Intrinsically Safe Fast Millivolt Input Module

User Manual

(Catalog Numbers 1771-IFMS)

ALLEN-BRADLEY • ROCKWELL SOFTWARE

Rockwell Automation

Important User Information

Solid state equipment has operational characteristics differing from those of electromechanical equipment. Safety Guidelines for the Application, Installation and Maintenance of Solid State Controls (publication SGI-1.1 available from your local Rockwell Automation sales office or online at http://www.rockwellautomation.com/literature/) describes some important differences between solid state equipment and hard-wired electromechanical devices. Because of this difference, and also because of the wide variety of uses for solid state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

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

WARNING 	Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.
IMPORTANT	Identifies information that is critical for successful application and understanding of the product.
ATTENTION 	Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequence
SHOCK HAZARD 	Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present.
BURN HAZARD 	Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures.

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About This Manual

Purpose

Use this manual to install and configure your Intrinsically Safe Fast Millivolt Input module, cat. no. 1771-IFMS.

Audience

We assume that you have previously used an Allen-Bradley programmable controller, that you are familiar with its features, and that you are familiar with the terminology we use. If not, read the user manual for your processor before reading this manual.

Vocabulary

In this manual, we refer to:

- the individual 1771-IFMS module as the "module," or the "IFMS."
- the programmable controller as the "controller" or the "processor."

What This Manual Contains

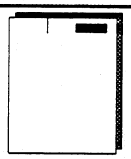
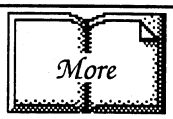
The contents of this manual are as follows:

Chapter	Title	What's Covered
1	Overview of the Intrinsically Safe Fast Millivolt Input module	• features of the module • how the module communicates with programmable controllers
2	Installing Your Module	• how to calculate chassis power requirements • choose module location • wire the module's field wiring arm • install the module
3	Module Programming	• block transfer programming • sample programs • extended input ranges • module scan times
4	Configuring Your Module	• how to configure your module • condition your inputs • enter your data
5	Module Status and Input Data	• how to read data from your module • block transfer format
6	Calibrating Your Module	• what tools and equipment you need • how to calibrate the module
7	Troubleshooting	• how to use the indicators for troubleshooting.

Appendix		
A	Specifications	Module specifications
B	Programming Examples	Sample programs for the PLC processors.
C	Data Formats	Information on BCD and 12-bit Binary
D	Block Transfer (Mini-PLC-2 and PLC-2/20 Processors)	How to use GET-GET instructions
E	Installation Drawing	Copy of drawing 560A-1771-IFMS

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	

Overview of the Intrinsically Safe Fast Millivolt Input Module

Chapter Objectives

This chapter gives you information on:

- features of the module
- how the input module communicates with programmable controllers

Module Description

The 1771-IFMS intrinsically safe fast millivolt input module is an intelligent block transfer module that interfaces analog input signals with any Allen-Bradley programmable controllers that have block transfer capability. Block transfer programming moves input data words from the module's memory to a designated area in the processor data table in a single scan. It also moves configuration words from the processor data table to module memory.

The input module is a single slot module and requires no external power supply. After scanning the analog inputs, the input data is converted to a specified data type in a digital format to be transferred to the processor's data table on request. The block transfer mode is disabled until this input scan is complete. Consequently, the minimum interval between block transfer reads is the same as the total input update time for each analog input module.

Features

The 1771-IFMS module senses 8 differential analog inputs and converts them to a proportional four-digit BCD or fifteen-bit binary value. The module reads a 0 to 50mV input signal. It can read slightly overrange or slightly underrange voltages.

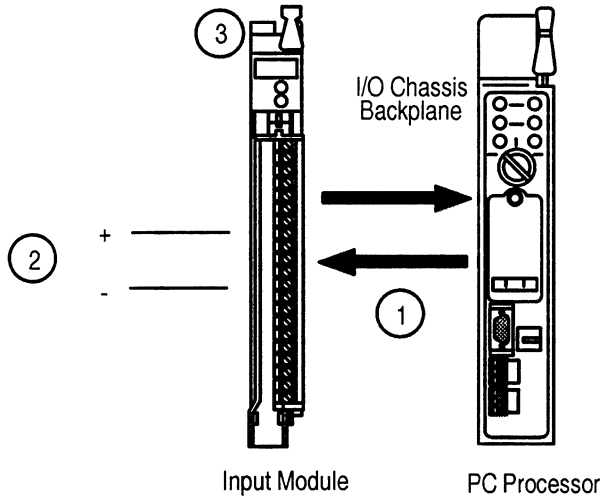
This module's features include:

- 8 differential inputs on one card
- Selectable real-time sampling
- Selectable scaling to engineering units
- Selectable digital filtering
- 0 to 50mV input range with extended linear range above 50mV and below 0mV

How Analog Modules Communicate with Programmable Controllers

The processor transfers data to and from the module using BTW (block transfer write) and BTR (block transfer read) instructions in your ladder diagram program. These instructions let the processor obtain input values and status from the module, and let you establish the module's mode of operation.

1. The processor transfers your configuration data and calibration values to the module using a block transfer write instruction.
2. External devices generate analog signals that are transmitted to the module.



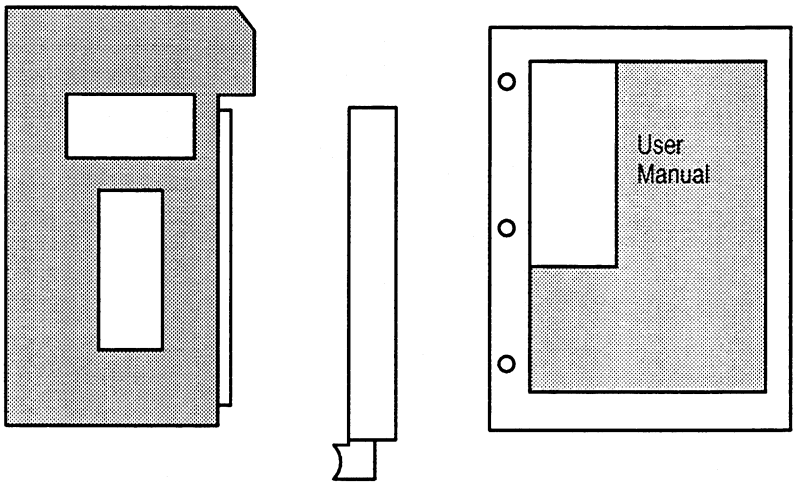
3. The module converts analog signals into binary or BCD format, and stores theses values until the processor requests their transfer.
4. When instructed by your ladder program, the processor performs a read block transfer of the values and stores them in a data table.
5. The processor and module determine that the transfer was made without error, and that input values are within specified range.
6. Your ladder program can use and/or move the data (if valid) before it is written over by the transfer of new data in a subsequent transfer.
7. Your ladder program should allow write block transfers to the module only when enabled by the operator at power-up.

Accuracy

The accuracy of the fast millivolt input module is described in Appendix A.

Getting Started

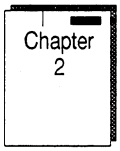
Your input module package contains the following items. Please check that each part is included and correct before proceeding.



1771-IFMS Module | Field Wiring Arm Cat. No. 1771-WG | User's Manual Publication 1771-6.5.119

Installing Your Module

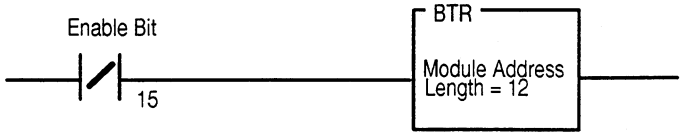
1. First, turn off power to the I/O chassis:
2. Key the backplane to accept only this kind of module.
3. Lift the chassis locking bar and slide the module into the chassis. Press firmly to seat the module into the backplane connectors.
4. Install the field wiring arm on the chassis.
5. Swing the wiring arm up to connect with the circuit board on the front of the module. Press firmly to seat and lock.
6. Turn on power to the chassis.

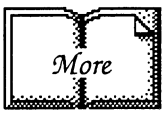


Checking Operation of Your Input Module

You can check operation of your input module by programming a simple rung and checking data values. Proceed as follows.

1. Program the following rung into your ladder logic or user program.





2. Place the PLC in run mode and observe data values in words 5 through 12. Your module is operating correctly if it is returning data in these words. **NOTE:** The module is operating in default mode, which is binary data type and 0-4095 scaling.

ATTENTION: Do not use this data for control purposes until you have read and understood the first six chapters of this manual. You must understand how the data acts under all circumstances to prevent unintended machine operation which could result in injury to personnel or damage to your process.

3. Proceed with Chapters 2 through 7 of this manual.

Extended Input Range

In any application where the inputs use the extended linear range, the program must monitor the overrange and underrange bits; especially when 0 to 9999 (BCD) scaling is used. The output data can rollover past 9999 (at V_{in} = 50mV) to 0000 (at V_{in} > 50mV).

Chapter Summary

In this chapter you read about the functional aspects of the input module and how the module communicates with programmable controllers.

Install the Module

Chapter Objectives

This chapter gives you information on:

- calculating the chassis power requirement
- choosing the module's location in the 1771 chassis
- keying a chassis slot for your module
- wiring the input module's field wiring arm
- installing the input module

Before You Install the Module

Before you insert the module into the chassis, you must complete the following.

Action required	See
Calculate the power requirements of all modules in each chassis	Appendix A, Specifications
Determine where to place the module in the I/O chassis	Module Location in the 1771 Chassis on page 4
Key the backplane connector in the I/O chassis	Key the Backplane Connector on page 5

IMPORTANT This module is a modular component of the 1771 I/O system requiring a properly installed system chassis. Refer to publication 1771-IN075 for detailed information on acceptable chassis along with proper installation and grounding requirements. Limit the maximum adjacent slot power dissipation to 10 W maximum.

ATTENTION

European Hazardous Location Approval
ASSOCIATED APPARATUS Certification

(The following applies when the product bears the Ex or EEx Marking)

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

The LCIE (Laboratoire Central des Industries Electriques) certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of apparatus for use in safe areas with Intrinsically Safe Circuits intended for use in potentially explosive atmospheres, given in Annex II to this Directive.

Compliance with the Essential Health and Safety Requirements has been assured by compliance with EN 60079-0 and EN 60079-11.

WARNING

- Equipment connected to the non-intrinsically safe side must not use or generate voltages greater than 250V rms.
- Provides intrinsically safe circuits with entity parameters of Voc = 38.2V, Isc = 40mA, Ca = 10nF, and La = 20mH when connected to thermocouples or other devices that do not contain energy storing or generating components.
- Each intrinsically safe channel must use a shielded grounded cable. Cable inductance must be below the Ca and La parameters of each intrinsically safe channel.

ATTENTION

Environment and Enclosure

This equipment is intended for use in a Pollution Degree 2 industrial environment, in overvoltage Category II applications (as defined in IEC 60664-1), at altitudes up to 2000 m (6562 ft) without derating.

This equipment is considered Group 1, Class A industrial equipment according to IEC/CISPR 11. Without appropriate precautions, there may be difficulties with electromagnetic compatibility in residential and other environments due to conducted and radiated disturbances.

This equipment is supplied as open-type equipment. It must be mounted within an enclosure that is suitably designed for those specific environmental conditions that will be present and appropriately designed to prevent personal injury resulting from accessibility to live parts. The enclosure must have suitable flame-retardant properties to prevent or minimize the spread of flame, complying with a flame spread rating of 5VA, V2, V1, V0 (or equivalent) if non-metallic. The interior of the enclosure must be accessible only by the use of a tool. Subsequent sections of this publication may contain additional information regarding specific enclosure type ratings that are required to comply with certain product safety certifications.

In addition to this publication, see:

Industrial Automation Wiring and Grounding Guidelines, for additional installation requirements, Allen-Bradley publication 1770-4.1.

NEMA Standards 250 and IEC 60529, as applicable, for explanations of the degrees of protection provided by different types of enclosure.

ATTENTION

Prevent Electrostatic Discharge

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

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

WARNING

The optional 17xx-xxx accessories are not certified for use in hazardous location applications.

Use these optional accessories only in nonhazardous location applications.

North American Hazardous Location Approval

The following information applies when operating this equipment in hazardous locations.	Informations sur l'utilisation de cet équipement en environnements dangereux.
Products marked "CL I, DIV 2, GP A, B, C, D" are suitable for use in Class I Division 2 Groups A, B, C, D, Hazardous Locations and nonhazardous locations only. Each product is supplied with markings on the rating nameplate indicating the hazardous location temperature code. When combining products within a system, the most adverse temperature code (lowest "T" number) may be used to help determine the overall temperature code of the system. Combinations of equipment in your system are subject to investigation by the local Authority Having Jurisdiction at the time of installation.	Les produits marqués "CL I, DIV 2, GP A, B, C, D" ne conviennent qu'à une utilisation en environnements de Classe I Division 2 Groupes A, B, C, D dangereux et non dangereux. Chaque produit est livré avec des marquages sur sa plaque d'identification qui indiquent le code de température pour les environnements dangereux. Lorsque plusieurs produits sont combinés dans un système, le code de température le plus défavorable (code de température le plus faible) peut être utilisé pour déterminer le code de température global du système. Les combinaisons d'équipements dans le système sont sujettes à inspection par les autorités locales qualifiées au moment de l'installation.

WARNING 	**EXPLOSION HAZARD -** • Do not disconnect equipment unless power has been removed or the area is known to be nonhazardous. • Do not disconnect connections to this equipment unless power has been removed or the area is known to be nonhazardous. Secure any external connections that mate to this equipment by using screws, sliding latches, threaded connectors, or other means provided with this product. • Substitution of components may impair suitability for Class I, Division 2. • If this product contains batteries, they must only be changed in an area known to be nonhazardous.	**AVERTISSEMENT** 	**RISQUE D'EXPLOSION –** • Couper le courant ou s'assurer que l'environnement est classé non dangereux avant de débrancher l'équipement. • Couper le courant ou s'assurer que l'environnement est classé non dangereux avant de débrancher les connecteurs. Fixer tous les connecteurs externes reliés à cet équipement à l'aide de vis, loquets coulissants, connecteurs filetés ou autres moyens fournis avec ce produit. • La substitution de composants peut rendre cet équipement inadapté à une utilisation en environnement de Classe I, Division 2. • S'assurer que l'environnement est classé non dangereux avant de changer les piles.

Module Location in the 1771 Chassis

Place the module in any slot of the 1771 chassis except for the left-most slot. This slot is reserved for the controller or adapter modules.

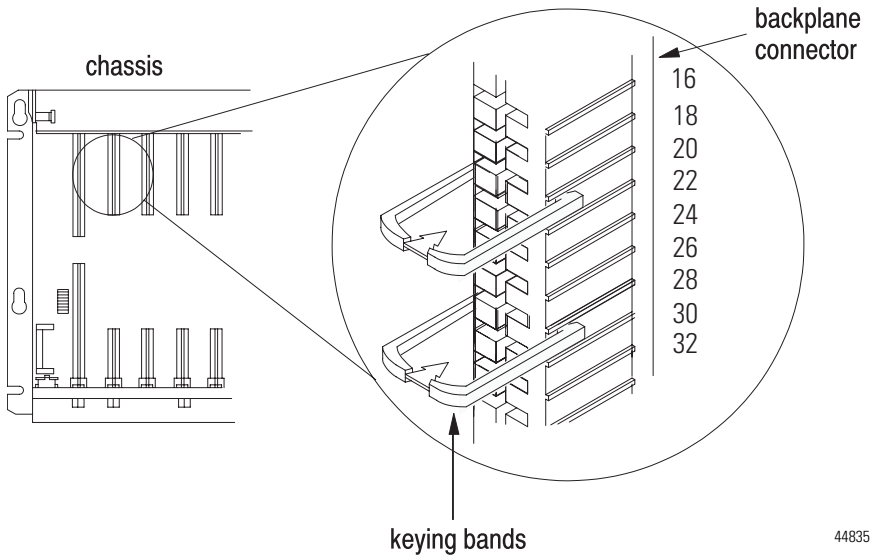
We recommend the following when placing your modules:

- Group modules to minimize adverse affects from radiated electrical noise and heat.
- Group analog input and low voltage DC modules away from AC modules or high voltage DC modules to minimize electrical noise interference.
- Do not place this module in the same I/O group with a discrete high-density I/O module when using 2-slot addressing. This module uses a byte in both the input and output image tables for block transfer.

Key the Backplane Connector

With your fingers, insert the keying bands in the backplane connector to correspond to the key slots on the module. This prevents you from inserting the wrong module into the slot. For this module, place the keying bands between the following connectors:

- 20 and 22
- 28 and 30



Install the Module and Wiring Arm

WARNING

When used in a Class I, Division 2, hazardous location, this equipment must be mounted in a suitable enclosure with proper wiring method that complies with the governing electrical codes.

Complete the following steps to install the module in the I/O chassis:

1. Remove power from the 1771 chassis.

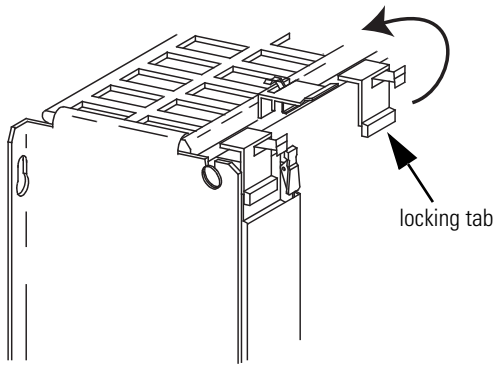
WARNING

If you insert or remove the module while backplane power is on, an electrical arc can occur. This could cause an explosion in hazardous location installations.

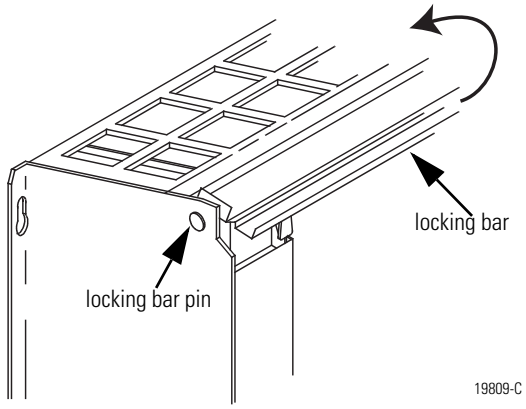
Be sure that power is removed before proceeding.

2. On the 1771 chassis, lift the locking bar or locking tab for the desired slot.

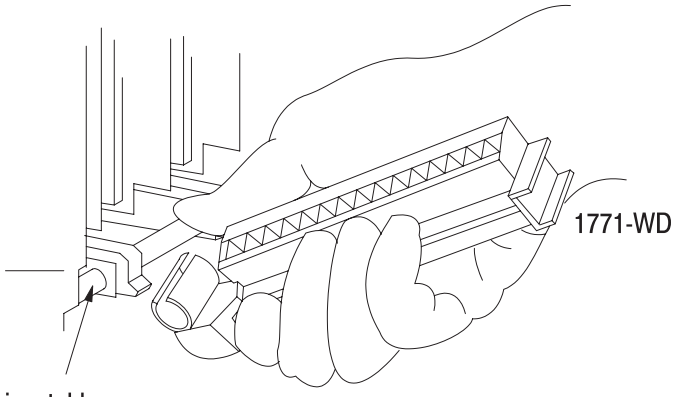
1771 Chassis



1771 Series B Chassis



3. Attach the wiring arm, 1771-WD, to the horizontal bar at the bottom of the chassis.



The wiring arm pivots upward and connects with the module so you can install or remove the module without disconnecting the wires.

4. Place the module in the plastic guides at the top and bottom of the chassis.

5. Using firm and even pressure, push the module into the slot until it is firmly seated in the chassis.

6. Snap the locking bar or tab over the module to secure it. Verify that the locking bar pin is fully engaged.

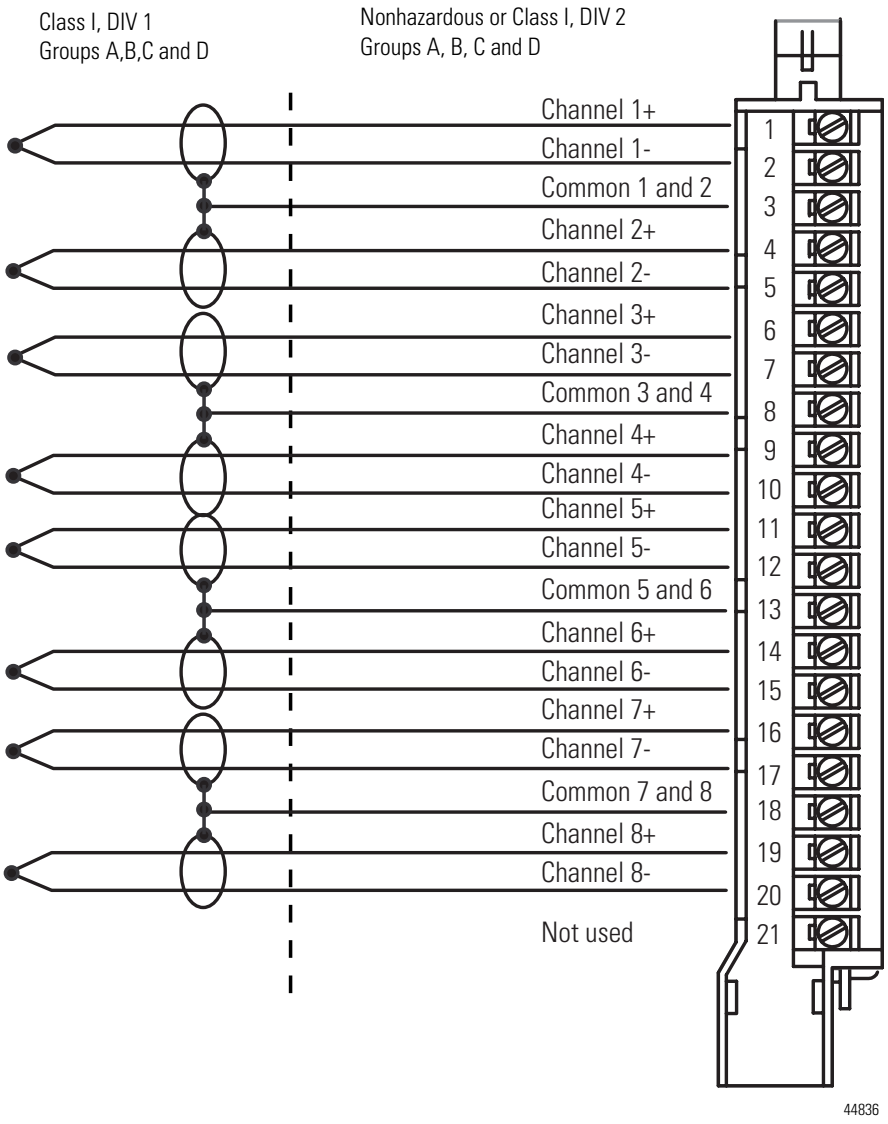
7. Swing the wiring arm into place at the front of the module.

Wire the Module

Using the diagram below, connect your I/O devices to the wiring arm.

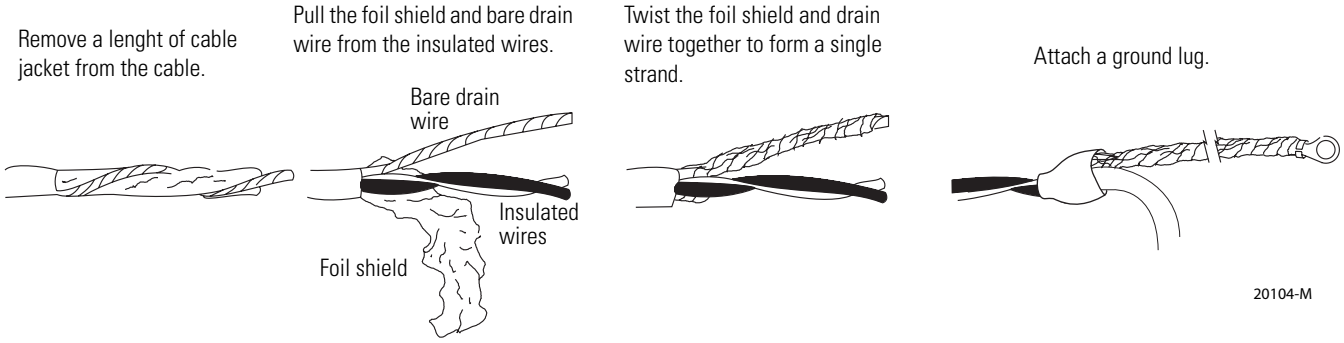
ATTENTION

Total analog input cable connection length must be less than 15 meters (50 ft).



Ground the Module

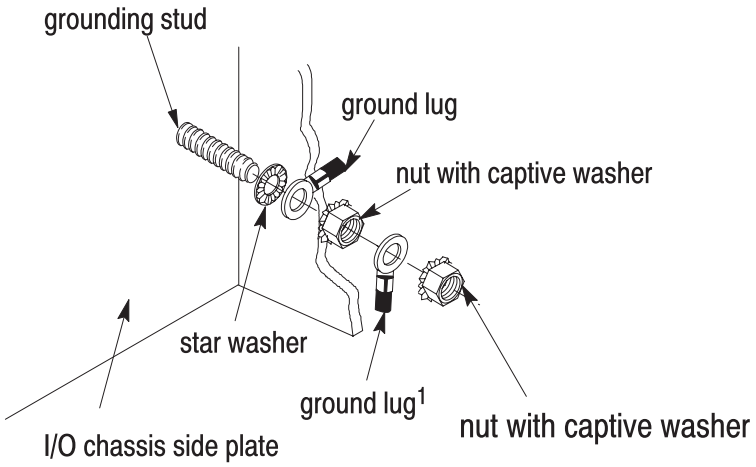
When using shielded cable wire, ground the foil shield and drain wire only at on end of the cable. We recommend that you wrap the foil shield and drain wire together and connect them to a chassis mounting bolt. At the opposite end of the cable, tape exposed shield and drain wire with electrical tape to insulate it from electrical contact.



Refer to the Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1, for additional grounding information.

Chassis Ground

When you connect grounding conductors to the chassis grounding stud, place a star washer under the first lug, then place a nut with a captive lock washer on top of each ground lug.



[1]Use the cup washer if crimp-on lugs are not used.

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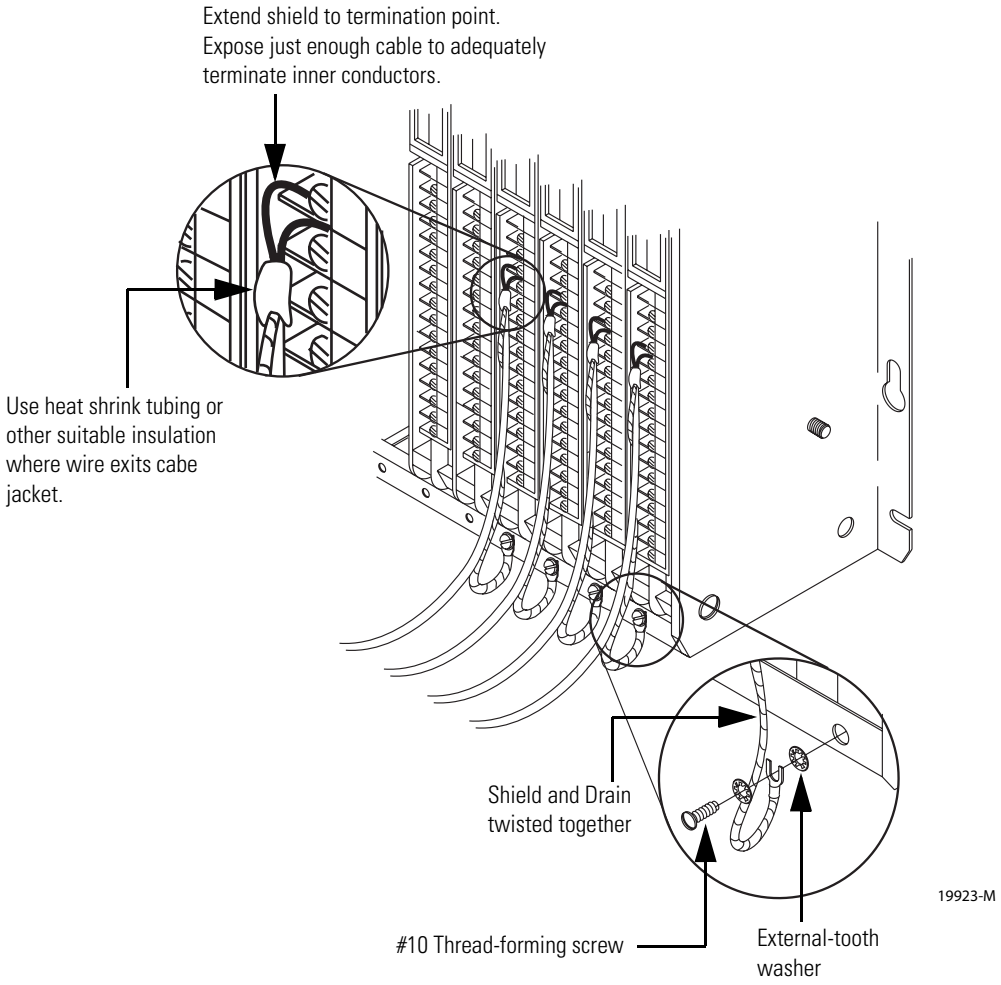
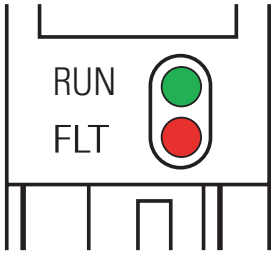
Single-point Grounding



Status Indicator Behavior

After applying power to the module, the red FLT indicator turns on during a self check. If there is not fault, the red FLT indicator turns off and the green RUN indicator turns on. If a fault occurs at a later time the red FLT indicator turns on again.

For possible module fault causes and corrective actions, see Chapter 8, Troubleshooting.



Green RUN indicator

Red FLT (fault) indicator

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Chapter Summary

In this chapter you learned how to install and wire the module.

Chapters 4 and 5 show you how to program and configure your module for the type of operation you require.

Module Programming

Chapter Objectives

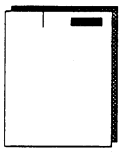
In this chapter, we describe:

- Block Transfer programming
- Sample programs in the PLC-2, PLC-3 and PLC-5 processors
- Module scan time issues

Block Transfer Programming

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

The block transfer write (BTW) instruction is initiated when the analog module is first powered up, and subsequently only when the programmer wants to write a new configuration to the module. At all other times the module is basically in a repetitive block transfer read (BTR) mode.



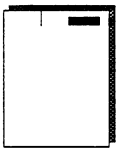
Your fast millivolt input module will power-up with a default configuration. See the configuration default section to understand what this configuration looks like. Also, refer to Appendix B for example configuration blocks and instruction addresses to get started.

The following example programs illustrate the minimum programming required for communication to take place.

PLC-5 Program Example

The PLC-5 program is very similar to the PLC-3 program with the following exceptions:

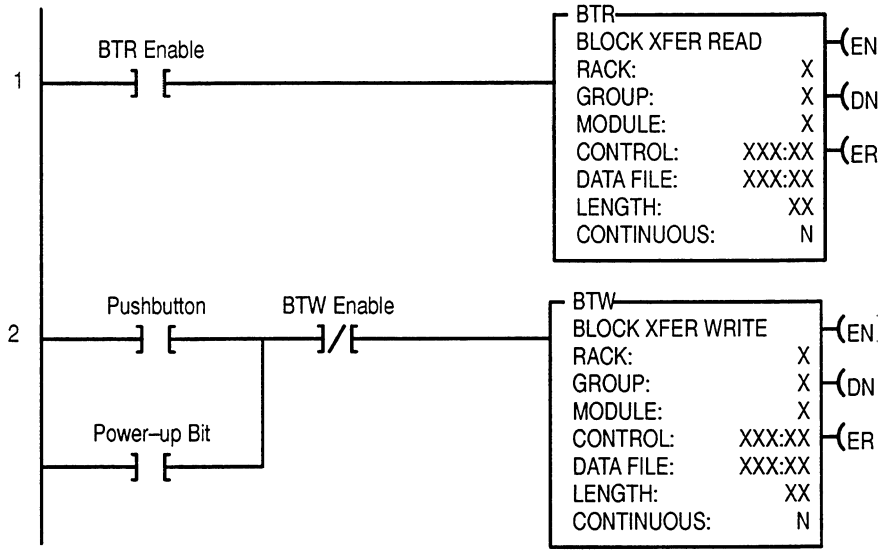
- You must use enable bits instead of done bits as the conditions on each rung.
- A separate control file must be selected for each of the BT instructions. Refer to Appendix B.



Program Action

Rungs 1 and 2 - At power-up, the program enables a block transfer read and examines the power-up bit in the BTR file (rung 1). Then, it initiates one block transfer write to configure the module (rung 2). Thereafter, the program continuously reads data from the module (rung 1).

A subsequent BTW operation is enabled by a pushbutton switch (rung 2). Changing processor mode will not initiate a block transfer write unless the first pass bit is added to the BTW input conditions.



PLC-3 Program Example

Block transfer instructions with the PLC-3 processor use one binary file in a data table section for module location and other related data. This is the block transfer control file. The block transfer data file stores data that you want transferred to the module (when programming a block transfer write) or from the module (when programming a block transfer read). The address of the block transfer data files are stored in the block transfer control file.

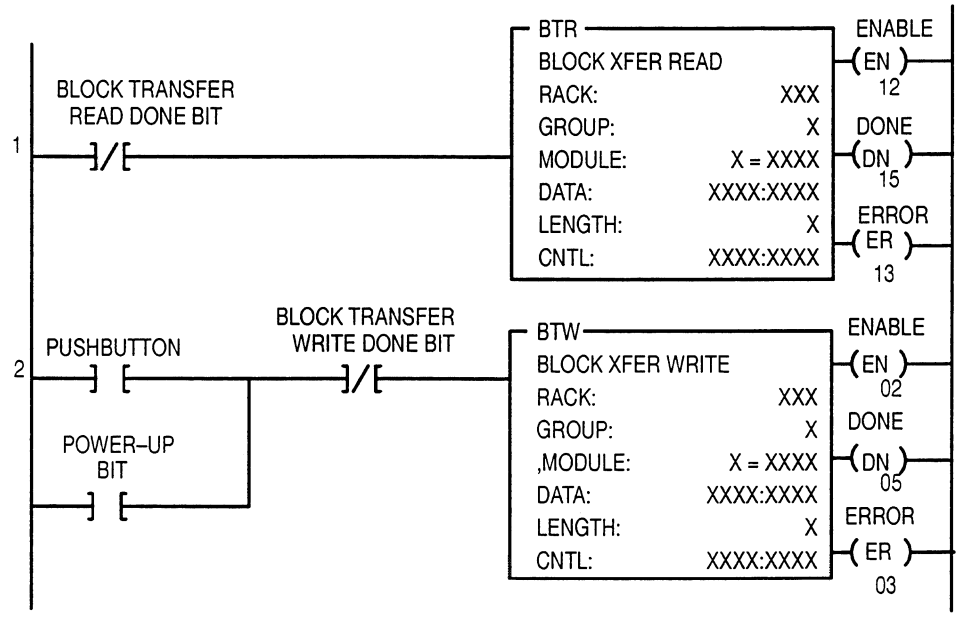
The industrial terminal prompts you to create a control file when a block transfer instruction is being programmed. **The same block transfer control file is used for both the read and write instructions for your module.** A different block transfer control file is required for every module.

A sample program segment with block transfer instructions is shown below.

Program Action

At power-up, the user program examines the BTR done bit in the block transfer read file, initiates a write block transfer to configure the module, and then does consecutive read block transfers continuously. The power-up bit can be examined and used anywhere in the program.

Rungs 1 and 2 - Rungs 1 and 2 are the block transfer read and write instructions. The BTR enable bit in rung 1, being false, initiates the first read block transfer. After the first read block transfer, the module performs a block transfer write and then does continuous block transfer reads until the pushbutton is used to request another block transfer write. After this single block transfer write is performed, the module returns to continuous block transfer reads automatically.



PLC-2 Program Example

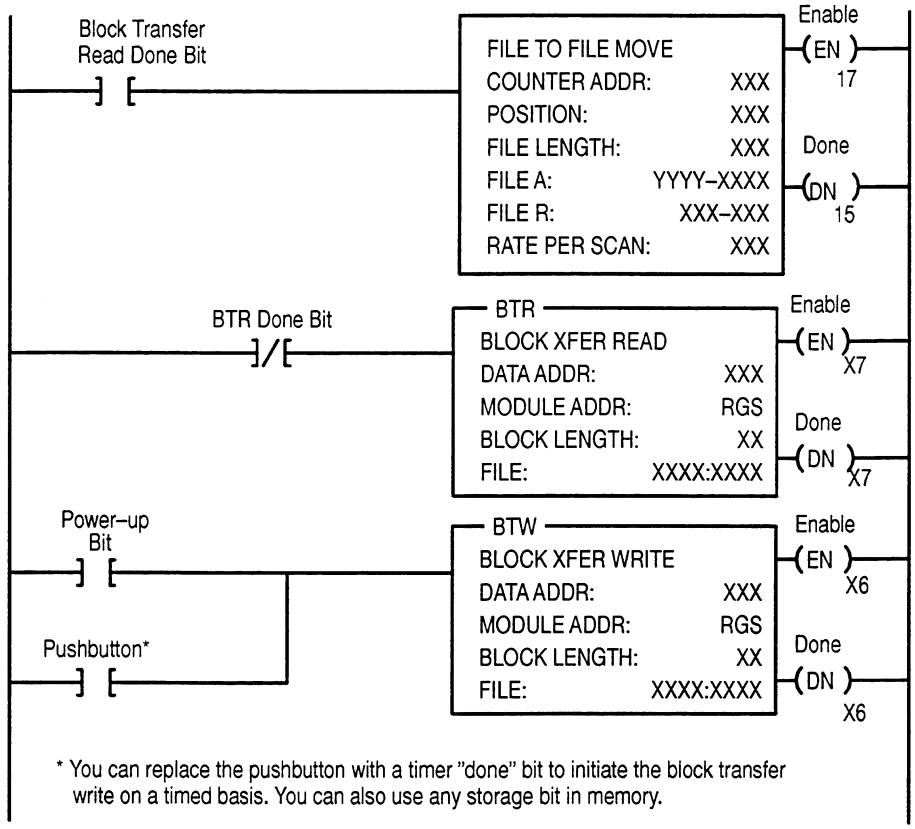
Note that PLC-2 processors that do not have the block transfer instruction must use the GET-GET block transfer format which is outlined in Appendix D.

Rung Descriptions

Rung 1 - Block transfer read buffer: the file-to-file move instruction holds the block transfer read (BTR) data (file A) until the processor checks the data integrity.

1. If the data was successfully transferred, the processor energizes the BTR done bit, initiating a data transfer to the buffer (file R) for use in the program.
2. If the data is corrupted during the BTR operation, the BTR done bit is not energized and data is not transferred to the buffer file. In this case, the data in the BTR file will be overwritten by data from the next BTR.

Rungs 2 and 3 - These rungs are the conditioning block transfer rungs. Include all the input conditioning shown in the example program.



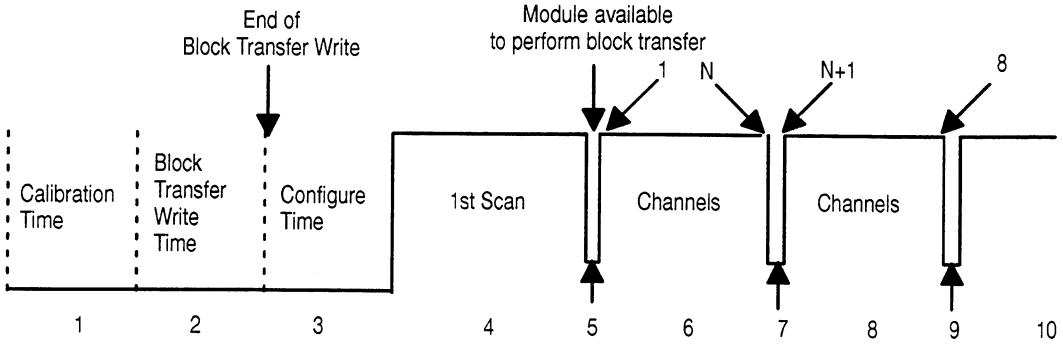
* You can replace the pushbutton with a timer "done" bit to initiate the block transfer write on a timed basis. You can also use any storage bit in memory.

Extended Input Range

In any application where the inputs use the extended linear range, the program must monitor the overrange and underrange bits; especially when 0 to 9999 (BCD) scaling is used. The output data can rollover past 9999 (at V_{in} = 50mV) to 0000 (at V_{in} > 50mV).

Module Scan Time

Scan time is defined as the amount of time it takes for the input module to read the input channels and place new data into the data buffer. Scan time for your module is shown below.



The following description references the sequence numbers in the illustration.

Following an initial self-calibration "1", a block transfer write "2", and a configuration set-up "3", the module will scan the inputs "4", and fill the data buffer "5". **Write block transfers, therefore, should only be performed when the module is being configured or calibrated.**

Any time after the second scan begins "6", a BTR request "7" can be acknowledged. This BTR empties the buffer. Input channel scanning "8" is not interrupted by the BTR.

Following the BTR the input module inhibits block transfer communications with the programmable controller until it has scanned its inputs "9". The input module repeats the scan sequence "10", updating the input values until another block transfer request is received. **Therefore, BTRs can only be completed as frequently as the total scan time of the input module.**

Scan times for the 1771-IFMS are:

- 14.5ms for 8 differential inputs.
- Add 2.5ms for digital filtering.
- Add 0.25ms for BCD data.
- Scaling adds no time.

Chapter Summary

In this chapter, you learned how to program your programmable controller. You were given sample programs for your PLC-2, PLC-3 and PLC-5 family processors.

You also read about module scan time.

Module Configuration

Chapter Objectives

In this chapter you will read how to configure your module's hardware, condition your inputs and enter your data.

Configuring Your Input Module

Because of the many analog devices available and the wide variety of possible configurations, you must configure your module to conform to the analog device and specific application that you have chosen. Data is conditioned through a group of data table words that are transferred to the module using a block transfer write instruction.

The software configurable features available with the Intrisically Safe Fast Millivolt Input Module (1771-IFMS) are:

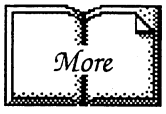
- data format
- digital filtering
- real time sampling
- scaling to engineering units

Data format, digital filtering and real time sampling can be configured with a block transfer write of only 3 or 5 words in length.

Input Type

You must also indicate what format will be used to read data from your module. Typically, BCD is selected with PLC-2 processors, and binary (also referred to as integer or decimal) is selected with PLC-3 and PLC-5 processors. To select the format, set the selection bit as indicated.

Decimal Bit 10 (Octal Bit 12)	Data Format
0	Binary
1	BCD



Refer to Appendix C for details on Data Format.

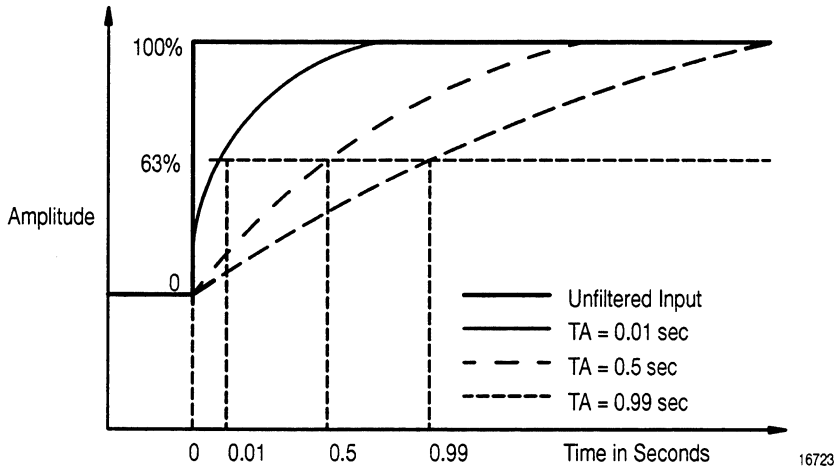
Digital Filtering

The analog input module has hardware-based high frequency filters on all channels to reduce the effect of electrical noise on the input signal. Software digital filtering is meant to reduce the effect of process noise on the input signal.

The digital filter equation is a classic first order lag equation (below). Using a step input change to illustrate the filter response, you can see that when the digital filter constant time elapses, 63.2% of the total response is reached. Each additional time constant achieves 63.2% of the remaining response.

$$Y_n = Y_{n-1} + \left[\frac{\Delta t}{\Delta t + TA} \right] (X_n - Y_{n-1})$$

Where: Y_n = present output, filtered peak voltage (PV)
Y_{n-1} = previous output, filtered PV
Δt = module channel update time (seconds)
TA = digital filter time constant (seconds)
X_n = present input, unfiltered PV



Digital filter time constant values of .00 BCD to .99 BCD (.00 BCD = no filter; .99 BCD = maximum filter) are set in bits 00 through 07 of word 3 of the block transfer write data table. If an invalid digital filter value is entered (e.g., 1F), the invalid scaling/filtering data bit in the BTR status area will be set. If an invalid digital filter value is entered, the module will not perform digital filtering. If you choose to use the digital filtering feature, the filter time constant value chosen will apply to all input signals.

Real Time Sampling

The real time sampling (RTS) mode of operation provides data from a fixed time period for use by the processor. It is available on all analog input modules.

RTS is invaluable for time based functions (such as PID and totalization) in the PLC. It allows accurate time based calculations in local or remote I/O racks.

In the RTS mode the module scans and updates its inputs at a user defined time interval (ΔT) instead of the default interval. The module ignores block transfer read (BTR) requests for data until the sample time period elapses. The BTR of **a particular data set** occurs only once at the end of the sample period and subsequent requests for transferred data are ignored by the module until a new data set is available. If a BTR does not occur before the end of the next RTS period, a time-out bit is set in the BTR status area. When set, this bit indicates that at least one data set was not transferred to the processor. (The actual number of data sets missed is unknown.) The time-out bit is reset at the completion of the BTR.

Set appropriate bits in the BTW data file to enable the RTS mode. You can select RTS periods ranging from 100 milliseconds (ms) to 3.1 seconds in increments of 100ms. Refer to the table below for actual bit settings and page 4–5 for bit locations. Note that the default mode of operation is implemented by placing all zeroes in bits 13 through 17. Note that binary representation of the RTS filter bit string is the RTS period X 100ms.

Example: 900ms = 01001 = (9 X 100ms)

Decimal Bits	15	14	13	12	11	Sample Time Period
Octal Bits	17	16	15	14	13	
	0	0	0	0	0	No RTS - Default setting = 14.5ms updates
	0	0	0	0	1	100 ms
	0	0	0	1	0	200 ms
	0	0	0	1	1	300 ms
	0	0	1	0	0	400 ms
	0	0	1	0	1	500 ms
	0	0	1	1	0	600 ms
	0	0	1	1	1	700 ms
	0	1	0	0	0	800 ms
	0	1	0	0	1	900 ms
	0	1	0	1	0	1.0 sec
	0	1	1	1	1	1.5 sec
	1	0	1	0	0	2.0 sec
	1	1	0	0	1	2.5 sec
	1	1	1	1	0	3.0 sec
	1	1	1	1	1	3.1 sec

Scaling

Your module can perform linear conversion of unscaled data to engineering units, (for example; gallons/minute, degrees C/degrees F and pounds/square inch). Unscaled data in the module has a range of 0 through 4095 for 0 to 50mV range.

The format of scaled data is 4-digit BCD or 15-bit binary. The resolution at the module of scaled values is the same as for unscaled data: one part in 4095. Resolution at the processor, however, is determined by the scaled ranges (i.e., if 0 = minimum and 500 = maximum, resolution is now 1 part in 500). Each input channel can be scaled independently of the other channels.

Implementing the Scaling Feature

You implement the scaling feature by inserting minimum and maximum scaled values in the appropriate configuration words of the block transfer write data table. See page 4–5.

Scaling Ranges

The maximum range of the scaling values is 9999 BCD or 32767 binary.

Typically, invalid scaling values are minimum values greater than maximum values, or values greater than 9999 in BCD or 32767 in binary. If invalid values are entered into the scaling words, the corresponding input in the BTR data will be zero and the invalid scaling/filtering data bit will be set. If the minimum and maximum scaling values are equal, the invalid scaling/filtering data bit will NOT be set, and the corresponding BTR data for that channel will be equal to the scaling values.

Channels Used	BTR File Length	BTW File Length
1	5	7
2	6	9
3	7	11
4	8	13
5	9	15
6	10	17
7	11	19
8	12	21

Important: Use decimally addressed bit locations for PLC-5 processors.

Fast Millivolt Input Module Default Settings

If no block transfer write block, or a write block length of 3 or 5 words with all zeroes, is sent to the Intrinsically Safe Analog Input Module (1771-IFMS), the module will default to the following configuration:

- Binary data format
- no real time sampling (RTS)
- no filtering
- 0 to 4095 scaling

A block transfer write of length 0 will default to a length of 21, so scaling values must be entered into the BTW data table.

Block Transfer Write Configuration Block

Decimal Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Octal Bit	17	16	15	14	13	12	11	10	07	06	05	04	03	02	01	00
Word 1	Not used															
2	Not used															
3	Real time sampling					Data Format	Not Used		Digital filter							
4	Not used															
5	Not used															
6	Channel one, minimum scaling value															
7	Channel one, maximum scaling value															
8	Channel two, minimum scaling value															
9	Channel two, maximum scaling value															
10	Channel three, minimum scaling value															
:	:															
21	Channel eight, maximum scaling value															

Bit/Word Descriptions for the Configuration Block

Word	Decimal Bits (Octal Bits)	Definition
1 and 2		Not used
3	Bits 0 - 7	Digital filter reduces effect of noise on input. (00 to 99 BCD)
	Bits 08 - 09 (Bits 10 - 11)	Not used
	Bit 10 (Bit 12)	Data format matches format of processor. Set for BCD (1), reset for Binary (0). See page 4–1.
	Bits 11 - 15 (Bits 13 - 17)	Real time sampling (0.1 to 3.1 sec) See page 4–3 for time intervals.

Word	Decimal Bits (Octal Bits)	Definition
4		Not used
5		Not used
6 thru 21	Bits 00 - 15 (Bits 00 - 17)	Minimum and maximum scaling values for each channel. Enter in same format as data format.

Chapter Summary

In this chapter you learned how to configure your module's hardware, condition your inputs and enter your data.

Module Status and Input Data

Chapter Objectives

In this chapter you will read about:

- reading data from your module
- input module read block format

Reading Data From Your Module

Block transfer read programming moves status and data from the input module to the processor's data table in one I/O scan (below). The processor's user program initiates the request to transfer data from the input module to the processor.

Decimal Bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00	Remarks
Octal Bit	**17**	**16**	**15**	**14**	**13**	**12**	**11**	**10**	**07**	**06**	**05**	**04**	**03**	**02**	**01**	**00**	
Word 1	Not used												Diagnostics				
2	Not used								8	7	6	5	4	3	2	1	Data underrange for channels 1 thru 8
3	Not used								8	7	6	5	4	3	2	1	Data overrange for channels 1 thru 8
4	Not used																
5	Channel 1 input																
6	Channel 2 input																
7	Channel 3 input																
8	Channel 4 input																
9	Channel 5 input																
10	Channel 6 input																
11	Channel 7 input																
12	Channel 8 input																

Block Transfer with the Fast Millivolt Input Module

Your module communicates with your processor through bidirectional block transfers. A bidirectional block transfer is the sequential performance of both read and write operations.

BTR Format

The intrinsically safe fast millivolt input module (1771-IFMS) reports the status of eight channels to the processor.

Word	Decimal Bits (Octal Bits)	Description
Word 1	Bit 00	**Power up bit** is used by the module to tell the processor that it's alive but not yet configured. It is a key element in the application program.
	Bit 01	**Out of range bit** is sent to tell the processor that one or more channels are either over or under range.
	Bit 02	**Invalid scaling/filtering data bit** reports that the scaling or filtering data is somehow invalid.
	Bit 03	**Real Time Sampling** time–out bit
Word 2	Bits 00–07	Individual **underrange bits** for each channel.
Word 3	Bits 00–07	Individual **overrange bits** for each channel.
Word 4		**Not used**
Words 5 thru 12	Bits 00–15 (Bits 00–17)	**Input values.**

Chapter Summary

In this chapter you learned the meaning of the status information that the input modules send to the processor.

Module Calibration

Chapter Objective

In this chapter we tell you:

- what tools and equipment you need
- how to calibrate your module.

Tools and Equipment

In order to calibrate your input module you will need the following tools and equipment:

Tool or Equipment	Description	Model/Type	Available from:
Precision Voltage Source	0-5V DC, 0.1mV resolution minimum	Analog 3100, Data Precision 8200 or equivalent	
Digital Voltmeter	5-1/2 digit, 0.01% accuracy minimum	Keithley 191, Fluke 8300A or equivalent	
Alignment Tool	For potentiometer adjustment	PN 35F616	Newark Electronics 5000 N. Pulaski Road Chicago, IL
Potentiometer Sealant	For sealing pots after adjustment	Torque Seal	Organic Products P.O. Box 928 Irving, TX
Industrial Terminal and Interconnect Cable	Programming terminal for A-B family processors	Cat. No. 1770-T3 or Cat. No. 1784-T45, -T50, etc.	Allen-Bradley Company Highland Heights, OH
Backplane Extender Card	To extend output module out from chassis for adjustments	Cat. No. 1771-EZ	Allen-Bradley Company Highland Heights, OH

How to Calibrate the Fast Millivolt Input Module

The fast millivolt input module is **shipped already calibrated.** If necessary to recalibrate the module, you must calibrate it in an I/O chassis. The module must communicate with the processor and industrial terminal. Calibration consists of adjusting the internal offset voltage.

ATTENTION: Do not attempt to calibrate your module until you have read and thoroughly understand this procedure. Also, do not attempt to calibrate this module in an operating system. Damage to the equipment or personal injury may result.

Adjusting the Internal Offset Voltage

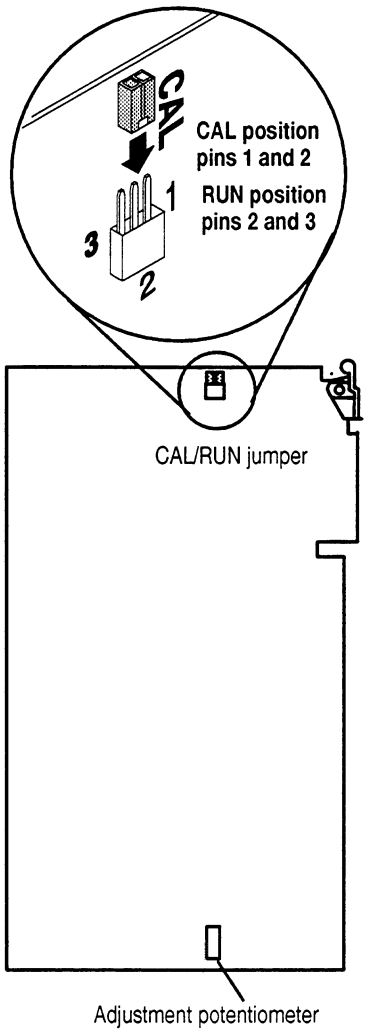
1. Turn off the power to your processor and I/O chassis.
2. Swing the field wiring arm out of the way.
3. Remove the module from the I/O chassis.
4. Remove the module covers.
5. Move the CAL/RUN jumper to the CAL position (pins 1 and 2).
6. Plug the module into the extender card (cat. no. 1771-EZ).
7. Insert the extender card (with module attached) into the chassis, and firmly seat it into the connector.
8. Reposition the field wiring arm on the module. Press firmly to seat.
9. Set the precision voltage source to 49.970mV.
10. Turn on power to the processor and I/O chassis.

Important: The calibration voltage is selected as full scale, 50mV, minus 5/2 LSBs, 30 microvolts, in order to ensure that all channels read within +1/2 LSB of each other. Verify the voltage at the input of the module.

11. With the module in the default configuration, observe the BTR file for all eight channels. Adjust the potentiometer on the bottom of the module until all eight channels flicker between FFDh and FFEh.

Important: All channel readings will not be the same. Some channels may stay on FFD while others may stay on FFE. Adjust the potentiometer until the majority of the channels flicker between FFD and FFE. When adjustment is complete, no channel should display any value other than FFD or FFE.

12. Turn off the power to the processor and I/O chassis.
13. Remove the module and extender card from the chassis and disconnect the module from the extender card.
14. Reposition the CAL/RUN jumper to the RUN position (pins 2 and 3).
15. Replace the covers and reinstall the IFM module in the chassis.



Troubleshooting

Chapter Objectives

In this chapter, we describe how to troubleshoot your module by observing the indicators and by monitoring status bits reported to the processor.

Diagnostics Reported by the Module

At power-up, the module turns on the RED indicator as a lamp test, then checks for:

- correct RAM operation
- firmware errors

Thereafter, the module turns off the red indicator and lights the green RUN indicator when operating without fault. If it detects a major fault condition, the red FAULT indicator will light. The module also reports status and specific faults (if they occur) in every transfer of data to the PC processor. Monitor the green and red indicators and status bits in word 1 of the BTR file when troubleshooting your module.

Analog Input Module

Diagnostic bits in the read block transfer status words provide diagnostic capabilities.

Word 1 provides power-up and valid data status. **Words 2 and 3** provide channel data status.

If a module on-board self test fault occurs, block transfers will be inhibited, the red fault (FLT) will light, and the green run (RUN) light will go out.

Word 1 - Diagnostics word 1 is the first data word in the read block transfer file for transfer to the central processor. It contains a power-up bit (bit 00) that is set (1) when the module is first powered up. It is reset (0) after a write block transfer. It also contains an under-range or over-range bit (bit 01) that is set when any input is under or over-range.

An invalid scaling/filtering data bit (bit 02) will be set if invalid scaling data is entered into any of the minimum/maximum scaling value words. If invalid values are entered into the minimum or maximum scaling words the corresponding read block transfer input channel word will be set to 0000. Bit 02 will also be set if an invalid digital filter value is entered (e.g., 1F). If an invalid digital filter value is entered, the module will not perform digital filtering.

The real time sample (RTS) time-out bit (bit 03) is set if the module is configured for RTS and a block transfer read has not occurred within the user-programmed period.

Word 2 - Word 2 provides for under-range conditions. When a particular channel input is under-range, the associated bit will be set. As long as inputs are under range the associated bit will remain set. Bit 00 corresponds to channel 1, bit 01 to channel 2, etc.

Word 3 - Word 3 provides for over-range conditions. When a particular channel input is over-range, the associated bit will be set. As long as inputs are in range the associated bit will remain reset. Bit 00 corresponds to channel 1, bit 01 to channel 2, etc.

The table below lists the probable cause and recommended actions for a number of common trouble indications.

Indicator Status (color)	Description of Fault or System Status	Action to Take
Module run ON (green) Module fault OFF (red)	Normal Indication	None
	Incorrect data in final storage word locations in processor's data table, possible severed or disconnected input cable associated with the affected channels.	Repair or replace cable.
	Input module is conditioned for BCD instead of binary, or vice versa, or invalid scaling values chosen.	Condition module for desired format (BCD or binary), enter correct data and initiate another block transfer write.
	Block transfers are not being performed: processor is in program mode when module powers up.	Place processor in run mode. Recycle power. Replace faulty module if necessary.
	Ladder diagram program error. Read and write block transfer both enabled in PLC-2 processor. Wrong module address in block transfer instruction, or wrong BTR or BTW lengths chosen.	Debug program.
	Equipment failure (PC processor, adapter module, etc.).	Isolate system component that has failed and replace it.
Module run OFF (green) Module fault ON (red)	Hardware failure in module.	Return module for repair.
Neither indicator ON	No power.	Turn power OFF. Remove and reinsert module into chassis. Turn power ON.
	Fuse is bad.	Return module for repair.

Specifications

Intrinsically Safe Fast Millivolt Input Module - 1771-IFMS

Attribute	Value
Inputs	8, differential, low-levels
Input voltage range	0…50 mV
Resolution	12-bit binary
Accuracy	0.1% of range @ 25 °C
Linearity	±1 LSB
Repeatability	±1 LSB
Input overvoltage protection	32V
Input impedance	1M Ω
Maximum input voltage	±10V
Common mode rejection	100dB dc - 60 Hz
Backplane current	0.75 A @ +5V
BCD and unscaled binary output to processor	$0000\ldots4095_{10}$
Engineering units sent to the processor	9999 BCD with selectable scaling 32767 Binary
A/D converter	Monotonic output with no missing codes Resolution: 12-bit binary Absolute accuracy: +0.1% full scale Quantizing error: +1/2 LSB Temperature coefficient: ±50ppm/°C of full scale range for 0…60 °C ambient Recalibration time: calibration should be checked at 6 month intervals to maintain specified accuracy Internal scan rate: 14.5 ms for 8 differential inputs (no digital filtering), add 2.5 ms for filtering
Isolation Voltage	Type tested at 1500V AC for 60 s, system to field channels No isolation between field channels
Wire Size	0.25…2.5 mm2 (22..14 AWG) solid or stranded copper wire rated at 75 °C (167 °F), or greater, 1.2 mm (3/64 in.) insulation max
Wiring Category(1)	2 - on signal ports
Wire Type	Shielded
Keying	between 20 and 22 between 28 and 30

Intrinsically Safe Fast Millivolt Input Module - 1771-IFMS

Attribute	Value
Wiring arm	1771-WG
Field Wiring Arm Screw Torque	0.8…1.0 Nm (7…9 lb•in)
Enclosure Type Rating	None (open-style)
North American Temp Code	T6

(1) Use this Conductor Category information for planning conductor routing. Refer to Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1.

Environmental Specifications

Attribute	Value
Operating Temperature	IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock): 0…60 °C (32…140 °F)
Non-Operating Temperature	IEC 60068-2-1 (Test Ab, Unpackaged Non-operating Cold), IEC 60068-2-2 (Test Bb, Unpackaged Non-operating Dry Heat), IEC 60068-2-14 (Test Na, Unpackaged Non-operating Thermal Shock): -40…85 °C (-40…185 °F)
Relative Humidity	IEC 60068-2-30 (Test Db, Unpackaged Damp Heat): 5…95% noncondensing
Vibration	IEC 60068-2-6 (Test Fc, Operating): 2 g @ 10…500 Hz
Operating Shock	IEC 60068-2-27 (Test Ea, Unpackaged Shock): 15 g
Non-Operating Shock	IEC 60068-2-27 (Test Ea, Unpackaged Shock): 30 g
Emissions	CISPR 11: Group 1, Class A (with appropriate enclosure)
ESD Immunity	IEC 61000-4-2: 6 kV indirect contact discharges 8 kV air discharges
Radiated RF Immunity	IEC 61000-4-3: 10V/m with 1 kHz sine-wave 80% AM from 80…2000 MHz 10V/m with 200 Hz 50% Pulse 100% AM at 900 MHz 10V/m with 200 Hz 50% Pulse 100% AM at 1890 MHz 3V/m with 1 kHz sine-wave 80% AM from 2000…2700 MHz
EFT/B Immunity	IEC 61000-4-4: ±1 kV at 5 kHz on signal ports
Conducted RF Immunity	IEC 61000-4-6: 10V rms with 1 kHz sine-wave 80% AM from 150 kHz…80 MHz

Certifications[1]

Attribute	Value
c-UL-us	UL Listed Industrial Control Equipment, certified for US and Canada. See UL File E112294.
CSA	CSA Certified Process Control Equipment for Class I, Division 2 Group A,B,C,D Hazardous Locations. See CSA File LR88915.
CE	European Union 2004/108/EC EMC Directive, compliant with: EN 61326-1; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity EN 61000-6-4; Industrial Emissions EN 61131-2; Programmable Controllers (Clause 8, Zone A & B)
C-Tick	Australian Radiocommunications Act, compliant with: AS/NZS CISPR 11; Industrial Emissions
Ex	European Union 94/9/EC ATEX Directive, compliant with: EN 60079-11; Explosive Atmospheres, Protection "i" EN 60079-0; General Requirements as associated apparatus with intrinsically safe circuits II (1) G [Ex ia] IIC

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

Programming Examples

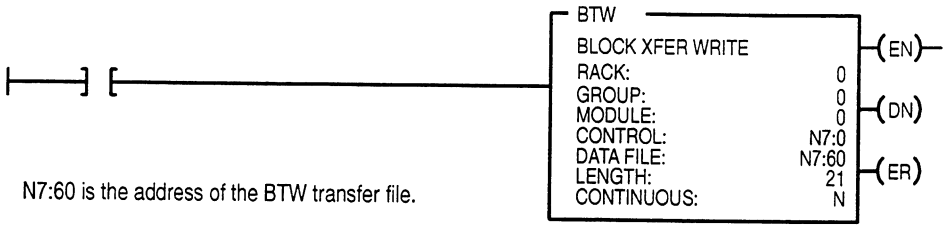
Sample Programs for the Analog Input Module

The following are sample programs for entering data in the configuration words of the write block transfer instruction when using the PLC-2, PLC-3 or PLC-5 family processors with the 1771-IFMS.

PLC-5 Family Processors

The following is a sample procedure for entering data in the configuration words of the block transfer write instruction when using a PLC-5 processor.

1. Enter the following rung:



2. Press [F8],[F5] and enter N7:60 to display the configuration block.

The industrial terminal screen should look like this.

Address	0	1	2	3	4	5	6	7	8	9
N10:0	0	0	1024	0	0	0	4095	4096	8191	8192
N10:10	12287	12288	16383	16384	20479	20480	24575	24576	28671	28672
N10:20	32767	0	0	0	0	0	0	0	0	0
N10:30	2	100	0	0	0	4096	8193	12288	16384	20481
N10:40	24577	28672	0	0	0	0	0	0	0	0
N10:50	0	0	0	0	0	0	2	100	0	0
N10:60	0	4096	8193	12288	16384	20481	24577	28672		

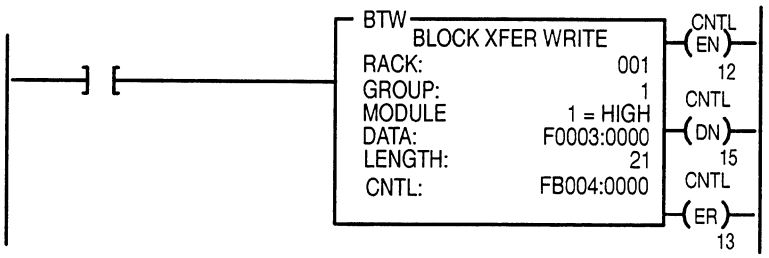
3. Enter the data corresponding to your bit selections and add scaling values, if scaling is desired.
4. [ESC] returns you to the main menu.

PLC-3 Family Processors

Following is a sample procedure for entering data in the configuration words of the write block transfer instruction when using a PLC-3 processor.

To enter data in the configuration words, follow these steps:

Example:
Enter the following rung for a write block transfer:



F0003:0000 is the address of the write block transfer data file. You want to enter/examine word 1.

1. Press [SHIFT][MODE] to display your ladder diagram on the industrial terminal.
2. Press DD,03:0[ENTER] to display the block transfer write file.

   The industrial terminal screen should look like this.

```
          START - W0003 : 0000

WORD #    0          1          2          3
00000  00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000
00004  00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000
00010  00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000
00014  00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000
00020  00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000

 DATA MONITOR                S W03:0 - [ ]
 PROG : I/O OFF  NO FORCES :  NO EDITS :  RUNG # [RM000000]  : MEM PROT OFF
```

   Notice the highlighted block of zeroes. This highlighted block is the cursor. It should be in the same place as it appears in the illustration. If not, you can move it to the desired position with the cursor control keys. Once you have the highlighted cursor in the right place, you can go on to step 3.

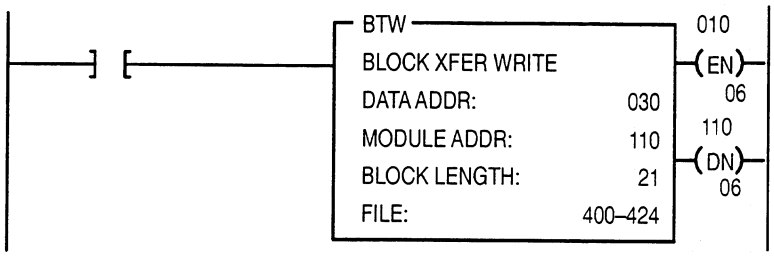
3. Enter the data corresponding to your bit selection in words 0 through 4.

4. When you have entered your data, press [ENTER]. If you make a mistake, make sure the cursor is over the word you desire to change. Enter the correct data and press [ENTER].
5. Press [CANCEL COMMAND]. This returns you to the ladder diagram.

PLC-2 Family Processors

To enter data in the configuration words, follow these steps:

Example:
Enter the following rung for a write block transfer:



400 is the address of the write block transfer data file. You want to examine configuration word 1.

In RUN/PROG Mode

Action	Result
1. Press [SEARCH]8<data address>	Finds the block address transfer instruction
2. Press CANCEL COMMAND	Removes preceeding command
3. Press [DISPLAY]0 or 1	Displays the file in binary or BCD
4. Press [SEARCH]51 Cursor defaults to first entry in file when SEARCH 51 is pressed.	On line data change
5. Press [INSERT]	Writes data to file element

In PROG Mode

Action	Result
1. Press [SEARCH]8<data address>	Finds the block transfer instruction
2. Press CANCEL COMMAND	Removes preceeding command
3. Press [DISPLAY]0 or 1	Displays the file in binary or BCD
4. Press [DISPLAY]001 and enter data	Puts cursor on word 1
5. Press [INSERT]	

Use the above procedure to enter the required words of the write block transfer instruction. Be aware that the block length will depend on the number of channels selected and whether scaling is or is not performed; for example, the block may contain only 3 words if no scaling is performed but may contain 21 words if using 8 inputs with scaling. The PLC-2 family write block transfer data file should look like this.

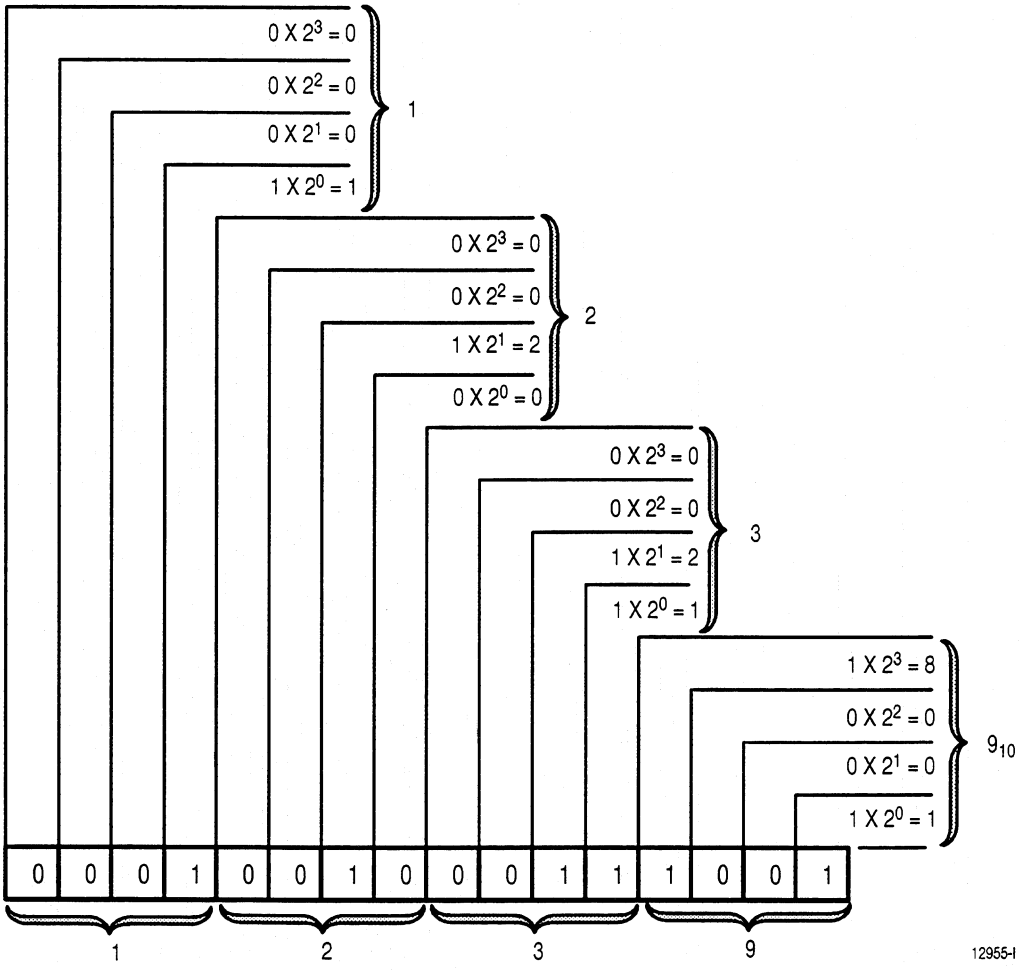
DATA ADDR: 030 BINARY DATA MONITOR BLOCK LENGTH: 21
BLOCK XFER WRITE
MODULE ADDR: 110
FILE: 400-424

POSITION	FILE DATA			
001	00000000	00000000	00000000	00000000
002	00000000	00000000	00000000	00000000
003	00000000	00000000	00000000	00000000
004	00000000	00000000	00000000	00000000
005	00000000	00000000	00000000	00000000
006	00000000	00000000	00000000	00000000
007	00000000	00000000	00000000	00000000
008	00000000	00000000	00000000	00000000

Data Formats

4-Digit Binary Coded Decimal (BCD)

The 4-digit BCD format uses an arrangement of 16 binary digits to represent a 4-digit decimal number from 0000 to 9999. The BCD format is used when the input values are to be displayed for operator viewing. Each group of four binary digits is used to represent a number from 0 to 9. The place values for each group of digits are 2^0, 2^1, 2^2 and 2^3 as shown below. The decimal equivalent for a group of four binary digits is determined by multiplying the binary digit by its corresponding place value and adding these numbers.



Binary coded decimal equivalents are shown below.

Place Value				Decimal Equivalent
2^3 (8)	2^2 (4)	2^1 (2)	2^0 (1)	
0	0	0	0	0
0	0	0	1	1
0	0	1	0	2
0	0	1	1	3
0	1	0	0	4
0	1	0	1	5
0	1	1	0	6
0	1	1	1	7
1	0	0	0	8
1	0	0	1	9

(12-bit) Binary

Binary should be used with the PLC-2 family of processors when performing computations in the processor.

The 12-bit binary format uses an arrangement of 12 binary digits to represent a decimal number ranging from 0 to 4095. The decimal equivalent of a 12-bit binary number is determined by multiplying the binary digit (0 or 1) by its corresponding place value and adding these numbers together.

Example: The following binary number is equal to decimal 3167.

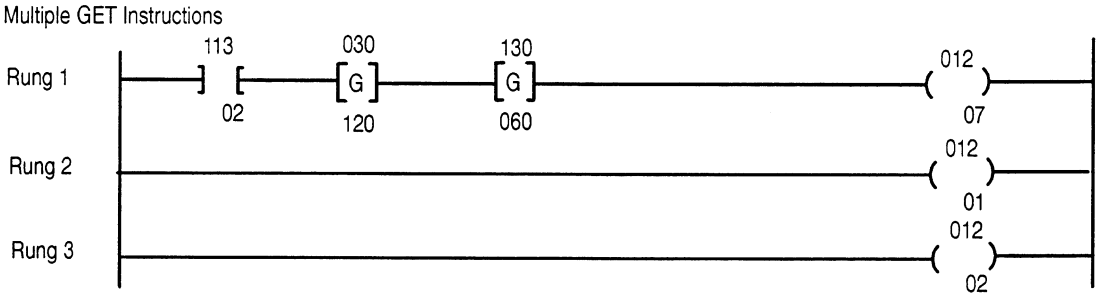
$$\begin{array}{llllllllllll} 2^{11} & 2^{10} & 2^9 & 2^8 & 2^7 & 2^6 & 2^5 & 2^4 & 2^3 & 2^2 & 2^1 & 2^0 \\ 1 & 1 & 0 & 0 & 0 & 1 & 0 & 1 & 1 & 1 & 1 & 1_2 = 3167_{10} \end{array}$$

Block Transfer (Mini-PLC-2 and PLC-2/20 Processors)

Multiple GET Instructions - Mini-PLC-2 and PLC-2/20 Processors

Programming multiple GET instructions is similar to block format instructions programmed for other PLC-2 family processors. The data table maps are identical, and the way information is addressed and stored in processor memory is the same. The only difference is in how you set up block transfer read instructions in your program.

For multiple GET instructions, individual rungs of ladder logic are used instead of a single rung with a block transfer instruction. A sample rung using multiple GET instructions is shown in and described in the following paragraphs.



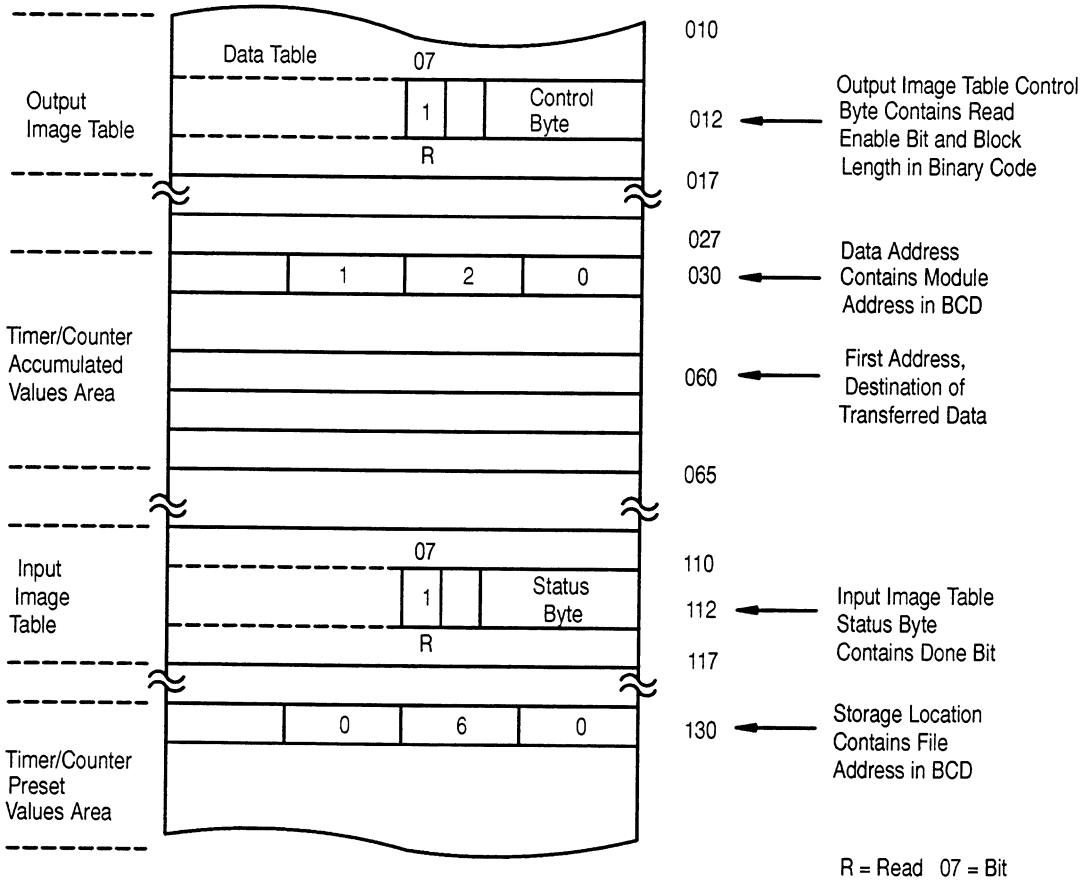
Rung 1: This rung is used to set four conditions.

- **Examine On Instruction (113/02)** - This is an optional instruction. When used, block transfers will only be initiated when a certain action takes place. If you do not use this instruction, block transfers will be initiated every I/O scan.
- **First GET Instruction (030/120)** - identifies the module's physical address (120) by rack, group and slot; and where in the accumulated area of the data table this data is to be stored (030).
- **Second GET Instruction (130/060)** - indicates the address of the first word of the file (060) that designates where the data will be transferred. The file address is stored in word 130, 100_8 above the data address.
- **Output Energize Instruction (012/07)** - enables the block transfer read operation. If all conditions of the rung are true, the block transfer read enable bit (07) is set in the output image data table control byte. The output image table control byte contains the read enable bit and the number of words to be transferred. The output energize instruction is defined as follows:
- "0" indicates that it is an output instruction
- "1" indicates the I/O rack address
- "2" indicates the module group location within the rack

- "07" indicates this is a block transfer read operation (if this were a block transfer write operation, "07" would be replaced by "06".)

Rungs 2 and 3: These output energize instructions (012/01 and 012/02) define the number of words to be transferred. This is accomplished by setting a binary bit pattern in the module's output image table control byte. The binary bit pattern used (bits 01 and 02 energized) is equivalent to 6 words or channels, and is expressed as 110 in binary notation.

Rung Summary: Once the block transfer read operation is complete, the processor automatically sets bit 07 in the input image table status byte and stores the block length of the data transferred.

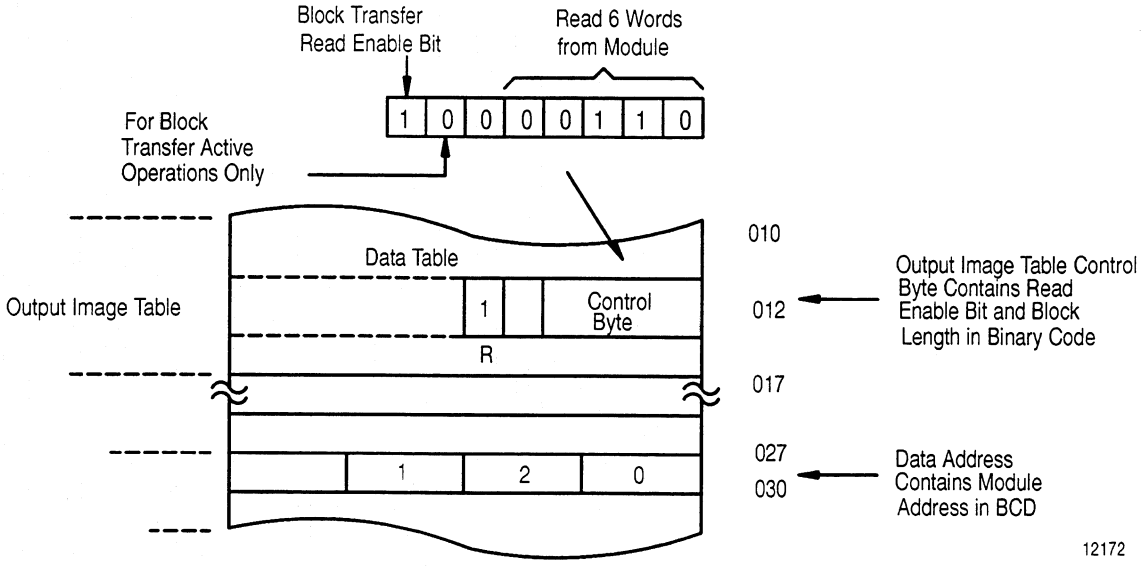


Setting the Block Length (Multiple GET Instructions only)

The input module transfers a specific number of words in one block length. The number of words transferred is determined by the block length entered in the output image table control byte corresponding to the module's address.

The bits in the output image table control byte (bits 00 - 05) must be programmed to specify a binary value equal to the number of words to be transferred.

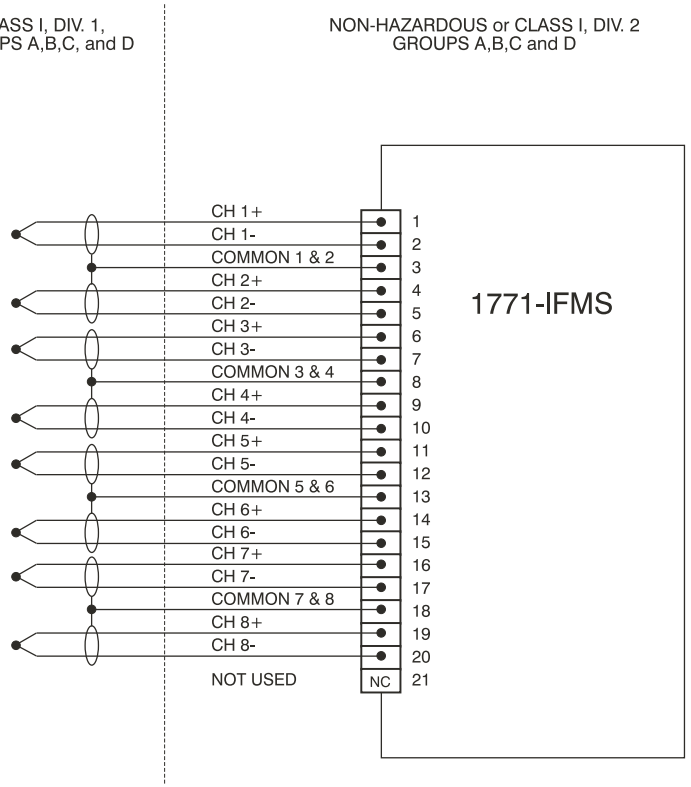
In the example below, if your input module is set up to transfer 6 words, you would set bits 01 and 02 of the lower image table control byte. The binary equivalent of 6 words is 000110. You would also set bit 07 when programming the module for block transfer read operations. Bit 06 is used when block transfer write operations are required.



Number of Words to Transfer	Binary Bit Pattern Lower Output Image Table Byte					
	05	04	03	02	01	00
Default	0	0	0	0	0	0
1	0	0	0	0	0	1
2	0	0	0	0	1	0
3	0	0	0	0	1	1
4	0	0	0	1	0	0
5	0	0	0	1	0	1
6	0	0	0	1	1	0
		:		:		
18	0	1	0	0	1	0
19	0	1	0	0	1	1

Installation Drawing

REVISIONS				
REV.	ECO NO.	DESCRIPTION	ENG./DATE	DFT./DATE
1	N/A	Change notes	NM 2/09	RD 2/09



Notes:

Provides intrinsically safe circuits with entity parameters of Voc = 38.2V, Isc = 40mA, Ca = 10nF and La = 20mH when connected to thermocouples or other devices that do not contain energy storing or generating components.

Each intrinsically safe channel must use a shielded, grounded cable. Cable capacitance and inductance must be below the Ca and La parameters of each I.S. channel.

The 1771-IFMS module shall be installed in accordance with the Canadian Electrical Code, Part I and shall be installed in an enclosure suitable for the location.

Equipment connected to the non-intrinsically safe side must not use or generate voltages > 250Vrms.

Warning - Explosion Hazard - Do not connect or disconnect module unless power has been switched off or the area is known to be non-hazardous

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A-B QUALITY

INSTALLATION DRAWING		
560A-1771-IFMS		
10/23/08		1 OF 1

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Rockwell Automation provides technical information on the Web to assist you in using its products. At http://www.rockwellautomation.com/support/, you can find technical manuals, a knowledge base of FAQs, technical and application notes, sample code and links to software service packs, and a MySupport feature that you can customize to make the best use of these tools.

For an additional level of technical phone support for installation, configuration, and troubleshooting, we offer TechConnect support programs. For more information, contact your local distributor or Rockwell Automation representative, or visit http://www.rockwellautomation.com/support/.

Installation Assistance

If you experience a problem within the first 24 hours of installation, please review the information that's contained in this manual. You can also contact a special Customer Support number for initial help in getting your product up and running.

United States	1.440.646.3434 Monday – Friday, 8am – 5pm EST
Outside United States	Please contact your local Rockwell Automation representative for any technical support issues.

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Rockwell Automation tests all of its products to ensure that they are fully operational when shipped from the manufacturing facility. However, if your product is not functioning and needs to be returned, follow these procedures.

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Outside United States	Please contact your local Rockwell Automation representative for the return procedure.

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Publication 1771-6.5.119 - April 2009
Supersedes Publication 1771-6.5.119 - January 1996

PN-40187
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