

Section 4. Analog Input Module (13 bits)

4-1. Description

The Ovation Analog Input Module with associated Personality Module provides signal conditioning and analog-to-digital conversion for eight individually-isolated analog inputs. Field inputs are surge protected and routed by the appropriate Personality Module and then sent to the Electronics Module for conversion.

The Analog Input Module (13 bits) is applicable for CE Mark Certified Systems.

Note

See [Section 3. I/O Modules](#) for environmental, installation, wiring, and fuse information.

4-2. Module Groups

4-2.1. Electronics Modules

There are six groups of Electronics modules for the Analog Input Module:

- 1C31113G01 provides voltage input range of ± 20 mV.
- 1C31113G02 provides voltage input range of ± 50 mV.
- 1C31113G03 provides voltage input range of ± 100 mV.
- 1C31113G04 provides voltage input range of ± 1 V.
- 1C31113G05 provides voltage input range of ± 5 V.
- 1C31113G06 provides voltage input range of ± 10 V.

4-2.2. Personality Modules

- 1C31116G01 provides voltage analog inputs.
- 1C31116G02 provides field-powered current analog inputs.
- 1C31116G03 provides locally powered current analog inputs.
- 1C31116G04 provides voltage analog inputs with a temperature sensor for cold junction thermocouple compensation.

Table 4-1. Analog Input Subsystem (13 Bit)

Range	Channels	Electronic Module	Personality Module
± 20mV	8	1C31113G01	1C31116G01
± 50mV	8	1C31113G02	1C31116G01
± 100mV	8	1C31113G03	1C31116G01
± 20mV Compensated (Thermocouple)	8 ¹	1C31113G01	1C31116G04
± 50mV Compensated (Thermocouple)	8 ¹	1C31113G02	1C31116G04
± 100 mV Compensated (Thermocouple)	8 ¹	1C31113G03	1C31116G04
± 1 VDC	8	1C31113G04	1C31116G01
± 5 VDC	8	1C31113G05	1C31116G01
± 10 VDC	8	1C31113G06	1C31116G01
0-20 mA Field powered (4-20 mA Field powered can also be selected in the I/O Builder; card will be configured appropriately)	8	1C31113G05	1C31116G02
0-20 mA Locally powered (4-20 mA Locally powered can also be selected in the I/O Builder; card will be configured appropriately)	8	1C31113G05	1C31116G03

¹ A ninth logical channel (does not connect to a device) is provided when using the Analog Input module with temperature sensor. This ninth point is needed for the CJ Compensation field of the Point Builder Instrumentation Tab when defining the eight other thermocouple points for the AI module (refer to [U3-1041](#), [NT-0060](#) or [WIN60](#) for additional information).

All Configurations are CE Mark Certified.

4-3. 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 Analog Input module uses the 1C31116G03 Personality module (configured with locally powered current analog inputs), the required voltage source may be obtained from the internal auxiliary power supply (backplane) or it may be obtained from an external power supply.

If an external power supply is used, see [Appendix D](#) for the steps to be undertaken before connecting the external power supply to the Analog Input module base unit terminal block. The Analog Input module auxiliary supply voltage level (24 VDC or 48 VDC) depends on the external transmitter devices being interfaced to the Analog Input module's analog inputs.

4-4. Specifications

Electronics Module (1C31113) Personality Module (1C31116)

Table 4-2. Analog Input Module Specifications

Description	Value
Number of channels	8
Input range ¹	± 20 mv ± 1 V ± 50 mv ± 5 V ± 100 mv ± 10 V 4 - 20 mA ²
Resolution	13 bits (including polarity)
Guaranteed accuracy (@25°C)	Accuracy over -25% to 100% range of full scale input level: $\pm 0.10\%$ of upper range value $\pm 10\mu\text{V}$ $\pm 1/2\text{LSB}$ @99.7% confidence. Accuracy over -100% to -25% range of full scale input level: $\pm 0.15\%$ of upper range value $\pm 10\mu\text{V}$ $\pm 1/2\text{LSB}$ @99.7% confidence.
Temperature coefficient	$\pm 0.24\%$ of the upper range value $\pm 24\mu\text{V}$ over 0 to 60°C.

Table 4-2. Analog Input Module Specifications (Cont'd)

Description	Value
Input impedance: ³ Groups G01 through G05 Group G06 (± 10 V input only)	10 M Ω 2 M Ω
Sampling rate	10 times per second
Offset and gain temperature drift compensation	Automatic
Diagnostics	Internal module operating faults. Out of range detection. Open thermocouple detection for thermocouple inputs. Open loop/blown fuse 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 at 50 Hz $\pm 1/2\%$ or 60 Hz $\pm 1/2\%$ 30 dB (typical) at 50 Hz $\pm 5\%$ or 60 Hz $\pm 5\%$
Common mode rejection	120 dB at DC, power line frequency and its harmonics $\pm 1/2\%$ tracking. 100 dB (typical) for nominal line frequency $\pm 5\%$ and harmonics.
Module power	Main: 2.5 W typical; 3.38 W maximum Aux: When used (1C31116G03) 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%
¹ Ranges are available via separate modules. ² Current inputs when using Personality module 1C31116G02 or 1C31116G03 with ± 5 V electronics module. The input range 0 to 20 mA is also available, but if selected, blown fuse detection will be disabled. If you select 0 to 20 mA, the software adds a suffix "A" to the Personality module identification. This "A" is not displayed, it is only used by the database to differentiate between 0 to 20 mA and 4 to 20 mA, in order to generate correct coefficients. ³ Only for modules used with voltage input Personality modules (1C1116G01 and 1C1116G04).	

4-5. Analog Input Terminal Block Wiring Information

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 4-1](#). 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 4-2](#) and [Figure 4-3](#) show how the various Personality modules require these connections or how the options are implemented.

[Figure 4-4](#) illustrates the jumper settings for the Personality module.

Notes

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

Voltage Input: (1C31116G01)

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 4-1. Terminal Block Connections for the Analog Input Personality Modules

4-6. Analog Input Field Connection Wiring Diagrams

Non-CE Mark Certified Systems

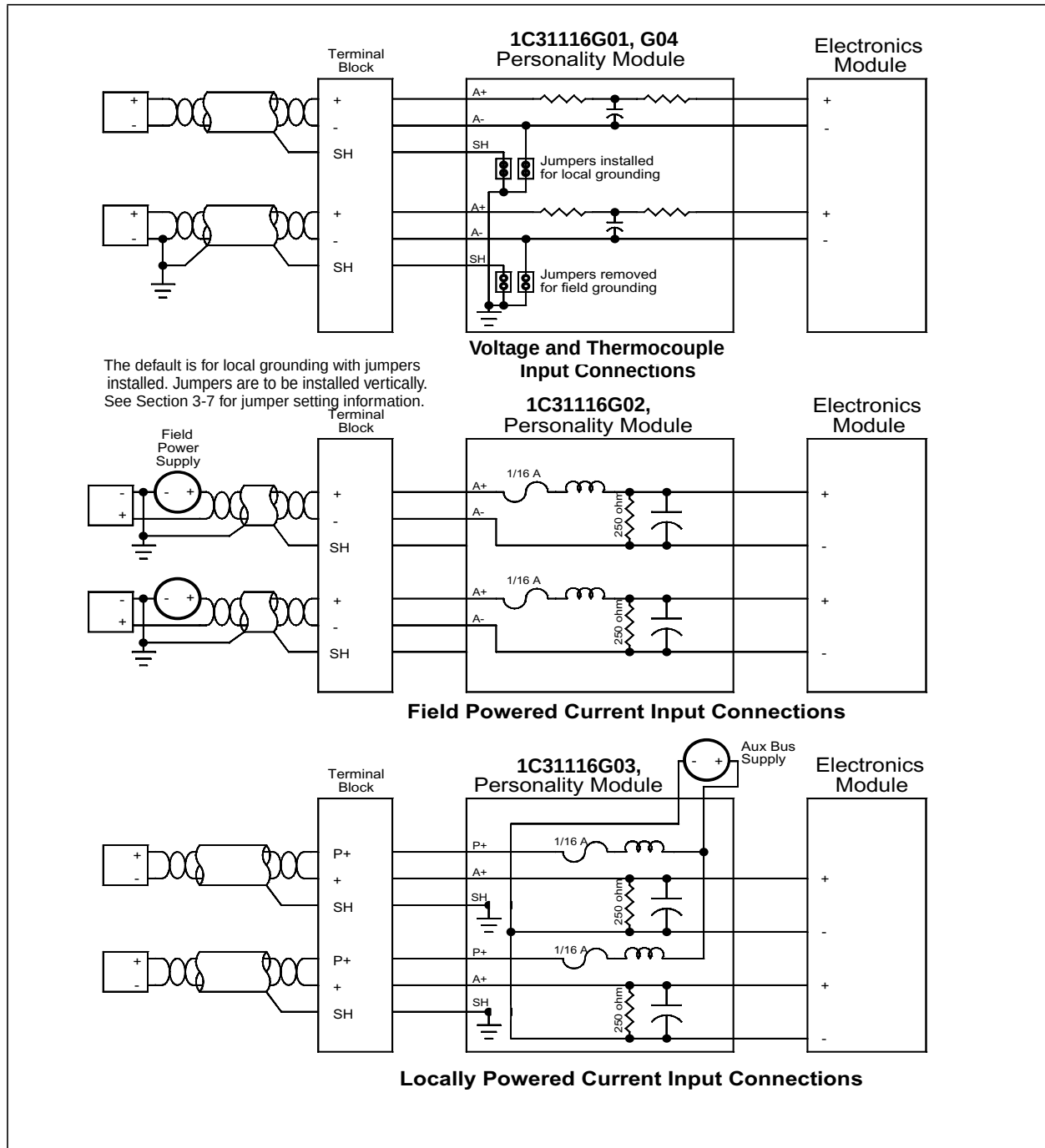


Figure 4-2. Field Connections for the Analog Input Personality Module (Non-CE Mark)

CE Mark Certified Systems

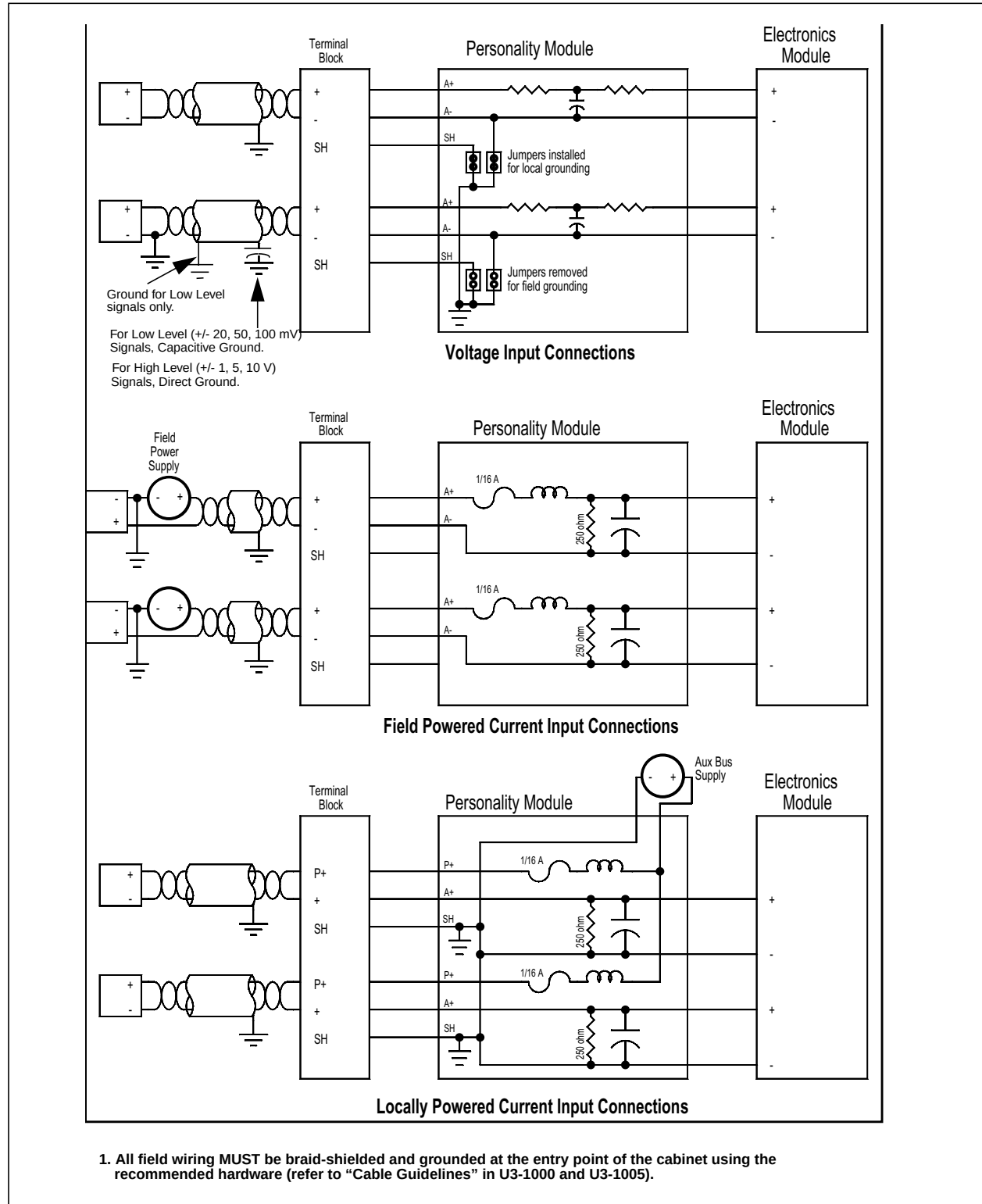


Figure 4-3. Field Connections for the Analog Input Personality Module (CE Mark)

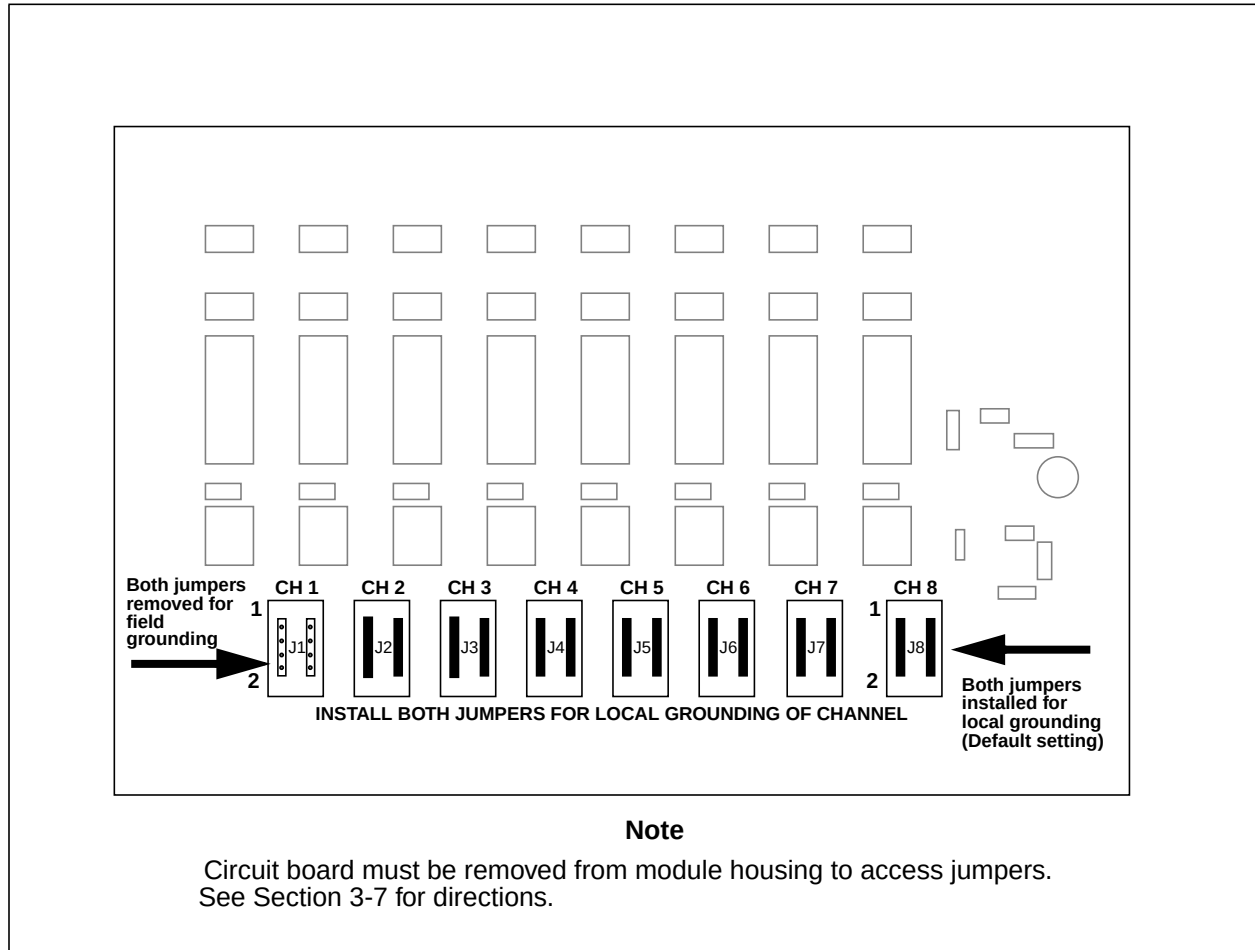


Figure 4-4. Jumper Settings for Analog Input Personality Module (1C31116G01 & 04)

4-7. 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 (V_t) between the two metals, a voltmeter (in this case, an analog input card) must be connected to each wire (see [Figure 4-5](#)). Unfortunately, this produces two new junctions and voltages (V_1 and V_2) between the terminals and the thermocouples. The following formula is used to find V_t : $V_t = V_m - V_1 - V_2$.

It is not possible to measure V_1 and V_2 without inducing more junctions and voltages; therefore, the analog input subsystem has a temperature sensor on the Personality module (1C31116G04) to measure the temperature (T_j) 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 V_1 and V_2 . This is called Cold Junction Compensation.

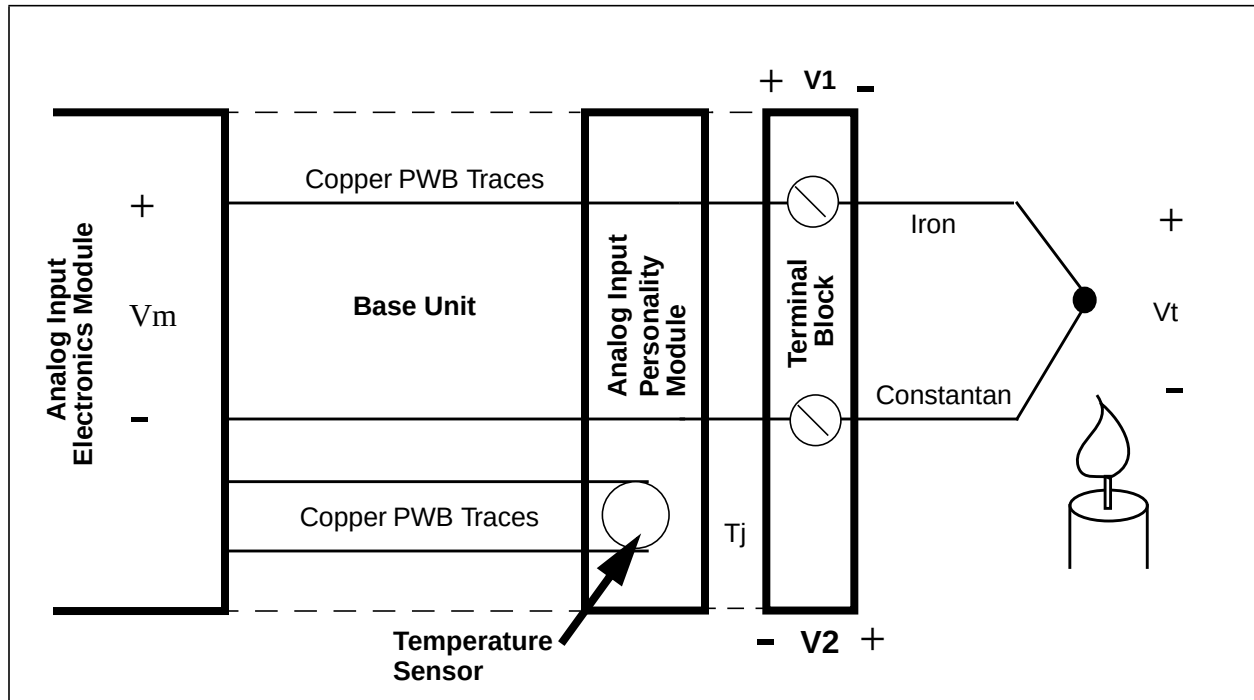


Figure 4-5. Thermocouple Illustration

4-7.1. Voltage Input Personality Module with Temperature Sensor (1C31116G04)

Personality module 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.

Note

Installation instructions for the terminal block cover are provided in the Temperature Compensation Cover Mounting Kit (1B30047G01).

The Group 4 Personality module provides a terminal block temperature measurement feature with the following specifications:

- Sampling Rate = 600 msec, maximum
300 msec, typical
- Resolution = +/- 0.5°C (+/- 0.9 °F)
- Accuracy = +/- 0.5°C over a 0°C to 70°C range
(+/- 0.9 °F over a 32°F to 158°F range)

More information about configuring cold junction points and thermocouple points is provided in “Ovation Record Types Reference Manual” (R3-1140), “Ovation Point Builder User’s Guide” (U3-1041), and “Ovation Developer Studio” (NT-0060 or WIN60).

4-7.2. Assigning Thermocouple Coefficients

Use the Instrumentation tab of the Point Builder to select the Field Instrumentation Type (B or TB, E or TE, J or TJ, K or TK, R or TR, S or TS, T or TT). The Ovation system then assigns the default thermocouple coefficients based on the Type selected. Refer to Table 4-3 for these coefficient definitions.

If you override the default coefficients by entering new values, the new values will remain **until** you select another thermocouple type. The values will then return to the default values for the type just selected.