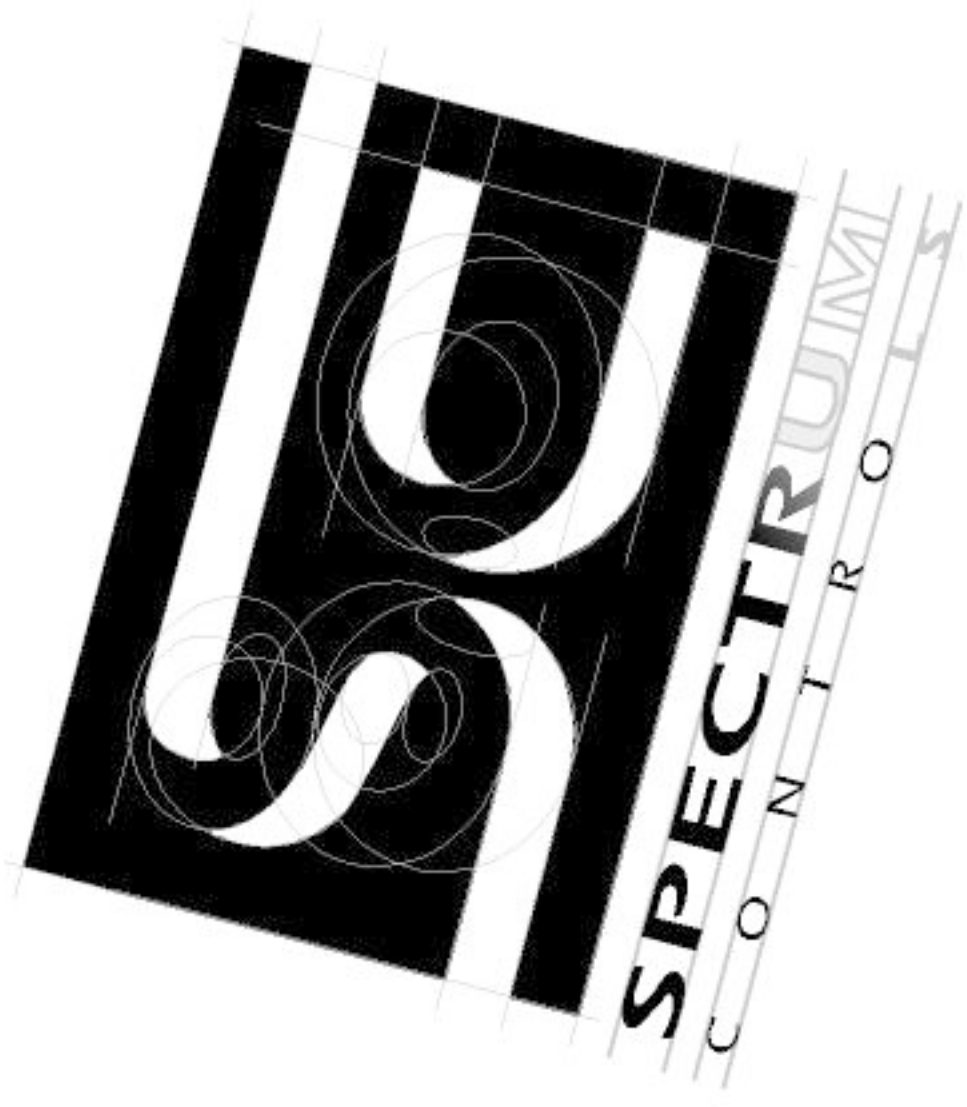
Owner's Guide 0300179-01 Rev. B

PLC-5™ 32 CHANNEL ANALOG INPUT MODULE

Catalog Numbers
1771sc-IFE32



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Important Notes

1. Please read all the information in this owner’s guide before installing the product.
2. The information in this owner's guide applies to hardware and firmware version 1.0 or later.
3. This guide assumes that the reader has a full working knowledge of the relevant processor.

Notice

The products and services described in this owner's guide are useful in a wide variety of applications. Therefore, the user and others responsible for applying the products and services described herein are responsible for determining their acceptability for each application. While efforts have been made to provide accurate information within this owner's guide, Spectrum Controls assumes no responsibility for the accuracy, completeness, or usefulness of the information herein.

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The information in this owner's guide is subject to change without notice.

Limited Warranty

Spectrum Controls warrants that its products are free from defects in material and workmanship under normal use and service, as described in Spectrum Controls literature covering this product, for a period of 1 year. The obligations of Spectrum Controls under this warranty are limited to replacing or repairing, at its option, at its factory or facility, any product which shall, in the applicable period after shipment, be returned to the Spectrum Controls facility, transportation charges prepaid, and which after examination is determined, to the satisfaction of Spectrum Controls, to be thus defective.

This warranty shall not apply to any such equipment which shall have been repaired or altered except by Spectrum Controls or which shall have been subject to misuse, neglect, or accident. In no case shall the liability of Spectrum Controls exceed the purchase price. The aforementioned provisions do not extend the original warranty period of any product which has either been repaired or replaced by Spectrum Controls.

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, Spectrum Controls 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.

Purpose of Manual:

This manual shows you how to use your Analog Input module with an Allen-Bradley programmable controller. It helps you install, program, calibrate, and troubleshoot your module.

Audience:

You must be able to program and operate an Allen-Bradley programmable controller to make efficient use of your input 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 this module.

Vocabulary:

In this manual, we refer to:

· The analog input module as the “input module” or the “module”
· The programmable controller as the “controller”

Manual Organization:

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

Chapter	Title	Topics Covered
1	Overview of Analog Input modules	Description of module including general and hardware features
2	Installing the Module	Module power requirements, keying, chassis location. Wiring of the terminal block
3	Module Programming	Sample Programs
4	Configuring Your Module	Hardware and Software Configuration Input range Selection
5	Module Status and Input Data	Reading Data from the Module Read block format
6	Calibrating Your Module	Information on Calibrating your Module
7	Troubleshooting Your Module	Troubleshooting guide for problem diagnosis
Appendix	**Title**	**Topics Covered**
A	Specifications	

Product Compatibility

The 1771-IFE 32 module can be used with any 1771 I/O chassis. Communication between the discrete analog module and the processor is bi-directional; the processor block-transfers output data through the output image table to the module and block-transfers input data from the module through the input image table. The module also requires an area in the data table to store the read block transfer data and write block transfer data. I/O image table use is an important factor in module placement and addressing selection.

You can place your input module in any I/O module slot of the I/O chassis. You can put two input modules in the same module group. You can put an input and an output module in the same module group.

Do not put the module in the same module group as a discrete high-density module. Avoid placing analog input modules close to ac modules or high voltage dc modules.

Related Publications

For a list of publications with information on Allen-Bradley programmable controller products, consult our publication index (SD499).

Contents

Chapter 1

Overview of the Analog Input Module

Chapter Objectives

This chapter, we describe:

· features of the module
· how the module communicates with programmable controllers

Module Description

The analog 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. (If using passive transducers for input, the user must supply loop power.) 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 Analog input module senses up to 32 single-ended or 16 differential analog inputs and converts them to a proportional four-digit BCD, 16 bit binary and 12 bit binary formats. You can select from five voltage or three current input ranges.

Channels may be configured to acquire data as singled-ended inputs or as differential pairs. During differential acquisition, odd channels (1, 3, 5, etc.) are the positive input and the even channels (2, 4, 6, etc.) the negative inputs. A channel pair consists of two consecutive channels (1&2, 3&4, 5&6, etc.). Within a channel pair both channels must be specified as single acquisition or both as differential acquisition. Within a group of 8 consecutive channels, all 8 channels must be from either 8 voltage or 8 current sources. If part of a voltage group, a channel may be any of the allowed voltage ranges and if in a current group a channel may be any of the allowed current ranges as long as all 8 are either voltage ranges or all 8 are current ranges.

This module's program selectable features include:

· 32 single-ended or 16 differential inputs
· User program selectable input ranges on a per channel basis (see table)
· Selectable real-time sampling
· Selectable scaling to engineering units
· Selectable digital filtering
· Selectable data format

Program Selectable Input Ranges

Valid acquisition types/ranges are listed below:

Single Ended Ranges:	Limits:	Differential Ranges:	Limits:
0*	-10 to +10 V	8	-10 to +10 V
1	0 to +10 V	9	0 to +10 V
2	0 to +5 V	10	0 to +5 V
3	+1 to +5 V	11	+1 to +5 V
4	-5 to +5 V	12	-5 to +5 V
5	0 to +20 ma	13	NA
6	+4 to +20 ma	14	NA
7	-20 to +20 ma	15	**Disabled

* = Default

** = Disabled. If this is the selected value, acquisition of this channel is disabled. This can be used to

improve throughput in modules where some channels are not used.

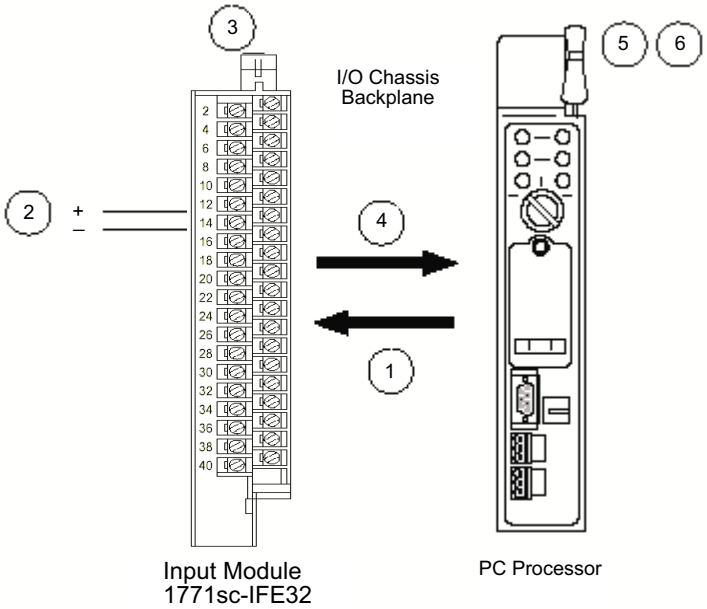
NA = Not allowed.

How Analog Modules Communicate with Programmable Controllers

The processor 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 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 to the module via 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 these 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 operator intervention or at power-up.

Accuracy

The accuracy of your input module is described in Appendix A.

Chapter Summary

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

Installing the Input Module

Chapter Objectives

In this chapter, we tell you about:
- calculating the chassis power requirement
- choosing the module's location in the I/O chassis
- configuring your module configuration plugs
- keying a chassis slot for your module
- installing the input module
- wiring the input module's field wiring arm

Compliance to European Union Directives

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.

Before You Install Your Input Module

Before installing your input module in the I/O chassis:

You need to:	As described under:
Calculate the power requirements of all modules in the chassis.	Power requirements, page....
Determine were to place the I/O module in the chassis Key the backplane connector to the I/O chassis	Module locating in the I/O chassis, page... Module Keying, page....
Make connections to the wiring arm	Wiring your input module, page... and grounding, page...

Important:

The 1771-IFE32 module is shipped from the factory set for voltage mode applications. *Refer to "Setting the Configuration on the Module"on page 2–3 for other combinations of current and voltage inputs.*

Electrostatic Damage:

Electrostatic discharge can damage semiconductor devices inside this module if you touch backplane connector pins. Guard against electrostatic damage by observing the following precautions:

ATTENTION: Electrostatic discharge can degrade performance or cause permanent damage. Handle the module as stated below.

- Wear an approved wrist strap grounding device, or touch a grounded object to rid yourself of electrostatic charge before handling the module.
- Handle the module from the front, away from the backplane connector. Do not touch backplane connector pins.
- Keep the module in its static-shield bag when not in use.

WARNING: Power, input and output (I/O) wiring must be in accordance with Class I, Division 2 wiring methods (Article 501-4(b) of the National Electrical Code, NFPA 70) and in accordance with the authority having jurisdiction.

- Peripheral equipment must be suitable for the location in which it is used.

WARNING – EXPLOSION HAZARD – SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABLIITY FOR CLASS I, DIVISION 2

WARNING – EXPLOSION HAZARD – WHEN IN HAZARDOUS LOCATIONS, TURN OFF POWER BEFORE REPLACING OR WIRING MODULES.

WARNING – EXPLOSION HAZARD – DO NOT DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS.

THIS EQUIPMENT IS SUITABLE FOR USE IN CLASS I, DIVISION 2, GROUPS A, B, C, AND D OR NON-HARZARDOUS LOCATIONS ONLY.

Power Requirements:

Your module receives its power through the 1771 I/O power supply. The module requires a maximum of 400mA from the backplane.

Add this current to the requirements of all other modules in the I/O chassis to prevent overloading the chassis backplane and/or backplane power supply.

Locating the Module in the I/O Chassis

Place your module in any I/O module slot of the I/O chassis except for the extreme left slot. This slot is reserved for PC processors or adapter modules.

Group your modules to minimize adverse affects from radiated electrical noise and heat. We recommend the following.

- 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

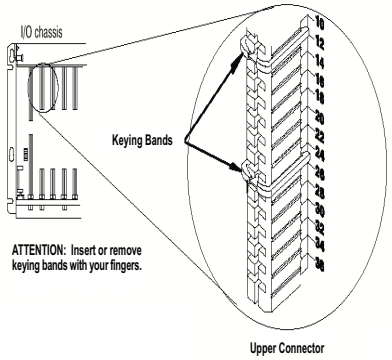
Place your module in any slot in the chassis except the leftmost slot, which is reserved for processors or adapters.

ATTENTION: Observe the following precautions when inserting or removing keys:

- insert or remove keys with your fingers
- make sure that key placement is correct incorrect keying or the use of a tool can result in damage to the backplane connector and possible system faults.

The 1771sc-IFE32 module is slitted at two places on the rear edge of the circuit board. These slots mate with plastic keying bands which mount on the backplane connector.

Position the keying bands in the backplane connector to correspond to the key slots.



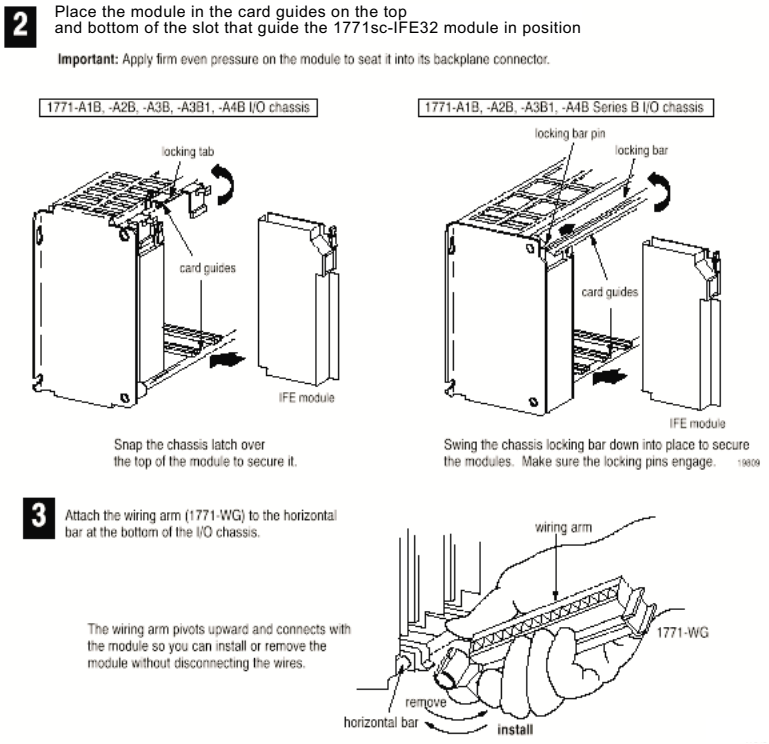
Wiring Your Analog Module

Connect your I/O devices to the cat. no. 1771-WG wiring arm shipped with the module. The wiring arm is attached to the pivot bar at the bottom of the I/O chassis. It pivots upward and connects with the module so you can install or remove the module without disconnecting the wires. You may also use a prewired swing arm, Allen-Bradley part number 1492-cable[1]WN.

ATTENTION:

Remove power from the 1771 I/O chassis backplane and field-wiring arm before removing or installing an I/O module.

- Failure to remove power from the backplane or wiring arm could cause module damage, degradation of performance, or injury.
- Failure to remove power from the backplane could cause injury or equipment damage due to possible unexpected operation.



To minimize ground-loop currents on input circuits:

- use differential mode
- use 2-wire transmitters with a common power supply
- separate 2-wire and 4-wire transmitters between different modules
- tie 4-wire transmitter and/or separate power supply grounds together

Important:
We do not recommend mixing 2-wire and 4-wire transmitter inputs on the same module. Power supply placement can make it impossible to eliminate ground loops.

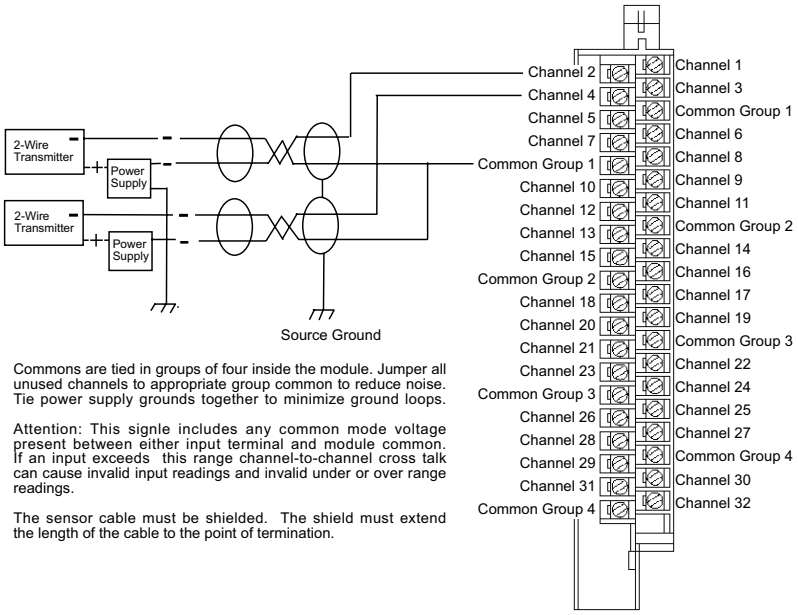
Cable Lengths

Recommended maximum cable length for voltage-mode input devices is 50 feet. This recommendation is based on considerations of signal degradation and electrical noise

immunity in typical industrial environments. Cable length for current-mode input devices need not be as restrictive because analog signals from these devices are less sensitive to electrical noise interference.

Input connections for the 1771sc-IFE32 module with single-ended and differntial inputs are shown in the following figures.

Connection Diagram for 32 Single-ended Inputs and Two-wire Transmitters

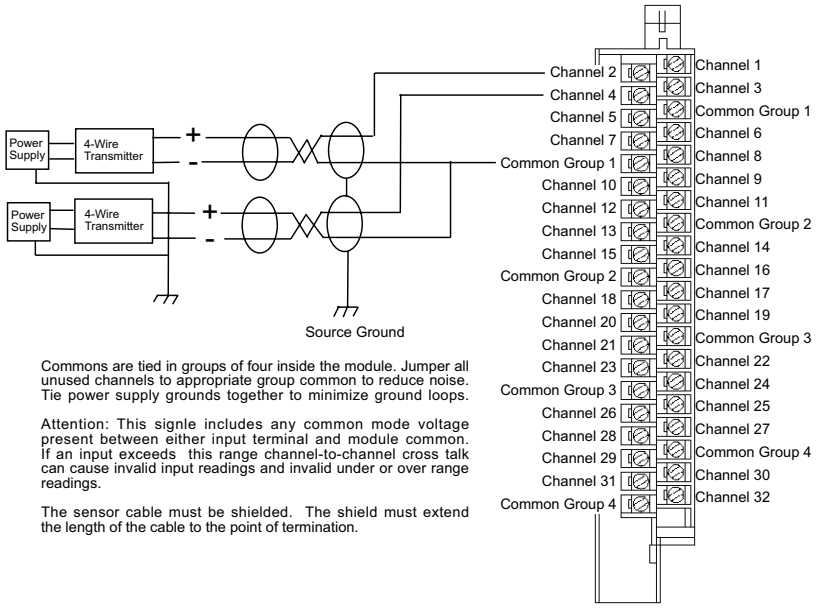


Commons are tied in groups of four inside the module. Jumper all unused channels to appropriate group common to reduce noise. Tie power supply grounds together to minimize ground loops.

Attention: This signle includes any common mode voltage present between either input terminal and module common. If an input exceeds this range channel-to-channel cross talk can cause invalid input readings and invalid under or over range readings.

The sensor cable must be shielded. The shield must extend the length of the cable to the point of termination.

Connection Diagram for 32 Single-ended Inputs and Four-wire Transmitters

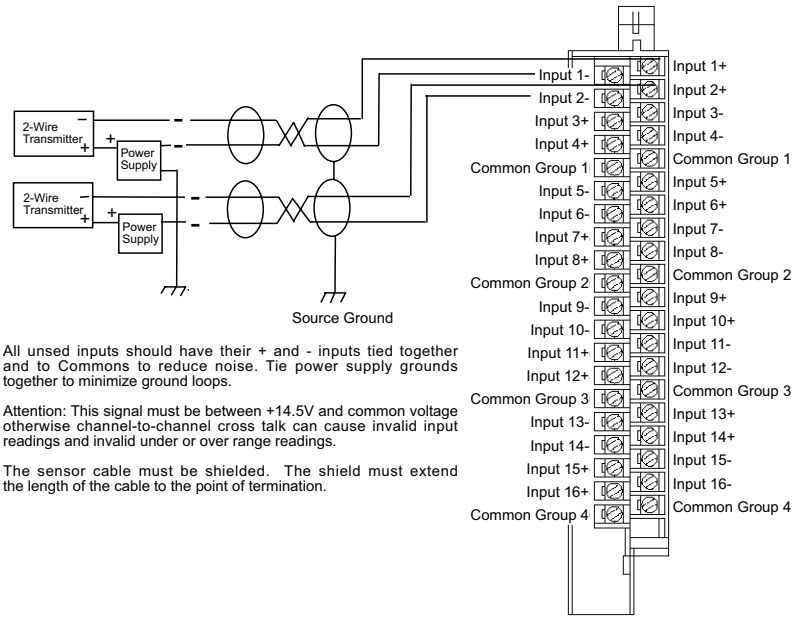


Commons are tied in groups of four inside the module. Jumper all unused channels to appropriate group common to reduce noise. Tie power supply grounds together to minimize ground loops.

Attention: This signle includes any common mode voltage present between either input terminal and module common. If an input exceeds this range channel-to-channel cross talk can cause invalid input readings and invalid under or over range readings.

The sensor cable must be shielded. The shield must extend the length of the cable to the point of termination.

Connection Diagram for 16 Differential Inputs and Two-wire Transmitters

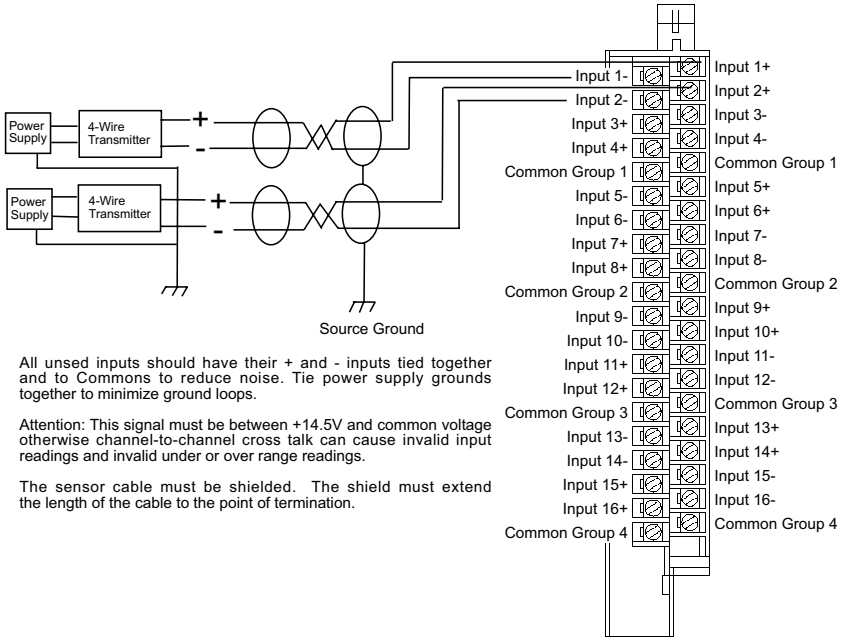


All unsed inputs should have their + and - inputs tied together and to Commons to reduce noise. Tie power supply grounds together to minimize ground loops.

Attention: This signal must be between +14.5V and common voltage otherwise channel-to-channel cross talk can cause invalid input readings and invalid under or over range readings.

The sensor cable must be shielded. The shield must extend the length of the cable to the point of termination.

Connection Diagram for 16 Differential Inputs and Four-wire Transmitters



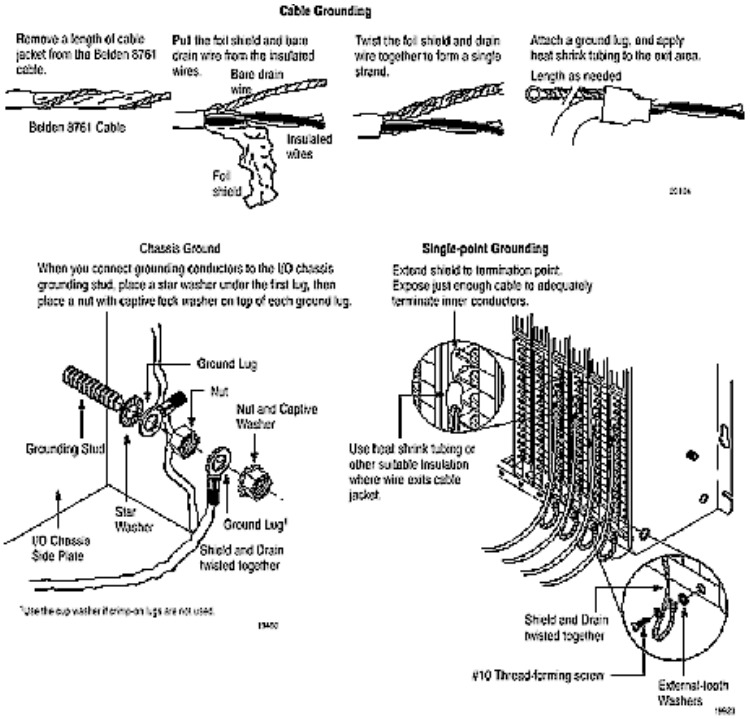
All unsed inputs should have their + and - inputs tied together and to Commons to reduce noise. Tie power supply grounds together to minimize ground loops.

Attention: This signal must be between +14.5V and common voltage otherwise channel-to-channel cross talk can cause invalid input readings and invalid under or over range readings.

The sensor cable must be shielded. The shield must extend the length of the cable to the point of termination.

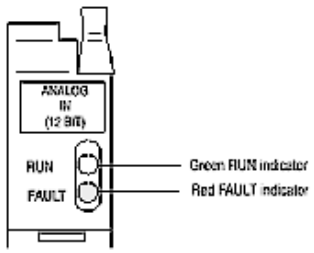
Grounding

When using shielded cable wire, ground the foil shield and drain wire only at one end of the cable. We recommend that you wrap the foil shield and drain wire together, and connect them to a chassis mounting bolt, grounding stud or chassis single-point grounding point (Figure 2.5). Use heat shrink tubing to seal the exit point of the wires. At the opposite end of the cable, tape exposed shield and drain wire with electrical tape to insulate it from electrical contact.



Indicator Lights:

The front panel of the analog input module contains a green RUN indicator and a red FAULT indicator. At power-up an initial module self-check occurs. If there is no fault, the red indicator turns off.



The green indicator comes on when the module is powered. It will flash until the module is programmed. If a fault is found initially or occurs later, the red fault indicator lights. Possible module fault causes and corrective action is discussed in Chapter 6, Troubleshooting.

Chapter Summary

In this chapter you learned how to install your input module in an existing programmable controller system and how to wire the field swing arm.

Module Programming

Chapter Objectives:

In this chapter we describe:

- block transfer programming
- sample programs for PLC-5 processors
- module scan time issues

Block Transfer Programming

Your module communicates with your processor through bi-directional 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.

The application programs for the three processor families were written to accomplish this handshaking in the described manner. They are minimum programs; all the rungs and conditioning must be included in your application program. If you wish to disable BTRs for any reason, or add interlocks to the BTW rung to prevent writes from happening at certain times, you are allowed to do it. You may **not** eliminate any storage bits or interlocks that are included in our examples. If interlocks are removed, the program may not work properly.

The analog input module's green LED will flash unit the module is programmed. The module will work with a default configuration of zeroes entered in all five words of a five word BTW configuration block. Upon writing zeros to the configuration word the LED will stop blinking. See the configuration default section to understand what this configuration will look like. Also, refer to Appendix C for example configuration blocks and instruction addresses to get started.

Figure 3.1
PLC-2 Family Sample Program Structure

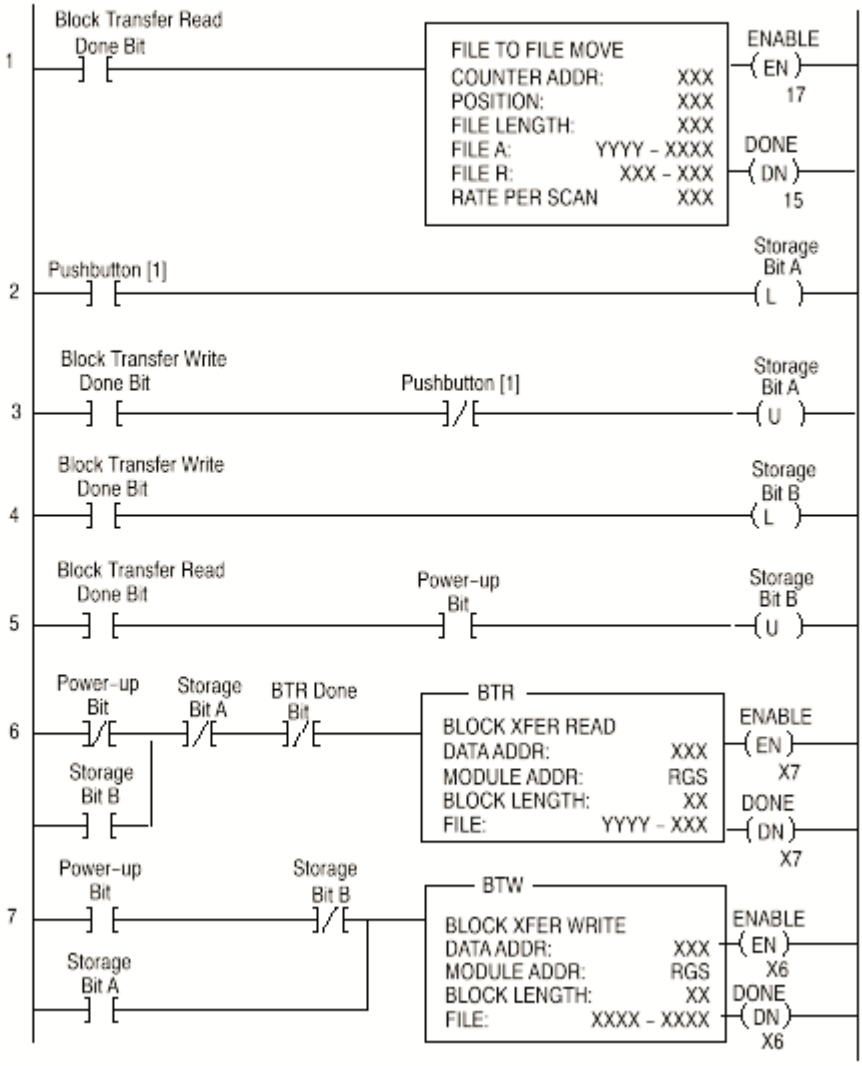
Rung 1
Block transfer read buffer: the file-to-file move instruction holds the block transfer read (BTR) data (file A) until the processor checks the data integrity. If the data was successfully transferred, the processor energizes the BTR done bit, initiating a data transfer to the buffer (file R) for use in the program.

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 provide for a user-initiated block transfer write (BTW) after the module is initialized at power-up. Pressing the pushbutton locks out BTR operation and initiates a BTW that reconfigures the module. Block transfer writes will continue for as long as the pushbutton remains closed.

Rungs 4 and 5
These rungs provide a "read-write-read" sequence to the module at power-up. They also make sure that only one block transfer (read or write) is enabled during a particular program scan.

Rungs 6 and 7
These rungs are the conditioning block transfer rungs. Include all the input conditioning shown in the example program.



[1] 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.

PLC-5 Programming:

The PLC-5 program is very straight forward with the following exceptions:

1. You must use enable bits instead of done bits as the conditions on each rung.
2. A separate control file must be selected for each of the block transfer instructions.

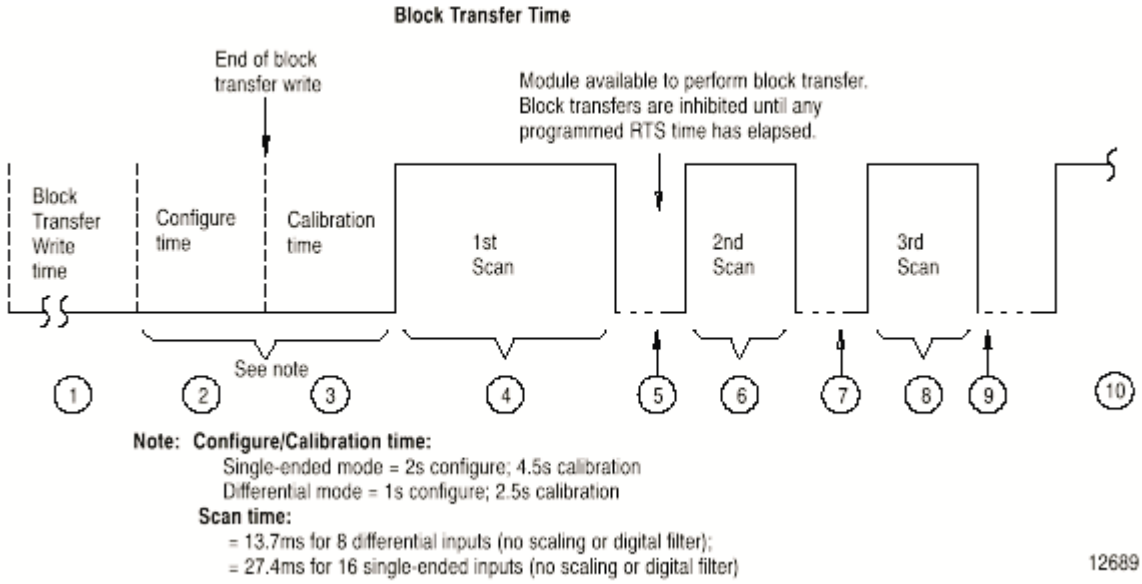
Module Scan Time

Update 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 in Appendix A.

Following a block transfer write “1” the module inhibits communication until after it has configured the data “2,” performed calibration check “3” (if requested), scanned the inputs “4,” and filled 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 interrupts the scan and the BTR empties the buffer. (If RTS is enabled, a BTR will only occur after the specified time period. Refer to chapter 4.)

Following the BTR, the input module inhibits block transfer communications with the programmable controller until it has scanned its inputs “8” and new data is ready ”9.” The input module repeats the scan sequence “10,” updating the input values until another block transfer request is received. Therefore, BTRs will only be completed as frequently as the total update time of the input module.



Chapter Summary

In this chapter, you learned to program your programmable controller. You were given a sample program for your PLC-5 processor.

Configuring Your Module

Chapter Objectives:

In this chapter, we describe;

· configuring your module's features
· conditioning your inputs
· entering 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 Analog Input Module (cat. no. 1771sc-IFE32 are:

· input range selection
· input type
· data format
· digital filtering
· real time sampling
· scaling to engineering units

Block Transfer Write (BTW) Maps

Two distinctly different block transfer writes (BTW) can be performed to configure the module. The first, BTW1, configures the module.

During normal operation the processor transfers 0 to 22 words to the module when you program a block transfer write instruction to the module's address. This BTW file contains configuration words for each channel.

When user-define scaling is used a second BTW word is required and it's length is 64 words.

BTW:	N Words:	Purpose:	Required?
BTW1	23	Module Configuration	Required
BTW2	64	User Scaling	Optional

Configuration Word

The channel configuration word is described below:

Input Type/Range must be configured using Binary or Hexidecimal values.

Word/Bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00	Group
0	Channel 4				Channel 3				Channel 2				Channel 1				*Type/Range
1	Channel 8				Channel 7				Channel 6				Channel 5				*Type/Range
2	Channel 12				Channel 11				Channel 10				Channel 9				*Type/Range
3	Channel 16				Channel 15				Channel 14				Channel 13				*Type/Range
4	Channel 20				Channel 19				Channel 18				Channel 17				*Type/Range
5	Channel 24				Channel 23				Channel 22				Channel 21				*Type/Range
6	Channel 28				Channel 27				Channel 26				Channel 25				*Type/Range
7	Channel 32				Channel 31				Channel 30				Channel 29				*Type/Range
8	Channel 4				Channel 3				Channel 2				Channel 1				Data Format
9	Channel 8				Channel 7				Channel 6				Channel 5				Data Format
10	Channel 12				Channel 11				Channel 10				Channel 9				Data Format
11	Channel 16				Channel 15				Channel 14				Channel 13				Data Format
12	Channel 20				Channel 19				Channel 18				Channel 17				Data Format
13	Channel 24				Channel 23				Channel 22				Channel 21				Data Format
14	Channel 28				Channel 27				Channel 26				Channel 25				Data Format
15	Channel 32				Channel 31				Channel 30				Channel 29				Data Format
16	Chan 8		Chan 7		Chan 6		Chan 5		Chan 4		Chan 3		Chan 2		Chan 1		Filter Freq
17	Chan 16		Chan 15		Chan 14		Chan 13		Chan 12		Chan 11		Chan 10		Chan 9		Filter Freq
18	Chan 24		Chan 23		Chan 22		Chan 21		Chan 20		Chan 19		Chan 18		Chan 17		Filter Freq
19	Chan 32		Chan 31		Chan 30		Chan 29		Chan 28		Chan 27		Chan 26		Chan 25		Filter Freq
20	Automatic Calibration Rate																Autocal
21	Debug Flags																Debug Flags
22	Real Time Sampling																RTS

Input Range Selection

Channels may be configured to acquire data as singled-ended inputs or as differential pairs. During differential acquisition, odd channels (1, 3, 5, etc.) are the positive input and the even channels (2, 4, 6, etc.) the negative inputs. A channel pair consists of two consecutive channels (1&2, 3&4, 5&6, etc.). **Within a channel pair both channels must be specified as single acquisition or both as differential acquisition.**

Word/Bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00	Group
0	Channel 4				Channel 3				Channel 2				Channel 1				*Type/Range
1	Channel 8				Channel 7				Channel 6				Channel 5				*Type/Range
2	Channel 12				Channel 11				Channel 10				Channel 9				*Type/Range
3	Channel 16				Channel 15				Channel 14				Channel 13				*Type/Range
4	Channel 20				Channel 19				Channel 18				Channel 17				*Type/Range
5	Channel 24				Channel 23				Channel 22				Channel 21				*Type/Range
6	Channel 28				Channel 27				Channel 26				Channel 25				*Type/Range
7	Channel 32				Channel 31				Channel 30				Channel 29				*Type/Range

Several input ranges for voltage and current are supported. Ranges that include both negative and positive values are referred to as bipolar ranges throughout this document. Ranges that include only positive values are referred to as unipolar. **Within a group of 8 consecutive channels, all 8 channels must be from either 8 voltage or 8 current sources. If part of a voltage group, a channel may be any of the allowed voltage ranges and if in a current group a channel may be any of the allowed current ranges as long as all 8 are either voltage ranges or all 8 are current**

ranges.

Valid acquisition types/ranges are listed below:

Single Ended Ranges:	Limits:
0*	-10 to +10 V
1	0 to +10 V
2	0 to +5 V
3	+1 to +5 V
4	-5 to +5 V
5	0 to +20 ma
6	+4 to +20 ma
7	-20 to +20 ma

Differential Ranges:	Limits:
8	-10 to +10 V
9	0 to +10 V
10	0 to +5 V
11	+1 to +5 V
12	-5 to +5 V
13	NA
14	NA
15	**Disabled

*Default
**Disabled – If this is the selected value, acquisition of this channel is disabled. This can be used to improve throughput in modules where some channels are not used.
NA – Not allowed.

The table below shows the incremented voltage or current assigned to each bit for the seven different input ranges. For example, if the channel 1 input range is 0 to +5V and the actual incoming signal is at mid-range (+2.5V) the value in the module's data word would be 0000 1000 0000 0000 (binary) or 2048 (decimal). The input is 2048/4096, or 1/2 of full scale. It is recommended that you use 16 bit signed integer data format to realize best module performance.

Input Signal:	16 Bit Signed:	Raw Form Signed:	16 Bit Unsigned:	Raw Form Unsigned:
-10 to +10 V	$-32{,}768_{10}$ to $32{,}767_{10}$	8001_{16} to $7FFF_{16}$	0_{10} to $65{,}535_{10}$	0000_{16} to $FFFF_{16}$
0 to +10 V	0_{10} to $32{,}767_{10}$	0000_{16} to $7FFF_{16}$	0_{10} to $65{,}535_{10}$	0000_{16} to $FFFF_{16}$
0 to +5 V	0_{10} to $32{,}767_{10}$	0000_{16} to $7FFF_{16}$	0_{10} to $65{,}535_{10}$	0000_{16} to $FFFF_{16}$
+1 to +5 V	0_{10} to $32{,}767_{10}$	0000_{16} to $7FFF_{16}$	0_{10} to $65{,}535_{10}$	0000_{16} to $FFFF_{16}$
-5 to +5 V	$-32{,}768_{10}$ to $32{,}767_{10}$	8001_{16} to $7FFF_{16}$	0_{10} to $65{,}535_{10}$	0000_{16} to $FFFF_{16}$
0 to +20 ma	0_{10} to $32{,}767_{10}$	0000_{16} to $7FFF_{16}$	0_{10} to $65{,}535_{10}$	0000_{16} to $FFFF_{16}$
+4 to +20 ma	0_{10} to $32{,}767_{10}$	0000_{16} to $7FFF_{16}$	0_{10} to $65{,}535_{10}$	0000_{16} to $FFFF_{16}$
-20 to +20 ma	$-32{,}768_{10}$ to $32{,}767_{10}$	8001_{16} to $7FFF_{16}$	0_{10} to $65{,}535_{10}$	0000_{16} to $FFFF_{16}$

Input Signal:	12 Bit Signed:	*Raw Form Signed:	12 Bit Unsigned:	Raw Form Unsigned:
-10 to +10 V	-4095_{10} to $+4095_{10}$	$1\ 0FFF_{16}$ to $0\ 0FFF_{16}$	0 to 4095_{10}	0000_{16} to $0FFF_{16}$
0 to +10 V	0 to 4095_{10}	$0\ 0000_{16}$ to $0\ 0FFF_{16}$	0 to 4095_{10}	0000_{16} to $0FFF_{16}$
0 to +5 V	0 to 4095_{10}	$0\ 0000_{16}$ to $0\ 0FFF_{16}$	0 to 4095_{10}	0000_{16} to $0FFF_{16}$
+1 to +5 V	0 to 4095_{10}	$0\ 0000_{16}$ to $0\ 0FFF_{16}$	0 to 4095_{10}	0000_{16} to $0FFF_{16}$
-5 to +5 V	-4095_{10} to $+4095_{10}$	$1\ 0FFF_{16}$ to $0\ 0FFF_{16}$	0 to 4095_{10}	0000_{16} to $0FFF_{16}$
0 to +20 ma	0 to 4095_{10}	$0\ 0000_{16}$ to $0\ 0FFF_{16}$	0 to 4095_{10}	0000_{16} to $0FFF_{16}$
+4 to +20 ma	0 to 4095_{10}	$0\ 0000_{16}$ to $0\ 0FFF_{16}$	0 to 4095_{10}	0000_{16} to $0FFF_{16}$
-20 to +20 ma	-4095_{10} to $+4095_{10}$	$1\ 0FFF_{16}$ to $0\ 0FFF_{16}$	0 to 4095_{10}	0000_{16} to $0FFF_{16}$

Input Signal:	BCD Signed:	*Raw Form Signed:	BCD Unsigned:	Raw Form Unsigned:
-10 to +10 V	-4095_{BCD} to $+4095_{BCD}$	$1\ 4095_{16}$ to $0\ 4095_{16}$	0 to 4095_{BCD}	0000_{16} to 4095_{16}
0 to +10 V	0 to 4095_{BCD}	$0\ 0000_{16}$ to $0\ 4095_{16}$	0 to 4095_{BCD}	0000_{16} to 4095_{16}
0 to +5 V	0 to 4095_{BCD}	$0\ 0000_{16}$ to $0\ 4095_{16}$	0 to 4095_{BCD}	0000_{16} to 4095_{16}
+1 to +5 V	0 to 4095_{BCD}	$0\ 0000_{16}$ to $0\ 4095_{16}$	0 to 4095_{BCD}	0000_{16} to 4095_{16}
-5 to +5 V	-4095_{BCD} to $+4095_{BCD}$	$1\ 4095_{16}$ to $0\ 4095_{16}$	0 to 4095_{BCD}	0000_{16} to 4095_{16}
0 to +20 ma	0 to 4095_{BCD}	$0\ 0000_{16}$ to $0\ 4095_{16}$	0 to 4095_{BCD}	0000_{16} to 4095_{16}
+4 to +20 ma	0 to 4095_{BCD}	$0\ 0000_{16}$ to $0\ 4095_{16}$	0 to 4095_{BCD}	0000_{16} to 4095_{16}
-20 to +20 ma	-4095_{BCD} to $+4095_{BCD}$	$1\ 4095_{16}$ to $0\ 4095_{16}$	0 to 4095_{BCD}	0000_{16} to 4095_{16}

Data Format:

You must indicate what format will be used to read data from your module. Typically, you select BCD with PLC-2 processors, and 2's complement binary with PLC-3 and PLC-5 processors. You use BTW words 8-15, bits 0-15 to set the data format.

Word/Bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00	Group
8	Channel 4				Channel 3				Channel 2				Channel 1				Data Format
9	Channel 8				Channel 7				Channel 6				Channel 5				Data Format
10	Channel 12				Channel 11				Channel 10				Channel 9				Data Format
11	Channel 16				Channel 15				Channel 14				Channel 13				Data Format
12	Channel 20				Channel 19				Channel 18				Channel 17				Data Format
13	Channel 24				Channel 23				Channel 22				Channel 21				Data Format
14	Channel 28				Channel 27				Channel 26				Channel 25				Data Format
15	Channel 32				Channel 31				Channel 30				Channel 29				Data Format

Data Format:	Comment:
0*	Signed 16 bit
1	Unsigned 16 bit
2	Signed 12 bit

Data Format:	Comment:
3	Unsigned 12 bit
4	Signed BCD
5	Unsigned BCD
6 through 15	NA

*Within a group of 8 channels (1..8, 9..16, 17..24, or 25..32) all 8 channels must be one of the valid voltage ranges or all 8 channels must be one of the valid current ranges. Mixing of voltage and current sources within a group of 8 is not allowed. Also, differential mode must be specified for two consecutive channels starting with an odd channel (1&2, 3&4, 5&6, etc).

Input Type/Range must be configured using Binary or Hexidecimal values.

For example: Setting Word 0 to BBBB hex sets channels 1-4 to a +1 to +5V input range.

Output is scaled to the range limits if no other scaling is applied as follows:

Digital Filtering:

The 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. Digital filtering is selected using BTW words 16-19, bits 0-15.

Word/Bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00	Group
16	Chan 8		Chan 7		Chan 6		Chan 5		Chan 4		Chan 3		Chan 2		Chan 1		Filter Freq
17	Chan 16		Chan 15		Chan 14		Chan 13		Chan 12		Chan 11		Chan 10		Chan 9		Filter Freq
18	Chan 24		Chan 23		Chan 22		Chan 21		Chan 20		Chan 19		Chan 18		Chan 17		Filter Freq
19	Chan 32		Chan 31		Chan 30		Chan 29		Chan 28		Chan 27		Chan 26		Chan 25		Filter Freq

The onboard ADC data filters may be selected for the following filter frequencies:

Filter:	-3dB Frequency:	Output Rate:	-64.5dB Frequency:
0*	13.65 Hz	350Hz	49Hz (50/60Hz rejection)
1	7.8 Hz	200 Hz	20Hz
2+	209.6 Hz	800 Hz	NA
3	1667 Hz	6400 Hz	NA

*Default
+ Filtering is set for a 1msec response, which is 800Hz for the AD7731.

Channel Update times based on filter frequency are listed below.

Filter	1 Channel	16 Channels	32 Channels
7.8 Hz	120 ms	1920 ms	3840 ms
13.65 Hz	67.8 ms	1085 ms	2170 ms
209.6 Hz	5.4 ms	86.5 ms	173 ms
1667 Hz	2.1 ms	33.6 ms	67.2 ms

Automatic System Calibration (Autocal)

The built in capability of the Analog to Digital Converter to perform system calibrations may be performed at a rate defined by the user. The exact time of system calibration can not be specified, only the rate at which is performed.

Word/Bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00	Group
20	Automatic Calibration Rate																Autocal

The table below illustrates the configuration options using Configuration Word 20.

AutoCal:	Rate:
0*	Once every 30 minutes.
1	Once an hour.
2	Once a day.
3	On command.
4	Once on power on/reset only.

* -Default

Flags

The user may specify the Block Transfer Read size using Configuration Word 21.

Word/Bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00	Group
21	Debug Flags																Debug Flags

Settings are as follows:

Flags:	Usage:
xxxx xxxx xxxx xxx0	BTR Data Only
xxxx xxxx xxxx xxx1	BTR Data Onlyand Configuration Data

0	PU	1 = Power up complete
1	OR*	1 = Out of range error occurred
2	IS	1 = Invalid scaling detected
3	RTS	1 = Real time sampling BTR timeout
4	CS*	1 = Calibration status
5	EE	1 = EEPROM valid
6	HF	1 = Hardware fault
7	CE*	1 = Configuration Error

* Channel faults. Channels 1 – 32 (1 to 20hex) loaded in diagnostics data.
If configuration error and 0 in diagnostics data, RTS or autocal values are invalid.

Power up complete

This bit is set when the power up test is complete, no hardware failures were detected, and the module is ready to start processing block transfer write requests and/

or block transfer read requests. It means that the module is alive but not yet configured. Cleared after a valid BTW for configuration.

Out of range error occurred

This bit is set during normal run mode to indicate that at least one channel is out of range. The diagnostic byte will be loaded with the channel ID of the last channel detected as out-of-range (1=chan 1, 2=chan 2, etc.).

Invalid scaling detected

This bit is set during normal run mode to indicate that at least one channels scaling is incorrectly defined. The diagnostic byte will be loaded with the channel ID of the last channel detected with this error (1=chan 1, 2=chan 2, etc.).

Real time sampling BTR timeout

In the RTS mode a BTR request must be received within the time period defined for RTS. If not, this flag is set.

Calibration Error

This bit is set while performing auto-calibrate. Does not clear if any calibration errors occur.

EEPROM Error

At power up, the EEPROM is validated and the status is placed in this bit. If this bit is a '1', the EEPROM is invalid.

Hardware fault

If this bit is set a hardware fault was detected.

Configuration Error

If this bit is set an error was found in the configuration data. The diagnostic byte will be loaded with the channel ID of the last channel detected with an error (1=chan 1, 2=chan 2, etc.). Otherwise, the diagnostic byte is zero.

Channel Faults

32 channel fault flags are provided to indicate hardware failure on a per channel basis.

Range Error Flags

32 channel overflow and 32 channel underflow flags are provided to indicate when the input signal is out of range on a per channel basis. Out of range is defined as an input signal sensed as approximately at or over/under the selected range endpoints. These flags will be set at greater than +100% or less than -100% full scale data.

Channel Data

32 16 bit words are used to transfer data for all 32 channels to the PLC in a single block transfer.

Real Time Sampling:

Intervals for use by the processor. In the RTS mode the module scans and updates its inputs at a user defined interval (DT). The module ignores block transfer read (BTR)

requests for data until the sample time period elapses. If the sample period elapses and no BTR requests have occurred since the interval started, the RTS bit is flagged indicating an RTS synchronization error.

Word/Bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00	Group
23	Real Time Sampling																RTS

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 (T) 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. Refer to the table below for actual bit settings. Note that the default mode of operation is implemented by placing all zeroes in bits 0–15.

The real time sampling (RTS) mode of operation provides data at a precisely gathered time interval. The RTS bit is defined in the diagnostics byte in the BTR map.

Bit settings for real time sample mode:

RTS:	Sample Time:
0*	Disabled
1	100 ms
2	200 ms
3	300 ms
4	400 ms
5	500 ms
6	600 ms
7	700 ms
8	800 ms
9	900 ms
10	1.0 s
11	1.1 s
12	1.2 s
13	1.3 s
14	1.4 s
15	1.5 s

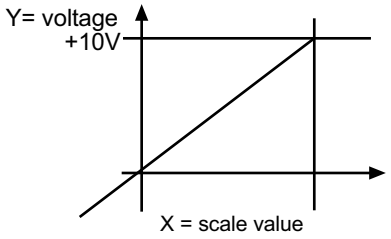
RTS:	Sample Time:
16	1.6 s
17	1.7 s
18	1.8 s
19	1.9 s
20	2.0 s
21	2.1 s
22	2.2 s
23	2.3 s
24	2.4 s
25	2.5 s
26	2.6 s
27	2.7 s
28	2.8 s
29	2.9 s
30	3.0 s
31	3.1 s

Scaling:

The user may define Scaling to be applied to the input data by defining a 16 bit word value for the minimum full scale reading and a 16 bit word value for the maximum full scale reading. The module will apply linear equations to the values sampled such that values sampled at the range end points are represented as equivalent to the user defined min/max scaling for a given channel. If both the min and max scale values are

set to zero (default), no user scaling is performed.

The slope line represented the module response may be defined from any two points on the line defined as (X0, Y0) and (X1, Y1). The X axis is assumed to be the scaled data value and the Y axis is the ADC output representing the channel input. The following is an example:



$Y = mX + B$

Y = value at Y axis
X = value at X axis
B = Y intercept when X = 0.
M = slope of line = (Y1 – Y0)/(X1 – X0)

Range: -10 to +10 Volts
Min Scale: -1000
Max Scale: +1000

X0 = -1000 (min scale)
Y0 = -10V (min range)
X1 = +1000 (max scale)
Y1 = +10V (max range)
M = (10 – (-10))/(1000 – (-1000)) = 2000/20 = 0.01
B = Y – mX = 10 – (0.01 * 1000) = 10 – 10 = 0
If Y = 10 X = (Y – B)/m = ((10) – 0)/0.01 = 1000

Channel Voltage:	Scaled Input Data:
-10V	-1000
-5V	-500
0V	0
+5V	+500
+10V	+1000

Scale values are defined using the same format as selected for their respective channels. If a channel group is configured for the BCD format, the scale values must be specified in BCD. If the group is configured for a binary format, the scale values must be specified in binary form.

Scale values may be defined using bipolar limits (e.g. -1000 to +1000) or unipolar limits (e.g. 0 to 1000) regardless of the input range specified.

If the signed 12 bit binary or signed BCD formats are selected, the min_scale/ max_scale values require special handling for negative values. The value to be entered in this case is abs(scale_value)+8000hex.

For example, if min_scale = -1000 and max_scale = 1000 and format is signed BCD:

$\text{min\_scale} = -1000_{BCD} = (\text{abs}(-1000_{BCD})) + 8000_{16} = 1000_{16} + 8000_{16} = 9000_{16}$

max_scale = $1000_{BCD} = 1000_{16}$

If scaling is defined properly the min scale value is less than the max scale value ($scale_{min} < scale_{max}$). If the min scale value is not less than the max scale value a configuration fault is declared and scaling is not applied.

*If min = max = 0 then scaling is disabled. This is the default configuration.

Scale Word Configuration Bits

Word/Bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00	Group
0	Channel 1 Min Scale																Min Scale
1	Channel 1 Max Scale																Max Scale
62	Channel 32 Min Scale																Min Scale
63	Channel 32 Max Scale																Max Scale

If differential mode is used every other channel scale group is skipped. For example, when channel 1 is used in differential mode Scale Word 0 (Min Scale) and Word 1 (Max Scale) are used. Word 2 and Word 3 are skipped. Word 4 and Word 5 are Min and Max Scale words for channel 2, etc.

Scaling:	*Default:
Min Scale Value (Binary)	0
Max Scale Value (Binary)	0

Important:

If scaling is selected for any channel, all channels must be scaled. If scaling is not required on certain channels, set those to the default input range: 0 to 4095 for 0 to + voltage or current ranges, and -4095 to +4095 for - to + voltage or current ranges.

If scaling is not selected, the module BTR file length will be 23.

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

The module will return values outside the scaling range. For example, if a module is in the 0–5V dc mode, scaled for 0 to 5000, and has –2V dc applied, it will return –2000.

Default Configuration:

If a write block of five words, with all zeroes, is sent to the Analog Input Module (cat. no. 1771sc-IFE32), default selections will be:

- 1 to 5V dc or 4 to 20mA (dependent on configuration jumper setting)
- BCD data format
- no real time sampling (RTS)

- no filtering
- no scaling
- single-ended inputs

Chapter Summary

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

Module Status and Input Data

Chapter Objectives:

In this chapter, we describe:

· reading data from your module

· block transfer 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 (Figure 5.1). The processor's user program initiates the request to transfer data from the input module to the processor.

Module input data is passed from the 1771sc-IFE32 to the PLC via a Block Transfer Read. Two BTR formats are supported.

Block Transfer Read (BTR) Maps

	Purpose:
41	Module data only
64	Module data and configuration

During normal operation, the processor transfers 41 words to the module when you program a BTR instruction to the module's address. When user scaling and configuration echo are desired 64 words are transfered.

The block memory maps are shown below:

Module Data BTR

Word/Bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00	
0	Diagnostic Data Byte								CE	HF	EE	CS	RT	IS	OR	PU	Diagnostics
1	16	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	Channel Fault
2	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	Channel Fault
3	16	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	Under Range
4	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	Under Range
5	16	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	Over Range
5	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	Over Range
7	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	Sign
8	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	Sign
9	Channel 1 Data																Data
10	Channel 2 Data																Data
.									.							.	
40	Channel 32 Data																Data

In differential mode every other channel is skipped. For example: Word 9 = Channel 1, Word 11 = Channel 2, Word 13 = Channel 3...

Module Data/Configuration Echo BTR

Word/Bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00	
0	Diagnostic Data Byte								CE	HF	EE	CC	RT	IS	OR	PU	Diagnostics
1	16	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	Channel Fault
2	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	Channel Fault
3	16	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	Under Range
4	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	Under Range
5	16	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	Over Range
5	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	Over Range
7	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	Sign
8	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	Sign
9	Channel 1 Data																Data
10	Channel 2 Data																Data

40	Channel 32 Data				Data
41	Channel 4	Channel 3	Channel 2	Channel 1	Type/Range
42	Channel 8	Channel 7	Channel 6	Channel 5	Type/Range
43	Channel 12	Channel 11	Channel 10	Channel 9	Type/Range
44	Channel 16	Channel 15	Channel 14	Channel 13	Type/Range
45	Channel 20	Channel 19	Channel 18	Channel 17	Type/Range
46	Channel 24	Channel 23	Channel 22	Channel 21	Type/Range
47	Channel 28	Channel 27	Channel 26	Channel 25	Type/Range
48	Channel 32	Channel 31	Channel 30	Channel 29	Type/Range
49	Channel 4	Channel 3	Channel 2	Channel 1	Data Format
50	Channel 8	Channel 7	Channel 6	Channel 5	Data Format
51	Channel 12	Channel 11	Channel 10	Channel 9	Data Format
52	Channel 16	Channel 15	Channel 14	Channel 13	Data Format
53	Channel 20	Channel 19	Channel 18	Channel 17	Data Format
54	Channel 24	Channel 23	Channel 22	Channel 21	Data Format
55	Channel 28	Channel 27	Channel 26	Channel 25	Data Format
56	Channel 32	Channel 31	Channel 30	Channel 29	Data Format

57	Chan 8	Chan 7	Chan 6	Chan 5	Chan 4	Chan 3	Chan 2	Chan 1	Filter Freq
58	Chan 16	Chan 15	Chan 14	Chan 13	Chan 12	Chan 11	Chan 10	Chan 9	Filter Freq
59	Chan 24	Chan 23	Chan 22	Chan 21	Chan 20	Chan 19	Chan 18	Chan 17	Filter Freq
60	Chan 32	Chan 31	Chan 30	Chan 29	Chan 28	Chan 27	Chan 26	Chan 25	Filter Freq
61	Automatic Calibration Rate								Autocal
62	Debug Flags								Debug Flags
63	Real Time Sampling								RTS

In **differential** mode every other channel is skipped. For example: Word 9 = Channel 1, Word 11 = Channel 2, Word 13 = Channel 3... The status bits are paired. For example, Bit 0 and 1 in Word 4 (Under Range) will be associated with Channel 0.

Chapter Summary

In this chapter you learned the meaning of the status information that the input module sends to the processor.

Troubleshooting Your Input Module

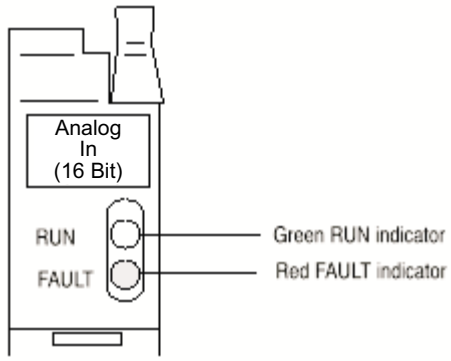
Chapter Objective:
In this chapter, we describe how to troubleshoot your module by:
· observing the indicators
· monitoring status bits reported to the processor.
· checking module operation
· checking for common mode voltages
· isolating a bad input

Diagnostics Reported by the Module

At power-up, the module momentarily turns on the red indicator as a lamp test, then checks for:
· correct RAM operation
· firmware errors

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

Diagnostic Bits Reported by the Analog input



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 data bit** (bit 02) is set if invalid scaling data is entered into any of the minimum/maximum scaling value words. **Note that minimum equal to maximum is an invalid value.** 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 is 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) fault 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.

Bit 04 is the **calibration status bit**. This bit is reset (0) when a successful calibration is completed. If the bit is set (1), an incorrect voltage/current was applied, or offset and gain calibrations were attempted together.

The **EEPROM status bit** (05) is set when an error occurs when saving calibration data to nonvolatile memory. If this bit is set at powerup, the EEPROM data did not pass checksum and calibration values are being used.

The **hardware failure bit** (06) is set when a blown fuse is detected or when the EEPROM can't recover from a fault.

The **configuration Error** (07) is set when an error was found in the configuration data

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 remains 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 set. As long as inputs are in range, the associated bit remains reset. Bit 00 corresponds to channel 1, bit 01 to channel 2, etc.

Word 4

Word 4 provides an indication of a particular channel's input polarity (set or 1 = negative; reset or 0 = positive). Bit 00 corresponds to channel 1, bit 01 to channel 2, etc.

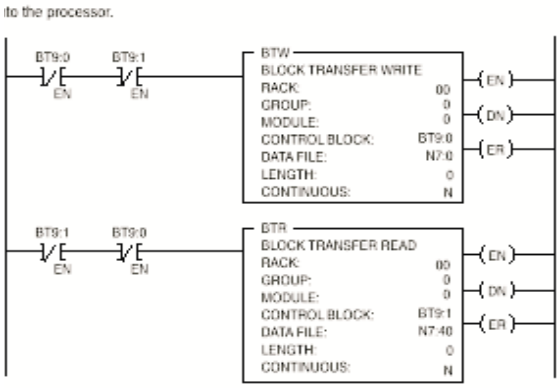
The following table lists the probable cause and recommended actions for some common trouble indications

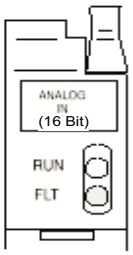
Legend
○ Off
● On
✱ Blinking

Indicators	Probable Cause	Recommended Action
● RUN (green) ○ FLT (red)	Normal operation	None
✱ RUN (blinking) ○ FLT (off)	Awaiting configuration Block Transfer Write	Send configuration BTW
○ RUN (green) ● FLT (red)	Hardware failure in module	Return module for repair
○ RUN Neither LED ○ FLT comes on	No power	Turn off power. Remove and reinsert module into chassis. Return power. If problem still exists, and chassis power supply is functioning properly, return the module for repair.

Checking Module Operation

The following allows you to run a check on module operation, and isolate a fault either to the module or external to the module.





Block Transfer Write

Data Table Report PLC-5/11 Addr 4 IFE Data Table File N7:0

ADDRESS	0	1	2	3	4	5	6	7	8	9
N7:0	0	0	0	0	0	0	16533	0	16533	0
N7:10	16533	0	16533	0	16533	0	16533	0	16533	0
N7:20	16533	0	16533	0	16533	0	16533	0	16533	0
N7:30	16533	0	16533	0	16533	0	16533	0	0	0
N7:40	2	-1	0	0	0	0	0	0	0	0
N7:50	0	0	0	0	0	0	0	0	0	0
N7:60	0	0	0	0	0	0	0	0	0	0
N7:70	0	0	0	0	0	0	0	0	0	0
N7:80	0	0	0	0	0	0	0	0	0	0
N7:90	0	0	0	0	0	0	0	0	0	0
N7:100	0	0	0	0	0	0	0	0	0	0

1. Make sure the field wiring arm is in position on the module.
2. Apply power to the 1771 I/O chassis.
3. Check each input (either single-ended or differential) for common mode voltages exceeding +14.25V with respect to module common.
   A. Hold the positive probe of the voltmeter on the first input terminal.
   B. Hold the negative probe of the voltmeter on a module common terminal (terminals 20 or 21).

4. If any voltage is seen that exceeds +14.25V, remove that channel's input wiring and observe the affect on the input data table of the programmable controller.

ATTENTION: Remove power from the 1771 I/O chassis backplane and field wiring arm before removing or installing input wiring.

- Failure to remove power from the backplane or wiring arm could cause module damage, degradation of performance, or injury.
- Failure to remove power from the backplane could cause injury or equipment damage due to possible unexpected operation.

If no other common mode voltages are present, the input data for all other channels should stabilize to some predictable value.

5. Attempt to equalize all grounds at the offending channel beforereconnecting the input wiring.

ATTENTION: Remove power from the 1771 I/O chassis backplane and field wiring arm before removing or installing input wiring.

- Failure to remove power from the backplane or wiring arm could cause module damage, degradation of performance, or injury.
- Failure to remove power from the backplane could cause injury or equipment damage due to possible unexpected operation.

6. If the common mode voltage cannot be removed on the input, an isolation device may be required on that channel.

Disconnecting inputs from the field wiring arm one at a time while observing module action.

During this procedure, monitor the input data table of the programmable controller and observe any changes which occur.
1. Make sure the field wiring arm is in position on the module.
2. Apply power to the 1771 I/O chassis.
3. While observing the input data table, remove one input at a time.

ATTENTION: Remove power from the 1771 I/O chassis backplane and field wiring arm before removing or installing input wiring.

- Failure to remove power from the backplane or wiring arm could cause module damage, degradation of performance, or injury.
- Failure to remove power from the backplane could cause injury or equipment damage due to possible unexpected operation.

4. When the offending input channel is disconnected, the input data table will stabilize to some predictable values.

Testing for Input Channel Functionality

To test the functionality of an input channel:

1. Remove the input wiring from the field wiring arm.

ATTENTION: Remove power from the 1771 I/O chassis backplane and field wiring arm before removing or installing input wiring.

- Failure to remove power from the backplane or wiring arm could cause module damage, degradation of performance, or injury.
- Failure to remove power from the backplane could cause injury or equipment damage due to possible unexpected operation.

2. Connect a battery (or other voltage source) across the input terminals. When the 4-20mA range is selected, the voltage source must not exceed 1-5V.

ATTENTION: The voltage source must be within the selected voltage range. If the source voltage is greater than the selected voltage range of the input, module damage will result.

3. Monitor the input data table for predictable values. (values relative to the input source voltage).

Chapter Summary

In this chapter you learned how to interpret the indicator lights, and troubleshoot your input module.

Appendix A

Electrical Specs

Specification	Description
Inputs per module	32 single-ended; 16 differential low level
Module location	17710 I/O chassis – 1 slot
Nominal input voltage	+1 to +5 Vdc, 0 to 5 Vdc, -5 to +5 Vdc, -10 to +10 Vdc, 0 to 10 Vdc
Nominal input current	+4 to +20 mA, 0 to +20 mA, -20 to +20 mA
Resolution	16 bit binary, 15 bit plus sign in bipolar ranges
Linearity	±1 LSB
Isolation voltage	Channel to back Plane Isolation of 500VDC
Input overvoltage protection	Voltage Ranges: ±20 Volts Current Ranges: ±20 mA
Common Mode Voltage	±15 Volts
Input impedance	Voltage Mode: 10 MegaOhms, min; Current Mode: 250 Ohms.
Common mode rejection	90 dB minimum at 50 or 60 Hz (frequency dependent)
Unscaled BCD and binary output to processor	0 to 65,535 for unipolar ranges (0 to 5V, 0 to 20mA, etc)
	-32,768 to +32,767 for bipolar ranges (±10V, ±20mA, etc)
Engineering units sent to processor	±9999 with selectable scaling
Accuracy	
Voltage Typ	.03% of full scale typical @ 25°C.
Voltage Max	.05% of full scale Maximum @ 60°C.
	Note: Accuracy is dependent on the filter frequency selection, range selection, data format, and input noise.
Voltage Repeatability	.03% of full scale Maximum @ 60°C.
Current Typ	.05% of full scale typical @ 25°C.
Current Max	.10% of full scale Maximum @ 60°C.
	Note: Accuracy is dependent on the filter frequency selection, range selection, data format, and input noise.
Current Repeatability	.05% of full scale Maximum @ 60°C.
Temp. coefficient	490ms real time auto calibration. Calibration for temp. compensation.
Display format	BCD, Two's complement, or signed magnitude; scaled or unscaled.
Input Filter	7.8Hz, 13.65Hz, 209.6Hz, 1667KHz Digital Notch Filter, Programmable in groups of 8 inputs.
Channel Update Time	See Channel Update Time chart vs filter selection
Single Channel Min	2.1ms 1667Hz filter, no cal
Single Channel Max	120ms 7.8Hz filter, no cal
32 Channel Min	67.2ms 1667Hz filter, no cal
32 Channel Max	3840ms 7.8Hz filter, no cal
Isolation	
Channel to Rack	500 VAC Continuous Optical & magnetic
Channel to Channel	12.5V
Group to Group	+-15V
Input Protection	±20VDC continuous, 1500W pulsed for 1msec. Max Input current voltage or Current mode = ±50mA
Power Requirements	
Internal rack +5v	500mA – Maximum / 400mA Typical
External	None
Fusing	None – External Customer option.

System Specifications

Specification	Description
Data Registers	Block Transfer Write (BTW) 25 words. Block Transfer Write (BTR) 41 words.
LED Indicators	1 Green Led labeled “RUN” 1 Red Led labeled “FAULT”
Terminal Block	Standard 1771 40 Pin Connector
Wire Size	1-14AWG, or 2-16AWG wires
Interface	1771 “T” Module Interface Controller (TIC) A-B P/N 943129-61
Compatibility	
Hardware	1771-A1B through –A4B or later I/O chassis only.
Software	6300 Programming Software, APS, RS Logix
Dimensions	Single 1771 slot, Standard Metal Enclosure and Separate Terminal Block.
Weight	0.90Kg

3.3 Environmental Specifications

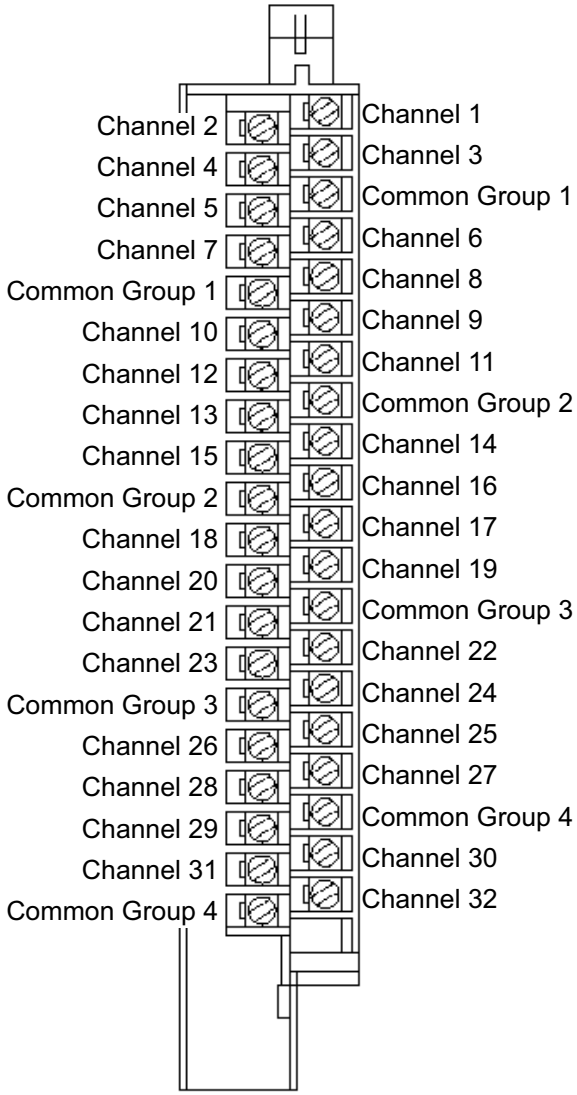
Test Description	Test Standard
Mechanical	
Vibration of Unpackaged Products	ICCG-ES #001 Rev A.
Shock of Unpackaged Products	ICCG-ES #002 Rev A.
Vibration of Packaged Products	ICCG-ES #003 Rev A.
Shock of Packaged Product	ICCG-ES #004 Rev A.
Temperature / Humidity	
Operating Temperature	ICCG-ES #006 Rev C.
Storage Temperature	ICCG-ES #006 Rev C.
Humidity-Temperature	ICCG-ES #008 Rev B.
Electrical	
	EN50082-2
Electrostatic Discharge (IEC 801-2)	ICCG-ES #005 Rev A./EN 61000-4-2 Level B
RF Electromagnetic Field Susceptibility (IEC 801-3)	ICCG-ES #011 Rev A./ENV 50140 Level A
RF Immunity to 900MHz	ICCG-ES #011 Rev A./ENV 50204
Fast/Burst Transient (IEC 801-4)	ICCG-ES #020 Rev A./ENV 61000-4-4 Level B
RF Common Mode Immunity (IEC 801-6)	ICCG-ES #022 Rev A./ENV 50141 Level A, Injected
	EN50081-2
Conducted Emissions (CISPR 11) class A	ICCG-ES #017 Rev A./ENV 55011, Group 1 Class A
Radiated Electromagnetic Emissions (CISPR 11) class A	ICCG-ES #021 Rev A./ENV 55011, Group 1 Class A

Terminal Block Pinouts

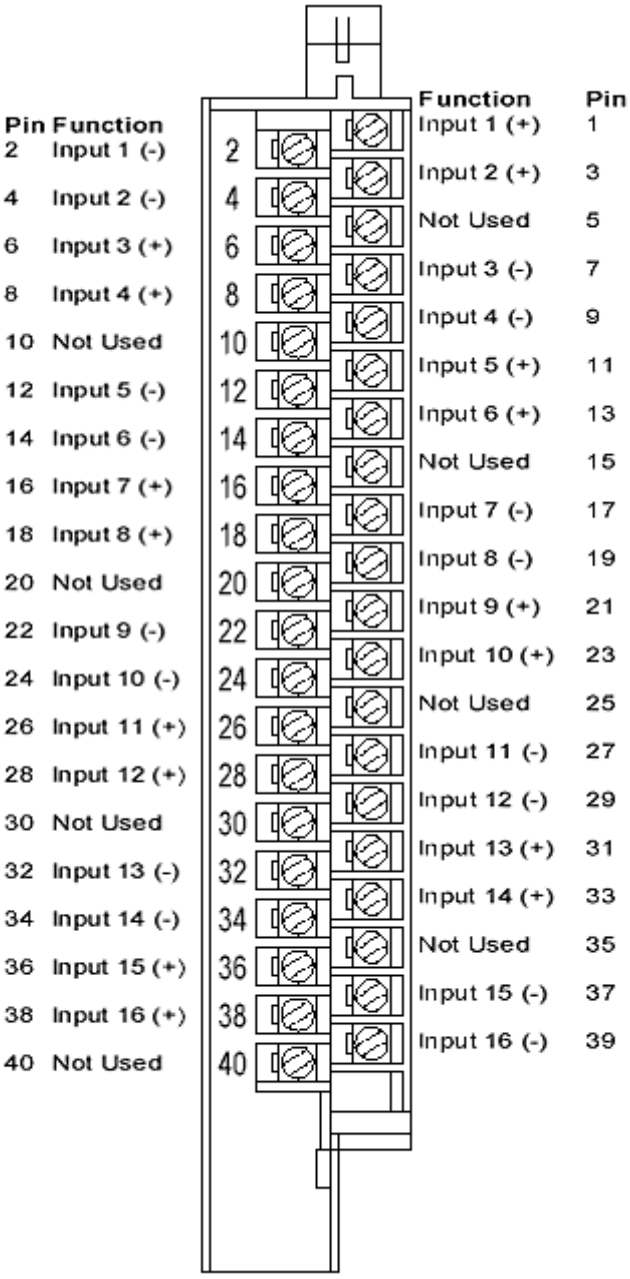
The modules terminal block will use Allen-Bradley's standard 40 pin input connector (Cat. No. 1771-WN).

Single Ended Input Wiring

Connection Diagram for
32 Single-ended Inputs



Differential Input Wiring



Getting Technical Assistance

If you need technical assistance, please review the information in Chapter 6, “Testing Your Module,” before calling your local distributor of Spectrum Controls.

Note that your module contains electronic components which are susceptible to damage from electrostatic discharge (ESD). An electrostatic charge can accumulate on the surface of ordinary plastic wrapping or cushioning material. **In the unlikely event that the module should need to be returned to Spectrum Controls, please ensure that the unit is enclosed in approved ESD packaging (such as static-shielding / metallized bag or black conductive container)**. Spectrum Controls reserves the right to void the warranty on any unit that is improperly packaged for shipment.

For further information or assistance, please contact your local distributor, or call the Spectrum Controls Customer Satisfaction department at (425) 746-9481 from 8:00 A.M. to 5:00 P.M. Pacific Time.

Declaration of Conformity

Declaration of Conformity

Application of Council Directive(s)	**73/23/EEC Low Voltage Directive** **89/336/EEC Electromagnetic Compatibility**
Standard(s) to which Conformity is Declared	**EN50081-2:1993, EN50082-2:1995** **EN61010-1:1993, EN61131-2:1995**
Manfacturer's Name *Manfacturer's Address*	**Spectrum Controls Inc.** **2700 Richards Road South East,** **Bellevue Washington, 98005 U.S.A.**
Importer's Name *Importer's Address*	**Spectrum Controls Inc.** **2700 Richards Road South East,** **Bellevue Washington, 98005 U.S.A.**
Type Of Equipment	**Allen-Bradley PLC1771** **Compatible I/O Modules**
Model No.	**1771sc-IMI16, 1771sc-OMI16, 1771sc-IFE32**

I, the undersigned, hereby declare that the equipment specified above conforms to the above Directive(s) and Standard(s)

Date Of Issue: 2/29/00

Place: **Bellevue, Washington U.S.A.**

(Signature)

Bruce M. Wanta
(Name)

Chairman
(Position)

SPECTRUM CONTROLS

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