Caution for CE Mark certified systems:

Base units containing differential digital input modules configuration with hazardous input voltages (>30 V RMS, 42.4 V peak, or 60 VDC) listed below must include a hazardous voltage warning label (1B30025H01) on that base unit. Hazardous voltage will be present on the individual module terminal blocks and module connector(s).

Configuration	Emod	Pmod
125VAC/VDC Digital Input (Diff)	1C31107G02	1C31110G02
125VAC/VDC Compact Digital Input (Diff)	1C31232G03	1C31238H01
125VDC Sequence of Events (Diff)	1C31157G02	1C31110G02
125VDC Compact Sequence of Events (Diff)	1C31233G03	1C31238H01

Base units containing single ended or fused digital input modules with hazardous voltages (>30 V RMS, 42.4 V peak, or 60 VDC) listed below must include a hazardous voltage warning label (1B30025H01) on the base unit as well as **ALL** base units of the branch. Hazardous voltage will be present on terminal block and module connectors of bases on an entire branch. In addition, auxiliary power fuses must be removed and a fuse cover kit should be added. See Appendix D (Using an External Power Supply) for details

Configuration	Emod	Pmod
125VAC/VDC Digital Input (Sing)	1C31107G02	1C31110G01
125VAC/VDC Compact Digital Input (Fused)	1C31232G03	5X00034G01
125VDC Sequence of Events (Sing)	1C31157G02	1C31110G01
125VDC Compact Sequence of Events (Fused)	1C31233G03	5X00034G01

Hazardous labels must be placed in a visible location on the base unit, preferable above the spare fuse location. This information must be indicated in the application specific project drawings.

2. Electronics module (Emod)

   The Electronics module (configured by adding the appropriate Personality module) fits into the base unit.

3. Personality module (Pmod)

   The Personality module (configures the Electronics module) fits into the base unit beside the appropriate Electronics module.

Note

The Personality module is installed in the base unit **first**. Then, the Electronics module is installed and interlocks with the Personality module. The blue corner latches on the Electronics module locks both modules into the base unit.

Wires from customer field devices are connected to terminal block in the base unit.

The wiring connections to the terminal block for each combination of Electronics module and Personality module are printed on each Personality module, and are illustrated in each module description in the following sections.

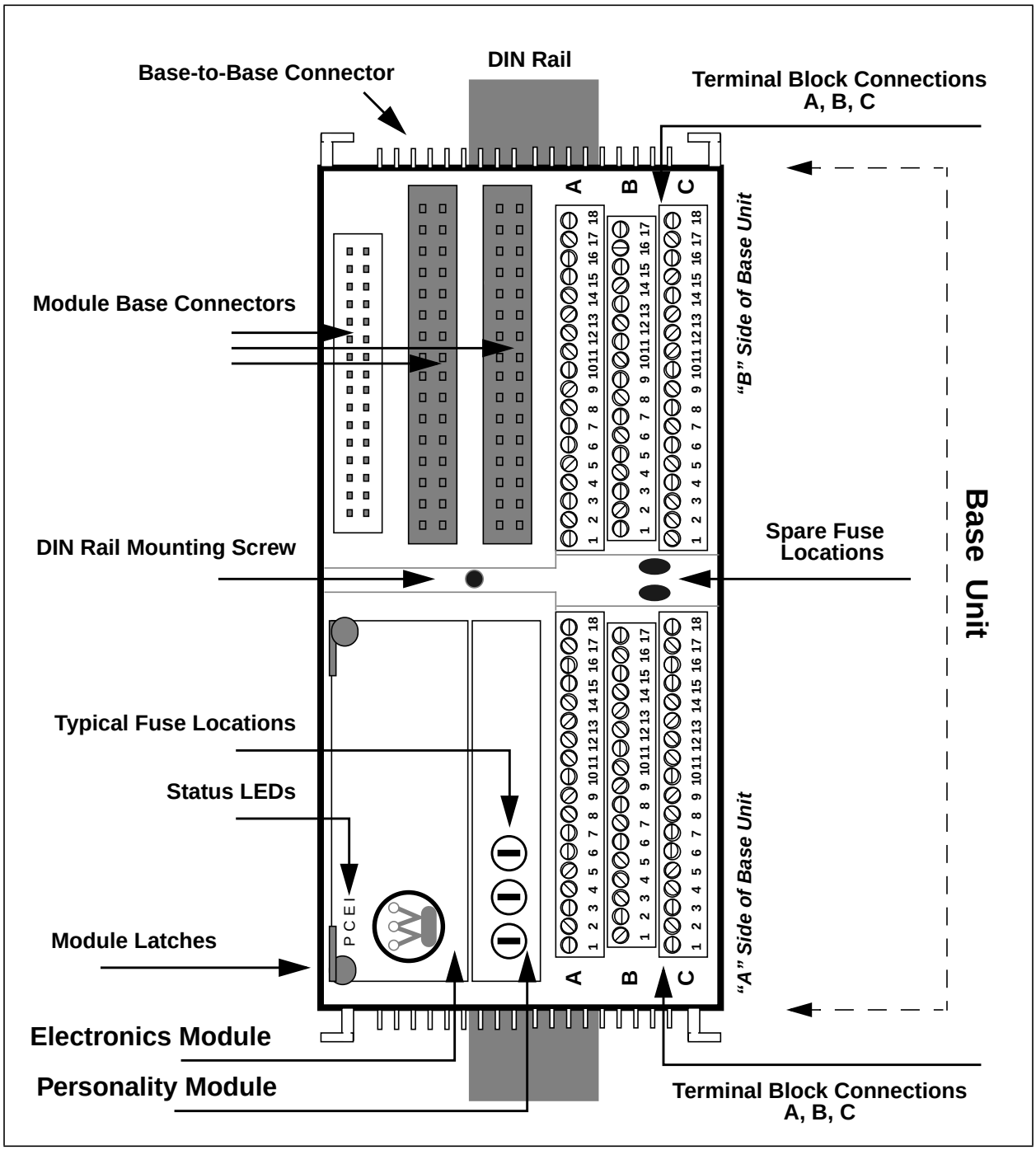


Figure 3-1. Ovation Modules (Top View)

Relay Module Components

The Ovation Relay module consists of two parts (Refer to Figure 3-2 and Figure 3-3.)

1. Base Unit

   The relay base assembly consists of a backplane with connectors, a plastic housing, and a DIN rail clamping/grounding mechanism. This unit accommodates the relays for interfacing with field devices.

2. Relay Output Electronics Module

   The relay output electronics module is an on-line replaceable module that provides the relay output circuit board. This board contains relay coil drive interfacing as well as I/O bus and bus power interface. This module plugs into the desired relay output base unit.

The wires from the customer field devices are connected to the terminal block in the base unit.

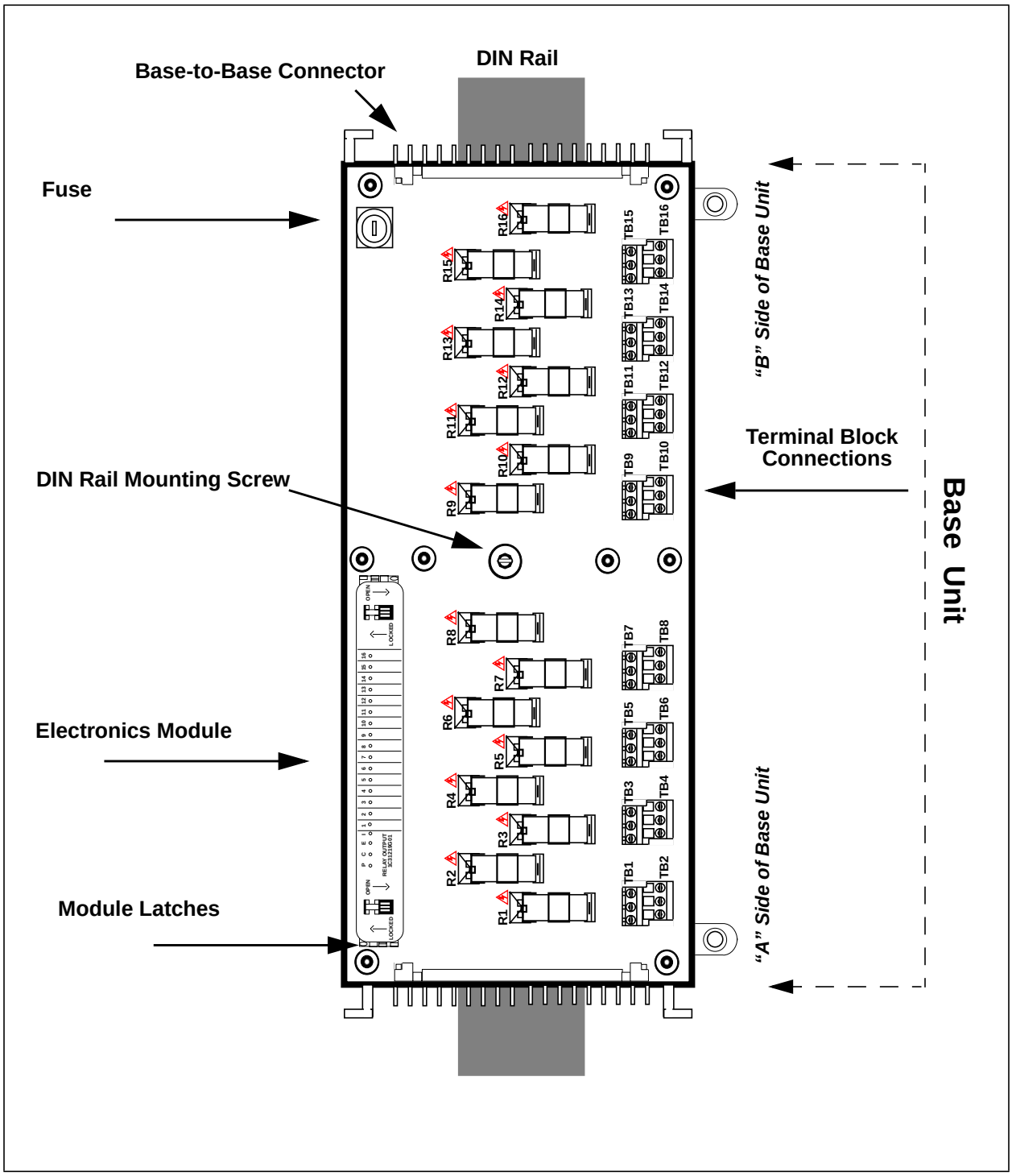


Figure 3-2. Relay Output Panel G2R

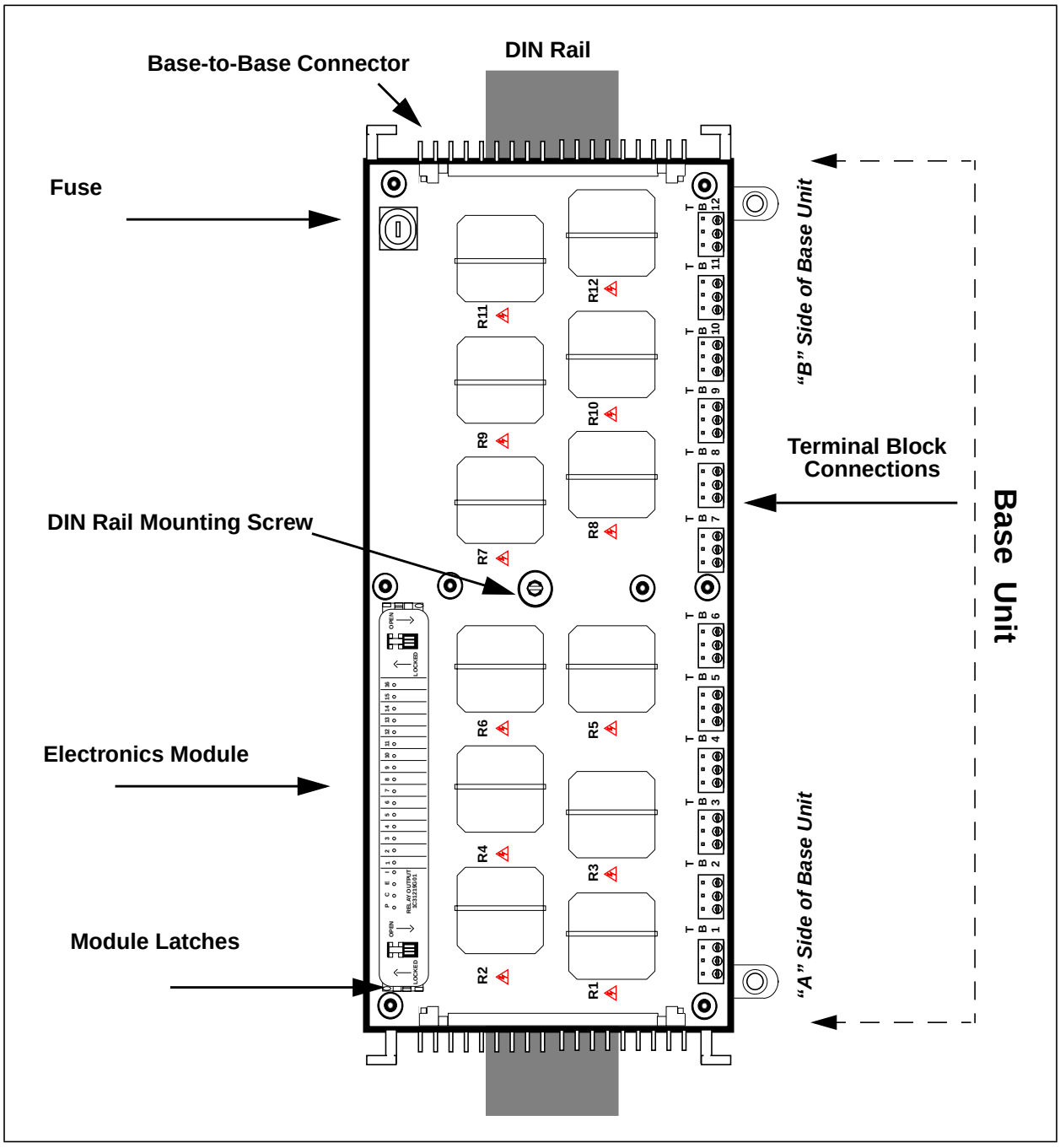


Figure 3-3. Relay Output KUEP

3-2. I/O Modules

Analog Input Modules

Analog Input 14 bit High Speed - provides an interface to eight individually isolated analog inputs with sampling rates of medium speed (16/20 time/sec.) or high speed (50/60 times/sec.). Several voltage and current input configurations are available including cold junction compensation for thermocouple inputs (Table 6-1).

Analog Input 14 bit - provides an interface to eight individually isolated analog inputs with a minimum sampling rate of 10 time/sec. A low cost 4-20 mA current input is available along with a 1V voltage input (legacy) configuration (Table 5-1).

Analog Input 13 bit (Legacy product) - provides interface to eight individually isolated analog inputs with sampling rates of approximately 10 time/sec. Several voltage and current configurations are available including cold junction compensation for thermocouple inputs (Table 4-1).

HART Analog Input - provides an interface for eight HART field devices with 4-20 mA current loop analog inputs (common reference). In addition to the analog inputs, digital information can be exchanged between HART compliant devices and the Controller (Table 13-1).

RTD Input - provides an interface to four Resistance Temperature Detectors. Several 3 and 4 wire RTD types are supported (Table 19-1).

Analog Output Modules

Analog Output - provides an interface to four individually isolated analog outputs using 12 bit digital-to-analog converters (Table 7-1).

HART Analog Output - provides an interface for eight HART field devices with 4-20 mA current loop analog outputs (common reference). In addition to the outputs, digital information can be exchanged between HART compliant devices and the Controller (Table 14-1).

Digital Input Modules

Digital Input - provides an interface for 16 digital inputs. The following input configurations are available: 24V, 48V, and 125V Isolated Differential or Single Ended (common return) (Table 10-1).

Compact Digital Input - provides a low cost interface for 16 digital inputs by eliminating the need for a Pmod. The following input configurations are available: 24V, 48V, 125 Isolated Differential or Single Ended (common return). If desired, a Pmod can be added to individually fuse inputs (with common return) (Table 11-1).

Contact Input - provides an interface for 16 digital contact inputs with common return. A +48V on-board power supply provides current limited contact wetting (Table 8-1).

Compact Contact Input - provides a low cost interface for 16 digital contact inputs with common return by eliminating the need for a Pmod. A +48V on-board power supply provides current limited contact wetting (Table 9-1).

Sequence of Events Input - provides an interface for 16 digital inputs with time tagging information to within 125 µs. An event tagging mask and filters to reject state changes and input chatter are provided along with time synchronization to the Controller with 1 ms resolution. Several input configurations are available (Table 20-1).

Compact Sequence of Events Input - provides a low cost interface for 16 digital inputs with time tagging information to within 125 µs. An event tagging mask and filters to reject state changes and input chatter is provided along with time synchronization to the Controller with 1 ms resolution. Several input configurations are available. If desired, a Pmod can be added to individually fuse some digital inputs (with common return) (Table 21-1).

Digital Output Modules

Digital Output - provides an interface to 16 single ended digital outputs. 5 to 60 VDC loads up to 500 mA each can be controlled. (Total current limited by fuse rating.) This module can also be used to interface KU, G2R or solid state relay panels for increased switching capability (Table 12-1).

Relay Output - provides an interface to either 12 KU relay or 16 G2R relay outputs. Special relay bases connect directly to the Ovation I/O branches and house the Relay Output Electronics module and relays (Table 18-1).

Specialty Modules

Link Controller - provides a serial RS232, RS422, or RS485 data communications link to a third party device or system (Table 15-1).

Loop Interface - provides an interface to the analog and digital I/O needed to control a single process loop (up to 2 AI, 1 AO, 2 DI, 2 DO). In addition, the loop interface can display the process information and provide for manual control via a local operator interface station (SLIM) (Table 16-1).

Pulse Accumulator - counts pulse for up to two input channels and provides the information to the Controller. The Pulse accumulator may be used to count over a defined time period to measure speed (frequency), count until instructed to stop, or can be used to measure the duration of a pulse (Table 17-7).

Servo Driver - provides an interface to an electro-hydraulic servo actuator (servo-motor) used to control a steam turbine (Table 22-1).

Speed Detector - provides the Controller with frequency measurements of a sinusoidal or pulse train tachometer. A 16 bit output can be updated at a rate of 5 ms for over-speed detection, and a 32 bit output can be updated at a variable rate for speed regulation (Table 24-1).

Valve Positioner - provides an interface to an electro-hydraulic servo actuator. Governor valves, interceptor valves, extraction valves and bypass valves can be controlled. The module provides closed loop valve positioning control and also interfaces to a local operator interface station (SLIM) (Table 25-1)

SLIM (Small Loop Interface Module) - contains displays and keyboard inputs needed for an operator to monitor and control the I/O functions of the Ovation Loop Interface or Valve Positioner module. The SLIM is located external to the Ovation I/O cabinet and connected to the Loop Interface or Valve Positioner via cable.

3-2.1. Ovation Module Choices

Table 3-1 lists the Ovation modules that can be added to an Ovation system.

Table 3-1. Ovation Module Choices

Module Type	Channel	Electronic Module	Personality Module
Analog Input (± 100mV) (13 bit)	8	1C31113G03	1C31116G01
Analog Input (± 100 mV w/temp. sensor) (13 bit)	8 [1]	1C31113G03	1C31116G04
Analog Input (± 20mV) (13 bit)	8	1C31113G01	1C31116G01
Analog Input (± 20mV w/temp. sensor) (13 bit)	8 [1]	1C31113G01	1C31116G04
Analog Input (± 50mV) (13 bit)	8	1C31113G02	1C31116G01
Analog Input (± 50mV w/temp. sensor) (13 bit)	8 [1]	1C31113G02	1C31116G04

Table 3-1. Ovation Module Choices (Cont'd)

Module Type	Channel	Electronic Module	Personality Module
Analog Input (± 1 V) (13 bit)	8	1C31113G04	1C31116G01
Analog Input (± 10 V) (13 bit)	8	1C31113G06	1C31116G01
Analog Input (± 5 V) (13 bit)	8	1C31113G05	1C31116G01
Analog Input (0 - 20 mA local powered) (13 bit)	8	1C31113G05	1C31116G03
Analog Input (0 - 20 mA remote powered) (13 bit)	8	1C31113G05	1C31116G02
Analog Input (4 - 20 mA local powered) (13 bit)	8	1C31113G05	1C31116G03
Analog Input (4 - 20 mA remote powered) (13 bit)	8	1C31113G05	1C31116G02
Analog Input (4 - 20 mA) (14 bit)	8	1C31224G01	1C31227G01
Analog Input (± 1 V) (14 bit)	8	1C31224G02	1C31227G02
Analog Input (4 - 20 mA) (14 bit High Speed (HS))	8	5X00070G01	1C31227G01
Analog Input (± 100mV, ± 250mV, ± 1V) (14 bit HS)	8	5X00070G02	1C31227G02
Analog Input (± 5V, ± 10V) (14 bit High Speed)	8	5X00070G03	1C31227G02
Analog Input (± 1mA, 2 wire local field powered) (14 bit HS)	8	5X00070G02	1C31227G03
Analog Input (± 1mA, 4wire field powered) (14 bit HS)	8	5X00070G02	1C31227G02
Analog Input (± 20mV, ± 50mV, ± 100mV Thermocouple) (14 bit HS)	8	5X00070G04	1C31227G04
Analog Output (0 to +10 V)	4	1C31129G02	1C31132G01
Analog Output (0 to +5 V)	4	1C31129G01	1C31132G01
Analog Output (0 to 20 mA w/diagnostics)	4	1C31129G03	1C31132G01
Analog Output (0 to 20 mA w/o diagnostics)	4	1C31129G04	1C31132G01
Analog Output (4 to 20 mA w/diagnostics)	4	1C31129G03	1C31132G01
Analog Output (4 to 20 mA w/o diagnostics)	4	1C31129G04	1C31132G01
Compact Contact Input w/Onboard 48 V aux	16	1C31234G01	Cavity Insert [2]
Contact Input w/Onboard 48 V auxiliary	16	1C31142G01	1C31110G03
Digital Input (125 VAC/DC differential)	16	1C31107G02	1C31110G02
Digital Input (125 VAC/DC single ended)	16	1C31107G02	1C31110G01

Table 3-1. Ovation Module Choices (Cont'd)

Module Type	Channel	Electronic Module	Personality Module
Digital Input (24 VAC/DC or 48 VDC differential)	16	1C31107G01	1C31110G02
Digital Input (24 VAC/DC or 48 VDC single ended)	16	1C31107G01	1C31110G01
Compact Digital Input (125 VAC/DC differential)	16	1C31232G03	5X00034G01 or Cavity Insert) [2]
Compact Digital Input (24/48 VAC/DC differential)	16	1C31232G02	5X00034G01 or Cavity Insert) [2]
Compact Digital Input (24/48 VDC single ended)	16	1C31232G01	Cavity Insert [2]
Digital Output (0 - 60 VDC)	16	1C31122G01	1C31125G01
Digital Output (0 - 60 VDC w/relay pnl comm)	16	1C31122G01	1C31125G02
Digital Output (0 - 60 VDC w/relay pnl comm ext fuses)	16	1C31122G01	1C31125G03
HART Analog Input (4 - 20 mA)	8	5X00058G01	5X00059G01
HART Analog Output (4 - 20 mA)	8	5X00062G01	5X00063G01
HART High Performance Analog Input (4 - 20 mA)	8	5X00062G01	5X00063G01
Loop Interface (AI: 0 - 10V AO: 0 - 10V)	6	1C31174G01	1C31177G01
Loop Interface (AI: 0 - 10V AO: 0 - 10V) User defined Digital Inputs[3]	6	1C31174G21	1C31177G01
Loop Interface (AI: 0 - 5V AO: 0 - 10V)	6	1C31174G02	1C31177G01
Loop Interface (AI: 0 - 5V AO: 0 - 10V) User defined Digital Inputs[3]	6	1C31174G22	1C31177G01
Loop Interface (AI: 4 - 20mA AO: 4 - 20mA remote powered)	6	1C31174G03	1C31177G03
Loop Interface (AI: 4 - 20mA AO: 4 - 20mA remote powered) User defined Digital Input[3]	6	1C31174G23	1C31177G03
Loop Interface (AI: 4 - 20mA AO: 4 - 20mA local powered)	6	1C31174G03	1C31177G02
Loop Interface (AI: 4 - 20mA AO: 4 - 20mA local powered) User defined Digital Input[3]	6	1C31174G23	1C31177G02
Loop Interface (AI: 4 - 20mA remote powered)	4	1C31174G04	1C31177G03

Table 3-1. Ovation Module Choices (Cont'd)

Module Type	Channel	Electronic Module	Personality Module
Loop Interface (AI: 4 - 20mA remote powered) User defined Digital Input[3]	4	1C31174G24	1C31177G03
Loop Interface (AI: 4 - 20mA local powered)	4	1C31174G04	1C31177G02
Loop Interface (AI: 4 - 20mA local powered) User defined Digital Input[3]	4	1C31174G24	1C31177G02
Pulse Accumulator (24/48V 5/12V med speed ext PS)	2	1C31147G01	1C31150G03
Pulse Accumulator (24/48V 5/12V med speed neg com)	2	1C31147G01	1C31150G01
Pulse Accumulator (24/48V 5/12V med speed pos com)	2	1C31147G01	1C31150G02
Pulse Accumulator (5V high speed ext PS)	2	1C31147G02	1C31150G03
Pulse Accumulator (5V high speed neg com)	2	1C31147G02	1C31150G01
Pulse Accumulator (5V high speed pos com)	2	1C31147G02	1C31150G02
Relay Output Module G2R	16	1C31219G01	1C31223G01 or (Base Unit)
Relay Output Module KUEP	12	1C31219G01	1C31222G01 or (Base Unit)
RTD Interface	4	1C31161G01	1C31164G01
RTD Interface (CE Mark certified)	4	1C31161G02	1C31164G02
Seq. of Events (125VDC differential)	16	1C31157G02	1C31110G02
Seq. of Events (125VDC single ended)	16	1C31157G02	1C31110G01
Seq. of Events (24/48VDC differential)	16	1C31157G01	1C31110G02
Seq. of Events (24/48VDC single ended)	16	1C31157G01	1C31110G01
Seq. of Events contact input w/48V auxiliary	16	1C31157G03	1C31110G03
Compact Seq. of Events (125VDC differential)	16	1C31233G03	5X00034G01 or Cavity Insert [2]
Compact Seq. of Events (24/48VDC differential)	16	1C31233G02	5X00034G01 or Cavity Insert [2]
Compact Seq. of Events (24VDC or 48VDC single ended)	16	1C31233G01	Cavity Insert [2]

Table 3-1. Ovation Module Choices (Cont'd)

Module Type	Channel	Electronic Module	Personality Module
Compact Seq. of Events contact input w/48V auxiliary	16	1C31233G04	Cavity Insert [2]
Serial Link Controller RS232	1	1C31166G01	1C31169G01
Serial Link Controller RS485 4 wire	1	1C31166G01	1C31169G02
Servo Driver with Readback (1 KHz LVT Output, 19VPP)	6	1C31199G02	1C31201G02
Servo Driver with Readback (3 KHz LVT Output, 19VPP)	6	1C31199G03	1C31201G02
Servo Driver with Readback (16V DC LVDT Output)	6	1C31199G01	1C31201G01
Speed Detector Interface	8	1C31189G01	1C31192G01
Valve Positioner (17 Volt LVDT: 24.8 mA)	8	1C31194G01 or 1C31194G02	1C31197G01
Valve Positioner (23.75 Volt LVDT: 16.8 mA)	8	1C31194G01 or 1C31194G02	1C31197G02
Valve Positioner (23.75Volt LVDT: 8.3 mA)	8	1C31194G01 or 1C31194G02	1C31197G03
Valve Positioner (23.75Volt LVDT: 36 mA)	8	1C31194G01 or 1C31194G02	1C31197G04

[1] A ninth channel 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 Section 4 for additional information).

[2] Cavity insert (1C31238H01) that fits into the Personality module position providing a wiring schematic label for the module. Typically, there is no actual Personality module required for this module type.

[3]Raise and Lower Runback inputs can be disabled and used as user-defined input points. Configuration instructions are included in Kit 1C31174G20.

3-3. Installing Ovation Modules

3-3.1. Standard and Compact I/O Modules

The Ovation standard and Compact modules are installed in base units mounted on DIN rails in Ovation cabinets. Each base unit can contain two I/O modules, and even if you only use one I/O module, you must still use a base unit that contains two terminal blocks.

DIN rails and modules are typically installed at the factory according to system requirements.

If you need to replace or add standard modules to your system, refer to "Planning and Installing Your Ovation System" (U3-1000 for FDDI and U3-1005 for Fast Ethernet) for instructions.

3-3.2. Relay Output Modules

The Ovation Relay Output modules are installed in base units mounted on DIN rails in Ovation cabinets. Each base unit can contain one Relay Output Electronic module and the appropriate relays.

There are two styles of Relay Output Base Units:

- 1C31223 (16 G2R relays) (Figure 3-2)
- 1C31222 (12 KUEP relays) (Figure 3-3)

DIN rails and modules are typically installed at the factory according to system requirements.

If you need to replace or add Relay Output modules to your system, refer to "Planning and Installing Your Ovation System" (U3-1000 for FDDI and U3-1005 for Fast Ethernet) for instructions.

3-4. Ovation Module Configuration and Status

An Ovation I/O module has 16 address locations, but a module might not use all 16 addresses.

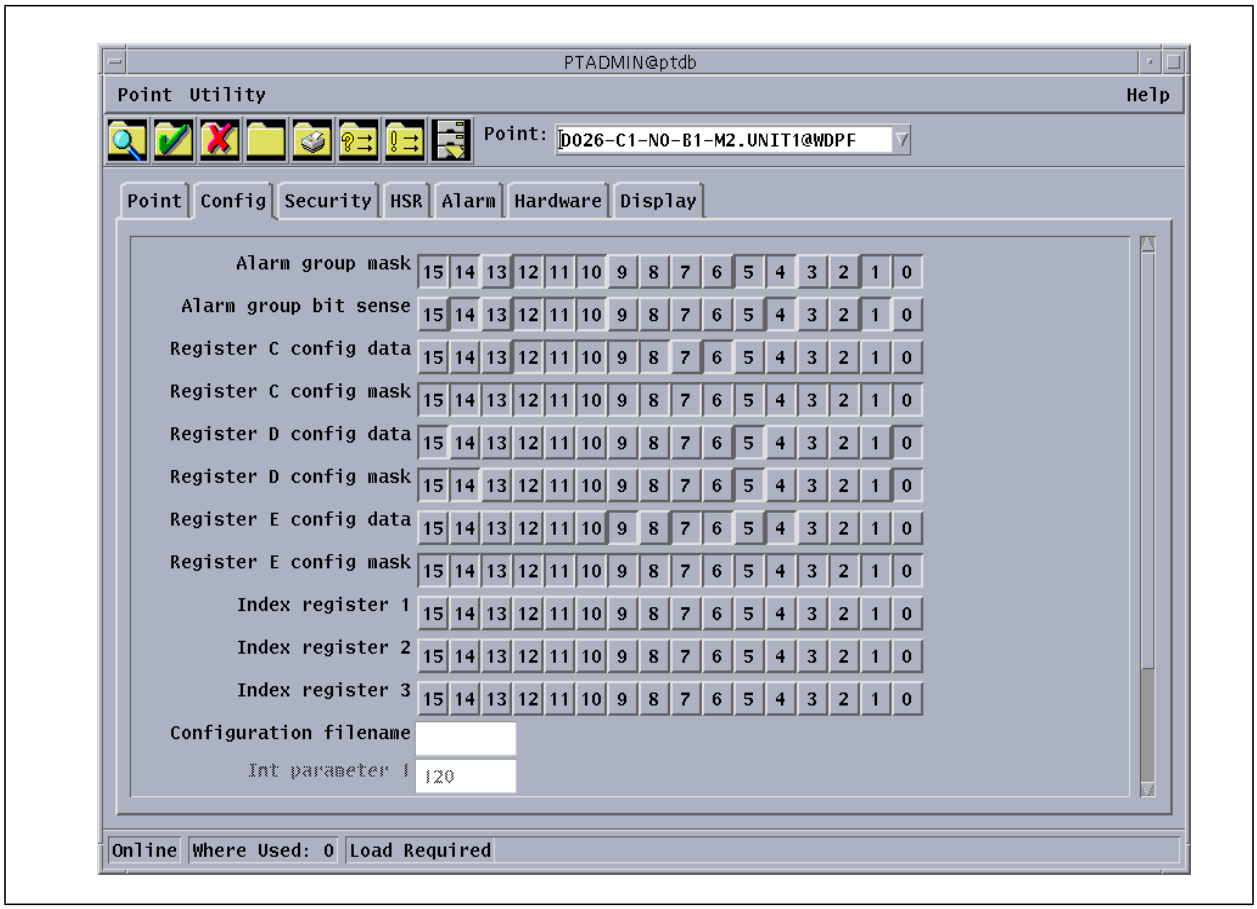
There are four possible address locations in each I/O module that are reserved for special use. Three of these addresses provide configuration (Write) and status (Read) information.

Definitions for these locations are provided for each module in the module reference pages:

- Address word 13 (D in Hex) is present for every module and is used for configuration and status. The module status provides diagnostic information that is read by the Controller when it is on-line. The status register can be read by using the Point Information window at an Ovation Operator Station (see the Bit Pattern Field on the Hardware Tab shown in "Ovation Operator Station User Guide" (U3-1031 or WIN20)).
- Address word 14 (E in Hex) is used as a secondary or expansion configuration register and is only used when needed.
- Address word 12 (C in Hex) is used for reporting point specific fault information and optionally as an expansion configuration register.
- Address word 15 (F in Hex), is used for the module Electronic ID information. This location and its use is identical for all modules. Appendix B provides information about the Electronic ID.

Configuration settings for these registers for a point can be viewed in an Ovation Solaris system through the Config Tab (see example below) in the Point Builder (refer to "Ovation Point Builder User Guide" (U3-1041). However, the actual configuration is done through the I/O Builder Power Tool (refer to "Ovation I/O Builder User Guide" (U3-1044). Windows users will find the information in the "Ovation Developers Studio" (NT-0060) or (WIN60).

When using an Ovation system, refer to “Ovation Developer Studio” (NT-0060) or (WIN60) for configuration information.



3-5. Ovation Module Diagnostic LEDs

Every Ovation module contains diagnostic LEDs. These are used to indicate the status of the module and to alert you to any module problems.

All I/O modules contain the following LEDs:

P = (Green) Power OK LED is lit when the power supply to the module is good.

C = (Green) Communications OK LED is lit when the Controller is communicating with the module, and when the communication watchdog timer is not timed out.

E = (Red) Optional External Error LED is lit when there is a problem external to the module, such as a blown common auxiliary power supply fuse.

I = (Red) Internal Fault LED is lit when a failure internal to the module has occurred. This LED is typically an indication that the Electronics module needs to be replaced.

Note

A communication timeout will also light the Internal Fault LED and turn off the Communications OK LED.

The other LEDs for each module will vary according to the functions of the module. Definitions for LEDs are provided for each module in the module reference pages.

3-6. User Serviceable Fuses

3-6.1. Electronics Module Fuses

Some Electronics modules (Emods) may contain fuses. These fuses are typically 5 x 20 mm micro-fuses, and are conveniently located for easy replacement (see Figure 3-1).

If a fuse needs to be replaced, push the fuse cap in, turn it one-quarter turn counter-clockwise, and the fuse will pop up. Replace the blown fuse with an exact replacement fuse. Fuse sizes are indicated on the Electronics module label. Refer to Table 3-2 for descriptions of fuses used by Ovation Electronics modules.

Note

In CE Mark Certified systems, the project drawings **MUST** include any fuses and their ratings, if they are replaceable by a qualified technician.

Table 3-2. Electronics Module Fuses

Type	Rating	Used On	Part Number
5 x 20 mm cartridge	0.50A; 250V; Fast acting	Compact Digital Input Emod 1C31232G01 Compact Sequence of Events Emod 1C31233G01	EX06100

3-6.2. Personality Module Fuses

Some Personality modules (Pmods) may contain fuses. These fuses are typically 5 x 20 mm fuses, and are conveniently located for easy replacement (see Figure 3-1).

If a 5x20 mm cartridge fuse needs to be replaced, push the fuse cap in, turn it one-quarter turn counter-clockwise, and the fuse will pop up. Replace the blown fuse with an exact replacement fuse. Fuse sizes are indicated on the Personality module label. Refer to Table 3-3 for descriptions of fuses used by Ovation Personality modules.

If the fuse is a micro fuse, pull the blown fuse out of its holder and plug the replacement fuse into the vacated holder.

Note

In CE Mark Certified systems, the project drawings **MUST** include any fuses and their ratings, if they are replaceable by a qualified technician.

Table 3-3. Personality Module Fuses

Type	Rating	Used On	Part Number
5 x 20 mm cartridge	0.50A; 250V; Fast acting	Digital Input Pmods Sequence of Events 1C31110G01	EX06100
5 x 20 mm cartridge	0.063A; 250V; Fast acting	Analog Input Pmods 1C31116G02 - G03 Loop Interface Pmods 1C31177G02 - G03	EX06102
5 x 20 mm cartridge	0.63A; 250V; Fast acting	Pulse Accum. Pmods 1C31150G01 - G03	EX06071
5 x 20 mm cartridge	1.0A; 250V Fast acting	Relay Base 16 G2R 1C31223G01	EX06104

Table 3-3. Personality Module Fuses (Cont'd)

Type	Rating	Used On	Part Number
5 x 20 mm cartridge	1.25A; 250V; Fast acting	Loop Interface Pmods 1C31177G01 - G03 Digital Output Pmods 1C31125G01 Valve Positioner Pmods 1C31197G01 - G04 Relay Panels (Solid State) 5A22410H01 - H02 Relay Panels (16 G2R) 5A22411H01	EX06098
5 x 20 mm cartridge	2.0A; 250V; Fast acting	Relay Panels (8 KU) 5A22412H01 Relay Base (12 KUEP) 1C31222G01	EX06105
5 x 20 mm cartridge	3.15A;250V Fast acting	Digital Output Pmods 1C31125G02	EX06101
Micro-Fuse Plug-in	0.5A;125V Fast acting	16 Point Individually fused Digital Input Pmod 5X00034G01	PS10007H03
Micro-Fuse Plug-in	0.063A;125V Fast acting	HART Analog Input Pmods Analog Inputs 5X00059G01	1X00030H01
Micro-Fuse Plug-in	0.6A;125V Fast acting	HART Analog Output Pmods 5X00063G01	PS10007H14
Micro-Fuse Plug-in	0.5A;125V Fast acting	HART Analog Input Pmods 5X00059G01 Rev. 2 or later	PS10007H03

3-6.3. Ovation Cabinet Fuses

In addition to Personality module fuses, there are other fuses that can also be serviced by users. Refer to Table 3-4 for descriptions of fuses used in Ovation cabinets.

Table 3-4. Ovation Cabinet Fuses

Type	Rating	Used On	Part Number	Notes
Micro-Fuse	5.0A; 250V; Fast acting	CBO Backplane 3A99200G01 - G02 ROP Panel 4D33922G01 TND Panel 4D33924G01 RRP Panel 3A99252G01 RRB Panel 3A99253G01	4A00120H01	Auxiliary power Branch fuses CBO: F1 -F4 ROP: F1, F2, F7, F8 TND: F1, F2, F6, F7 RRP: F1, F2 RRB: F1, F2
3 AB	15A; 250V; Fast acting	Power Distribution Panel 5A26304G02	EX06009	AC Main fuses F1, F2

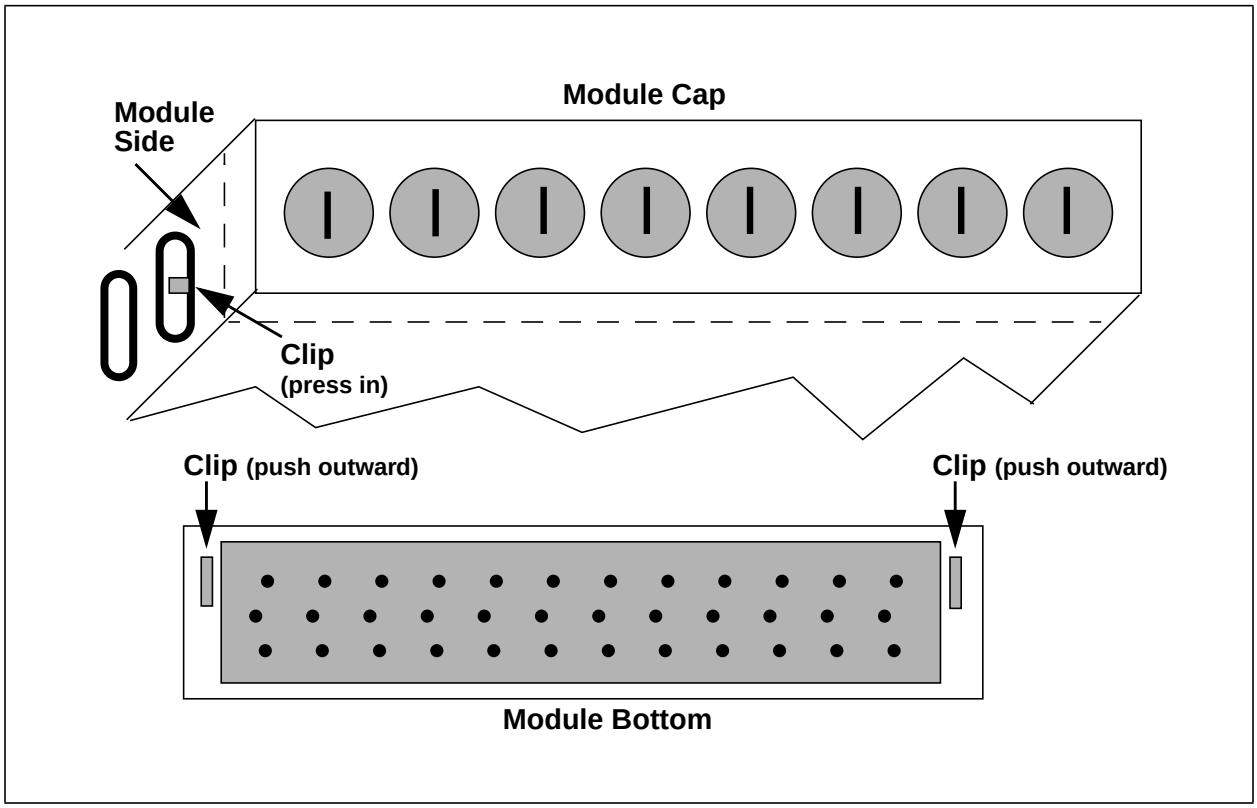
3-7. Personality Module Jumpers

Most of the Ovation Personality modules do not have configurable jumpers. However, if a module does have configurable jumpers, and the default settings need to be changed, the card must be removed from the Personality module case in order to be configured. Use the following procedure to open a Personality module case:

Note

Be sure to observe static electricity guidelines.

1. Use a small straight-edge screwdriver to press in one of the clips located on the side of the module until the module cap is loosened. Remove the module cap.
2. Push both clips on the module bottom outward until the card is free to slide.
3. Slide the card out the top of the module and make the desired jumper changes.
4. Slide the card back into the module case, being sure the card is positioned in the card channels, and the bottom clips are engaged.
5. Replace the module cap.



3-8. I/O Environmental Specifications

Table 3-5. I/O Module Specifications

Description	Minimum Value	Maximum Value
Temperature	0°C (32° F) Operating - 40°C (-40°F) Storage	60°C (140°F) Operating 85°C (185°F) Storage
Humidity	0% Operating	95% Operating (Non-CE Mark) 90% Operating (CE Mark) Maximum wet bulb temp 35°C

Table 3-6. Relay Output Module Specifications

Description	Minimum Value	Maximum Value
Temperature		
Relay Output G2R/KUEP Form X	0°C (32° F) Operating Storage N/A	60°C (140°F) Operating Storage N/A
Relay Output KUEP Form C	0°C (32° F) Operating Storage N/A	45°C (113°F) Operating Storage N/A
Humidity		
Relay Output G2R	35% Operating	85% Operating (Non-CE Mark) Maximum wet bulb temp 35°C
Relay Output KUEP Form X/Form C	N/A	N/A
1 See Section 18 for additional temperature and derating information relative to specific cabinet configuration.		

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 ±50 mv ±100 mv 4 - 20 mA [2] ±1 V ±5 V ±10 V
Resolution	13 bits (including polarity)
Guaranteed accuracy (@25°C)	Accuracy over -25% to 100% range of full scale input level: ±0.10% of upper range value ±10µV ±1/2LSB @99.7% confidence. Accuracy over -100% to -25% range of full scale input level: ±0.15% of upper range value ±10µV ±1/2LSB @99.7% confidence.
Temperature coefficient	±0.24% of the upper range value ±24µV 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 (± 10V input only)	 10 MΩ 2 MΩ
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 ± 1/2% or 60 Hz ± 1/2% 30 dB (typical) at 50 Hz ± 5% or 60 Hz ± 5%
Common mode rejection	120 dB at DC, power line frequency and its harmonics ± 1/2% tracking. 100 dB (typical) for nominal line frequency ± 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 ± 5V 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

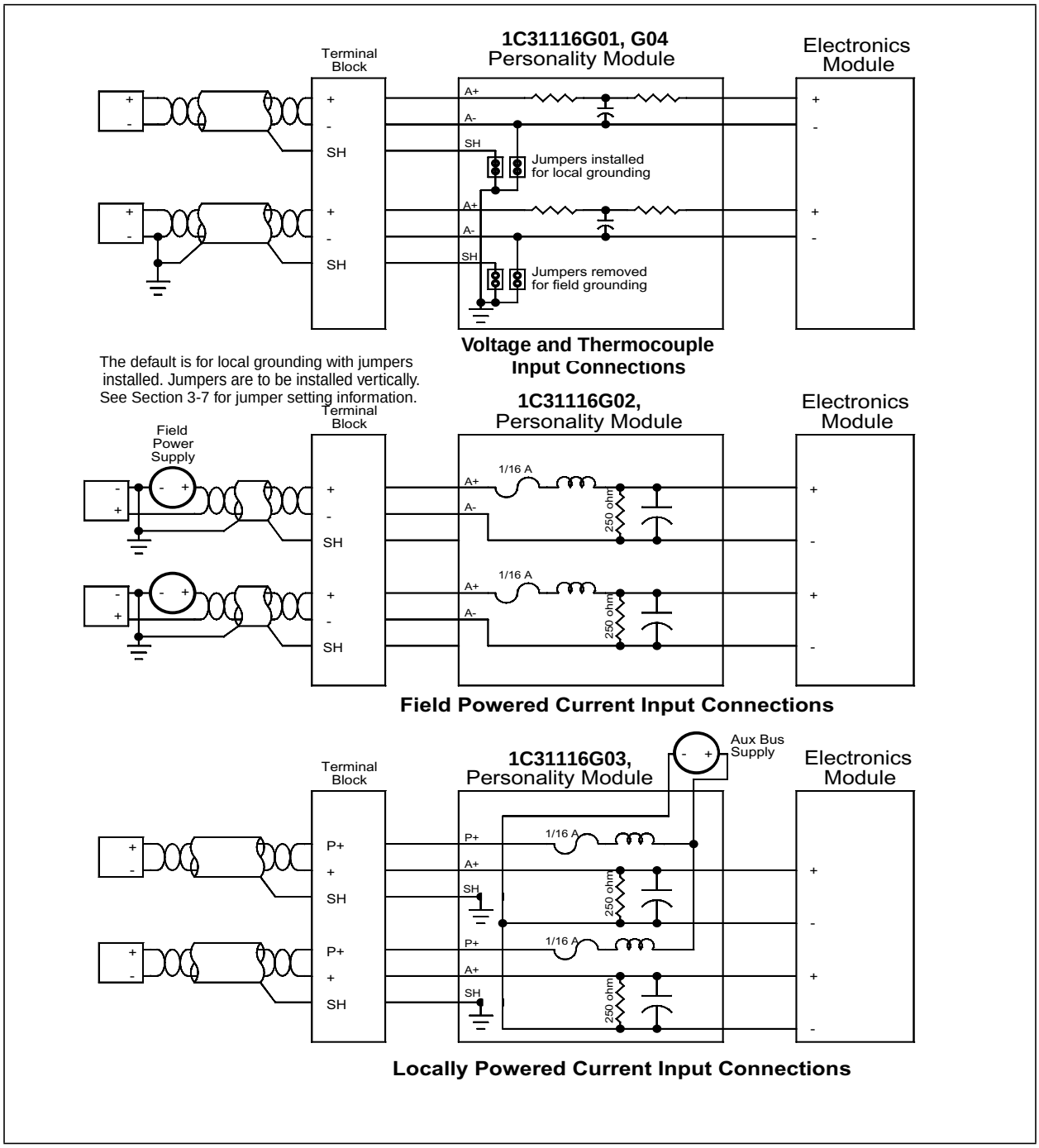
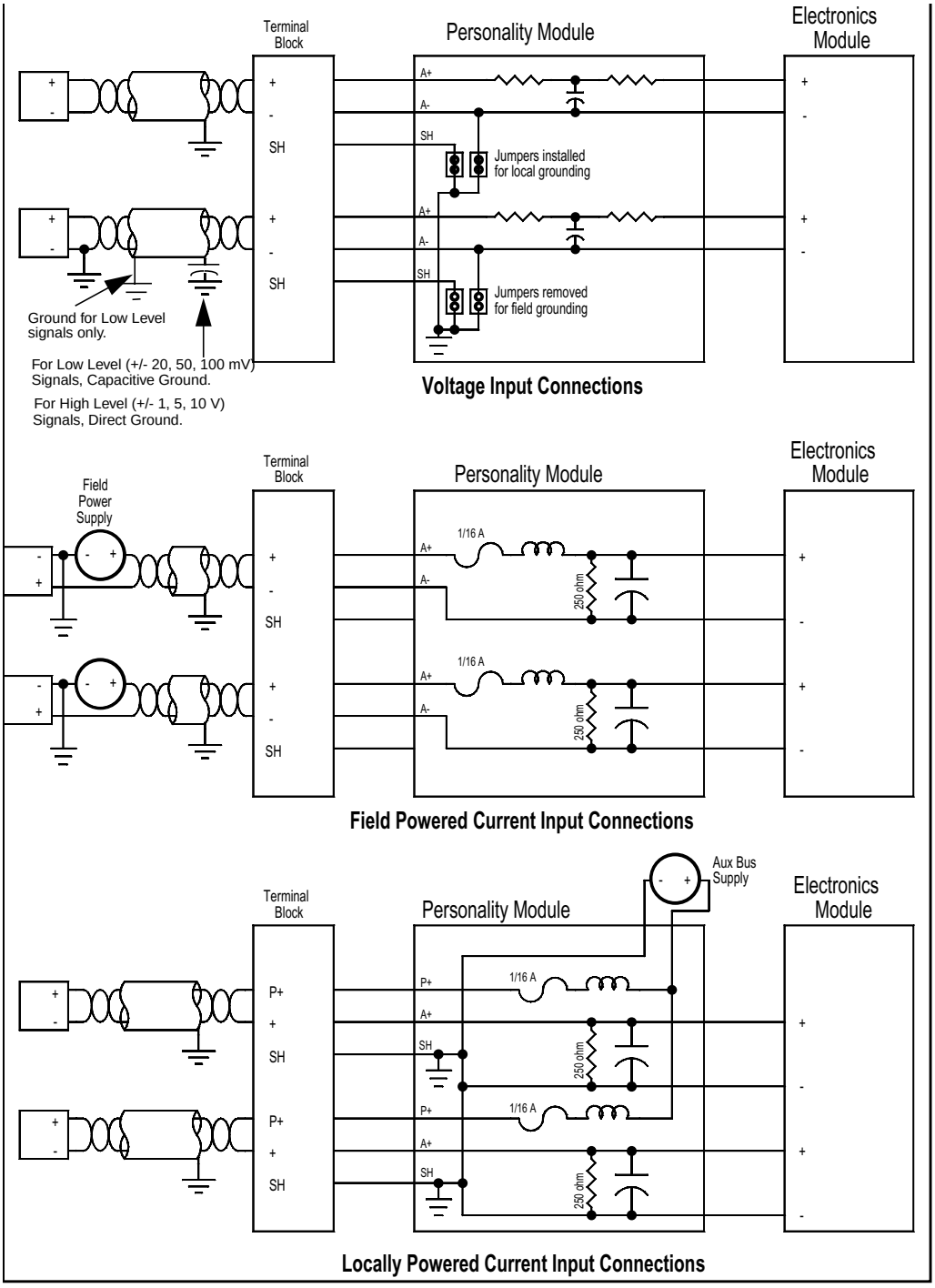


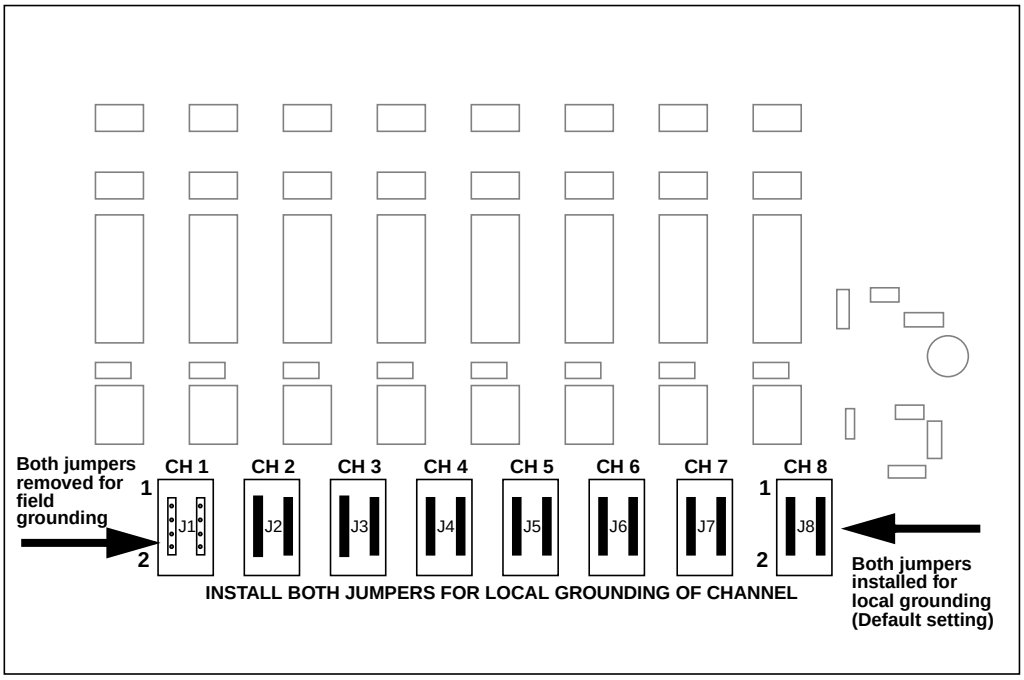
Figure 4-2. Field Connections for the Analog Input Personality Module (Non-CE Mark)

CE Mark Certified Systems



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 4-3. 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 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 (Vt) 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 (V1 and V2) between the terminals and the thermocouples. The following formula is used to find Vt: Vt = Vm -V1 -V2.

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.

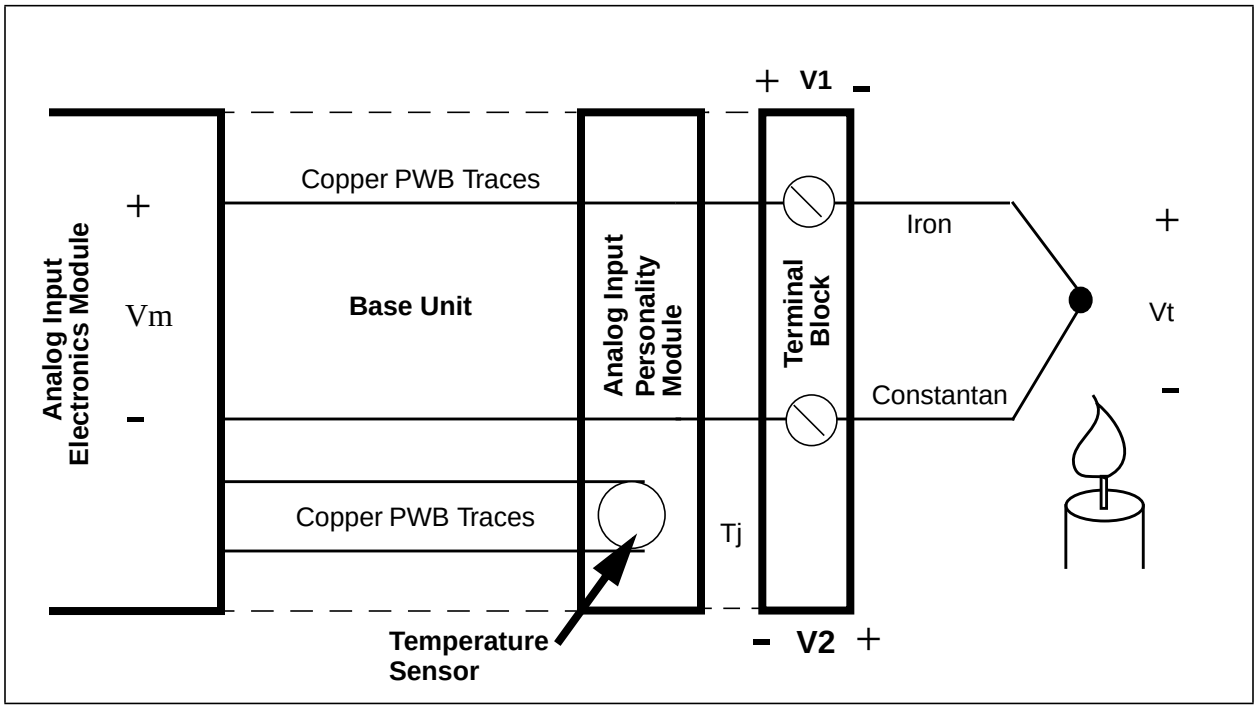


Figure 4-5. Thermocouple Illustration

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.

.

Table 4-3. Thermocouple Coefficient Definitions

Thermocouple Type	Standard Temperature Range	Actual range in MV / TEMP	Best Fit
B or TB	400 to 1100 Degrees C 800 to 2000 Degrees F	0.000 to 13.814 (0 to 1820) 0.006 to 13.814 (0 to 3308)	20 mv card 20 mv card
Fahrenheit COEF_1 = 3.5164700E+02 COEF_2 = 6.1388490E+05 COEF_3 = -1.5397740E+08 COEF_4 = 3.3593730E+10 COEF_5 = -4.0518260E+12 COEF_6 = 2.0039330E+14 COEF_7 = -2.0E-06 COEF_8 = 0.0		**Centigrade** COEF_1 = 1.7758167E+02 COEF_2 = 3.4104717E+05 COEF_3 = -8.5543000E+07 COEF_4 = -8.5543000E+07 COEF_5 = -8.5543000E+07 COEF_6 = 1.1132961E+14 COEF_7 = -2.0E-06 COEF_8 = 0.0	
Thermocouple Type	**Standard Temperature Range**	**Actual range in MV/TEMP**	**Best Fit**
E or TE	-18 to 286 Degrees C 0 to 550 Degrees F -18 to 661 Degrees C 0 to 1200 Degrees F -18 to 1000 Degrees C 0 to 1832 Degrees F	-9.835 to 19.945 (-270 to 286) -9.835 to 19.945 (-450 to 548) -9.835 to 49.992 (-270 to 661) -9.835 to 49.956 (-450 to 1221) -9.835 to 76.358 (-270 to 1000) -9.835 to 76.358 (-450 to 1832)	20 mv card 20 mv card 50 mv card 50 mv card 100 mv card 100 mv card
Fahrenheit COEF_1 = 3.1672830E+01 COEF_2 = 3.0306280E+04 COEF_3 = -3.3449490E+05 COEF_4 = 6.8495880E+06 COEF_5 = -6.9753490E+07 COEF_6 = 2.923653E0+08 COEF_7 = -1.0939E-03 COEF_8 = 3.365E-05		**Centigrade** COEF_1 = -1.8176111E-01 COEF_2 = 1.6836822E+04 COEF_3 = -1.8583050E+05 COEF_4 = 3.8053267E+06 COEF_5 = -3.8751939E+07 COEF_6 = 1.6242517E+08 COEF_7 = -1.71E-05 COEF_8 = 6.057E-05	

Table 4-3. Thermocouple Coefficient Definitions (Cont'd)

Thermocouple Type	Standard Temperature Range	Actual range in MV / TEMP	Best Fit
J or TJ	-18 to 365 Degrees C -140 to 700 Degrees F -18 to 760 Degrees C -140 to 1400 Degrees F	-8.096 to 19.971 (-210 to 366) -8.137 to 19.977 (-350 to 691) -8.096 to 42.922 (-210 to 760) -8.137 to 42.922 (-350 to 1400)	20 mv card 20 mv card 50 mv card 50 mv card
Fahrenheit COEF_1 = 3.112531E+01 COEF_2 = 3.6070270E+04 COEF_3 = -4.2886170E+05 COEF_4 = 2.2613820E+07 COEF_5 =-5.1743790E+08 COEF_6 = 3.9727830E+09 COEF_7 =-9.256E-04 COEF_8 = 2.862E-05		**Centigrade** COEF_1 = -4.8593889E-01 COEF_2 = 2.0039039E+04 COEF_3 = -2.3825650E+05 COEF_4 = 1.2563233E+07 COEF_5 = -2.8746550E+08 COEF_6 = 2.2071017E+09 COEF_7 = -9.76E-06 COEF_8 = 5.1516E-05	
Thermocouple Type	**Standard Temperature Range**	**Actual range in MV/TEMP**	**Best Fit**
K or TK	-18 to 480 Degrees C 0 to 900 Degrees F -18 to 1230 Degrees C 0 to 2250 Degrees F -18 to 1370 Degrees C 0 to 2500 Degrees F	-6.458 to 19.959 (-270 to 484) 6.456 to 19.978 (-450 to 904) 6.458 to 49.988 (-270 to 1232) 6.456 to 49.996 (-450 to 2250) -6.458 to 54.875 (-270 to 1372) -6.456 to 54.845 (-450 to 2500)	20 mv card 20 mv card 50 mv card 50 mv card 100 mv card 100 mv card
Fahrenheit COEF_1 = 3.0344730E+01 COEF_2 = 4.4031910E+04 COEF_3 = 1.615839E+05 COEF_4 = -1.616257E+07 COEF_5 = 4.4011090E+08 COEF_6 = -3.599650E+09 COEF_7 = -7.259E-04 COEF_8 = 2.243E-05		**Centigrade** COEF_1 = -9.1959444E-01 COEF_2 = 2.4462172E+04 COEF_3 = 8.9768833E+04 COEF_4 = -8.9792056E+06 COEF_5 = 2.4450606E+08 COEF_6 =- 1.9998056E+09 COEF_7 = -8.14E-06 COEF_8 = 4.0374E-05	

Table 4-3. Thermocouple Coefficient Definitions (Cont'd)

Thermocouple Type	Standard Temperature Range	Actual range in MV / TEMP	Best Fit
R or TR	260 to 1100 Degrees C 500 to 2000 Degrees F	0.000 to 19.998 (0 to 1684) 0.089 to 19.997 (0 to 3063)	20 mv card 20 mv card
Fahrenheit COEF_1 = 8.3628480E+01 COEF_2 = 2.2737160E+05 COEF_3 = -1.2482860E+07 COEF_4 = 1.2062540E+09 COEF_5 = -7.4221280E+10 COEF_6 = 1.89930000E+12 COEF_7 =-1.084E-04 COEF_8 = 3.24E-06		**Centigrade** COEF_1 = 2.8682489E+01 COEF_2 = 1.2631756E+05 COEF_3 = -6.9349222E+06 COEF_4 = 6.7014111E+08 COEF_5 = -4.1234044E+10 COEF_6 = 1.0551667E+12 COEF_7 = -4.72E-06 COEF_8 = 5.832E-06	
Thermocouple Type	**Standard Temperature Range**	**Actual range in MV / TEMP**	**Best Fit**
S or TS	400 to 1100 Degrees C 750 to 2000 Degrees F	0.000 to 18.698 (0 to 1768) -0.092 to 18.696 (0 to 3214)	20 mv card 20 mv card
Fahrenheit COEF_1 = 1.1803440E+02 COEF_2 = 1.9859180E+05 COEF_3 = -1.9730960E+04 COEF_4 = -5.0093290E+08 COEF_5 = 4.1104880E+10 COEF_6 = -1.1557940E+12 COEF_7 = -1.0847E-04 COEF_8 = 3.26E-06		**Centigrade** COEF_1 = 4.7796889E+01 COEF_2 = 1.1032878E+05 COEF_3 = -1.0961644E+04 COEF_4 = -2.7829606E+08 COEF_5 = 2.2836044E+10 COEF_6 = -6.4210778E+11 COEF_7 = -4.15E-06 COEF_8 = 5.868E-06	
Thermocouple Type	**Standard Temperature Range**	**Actual range in MV / TEMP**	**Best Fit**
T or TT	-46 to 400 Degrees C -50 to 750 Degrees F	-6.258 to 19.945 (-270 to 385) -6.254 to 19.979 (-450 to 726)	20 mv card 20 mv card
Fahrenheit COEF_1 = 3.1892240E+01 COEF_2 = 4.6693280E+04 COEF_3 = -1.3257390E+06 COEF_4 = 6.9620670E+07 COEF_5 = -2.3278080E+09 COEF_6 = 3.3306460E+10 COEF_7 = -7.3333E-04 COEF_8 = 2.243E-05		**Centigrade** COEF_1 =-5.9866667E-02 COEF_2 = 2.5940711E+04 COEF_3 = -7.3652167E+05 COEF_4 = 3.8678150E+07 COEF_5 = -1.2932267E+09 COEF_6 = 1.8503589E+10 COEF_7 = -1.55700E-05 COEF_8 = 4.0374E-05	

4-8. Analog Input Address Locations

4-8.1. Configuration and Status Register

Word address 13 (D in Hex) is used to write to the Module Configuration Register and to read the Module Status Register. The status register can be read by using the Point Information window at an Operator Station (see the Bit Pattern Field on the Hardware Tab).

Table 4-4. Analog Input Configuration/Status Register (Address 13 or D in Hex)

Bit	Data Description - Configuration Register (Write)	Data Description - Status Register (Read)
0	Configure Module	Module Configured (1 = configured; 0 = unconfigured)
1	Force Error	Internal or forced error (1 = forced error; 0 = no forced error)
2	Not Used	Not Used (0)
3	Not Used	Not Used (0)
4	Not Used	Not Used (0)
5	Not Used	Not Used (0)
6	Not Used	Not Used (0)
7	Not Used	EEPROM Checksum Error - Module Uncalibrated (1 = error; 0 = no error
8	50/60 Hz Selection (0 = 60Hz, 1 = 50Hz)	50 Hz/60 Hz System (0 = 60Hz; 1 = 50Hz)
9	Use Line Sync if Present (1 = use)	Using Line Sync
10	Not Used	Line Frequency Tracking Active
11	Not Used	EE PROM Program Enabled
12	Not Used	PSD Generator Malfunction
13	Not Used	Internal Memory Error (EPROM Checksum or Static RAM Error)
14	Not Used	Temperature Sensor Failure
15	Not Used	Point Fault [1]
[1] Refer to Table 4-6 for descriptions of the Point Faults.		

Bit 0: This bit configures the module (write) or indicates the configuration state of the module (read). A “1” indicates that the module is configured. Note that until the module is configured, accessing addresses 0 through 11 (B in Hex) will produce an attention status.

Bit 1: This bit (write “1”) forces the module into its error state, resulting in the error LED being lit. The read of bit 1 indicates the error state of the module, with “1” indicating that there is an internal error in the module or the Controller has forced the module into an error state. The state of this

bit is always reflected by the module's Internal Error LED. Whenever this bit is set, an attention status is returned to the Controller when the point data is read (that is, accessing addresses 0 through 11).

Bits 2 - 6: These bits are “not used” values and are read as “0” under normal operation.

Bit 7: This bit is the result of a checksum test of the EEPROM. A failure of this test can indicate a bad EEPROM, but typically indicates that the module has not been calibrated. A “0” indicates that there is no error condition. If this error is present, the error will be indicated by the module error LED being lit and the module will not process the point information. The point fault bit will also be set as all the point data is uncalibrated. When this error is present, no other processing takes place. The “1” state of this bit indicates an unrecoverable error condition in the field.

Bit 8: This bit indicates whether the on-board integrating timebase is 80 msec (4 line cycles of a 50 Hz system) or 83.3 msec (5 line cycles of a 60 Hz system). A “0” indicates that the timebase is 83.3 msec (60 Hz line frequency) and is the default setting.

Bit 9: This bit indicates whether to use the line frequency tracking if it is present. A write of “1” indicates to use the tracking input. A read of “1” indicates that the module is using the tracking input. The default state is a “0.”

Note

Line frequency tracking is presently **NOT** supported by the Ovation I/O system.

Bit 10: This bit indicates whether the line frequency tracking signal is present and active for greater normal and common mode rejection. A “0” indicates that the line frequency tracking signal is NOT present.

Bit 11: This bit indicates whether the hardware EEPROM PE signal is active. A “0” indicates that the module is in normal operating mode and calibration and ID programming commands will not be processed.

Bit 12: This bit reflects the detection of the internal 625 KHz PSD signal at module initialization. This verifies that the multifunction FPGA and the microcontroller's timer 0 are functioning. A “0” indicates that there is no error condition. A “1” indicates an unrecoverable error condition in the field.

Bit 13: This bit is a basic check of program and data memory, along with the microcontroller's data, address, and control buses. A “0” indicates that there is no error condition. A “1” indicates an unrecoverable error condition in the field.

Bit 14: This bit indicates the fault status of the digital temperature sensor. A “0” indicates the sensor is present and communicating properly with the microcontroller. A “1” indicates a fault exists; either there is no sensor present, or problems exist in communicating with the sensor. On an uncalibrated module, a sensor failure is always reported because the uncalibrated status prevents the sensor from being checked.

Bit 15: This bit indicates the point fault status of the module. It is the logical “OR” of the eight individual point quality statuses plus bits 1, 7, 12, and 13 of this register. A “0” indicates that all eight points have good quality and no module errors exist. A “1” indicates that at least one of the points has bad quality and is therefore in fault.

A subsequent read of the Point Quality Status Register at Address 12 (C in Hex) will reveal which of the eight points has bad quality and the cause of the bad quality condition (refer to Table 4-6). The Address 12 (C in Hex) Point Quality Status Register contains data only when the module fault is due to a bad point quality; that is, bits 7, 12, and 13 of this register or the forced error bit are not set. Note that the Temperature Sensor (Address 8) status is treated separately and is not included in this module point fault bit.

4-8.2. Secondary Configuration and Status Register

Word address 14 (E in Hex) serves the purpose of the Current/Voltage Configuration/Status Register. The bit definitions for this register are encoded as shown in Table 4-5.

The default state of the register under normal operation is “0” for voltage inputs. The lower 8 bits are configuration bits which are written to and read from the module. The upper 8 bits are read-only status bits indicating the blown fuse status only for those channels which have been configured as current inputs.

Table 4-5. Secondary Configuration/Status Register (Address 14 or E in Hex)

Bit	Data Description Current/Voltage Configuration (Write)	Data Description Current/Voltage Status (Read)
0	Select Point 1 Current/Voltage (1 = Current)	Select Point 1 Current/Voltage (1 = Current)
1	Select Point 2 Current/Voltage (1 = Current)	Select Point 2 Current/Voltage (1 = Current)
2	Select Point 3 Current/Voltage (1 = Current)	Select Point 3 Current/Voltage (1 = Current)
3	Select Point 4 Current/Voltage (1 = Current)	Select Point 4 Current/Voltage (1 = Current)

Table 4-5. Secondary Configuration/Status Register (Address 14 or E in Hex) (Cont'd)

Bit	Data Description Current/Voltage Configuration (Write)	Data Description Current/Voltage Status (Read)
4	Select Point 5 Current/Voltage (1 = Current)	Select Point 5 Current/Voltage (1 = Current)
5	Select Point 6 Current/Voltage (1 = Current)	Select Point 6 Current/Voltage (1 = Current)
6	Select Point 7 Current/Voltage (1 = Current)	Select Point 7 Current/Voltage (1 = Current)
7	Select Point 8 Current/Voltage (1 = Current)	Select Point 8 Current/Voltage (1 = Current)
8	Not Used	Point 1 Current Blown Fuse (1 = Blown)
9	Not Used	Point 2 Current Blown Fuse (1 = Blown)
10	Not Used	Point 3 Current Blown Fuse (1 = Blown)
11	Not Used	Point 4 Current Blown Fuse (1 = Blown)
12	Not Used	Point 5 Current Blown Fuse (1 = Blown)
13	Not Used	Point 6 Current Blown Fuse (1 = Blown)
14	Not Used	Point 7 Current Blown Fuse (1 = Blown)
15	Not Used	Point 8 Current Blown Fuse (1 = Blown)

4-8.3. Point Quality Register

Word address 12 (C in Hex) serves the purpose of reporting the point quality of the eight channel inputs. The bit definitions for this register are encoded as shown in Table 4-6.

Table 4-6. Point Quality Register (Address 12 or C in Hex)

Point	Bit	Description
1	0	Auto Calibration Reasonability Check Failed
	1	Overrange Input/Blown Fuse/Open Loop/Open Thermocouple
2	2	Auto Calibration Reasonability Check Failed
	3	Overrange Input/Blown Fuse/Open Loop/Open Thermocouple
3	4	Auto Calibration Reasonability Check Failed
	5	Overrange Input/Blown Fuse/Open Loop/Open Thermocouple
4	6	Auto Calibration Reasonability Check Failed
	7	Overrange Input/Blown Fuse/Open Loop/Open Thermocouple
5	8	Auto Calibration Reasonability Check Failed
	9	Overrange Input/Blown Fuse/Open Loop/Open Thermocouple
6	10	Auto Calibration Reasonability Check Failed
	11	Overrange Input/Blown Fuse/Open Loop/Open Thermocouple
7	12	Auto Calibration Reasonability Check Failed
	13	Overrange Input/Blown Fuse/Open Loop/Open Thermocouple
8	14	Auto Calibration Reasonability Check Failed
	15	Overrange Input/Blown Fuse/Open Loop/Open Thermocouple

Auto Calibration Reasonability Check Failed - This bit is set when the auto calibration zero or reference reading is out of tolerance (±6% of the nominal reading).

Overrange Input/Blown Fuse/Open Loop/Open Thermocouple - This bit is set under the following conditions:

Voltage Input Configuration (all groups) - when an overrange input of ±125% of the full scale value is read on the input.

Current Input Configuration (Group 5) - when an input less than 2.5mA (a blown fuse or open loop condition) is detected or an overrange of greater than 25mA of full scale is present.

4-9. Diagnostic LEDs

Table 4-7. Analog Input Diagnostic LEDs

LED	Description
P (Green)	Power OK LED. Lit when the +5V power is OK.
C (Green)	Communications OK LED. Lit when the Controller is communicating with the module.
I (Red)	Internal Error LED. Lit whenever there is any type of error with the module **except** for a loss of power. Possible causes are: - Module is initialization. - I/O Bus timeout has occurred. - EPROM checksum error or static RAM error. - PSD generator malfunction. - Module reset. - Module input power (+24V) not OK. - Module is uncalibrated. - Forced error has been issued by the Controller.
CH1 - CH 8 (Red)	Channel error. Lit whenever there is an error associated with a channel or channels. Possible causes are: - Positive overrange: Input voltage greater than +125% of full scale value. - Negative overrange: Input voltage less than -125% of full scale value. - Broken current loop input or blown fuse for module configured as current input. - Auto calibration readings out of range.

Section 5. Analog Input Module (14 bits)

5-1. Description

The combined Personality and Electronics Modules form the 14 Bit Analog Input Module. Eight sets of individually isolated input channels are provided. 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.

No thermocouple provisions are provided for this module.

Note

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

5-2. Module Groups

5-2.1. Electronics Modules

There are two groups of Electronics modules for the 14 Bit Analog Input Module:

- 1C31224G01 provides current signals with an input range of 4 to 20 mA.
- 1C31224G02 provides voltage signals with an input range of ± 1V.

5-2.2. Personality Modules

There are two groups of Personality modules for the 14 Bit Analog Input Module:

- 1C31227G01 provides current signals with an input range of 4 to 20 mA.
- 1C31227G02 provides voltage signals with an input range of ± 1V.

Table 5-1. Analog Input Subsystem (14 Bit)

Range	Channels	Electronic Module	Personality Module
4 - 20mA, Field or Locally powered	8	1C31224G01	1C31227G01
± 1 VDC	8	1C31224G02	1C31227G02

Only 4-20mA Configuration is CE Mark Certified.

5-3. Module Block Diagram

The simplified block diagram for the voltage input configuration of the14 bit 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.

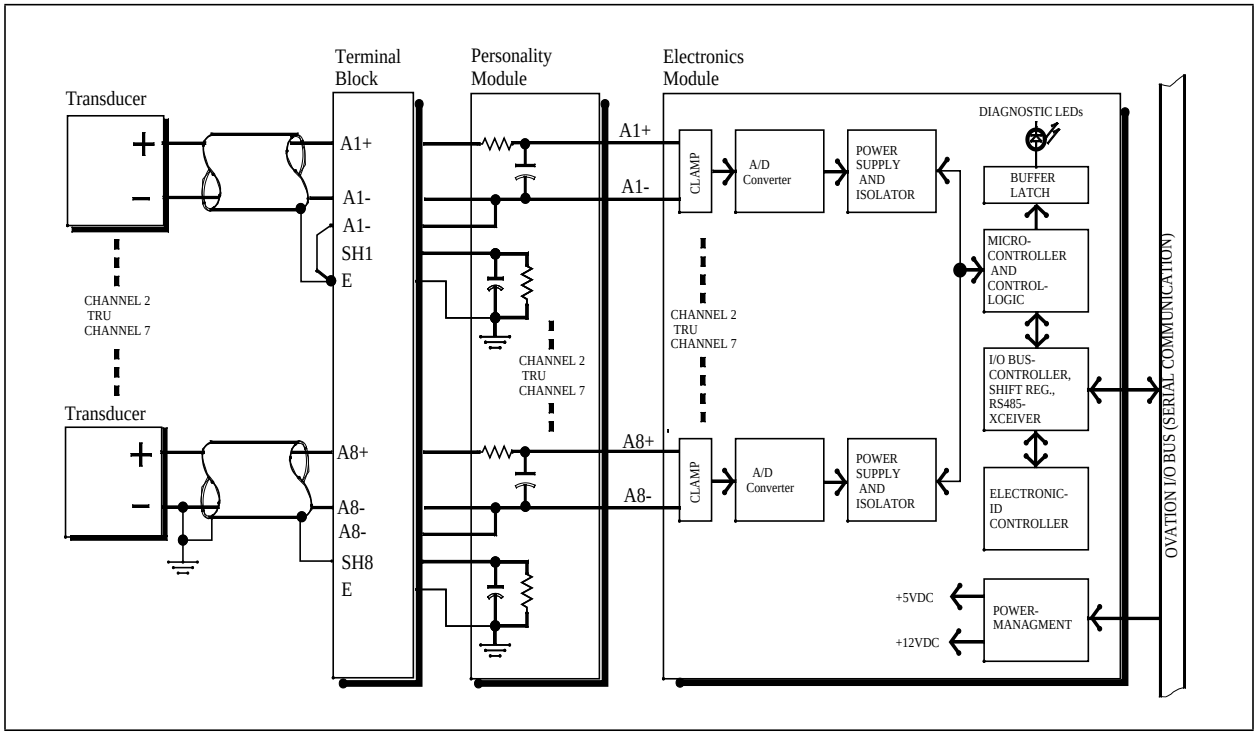


Figure 5-1. Voltage Input Connections

5-4. 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 14 Bit Analog Input module uses the 1C31227G01 Personality module, the required voltage source is obtained from the internal auxiliary power supply (backplane).

Also, personality module 1C31227G01 supports field-powered configurations.

5-5. Specifications

Electronics Module (1C31224)
Personality Module (1C31227)

Table 5-2. 14-Bit Analog Input Module Specifications

Description	Value
Number of channels	8
Input range	4 - 20 mA [1] ±1V [2]
Resolution	Group 1:14 bits, Group 2:13 bits & Sign
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]	10 MΩ
Sampling rate	20 times per second minimum when configured for 60 Hz rejection 25 times per second minimum when configured for 50Hz rejection
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%

[1] Current inputs when using Personality module 1C31224G01 with 1C31227G01 Electronics Module.
[2] Voltage inputs when using Personality module 1C31224G02 with 1C31227G02 Electronics Module.
[3] Only for the voltage input module (Personality module 1C31224G02 with 1C31227G02 Electronics Module).

5-6. 14-Bit 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 5-2. The following table lists and defines the abbreviations used in those diagrams.

Abbreviation	Definition
A1 - A8 +	Analog Input positive terminal connection (connected to the positive terminal of the field device).
A1 - A8 -	Analog Input negative terminal connection (voltage input group only).
P-1 - P-8	Loop power output terminals (for locally powered loops).
CI1 - CI8	Current input terminals.
SH1 - SH8	Shield terminal connection.
RSV	Reserved terminal. No connections allowed on these terminals.
	Earth ground terminals.
PS+, PS-	Auxiliary power supply terminals.

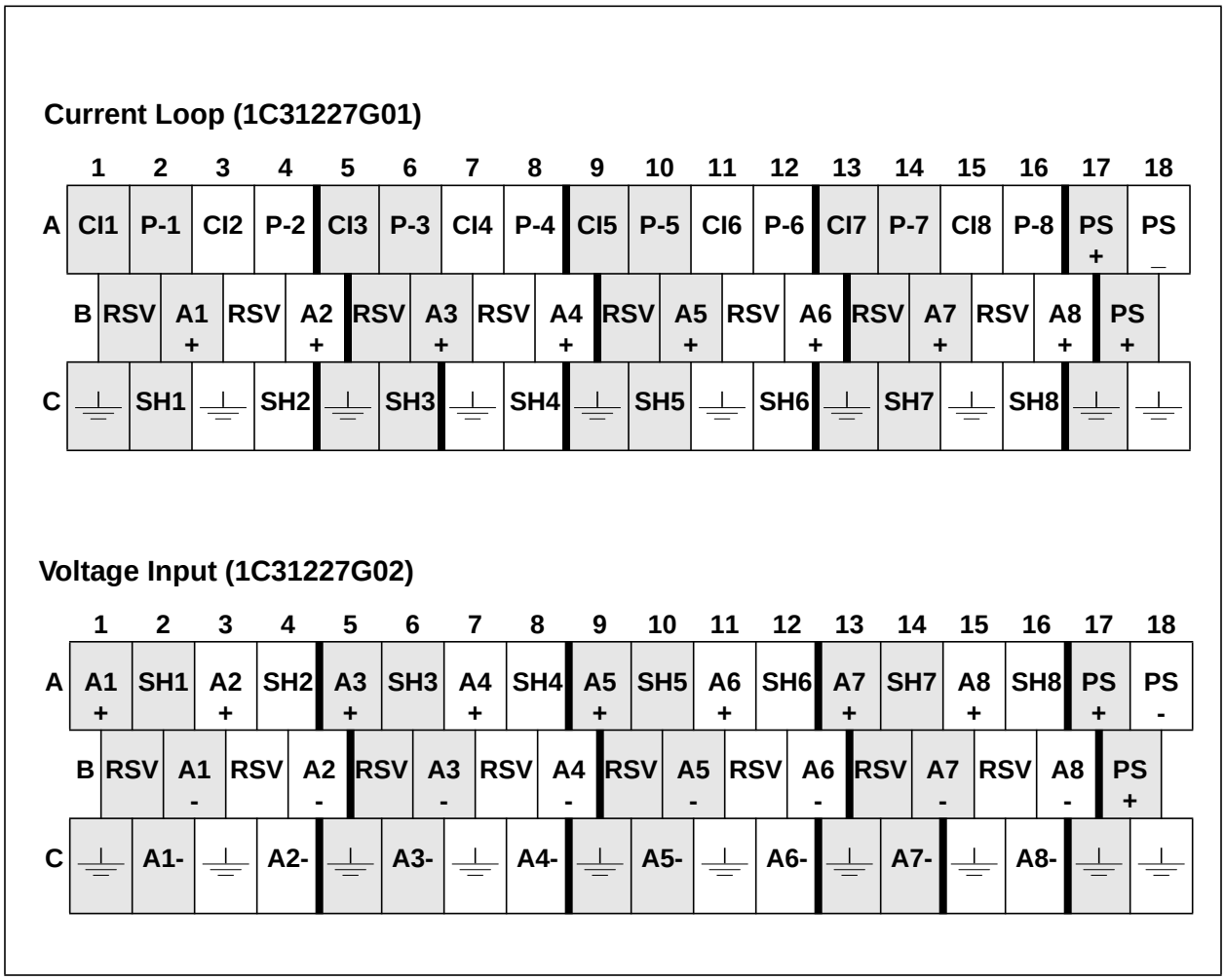


Figure 5-2. Terminal Block Connections for the Analog Input Personality Modules

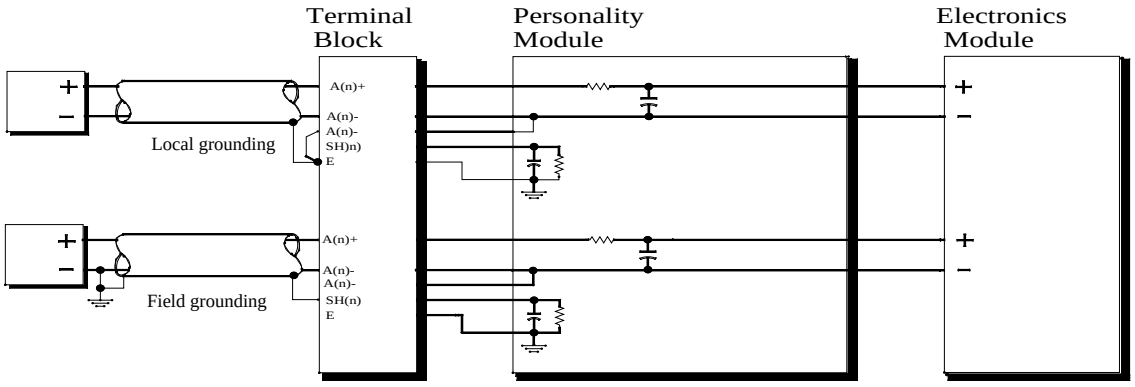
Use shielded twisted pair wire for the field wiring. Tie the Analog Input negative terminal and shield together and to earth ground, either locally at the cabinet or at the field device. Voltage inputs use the 1C31227G02 Personality Modules. Grounding the shield and the analog input negative terminal at the cabinet or at the field device is arranged by the proper Terminal Block connections.

Similarly, current inputs using the 1C31227G01 Personality Modules can accommodate field or locally powered devices by using the correct terminal block connections.

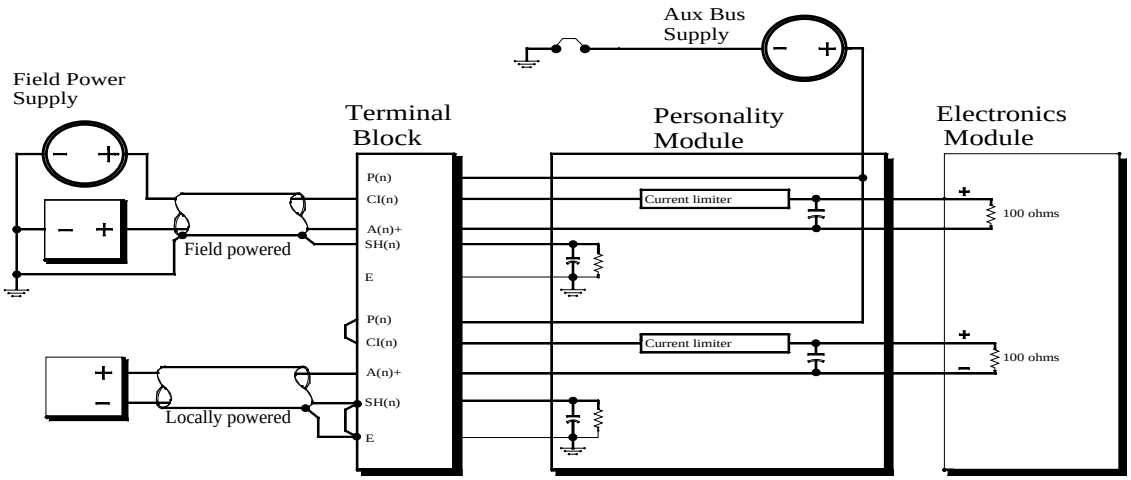
The Personality Modules have a field connection diagram label on top of each module to facilitate field wiring. The following figures show the implementations of the field connections for the various Personality Module and field device combinations.

5-7. 14-Bit Analog Input Field Connection Wiring Diagrams

Non-CE Mark Certified Systems



Voltage Input Connections



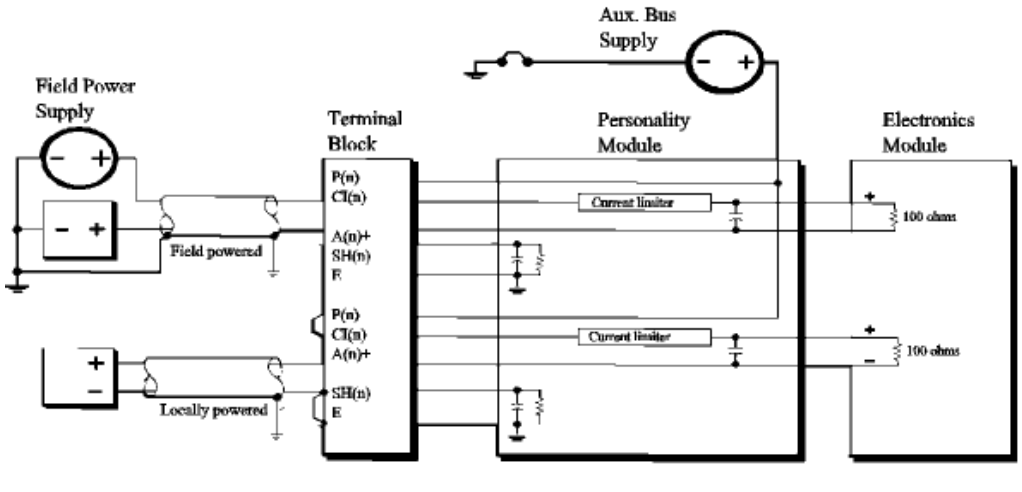
Current Input Connections

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 5-3. Field Connections for the Input Connectors (Non-CE Mark)

CE Mark Certified Systems



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 recommended hardware (refer to "Cable Guides" in U3-1000 and U3-1005).

Figure 5-4. Field Connections for the Input Connectors (CE Mark)

5-8. 14-Bit Analog Input Address Locations

5-8.1. Configuration and Status Register

Word address 13 (D in Hex) is used to write to the Module Configuration Register and to read the Module Status Register. The status register can be read by using the Point Information window at an Operator Station (see the Bit Pattern Field on the Hardware Tab).

Table 5-3. 14-Bit Analog Input Configuration/Status Register (Address 13 or D in Hex)

Bit	Data Description - Configuration Register (Write)	Data Description - Status Register (Read)
0	Configure Module	Module Configured (1 = configured; 0 = unconfigured)
1	Force Error	Internal or forced error (1 = forced error; 0 = no forced error)
2	0, (ADD4 bit during diagnostics)	Not Used (0)
3	0, (ADD5 bit during diagnostics)	Not Used (0)
4	0, (ADD6 bit during diagnostics)	Warming
5	0, (ADD7 bit during diagnostics)	Not Used (0)

Table 5-3. 14-Bit Analog Input Configuration/Status Register (Address 13 or D in Hex)

Bit	Data Description - Configuration Register (Write)	Data Description - Status Register (Read)
6	0, (ADD8 bit during diagnostics)	Not Used (0)
7	0, (DIAG_SET, initiates diagnostics)	Module is not calibrated
8	50/60 Hz Selection (0 = 60Hz, 1 = 50Hz)	50 Hz/60 Hz System (0 = 60Hz; 1 = 50Hz)
9	A/D conversion rate selection bit (0 = Normal, 1 = High speed)	A/D conversion rate bit (0 = Normal, 1 = High speed)
10	0, (SYS_CAL, initiates system calibration during diagnostics)	SYS_CAL in progress (during diagnostics)
11	SELF_CAL (initiates self calibration)	SYS_CAL completed (during diagnostics)
12	Not defined	SYS_CAL failed (during diagnostics)
13	Not defined	Internal Memory Error (FLASH Checksum, Register, or Static RAM Error)
14	Not defined	Module in diagnostic mode (during diagnostics)
15	Not defined	Point Fault [1]
[1] Refer to the Point Quality Register for descriptions of the Point Faults.		

Bits defined for diagnostics are used only during factory testing.

Bit 0: This bit configures the module (write) or indicates the configuration state of the module (read). A “1” indicates that the module is configured. Note that until the module is configured, reading from addresses 0 through 11 (B in Hex) will produce an attention status.

Bit 1: This bit (write “1”) forces the module into its error state, resulting in the error LED being lit. The read of bit 1 indicates that there is an internal module error, or the Controller has forced the module into the error state. The state of this bit is always reflected by the module's Internal Error LED. Whenever this bit is set, an attention status is returned to the Controller when addresses 0 through 11 (B in Hex) are read.

Bits 2-3: These bits are “not used” and are read as “0” under normal operation.

Bit 4: This bit (read) indicates that the module is in the “Warming” state. This state exists after power up and terminates after 8.16 seconds. The module will be in the error condition during the warm up period.

Bits 5-6: These bits are “not used” and are read as “0” under normal operation.

Bit 7: This bit is the result of a checksum test of the EEPROM. A failure of this test can indicate a bad EEPROM, but typically indicates that the module has not been calibrated. A “0” indicates that there is no error condition.

If an error is present, the error will be indicated by the module error LED being lit. The point fault bit will also be set as all the point data is not calibrated. The “1” state of this bit indicates an unrecoverable error condition in the field.

Bits 8: A write to this bit configures the conversion rate of the A/C converters as follows:.

Conversion Rate (1/sec)	Bit 8
20 (for 60Hz systems)	0
25 (for 50Hz systems)	1

The status of these bits (read) indicate the conversion rate to which the module is set.

Bit 9: Reserved

Bit 10: This bit is “not used” and is read as “0” under normal operation.

Bit 11: This bit (write) is used to initiate self-calibration. The sampling rate during self-calibration will be 2 per second. The status (read) bit is not used and is read as “0” under normal operation.

Bit 12: This bit is “not used” and is read as “0” under normal operation.

Bit 13: This bit (read) indicates that the module has internal memory error (FLASH, checksum, Register, or Static RAM error). If this error is present, the module error LED is lit, the point fault bit will also be set since the condition of the module is undetermined.

Bit 14: This bit is “not used” and is read as “0” under normal operation.

Bit 15: This bit indicates the point fault status of the module. It is the logical “OR” of the eight individual point quality statuses plus bits 1, 7, 12, and 13 of this register. A “0” indicates that all eight points have good quality and no module errors exist.

When bits 1, 4, 7 or 13 of the Status Register are not set, this bit (when set to “1”) indicates that at least one of the points has bad quality.

A subsequent read of the Point Quality Register at Address 12 (C in Hex) will reveal the point(s) that have bad quality (see Table 5-4). The Address 12 (C in Hex) Point Quality Register contains data only when the module fault is due to a bad point quality.

5-8.2. Secondary Configuration and Status Register

Word address 14 (E in Hex) is not used and is read as “0” under normal operation.

5-8.3. Point Quality Register

Word address 12 (C in Hex) serves the purpose of reporting the point quality of the eight channel inputs. The bit definitions for this register are encoded as shown in Table 5-4.

Table 5-4. Point Quality Register (Address 12 or C in Hex)

Point	Bit	Description
1	0	Communication to the Isolated Channel Failed
	1	Overrange Input/Blown Fuse/Open Loop
2	2	Communication to the Isolated Channel Failed
	3	Overrange Input/Blown Fuse/Open Loop
3	4	Communication to the Isolated Channel Failed
	5	Overrange Input/Blown Fuse/Open Loop
4	6	Communication to the Isolated Channel Failed
	7	Overrange Input/Blown Fuse/Open Loop
5	8	Communication to the Isolated Channel Failed
	9	Overrange Input/Blown Fuse/Open Loop
6	10	Communication to the Isolated Channel Failed
	11	Overrange Input/Blown Fuse/Open Loop
7	12	Communication to the Isolated Channel Failed
	13	Overrange Input/Blown Fuse/Open Loop
8	14	Communication to the Isolated Channel Failed
	15	Overrange Input/Blown Fuse/Open Loop

Communication to the Isolated Channel Failed - This bit is set when the communication to the corresponding isolated channel has failed.

Overrange Input/Blown Fuse/Open Loop – This bit is set as follows:

- Current Input (Group #1) – When an input current less than 2.5mA (a blown fuse or open loop condition) is detected, or an overrange (greater than 24.6mA) of full scale is present.
- Voltage Input (Group #2) – When an overrange input of 121%of the full scale value is read.

5-9. Diagnostic LEDs

Table 5-5. 14-Bit Analog Input Diagnostic LEDs

LED	Description
P (Green)	Power OK LED. Lit when the +5V power is OK.
C (Green)	Communications OK LED. Lit when the Controller is communicating with the module.
I (Red)	Internal Error LED. Lit whenever there is any type of error with the module **except** for a loss of power. Possible causes are: - Module initialization is in progress. - I/O Bus timeout has occurred. - Register, static RAM, or FLASH checksum error. - Module reset - Module is uncalibrated. - Forced error has been received from the Controller. - Communication between the Field and Logic boards failed.
CH1 - CH 8 (Red)	Channel error. Lit whenever there is an error associated with a channel or channels. Possible causes are: - Positive overrange: Input voltage greater than +121% of full scale value (for modules configured as voltage input). - Negative overrange: Input voltage less than -121% of full scale value (for modules configured as voltage input). - Input current less than 2.5mA or blown fuse (for module configured as current input). - An overrange (greater than 24.6mA) of full scale is present (for modules configured as current input). - Self calibration readings out of range.