Section 6. Analog Input Module (High Speed)

6-1. Description

The combined Personality and Electronics Modules form the High Speed Analog Input Module. Eight sets of individually isolated input channels provide 14-bit resolution with 50 or 60 samples per second conversion rates. The input signals are conditioned and routed through the appropriate Personality Module to the Electronics Module. The Personality Module also provides surge protection to protect the input circuits of the Electronics Module. The Electronics Module performs the analog to digital conversions and provides interfacing to the Ovation Serial I/O Bus.

The 14 bit High Speed Analog Input is applicable for CE Mark certified systems.

Note

See **Section 3. I/O Modules** for environmental, installation, wiring, and fuse information.

6-2. Module Groups

6-2.1. Electronics Modules

There are four groups of Electronics modules for the High Speed Analog Input Module:

- 5X00070G01 interfaces to current signals with an input range of 4 to 20 mA.
- 5X00070G02 interfaces to voltage signals with an input range of ±1V, ±250mV, ±100mV.
- 5X00070G03 interfaces to voltage signals with an input range of ±5V, ±10V.
- 5X00070G04 interfaces to thermocouple inputs ± 20mV, ± 50Vm, ± 100mV.

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6-2.2. Personality Module

The High Speed Analog Input Module is compatible with the following Personality modules:

- 1C31227G01 interfaces to current input with an input range of 9-20 mA.
- 1C31227G02 voltage input.
- 1C31116G02 field powered current input ± 1mA
- 1C31116G03 local powered ± 1mA current only.
- 1C31116G04 voltage inputs to temperature sensor.

Table 6-1. Analog Input Subsystem (14 bit High Speed)

Range	Channels	Electronic Module	Personality Module
4 - 20mA, Field or Locally powered	8	5X00070G01	1C31227G01
± 100mV, ± 250mV, ± 1V	8	5X00070G02	1C31227G02
± 5V, ± 10V	8	5X00070G03	1C31227G02
± 1mA 2 wire local powered	8	5X00070G02	1C31116G03
± 1mA 4wire field powered	8	5X00070G02	1C31116G02
± 20mV, ± 50mV, ± 100 (with temperature sensor for cold junction thermocouple compensation) (Medium Speed)	8	5X00070G04	1C31116G04
± 20mV, ± 50mV, ± 100 (Medium Speed)	8	5X00070G04	1C31116G01

All Configurations CE Mark Certified

6-3. Module Block Diagram

The simplified block diagram for the voltage input configuration of the High Speed Analog Input module is shown below. The channel #1 input is grounded locally at the cabinet, and grounding at the field device is shown for the channel #8 input.

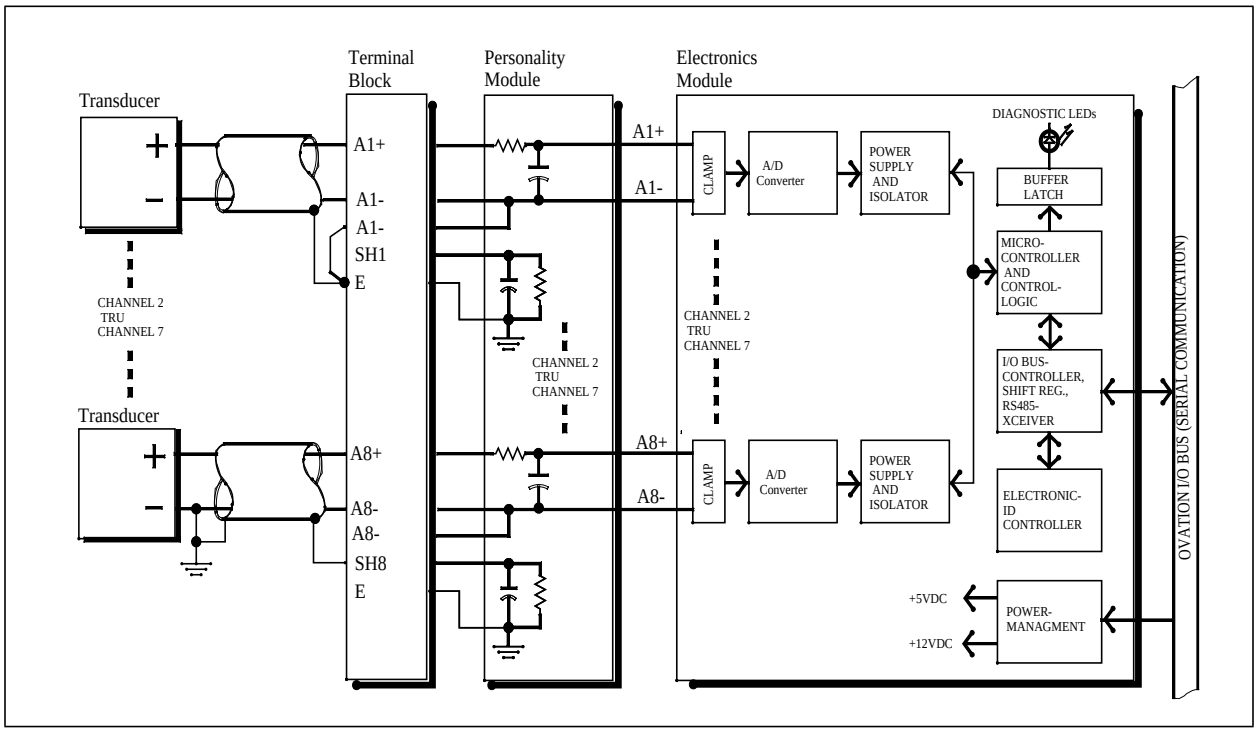


Figure 6-1. Voltage input Configuration using Pmod 1C31227G02

6-4. External Power Supplies

Note

Module power specifications (main and auxiliary) refer to the actual power drawn by the module from the 24VDC main power supply and from the auxiliary power supply (if required) and **NOT** from the AC or DC Mains.

If the High Speed Analog Input module uses the current input 1C31227G01 or 1C31116G03) Personality modules, the required voltage source may be obtained from the internal auxiliary power supply (backplane).

If it uses Pmod 1C31227G01 or 1C1116G02, field powered current loops can be used. Note that 1C31227G01 supplies both field and local power.

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6-5. Specifications

Electronics Module (5X00070)
Personality Module (1C31227, 1C31116)

Table 6-2. High Speed Analog Input Module Specifications

Description	Value
Number of channels	8
Input range	4 - 20 mA, ±1mA ±1V, ±5V, ±10V ±20mV, 50mV, ±100V, ±250mV
Resolution	14 bits (including polarity)
Guaranteed accuracy (@25°C)	±0.10% of full scale value ±1/2LSB @99.7% confidence.
Temperature coefficient	±0.24% of the full scale value over 0 to 60°C.
Input impedance:	3.3 MΩ (G02, G04) field configured; 200 MΩ (Go3) field configured; 300 MΩ @20 mA for G01 field configured
Sampling rate (per second)	16 when configured for 50 Hz 20 when configured for 60 Hz
Self-calibration	On demand by the Ovation Controller.
Diagnostics	Internal module operating faults. Out of range detection. Open loop detection for current inputs.
Dielectric isolation: Channel to channel Channel to logic	 1000 V AC/DC 1000 V AC/DC
Normal mode rejection	60 dB @50 Hz ± 1/2% or @60 Hz ± 1/2% (when properly configured) 30 dB (typical) @50 Hz ± 5% or @60 Hz ± 5% (when properly configured)
Common mode rejection	120 dB @ DC or @ the nominal (50/60 Hz) line frequency ± 1/2% and harmonics. 100 dB (typical) for nominal line frequency ± 5% and harmonics.
Module power	Main: 2.4 W typical; 3.125 W maximum Aux: When used (1C31227G01) Aux power supply voltage = 24 V DC 3.84 W typical (8 inputs @ 20mA each)
Operating temperature range	0 to 60°C (32°F to 140°F)
Storage temperature range	-40°C to 85°C (-40°F to 185°F)
Humidity (non-condensing)	0 to 95%

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6-7. High Speed Analog Input Terminal Block Wiring Information

For Pmod 1C31116

Each Personality module has a simplified wiring diagram label on its side, which appears above the terminal block. This diagram indicates how the wiring from the field is to be connected to the terminal block in the base unit.

The diagrams for the analog input Personality modules are illustrated in Figure 6-2. The following table lists and defines the abbreviations used in those diagrams.

Abbreviation	Definition
A1 - A8 +	Analog Input positive terminal connection.
A1 - A8 -	Analog Input negative terminal connection.
	Earth ground terminals.
P1 - P8 +	Positive terminal connection for current loop power.
PS+, PS-	Auxiliary power supply terminals.
RSV	Reserved terminal. No connections allowed on these terminals.
SH1 - SH8	Shield terminal connection (for non-CE Mark certified systems).

As is standard for analog signals, shielded twisted-pair wire should be used for the field interface. For the analog input, the (-) and shield should be tied together and to earth ground, either locally at the cabinet or at the field device. Figure 6-4 through Figure 6-7 show how the various Personality modules require these connections or how the options are implemented.

Figure 6-8 illustrates the jumper settings for the Personality module.

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Notes

1. Do **not** use unmarked terminal block locations.
2. Shield terminals (SH) are **not** connected in CE Mark systems.

Thermocouple Input: (1C31116G04)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
A	A1 +	SH1	A2 +	SH2	A3 +	SH3	A4 +	SH4	A5 +	SH5	A6 +	SH6	A7 +	SH7	A8 +	SH8	PS +	PS -
B	RSV	A1 -	RSV	A2 -	RSV	A3 -	RSV	A4 -	RSV	A5 -	RSV	A6 -	RSV	A7 -	RSV	A8 -	PS +	
C																	⏚	⏚

Note: Internal jumpers are in this personality module for locally grounding the shield and (-) connections to earth ground.

Field Powered Current Loop: (1C31116G02)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
A	A1 +	SH1	A2 +	SH2	A3 +	SH3	A4 +	SH4	A5 +	SH5	A6 +	SH6	A7 +	SH7	A8 +	SH8	PS +	PS -
B	RSV	A1 -	RSV	A2 -	RSV	A3 -	RSV	A4 -	RSV	A5 -	RSV	A6 -	RSV	A7 -	RSV	A8 -	PS +	
C																	⏚	⏚

Locally Powered Current Loop: (1C31116G03)

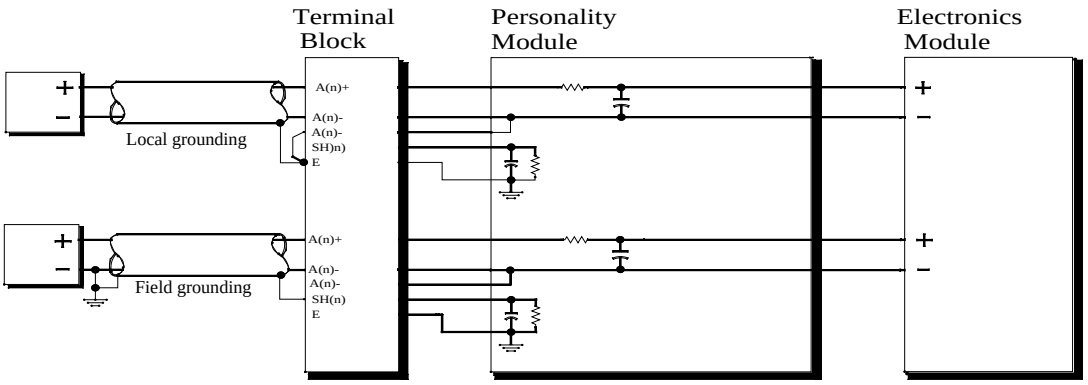
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
A	P1 +	SH1	P2 +	SH2	P3 +	SH3	P4 +	SH4	P5 +	SH5	P6 +	SH6	P7 +	SH7	P8 +	SH8	PS +	PS -
B	A1 +	RSV	A2 +	RSV	A3 +	RSV	A4 +	RSV	A5 +	RSV	A6 +	RSV	A7 +	RSV	A8 +	RSV	PS +	
C																	⏚	⏚

Figure 6-3. Terminal Block Connections for the Analog Input Personality Modules

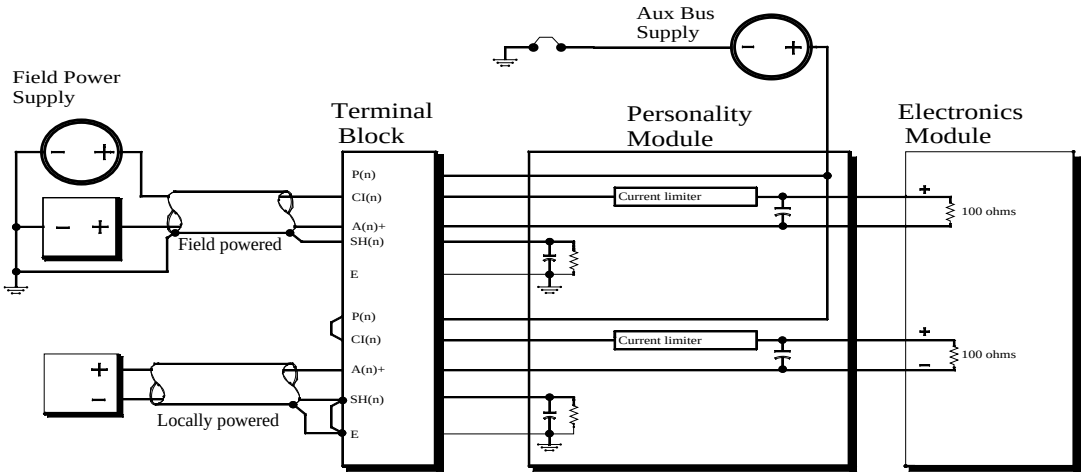
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6-8. High Speed Analog Input Field Connection Wiring Diagrams

Non-CE Mark Systems



Voltage Input Connections 1C31227G02



Current Input Connections 1C31227G01

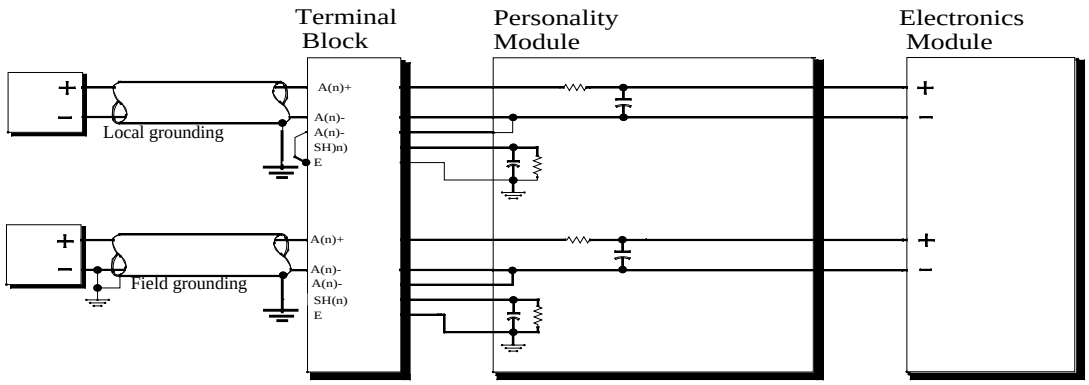
Caution

When using locally powered current inputs, the power distribution panel **MUST** be equipped with jumper module 5A26471G01 to ensure proper grounding of the Aux Bus supply.

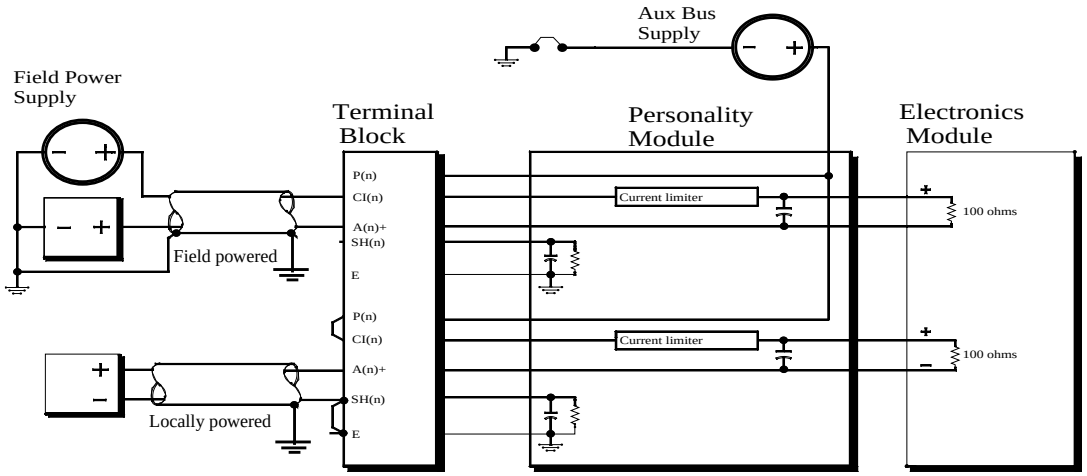
Figure 6-4. Field Connections for the Input Connectors (Non-CE Mark)

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CE Mark Systems



Voltage Input Connections 1C31227G02



Current Input Connections 1C31227G01

Caution

When using locally powered current inputs, the power distribution panel **MUST** be equipped with jumper module 5A26471G01 to ensure proper grounding of the Aux Bus supply.

1. All field wiring MUST be braid-shielded and grounded at the entry point of the cabinet using the recommended hardware (refer to "Cable Guidelines" in U3-1000 and U3-1005).

Figure 6-5. Field Connections for the Input Connectors (CE Mark)

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Non-CE Mark Certified Systems

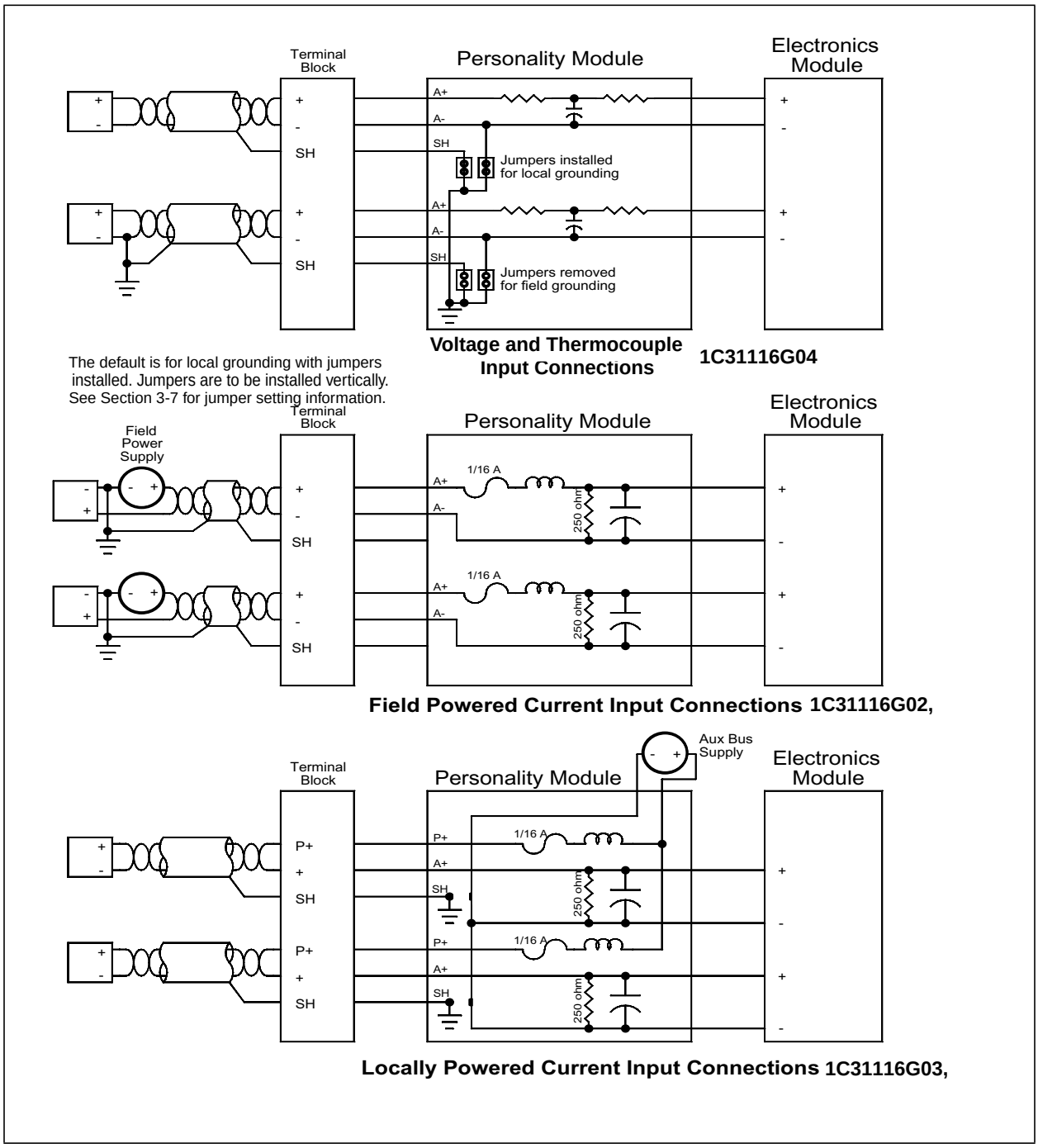
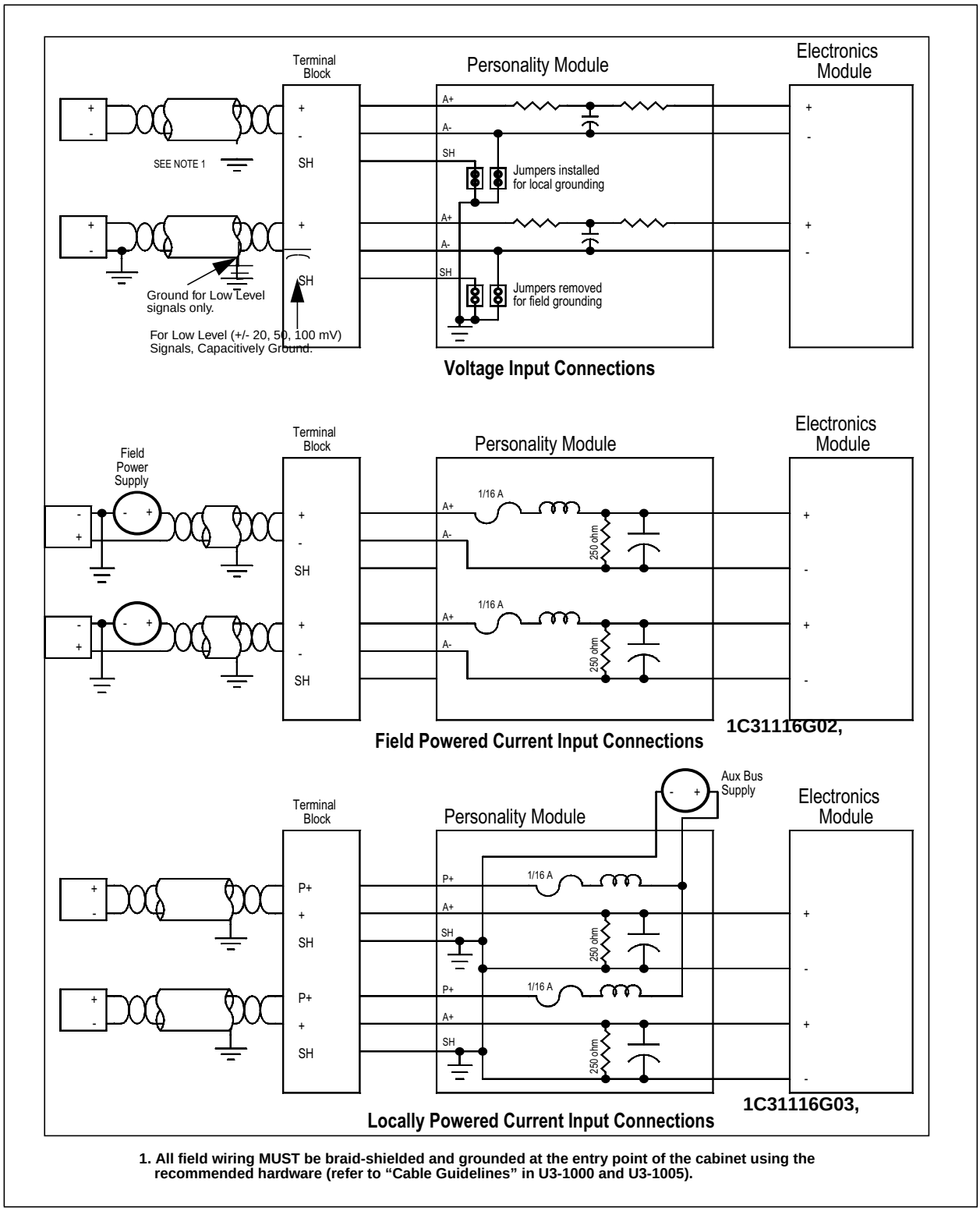


Figure 6-6. Field Connections for the Analog Input Personality Module (Non-CE Mark)

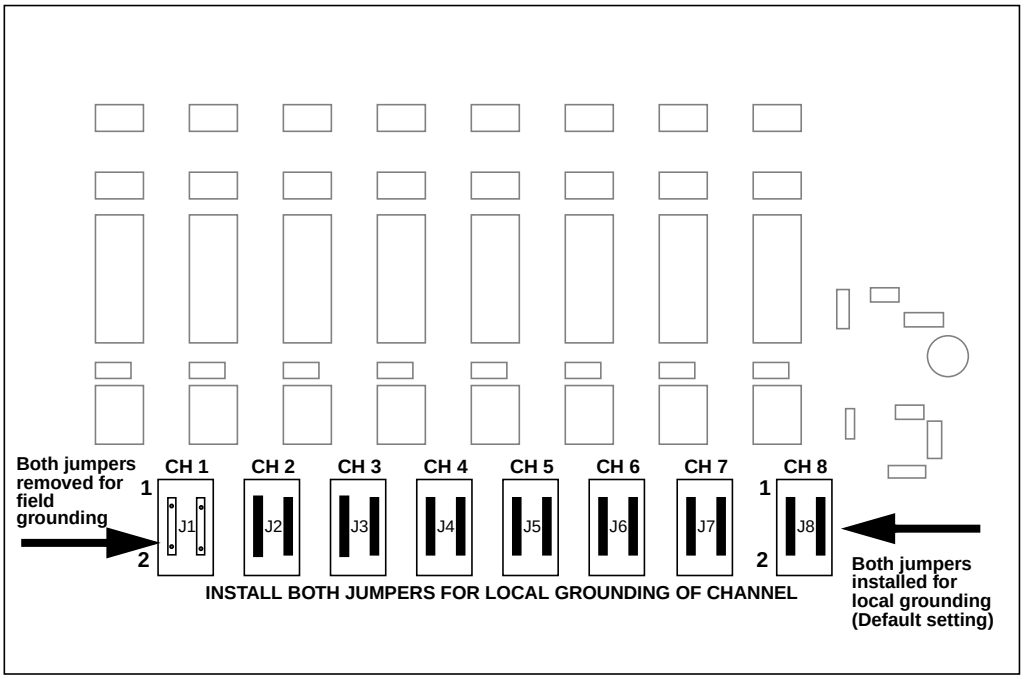
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CE Mark Certified Systems



1. All field wiring MUST be braid-shielded and grounded at the entry point of the cabinet using the recommended hardware (refer to "Cable Guidelines" in U3-1000 and U3-1005).

Figure 6-7. Field Connections for the Analog Input Personality Module (CE Mark)



Note

Circuit board must be removed from module housing to access jumpers. See Section 3-7 for directions.

Figure 6-8. Jumper Settings for Analog Input Personality Module (1C31116G04)

6-9. Thermocouple Function

When two dissimilar metals (a thermocouple) are joined together, a voltage (the Seebeck Voltage) is generated between them. This voltage is directly related to the temperature at the junction of the two metals. The relationship between the voltage and the temperature can be best described by a fifth order polynomial, determined by the two types of metals that are joined.

To measure the voltage (Vt) between the two metals, a voltmeter (in this case, an analog input card) must be connected to each wire (see Figure 6-9). Unfortunately, this produces two new junctions and voltages (V1 and V2) between the terminals and the thermocouples. The following formula is used to find Vt: Vt = Vm -V1 -V2.

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It is not possible to measure V1 and V2 without inducing more junctions and voltages; therefore, the analog input subsystem has a temperature sensor on the Personality module (1C31116G04) to measure the temperature (Tj) at the terminal block of the base unit.

A conversion formula, determined from the junction metal and thermocouple metals, is used to calculate the combined voltage of V1 and V2. This is called Cold Junction Compensation.

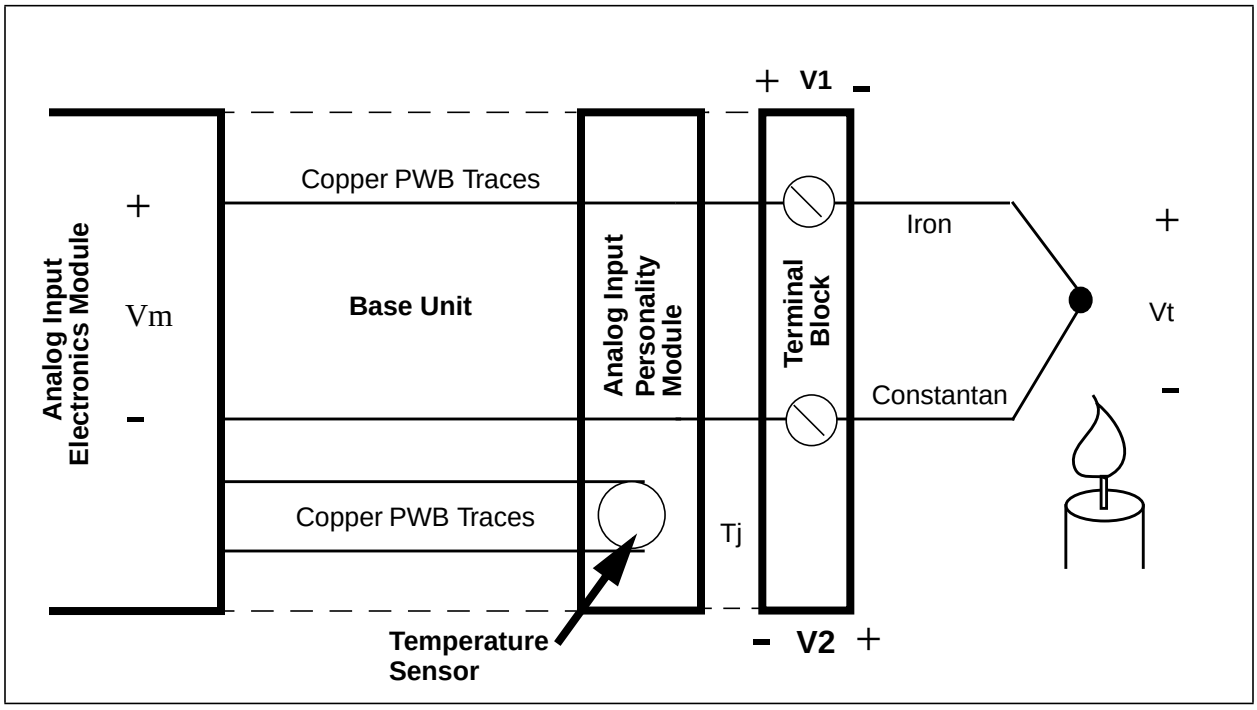


Figure 6-9. Thermocouple Illustration

6-9.1. Temperature Sensor Personality Module (1C31116G04)

Personality module 1C1116G04 of the analog input subsystem includes a temperature sensor IC. This is used for measuring the temperature of the terminal block to provide cold junction compensation for thermocouple inputs.

This module is used in conjunction with a terminal block cover (1C31207H01) to maintain a uniform temperature of the terminal block and sensor area. The cover fits over an entire base; however, the sensor will only accurately measure the temperature under the half of the cover where the temperature sensor personality module is installed. Therefore, if both modules under the cover require cold junction compensation, they will each require the temperature sensor personality module.

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