



## **Allen-Bradley Isolated Analog Input Module**

(Cat. No. 1771-IL)

### Product Data



### **Description**

Your Isolated Analog Input Module senses up to eight analog signals at its inputs and converts them to a proportional fourdigit BCD or twelve-bit binary value while providing channel to channel and channel to ground isolation of  $\pm 1000$  volts. You can select from five voltage or three current input ranges. Each input is software selectable on a per channel basis. This allows interface between a programmable controller and several types of analog devices such as those measuring temperature, pressure, RPM, light intensity and position. All outputs of these devices should conform to the voltage or current range selected for each module input channel.

Your module can be used with any programmable controller using the 1771 I/O structure with block transfer capability. Block transfer programming moves all 12 input channel and module status words from the module's memory to a designated area in the data table in a single scan (block transfer read) or up to 19 module configuration words from the data table to module memory (block transfer write). See figures 2 and 3 for information on other data included in the block transfer process.

Allen-Bradley Drives

Conversion of the analog input value to a four-digit BCD or 12 bit binary format sets the resolution of the module to 1 part in 4095. This defines the number of units available to the module in dividing up its particular voltage or current range. The BCD or binary value from each input channel is contained in a 16 bit input data word that is stored in the module's memory.

## Features

- $\pm 1000V$  input isolation, channel to channel, channel to ground
- Software selectable input ranges on a per channel basis
- Selectable scaling to engineering units
- No external power required for module operation
- Standard input filtering

## Data Transfer

A read block transfer instruction moves up to 12 input and module status words from the module's memory. A write block transfer instruction moves up to 19 module configuration words from the processor data table to the module's memory.

## Input Channels

Your isolated analog input module has 8 differential, fully isolated input channels. Individual inputs are software configurable to operate with any one of five voltage or three current input ranges (tables A and B).

**Table A**  
**Input Voltage Ranges**

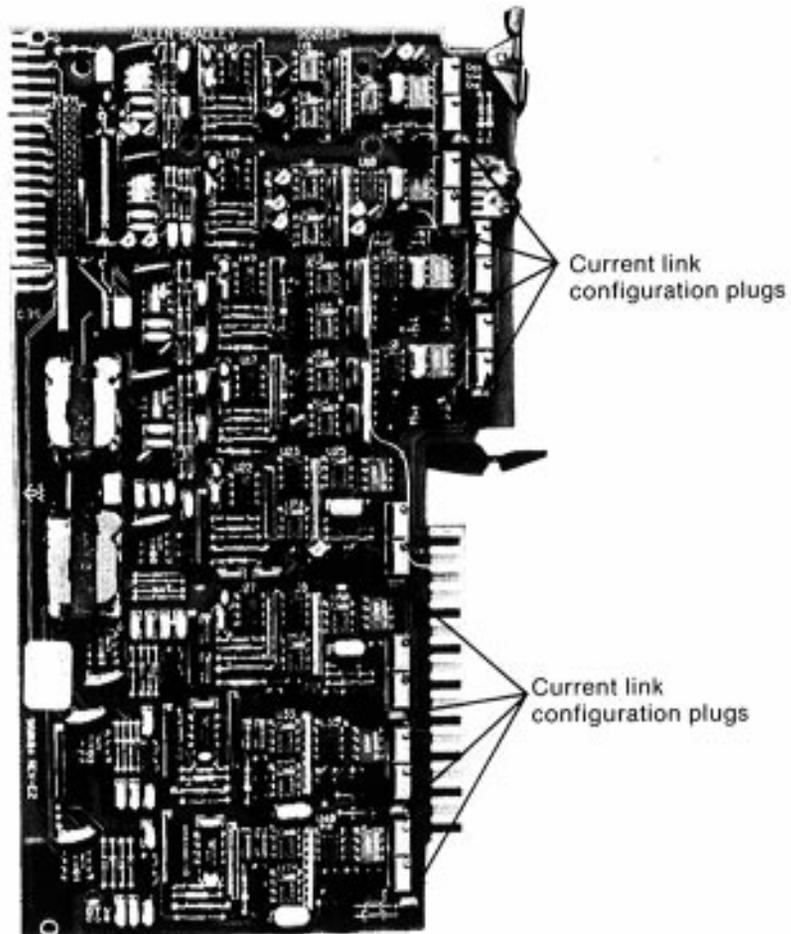
Nominal Voltage Range	Corresponding 4-Digit BCD Output Range	Corresponding 12-Bit Binary Output Range	Volts Per Bit
+1 to 5V	0000 to +4095	0000 to +4095	0.98mV
0 to +5V	0000 to +4095	0000 to +4095	1.22mV
-5 to +5V	-4095 to +4095	-4095 to +4095	1.22mV
0 to +10V	0000 to +4095	0000 to +4095	2.44mV
-10 to +10V	-4095 to +4095	-4095 to +4095	2.44mV

**Table B**  
**Input Current Ranges**

Nominal Current Range	Corresponding 4-Digit BCD Output Range	Corresponding 12-Bit Binary Output Range	Current Per Bit
0 to +20mA	0000 to +4095	0000 to +4095	.0049mA
+4 to +20mA	0000 to +4095	0000 to +4095	.0039mA
-20 to +20mA	-4095 to +4095	-4095 to +4095	.0049mA

All current input channels require insertion of current configuration plugs (figure 1) before the module is installed in a 1771 I/O rack. The module has input overvoltage protection to  $\pm 40\text{V}$  peak (continuous). Exceeding this limit may damage the module. Channel to channel/channel to ground isolation provides  $\pm 1000\text{V}$  common mode voltage protection at each of the module inputs. Nominal voltage and current specifications are given in the specifications section and in tables [A](#) and [B](#).

**Figure 1**  
Location of Current Link Configuration Plugs



## Real Time Sampling

Real Time Sampling (RTS) increases the process control capabilities of your PLC-3, PLC-3/10 and PLC-5/15 processors by providing data from a fixed time period for use in the control algorithm. You can select RTS periods ranging from 100 milliseconds to 3.1 seconds using word #2, bits 13 through 17 of the write block transfer instruction (refer to figure 2).

# Allen-Bradley Drives

## Scaling

Your module can do linear conversion of raw data to engineering units (e.g. gallons/minute, degrees C/ degrees F, and pounds/square inch). Unscaled data in the input module has a range of 0 through 4095 or -4095 through +4095 depending on the input range selected. The resolution of this data is 12-bit binary corresponding to one part in 4095. The resolution of scaled values is the same as for raw data, one part in 4095, regardless of the chosen scale. Each input channel can be scaled independent of the other channels.

Implement the scaling feature by selecting the sign (+ or -) for maximum and minimum scaling values using word #3, bits 00 through 17 of the write block transfer instruction (reset, or 0 = +; set, or 1 = -). Use bits 00 through 07 for minimum values and bits 10 through 17 for maximum values. Use word #4 through #19 of the write block transfer instruction to enter the minimum and maximum scaling values for each of the 8 channels (refer to figure 2). BCD format is -9999 to +9999.

**Figure 2**  
**Word Assignments for Write Block Transfer**

Bit Word	17	16	15	14	13	12	11	10	07	06	05	04	03	02	01	00
1	range selection (channels 1 through 8)															
2	Real Time Sample						data format		not used							
3	sign bits max. scaling values								sign bits min. scaling values							
4	Channel 1, minimum scaling															
5	Channel 1, maximum scaling															
6	Channel 2, minimum scaling															
7	Channel 2, maximum scaling															
8	Channel 3, minimum scaling															
9	Channel 3, maximum scaling															
10	Channel 4, minimum scaling															
19	Channel 8, maximum scaling															

12874

The scaled input values will be found in words 5 through 12 of the read block transfer instruction (refer to figure 3).

**Figure 3**  
**Word Assignments for Read Block Transfer**

Bit Word	17	16	15	13	13	12	11	10	07	06	05	04	03	02	01	00
1	not used												diagnostics			
2	not used								data under-range (channels 1 to 8)							
3	not used								data over-range (channels 1 to 8)							
4	not used								data polarity (channels 1 to 8)							
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															

12875

## Read Block Transfer

The read block transfer instruction (figure 3) supplies diagnostic and data information to the processor. Word #1 provides power-up and valid data status. Words #2, #3 and #4 provide channel data status (i.e. under-range conditions, overrange conditions and polarity). Words #5 through #12 provide actual data for channels 1 through 8.

## Write Block Transfer

You can select channel ranges using word #1 of the write block transfer instruction (refer to figure 2). Each channel is represented by two bits.

Use word #2 of the write block transfer instruction to select the data format (BCD or binary) and Real Time Sampling.

## Input Filtering

Input filtering is applied to analog input signals to reduce the affects of electrical noise. Your input module has standard input filtering at better than 60db at 60 Hz.

## Diagnostics

Your module has diagnostic features that monitor internal communication and memory processes for faults. If an onboard self test fault occurs, the red fault (FLT) LED (figure 4) will light and the green run (RUN) LED will go off.

**Figure 4**  
**Module Diagnostic Indicators**



Figure 3 shows the word assignments for the read block transfer instruction. The diagnostics word (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 successful write block transfer. After initial power up the green LED flashes until the first successful write block transfer. Word #1 also contains an out-of-range bit (bit 01) that is set when any input is under or over-range and a bad scaling value data bit (bit 03).

## Power Requirements

System power is supplied through the I/O chassis backplane. The module requires 1.2A at 5V from the backplane. This amount should be totalled with the current requirements of other modules in the rack to avoid overloading the supply or exceeding the backplane capacity.

## Wiring



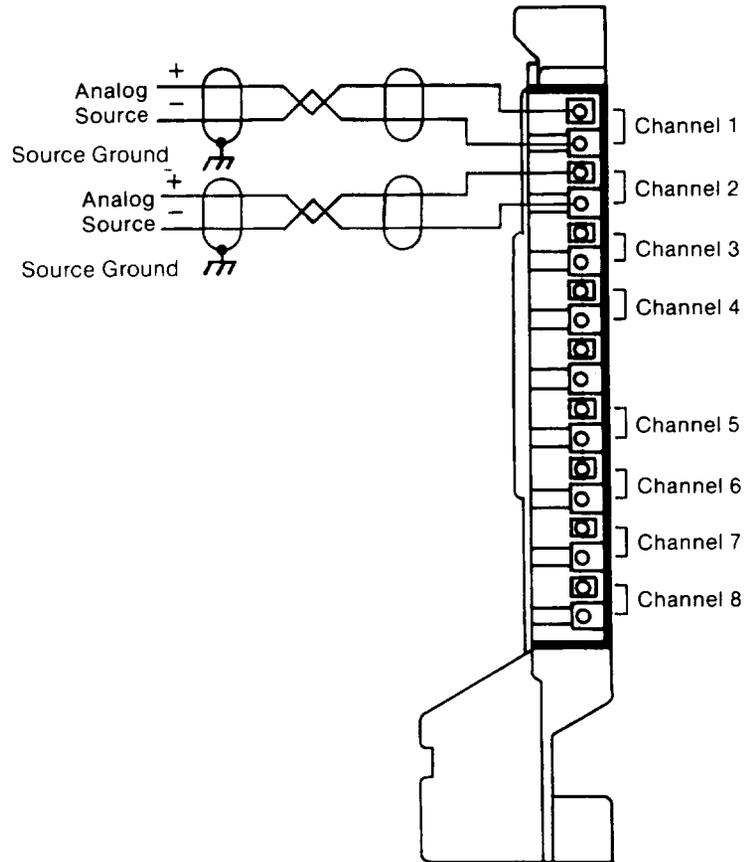
**CAUTION:** Remove system power before removing or installing your module in the 1771 I/O chassis. Failure to remove system power could result in damage to module circuitry.

Make wiring connections to the field wiring arm using Belden 8761 or equivalent cable (figures 5 and 6). The wiring arm pivots on the I/O chassis to connect with terminals on the front of the module. The wiring arm allows you to remove the module from the chassis without disconnecting wiring. Ground the foil shield and stranded drain wire at the end of the cable only. The best ground for this connection is source ground. Cut and tape the shield to insulate it from any electrical contact at the module end of the cable. Recommended maximum cable length for voltage mode input devices is 500 feet. This recommendation is based on considerations of signal degradation and noise immunity in typical industrial environments. Cable length for current mode input devices, however, need not be as restrictive. (Current mode analog signals are less sensitive than voltage signals to noise induced along transmission cables.)

**Figure 5**  
**Field Wiring Arm Connections**



**Figure 6**  
**Input Module Connections for 8 Differential Inputs**



12547

## Module Location

Your module may be placed in any I/O module slot of the I/O chassis with the exception of the same module group as a discrete high density module. Group input modules together within an I/O chassis whenever possible to minimize noise. Avoid placing analog modules close to AC modules or high voltage DC modules.

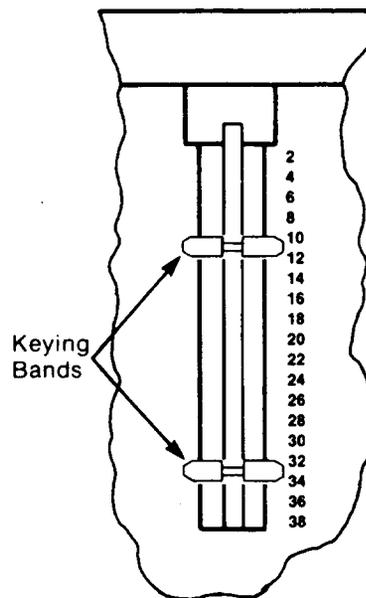
## Keying

Initially the input module may be inserted into any I/O module group in the I/O chassis. However, once a group has been designated for a module, care should be taken so that other types of modules will not be placed into these slots. Plastic keying bands, shipped with each I/O chassis, provide an easy method for keying I/O slots to accept only one type of module. Allen-Bradley strongly recommends use of these keying bands.

This type of I/O module is slotted in two places on the rear edge of the board. The position of the keying bands on the backplane connector must correspond to these slots to allow insertion of the module. Any I/O rack connector may be keyed to receive the module assembly. Snap the keying bands onto the upper backplane connectors between these numbers printed on the backplane (figure 7).

- Between 10 and 12
- Between 32 and 34

**Figure 7**  
**Keying Diagram for Placement of Module Keying Bands**



The position of these bands may be changed if subsequent system design and rewiring makes insertion of a different type of module necessary. Use needle-nose pliers to insert or remove keying bands.

## Specifications

### Inputs per Module

- 8 fully isolated differential

### Module Location

- Single slot in 1771 I/O chassis

### Input Voltage Ranges (nominal)

- +1 to +5V DC
- 0 to +5V DC
- -5 to +5V DC
- 0 to +10 V DC
- -10 to +10 V DC

### Input Current Ranges (nominal)

- +4 to +20 mA
- 0 to +20 mA
- -20 to +20 mA

### Isolation

- $\pm 1000V$ , channel to channel, channel to ground

### Common Mode Rejection

- $> 120db$  @ 60Hz and 1K ohm source imbalance

### Common Mode Impedance

- $> 50 M$  ohms shunted by  $< 5 \eta f$

### Normal Mode Rejection

- $> \times 60db$  @ 60Hz

### Resolution

- 12-bit binary

### Accuracy

- $\pm 0.1\%$  of range @ 25°C

### Input Overvoltage Protection

- $\pm 40$  peak, continuous

### Temperature Coefficients

- Voltage Input: 40 ppm/°C
- Current Range: 50 ppm/°C

### Input Impedance

- $> 10 M$  ohms for voltage ranges
- 250 ohms for current ranges

### Current Requirements

- 1.3A at 5V from I/O chassis backplane

### BCD and Binary Output to Processor

- 0000 to +4095 10 for +1 to +5V, 0 to +5V, 0 to +10V, 0 to +20mA, +4 to +20mA input ranges
- -4095 10 to +4095 10 for  $\pm 5V$ ,  $\pm 10V$ ,  $\pm 20mA$  input ranges

### Environmental Conditions

- Operating Temperature: 0 to 60° C (32 to 140°F)
- Storage Temperature: -40 to 85°C (-40 to 185°F)
- Relative Humidity: 5 to 95% (without condensation)

### Keying

- Between 10 and 12
- Between 32 and 34

### Scan Time

- 500 msec for all 8 channels

©1986 Allen-Bradley Company  
PLC is a registered trademark of Allen-Bradley Company



As a subsidiary of Rockwell International, one of the world's largest technology companies — Allen-Bradley meets today's challenges of industrial automation with over 85 years of practical plant-floor experience. More than 11,000 employees throughout the world design, manufacture and apply a wide range of control and automation products and supporting services to help our customers continuously improve quality, productivity and time to market. These products and services not only control individual machines but integrate the manufacturing process, while providing access to vital plant floor data that can be used to support decision-making throughout the enterprise.

## With offices in major cities worldwide

**WORLD HEADQUARTERS**  
Allen-Bradley  
1201 South Second Street  
Milwaukee, WI 53204 USA  
Tel: (1) 414 382-2000  
Telex: 43 11 016  
FAX: (1) 414 382-4444

**EUROPE/MIDDLE EAST/AFRICA HEADQUARTERS**  
Allen-Bradley Europe B.V.  
Amsterdamseweg 15  
1422 AC Uithoorn  
The Netherlands  
Tel: (31) 2975/43500  
Telex: (844) 18042  
FAX: (31) 2975/60222

**ASIA/PACIFIC HEADQUARTERS**  
Allen-Bradley (Hong Kong) Limited  
Room 1006, Block B, Sea View Estate  
28 Watson Road  
Hong Kong  
Tel: (852) 887-4788  
Telex: (780) 64347  
FAX: (852) 510-9436

**CANADA HEADQUARTERS**  
Allen-Bradley Canada Limited  
135 Dundas Street  
Cambridge, Ontario N1R 5X1  
Canada  
Tel: (1) 519 623-1810  
FAX: (1) 519 623-8930

**LATIN AMERICA HEADQUARTERS**  
Allen-Bradley  
1201 South Second Street  
Milwaukee, WI 53204 USA  
Tel: (1) 414 382-2000  
Telex: 43 11 016  
FAX: (1) 414 382-2400