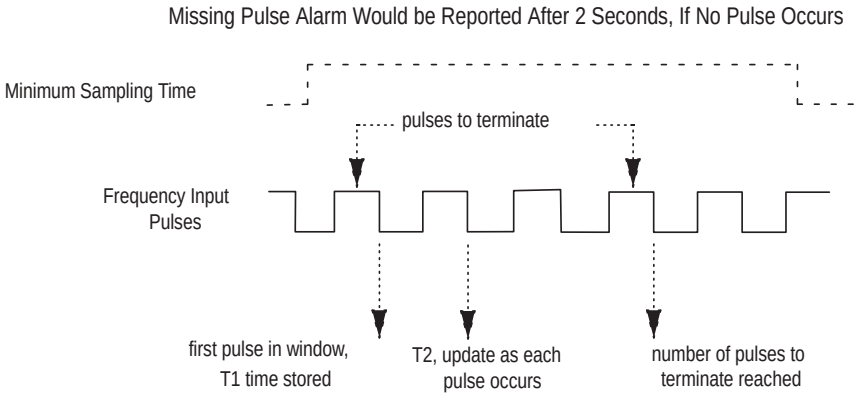
The normal mode is designed to provide wide bandwidth. However, it requires the full 2 seconds to report a missing pulse. Another user parameter, Number of Pulses to Terminate Sampling, is provided for those situations where many pulses are expected within the sampling window, such that early determination of frequency is possible.

During normal operation, there is a sufficient number of pulses to prevent the module from entering the 2 second extension mode. Once the user defined number of pulses is reached within the sampling window, the frequency is immediately reported.

If the sampling window was extended to 2 seconds while waiting for a second pulse to occur, a situation which can occur during system startup, the module will not wait for the number of pulses to be reached. Instead, as soon as a second pulse occurs, the frequency will be calculated based on the time between the 2 pulses, and the procedure starts over.

Termination on Number of Pulses

$$\text{Frequency Reported at Number of Pulses to Terminate Reached} = \frac{\text{Pulses to Terminate} - 1}{T2 - T1}$$

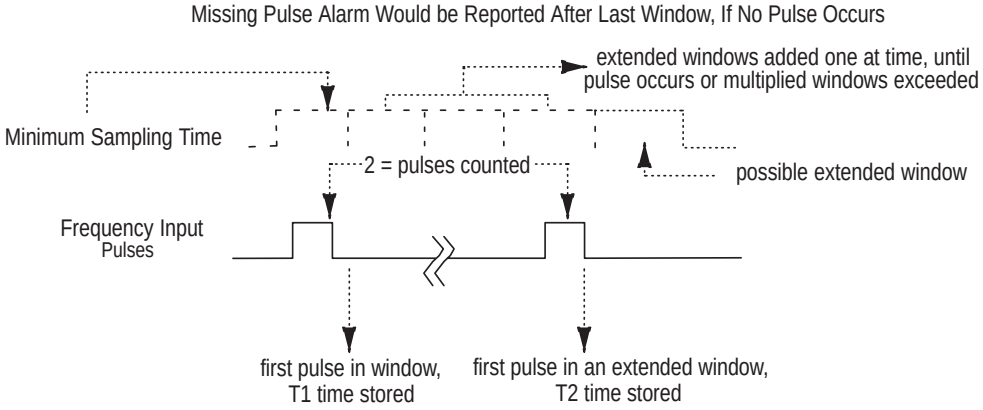


Missing Pulse Multiplier

The last user parameter which is provided to modify the frequency algorithm is the Missing Pulse Multiplier. In this case, the user can set the number of Minimum Frequency Sampling Time windows they will allow to extend the time to capture a second pulse, before reporting a Missing Pulse Alarm. The intent with this parameter is to allow a tradeoff of the bandwidth available with the response time to report a missing pulse. This mechanism is shown in the following figure.

Missing Pulse Multiplier

$$\text{Frequency Reported at First Pulse in Extended Time} = \frac{2-1}{T2-T1}$$

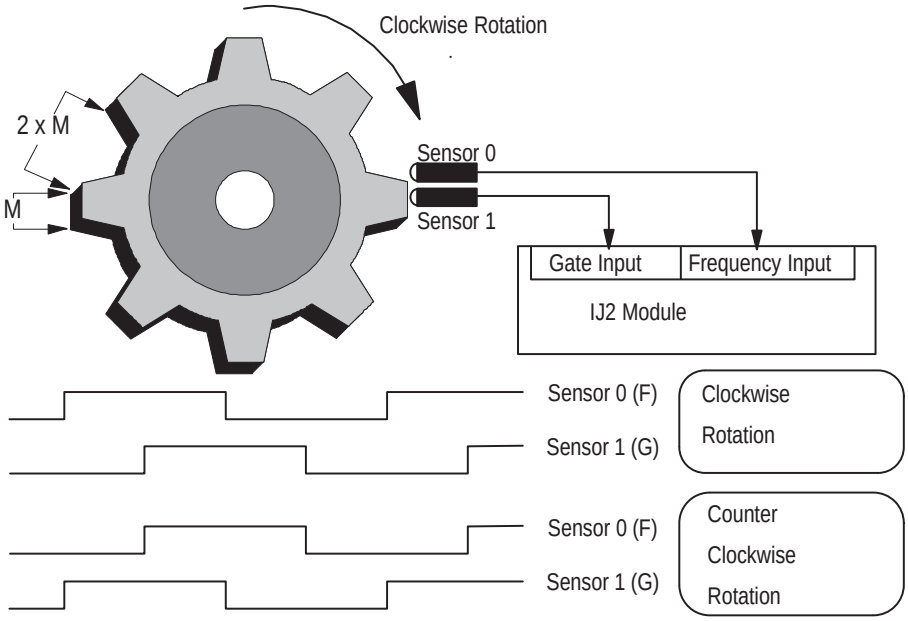


Direction Detection

Direction detection is accomplished by using the Frequency input, Gate input, and two sensors. The module expects to see a Low to High transition on the Frequency input, followed by a Low to High transition on the Gate input. This assumes both input polarity select bits are the same selection.

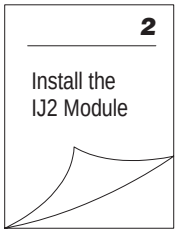
This corresponds to Clockwise rotation (see figure). If a Low to High transition occurs on the Gate input, followed by one on the Frequency input, the rotation is CounterClockwise.

Direction Detection – Principle of Operation



Chapter Summary

In this chapter, you learned about the frequency input module, block transfer communication, and details of how the module functions. Now you can install the module.



How to Install Your Frequency Input Module

What This Chapter Contains

In this chapter, we tell you about:

Before You Install Your Input Module

Before installing your frequency input module in the FLEX I/O system:

You need to:	As described under:
Calculate the power requirements of all modules in each FLEX system.	Power Requirements, page 2-2
Position the keyswitch on the terminal base	Installing the Module, page 2–4

ATTENTION: The frequency input module does not receive power from the backplane. +24V dc power must be applied to your module before installation. If power is not applied, the module position will appear to the adapter as an empty slot in your chassis.

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 50081-2EMC – Generic Emission Standard, Part 2 – Industrial Environment
- EN 50082-2EMC – 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
- Guidelines for Handling Lithium Batteries, publication AG-5.4
- 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.

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 10A.

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

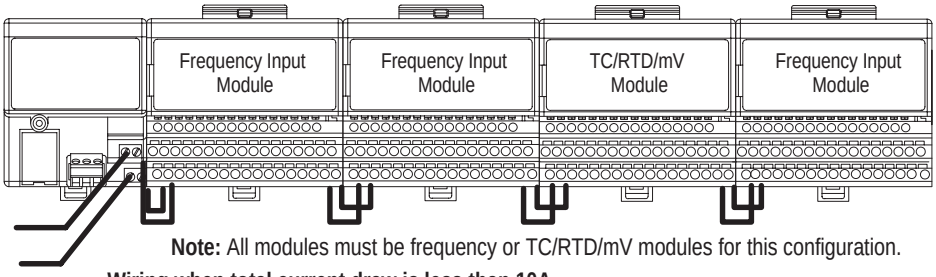
The frequency input module requires 30mA at 5V dc from the flexbus backplane.

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

Wiring the Terminal Base Units (1794-TB3G shown)

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

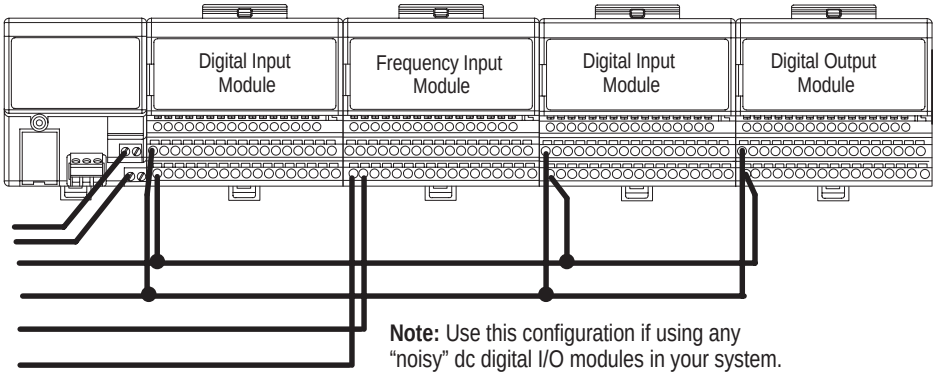
Daisy-chaining



Note: All modules must be frequency or TC/RTD/mV modules for this configuration.

Wiring when total current draw is less than 10A

Individual

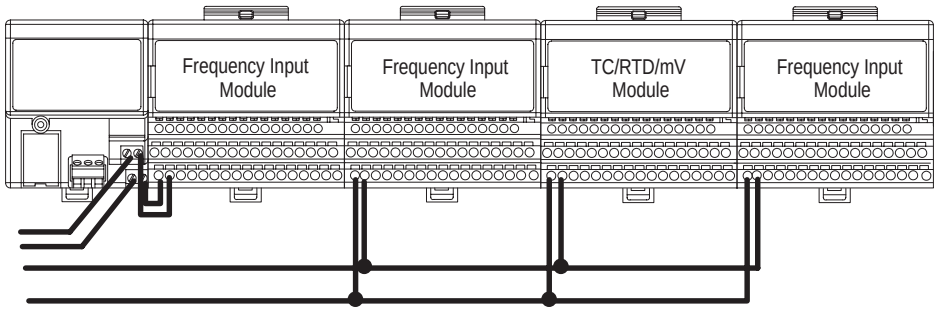


Note: Use this configuration if using any "noisy" dc digital I/O modules in your system.

Frequency Input Module wiring separate from digital wiring.

Wiring when total current draw is greater than 10A

Combination



Note: All modules powered by the same power supply must be frequency or TC/RTD/mV modules for this configuration.

Total current draw through any base unit must not be greater than 10A

Installing the Module

Installation of the frequency input module consists of:

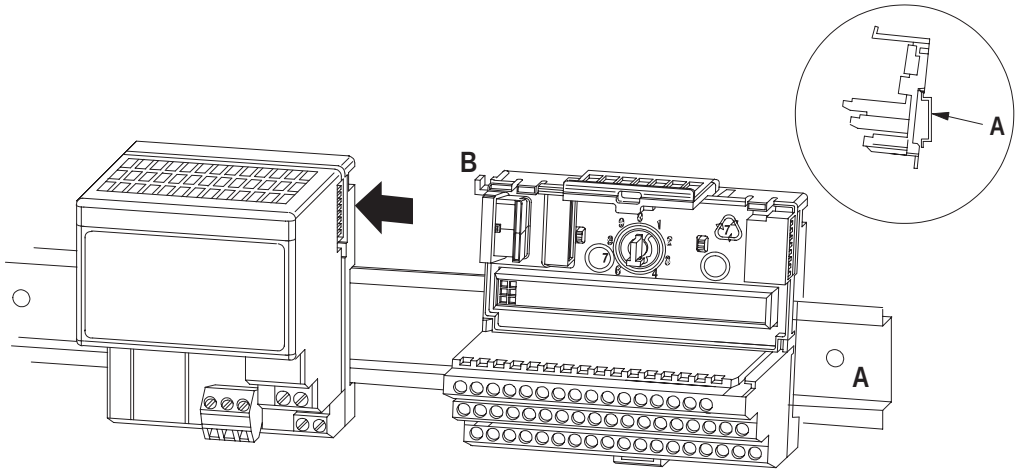
- mounting the terminal base unit
- installing the module into the terminal base unit
- installing the connecting wiring to the terminal base unit

If you are installing your module into a terminal base unit that is already installed, proceed to "Mounting the Frequency Input Module on the Terminal Base" on page 2–7.

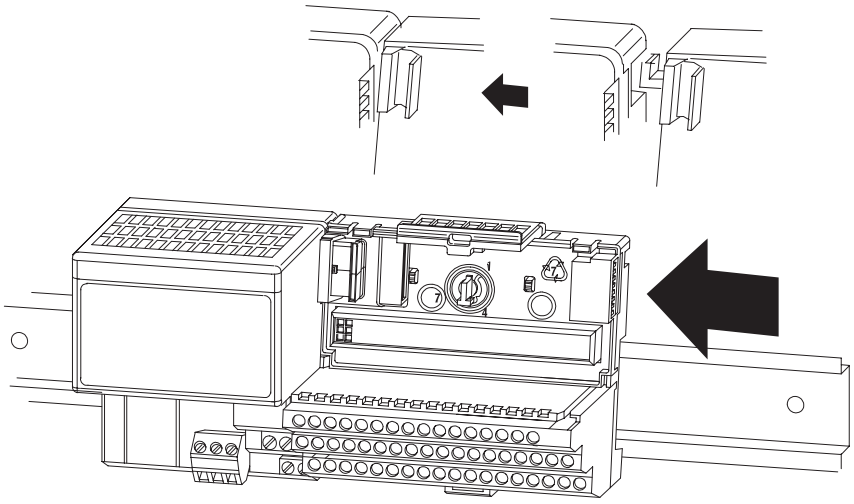
Mounting the Terminal Base Unit on a DIN Rail

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.

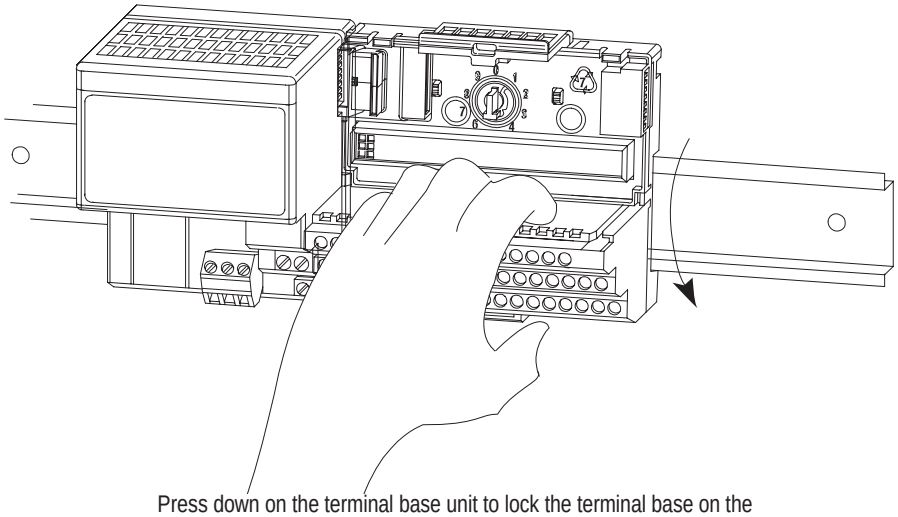
1. Remove the cover plug (if used) in the male connector of the unit to which you are connecting this terminal base unit.
2. Check to make sure that the 16 pins in the male connector on the adjacent device are straight and in line so that the mating female connector on this terminal base unit will mate correctly.
3. Position the terminal base on the 35 x 7.5mm DIN rail **A** (A-B pt. no. 199-DR1; 46277-3) at a slight angle with hook **B** on the left side of the terminal base hooked into the right side of the unit on the left. Proceed as follows:



Position terminal base at a slight angle and hooked over the top of the DIN rail.

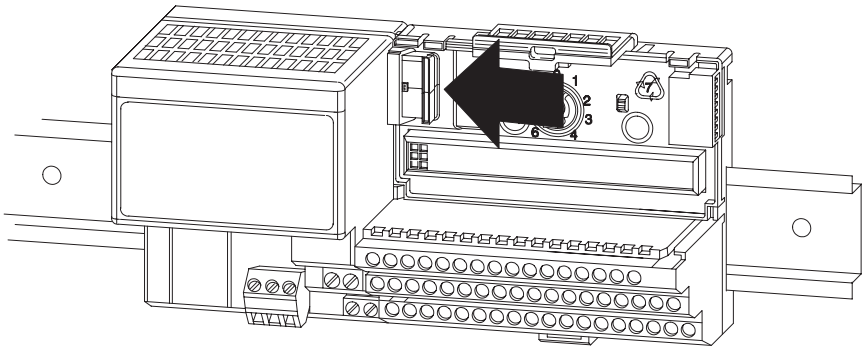


Slide the terminal base unit over tight against the adapter. Make sure the hook on the terminal base slides under the edge of the adapter and the flexbus connector is fully retracted.



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.

30077–M



Gently push the flexbus connector into the side of the adapter to complete the backplane connection.

4. Repeat the above steps to install the next terminal base.

Panel/Wall Mounting

Installation 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

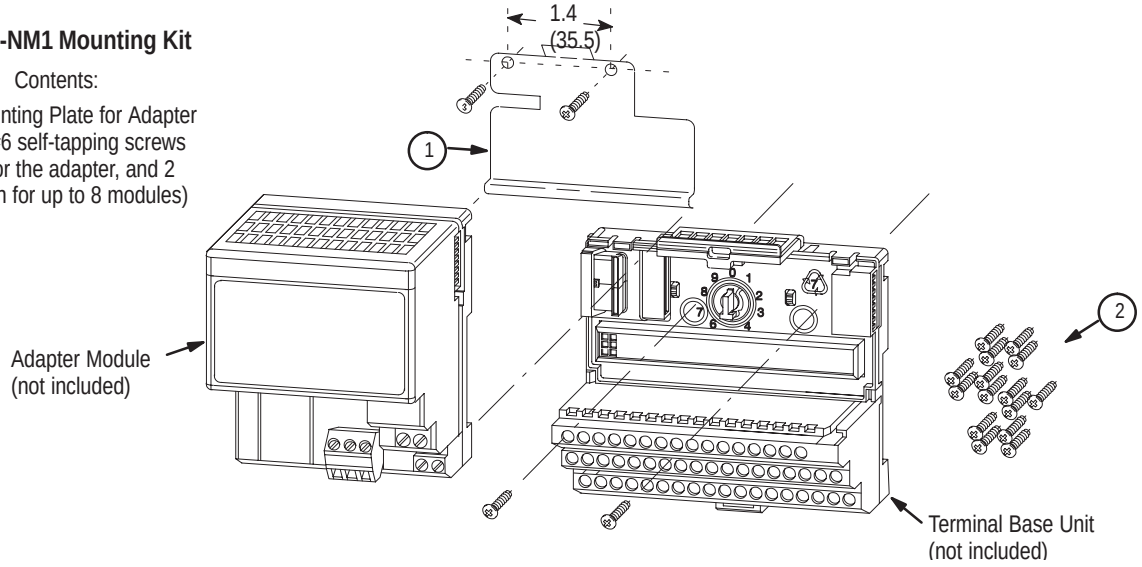
If you are installing your module into a terminal base unit that is already installed, proceed to "Mounting the Frequency Input Module on the Terminal Base" on page2–7.

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

1794-NM1 Mounting Kit

Contents:

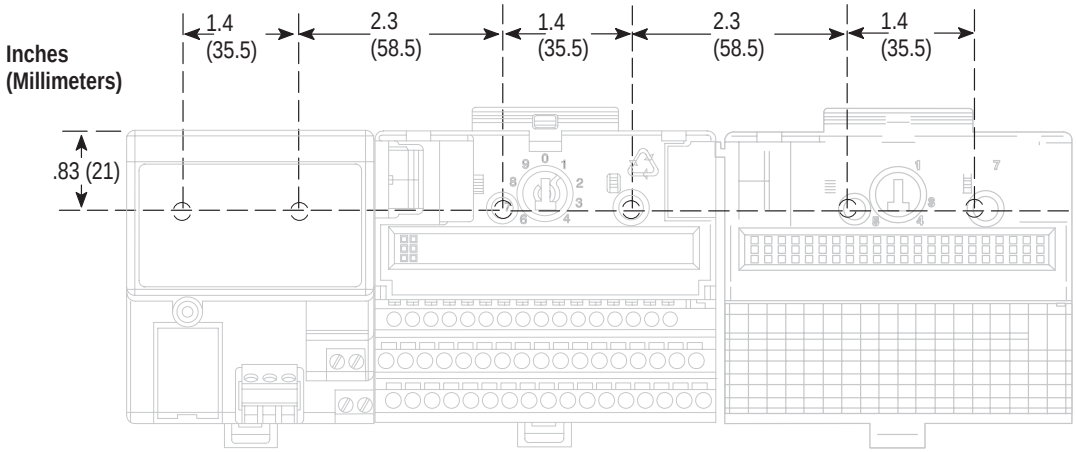
1 – Mounting Plate for Adapter
2 – 18 #6 self-tapping screws (2 for the adapter, and 2 each for up to 8 modules)



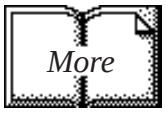
To install the mounting plate on a wall or panel:

1. Lay out the required points on the wall/panel as shown in the drilling dimension drawing.

Drilling Dimensions for Panel/Wall Mounting of FLEX I/O



2. Drill the necessary holes for the #6 self-tapping mounting screws.
3. Mount the mounting plate (1) 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. Refer to "Industrial Automation Wiring and Grounding Guidelines," publication 1770-4.1.

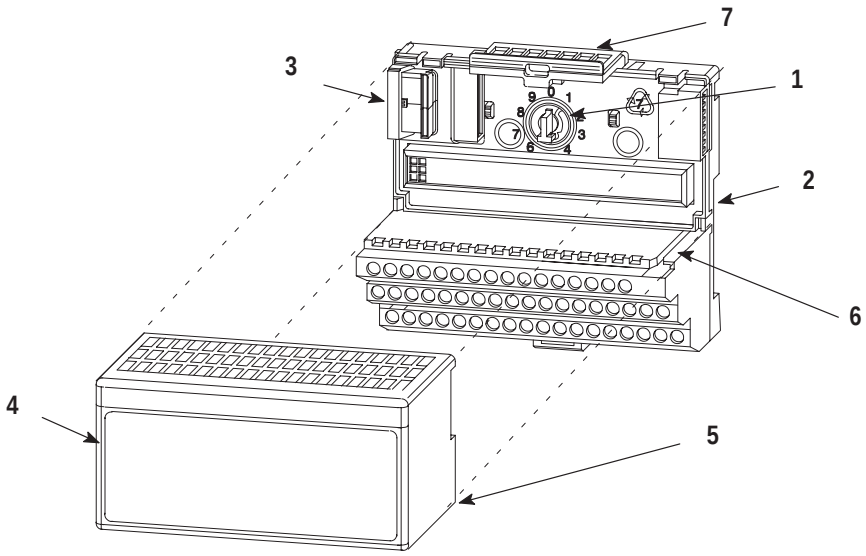
4. Hold the adapter (2) at a slight angle and engage the top of the mounting plate in the indention on the rear of the adapter module.
5. Press the adapter down flush with the panel until the locking lever locks.
6. Position the terminal base unit up against the adapter and push the female bus connector into the adapter.
7. Secure to the wall with two #6 self-tapping screws.
8. Repeat for each remaining terminal base unit.

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

Mounting the Frequency Input Module on the Terminal Base Unit

The Frequency input module mounts on a 1794-TB3G or TB3GS terminal base unit.

1. Rotate the keyswitch (1) on the terminal base unit (2) clockwise to position 1 as required for the frequency input module.



2. Make certain the flexbus connector (3) is pushed all the way to the left to connect with the neighboring terminal base/adapter. **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.

ATTENTION: Remove field-side power before removing or inserting the 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.

---

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.
6. Repeat the above steps to install the next module in its terminal base unit.

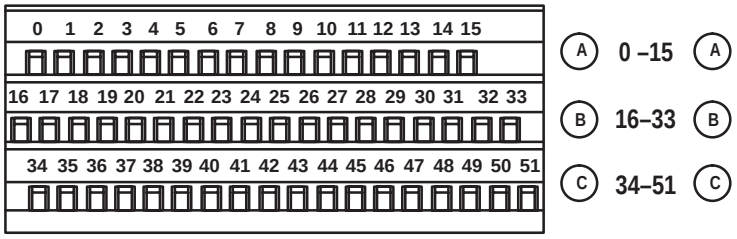
Connecting Wiring for Your Frequency Input Module

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

Compatible terminal base units are:

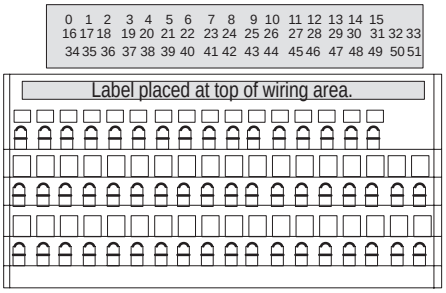
Module	1794-TB3G	1794-TB3GS
1794-IJ2	Yes	Yes

1794-TB3G



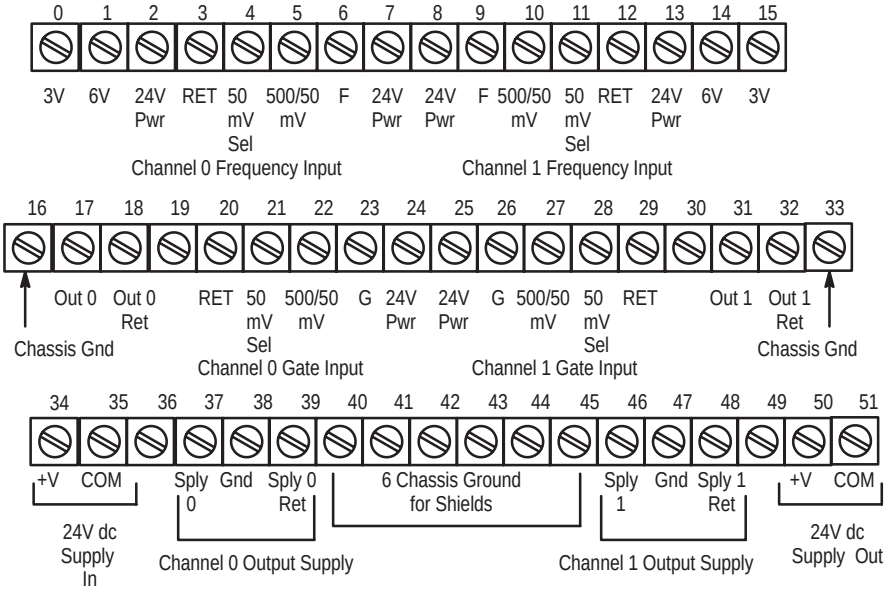
34 and 50 = 24V dc
35 and 51 = common
16 and 33 = chassis ground
40 thru 45 = chassis ground

1794-TB3GS



34 and 50 = 24V dc
35 and 51 = common
16 and 33 = chassis ground
40 thru 45 = chassis ground

Connections for Terminal Base 1794-TB3G shown



Connecting Wiring using a 1794-TB3G and -TB3GS Terminal Base Units

1. Connect the individual signal wiring to the proper numbered terminals on the **0–15** row **(A)** and **16–33** row **(B)** on the terminal base unit. Connect the inputs as shown in the table on page 2–11.
2. Connect output signal and supply wiring to the numbered terminals on rows **B** and **C**, as shown in the wiring connection on page 2–11.
3. Terminate shields to terminals 16 or 33 on row **B**, or 40 through 45 on row **C**.
4. Connect +24V dc to terminal 34 on the **34-51** row (C), and 24V common to terminal 35 on the **34-51** row (C).

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

5. If daisy chaining the +24V dc power to the next 1794-TB3G or -TB3GS base unit, connect a jumper from terminal 50 (+24V) on this base unit to terminal 34 and from terminal 51 (24V dc common) to terminal 35 on the next 1794-TB3G or -TB3GS base unit.

NOTE: Use extreme care when connecting wiring to an adjacent terminal base unit. Wiring for the 1794-TB3G and -TB3GS terminal base units is different from other 1794 terminal base units.

ATTENTION: Do not daisy chain power or ground from the 1794-TB3G or -TB3GS terminal base unit to any ac or dc digital module terminal base unit.

ATTENTION: This module does not receive power from the backplane. +24V dc power must be applied to your module before operation. If power is not applied, the module position will appear to the adapter as an empty slot in your chassis. If the adapter does not recognize your module after installation is completed, cycle power to the adapter.

Wiring connections for the 1794-IJ2 Frequency Input Module

	Channel 0 Terminals[5]			Channel 1 Terminals[5]			
Types of Inputs	**Power**	**Input**	**RET[6]**	**Power**	**Input**	**RET[6]**	**GND[5]**
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[7]	5	3	8	10	12	
50mV ac Magnetic Pickup[4]	7[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) – (≈50KΩ)
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.
7 24V terminal may not be used on 2-wire magnetic devices

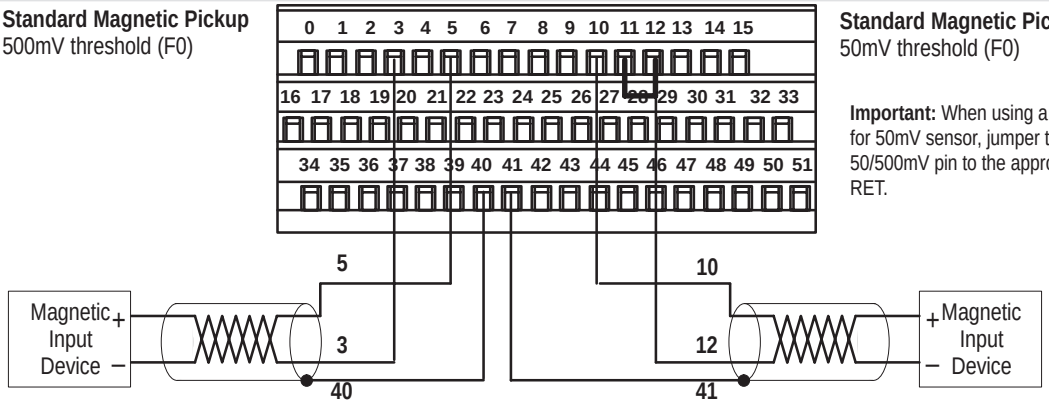
	Channel 0 Terminals[1]				Channel 1 Terminals[1]			
Output Alarm Connections	**Sply +**	**Sply RET**	**Out +**	**Out RET**	**Sply +**	**Sply RET**	**Out +**	**Out RET**
Supply Connection	37	39			46	48		
Output Connection			17	18			31	32

1 Connect cable shields to GND connections.

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

Examples of Wiring to a 1794-TB3G Terminal Base Unit

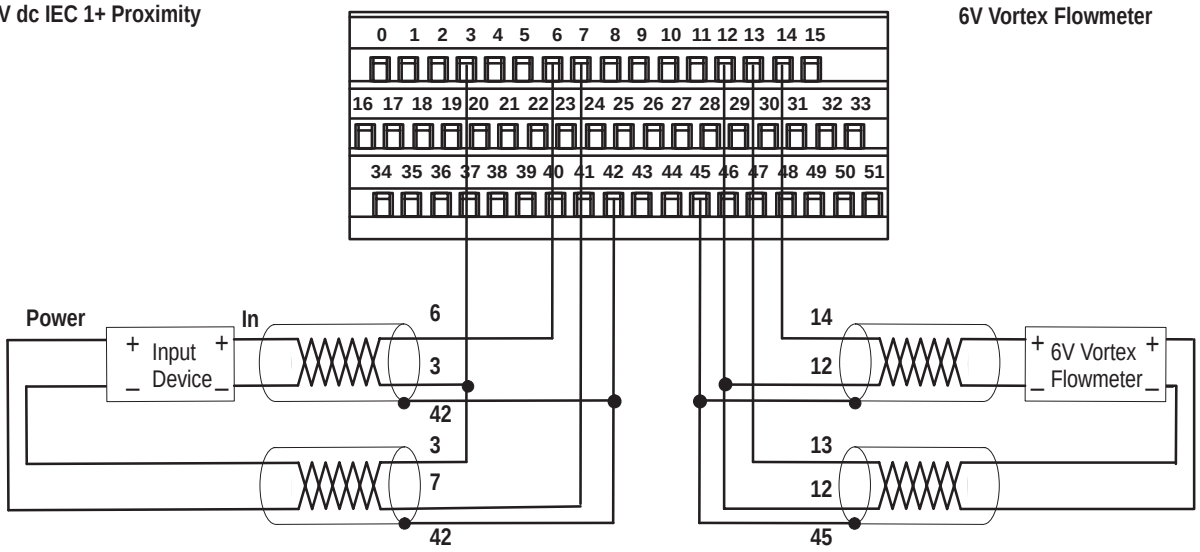
Standard Magnetic Pickup
500mV threshold (F0)



Standard Magnetic Pickup
50mV threshold (F0)

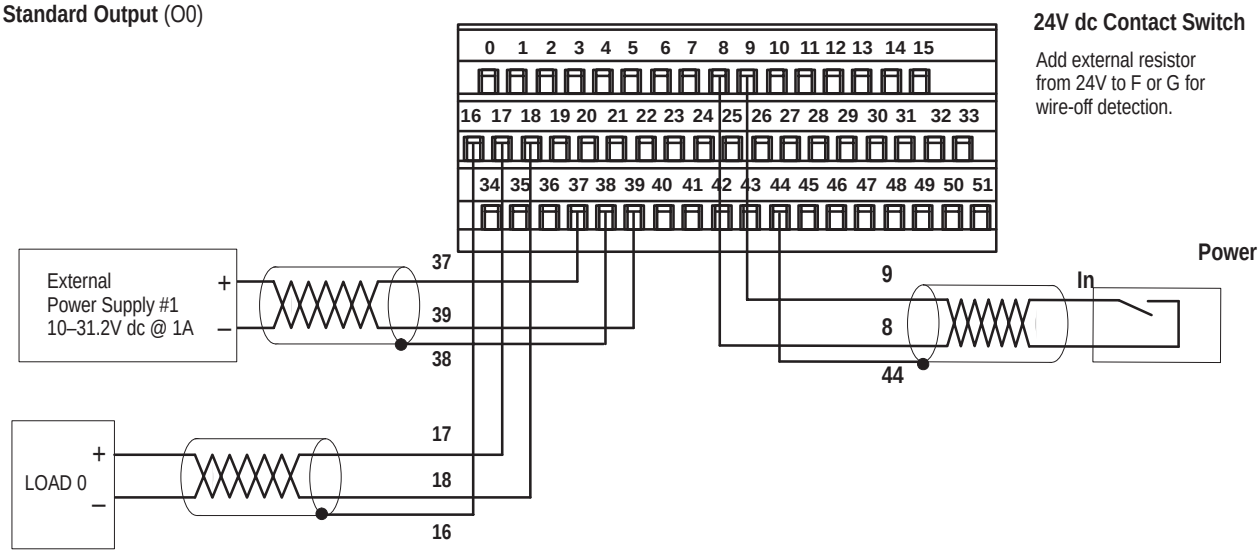
Important: When using a channel for 50mV sensor, jumper the 50/500mV pin to the appropriate RET.

24V dc IEC 1+ Proximity



6V Vortex Flowmeter

Standard Output (O0)

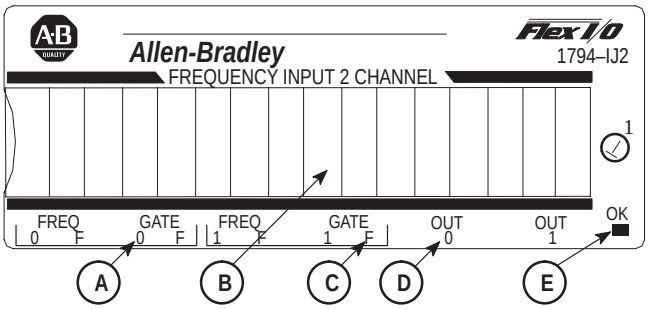


24V dc Contact Switch

Add external resistor from 24V to F or G for wire-off detection.

Module Indicators

The Frequency Input module has one status indicator (PWR) that is on when power is applied to the module, one fault indicator (F) for each input, and an input status indicator for each input (0 or 1) and an output indicator for each output (0 or 1).



A = Input indicators for each input channel.

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

C = Wire-off Fault indicators for each input channel.

D = Output indicators for each output channel.

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

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 IEC 1+ 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

Chapter Summary

In this chapter, we told you how to install your input module in an existing programmable controller system and how to wire to the terminal base units.

Programming Your Frequency Input Module

What This Chapter Contains

To initiate communication between the frequency input module 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.

Enter Block Transfer Instructions

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

Before you configure the module, you need to enter block transfer instructions into your ladder logic. The following example programs illustrate the minimum programming required for communication to take place between the module and a PLC processor. These programs can be modified to suit your application requirements.

A configuration block transfer write (BTW) is initiated when the frequency 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 scalars and alarm values, 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.

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

PLC-2 Family Processor

The 1794 frequency I/O module is not recommended for use with PLC-2 family programmable controllers due to the number of digits needed for high resolution.

Important: The frequency input module functions with reduced performance in PLC-2 systems. Because the module does not support BCD and the PLC-2 processor is limited to values of 4095 (12 bit binary), many values returned in the BTR file may not provide meaningful data to the PLC-2 processor.

PLC-3 Family Processor

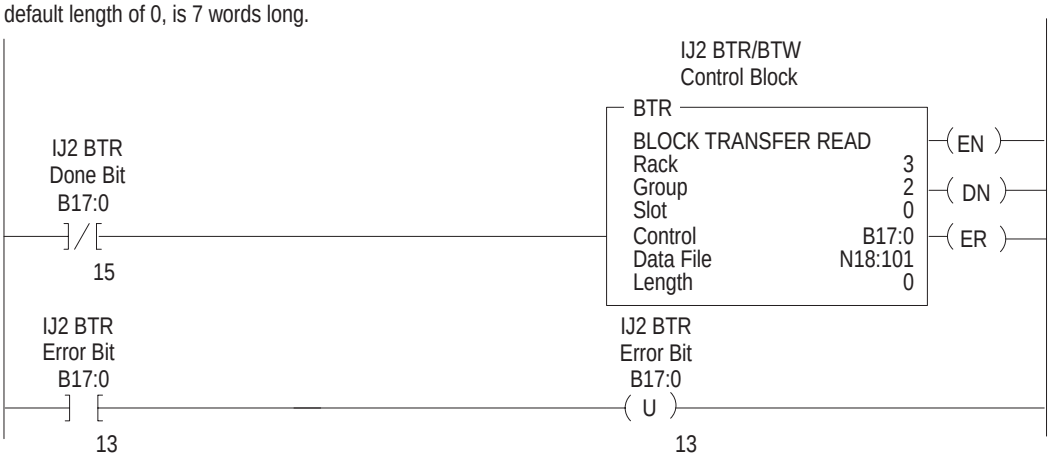
Block transfer instructions with the PLC-3 processor use a control file and a data file. The block transfer control file contains the data table section for module location, the address of the block transfer data file and other related data. The block transfer data file stores data that you want transferred to the module (when programming a BTW) or from the module (when programming a BTR).

The programming terminal prompts you to create a control file when a block transfer instruction is being programmed. **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.

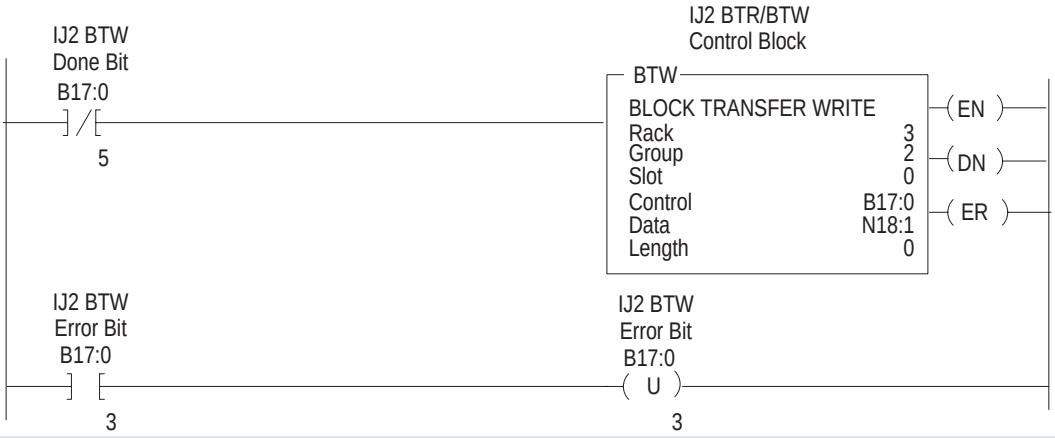
PLC-3 Processor Program Example

Rung M:0

The IJ2 module is located in rack 3, I/O group 2, slot 0. The control file is a 10 word file starting at B17:0 that is shared by the BTR/BTW. The data obtained by the PLC3 processor is placed in memory starting at location N18:101, and with the default length of 0, is 7 words long.



The IJ2 module is located in rack 3, I/O group 2, slot 0. The control file is a 10 word file starting at B17:0 that is shared by the BTR/BTW. The data sent by the PLC-3 processor to the IJ2 module is from PLC memory starting at N18:1, and with the default length of 0, is 8 words long.



PLC-5 Family Processor

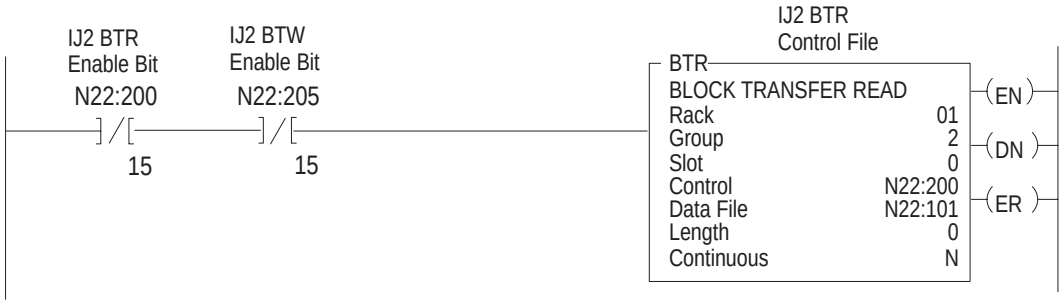
Block transfer instructions with the PLC-5 processor use a control file and a data file. The block transfer control file contains the data table section for module location, the address of the block transfer data file and other related data. The block transfer data file stores data that you want transferred to the module (when programming a BTW) or from the module (when programming a BTR).

The programming terminal prompts you to create a control file when a block transfer instruction is being programmed. **A different block transfer control file is used for the read and write instructions for your module.**

PLC-5 Processor Program Example

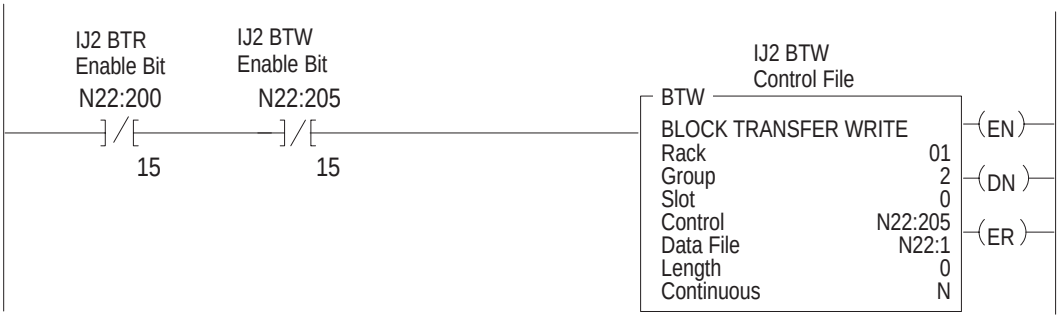
Rung 2:0

The IJ2 module is located in rack 1, I/O group 2, slot 0. The integer control file starts at N22:200, is 5 words long and is compatible with all PLC-5 family members. The data obtained by the PLC-5 processor from the IJ2 module is placed in memory starting at N22:101, and with the default length of 0, is 7 words long. The length can be any number between 0 and 7. In enhanced PLC-5 processors①, the block transfer data type may be used as a control file.



Rung 2:1

The IJ2 module is located in rack 1, group 2, slot 0. The integer control file starts at N22:205, is a 5 words long and is compatible will all PLC-5 family members. The data sent by the PLC-5 processor to the IJ2 module starts at N22:1, and with the default length of 0, is 8 words long. Valid BTW lengths can be any number from 0 to 8. In enhanced PLC-5 processors[1], the block transfer data type may be used as a control file.



① Enhanced PLC-5 processors include: PLC-5/11, -5/20, -5/3*x*, -5/4*x*, and -5/6*x*.

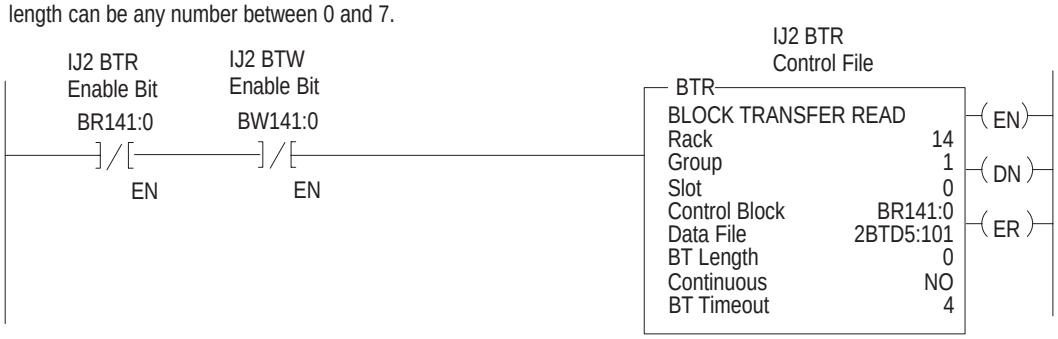
PLC-5/250 Processor

Block transfer instructions with the PLC-5/250 processor use a control file and a data file. The block transfer control file contains the data table section for module location, the address of the block transfer data file and other related data. The block transfer data file stores data that you want transferred to the module (when programming a BTW) or from the module (when programming a BTR).

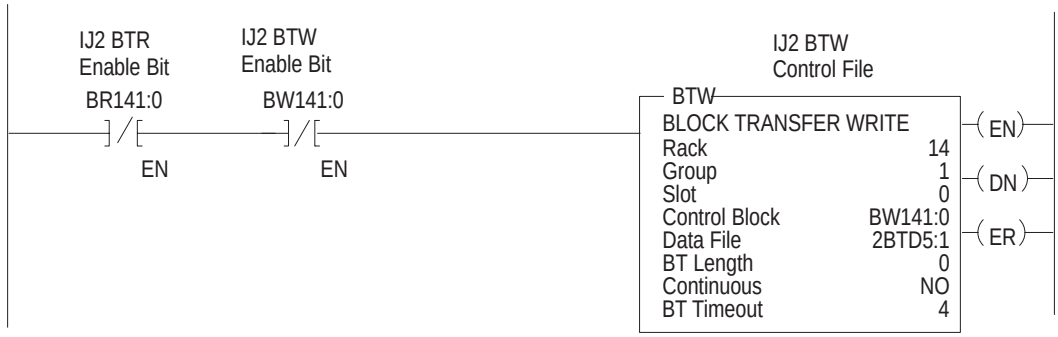
The programming terminal will automatically select the control file based on rack, group and module, and whether it is a read or write. **A different block transfer control file is used for the read and write instructions for your module.** A different block transfer control file is required for every module.

PLC-5/250 Processor Program Example

Rung 1STEPO:1
The IJ2 module is located in rack 14, I/O group 1, slot 0. The data obtained by the PLC-5/250 processor from the IJ2 module is placed in the data table starting at 2BTD5:101, and with the default length of 0, is 7 words long. The length can be any number between 0 and 7.

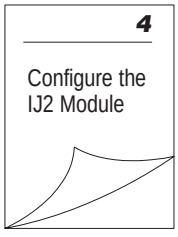


Rung 1STEPO:1
The IJ2 module is located in rack 14, I/O group 1, slot 0. The data sent to the IJ2 module from the PLC-5/250 processor is from the data table starting at 2BTD5:1, and with a default length of 0, is 8 words long.
Valid BTW lengths can be any number between 0 and 8.



Chapter Summary

In this chapter, you learned how to program your IJ2 input module using block transfer instructions and ladder logic. Now, you can configure your module.



Writing Configuration to and Reading Status from Your Module with a Remote I/O Adapter

What This Chapter Contains

In this chapter, we tell you about:

Configuring Your Frequency Input Module

The frequency module is configured using a group of data table words that are transferred to the module using a block transfer write instruction.

Some of the software configurable features available are:

- frequency range
- number of pulses to sample
- sampling time
- safe states
- fault modes
- alarms

Configure your module for its intended operation by means of your programming terminal and write block transfers.

Note: Programmable controllers that use 6200 software (release 4.2 or higher) programming tools can take advantage of the IOCONFIG Addendum utility to configure this module. IOCONFIG Addendum uses menu–based screens for configuration without having to set individual bits in particular locations. Refer to your 6200 software literature for details.

Important: It is strongly recommended that you use IOCONFIG Addendum to configure this module. The IOCONFIG Addendum utility greatly simplifies configuration. If the IOCONFIG Addendum is not available, you must enter data directly into the data table. Use this chapter as a reference when performing this task.

During normal operation, the processor transfers from 1 to 8 words to the module when you program a BTW instruction to the module's address.

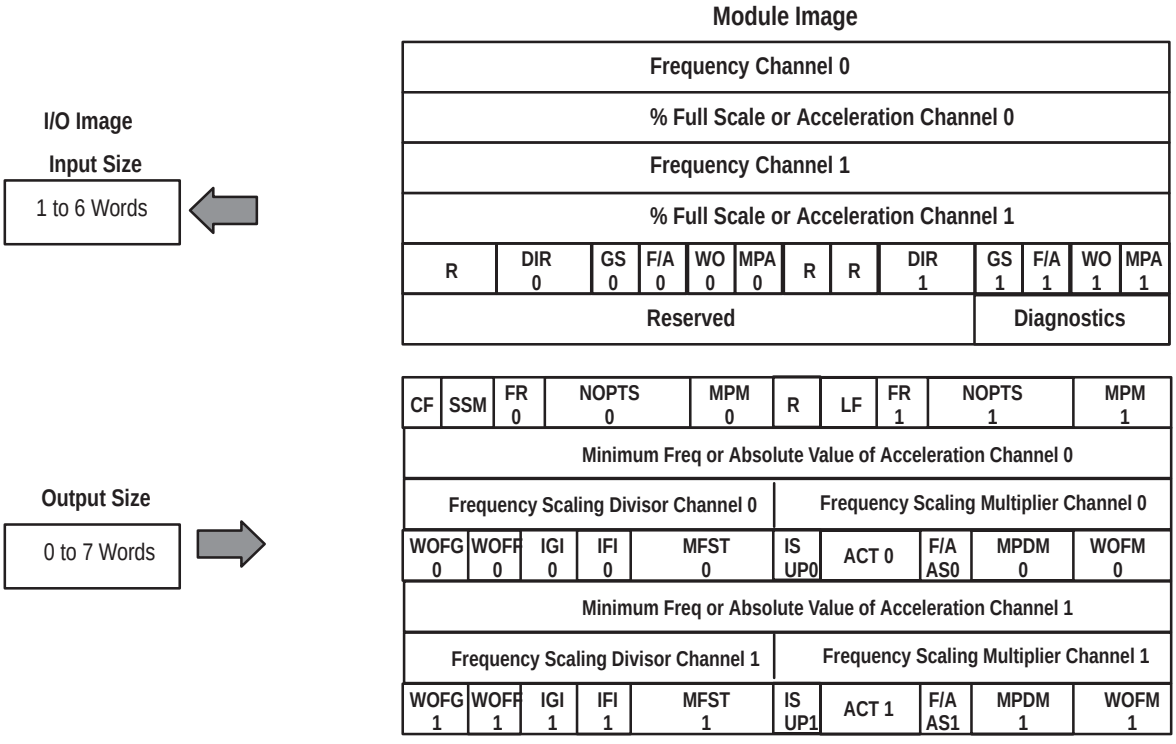
Reading Data From Your Module

Read programming moves status and data from the frequency input module to the processor's data table in one I/O scan. The processor's user program initiates the request to transfer data from the frequency input module to the processor.

Mapping Data for the Module

The following read and write words and bit/word descriptions describe the information written to and read from the frequency input module. The module uses up to 6 words of input data and up to 7 words of output data. Each word is composed of 16 bits.

Frequency Input Module (1794-IJ2) Image Table Mapping



Block Transfer Read Word Assignments for the Frequency Input Module (1794-IJ2)

(Octal Bit)	17	16	15	14	13	12	11	10	07	06	05	04	03	02	01	00
Decimal Bit	**15**	**14**	**13**	**12**	**11**	**10**	**09**	**08**	**07**	**06**	**05**	**04**	**03**	**02**	**01**	**00**
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 Ch 0		GS Ch 0	F/A Ch 0	WO Ch 0	MPA Ch 0	R	R	Direction Ch 1		GS Ch 1	F/A Ch 1	WO Ch 1	MPA Ch 1
5	Reserved												Diagnostic Status			

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

Bit/Word Definitions for Block Transfer Read Words for the Frequency Input Module

Word	Bit	Definition
Read Word 0	Bit 00–15 (00–17)	Calculated value of Frequency (channel 0) – Frequency can be reported down to 1 or 1.0 Hz, depending on the Frequency Range bit setting; below a 1 Hz value, 0 is reported; below a 1.0 Hz value, 0.0 is reported. Calculated frequency depends on Minimum Sampling Time and Missing Pulse Multiplier.
Word 1	Bit 00–15 (00–17)	% of Full Scale or Acceleration (channel 0) – Value of the calculated Frequency scaled by the Maximum Frequency, or Calculated Value of Acceleration in Hz / second, depending on the state of the Freq or Accel Alarm Select bit. Note: % Full scale will be calculated accurately up to a maximum of 3,276.7%. Beyond this maximum, the value of 3,276.7% will be returned, and a "Calculation Failure" (9) will be set in the Diagnostic Status byte.
Word 2	Bit 00–15 (00–17)	Calculated value of Frequency (channel 1) – Frequency can be reported down to 1 or 1.0 Hz, depending on the Frequency Range bit setting; below a 1 Hz value, 0 is reported; below a 1.0 Hz value, 0.0 is reported. Calculated frequency depends on Minimum Sampling Time and Missing Pulse Multiplier.
Word 3	Bit 00–15 (00–17)	% of Full Scale or Acceleration (channel 1) – Value of the calculated Frequency scaled by the Maximum Frequency, or Calculated Value of Acceleration in Hz / second, depending on the state of the Freq or Accel Alarm Select bit. Note: % Full scale will be calculated accurately up to a maximum of 3,276.7%. Beyond this maximum, the value of 3,276.7% will be returned, and a "Calculation Failure" (9) will be set in the Diagnostic Status byte.

Word	Bit	Definition
Word 4	Bits 00	Missing Pulse Alarm (channel 1) – Indicates when no Frequency input pulse has occurred within the period determined by the Minimum Frequency Sampling Time and the Missing Pulse Multiplier. Primary control is given to the Missing Pulse Multiplier to determine when this bit is set. However, if the Missing Pulse Multiplier is set to 0, then the Minimum Frequency Sampling Time characteristics will determine when this bit is set.
	Bit 01	Wire Off Fault Alarm (channel 1) – when set, indicates when 24 Vdc Input (IEC 1+ or Switch Contact with shunt) Wire Off Detection has gone true for any of the Frequency or Gate inputs on a channel that has the Wire Off Fault Select = 1.
	Bit 02	Frequency or Acceleration Alarm (channel 1) – Changes state from 0 to 1 if the calculated Frequency (actual or scaled) exceeds the user programmed Maximum Frequency, or the absolute value of calculated Acceleration/Deceleration exceeds the user programmed Maximum Acceleration Value. The Frequency Alarm turns off when the Frequency drops below **95%** of the Alarm Value. The Acceleration Alarm turns off when the Acceleration drops below **90%** of the Alarm Value.
	Bit 03	Gate Input State (channel 1) – Indicates if there is a valid signal on the gate input. This parameter is only determined once every 0.5 – 2s.
	Bits 04–05	Direction (channel 1) – Indicates the current Direction of Rotation, using both the Frequency and Gate inputs. (Frequency leads Gate = Clockwise, Gate leads Frequency = CounterClockwise). Used for slow speed detection from 1 – 1,500Hz. “No” or “Stopped” rotation can be determined by the state of the Missing Pulse Alarm, when it is switched on. A missing Frequency Input will generate a Missing Pulse Alarm, a missing Gate Input will only generate a “No Sensor Present / Detected” status (3).
	Bits 06–07	Not used
	Bits 08 (10)	Missing Pulse Alarm (channel 0) – Indicates when no Frequency input pulse has occurred within the period determined by the Minimum Frequency Sampling Time and the Missing Pulse Multiplier. Primary control is given to the Missing Pulse Multiplier to determine when this bit is set. However, if the Missing Pulse Multiplier is set to 0, then the Minimum Frequency Sampling Time characteristics will determine when this bit is set.
	Bit 09 (11)	Wire Off Fault Alarm (channel 0) – When set, indicates when 24 Vdc Input (IEC 1+ or Switch Contact with shunt) Wire Off Detection has gone true for any of the Frequency or Gate inputs on a channel that has the Wire Off Fault Select = 1.
	Bit 10 (12)	Frequency or Acceleration Alarm (channel 0) – Changes state from 0 to 1 if the calculated Frequency (actual or scaled) exceeds the user programmed Maximum Frequency, or the absolute value of calculated Acceleration/Deceleration exceeds the user programmed Maximum Acceleration Value. The Frequency Alarm turns off when the Frequency drops below **95%** of the Alarm Value. The Acceleration Alarm turns off when the Acceleration drops below **90%** of the Alarm Value.
	Bit 11 (13)	Gate Input State (channel 0) – Indicates if there is a valid signal on the gate input. This parameter is only determined once every 0.5 – 2s.
	Bits 12–13 (14–15)	Direction (channel 0) – Indicates the current Direction of Rotation, using both the Frequency and Gate inputs. (Frequency leads Gate = Clockwise, Gate leads Frequency = CounterClockwise). Used for slow speed detection from 1 – 1,500Hz. “No” or “Stopped” rotation can be determined by the state of the Missing Pulse Alarm, when it is switched on. A missing Frequency Input will generate a Missing Pulse Alarm, a missing Gate Input will only generate a “No Sensor Present / Detected” status (3).
	Bits 14–15 (16–17)	Not used

Word	Bit	Definition					
Word 5	Bits 00–03		Diagnostic Status – indicate the response from the module; a normal or non–normal operating condition.				
		Bit	03	02	01	00	
			0	0	0	0	0 = Normal Operation (No Failure)
			0	0	0	1	1 = Calibration Failure
			0	0	1	0	2 = Configuration Failure A Minimum Frequency Sample Time value other than 0–9 was selected.
			0	0	1	1	3 = Message Failure
			0	1	0	0	4 = Lead Break Detection Hardware Failure
			0	1	0	1	5 = Major Hardware Failure
			0	1	1	0	6 = EEPROM Failure
			0	1	1	1	7 = RAM Failure
			1	0	0	0	8 = ROM Failure
			1	0	0	1	9 = Calculation Failure The actual Frequency is greater than 32,767 Hz. or 3,276.7 Hz. (overange). The scaled Frequency is greater than 32,767 Hz. or 3,276.7 Hz. (overange). The % Full Scale calculation (based on Maximum Frequency) is > 3,276.7%.
			1010–1111				10 – 15 = Not Used
	Bits 04–15 (04–17)	Reserved					

Block Transfer Write Word Assignments for the Frequency Input Module

(Octal Bit)	17	16	15	14	13	12	11	10	07	06	05	04	03	02	01	00
Dec. Bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
0	CF	SSM	FR Ch 0	Number Of Pulses To Terminate Sampling Ch 0			MPM Ch 0		R	LF	FR Ch 1	Number Of Pulses To Terminate Sampling Ch 1			MPM 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	WOFG Ch 0	WOFF Ch 0	IGI Ch 0	IFI Ch 0	Minimum Frequency Sample Time Ch 0				Init St Up Ch 0	ACT Ch 0		F/A AS Ch 0	MPDM Ch 0		WOFM 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							

(Octal Bit)	17	16	15	14	13	12	11	10	07	06	05	04	03	02	01	00
Dec. Bit	**15**	**14**	**13**	**12**	**11**	**10**	**09**	**08**	**07**	**06**	**05**	**04**	**03**	**02**	**01**	**00**
6	WOFG Ch 1	WOFF Ch 1	IGI Ch 1	IFI Ch 1	Minimum Frequency Sample Time Ch 1				Init St Up Ch 1	ACT Ch 1		F/A AS Ch 1	MPDM Ch 1		WOFM Ch 1	

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
WOFG = Wire-off fault gate
WOFM = Wire-off fault mode
IGI = Invert gate input
IFI = Invert frequency input
ACT = Acceleration Calculation Time
MPDM = Missing pulse delay multiplier
R = Reserved

Bit/Word Definitions for the Block Transfer Write Words for the Frequency Input Module

Word	Bit	Definition
Write Word 0	Bits 00-01	Missing pulse multiplier bits (channel 1) – used to modify the Minimum Frequency Sampling Time to allow the frequency bandwidth to be more closely adjusted to the value needed to report the proper frequency and report a missing pulse more quickly. **Default** = no multiplier; alarm generated immediately

Bit	01	00	Missing Pulse Multiplier
	0	0	No Multiplier, normal mode with 2s delay
	0	1	X2
	1	0	X8
	1	1	X32

Word	Bit	Definition
	Bits 02–04	Number of pulses to terminate sampling (channel 1) – Lets you calculate Frequency when a specified number of input pulses have occurred. This allows earlier reporting of the frequency than the Minimum Frequency Sampling Time, when many input pulses are occurring. Accurate frequency determination is possible without waiting for the full Minimum Frequency Sampling Time to expire. **Default** = minimum frequency sampling time.

Bit	04	03	02	Number of pulses to terminate sampling
	0	0	0	Use minimum frequency sampling time
	0	0	1	2
	0	1	0	4
	0	1	1	8
	1	0	0	16
	1	0	1	32
	1	1	0	64
	1	1	1	128

Word	Bit	Definition
Word 0 cont.	Bits 05	Frequency range bits (channel 1) – Specifies the Frequency Range of the Frequency input. 0 = 1–32767 (below 1Hz reports 0); 1 = 1.0–3276.7 (below 1.0Hz reports 0.0). **Default** = 0
	Bit 06	Local fault mode selection – determines how the Module Safe State data will be used to control alarm outputs for bus communication and internal module faults (local fault = Wire Off Fault or Missing Pulse Alarm). 0 = safe states activated by bus communication only; 1 = safe states activated by any failure (bus communication, internal module faults, etc.) **Default** = 0, safe states activated by bus communication only
	Bit 07	Not used
	Bits 08–09 (10–11)	Missing pulse multiplier bits (channel 0)– used to modify the Minimum Frequency Sampling Time to allow the frequency bandwidth to be more closely adjusted to the value needed to report the proper frequency and report a missing pulse more quickly. **Default** = no multiplier; alarm generated immediately

Bit	09 (11)	08 (10)	Minimum frequency sampling time
	0	0	No Multiplier, alarm generated immediately (normal mode with 2s delay)
	0	1	X2
	1	0	X8
	1	1	X32

	Bits 10–12 (12–14)	Number of pulses to terminate sampling (channel 0) – Lets you calculate Frequency when a specified number of input pulses have occurred. This allows earlier reporting of the frequency than the Minimum Frequency Sampling Time, when many input pulses are occurring. Accurate frequency determination is possible without waiting for the full Minimum Frequency Sampling Time to expire. **Defaul**t = minimum frequency sampling time.

Bit	12 (14)	11 (13)	10 (12)	Number of pulses to terminate sampling
	0	0	0	Use minimum frequency sampling time
	0	0	1	2
	0	1	0	4
	0	1	1	8
	1	0	0	16
	1	0	1	32
	1	1	0	64
	1	1	1	128

Word 0 cont.	Bit 13 (15)	Frequency range bits (channel 0) – Specifies the Frequency Range of the Frequency input. 0 = 1–32767 (below 1Hz reports 0); 1 = 1.0–3276.7 (below 1.0Hz reports 0.0). **Default** = 0
	Bit 14 (16)	Safe state mode bit – selection determines how module alarm outputs react to bus communication and internal module faults (local fault = Wire Off Fault or Missing Pulse Alarm). 0 = Reset outputs 1 = Hold last state **Default** = 0 (reset outputs).
	Bit 15 (17)	Communication fault – Signals the module that communications has been interrupted on the network. The adapter signals that the module should execute its fault routine or go to the Safe State and control any Alarm Outputs accordingly. During normal startup, this bit must be set (1) by the user program to begin normal module operation of Alarm Outputs (in effect, an output enable). When the adapter communication link is broken, the adapter will reset this bit (0). **– (Adapter dependent.)** **Default** = 0.

Word	Bit	Definition
Word 1	Bits 00-15 (00–17)	Maximum frequency or absolute value acceleration/deceleration (channel 0) – Specifies the highest Frequency or absolute Acceleration/Deceleration value allowed on the Frequency input. 0–32,767, 0.0–3,276.7Hz. **–OR–** 0–32,767Hz/s depending on the Frequency Range and Frequency/Acceleration Alarm Select bits.
Word 2	Bits 00–07	Frequency scaling multiplier (channel 0) – Specifies a multiplier to scale the incoming Frequency value. 0–255. **Default** = 0 – no scaling multiplication performed (x1)
	Bits 08–15 (10–17)	Frequency scaling divisor (channel 0) – Specifies divisor to scale the incoming Frequency value. 0–255. **Default** = 0 – no scaling division performed (divided by 1)
Word 3	Bits 00–01	Wire-Off/Missing Pulse fault select mode (channel 0) – Sets the mode for 24 Vdc IEC 1+ Wire Off Input Detection and Missing Pulse Detection result for any input (Frequency or Gate). The Maximum Frequency is determined by Frequency Range bit and the Maximum Frequency value, and the Minimum Frequency is determined by Frequency Range bit. The Wire Off detect time (in mode 1, 2, & 3) is 2 seconds maximum.
		Bit 01 00 — Channel wire-off/missing pulse detection mode
		0 0 — Disabled
		0 1 — Alarm only (frequency unchanged)
		1 0 — Alarm and force frequency to maximum frequency value (32767 or 3276.7 or maximum frequency value ≠ 0).
		1 1 — Alarm and force frequency to minimum frequency value (0 or 0.0).
	Bits 02–03	Missing pulse delay multiplier bits (channel 0)– Specifies the number of Missing Pulse Alarms periods (Minimum Frequency Sampling Times) which will be tolerated before the alarm is actually generated, if enabled. (Used to defeat the Missing Pulse Alarm during a system startup.) **Default** = 0 – No multiplier; alarm generated immediately (normal mode with 2s extension delay)
		Bit 03 02 — Alarm periods before alarm generated
		0 0 — No multiplier; alarm generated immediately (normal mode with 2s extension delay)
		0 1 — 2 sample periods + 2s delay before alarm
		1 0 — 8 sample periods + 2s delay before alarm
		1 1 — 32 sample periods + 2s delay before alarm
	Bit 04	Frequency or Acceleration Alarm Select (channel 0)– Determines if the value in the Maximum Frequency or Acceleration write word is a Frequency (actual or scaled) or Acceleration Alarm value. If set to Frequency, Acceleration is not calculated. 0 = frequency alarm 1 = acceleration alarm **Default** = 0 – frequency alarm

Word	Bit	Definition					
Word 3	Bits 05–06	Acceleration Calculation Time (channel 0) – Specifies the number of Frequency Sample Times over which the module calculates acceleration. **Default** = 0 – Rolling Average (previous 4 samples)					
		Bit	06	05	Acceleration Calculation Time in Frequency Sample Times		
			0	0	Rolling Average (previous 4 samples)		
			0	1	8		
			1	0	16		
			1	1	32		
	Bit 07	Initiate Startup Select (channel 0) – Alerts a channel that if process start up is in progress to defeat the missing pulse alarm for a time determined by the missing pulse delay multiplier. 0 = Normal Run Mode; 1 = Startup Mode – defeat/delay Missing Pulse Alarm **Default** = 0 – Normal Run Mode					
	Bits 08–11 (10–13)	Minimum Frequency Sampling Time (channel 0) – Specifies the minimum time (in ms) the module will spend collecting pulses to determine the Frequency.					
		Bit	11 (13)	10 (12)	09 (11)	08 (10)	Minimum Frequency Sampling Time – in ms
			0	0	0	0	2
			0	0	0	1	4
			0	0	1	0	5
			0	0	1	1	10
			0	1	0	0	20
			0	1	0	1	50
			0	1	1	0	100
			0	1	1	1	200
			1	0	0	0	500
			1	0	0	1	1000
			1010 to 1111 not used – 2ms default sample time used				

Word	Bit	Definition
Word 3 cont.	Bit 12 (14)	Invert Select – Frequency Input (channel 0) – Selects whether to invert the Frequency input signal, if not using an Active High (24V = On) 24 Vdc IEC 1+ sensor or “Normally Open” relay or switch contact on the 24 Vdc Frequency Input terminal. Allows compatibility with an Active Low (0V = On) 24 Vdc IEC 1+ sensor or “Normally Closed” relay contact on the 24 Vdc Frequency Input terminal. 0 = Normal (Active High, 24V = On), 1 = Invert input (Active Low, 0V = On). **Default** = 0 – Normal (Active High, 24V = On)
	Bit 13 (15)	Invert Select – Gate Input (channel 0)**–** Selects whether to invert the Gate input signal, if not using an Active High (24V = On) 24 Vdc IEC 1+ sensor or “Normally Open” relay or switch contact on the 24 Vdc Gate Input terminal. Allows compatibility with an Active Low (0V = On) 24 Vdc IEC 1+ sensor or “Normally Closed” relay contact on the 24 Vdc Gate Input terminal. 0 = Normal (Active High, 24V = On), 1 = Invert input (Active Low, 0V = On) **Default** = 0 – Normal (Active High, 24V = On)
	Bit 14 (16)	Wire Off Fault Select – Frequency Input (channel 0) – Selects whether to turn On or Off the 24 Vdc Frequency input IEC 1+ hardware Wire Off (Lead Breakage) detection. NOTE: Customer devices must draw more than 0.4 mA in the On and Off State. To use this feature with relays or switches, connect a “shunt resistor” (~ 50K) across the contacts. 0 = Disable, 1 = Enable **Default**: = 0 – Disable
	Bit 15 (17)	Wire Off Fault Select – Gate Input (channel 0) – Selects whether to turn On or Off the 24 Vdc Gate input IEC 1+ hardware Wire Off (Lead Breakage) detection. NOTE: Customer devices must draw more than .4 mA in the On and Off State. To use this feature with relays or switches, connect a “shunt resistor” (~ 50K) across the contacts. 0 = Disable, 1 = Enable **Default** = 0 – Disable
Word 4	Bits 00-15 (00–17)	Maximum frequency or absolute value acceleration/deceleration (channel 1) – Specifies the highest Frequency or absolute Acceleration/Deceleration value allowed on the Frequency input. 0–32,767, 0.0–3,276.7Hz. **–OR–** 0–32,767Hz/s depending on the Frequency Range and Frequency/Acceleration Alarm Select bits.
Word 5	Bits 00–07	Frequency scaling multiplier (channel 1) – Specifies a multiplier to scale the incoming Frequency value. 0–255. **Default** = 0 – no scaling multiplication performed (x1)
	Bits 08–15 (10–17)	Frequency scaling divisor (channel 1) – Specifies divisor to scale the incoming Frequency value. 0–255. **Default** = 0 – no scaling division performed (divided by 1)

Word	Bit	Definition
Word 6	Bits 00–01	Wire-Off/Missing Pulse fault select (channel 1) – Sets the mode for 24 Vdc IEC 1+ Wire Off Input Detection and Missing Pulse Detection result for any input (Frequency or Gate). The Maximum Frequency is determined by Frequency Range bit and the Maximum Frequency value, and the Minimum Frequency is determined by Frequency Range bit. The Wire Off detect time (in mode 1, 2, & 3) is 2 seconds maximum.
		Bit 01 00 — Channel wire-off/missing pulse fault mode 0 0 — Disabled 0 1 — Alarm only (frequency unchanged) 1 0 — Alarm and force frequency to maximum frequency value (32767 or 3276.7 or maximum frequency value ≠ 0). 1 1 — Alarm and force frequency to minimum frequency value (0 or 0.0).
	Bits 02–03	Missing pulse delay multiplier bits (channel 1)– Specifies the number of Missing Pulse Alarms periods (Minimum Frequency Sampling Times) which will be tolerated before the alarm is actually generated, if enabled. (Used to defeat the Missing Pulse Alarm during a system startup.) **Default** = 0 – No multiplier; alarm generated immediately (normal mode with 2s extension delay)
		Bit 03 02 — Alarm periods before alarm generated 0 0 — No multiplier; alarm generated immediately (normal mode with 2s extension delay) 0 1 — 2 sample periods + 2s delay before alarm 1 0 — 8 sample periods + 2s delay before alarm 1 1 — 32 sample periods + 2s delay before alarm
	Bit 04	Frequency or Acceleration Alarm Select (channel 1)– Determines if the value in the Maximum Frequency or Acceleration write word is a Frequency (actual or scaled) or Acceleration Alarm value. If set to Frequency, Acceleration is not calculated. 0 = frequency alarm 1 = acceleration alarm **Default** = 0 – frequency alarm
	Bits 05–06	Acceleration Calculation Time (channel 1) – Specifies the number of Frequency Sample Times over which the module calculates acceleration. **Default** = 0 – Rolling Average (previous 4 samples)
		Bit 06 05 — Acceleration Calculation Time in Frequency Sample Times 0 0 — Rolling Average (previous 4 samples) 0 1 — 8 1 0 — 16 1 1 — 32
	Bit 07	Initiate Startup Select (channel 1) – Alerts a channel that if process start up is in progress to defeat the missing pulse alarm for a time determined by the missing pulse delay multiplier. 0 = Normal Run Mode; 1 = Startup Mode – defeat/delay Missing Pulse Alarm **Default** = 0 – Normal Run Mode

<table>
<tr><th>Word</th><th>Bit</th><th>Definition</th></tr>
<tr><td rowspan="5">Word 6</td><td>Bits 08–11 (10–13)</td><td>Minimum Frequency Sampling Time (channel 1) – Specifies the minimum time (in ms) the module will spend collecting pulses to determine the Frequency.
<table>
<tr><th>Bit</th><th>11 (13)</th><th>10 (12)</th><th>09 (11)</th><th>08 (10)</th><th>Minimum Frequency Sampling Time – in ms</th></tr>
<tr><td></td><td>0</td><td>0</td><td>0</td><td>0</td><td>2</td></tr>
<tr><td></td><td>0</td><td>0</td><td>0</td><td>1</td><td>4</td></tr>
<tr><td></td><td>0</td><td>0</td><td>1</td><td>0</td><td>5</td></tr>
<tr><td></td><td>0</td><td>0</td><td>1</td><td>1</td><td>10</td></tr>
<tr><td></td><td>0</td><td>1</td><td>0</td><td>0</td><td>20</td></tr>
<tr><td></td><td>0</td><td>1</td><td>0</td><td>1</td><td>50</td></tr>
<tr><td></td><td>0</td><td>1</td><td>1</td><td>0</td><td>100</td></tr>
<tr><td></td><td>0</td><td>1</td><td>1</td><td>1</td><td>200</td></tr>
<tr><td></td><td>1</td><td>0</td><td>0</td><td>0</td><td>500</td></tr>
<tr><td></td><td>1</td><td>0</td><td>0</td><td>1</td><td>1000</td></tr>
<tr><td></td><td colspan="5">1010 to 1111 not used – 2ms default sample time used</td></tr>
</table></td></tr>
<tr><td>Bit 12 (14)</td><td>Invert Select – Frequency Input (channel 1) – Selects whether to invert the Frequency input signal, if not using an Active High (24V = On) 24 Vdc IEC 1+ sensor or “Normally Open” relay or switch contact on the 24 Vdc Frequency Input terminal. Allows compatibility with an Active Low (0V = On) 24 Vdc IEC 1+ sensor or “Normally Closed” relay contact on the 24 Vdc Frequency Input terminal.
0 = Normal (Active High, 24V = On),
1 = Invert input (Active Low, 0V = On).
Default = 0 – Normal (Active High, 24V = On)</td></tr>
<tr><td>Bit 13 (15)</td><td>Invert Select – Gate Input (channel 1)– Selects whether to invert the Gate input signal, if not using an Active High (24V = On) 24 Vdc IEC 1+ sensor or “Normally Open” relay or switch contact on the 24 Vdc Gate Input terminal. Allows compatibility with an Active Low (0V = On) 24 Vdc IEC 1+ sensor or “Normally Closed” relay contact on the 24 Vdc Gate Input terminal.
0 = Normal (Active High, 24V = On),
1 = Invert input (Active Low, 0V = On)
Default = 0 – Normal (Active High, 24V = On)</td></tr>
<tr><td>Bit 14 (16)</td><td>Wire Off Fault Select – Frequency Input (channel 1) – Selects whether to turn On or Off the 24 Vdc Frequency input IEC 1+ hardware Wire Off (Lead Breakage) detection. NOTE: Customer devices must draw more than 0.4 mA in the On and Off State. To use this feature with relays or switches, connect a “shunt resistor” (~ 50K) across the contacts.
0 = Disable,
1 = Enable
Default: = 0 – Disable</td></tr>
<tr><td>Bit 15 (17)</td><td>Wire Off Fault Select – Gate Input (channel 1) – Selects whether to turn On or Off the 24 Vdc Gate input IEC 1+ hardware Wire Off (Lead Breakage) detection. NOTE: Customer devices must draw more than .4 mA in the On and Off State. To use this feature with relays or switches, connect a “shunt resistor” (~ 50K) across the contacts.
0 = Disable,
1 = Enable
Default = 0 – Disable</td></tr>
</table>

Chapter Summary

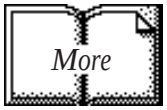
In this chapter, you learned how to configure your module’s features and enter your data.

How Communication Takes Place and I/O Image Table Mapping with the DeviceNet Adapter

What This Chapter Contains

In this chapter, we tell you about:

About DeviceNetManager Software



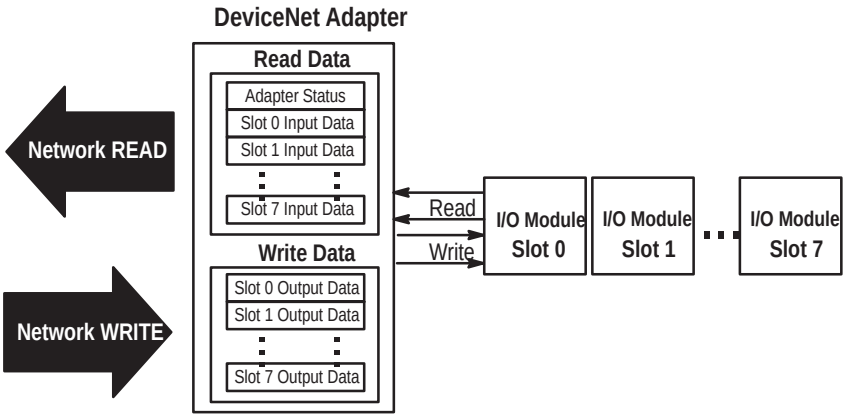
DeviceNetManager software is a tool used to configure your FLEX I/O DeviceNet adapter and its related modules. This software tool can be connected to the adapter via the DeviceNet network.

You must understand how DeviceNetManager software works in order to add a device to the network. Refer to the DeviceNetManager Software User Manual, publication 1787-6.5.3.

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.

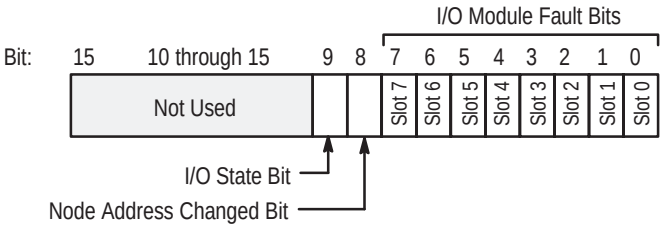
The first word of input data sent by the adapter is the Adapter Status Word. This is followed by the input data from each slot, in the order of the installed I/O modules. The Input data from Slot 0 is first after the status word, followed by Input data from Slot 2, and so on up to slot 7.



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 the following table.

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 thru 15	Not used – sent as zeroes.

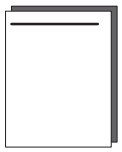
Possible causes for an **I/O Module Fault** are:

- 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 affect until the adapter has been powered down and then powered back up.

System Throughput

System throughput, from frequency input to backplane, is a function of:



- the configured minimum frequency sample time
- the number of channels actually configured for connection to a specific sensor (0 or 1)

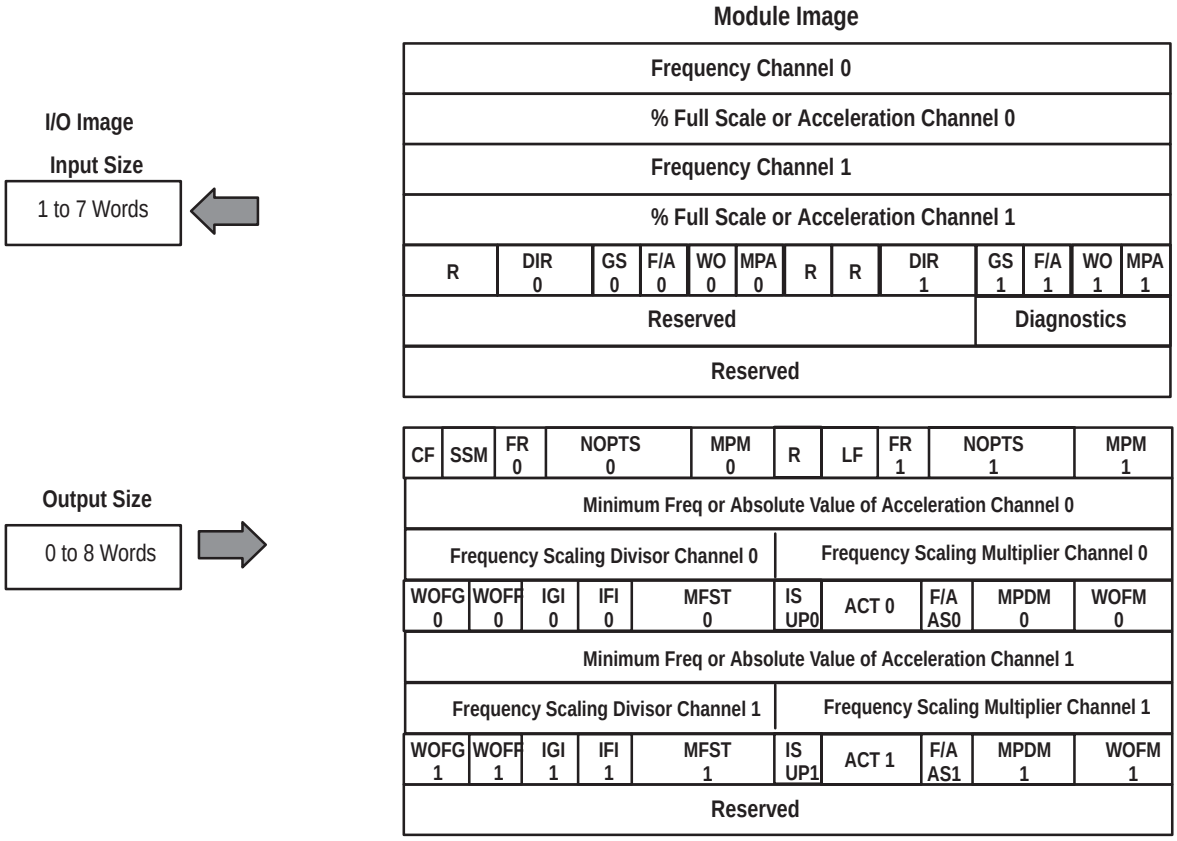
You can set the minimum frequency time during module configuration. The selection influences the sample data rate, thus affecting system throughput.

The number of channels included in each input scan also affects system throughput.

Mapping Data into the Image Table

FLEX I/O frequency input module data table mapping is shown below.

Frequency Input Analog Module (1794-IJ2) Image Table Mapping



Block Transfer Read Word Assignments for the Frequency Input Module (1794-IJ2)

(Octal Bit)	17	16	15	14	13	12	11	10	07	06	05	04	03	02	01	00
Decimal Bit	**15**	**14**	**13**	**12**	**11**	**10**	**09**	**08**	**07**	**06**	**05**	**04**	**03**	**02**	**01**	**00**
1	Frequency 0 – 32,767 or 0.0 – 3,276.7 Channel 0															
2	% Full Scale 0.0% to 3,276.7% Channel 0 or Acceleration –32,768 to +32,767 Channel 0															
3	Frequency 0 – 32,767 or 0.0 – 3,276.7 Channel 1															
4	% Full Scale 0.0% to 3,276.7% Channel 1 or Acceleration –32,768 to +32,767 Channel 1															
5	R	R	Direction Ch 0		GS Ch 0	F/A Ch 0	WO Ch 0	MPA Ch 0	R	R	Direction Ch 1		GS Ch 1	F/A Ch 1	WO Ch 1	MPA Ch 1
6	Reserved												Diagnostic Status			
7	Reserved															

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

Block Transfer Write Word Assignments for the Frequency Input Module

(Octal Bit)	17	16	15	14	13	12	11	10	07	06	05	04	03	02	01	00
Dec. Bit	**15**	**14**	**13**	**12**	**11**	**10**	**09**	**08**	**07**	**06**	**05**	**04**	**03**	**02**	**01**	**00**
1	CF	SSM	FR Ch 0	Number Of Pulses To Terminate Sampling Ch 0			MPM Ch 0		R	LF	FR Ch 1	Number Of Pulses To Terminate Sampling Ch 1			MPM Ch 1	
2	Maximum Frequency 0 – 32,767 – or – 0.0 – 3,276.7 – or – Absolute Value of Acceleration 0 to 32,767 – Channel 0															
3	Frequency Scaling Divisor 0 – 255 Ch 0								Frequency Scaling Multiplier 0 – 255 Ch 0							
4	WOFG Ch 0	WOFF Ch 0	IGI Ch 0	IFI Ch 0	Minimum Frequency Sample Time Ch 0				Init St Up Ch 0	ACT Ch 0		F/A AS Ch 0	MPDM Ch 0		WOFM Ch 0	
5	Maximum Frequency 0 – 32,767 – or – 0.0 – 3,276.7 – or – Absolute Value of Acceleration 0 to 32,767 – Channel 1															
6	Frequency Scaling Divisor 0 – 255 Ch 1								Frequency Scaling Multiplier 0 – 255 Ch 1							
7	WOFG Ch 1	WOFF Ch 1	IGI Ch 1	IFI Ch 1	Minimum Frequency Sample Time Ch 1				Init St Up Ch 1	ACT Ch 1		F/A AS Ch 1	MPDM Ch 1		WOFM Ch 1	
8	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
WOFG = Wire-off fault gate
WOFM = Wire-off fault mode
IGI = Invert gate input
IFI = Invert frequency input
ACT = Acceleration Calculation Time
MPDM = Missing pulse delay multiplier
R = Reserved

Bit/Word Descriptions for the Frequency Input Module (1794-IJ2)

Word	Bit	Definition
Read Word 1	Bit 00–15 (00–17)	Calculated value of Frequency (channel 0) – Frequency can be reported down to 1 or 1.0 Hz, depending on the Frequency Range bit setting; below a 1 Hz value, 0 is reported; below a 1.0 Hz value, 0.0 is reported. Calculated frequency depends on Minimum Sampling Time and Missing Pulse Multiplier.
Word 2	Bit 00–15 (00–17)	% of Full Scale or Acceleration (channel 0) – Value of the calculated Frequency scaled by the Maximum Frequency, or Calculated Value of Acceleration in Hz / second, depending on the state of the Freq or Accel Alarm Select bit. Note: % Full scale will be calculated accurately up to a maximum of 3,276.7%. Beyond this maximum, the value of 3,276.7% will be returned, and a "Calculation Failure" (9) will be set in the Diagnostic Status byte.
Word 3	Bit 00–15 (00–17)	Calculated value of Frequency (channel 1) – Frequency can be reported down to 1 or 1.0 Hz, depending on the Frequency Range bit setting; below a 1 Hz value, 0 is reported; below a 1.0 Hz value, 0.0 is reported. Calculated frequency depends on Minimum Sampling Time and Missing Pulse Multiplier.
Word 4	Bit 00–15 (00–17)	% of Full Scale or Acceleration (channel 1) – Value of the calculated Frequency scaled by the Maximum Frequency, or Calculated Value of Acceleration in Hz / second, depending on the state of the Freq or Accel Alarm Select bit. Note: % Full scale will be calculated accurately up to a maximum of 3,276.7%. Beyond this maximum, the value of 3,276.7% will be returned, and a "Calculation Failure" (9) will be set in the Diagnostic Status byte.
Word 5	Bits 00	Missing Pulse Alarm (channel 1) – Indicates when no Frequency input pulse has occurred within the period determined by the Minimum Frequency Sampling Time and the Missing Pulse Multiplier. Primary control is given to the Missing Pulse Multiplier to determine when this bit is set. However, if the Missing Pulse Multiplier is set to 0, then the Minimum Frequency Sampling Time characteristics will determine when this bit is set.
	Bit 01	Wire Off Fault Alarm (channel 1) – when set, indicates when 24 Vdc Input (IEC 1+ or Switch Contact with shunt) Wire Off Detection has gone true for any of the Frequency or Gate inputs on a channel that has the Wire Off Fault Select = 1.
	Bit 02	Frequency or Acceleration Alarm (channel 1) – Changes state from 0 to 1 if the calculated Frequency (actual or scaled) exceeds the user programmed Maximum Frequency, or the absolute value of calculated Acceleration/Deceleration exceeds the user programmed Maximum Acceleration Value. The Frequency Alarm turns off when the Frequency drops below **95%** of the Alarm Value. The Acceleration Alarm turns off when the Acceleration drops below **90%** of the Alarm Value.
	Bit 03	Gate Input State (channel 1) – Indicates if there is a valid signal on the gate input. This parameter is only determined once every 0.5 – 2s.
	Bits 04–05	Direction (channel 1) – Indicates the current Direction of Rotation, using both the Frequency and Gate inputs. (Frequency leads Gate = Clockwise, Gate leads Frequency = CounterClockwise). Used for slow speed detection from 1 – 1,500Hz. "No" or "Stopped" rotation can be determined by the state of the Missing Pulse Alarm, when it is switched on. A missing Frequency Input will generate a Missing Pulse Alarm, a missing Gate Input will only generate a "No Sensor Present / Detected" status (3).
	Bits 06–07	Not used
	Bits 08 (10)	Missing Pulse Alarm (channel 0) – Indicates when no Frequency input pulse has occurred within the period determined by the Minimum Frequency Sampling Time and the Missing Pulse Multiplier. Primary control is given to the Missing Pulse Multiplier to determine when this bit is set. However, if the Missing Pulse Multiplier is set to 0, then the Minimum Frequency Sampling Time characteristics will determine when this bit is set.
	Bit 09 (11)	Wire Off Fault Alarm (channel 0) – When set, indicates when 24 Vdc Input (IEC 1+ or Switch Contact with shunt) Wire Off Detection has gone true for any of the Frequency or Gate inputs on a channel that has the Wire Off Fault Select = 1.
	Bit 10 (12)	Frequency or Acceleration Alarm (channel 0) – Changes state from 0 to 1 if the calculated Frequency (actual or scaled) exceeds the user programmed Maximum Frequency, or the absolute value of calculated Acceleration/Deceleration exceeds the user programmed Maximum Acceleration Value. The Frequency Alarm turns off when the Frequency drops below **95%** of the Alarm Value. The Acceleration Alarm turns off when the Acceleration drops below **90%** of the Alarm Value.

Word	Bit	Definition					
Word 5 cont.	Bit 11 (13)	Gate Input State (channel 0) – Indicates if there is a valid signal on the gate input. This parameter is only determined once every 0.5 – 2s.					
	Bits 12–13 (14–15)	Direction (channel 0) – Indicates the current Direction of Rotation, using both the Frequency and Gate inputs. (Frequency leads Gate = Clockwise, Gate leads Frequency = CounterClockwise). Used for slow speed detection from 1 – 1,500Hz. "No" or "Stopped" rotation can be determined by the state of the Missing Pulse Alarm, when it is switched on. A missing Frequency Input will generate a Missing Pulse Alarm, a missing Gate Input will only generate a "No Sensor Present / Detected" status (3).					
	Bits 14–15 (16–17)	Not used					
Word 6	Bits 00–03		Diagnostic Status – indicate the response from the module; a normal or non–normal operating condition.				
		Bit	03	02	01	00	
			0	0	0	0	0 = Normal Operation (No Failure)
			0	0	0	1	1 = Calibration Failure
			0	0	1	0	2 = Configuration Failure A Minimum Frequency Sample Time value other than 0–9 was selected.
			0	0	1	1	3 = Message Failure
			0	1	0	0	4 = Lead Break Detection Hardware Failure
			0	1	0	1	5 = Major Hardware Failure
			0	1	1	0	6 = EEPROM Failure
			0	1	1	1	7 = RAM Failure
			1	0	0	0	8 = ROM Failure
			1	0	0	1	9 = Calculation Failure The actual Frequency is greater than 32,767 Hz. or 3,276.7 Hz. (overange). The scaled Frequency is greater than 32,767 Hz. or 3,276.7 Hz. (overange). The % Full Scale calculation (based on Maximum Frequency) is > 3,276.7%.
			1010–1111				10 – 15 = Not Used
	Bits 04–15 (04–17)	Reserved					
Word 7	Bits 00–15 (00–17	Reserved					

Word	Bit	Definition
Write Word 1	Bits 00-01	Missing pulse multiplier bits (channel 1) – used to modify the Minimum Frequency Sampling Time to allow the frequency bandwidth to be more closely adjusted to the value needed to report the proper frequency and report a missing pulse more quickly. **Default** = no multiplier; alarm generated immediately
		Bit 01 00 Missing Pulse Multiplier 0 0 No Multiplier, alarm generated immediately (normal mode with 2s delay) 0 1 X2 1 0 X8 1 1 X32
	Bits 02–04	Number of pulses to terminate sampling (channel 1) – Lets you calculate Frequency when a specified number of input pulses have occurred. This allows earlier reporting of the frequency than the Minimum Frequency Sampling Time, when many input pulses are occurring. Accurate frequency determination is possible without waiting for the full Minimum Frequency Sampling Time to expire. **Defaul**t = minimum frequency sampling time.
		Bit 04 03 02 Number of pulses to terminate sampling 0 0 0 Use minimum frequency sampling time 0 0 1 2 0 1 0 4 0 1 1 8 1 0 0 16 1 0 1 32 1 1 0 64 1 1 1 128
	Bits 05	Frequency range bits (channel 1) – Specifies the Frequency Range of the Frequency input. 0 = 1–32767 (below 1Hz reports 0); 1 = 1.0–3276.7 (below 1.0Hz reports 0.0). **Default** = 0
	Bit 06	Local fault mode selection – determines how the Module Safe State data will be used to control alarm outputs for bus communication and internal module faults (local fault = Wire Off Fault or Missing Pulse Alarm). 0 = safe states activated by bus communication only; 1 = safe states activated by any failure (bus communication, internal module faults, etc.) **Default** = 0, safe states activated by bus communication only
	Bit 07	Not used
	Bits 08–09 (10–11)	Missing pulse multiplier bits (channel 0)– used to modify the Minimum Frequency Sampling Time to allow the frequency bandwidth to be more closely adjusted to the value needed to report the proper frequency and report a missing pulse more quickly. **Default** = no multiplier; alarm generated immediately
		Bit 09 (11) 08 (10) Minimum frequency sampling time 0 0 No Multiplier, alarm generated immediately (normal mode with 2s delay) 0 1 X2 1 0 X8 1 1 X32

<table>
<tr><th>Word</th><th>Bit</th><th>Definition</th></tr>
<tr><td rowspan="11">Write word 1 cont.</td><td rowspan="11">Bits 10–12 (12–14)</td><td>Number of pulses to terminate sampling (channel 0) – Lets you calculate Frequency when a specified number of input pulses have occurred. This allows earlier reporting of the frequency than the Minimum Frequency Sampling Time, when many input pulses are occurring. Accurate frequency determination is possible without waiting for the full Minimum Frequency Sampling Time to expire.
Default = minimum frequency sampling time.</td></tr>
<tr><td>
<table>
<tr><th>Bit</th><th>12 (14)</th><th>11 (13)</th><th>10 (12)</th><th>Number of pulses to terminate sampling</th></tr>
<tr><td></td><td>0</td><td>0</td><td>0</td><td>Use minimum frequency sampling time</td></tr>
<tr><td></td><td>0</td><td>0</td><td>1</td><td>2</td></tr>
<tr><td></td><td>0</td><td>1</td><td>0</td><td>4</td></tr>
<tr><td></td><td>0</td><td>1</td><td>1</td><td>8</td></tr>
<tr><td></td><td>1</td><td>0</td><td>0</td><td>16</td></tr>
<tr><td></td><td>1</td><td>0</td><td>1</td><td>32</td></tr>
<tr><td></td><td>1</td><td>1</td><td>0</td><td>64</td></tr>
<tr><td></td><td>1</td><td>1</td><td>1</td><td>128</td></tr>
</table>
</td></tr>
<tr><td>Bit 13 (15)</td><td>Frequency range bits (channel 0) – Specifies the Frequency Range of the Frequency input.
0 = 1–32767 (below 1Hz reports 0);
1 = 1.0–3276.7 (below 1.0Hz reports 0.0).
Default = 0</td></tr>
<tr><td>Bit 14 (16)</td><td>Safe state mode bit – selection determines how module alarm outputs react to bus communication and internal module faults (local fault = Wire Off Fault or Missing Pulse Alarm).
0 = Reset outputs
1 = Hold last state
Default = 0 (reset outputs).</td></tr>
<tr><td>Bit 15 (17)</td><td>Communication fault – Signals the module that communications has been interrupted on the network. The adapter signals that the module should execute its fault routine or go to the Safe State and control any Alarm Outputs accordingly. During normal startup, this bit must be set (1) by the user program to begin normal module operation of Alarm Outputs (in effect, an output enable). When the adapter communication link is broken, the adapter will reset this bit (0). – (Adapter dependent.)
Default = 0.</td></tr>
<tr><td>Word 2</td><td>Bits 00-15 (00–17)</td><td>Maximum frequency or absolute value acceleration/deceleration (channel 0) – Specifies the highest Frequency or absolute Acceleration/Deceleration value allowed on the Frequency input. 0–32,767, 0.0–3,276.7Hz. –OR– 0–32,767Hz/s depending on the Frequency Range and Frequency/Acceleration Alarm Select bits.</td></tr>
<tr><td rowspan="2">Word 3</td><td>Bits 00–07</td><td>Frequency scaling multiplier (channel 0) – Specifies a multiplier to scale the incoming Frequency value. 0–255.
Default = 0 – no scaling multiplication performed (x1)</td></tr>
<tr><td>Bits 08–15 (10–17)</td><td>Frequency scaling divisor (channel 0) – Specifies divisor to scale the incoming Frequency value. 0–255.
Default = 0 – no scaling division performed (divided by 1)</td></tr>
</table>

Word	Bit	Definition			
Word 4	Bits 00–01	Wire-Off/Missing Pulse fault select mode (channel 0) – Sets the mode for 24 Vdc IEC 1+ Wire Off Input Detection and Missing Pulse Detection result for any input (Frequency or Gate). The Maximum Frequency is determined by Frequency Range bit and the Maximum Frequency value, and the Minimum Frequency is determined by Frequency Range bit. The Wire Off detect time (in mode 1, 2, & 3) is 2 seconds maximum.			
	Bits 00–01	Bit	01	00	Channel wire-off/missing pulse fault mode
			0	0	Disabled
			0	1	Alarm only (frequency unchanged)
			1	0	Alarm and force frequency to maximum frequency value (32767 or 3276.7 or maximum frequency value ≠ 0).
			1	1	Alarm and force frequency to minimum frequency value (0 or 0.0).
	Bits 02–03	Missing pulse delay multiplier bits (channel 0)– Specifies the number of Missing Pulse Alarms periods (Minimum Frequency Sampling Times) which will be tolerated before the alarm is actually generated, if enabled. (Used to defeat the Missing Pulse Alarm during a system startup.) **Default** = 0 – No multiplier; alarm generated immediately (normal mode with 2s extension delay)			
		Bit	03	02	Alarm periods before alarm generated
			0	0	No multiplier; alarm generated immediately (normal mode with 2s extension delay)
			0	1	2 sample periods + 2s delay before alarm
			1	0	8 sample periods + 2s delay before alarm
			1	1	32 sample periods + 2s delay before alarm
	Bit 04	Frequency or Acceleration Alarm Select (channel 0)– Determines if the value in the Maximum Frequency or Acceleration write word is a Frequency (actual or scaled) or Acceleration Alarm value. If set to Frequency, Acceleration is not calculated. 0 = frequency alarm 1 = acceleration alarm **Default** = 0 – frequency alarm			
	Bits 05–06	Acceleration Calculation Time (channel 0) – Specifies the number of Frequency Sample Times over which the module calculates acceleration. **Default** = 0 – Rolling Average (previous 4 samples)			
		Bit	06	05	Acceleration Calculation Time in Frequency Sample Times
			0	0	Rolling Average (previous 4 samples)
			0	1	8
			1	0	16
			1	1	32
	Bit 07	Initiate Startup Select (channel 0) – Alerts a channel that if process start up is in progress to defeat the missing pulse alarm for a time determined by the missing pulse delay multiplier. 0 = Normal Run Mode; 1 = Startup Mode – defeat/delay Missing Pulse Alarm **Default** = 0 – Normal Run Mode			

<table>
<tr><th>Word</th><th>Bit</th><th>Definition</th></tr>
<tr><td rowspan="14">Word 4 cont.</td><td>Bits 08–11 (10–13)</td><td>Minimum Frequency Sampling Time (channel 0) – Specifies the minimum time (in ms) the module will spend collecting pulses to determine the Frequency.
<table>
<tr><th>Bit</th><th>11 (13)</th><th>10 (12)</th><th>09 (11)</th><th>08 (10)</th><th>Minimum Frequency Sampling Time – in ms</th></tr>
<tr><td></td><td>0</td><td>0</td><td>0</td><td>0</td><td>2</td></tr>
<tr><td></td><td>0</td><td>0</td><td>0</td><td>1</td><td>4</td></tr>
<tr><td></td><td>0</td><td>0</td><td>1</td><td>0</td><td>5</td></tr>
<tr><td></td><td>0</td><td>0</td><td>1</td><td>1</td><td>10</td></tr>
<tr><td></td><td>0</td><td>1</td><td>0</td><td>0</td><td>20</td></tr>
<tr><td></td><td>0</td><td>1</td><td>0</td><td>1</td><td>50</td></tr>
<tr><td></td><td>0</td><td>1</td><td>1</td><td>0</td><td>100</td></tr>
<tr><td></td><td>0</td><td>1</td><td>1</td><td>1</td><td>200</td></tr>
<tr><td></td><td>1</td><td>0</td><td>0</td><td>0</td><td>500</td></tr>
<tr><td></td><td>1</td><td>0</td><td>0</td><td>1</td><td>1000</td></tr>
<tr><td></td><td colspan="5">1010 to 1111 not used – 2ms default sample time used</td></tr>
</table></td></tr>
<tr><td>Bit 12 (14)</td><td>Invert Select – Frequency Input (channel 0) – Selects whether to invert the Frequency input signal, if not using an Active High (24V = On) 24 Vdc IEC 1+ sensor or “Normally Open” relay or switch contact on the 24 Vdc Frequency Input terminal. Allows compatibility with an Active Low (0V = On) 24 Vdc IEC 1+ sensor or “Normally Closed” relay contact on the 24 Vdc Frequency Input terminal.
0 = Normal (Active High, 24V = On),
1 = Invert input (Active Low, 0V = On).
Default = 0 – Normal (Active High, 24V = On)</td></tr>
<tr><td>Bit 13 (15)</td><td>Invert Select – Gate Input (channel 0)– Selects whether to invert the Gate input signal, if not using an Active High (24V = On) 24 Vdc IEC 1+ sensor or “Normally Open” relay or switch contact on the 24 Vdc Gate Input terminal. Allows compatibility with an Active Low (0V = On) 24 Vdc IEC 1+ sensor or “Normally Closed” relay contact on the 24 Vdc Gate Input terminal.
0 = Normal (Active High, 24V = On),
1 = Invert input (Active Low, 0V = On)
Default = 0 – Normal (Active High, 24V = On)</td></tr>
<tr><td>Bit 14 (16)</td><td>Wire Off Fault Select – Frequency Input (channel 0) – Selects whether to turn On or Off the 24 Vdc Frequency input IEC 1+ hardware Wire Off (Lead Breakage) detection. NOTE: Customer devices must draw more than 0.4 mA in the On and Off State. To use this feature with relays or switches, connect a “shunt resistor” (~ 50K) across the contacts.
0 = Disable,
1 = Enable
Default: = 0 – Disable</td></tr>
<tr><td>Bit 15 (17)</td><td>Wire Off Fault Select – Gate Input (channel 0) – Selects whether to turn On or Off the 24 Vdc Gate input IEC 1+ hardware Wire Off (Lead Breakage) detection. NOTE: Customer devices must draw more than .4 mA in the On and Off State. To use this feature with relays or switches, connect a “shunt resistor” (~ 50K) across the contacts.
0 = Disable,
1 = Enable
Default = 0 – Disable</td></tr>
<tr><td>Word 5</td><td>Bits 00-15 (00–17)</td><td>Maximum frequency or absolute value acceleration/deceleration (channel 1) – Specifies the highest Frequency or absolute Acceleration/Deceleration value allowed on the Frequency input. 0–32,767, 0.0–3,276.7Hz. –OR– 0–32,767Hz/s depending on the Frequency Range and Frequency/Acceleration Alarm Select bits.</td></tr>
<tr><td rowspan="2">Words 6</td><td>Bits 00–07</td><td>Frequency scaling multiplier (channel 1) – Specifies a multiplier to scale the incoming Frequency value. 0–255.
Default = 0 – no scaling multiplication performed (x1)</td></tr>
<tr><td>Bits 08–15 (10–17)</td><td>Frequency scaling divisor (channel 1) – Specifies divisor to scale the incoming Frequency value. 0–255.
Default = 0 – no scaling division performed (divided by 1)</td></tr>
</table>

Word	Bit	Definition			
Word 7	Bits 00–01	Wire-Off/Missing Pulse fault select mode (channel 1) – Sets the mode for 24 Vdc IEC 1+ Wire Off Input Detection and Missing Pulse Detection result for any input (Frequency or Gate). The Maximum Frequency is determined by Frequency Range bit and the Maximum Frequency value, and the Minimum Frequency is determined by Frequency Range bit. The Wire Off detect time (in mode 1, 2, & 3) is 2 seconds maximum.			
	Bits 00–01	Bit	01	00	Channel wire-off/missing pulse fault mode
			0	0	Disabled
			0	1	Alarm only (frequency unchanged)
			1	0	Alarm and force frequency to maximum frequency value (32767 or 3276.7 or maximum frequency value ≠ 0).
			1	1	Alarm and force frequency to minimum frequency value (0 or 0.0).
	Bits 02–03	Missing pulse delay multiplier bits (channel 1)– Specifies the number of Missing Pulse Alarms periods (Minimum Frequency Sampling Times) which will be tolerated before the alarm is actually generated, if enabled. (Used to defeat the Missing Pulse Alarm during a system startup.) **Default** = 0 – No multiplier; alarm generated immediately (normal mode with 2s extension delay)			
		Bit	03	02	Alarm periods before alarm generated
			0	0	No multiplier; alarm generated immediately (normal mode with 2s extension delay)
			0	1	2 sample periods + 2s delay before alarm
			1	0	8 sample periods + 2s delay before alarm
			1	1	32 sample periods + 2s delay before alarm
	Bit 04	Frequency or Acceleration Alarm Select (channel 1)– Determines if the value in the Maximum Frequency or Acceleration write word is a Frequency (actual or scaled) or Acceleration Alarm value. If set to Frequency, Acceleration is not calculated. 0 = frequency alarm 1 = acceleration alarm **Default** = 0 – frequency alarm			
	Bits 05–06	Acceleration Calculation Time (channel 1) – Specifies the number of Frequency Sample Times over which the module calculates acceleration. **Default** = 0 – Rolling Average (previous 4 samples)			
		Bit	06	05	Acceleration Calculation Time in Frequency Sample Times
			0	0	Rolling Average (previous 4 samples)
			0	1	8
			1	0	16
			1	1	32
	Bit 07	Initiate Startup Select (channel 1) – Alerts a channel that if process start up is in progress to defeat the missing pulse alarm for a time determined by the missing pulse delay multiplier. 0 = Normal Run Mode; 1 = Startup Mode – defeat/delay Missing Pulse Alarm **Default** = 0 – Normal Run Mode			

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<tr><th>Word</th><th>Bit</th><th>Definition</th></tr>
<tr><td rowspan="13">Word 7 cont.</td><td rowspan="13">Bits 08–11 (10–13)</td><td>Minimum Frequency Sampling Time (channel 1) – Specifies the minimum time (in ms) the module will spend collecting pulses to determine the Frequency.</td></tr>
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<table>
<tr><th>Bit</th><th>11 (13)</th><th>10 (12)</th><th>09 (11)</th><th>08 (10)</th><th>Minimum Frequency Sampling Time – in ms</th></tr>
<tr><td></td><td>0</td><td>0</td><td>0</td><td>0</td><td>2</td></tr>
<tr><td></td><td>0</td><td>0</td><td>0</td><td>1</td><td>4</td></tr>
<tr><td></td><td>0</td><td>0</td><td>1</td><td>0</td><td>5</td></tr>
<tr><td></td><td>0</td><td>0</td><td>1</td><td>1</td><td>10</td></tr>
<tr><td></td><td>0</td><td>1</td><td>0</td><td>0</td><td>20</td></tr>
<tr><td></td><td>0</td><td>1</td><td>0</td><td>1</td><td>50</td></tr>
<tr><td></td><td>0</td><td>1</td><td>1</td><td>0</td><td>100</td></tr>
<tr><td></td><td>0</td><td>1</td><td>1</td><td>1</td><td>200</td></tr>
<tr><td></td><td>1</td><td>0</td><td>0</td><td>0</td><td>500</td></tr>
<tr><td></td><td>1</td><td>0</td><td>0</td><td>1</td><td>1000</td></tr>
<tr><td></td><td colspan="5">1010 to 1111 not used – 2ms default sample time used</td></tr>
</table>
</td></tr>
<tr><td>Bit 12 (14)</td><td>Invert Select – Frequency Input (channel 1) – Selects whether to invert the Frequency input signal, if not using an Active High (24V = On) 24 Vdc IEC 1+ sensor or “Normally Open” relay or switch contact on the 24 Vdc Frequency Input terminal. Allows compatibility with an Active Low (0V = On) 24 Vdc IEC 1+ sensor or “Normally Closed” relay contact on the 24 Vdc Frequency Input terminal.
0 = Normal (Active High, 24V = On),
1 = Invert input (Active Low, 0V = On).
Default = 0 – Normal (Active High, 24V = On)</td></tr>
<tr><td>Bit 13 (15)</td><td>Invert Select – Gate Input (channel 1)– Selects whether to invert the Gate input signal, if not using an Active High (24V = On) 24 Vdc IEC 1+ sensor or “Normally Open” relay or switch contact on the 24 Vdc Gate Input terminal. Allows compatibility with an Active Low (0V = On) 24 Vdc IEC 1+ sensor or “Normally Closed” relay contact on the 24 Vdc Gate Input terminal.
0 = Normal (Active High, 24V = On),
1 = Invert input (Active Low, 0V = On)
Default = 0 – Normal (Active High, 24V = On)</td></tr>
<tr><td>Bit 14 (16)</td><td>Wire Off Fault Select – Frequency Input (channel 1) – Selects whether to turn On or Off the 24 Vdc Frequency input IEC 1+ hardware Wire Off (Lead Breakage) detection. NOTE: Customer devices must draw more than 0.4 mA in the On and Off State. To use this feature with relays or switches, connect a “shunt resistor” (~ 50K) across the contacts.
0 = Disable,
1 = Enable
Default: = 0 – Disable</td></tr>
<tr><td>Bit 15 (17)</td><td>Wire Off Fault Select – Gate Input (channel 1) – Selects whether to turn On or Off the 24 Vdc Gate input IEC 1+ hardware Wire Off (Lead Breakage) detection. NOTE: Customer devices must draw more than .4 mA in the On and Off State. To use this feature with relays or switches, connect a “shunt resistor” (~ 50K) across the contacts.
0 = Disable,
1 = Enable
Default = 0 – Disable</td></tr>
<tr><td>Word 8</td><td>Bits 00–15 (00–17)</td><td>Reserved</td></tr>
</table>

Defaults

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

Module Defaults for:		Factory Defaults		Real Time Size	
Catalog Number	Description	Input Default	Output Default	Input Default	Output Default
1794-IJ2	2 Frequency Input Module	7	8	4	0

Factory defaults are the values assigned by the adapter when you:

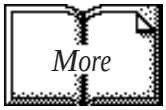
- first power up the system, and
- no previous stored settings have been applied.

For frequency input modules, the defaults reflect the actual number of input words/output words. For example, for the frequency input module, you have 7 input words, and 8 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 sizes.”

Real time sizes are the settings that provide optimal real time data to the adapter module.

Frequency input modules have 15 words assigned to them. This is divided into input words/output words. You can reduce the I/O data size to fewer words to increase data transfer over the backplane.



For information on using DeviceNetManager software to configure your adapter, refer to the DeviceNetManager Software User Manual, publication 1787-6.5.3.

Troubleshoot the Frequency Input Module

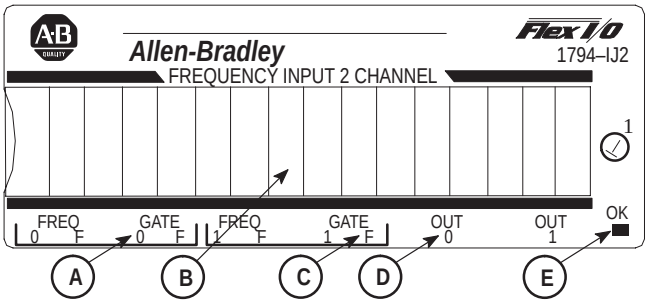
What This Chapter Contains

Use this chapter to troubleshoot the frequency input module by interpreting the:

Status Indicators

The module contains indicators for each of the following:

- Frequency and Gate Inputs
- Frequency and Gate Wire–Off Faults
- Alarm Outputs.



A = Input indicator.
B = Insertable label for writing individual I/O assignments.
C = Wire-Off Fault indicator.
D = Output indicator.
E = Power/status indicator – indicates power applied to module and status of module.

When an input indicator (yellow) is lighted, it indicates that a valid signal (active high or active low) is present at one of the Input terminals.

When wire–off detection is enabled, and a wire–off fault is detected (24 Vdc IEC 1+ input terminal only), a fault indicator (red) is blinked/flashed at a rate of 1Hz to signal a fault condition. A wire–off fault signal will also be sent to the backplane. A flashing red fault indication means a valid wire–off condition for a 24 Vdc IEC 1+ Input or a 24 Vdc contact switch input with a shunt resistor.

When an output indicator is yellow, the logic is driving an output alarm On. After detecting a fault, the internal circuitry will set the output data to the appropriate safe state, as defined by the module data table. Safe state control may be adapter dependent.

The input and output indicators are on the field side of the isolation path, and display the logic state of the actual microcontroller input and output.

The status indicator initially powers up as solid green, indicating the power supply is operating and internal diagnostic tests are being performed. After a successful power up test, the indicator remains green. The indicator turns red in about 1.5s if there is an internal diagnostics error

The module is operating correctly when the green OK indicator is on.

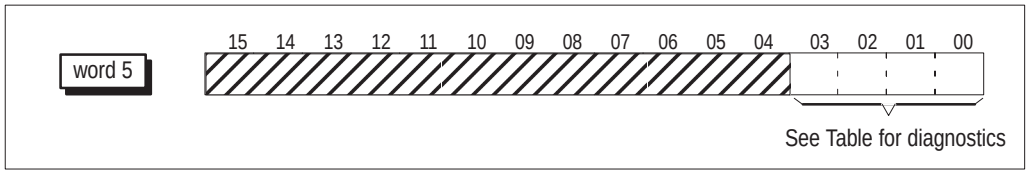
A red OK indicator shows that the module is in a Faulted condition (internal error).

Indicator	Condition	Operating Description
Input (0, 1)	Off (Dark)	Input Turned Off, Input Not Used, or Wire Disconnected
(Freq, or Gate)	On (Yellow)	Input Turned On (Active High or Active Low if Inverted)
Fault (F)	Off (Dark)	Wire Connected, Normal Operation or Detection Disabled
(Freq, or Gate)	On (Red Flashing)	Wire Disconnected, Fault Condition (Or low shunt current)
Output	Off (Dark)	Output Alarm Turned Off
(0, 1)	On (Yellow)	Output Alarm Turned On (Logic Drive On)
Status (OK)	Off (Dark)	24V Power Turned Off, or 5V Logic Power Problem
	Solid Green	Module OK, Normal Operating Mode
	Solid Red	Module MicroController / Watchdog Fault, Outputs Disabled

Diagnostics

The frequency input module returns diagnostics to the PLC processor in word 5 of the BTR file. These diagnostics give you information on the status or condition of the module.

Diagnostic Bits in Word 5 of the BTR File



		Diagnostic Status – indicates the response from the module; a normal or non–normal operating condition.					
		Bit	03	02	01	00	Decimal equivalent and condition
Word 5	Bits 00–03		0	0	0	0	0 = Normal Operation (No Failure)
			0	0	0	1	1 = Calibration Failure
			0	0	1	0	2 = Configuration Failure – A Minimum Frequency Sample Time value other than 0–9 was selected.
			0	0	1	1	3 = Message Failure
			0	1	0	0	4 = Lead Break Detection Hardware Failure
			0	1	0	1	5 = Major Hardware Failure
			0	1	1	0	6 = EEPROM Failure
			0	1	1	1	7 = RAM Failure
			1	0	0	0	8 = ROM Failure
			1	0	0	1	9 = Calculation Failure The actual Frequency is greater than 32,767 Hz. or 3,276.7 Hz. (overange). The scaled Frequency is greater than 32,767 Hz. or 3,276.7 Hz. (overange). The % Full Scale calculation (based on Maximum Frequency) is > 3,276.7%.
			1010–1111				10 – 15 = Not Used

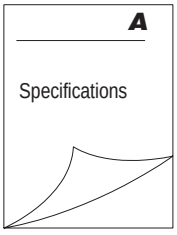
What's Next

To find out more about the IJ2 module:

See appendix A

or

appendix B



For

specifications on the IJ2 module

simplified schematics

Specifications

What This Appendix Contains

This appendix contains the frequency accuracy and general specifications of the Frequency Input module (cat. no. 1794-IJ2).

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)	20µs
Resolution/Accuracy	Refer to Resolution/Accuracy table on page A–4
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 ≦3V – Vortex Flowmeter low range ≧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 50kΩ shunt resistor
Frequency Input Impedance	>5KΩ for 50mV extended magnetic pickup >5KΩ for 500mV magnetic pickup >10KΩ for 3V vortex flowmeter >10KΩ for 6V vortex flowmeter >2.5KΩ for 24V dc IEC1+ proximity or encoder input >2.5KΩ for 24V dc contact switch input
Gate Input Impedance	>5KΩ for 50mV extended magnetic pickup >5KΩ for 500mV magnetic pickup >2.5KΩ for 24V dc IEC1+ proximity or encoder input >2.5KΩ for 24V dc contact switch input
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
Specifications continued on next page.	

Specifications – 1794-IJ2 Frequency Input Module	
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 300µA @ 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
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 Storage Temperature Relative Humidity Shock Operating Non-operating Vibration	 0 to 55°C (32 to 131°F) –40 to 85°C (–40 to 185°F) 5 to 95% noncondensing (operating) 5 to 80% noncondensing (nonoperating) 30 g peak acceleration, 11(+1)ms pulse width 50 g peak acceleration, 11(±1)ms pulse width Tested 5 g @ 10–500Hz per IEC 68-2-6
Input Conductors Wire Category Length (max)	 Belden 8761 2[1] 1000ft (304.8m)
Output Conductors Wire Category	 Belden 8761 2[1]
Agency Certification (when product is marked)	• 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."

Resolution and Accuracy

±1Hz or ±0.1Hz (depending on frequency range bit setting), or ± accuracy specification listed below, whichever is greater.

Resolution percent is defined as:

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

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 Frequency 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 Frequency Range	1–32767 Frequency Range	
2	±0.02%	±0.0225%	±0.0425%	±0.1–1.4Hz	±1–14Hz	0.01%
4	±0.01%	±0.0225%	±0.0325%	±0.1–1.1Hz	±1–11Hz	0.005%
5	±0.008%	±0.0225%	±0.0305%	±0.1–1.0Hz	±1–10Hz	0.004%
10	±0.004%	±0.0225%	±0.0265%	±0.1–0.9Hz	±1–9Hz	0.002%
20	±0.002%	±0.0225%	±0.0245%	±0.1–0.8Hz	±1–8Hz	0.001%
50	±0.0008%	±0.0225%	±0.0233%	±0.1–0.8Hz	±1–8Hz	0.0004%
100	±0.0004%	±0.0225%	±0.0229%	±0.1–0.8Hz	±1–8Hz	0.0002%
200	±0.0002%	±0.0225%	±0.0227%	±0.1–0.7Hz	±1–7Hz	0.0001%
500	±0.00008%	±0.0225%	±0.02258%	±0.1–0.7Hz	±1–7Hz	0.00004%
1000	±0.00004%	±0.0225%	±0.02254%	±0.1–0.7Hz	±1–7Hz	0.00002%

Schematics

What This Appendix Contains

Use this appendix to understand the internal logic of the 1794-IJ2 module.

▶ Follow the wiring practices described in "Industrial Automation Wiring and Grounding Guidelines for Noise Immunity," publication 1770-4.1, when wiring your I/O devices. This includes:

- routing conductors
- grounding practices
- use of shielded cables

Input Circuits

The frequency input module input logic consists of:

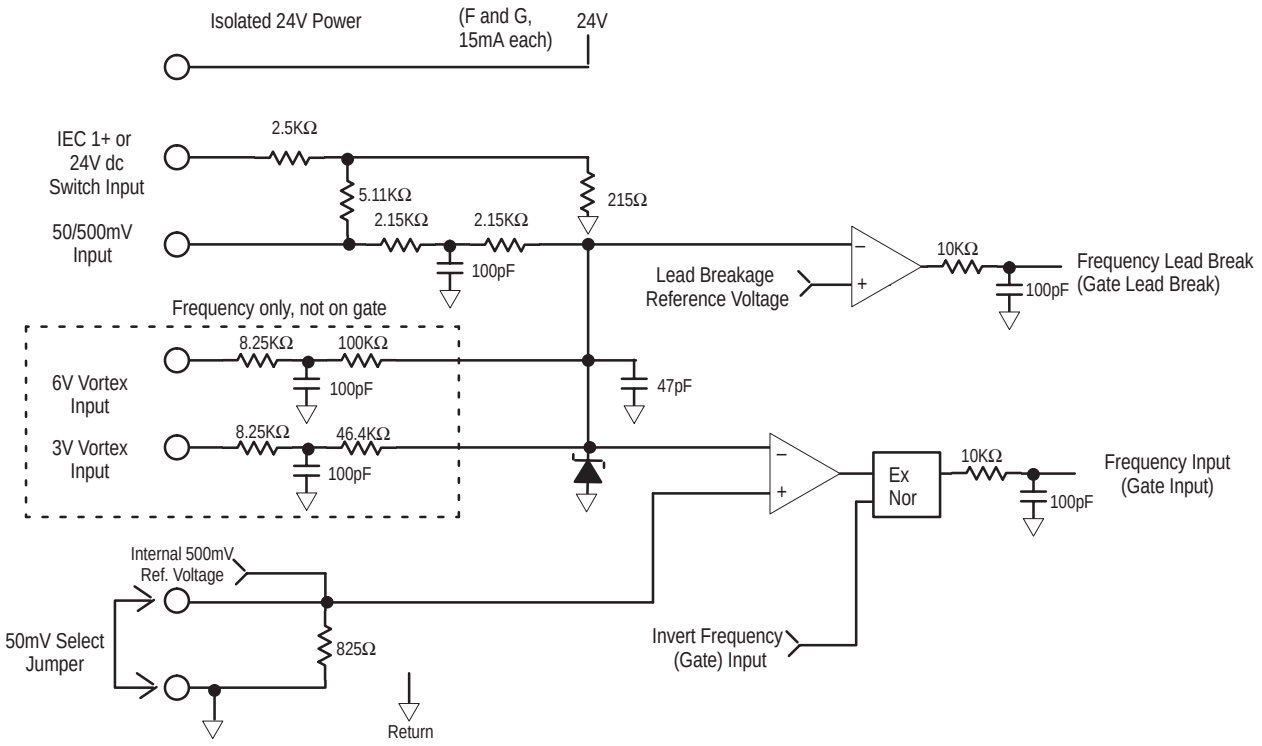
- frequency input circuits
- gate input circuits

Frequency Inputs

The frequency input circuit uses a comparator to determine when the input voltage threshold is exceeded. When exceeded, it provides logic pulses internal to the IJ2 module. The circuit is designed to interface with both active or passive sensor inputs by accepting any pulse output device (such as vortex flowmeter, magnetic pickup or digital pickup).

Gate Inputs

Gate inputs are similar to frequency inputs and are used for determining direction. There is one gate associated with each frequency input circuit (G0 corresponds to F0). The circuit is designed to interface with both active or passive sensor inputs by accepting any pulse output device (such as magnetic pickup or digital pickup).

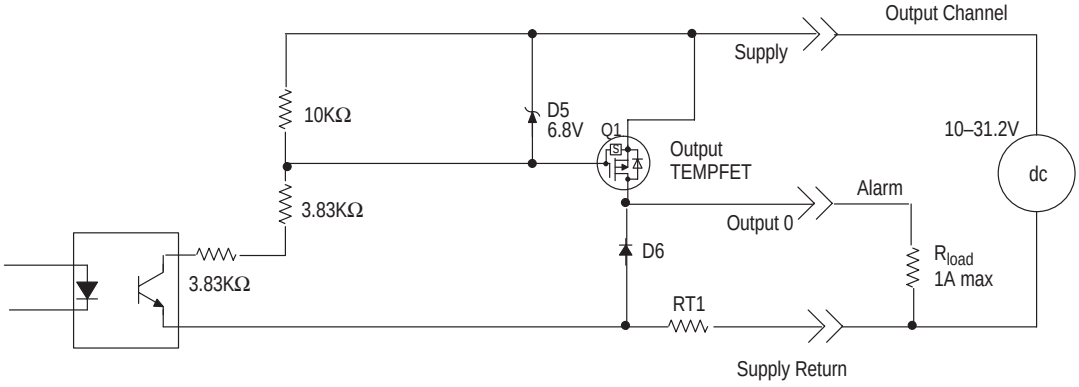


Output Circuits

The 1794-IJ2 module output logic consists of digital outputs.

Digital Outputs

The module's output is comprised of an isolated power MOSFET. This device operates in current sourcing mode, and is capable of delivering up to 1A (@ 10-31.2V dc).



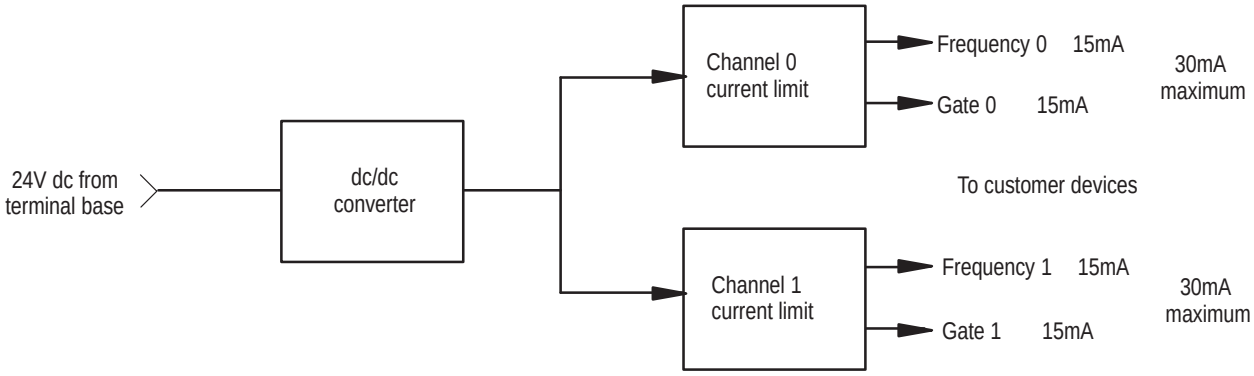
Customer supplied power, ranging from +10V to +31.2V dc, is connected internally to the power output transistor. When an output is turned on, current flows into the source, out of the drain, through the load connected to the ground of the customer supply (customer return). Diode D6 protects the power output transistors from damage due to inductive loads.

Output Q1 is a thermally protected FET and will turn off @ 3A (approximately). After an output goes into thermal shutdown, you must fix the cause of the shutdown and toggle the outputs ON and OFF to reenergize the output.

RT1 protects D6 and Q1 if power supply polarity is reversed.

DC to DC Converters (24V dc power supplies)

The module provides two 24V (±10%) power sources rated at 15mA each. Each power source can power one Bently Nevada 3300 (5mm or 8mm) Proximity Transducer.



The frequency input module isolated power supply consists of 1 isolated 24V dc power supply that provides 2 current limited outputs of 30mA maximum (1 for each channel).

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