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# Modicon
# B875–111 Analog Input Module
# Installation Instructions

GI–B875–111 Rev. C

AEG



MODICON

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# Modicon
# B875–111 Analog Input Module
# Installation Instructions

GI–B875–111 Rev. C

April, 1992

**MODICON, Inc., Industrial Automation Systems**
**One High Street**
**North Andover, Massachusetts 01845**

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# Preface

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This document is written expressly for the Installer/Maintainer of this module. It describes its features, functional operation, typical connections, installation, and specifications.

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# List of Related Documents

| Part Number | Modicon Title |
|---|---|
| GM–0984–201 | 984–380 and 984–381 System Planning & Installation Guide |
| GM–0984–301 | 984–480 System Planning & Installation Guide |
| GM–0984–101 | 984–680 System Planning & Installation Guide |
| GM–0984–IBM | IBM Programming Guide |
| GM–0984–001 | P190 Programming Guide |

# How to use this Manual

Everyone should read Chapter One first. Then refer to Chapter Two for installation, and refer to the other parts, depending upon your needs.



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# Incoming Inspection Guidelines

**Procedure** **Guidelines for Inspection**

**Step 1** Before you do anything, verify that your shipment is complete and undamaged. Refer to the Components of the B875 Package section to verify completeness. If the shipment is incomplete or damaged, notify the carrier and your distributor.

**Step 2** Remove everything from its packing material, and check for defects or damage. If the equipment is defective or damaged, notify your Modicon representative.

☞ **Note** Save shipping materials until installation is complete.

Sending Something Back?

- Do not return a product to Modicon before obtaining a return authorization number (RA) from Customer Service. Refer to Customer Service section.
- Use the original packing materials supplied by Modicon.
- Pack all returned equipment firmly so that it cannot move around in its shipping container.
- Protect all equipment against impact during shipment.

# Components of the B875 Package

The Analog Input package contains:

One AS–B875–111 Analog Input Module

One copy of this book, GI–B875–111



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# Customer Service

Modicon telephone numbers are:

- From anywhere in the United States, and Canada:

1–(800)–468–5342

- From outside the United States, or Canada:

1–(508)–794–0800

When you call the Modicon 1–800 telephone number, you hear a recording that asks you to dial one or more digits, depending on the type of service you want. To obtain a RA number, dial three. The five extra digit categories:

Dial 1 – Hardware or software technical support

Dial 2 – Order entry, buying hardware or software

Dial 3 – To inquire about return/exchange procedure

Dial 4 – To inquire about, or register for, training classes

Dial 5 – Any information other than above.



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# Chapter 1
# Introduction

- The B875–111 Analog Input module
- Indicators
- PC Mainframe Compatibilities



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# The B875–111 Analog Input Module

The B875–111 Analog analog–to–digital (A/D) Input Module (B875) converts input voltage and/or input current ranges into binary data. The Analog Input module can convert either 8 differential (B875) or 16 single ended (B877) inputs.

The Analog Input module allows you to pole a wide array of field devices requiring different voltages and different currents based upon your unique application. You can select from five available input voltage ranges on a module wide basis. The ranges, which are 0 to 5V, 1 to 5V, –5 to 5V, 0 to 10V, and –10 to 10V, are selected by means of four DIP–switches on the Module Configuration Switch.

You can select from three available input current ranges,which are 0 to 20mA, 4 to 20mA, and –20 to 20mA.

You can select from four available output formats. The formats, which are standard, elevated, full resolution, and decimal, are selected by means of two DIP–switches on the Module Configuration Switch.

You can select either 1, 8, 16, or 32 sample inputs to be averaged to generate each output by means of two DIP–switches on the Module Configuration Switch.

Some application examples include food processing, press operating, chemical processing, painting, and foundry casting.

The module has eight/sixteen analog inputs and is capable of updates to all channels every 10/20 msecs. The greater than 12–bit resolution and the absolute accuracy of +/–0.1% at 0 to 60° C provides precise control of your application. Refer to Figure 1 for the simplified schematic of the module.

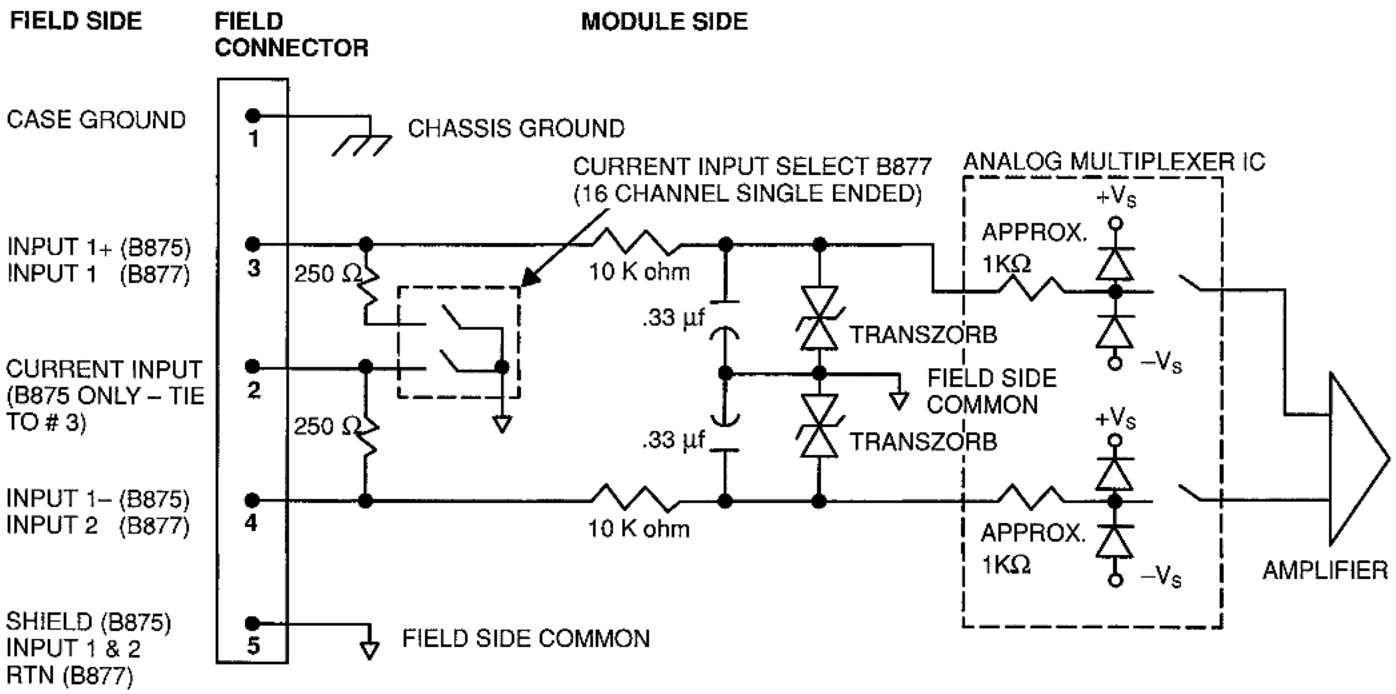



**Figure 1 B875–111 Simplified Schematic**



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# Indicators

All indicators are located on the front of the Analog Input module, and show the modules status, as listed below. Refer to Figure 2 for front, side, and rear view of the module.

**ACTIVE** The green indicator is ON when the module has passed its power up diagnostics without error, and remains ON until loss of internal voltage or loss of communication with the programmable controller.

Upon power–up the indicator FLASHES RAPIDLY showing that communication with the programmable controller has been established, but that the input data being returned is not valid. (4000 Hexadecimal is sent to the controller during the initialization time). When the module initialization is complete, and valid input data is being transferred the indicator is either STEADY ON, or FLASHING SLOWLY when any input is out–of–range.

☞ **Note** The active indicator does not represent the condition of the inputs. The indicator may be lit with one or more of the input channels not working properly.



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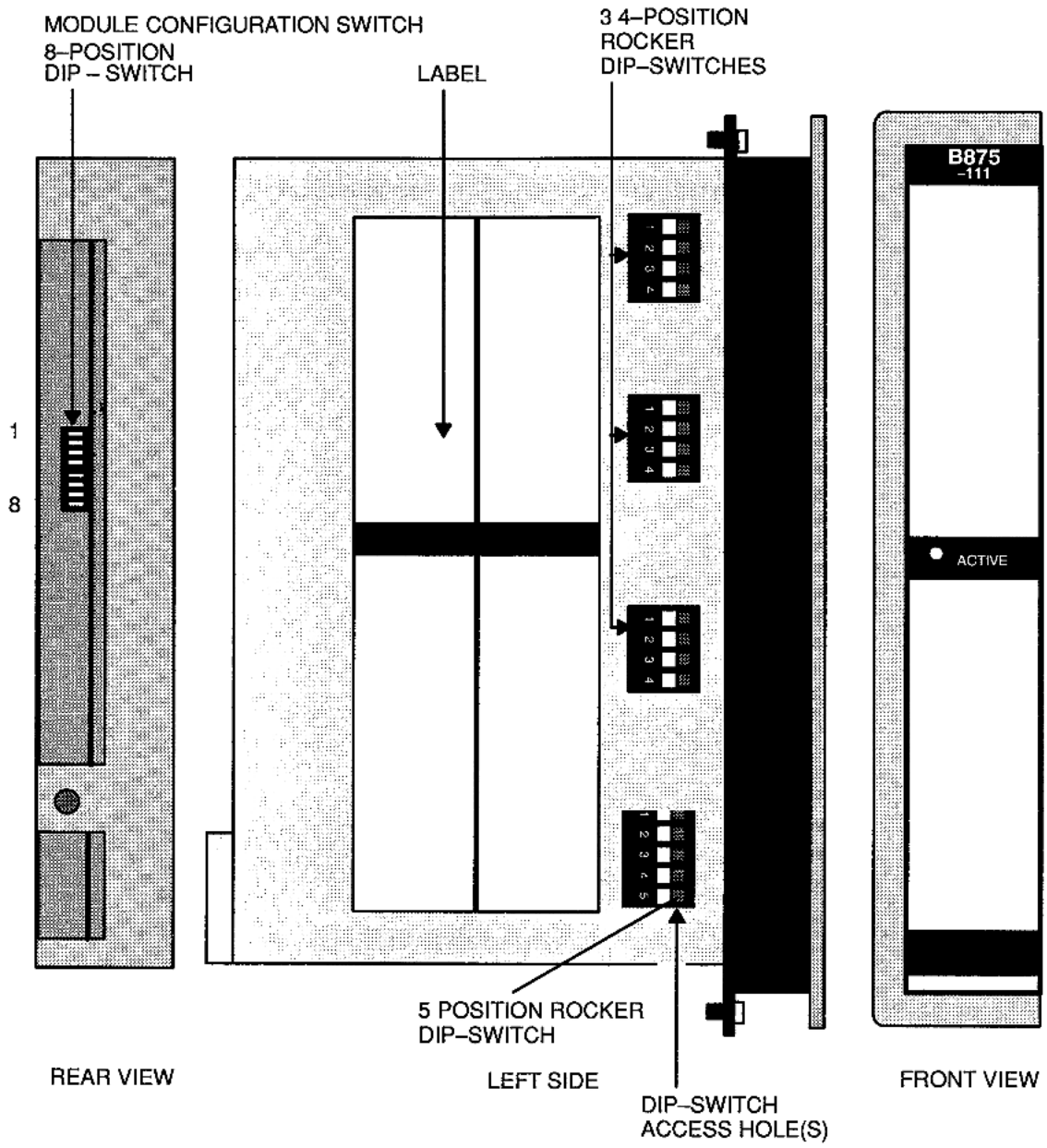



**Figure 2 B875–111 Analog Input Module**



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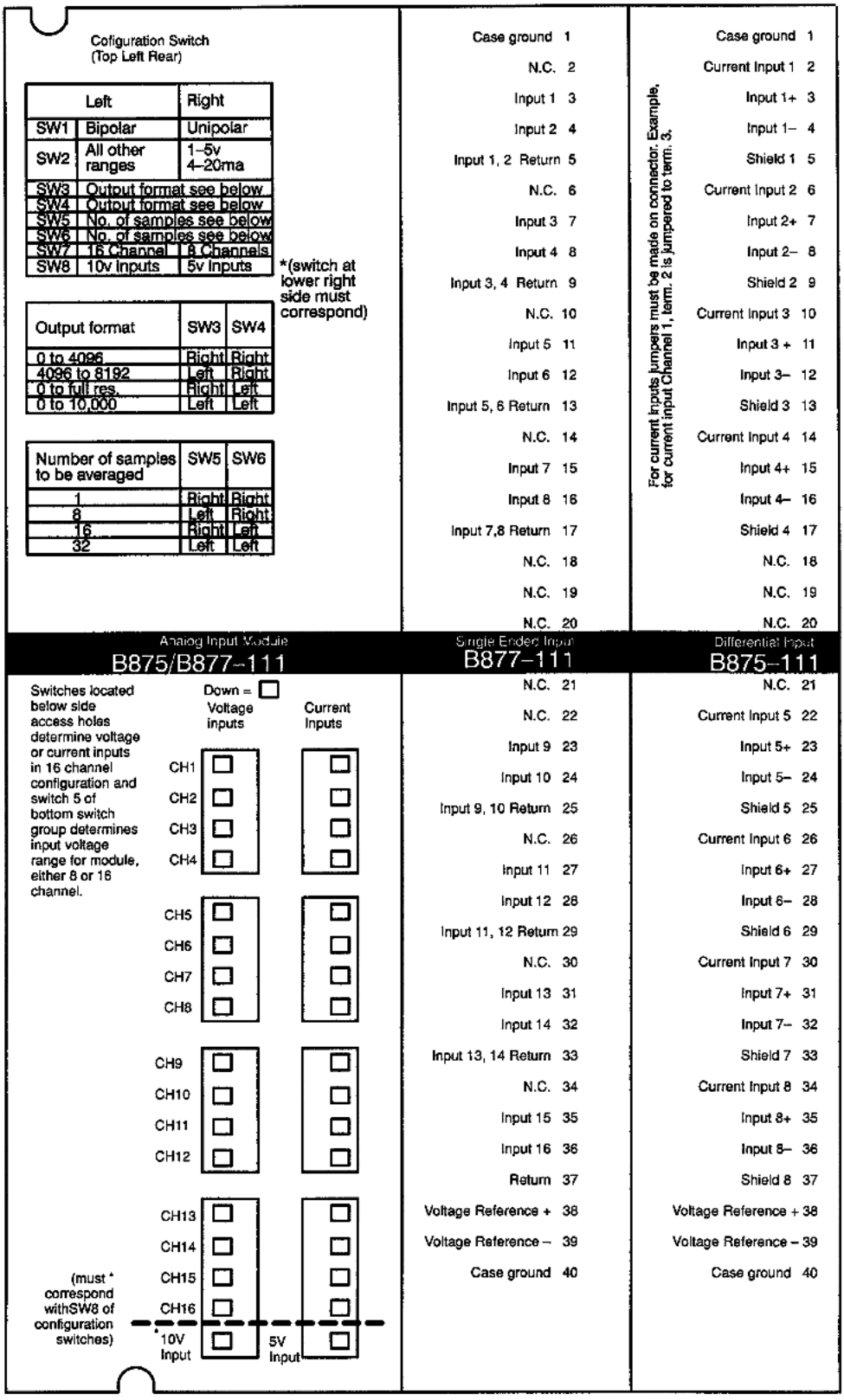



**Figure 3 B875–111 Side Label**



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# PC Mainframe Compatibilities

This section describes the interfaces between the module and programmable controller and the typical system configuration required to operate the Analog Input module.

**The Analog Input module operates in any 800–series I/O slot.**



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# Chapter 2
# Installation

- Module Installation
- Module Configuration
- Field Connections
- Securing the Module



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# Module Installation

Installation of your Analog Input module involves: unpacking the module, wiring the field connector, installing key pins in the housing, and mounting the module in the housing.

**Step 1** Remove the module from its shipping box and check for damage.

If damage is found, contact your salesman or distributor for correct return procedure. (Refer to the "Sending Something Back?" section of this document for information.)

**Step 2** Ensure power to housing is OFF.

**Step 3** Designate the housing slot for this module.

**Step 4** Locate the required connector assembly (Modicon part # AS–8535–000). This assembly consists of two 20–pin connectors.

☞ **Note** Remove the keying tabs on the AS–8535–000 high density connector prior to installing module.

**Step 5** Remove the old duct, if a different connector/cabling duct assembly is already present in the designated housing slot.

**Step 6** (Optional) If there is a module to the immediate left of the slot designated for this module's installation, temporarily remove it.

**Step 7** Locate the eight–position Module Configuration DIP–switch on the rear of the Analog Input module. These DIP–switches are used to select input range, output format, number of samples to be averaged, and input type.

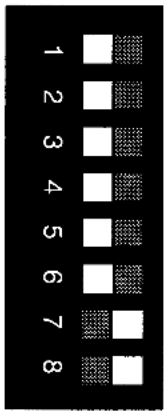
# Module Configuration

**Step 8** Set the Module Configuration Switch and the five position DIP–switch based upon your application needs prior to installing. Refer to Figure 4, and Figure 5 for the DIP–switch settings. Also, refer to the label located on the left side of the Analog Input module itself. The Analog Input module is shipped set for 1 to 5V range, 0–4095 output format (standard), one sample averaged, voltage inputs, 8 channel (B875–111), that is, all DIP switches to the right.



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**MODULE CONFIGURATION SWITCH**
**8–POSITION DIP–SWITCH**
**TOP OF MODULE**




1 ON LEFT DOWN
0 OFF RIGHT UP

**SWITCH TO FUNCTION RELATIONSHIP**

SW1= BIPOLAR/UNIPOLAR
SW2= ALL OTHER RANGES/1–5V & 4–20MA
SW3= OUTPUT FORMAT
SW4= OUTPUT FORMAT
SW5= NO. OF SAMPLES AVERAGED
SW6= NO. OF SAMPLES AVERAGED
SW7= 16/8 CHANNELS
SW8= 10V/5V

| SWITCHES | FUNCTIONS |
|---|---|
| SW1 | **INPUT RANGE**<br>FOR BIPOLAR (+ / – 10V, + / – 5V, + / –20mA):<br>SW1 = L<br><br>FOR UNIPOLAR (0 – 10V, 0 – 5V, 0 – 20mA, 1 – 5V, 4 – 20mA):<br>SW1 = R |
| SW2 | **INPUT RANGE**<br>FOR OFFSET (1–5V OR 4–20mA):<br>SW2 = R<br><br>FOR NO OFFSET (ALL OTHER RANGES):<br>SW2 = L |
| SW3&4 | **OUTPUT FORMAT** *SEE TABLE 1 FOR RESOLUTIONS<br>FOR STANDARD (0000–4095):<br>SW3 = R AND<br>SW4 = R<br><br>FOR ELEVATED (4096–8191):<br>SW3 = L AND<br>SW4 = R<br><br>FOR FULL RESOLUTION (RAW BINARY):<br>SW3 = R AND<br>SW4 = L<br><br>FOR DECIMAL (0001–9999):<br>SW3 = L AND<br>SW4 = L |

**Figure 4 Module Configuration DIP–Switch Settings**



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| SWITCHES | FUNCTIONS |
|---|---|
| SW5&6 | **SAMPLES TO AVERAGED**<br>FOR 1 SAMPLE:<br>SW5 = R AND<br>SW6 = R<br><br>FOR 8 SAMPLES:<br>SW5 = L AND<br>SW6 = R<br><br>FOR 16 SAMPLES:<br>SW5 = R AND<br>SW6 = L<br>FOR 32 SAMPLES:<br>SW5 = L AND<br>SW6 = L |
| SW7 | **INPUT TYPES**<br>FOR 8 DIFFERENTIAL: (B875)<br>SW7 = R<br><br>FOR 16 SINGLE ENDED: (B877)<br>SW7 = L |
| SW8 | **INPUT RANGES**<br>FOR 10V (+ / – 10V OR 0 – 10V):<br>SW8 = L<br><br>FOR 5V (ALL OTHERS):<br>SW8 = R |

**Figure 5 DIP–Switch Settings Cont.**



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## Output Format Selection

Table 1 provides the various output formats and their resolution relationships. For a more detailed explanation of each output format refer to the descriptions following Table 1.

**Table 1 Output Format and Resolution Relationship**

| Output Format | Under Range | Normal Range | Over Range | Resolution | Actual Format |
|---|---|---|---|---|---|
| Standard | 0000 | 0000–4095 | 4096 | 12 Bits | Raw binary, unsigned |
| Elevated | 4095 | 4096–8191 | 8192 | 12 Bits | Raw binary, unsigned |
| Full Resolution | Bit 16 =1<br>Bit 15 =1 | Bit 16 =0<br>Bit 15 =0 | | Bipolar=<br>1/15000cts | *Raw binary & two flags |
| | | 1–7499 | | Unipolar=<br>1/7500cts | |
| | | | | Offset=<br>1/6000cts | |
| Decimal | Bit 16 =1<br>Bit 15 =1 | Bit 16 =0<br>Bit 15 =0 | Bit 16 =1<br>Bit 15 =0 | Bipolar=<br>1/10000cts | *Raw binary & two flags |
| | | 1–9999 | | Unipolar=<br>1/7500cts | 1–9999 counts |
| | | | | Offset=<br>1/6000cts | 1–9999 counts |

*When an under or over range condition exists the output word contains the applicable flag and the under or out–of–range value.

**Standard output format** is raw binary output, 0–4095 counts. Under range is 0000 and over range is 4096.

**Elevated output format** is raw binary output, 4096–8191 counts. Under range is 4095 and over range is 8192.

**Full resolution output format** provides the true resolution of the module which depends on the input range.

Bipolar inputs produce an output of 0001–14,999 counts
Unipolar inputs produce an output of 0001–7499 counts.
Unipolar and offset inputs produce an output of 0001–5999 counts.

In the full resolution format, out–of–range values of +/– 2.4% may be read to the specified accuracy of the module. They can be read in this manner. When an out–of–range condition occurs which is over range the MSB (bit 16) is set to 1. If an under range occurs the second MSB (bit 15) is also set to 1. The remaining 14 bits give the absolute value of the amount over or under range. For example, for a unipolar input of 5.120 volts the output would have bit 16 set to 1. The remaining output bits equaling the raw binary representation of 120 millivolts. Any input above the .120 volts in this range will not be within the specified accuracy of the module.



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**Decimal output format** allows scaled outputs to provide 0001–9999 counts full scale. This format does not indicate the true resolution of the module. For bipolar inputs the output is scaled down and for unipolar inputs the output is scaled up. This format also reports out–of–range values in the same manner as the full resolution mode.

☞ **Note** For unipolar & unipolar with offset input ranges the process of scaling the lower resolution output values to the 1–9999 output format creates the possibility of missing codes due to rounding off of numbers in the microcontroller.

☞ **Note** At power–up, or after a reset the module transfers 4000 Hexadecimal during its internal reset, and initialization time until valid data is ready to be transferred. (4000 Hexadecimal corresponds to the second MSB = 1, all other bits = 0).

**Step 9** Locate the four access holes on the left side of the module. These holes allow access to three four–position and one five–position DIP switch.

### Input Selection

**Step 10** Set switch position 5 (SW5) of the five–position DIP switch found in the bottom access hole on the left side of the module, to select input range. This switch must correspond to switch position 8 (SW8) of the eight–position module configuration DIP switch. SW5 and SW8 settings must be identical. Refer to Figure 6, and Figure 9.

| WHERE: | **SWITCHES** | **FUNCTIONS** |
|---|---|---|
| | SW5 | **INPUT RANGES**<br>FOR 10V (+ / – 10V OR 0 – 10V):<br>SW5 = L<br><br>FOR 5V (ALL OTHERS):<br>SW5 = R |

**Figure 6 Input Range Settings**

# Field Connections

There are two ways to configure the Analog Input module to accept current inputs; for 16 single ended inputs or for 8 differential inputs. Refer to Step 11 if your module is configured for 8 differential inputs or to Step 13 if configured for 16 single ended inputs.



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## 8 Differential Current/Voltage Inputs

**Step 11** If you are configuring for 8 differential current inputs, note the channels that are receiving these inputs. Current inputs are selected by placing a jumper on the field connector between the positive voltage input and the current input terminal for the appropriate channel. For example, if channel 2 is to receive a current input a jumper must be made between terminal #7 (CH2), and terminal #6 (Current Input CH2). Refer to Figure 7.

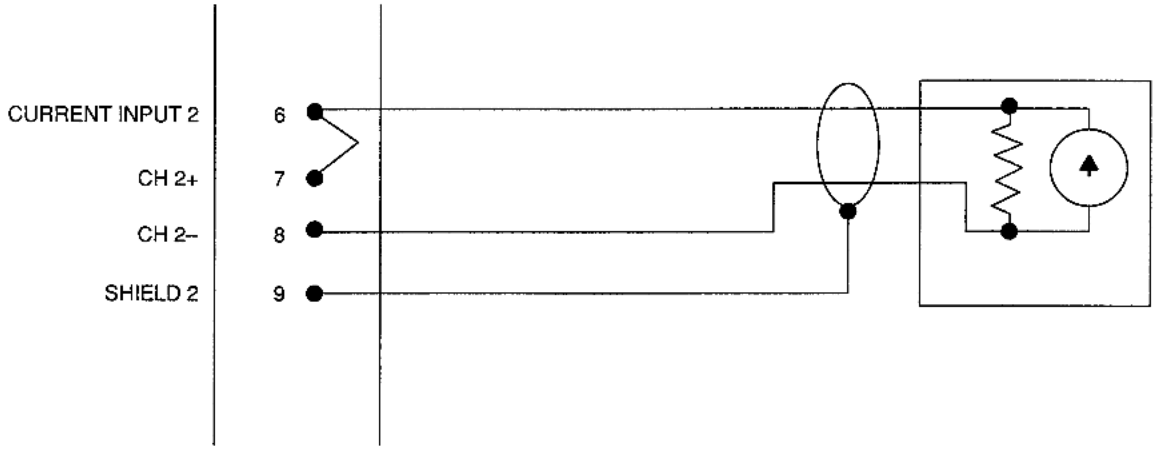



**Figure 7 Current Input Example**

**Caution DIP switches accessible through side cover are not used in differential mode, and MUST be left in the voltage input position, as set at the factory.**

**Note** You can have both current and voltage inputs only if one of these conditions exit: 1–5V and 4–20mA, or 0–5V and 0–20mA, or +/–5V and +/–20mA.

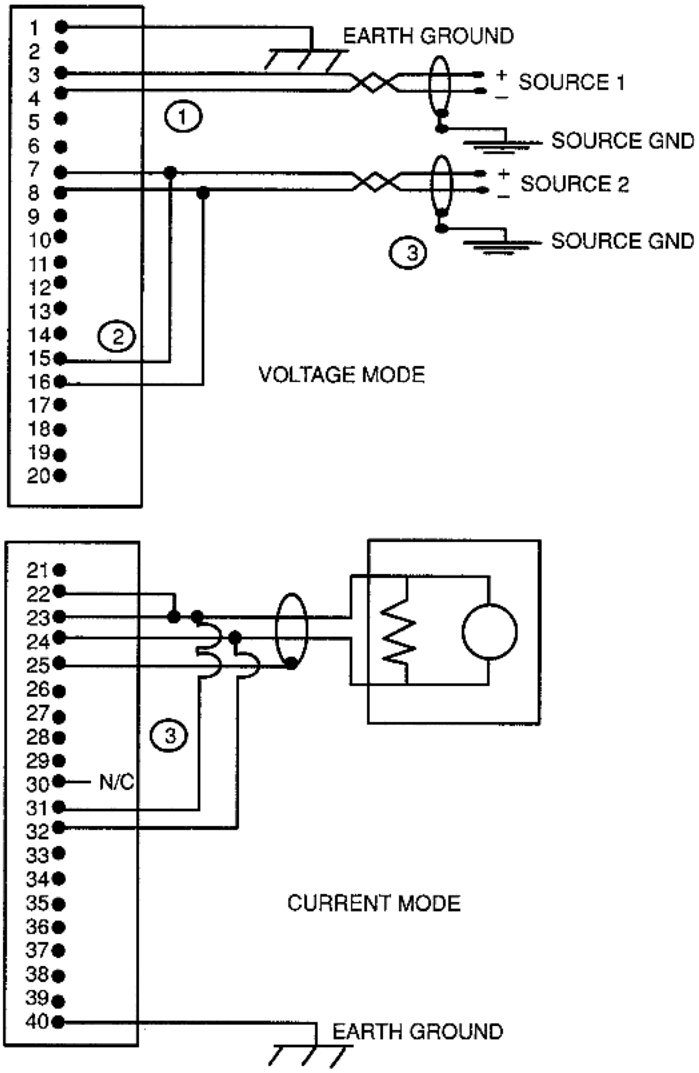
**Step 12** Referring to Figure 8, connect field side wiring to proper pins on the field connector when the Analog Input module is configured for 8 differential inputs. Voltage inputs do not require a jumper on the field connector.

**Note** Open circuit voltage inputs may drift either positively or negatively. If open circuit detection is required a current input should be used. When using inputs an open circuit can be detected if a large value resistor (2 Meg Ohm or greater) is placed at the field connector across the plus (+) and negative (–) inputs. The resistor clamps the channel to a small offset voltage (<100mV), if the field connections are broken.



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| SIGNAL | TERMINAL NO. |
|---|---|
| CASE GROUND | 1 |
| CURRENT INPUT 1 | 2 |
| INPUT 1 + | 3 |
| INPUT 1 – | 4 |
| SHIELD 1 | 5 |
| CURRENT INPUT 2 | 6 |
| INPUT 2 + | 7 |
| INPUT 2 – | 8 |
| SHIELD 2 | 9 |
| CURRENT INPUT 3 | 10 |
| INPUT 3 + | 11 |
| INPUT 3 – | 12 |
| SHIELD 3 | 13 |
| CURRENT INPUT 4 + | 14 |
| INPUT 4 + | 15 |
| INPUT 4 – | 16 |
| SHIELD 4 | 17 |
| NO CONNECTION | 18 |
| NO CONNECTION | 19 |
| NO CONNECTION | 20 |
| NO CONNECTION | 21 |
| CURRENT INPUT 5 | 22 |
| INPUT 5 + | 23 |
| INPUT 5 – | 24 |
| SHIELD 5 | 25 |
| CURRENT INPUT 6 | 26 |
| INPUT 6 + | 27 |
| INPUT 6 – | 28 |
| SHIELD 6 | 29 |
| CURRENT INPUT 7 | 30 |
| INPUT 7 + | 31 |
| INPUT 7 – | 32 |
| SHIELD 7 | 33 |
| CURRENT INPUT 8 | 34 |
| INPUT 8 + | 35 |
| INPUT 8 – | 36 |
| SHIELD 8 | 37 |
| VOLTAGE REFERENCE + | 38 |
| VOLTAGE REFERENCE – | 39 |
| CASE GROUND | 40 |




*** FOR REFERENCE ONLY. DO NOT ATTACH FIELD WIRING.**

(1) SHIELDS 1–8 ARE COMMON AND TIED TO FIELD SIDE GROUND.

(2) JUMPER UNUSED CHANNELS IN PARALLEL WITH A VALID INPUT TO AVOID OUT OF RANGE ERRORS.

(3) WHEN TERMINATING UNUSED CHANNELS IN CURRENT MODE, DO NOT JUMPER THE "CURRENT INPUT" PIN OF THE UNUSED CHANNEL.USING SHIELDED FIELD CIRCUIT WIRES, GROUND SHIELD AT ONE END ONLY.

(4) WHEN USING SHIELDED FIELD CIRCUIT WIRES, GROUND SHIELD AT ONE END ONLY.

**Figure 8 Typical Field Circuit Connections, 8 Differential Inputs**



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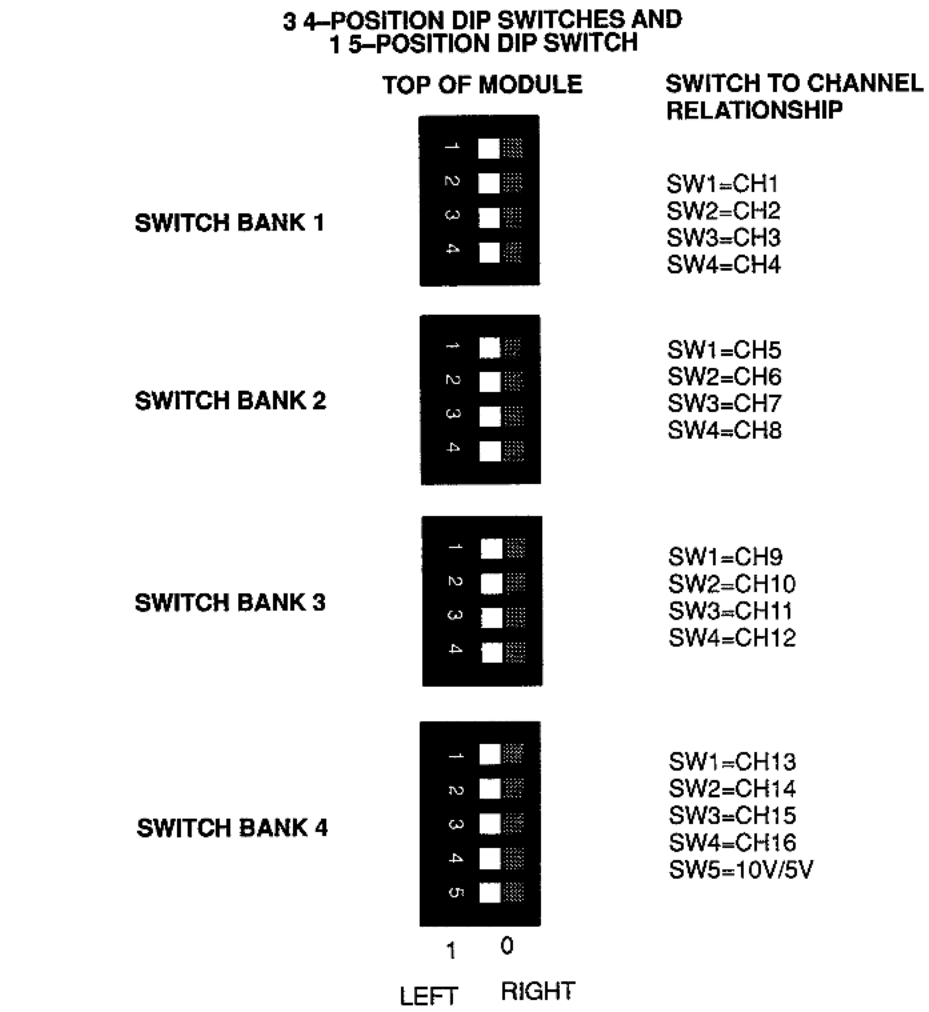
## 16 Single Ended Current/Voltage Inputs

**Step 13** If you are configuring for 16 single ended inputs, refer to Figure 10 for field connections for either voltage or current inputs. Current inputs are selected by setting the DIP switches accessible through the side cover for each channel that is receiving an input. This switch places a 250 ohm precision resistor between the plus input and analog return.

The fifth switch (SW5) on switch bank 4, located on the left side selects the voltage range for both B875 and B877 operation. This switch must correspond to (SW8) of the module configuration switch, located on the rear of the module. Refer to Figure 9 for the DIP–switch settings. Also, refer to the label located on the left side of the Analog Input module itself.



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| WHERE: | SWITCHES | FUNCTIONS |
|---|---|---|
| | | **CURRENT INPUTS** |
| | SWITCH BANK 1 | FOR CHANNELS 1–4 : SW1–4 = RIGHT SIDE DOWN |
| | SWITCH BANK 2 | FOR CHANNELS 5–8: SW1 –4 = RIGHT SIDE DOWN |
| | SWITCH BANK 3 | FOR CHANNELS 9–12: SW1–4 = RIGHT SIDE DOWN |
| | SWITCH BANK 4 | FOR CHANNELS 13–16: SW1–4 = RIGHT SIDE DOWN |
| | | **INPUT RANGES** |
| | SWITCH BANK 4 | FOR 10V ( + / – 10V OR 0 – 10V): SW5 = LEFT SIDE DOWN |
| | | FOR 5V (ALL OTHERS): SW5 = RIGHT SIDE DOWN |

**Figure 9 Current Settings for Single Ended Inputs**



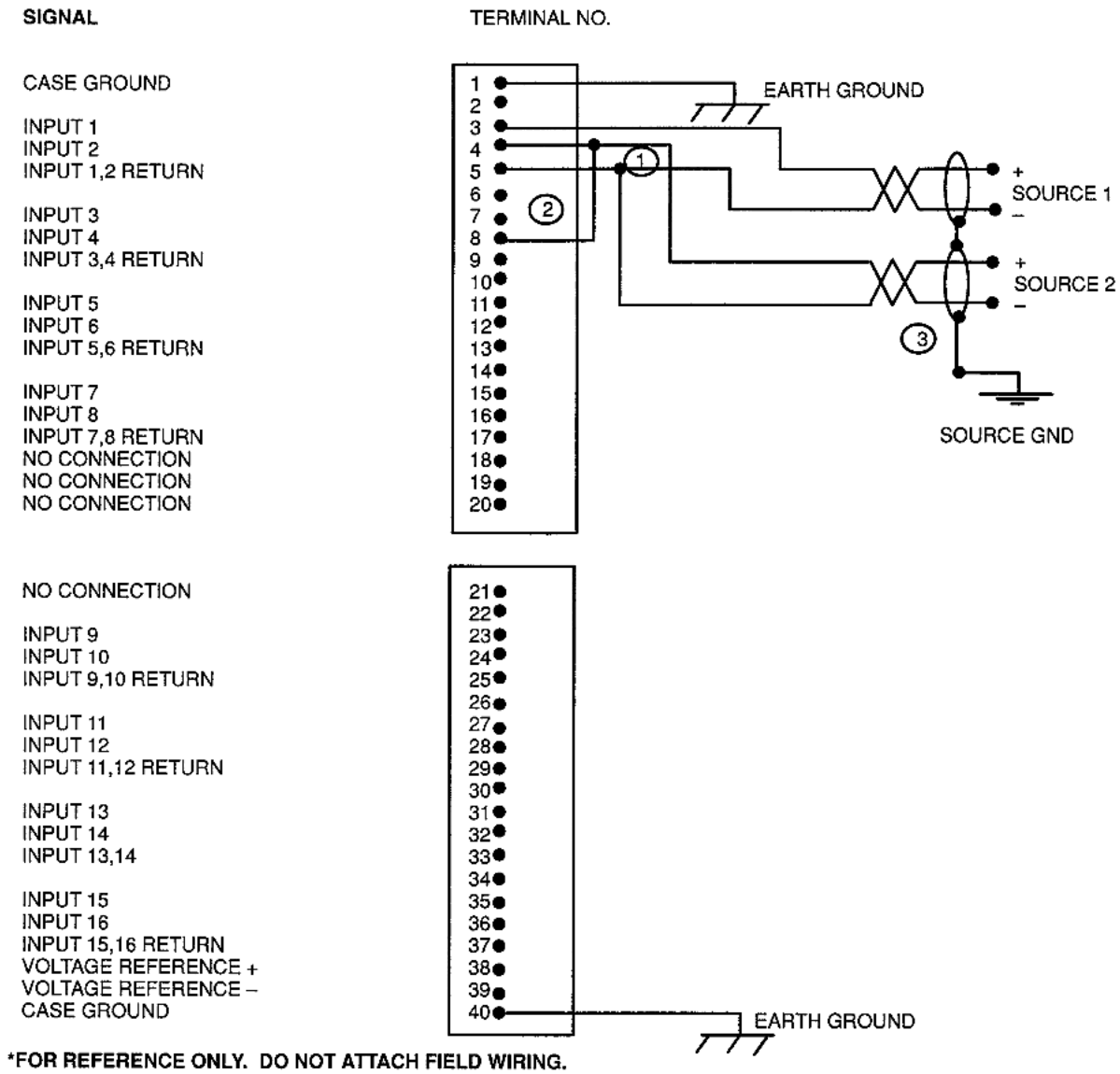
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**Step 14** Referring to Figure 10, connect field side wiring to proper pins on the field connector when the Analog Input module is configured for 16 single ended inputs.

☞ **Note** Open circuit voltage inputs may drift either positively or negatively. If open circuit detection is required a current input should be used. When using voltage inputs an open circuit can be detected if a large value resistor (2 Meg Ohm or greater) is placed at the field connector across the plus (+) and negative (–) inputs. The resistor clamps the channel to a small offset voltage (<100mV), if the field connections are broken.



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*FOR REFERENCE ONLY. DO NOT ATTACH FIELD WIRING.

(1) ALL RETURNS ARE ELECTRICALLY TIED TOGETHER INSIDE THE MODULE.

(2) JUMPER UNUSED CHANNELS IN PARALLEL WITH A "VALID" INPUT TO AVOID OUT OF RANGE ERRORS. IF OPERATING IN CURRENT MODE, DO NOT SELECT CURRENT MODE OPERATION FOR THE UNUSED CHANNEL

(3) WHEN USING SHIELDED FIELD CIRCUIT WIRES, GROUND SHIELD AT ONE END ONLY.

**Figure 10 Typical Field Circuit Connections, Single Ended Inputs**



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**Step 15** Re–install any module temporarily removed.

**Step 16** When using key pins (provided with housing shipment), install them above and below the housing slot selected for this module's installation.

Figure 11 shows a housing slot key pin installation pattern unique to this module. Using a 1/2 inch plastic headed mallet or equivalent, drive the knurled end of the key pins approximately 1/4" into the key pin holes above and below the designated module slot as indicated (P) on the installation pattern illustrated.

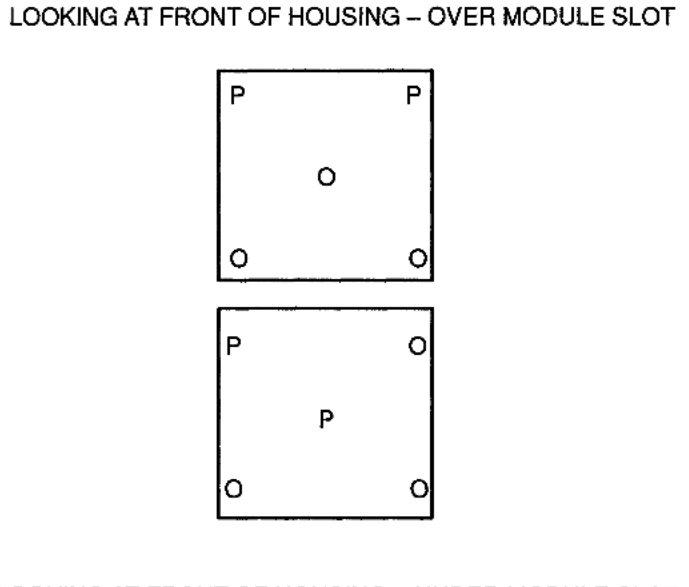



**Figure 11 Key Pin Installation Pattern**

**Step 17** Insert the module into the housing firmly but carefully, seating the edge connector in the backplane.

**Step 18** Secure the module to the housing using the captive slotted mounting screws at the top and bottom of the module front panel.

END OF PROCEDURE



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# Chapter 3
# Quick Start

- Quick Start Test



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# Quick Start Test

This test configures the module as follows: B875 (8 channel differential), 0–10 volt input range, 0–4096 counts output format, and no sample averaging.

**Step 1** Set the Module Configuration Switch as follows: (viewing the rear of the module when held vertically)

| | | |
|---|---|---|
| SW1 | Right | Selects Unipolar Inputs |
| SW2 | Left | Selects no offset (not 1–5V, 4–20mA) |
| SW3&4 | Right | Selects 0–4096 output format |
| SW5&6 | Right | Selects no averaging |
| SW7 | Right | Selects 8 channel (B875) |
| SW8 | Left | Selects 10 volt inputs |

**Step 2** Set the Voltage/Current Switches as Follows: All channels set for voltage inputs 10VDC input range. Place all switches (located below the side access holes) to the left.

**Step 3** Wire input terminal 38 to 3 and 39 to 4 on AS–8535–000 high density connector.

☞ **Note** Terminals 38–39 are a voltage reference only (4.5000VDC). They are not to be used for anything other than this test and calibration of the module.

☞ **Note** Remove the keying tabs on the AS–8535–000 high density connector prior to installing module.

**Step 4** Determine which channel and slot location are being used for this module.

**Step 5** Stop the controller.

**Step 6** Traffic cop the module as a B875, registers 30001–30008 binary.

**Step 7** Start the controller.

**Step 8** Confirm that the modules active light is illuminated.

☞ **Note** Active on steady = OK. Active flashing = OK, but inputs may be out of range.

**Step 9** Monitor input 30001 it should read approximately 1843 decimal.

☞ **Note** 4096 format / 10V range = 409.6 counts per volt 409.6 X 4.5000VDC = approximately 1843 decimal.



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# Chapter 4
# Traffic Copping

- Traffic Copping the Module



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# Traffic Copping the Module

The traffic cop directs the flow of data between the various I/O modules and the programmable controller's logic program. It links the references in the logic program and the I/O module points. The traffic cop allows you to match the programmable controller's node references with the I/O that monitor/control the field devices.

To traffic cop the controller using a P190 programming panel, you need a P190/984 Traffic Cop Tape (Modicon part number AS–T984–302 Rev L or higher) that contains program PG–T984–302 Ver 3.0 or higher

To traffic cop the host controller using an IBM programming panel, you need an IBM/984 Traffic Cop Disk (Modicon part number AS–DIBM–902 Rev Z or higher) that contains program PG–DIBM–902 Ver 4.0 or higher.

Program the traffic cop for your application. You may want to refer to the Programming Guide under Traffic Cop. (See List of Related Documents on page iii).

When you load the traffic cop tape/disk, attach to the Controller, press EXIT, select I/O CONFIG OPERATIONS, and select EDIT I/O TRAF COP, then Drop 1, Rack 1 is presented.

The Controller must be stopped before you can modify the traffic cop.

## S908/800–Series I/O Configuration

When you select I/O CONFIG OPERATIONS the 800 series traffic cop is automatically presented. The software labels for the traffic cop screen for 800/900 Series I/O are shown below. Remember, the Controller must be stopped to build the traffic cop.

**800/900 Series Traffic Cop** Press 800 SERIES TRAFFIC COP to display the I/O Channel traffic cop screen. If configured as a B875 (8 differential inputs), you need eight consecutive 3XXXX input registers. If configured as a B877 (single ended inputs), you need sixteen consecutive 3XXXX input registers. Figure 12 shows the I/O slot configuration for drop 1, rack 1.



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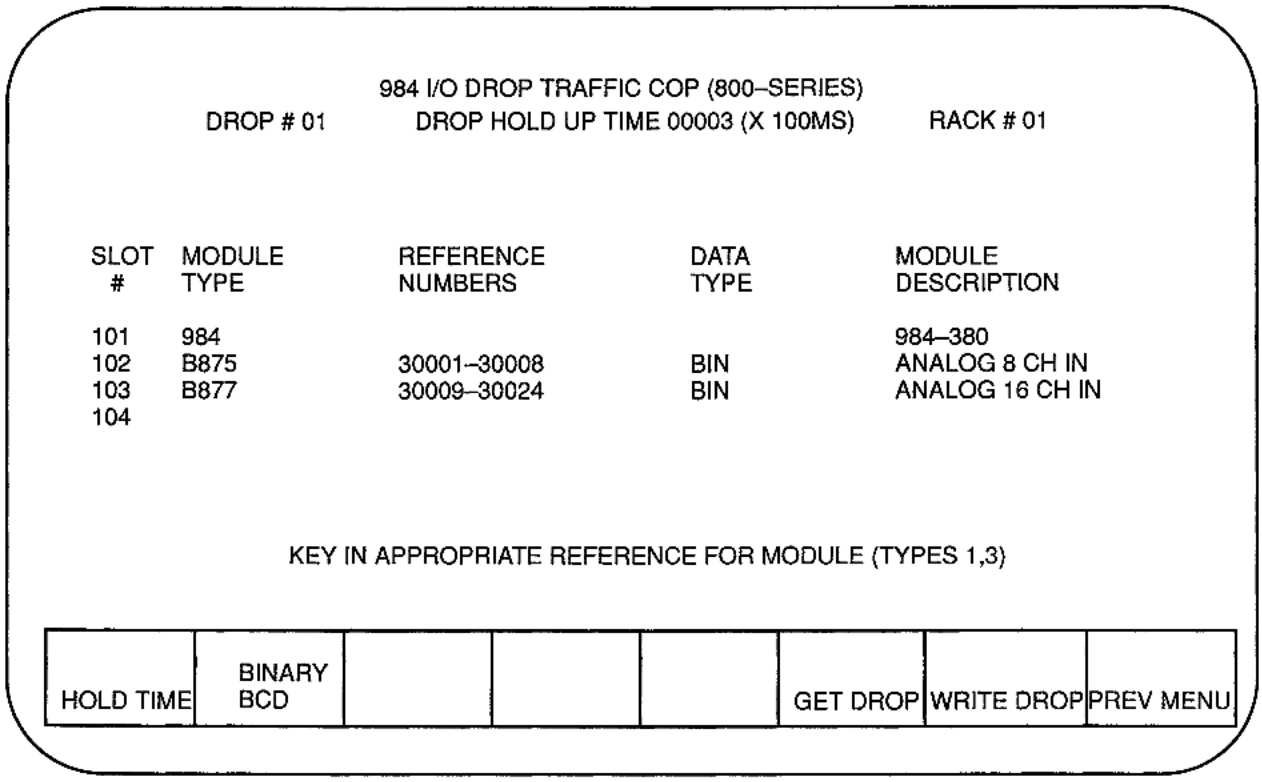



**Figure 12 Module Traffic Cop**

## Binary/BCD

When references are entered into the reference number field on the screen, the data type defaults to binary for 3XXXX and 4XXXX references and to discrete for 0XXXX and 1XXXX references.

**Only binary applies to this module.**

## Get Drop

Drop 1, rack 1 is shown here, use this function key to select other drops.

## Write Drop

Press the WRITE DROP key and then the PROCEED key to enter the traffic cop information into the module. If this is not done, all traffic cop additions and modifications are lost. When WRITE DROP is pressed, PROCEED and CANCEL are displayed along with the following prompt: PRESS PROCEED TO WRITE DROP TO THE PC or CANCEL TO ABORT. If the WRITE DROP and PROCEED keys are not pressed, the new traffic cop information is not sent to the module.



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# Appendix A
# Specifications

- Input Range
- Input Isolation
- Conversion
- Outputs
- System Power Requirements
- Environmental Ranges



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# Specifications

## Input Range

| | |
|---|---|
| Analog Inputs per Module | 8 Differential (B875) or 16 Single ended (B877) |
| Voltage Range | 0 to 5V, 1 to 5V, –5 to +5V, 0 to 10V, and –10 to +10V |
| Current Range | 0 to 20mA, 4 to 20mA, and –20 to –20mA |
| Input Filter | Single pole low pass, with –3db cut–off frequency of 48hz, +/–10% |
| Input Resistance | |
| Current Mode | 250ohms, +/–0.05% |
| Voltage Mode | Within range >10Mohms, outside range 10,000ohms |
| Input Resistance (No power to module) | |
| Differential Inputs | 20Kohms per channel |
| Single Ended Inputs | 10Kohms per channel |
| Input Protection | |
| Normal Mode | 120V RMS differential input |
| Common Mode | 120V RMS |
| Over Current Protection | Up to 30mA |
| Common Mode Range | +/–2V for 10V, +/–7V for 5V |
| Rejection | –40dB typical, DC to 60Hz |

## Input Isolation

| | |
|---|---|
| Input to OURBUS | 1500VAC RMS for one minute |
| Input to Case | 1500VAC RMS for one minute |
| Input to Input | 25Volts |



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## Conversion

| | |
|---|---|
| Resolution | >12 Bits all ranges<br>Bipolar 1 part in 15,000<br>Unipolar 1 part in 7,500<br>Unipolar with offset 1 part in 6,000 |
| Accuracy | +/–0.1% absolute accuracy over temperature range |
| Throughput | 10mS for 8 channels, 20mS for 16 channels |

☞ **Note** The module has an internal scan time set to start every 10/20 msecs. More than 3 interrupts per internal scan time degrades throughput.

| | |
|---|---|
| Linearity Error | +/–0.05% of full scale over the operating range |
| Differential Nonlinearity | +/–0.006% of full scale over the operating range |
| Repeatability | 0.025% of full scale RMS, constant temperature, no averaging |

## Outputs

| | |
|---|---|
| Out of Range Data | 2.4% above and below range |
| Output Range | 4 selectable output formats |
| Output Averaging | Options are 1,8,16, and 32 |

## System Power Requirements

| | |
|---|---|
| Power Supply Loading* | ±5: 500 mA<br>+4.3: 900 mA<br>–5: 0 mA |
| | *Refer to the electrical specifications of the power supply that is used with this module. |
| Maximum Wire Size | 1–12 AWG, 2–14AWG |
| EMI/RFI | Complies with applicable FCC class A requirements |
| ANSI/IEEE Surge Withstand | Complies with applicable SWC Test and NEMA Document 65A requirements |



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## Environmental Range

| | |
|---|---|
| Operating | |
| Temperature | 0 to 60°C (32 to 140°F) |
| Humidity | 0 to 95% (noncondensing) at 60°C |
| Storage | |
| Temperature | –40 to 85°C (–40 to 185°F) |
| Humidity | 0 to 95% (noncondensing) at 60°C |
| Shock | |
| Operating | +/– 15G peak, 11 ms, half–sine wave |
| Non–operating | +/– 15G peak, 11 ms, half–sine wave |
| Vibration | |
| Operating | 0.005" D.A. Sine, from 10 to crossover frequency (57 to 62 Hz),1.0 G from crossover frequency to 500 Hz |
| Non–operating | 0.029 G sq/Hz, 10–50 Hz rolloff at –8db/octive from 50 Hz to 500 Hz |
| Mounting | Plugs into any 800–series I/O slot. |
| Weight | 2.4 lbs (1.1 kg) |
| No. of Slots Required | 1 |
| Dimensions | 10.5 x 8.2 x 2.0 in. (266.7 x 203.2 x 50.8 mm) |



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# Appendix B
# Application

- Module Setup
- Traffic Cop
- Wire Inputs
- Module Checkout
- Application Example



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# Module Setup

This section deals with the set up of the B875–111.

## Configuration Switch Pack

The B875–111 can be configured to accept 8 differential or 16 single ended inputs. When selected for 8 differential inputs, the card is called a B875–111. When selected for 16 single ended inputs, the card is called a B877–111.

This selection is made by switch 7 on the configuration switch pack found at the rear of the module. SW7 in the left position is equal to 16 inputs, in the right position it is equal to 8 inputs.

In addition to selecting the number of inputs, you also select voltage range, output format, polarity, offset and number of samples. Refer to the Installation Instructions and the DIP–switch chart on the left side of the module for details.

For a quick start setup, you can use the following settings to interface a 0 to +10V input signal. For the following input parameters:

0 to +10V input
0 to full scale output format
1 sample
8 differential inputs

Set your switch settings as follows:
SW1 =R
SW2 =L
SW3 =R
SW4 =L
SW5 =R
SW6 =R
SW7 =R
SW8 =L

## Input Type Selection (Voltage or Current)

If configured as a B875 (8 differential inputs), current inputs (4–20mA) are selected by placing a jumper at the field connector between the positive voltage input and the current input terminal for the appropriate channel. Refer to Figure 13.



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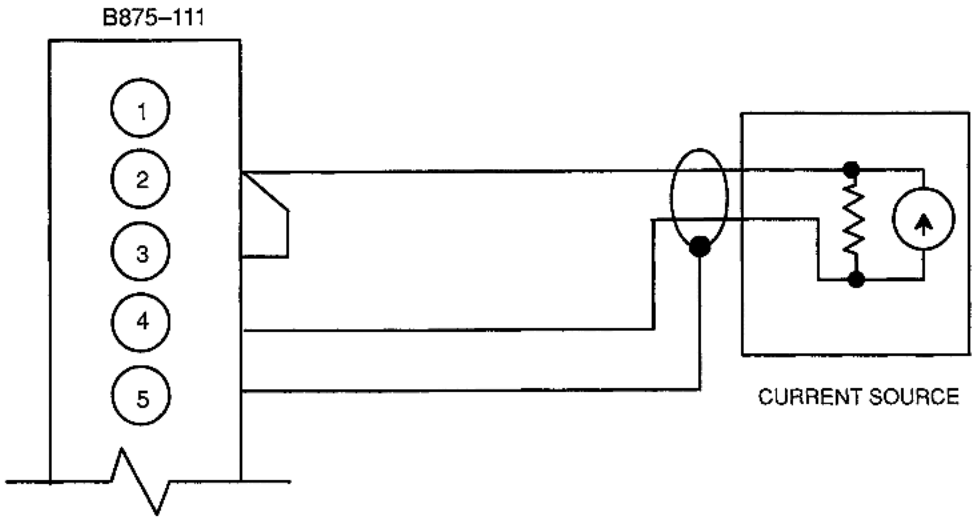



**Figure 13 Channel 1 Shown**

If configured as a B877 (16 single ended current inputs), input type is selected by the switches on the left side of the module. There is one switch for each of the 16 inputs. This switch places a 250 ohm precision resistor between the plus input and analog return. External jumpers are not used and must be removed. The left position is equal to voltage input, and the right position is equal to current input.

The fifth switch on switch bank 4 (left side) selects the voltage range for both B875 and B877 operations. This switch must correspond to switch 8 of the configuration switch bank (at rear of module). The left position of SW5 is equal to 10 volts, and the right position is equal to 5 volts. SW8 must be in the same position as SW5.

For the 0 to +10V input signal example, set all the input switches to the left (down or towards the numbers).

# Traffic Cop

This section deals with the Traffic Cop of the B875–111.

## S908

Install the module and initialize the traffic cop drop. The controller will read the module and the traffic cop will indicate the module type and slot location on the screen. If setup for 8 differential inputs, the module type will be a B875 and requires 8 consecutive 3xxxx binary registers. If setup for 16 single ended inputs, the module type will be a B877 and require 16 consecutive 3xxxx binary registers. Refer to the *J890/J892 Installation Instructions* for DIP switch settings part number GI–J890–001. Refer to Figure 14.



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984 I/O DROP TRAFFIC COP (800–SERIES)

| SLOT # | MODULE TYPE | REFERENCE NUMBERS | DATA TYPE | MODULE DESCRIPTION |
|---|---|---|---|---|
| 101 | P800 | | | POWER SUPPLY |
| 102 | J890 | | | REMOTE INTERFACE |
| 103 | J890 | | | REMOTE INTERFACE |
| 104 | B875 | 30001–30008 | BIN | ANALOG 8 CH IN |
| 105 | | | | |
| 106 | | | | |
| 107 | | | | |

**Figure 14 S908 Traffic Cop**

## S901/J200

The traffic cop must be updated to reflect the addition of the module to a channel. If the module is configured for 8 differential inputs, the traffic cop will require 8 binary 3xxxx registers. If the module is configured for 16 single ended inputs, the traffic cop will require 16 binary registers.

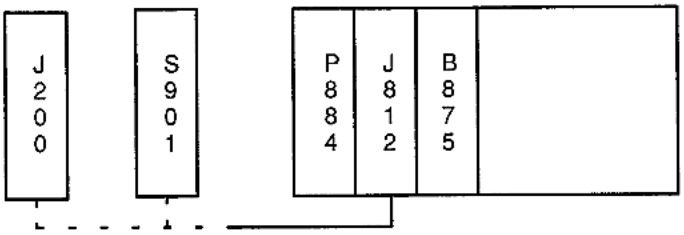
Care must be taken when utilizing a S901/J200 and multi–word modules. Refer to the *J810/J812 Installation Instructions* part number GI–J810–002 for configuration guidelines and switch settings of the J810/J812 for your particular application.

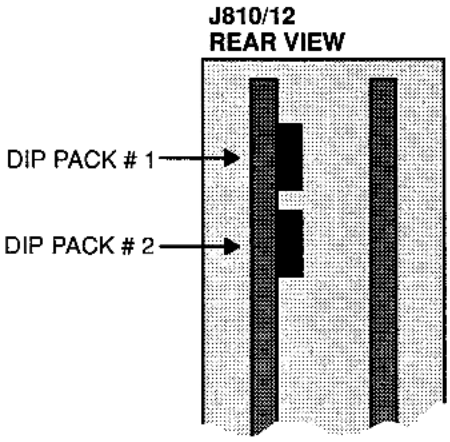
If the B875–111 is placed next to the J810/J812, the quick start example is shown in Figure 15.

☞ **Note** Upon power–up the module's active indicator flashes rapidly showing that communication with the programmable controller has been established but, that the input data being returned is not valid. (4000 Hexadecimal is sent to the controller during the initialization time). When module initialization is complete, and valid input data is being transferred, the indicator is either steady on, or flashing slowly when any input is out–of–range.



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**SWITCH SETTINGS***

| DIP PACK #1 | | DIP PACK #2 | | *ASSUMES: |
|---|---|---|---|---|
| SW 1 | L | SW1 | L | – Channel 1 |
| SW 2 | L | SW2 | R | – 300 ms Timeout |
| SW 3 | L | SW3 | L | – Normal Confidence |
| SW 4 | L | SW4 | L | Mode |
| SW 5 | L | SW5 | L | – 1 Dense Slot |
| SW 6 | L | SW6 | L | – 19" Housing |
| SW 7 | L | SW7 | L | – Slot Density = 8 Words |
| SW 8 | L | SW8 | R | |

TRAFFIC COP

CHANNEL 1

| | INPUT | | OUTPUT | |
|---|---|---|---|---|
| SLOT | REF # | TYPE | REF # | TYPE |
| 1 | 30001 | BIN | INHIBIT | |
| 2 | 30002 | BIN | INHIBIT | |
| 3 | 30003 | BIN | INHIBIT | |
| 4 | 30004 | BIN | INHIBIT | |
| 5 | 30005 | BIN | INHIBIT | |
| 6 | 30006 | BIN | INHIBIT | |
| 7 | 30007 | BIN | INHIBIT | |
| 8 | 30008 | BIN | INHIBIT | |

**Figure 15 S901/J200 Traffic Cop & Settings**



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# Wire Inputs

The B875–111 and B877–111 requires a high density connector part number AS–8535–000. Refer to Chapter 2 for installation steps or to the left side of the module for pinouts. Refer to Figure 16.

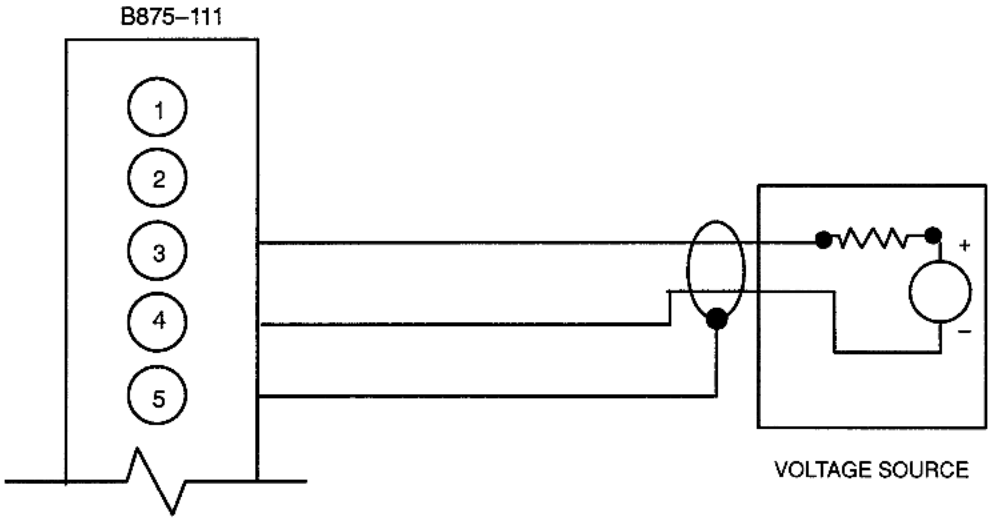



**Figure 16 0 to +10V Input Example**

# Module Checkout

The B875–111 and B877–111 will perform an analog to digital conversion on the inputs. The resolution of the analog to digital conversion is dependent upon the input range and output format selected with the configuration switch bank.

Using a P190 or IBM programmer call up the appropriate traffic copped registers. Vary the input signal and check that the register content varies correctly.

For the quick start example:

| | |
|---|---|
| at 0 volts | 3xxxx = 001 +/– (decimal) |
| at 5 volts | 3xxxx = 3750 +/– |
| at 10 volts | 3xxxx = 7500 +/– |
| at 11 volts | 3xxxx > 9999 (decimal). The active light indicator should be flashing indicating the input is out of range. |



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# Application Example

In many applications, analog signals are provided to operators in units (points, gallons per second, degrees C, feet per minute, etc.) via LED displays, CRT monitors or report printouts. An analog input can be scaled to engineering units.

To illustrate the technique, assume that the 0 to +10V signal, in the quick start example, represents a temperature from –40 to +140 degrees Fahrenheit. Refer to Figure 17.

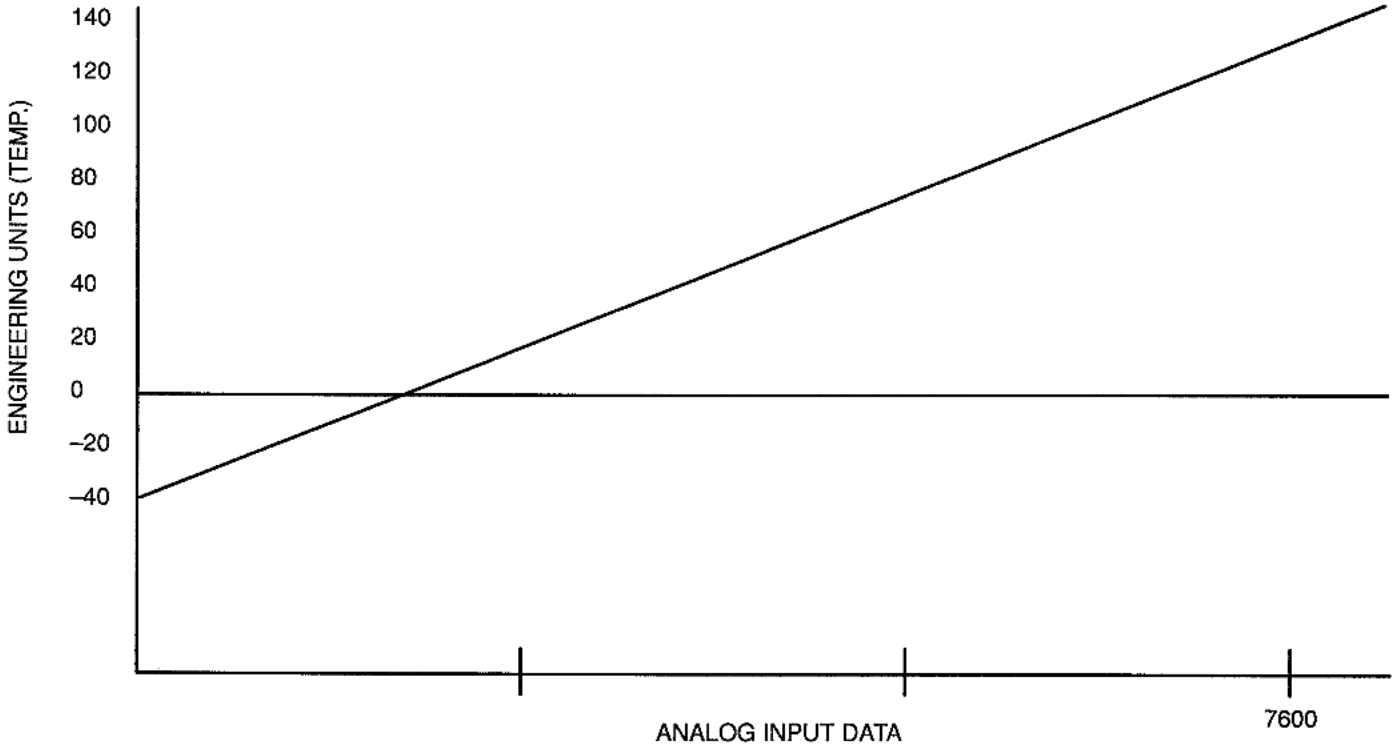



**Figure 17 Signal to Temperature Relationship**

- What is the engineering unit range? In this example it is 140 – (–40) = 180.
- Divide this number by 7500 using a calculator. 180/7500 = .024.
- Multiply this answer by 10,000 to obtain the multiply block constant. .024 x 10,000 = 240.
- Multiply analog input by the above constant. The high order result register will contain the range.
- Add or subtract the Y intercept (–40 in this example) to obtain the answer.



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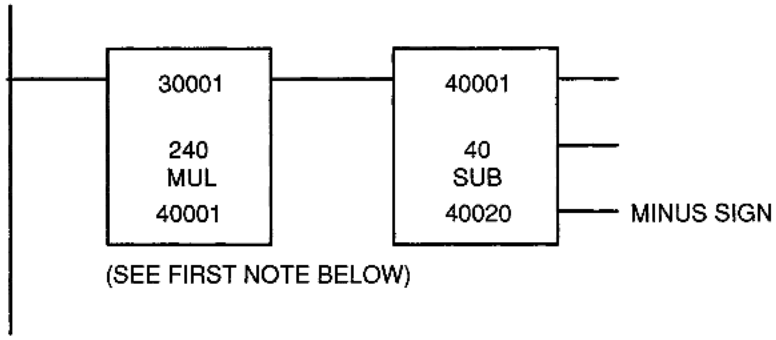



**Figure 18 Scaled Value from Analog Signal Example**

☞ **Note** The logic shown in used to generate the scaled value in register 40020, from the analog signal in 30001. For example:
30001 = 3800
40020 = 0051 degrees Fahrenheit

☞ **Note** Only the high order result of the multiply is used and no compensation for round off is used in this example.



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# Appendix C
# Calibration

- Calibration Tools
- Calibration Procedure



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# Calibration Tools

The Analog Input module is calibrated at the factory prior to shipment. To ensure the module's accuracy you should calibrate the trim–pot regularly. Calibration is recommended at 12 month intervals.

The following tools are needed to calibrate an Analog Input module:

1) A precision digital readout voltmeter with an accuracy of +/–0.0001 volts on a 10 volt scale

2) A 1/4 inch Phillips screwdriver

3) A 1/8 inch standard screwdriver

4) An adhesive for the trim–pot adjusting screw (e.g. Locktight Glyptol)

# Calibration Procedure

**Step 1** Remove the two screws and the label located on the front panel of the Analog Input module. This allows you access to the trim–pot. The trim–pot adjusts the range's total magnitude (full scale). Refer to Figure 19.



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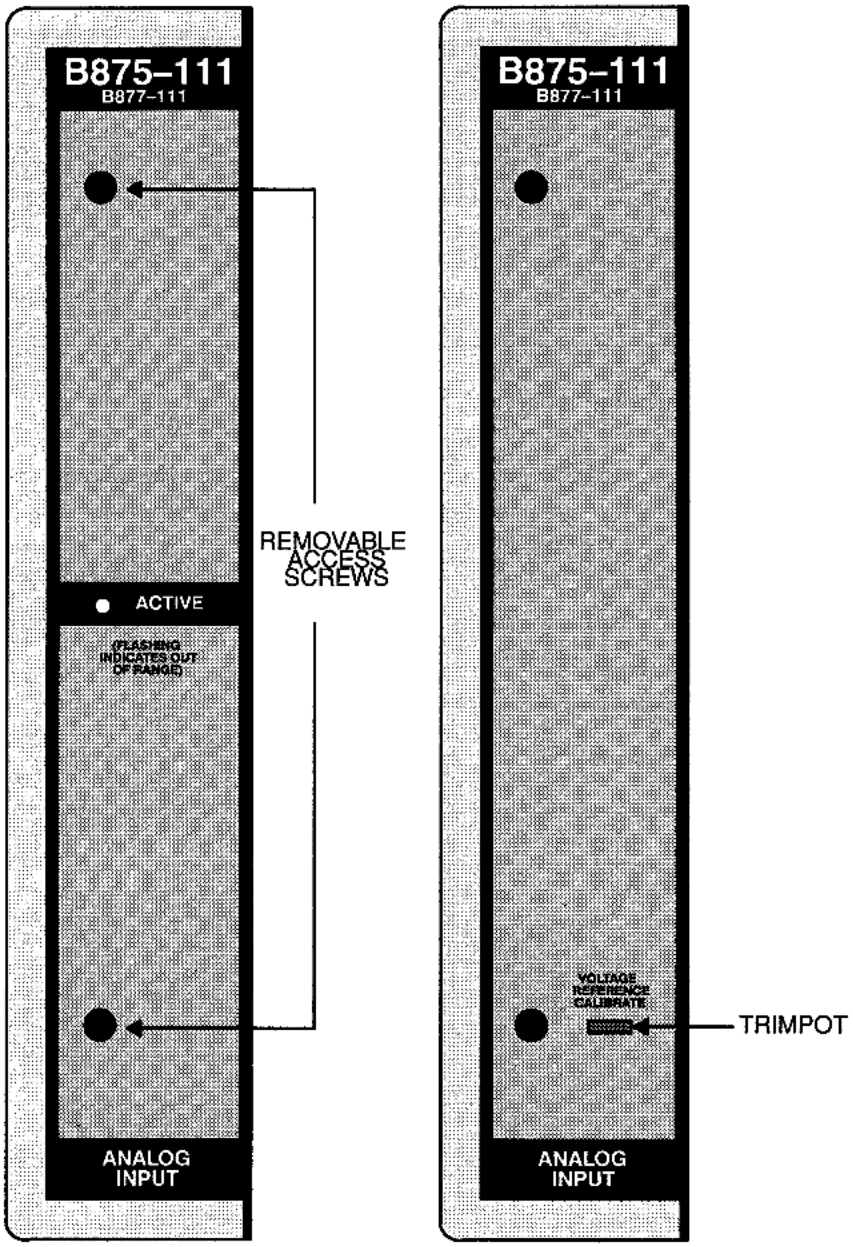



**Figure 19 Location of Trim–Pot**

**Step 2** Open the Analog Input module handle to expose the connectors and terminals.

**Step 3** Connect the digital voltmeter (DVM) minus lead to the Voltage Reference– (terminal number 38) and the plus lead to the Voltage Reference+ (terminal number 39). Refer to Figure 20.

☞ **Note** Field wiring may remain connected during calibration. Also, five minutes of warm up is sufficient to attain temperature stability.



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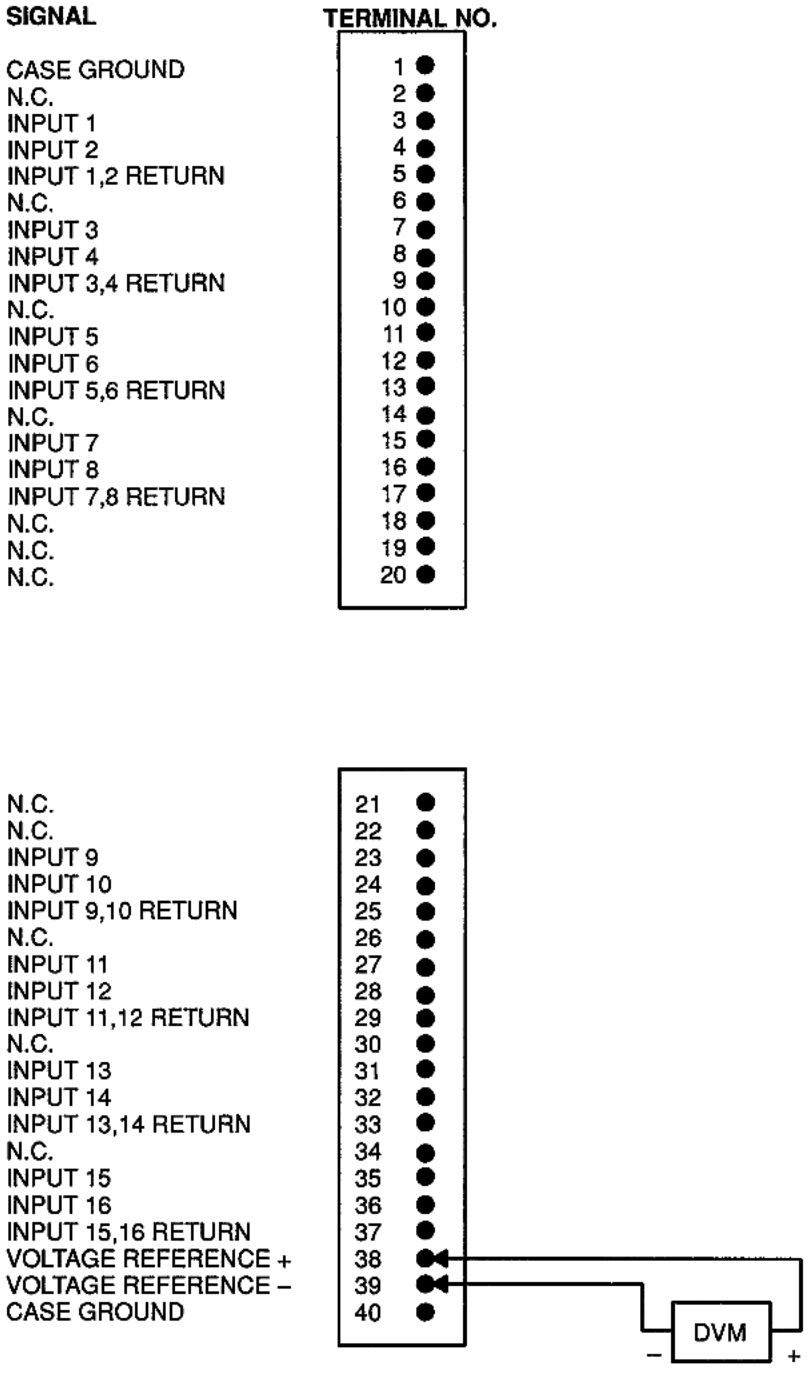



**Figure 20 Voltmeter Connections Diagram**

**Step 4** Adjust reference voltage trim pot for 4.500 volts, +/– 0.0001 volts.

**Step 5** Secure (glue) trim–pot.

**Step 6** After the calibration procedure is complete, disconnect the voltmeter, return connections to their original state, close module handle, and replace front label that covers the trim–pot.

END OF PROCEDURE



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# Appendix D
# Quick Reference

- DIP–Switch Configurations



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# DIP–Switch Configurations

To setup the Analog Input module you need to establish your input range, output format, number of samples to be averaged, and the type of inputs to fit your specific application. This requires you to set an eight–position DIP switch and SW5 of a five–position DIP switch located on the left side of the Analog Input module. Table 2 is a quick reference to aid you in this task.

**Table 2 DIP–Switch Configuration Parameters**

| | 8–Position DIP–Switch | | | 5–Position DIP–Switch |
|---|---|---|---|---|
| INPUT RANGE | SW1 | SW2 | SW8 | SW5 |
| +/–5V, +/–20mA | L | L | R | R |
| 0–5V, 0–20mA | R | L | R | R |
| 1–5V, 4–20mA | R | R | R | R |
| +/– 10V | L | L | L | L |
| 0–10V | R | L | L | L |
| OUTPUT FORMAT | SW3 | SW4 | | |
| Standard (0 to 4096) | R | R | | |
| Elevated (4096 to 8192) | L | R | | |
| Variable (0 to full res.) | R | L | | |
| Decimal (0 to 10,000) | L | L | | |
| SAMPLES TO BE AVERAGED | SW5 | SW6 | | |
| 1 | R | R | | |
| 8 | L | R | | |
| 16 | R | L | | |
| 32 | L | L | | |
| TYPE OF INPUTS | SW7 | | | |
| Differential | R | | | |
| Single Ended | L | | | |

For example, assume that you want the following: +/–5V input, 0–10,000 counts output, no averaging, and differential inputs. Your switches should be set as noted here:

Module Configuration Switch

SW 1–4 = L
SW 5–8 = R

Switch Bank 4

SW 5 = R


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