Ovation™ Interim Publication Update

Date: 11/01
IPU No. 211

PUBLICATION TITLE

Ovation I/O
Reference Manual
Revision 2, January 2001

Publication No. R3-1150

This publication update contains the following new information.

- New table for the HART Analog Input Module.
- New table for the HART Analog Output Module.
- New section that describes the HART Analog Input Module(16 bits).
- New section that describes the HART Analog Output Module (14 bits).
- Replace Module Group Numbers in Table 24-1. MAU Subsystem.
- Add Module Group Numbers for the Remote Node Controller Module.
- New Appendix C.

Add the following new Table 3-11A:
Page 3-22

Table 3-11A. HART Analog Input Subsystem (16 Bit)

Range	Channels	Electronic Module	Personality Module
4-20 mA loop powered (2 wire) or active source (4 wire)	8	5X00058G01	5X00059G01

Add the following new Table 3-11B:
Page 3-22

Table 3-11-B. HART Analog Output Subsystem (14 Bit)

Range	Channels	Electronic Module	Personality Module
4-20 mA	8	5X00062G01	5X00063G01

Add the following new Section 11-A:

Section 11-A. HART Analog Input Module

11-1. Description

HART (Highway Addressable Remote Transducer) is a digital communication protocol designed for industrial process measurement applications. Field measurement devices (transmitters) interface a process control system via an analog 4-to-20 mA current loop. HART uses a low-level frequency-shift-keyed sine wave signal that is superimposed on the standard 4-to-20 mA process measurement current loop. Since the HART sine wave signal is small and its average value is zero, the current loop analog 4-to-20 mA signal is not significantly affected by the presence of the HART signal. Using HART allows a field device to provide more than one measurement, which is a feature not available when using only the 4-to-20 mA analog current signal.

"Smart" field devices may be described as field devices in which the analog 4-to-20 mA signal, digital communication, and sometimes power, co-exist on the same pair of wires. The Ovation HART Analog Input (HAI) module is a standard form factor Ovation I/O module, which will permit Ovation to communicate with HART devices.

11-1.1. Module Groups

Electronics Module

There is one Electronics Module group for the HART Analog Input Module:

- **5X00058G01** interfaces to eight current loop signals with an input range of 4-20 mA.

Personality Module

There is one Personality Module group for the HART Analog Input Module.

- **5X00059G01** contains a single printed circuit board assembly with eight fused two-wire loop-powered or non-fused active-source (four-wire isolated current output) transmitter inputs.

11-1.2. Module Block Diagram

The Ovation HART Analog Input Module assembly consists of two modules, an electronics module containing a logic printed circuit board (LHA) and a field printed circuit board (FHI). The simplified block diagram for the FHI field board is shown in Figure 11-1. The electronics module is used in conjunction with a personality module, which contains a single printed circuit board (PHAI).

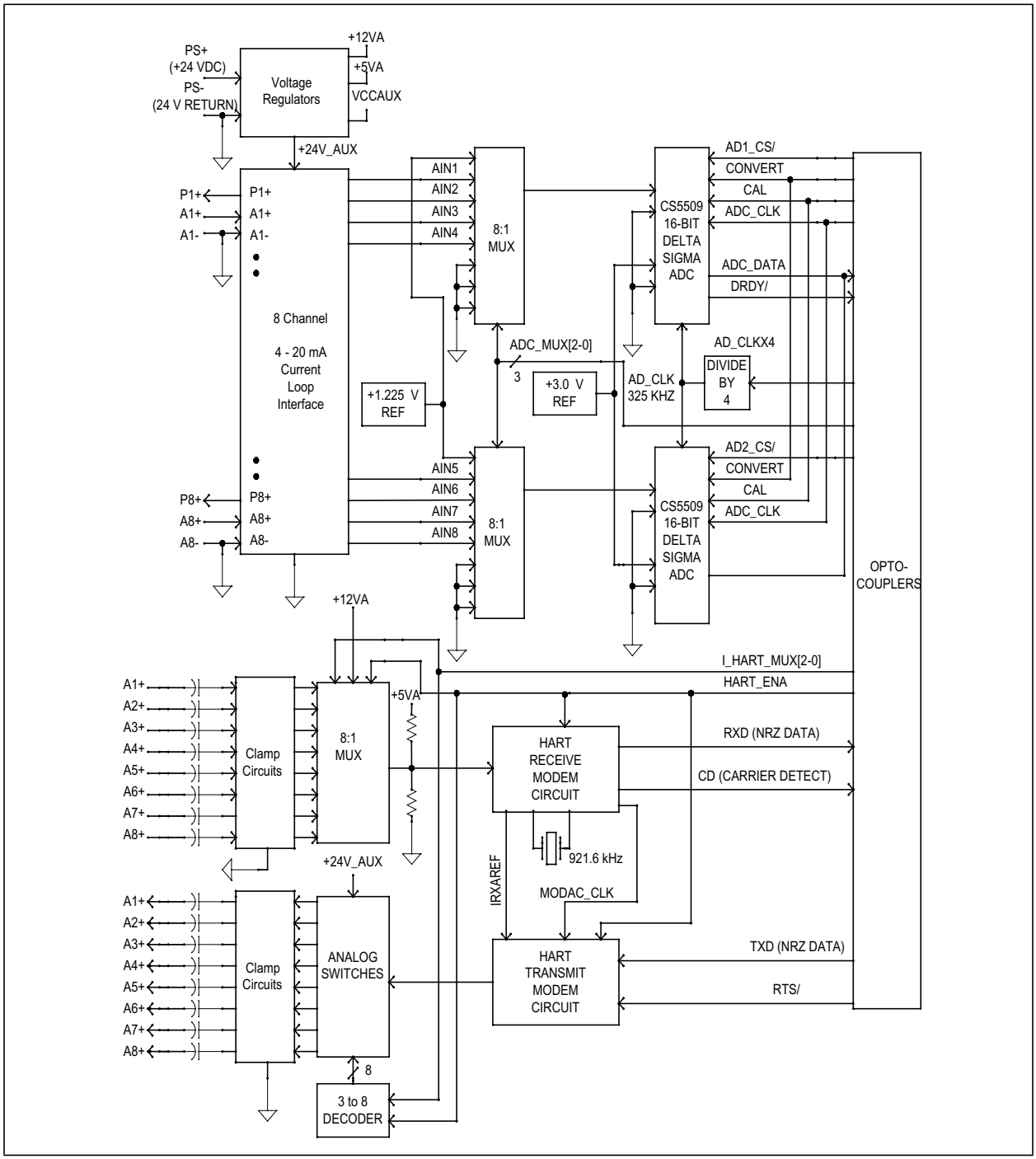


Figure 11-1. HART Analog Input Electronics Module FHI Field Board Block Diagram

11-1.3. External Power Supplies

Note

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

The HART Analog Input Module utilizes the standard +24V Ovation main power supply to provide the power required for the logic circuitry.

The HART Analog Input Module utilizes a +24 auxiliary power supply to provide the power required for the field circuitry. This includes all 4-20 mA loop power, A/D conversion, and the remaining output channel components.

Due to the low signal levels of the HART communications, it is recommended that a low noise (</=1.2 mV rms) power supply, such as an external linear power supply, be used for the auxiliary power.

If an external supply is utilized to provide auxiliary power, see Appendix D for the steps to be taken before connecting the external power supply to the Ovation I/O base unit terminal block.

In addition, all modules utilizing the auxiliary power supplies, including the HART modules, **MUST** utilize shielded I/O cables in order to suppress coupled noise and transients into the HART modules. This includes modules on the same branch, utilizing the auxiliary power, or modules on other branches utilizing the same auxiliary power. This recommendation applies regardless of the type of power supply chosen by the user.

11-1.4. Specifications

Electronics Module (5X00058)
Personality Module (5X00059)

Table 11-1. HART Analog Input Module Specifications

Description	Value
Number of channels	8
Input range	4 to 20 mA 2 to 22 mA with under-range and over-range checking
A/D Resolution	16 bits
Reference accuracy (@ 25^{o}C)	+/-0.05% of span @ 99.7% confidence
Accuracy over temperature[1]	+/-0.1% of span over the full operating temperature range
Sampling rate (per ms)	Each channel is sampled every 24 ms.
Dielectric isolation: Channel to channel Channel to logic	 No channel to channel isolation 1000 VAC/VDC for one minute
Operating temperature range	0^{o} to 60^{o}C. (32^{o}F to 140^{o}F)
Humidity (non-condensing)	0% to 95%
Module power	Main: 1.2W typical. 2.5W maximum Aux. power supply voltage = 24 VDC -5%, +6.25% Aux: 4.1W typical. 7.2W maximum
Two-wire transmitter power	13.5V minimum (P_{n+} to A_{n+}) @ 20 mA where n = 1 to 8 (current limited to 32 mA maximum)
[1] See additional accuracy statements for CE Mark certified systems in Appendix C.	

11-1.5. Hart 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 HART Analog Input Personality modules are illustrated in Figure 11-2. The following table lists and defines the abbreviations used in those diagrams.

Abbreviation	Definition
A1 - A8 +	Analog Input terminal connection (connected to the negative terminal of a loop powered two-wire current transmitter or the positive terminal of an active-source current transmitter).
A1 - A8 -	Analog Input negative terminal connection (active-source only).
P1 - P8 +	Loop power output terminals (for loop powered two-wire current transmitters - connect to their positive terminal).
SH1 - SH8	Shield terminal connection.
⏚	Earth ground terminals.
PS+, PS-	External Auxiliary power supply terminals.
RSV	Reserved terminal. No connections are allowed on these terminals.

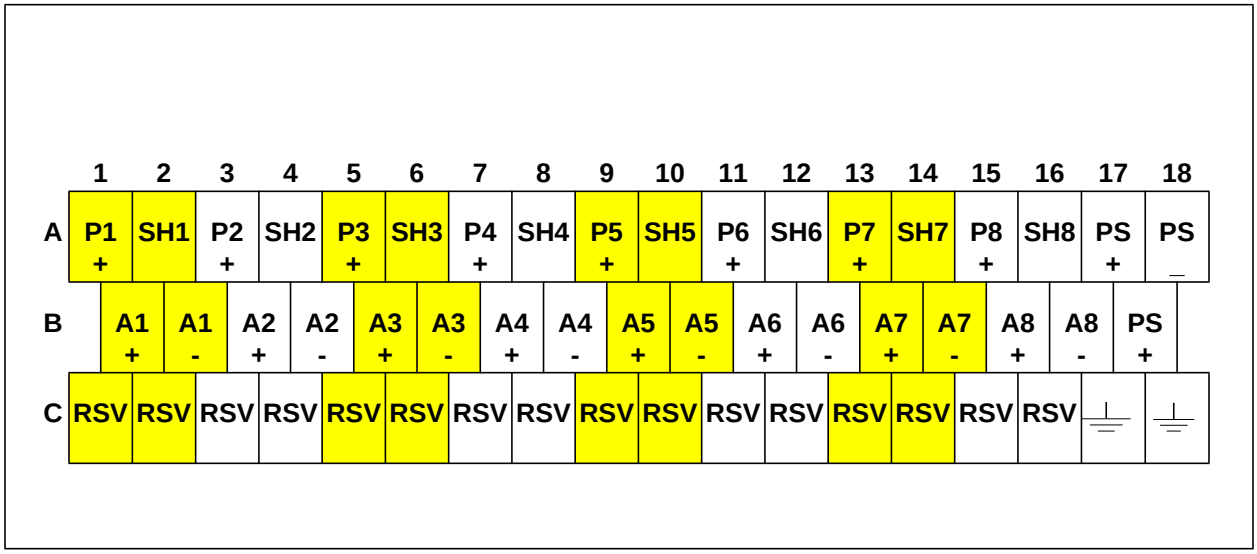


Figure 11-2. HART Analog Input Terminal Block Pin Assignments

11-1.6. HART Analog Input Field Connection Wiring Diagrams

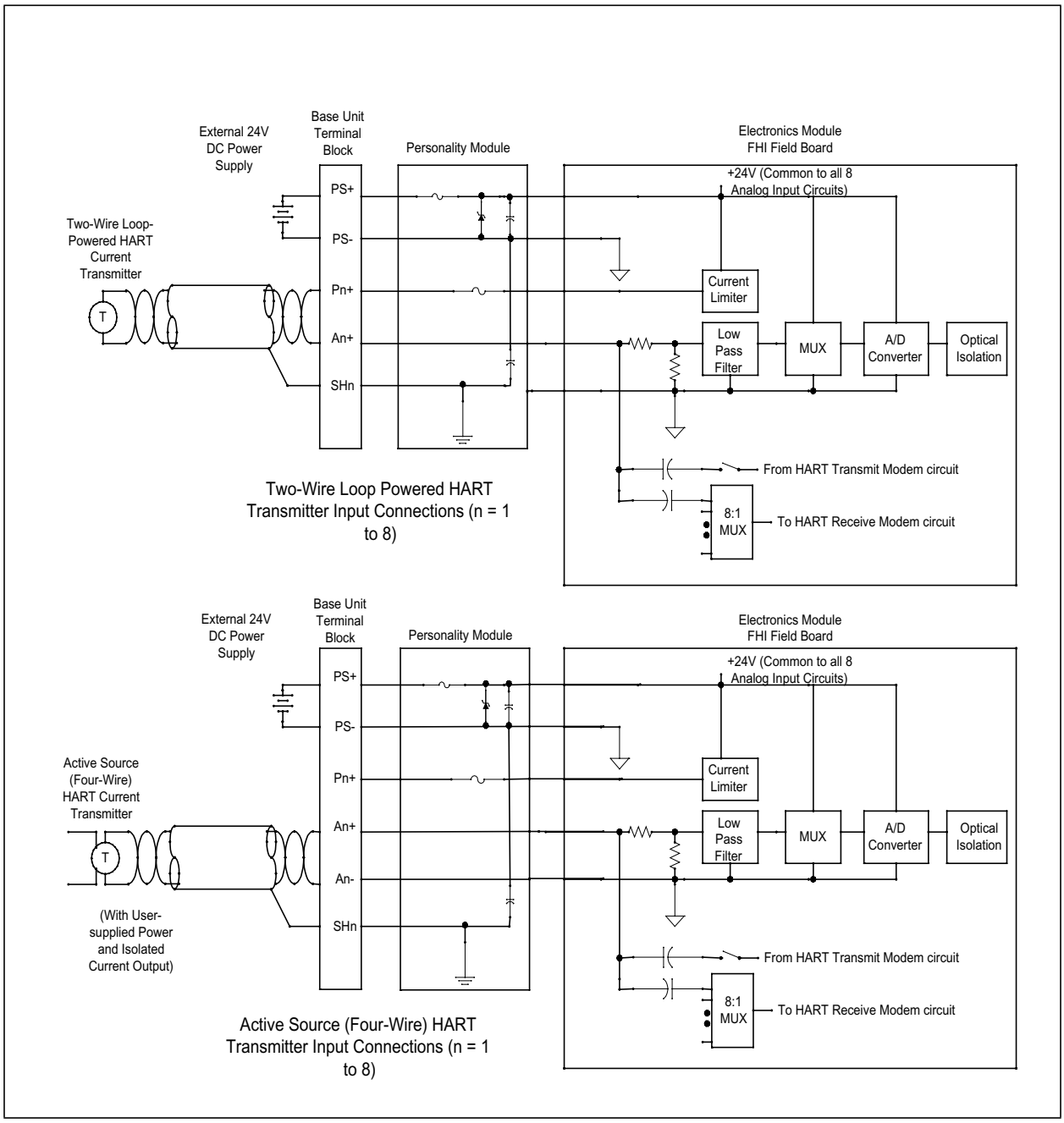
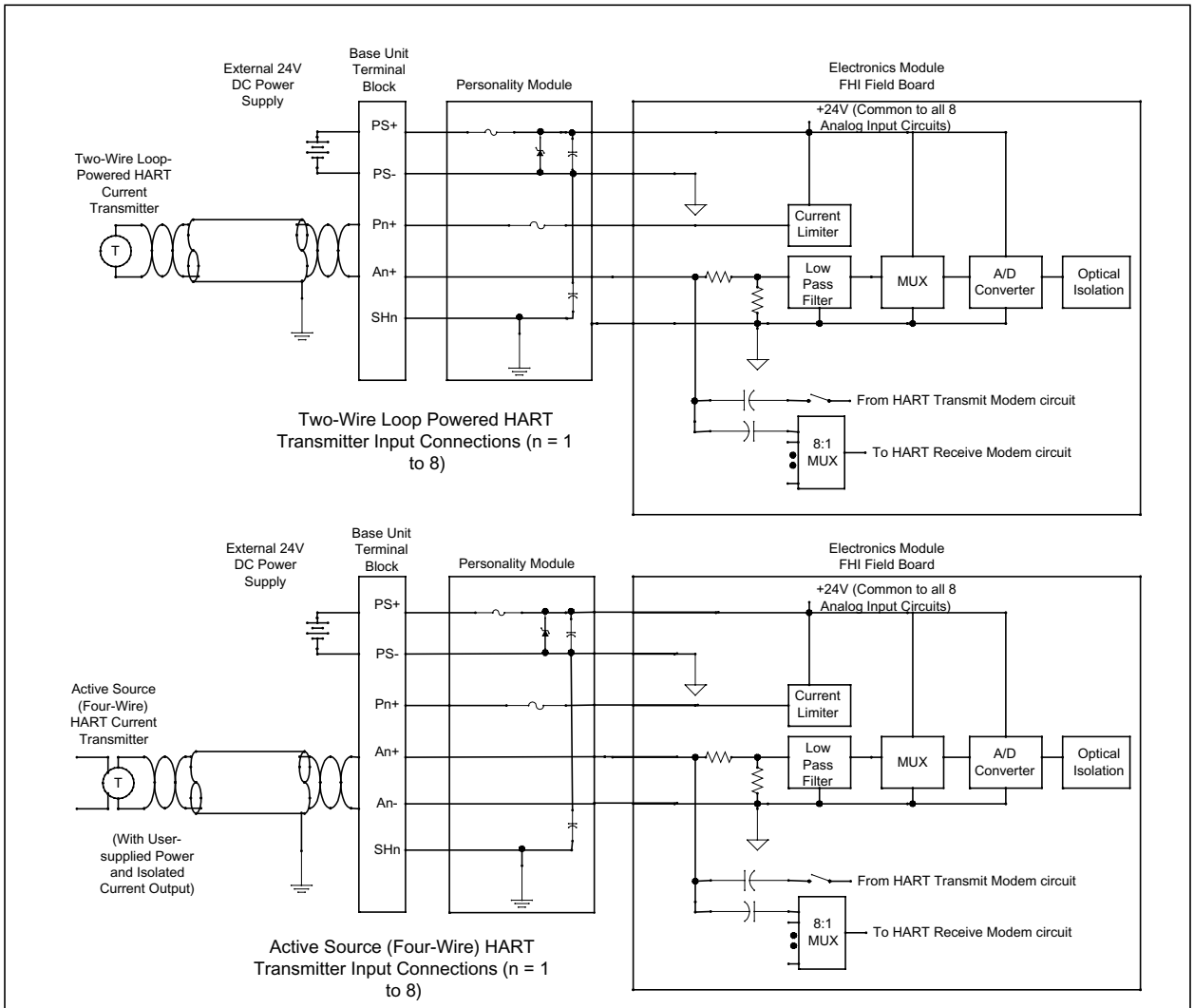


Figure 11-3. HART Analog Input Connections (Non-CE Mark)



Note

All field wiring must be braid-shielded and grounded at the point of entry of the cabinet using the recommended hardware (refer to “Cable Guidelines” in U3-1000 or U3-1005)

Figure 11-4. HART Analog Input Field Connections (CE Mark)

11-1.7. Field Wiring Cable Requirements

Table 11-2. Cable Requirements

Cable Length	Cable Size	Cable Type
Less than 5,000 feet (1524 meters)	24 AWG (minimum)	Single or multiple twisted-pair[1] with over -all shield.
Greater than 5,000 feet, but less than 10,000 feet (3048 meters)	20 AWG (minimum)	Single twisted-pair with over-all shield.
[1] If multiple twisted-pair cable with over-all shield is used, the shield must be connected to earth ground in the Ovation cabinet.		

Refer to the HART FSK Physical Layer Specification (HFC_SPEC-54) for additional cabling information.

11-1.8. HART Analog Input Address Locations

Configuration and Status Register

Each of the 16 direct registers on the HAI module is summarized here and shown in more detail in the following tables. The status register can be read by using the Point Information window at an Operator's Station.

Table 11-3. HART Analog Input Configuration/Status Register

Reg	Data Description - Configuration Register (Write)	Data Description - Status Register (Read)
0	Indirect Memory Index	
1	Indirect Memory Data	Indirect Memory Data
2		Analog Input - Channel 1
3		Analog Input - Channel 2
4		Analog Input - Channel 3
5		Analog Input - Channel 4
6		Analog Input - Channel 5
7		Analog Input - Channel 6
8		Analog Input - Channel 7
9		Analog Input - Channel 8
10		Firmware Status Flags
11		HAI Firmware Revision
12		Channel Error Bits
13	Module Configuration Register	Module Status Register
14	HART Enable (See Table 11-6 for further information).	
15		Module Electronic ID Data

Table 11-4. HART Analog Input Point Fault per Channel (Address 12 or C in Hex)

Bit	Data Description - Configuration Register (Write)	Data Description - Status Register (Read)
0		Channel 1 reference error
1		Channel 1 overrange or underrange
2		Channel 2 reference error
3		Channel 2 overrange or underrange
4		Channel 3 reference error
5		Channel 3 overrange or underrange
6		Channel 4 reference error
7		Channel 4 overrange or underrange
8		Channel 5 reference error
9		Channel 5 overrange or underrange
10		Channel 6 reference error
11		Channel 6 overrange or underrange
12		Channel 7 reference error
13		Channel 7 overrange or underrange
14		Channel 8 reference error
15		Channel 8 overrange or underrange
Note: A channel is considered overrange when the reading indicates a current of greater than 22 mA. A channel is considered underrange when the reading indicates a current of less than 2 mA.		

.

Table 11-5. HART Analog Input Fault per Channel (Address 13 or D in Hex)

Bit	Data Description (Write)	Data Description (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	Reserved	
3	Reserved	
4	Reserved	
5	Reserved	
6	Reserved for Factory Test (must always be set to 0)	
7	Reserved for Factory Test (must always be set to 0)	
8		Hardware Error
9		Bank 1 reference error
10		Bank 2 reference error
11	Not Used	Not Used
12	Not Used	Not Used
13	Not Used	Not Used
14		Field power failed
15	Reserved	Reserved

Bit 0: This bit configures the module (write) or indicates the configuration state of module (read). A “1” indicates that the module is configured.

Bit 1: Forces the module into error state, illuminating the module’s Error LED.

Bits 2-5: Not used by the HART Analog Input module.

Bits 6-7: Reserved for factory test. Must always be set to 0.

Bit 8: Hardware Error. Indicates one or more of the following are true:
- The FPGA did not program correctly on startup.
-The EE memory checksum is incorrect.
-The PROM checksum test has failed.
- Internal memory diagnostic has failed.

Bit 9: Reference error on first mux/AD combination.

Bit 10: Reference error on second mux/AD combination.

Bit 14: Field power failed.

Bit 15: Reserved

Table 11-6. HART Analog Input Enable Register (Address 14 or E in Hex)

Bit	Data Description - Configuration Register (Write)	Data Description - Status Register (Read)
0	Not Used	Not Used
1	Not Used	Not Used
2	Not Used	Not Used
3	Not Used	Not Used
4	Not Used	Not Used
5	Not Used	Not Used
6	Not Used	Not Used
7	Not Used	Not Used
8	HART Enabled - Channel 1	Not Used
9	HART Enabled - Channel 2	Not Used
10	HART Enabled - Channel 3	Not Used
11	HART Enabled - Channel 4	Not Used
12	HART Enabled - Channel 5	Not Used
13	HART Enabled - Channel 6	Not Used
14	HART Enabled - Channel 7	Not Used
15	HART Enabled - Channel 8	Not Used

Bits 0 through 7: Not used.

Bits 8 through 15: A “1” in any of these bits indicate that a HART compliant device exists on the corresponding channel.

To avoid a HART communication error message, set each bit at “0” when connecting a non-HART output device.

11-1.9. Diagnostic LEDs

Table 11-7. HART Analog Input Diagnostic LEDs

LED	Description
P (Green)	**Power OK LED.** Illuminated when the +5V power is OK.
C (Green)	**Communications OK LED.** Illuminated when the Controller is communicating with the module.
E (Red)	**External Error LED.** Illuminated upon loss of external auxiliary (field) power, as indicated by the loss of normal transitions of the EOC (end-of-convert) signal.
I (Red)	**Internal Error LED.** Illuminated whenever there is any type of error within the module except for a loss of external auxiliary power. Possible causes are: - The Controller sets the module's Force Error bit. - Communications with the Controller is lost. - The ground or reference reading is out of range. - Flash memory, EE memory or RAM diagnostic failure.
1-8 (Green)	After module configuration, the bank of eight channel LEDs (LEDs 1 through 8) is used to indicate HART communication activity. When a HART message is sent, the LED for that particular channel is illuminated. When the HART response is received correctly, the LED is extinguished. Therefore, when all is normal, that is, messages and responses are properly exchanged, a single LED blink will be observed on the module's front cap. If a HART message is sent and no response is received, the HART Analog Input module exclusive-OR's the channel LED display with hex code 0xFF. This results in all channel LEDs being illuminated except for the selected channel. For example, if the HART Analog Input module sent a HART module to device on channel 2, but the device was not connected to channel 2, the module would first illuminate LED 2 (all seven other channel LEDs extinguished). The module would then extinguish LED 2 and flash the other seven channel LEDs. This status indicates that the module sent a HART message on channel 2 and did not receive a valid response message after the initial message attempt or after any of the subsequent message retries.

Add the following new Section 11-B:

Section 11-B. HART Analog Output Module

11-1. Description

The Ovation HART Analog Output Module consists of an electronic module and a personality mode. The Ovation HART Analog Output Module is designed to interface with 8 HART compliant output devices utilizing a 4-20 mA control loop signal. A HART compliant output device will exchange digital information with the Ovation control system in addition to the standard 4-20 mA control loop signal. The digital information is imposed on the 4-20 mA signal according to the guidelines of the HART Protocol Specification. HART uses a low-level frequency - shift - keyed sine-wave signal that is superimposed on the 4-20 mA signal. The average value of the HART signal is zero. Therefore, the HART signal does not interfere with the 4-20 mA control signal.

11-1.1. Module Groups

Electronics Module

There is one Electronics module group for the HART Analog Output Module:

- **5X00062G01** contains 8 multiplexed, 4-20 mA output channels that interface with 8 HART output devices.

Personality Module

There is one Personality Module group for the HART Analog Output Module:

- **5X00063G01** contains passive circuitry for each of the 8 channels. There is a user serviceable fuse located on the personality module. This provides fusing for the auxiliary power supply which powers the 8 output channels and field side circuitry.

11-1.2. Module Block Diagrams

The Ovation HART analog output module assembly consists of two modules inserted into an Ovation base unit. The electronics module contains a logic printed circuit board (LHA) and a field printed circuit board (FHO). The simplified block diagram for the HART analog output electronics modules FHO board is shown below in Figure 11-5. The electronics module is used in conjunction with a personalty module, which contains a single printed circuit board (PHAO).

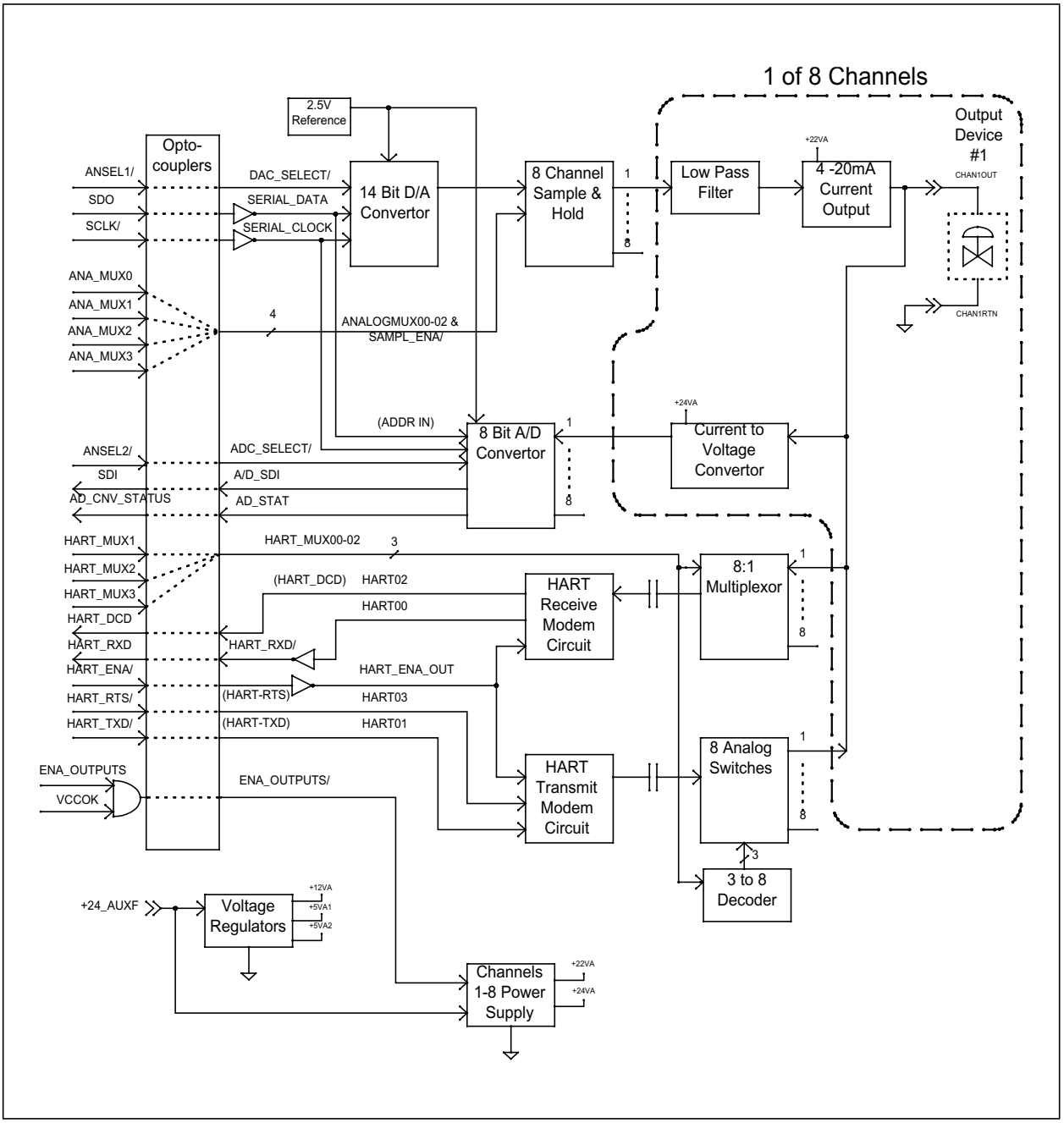


Figure 11-5. HART Analog Output Field Board Block Diagram

11-1.3. Power Supply Requirements:

Note

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

The HART Analog Output Module utilizes the standard +24V Ovation main power supply to provide the power required for the logic circuitry.

The HART Analog Output Module utilizes a +24 auxiliary power supply to provide the power required for the field circuitry. This includes all 4-20 mA loop power, D/A conversion, and the remaining output channel components.

Due to the low signal levels of the HART communications, it is recommended that a low noise (</=1.2 mV rms) power supply, such as an external linear power supply, be used for the auxiliary power.

If an external supply is utilized to provide auxiliary power, see Appendix D for the steps to be taken before connecting the external power supply to the Ovation I/O base unit terminal block.

In addition, all modules utilizing the auxiliary power supplies, including the HART modules, **MUST** utilize shielded I/O cables in order to suppress coupled noise and transients into the HART modules. This includes modules on the same branch, utilizing the auxiliary power, or modules on other branches utilizing the same auxiliary power. This recommendation applies regardless of the type of power supply chosen by the user.

11-1.4. Specifications

Electronics Module (5X00062)
Personality Module (5X00063)

Table 11-8. HART Analog Output Channel Specifications

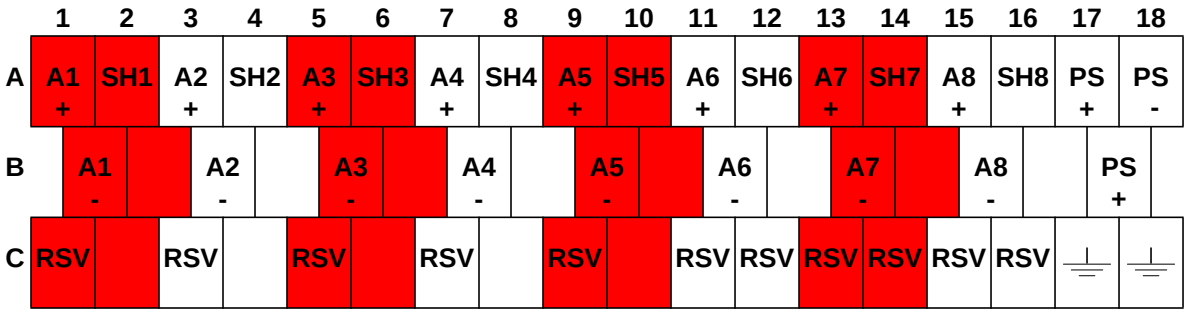
Description	Value
Number of channels	8
Channel Update Rate	24 mS (Each channel is updated once every 24 mS by the on-board microcontroller, 14 Bit resolution typ.).
Output Range	4 to 20 mA
D/A Resolution	14 Bits
Accuracy over Temperature Range[1]	0.25% of Span
User Loop Voltage	Power for loop current is supplied through the module by an auxiliary power supply.
Diagnostics	Open loop feedback detection. 8 Pass/Fail bits are stored in data register 0xC in Hex.
Dielectric isolation: Channel to Channel Channel to logic	 None 1000 VAC/VDC for 1 minute.
Output Loading	4-20 mA into 700 ohm load maximum (230 ohm minimum).[2]
Output Compliance	20 mA@21.6 VDC Supply into 700 ohm load.
Operating Temperature Range	0^{o} to 60^{o} C
Humidity (non-condensing)	0% to 95%
Module Power	Main: 24 VDC 1.2 W typical, 2.5W maximum Aux: 24 VDC (-5%,+6.25%) 6W typical, 7.2W maximum

1 See additional accuracy statements for CE Mark Certified systems in Appendix C.
2 Minimum load from the HART Physical Layer Specification.

11-1.5. HART Analog Output 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 HART Analog Output Personality Modules are illustrated in Figure 11-6. The following table lists and defines the abbreviations used in those diagrams.

Abbreviation	Definition
A1 - A8 +	Analog Output positive terminal connection (connected to the positive terminal of a HART analog output device.
A1 - A8 -	Analog Output negative terminal connection (connected to the negative terminal of a HART analog output device)
SH1 - SH8	Shield terminal connection
⏚	Earth ground terminals
PS+, PS-	External Auxiliary power supply terminals



Do not make connections to RSV or unlabeled terminals.

Figure 11-6. HART Analog Output Terminal Block Pin Assignments

11-1.6. HART Analog Output Field Connection Wiring Diagrams

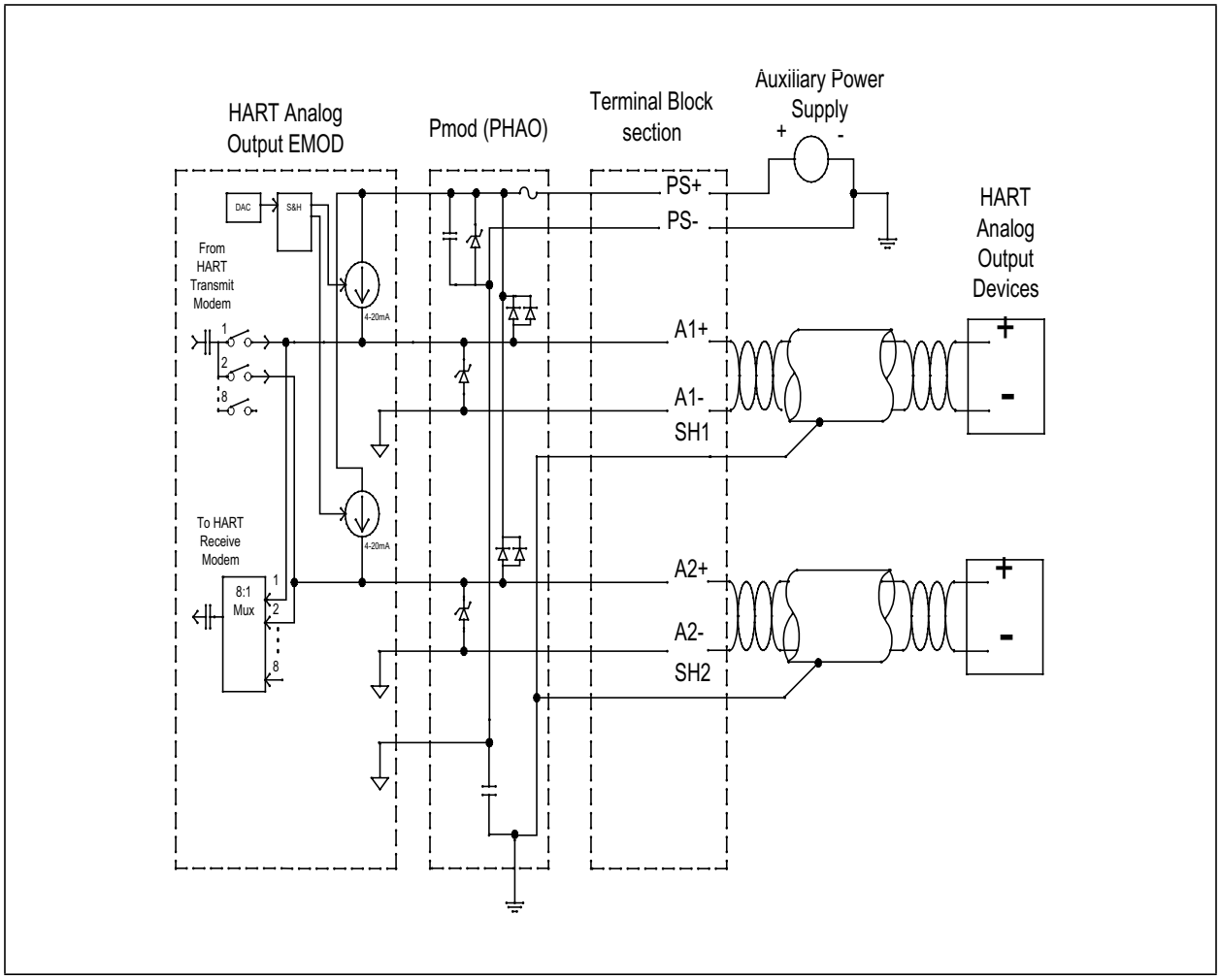
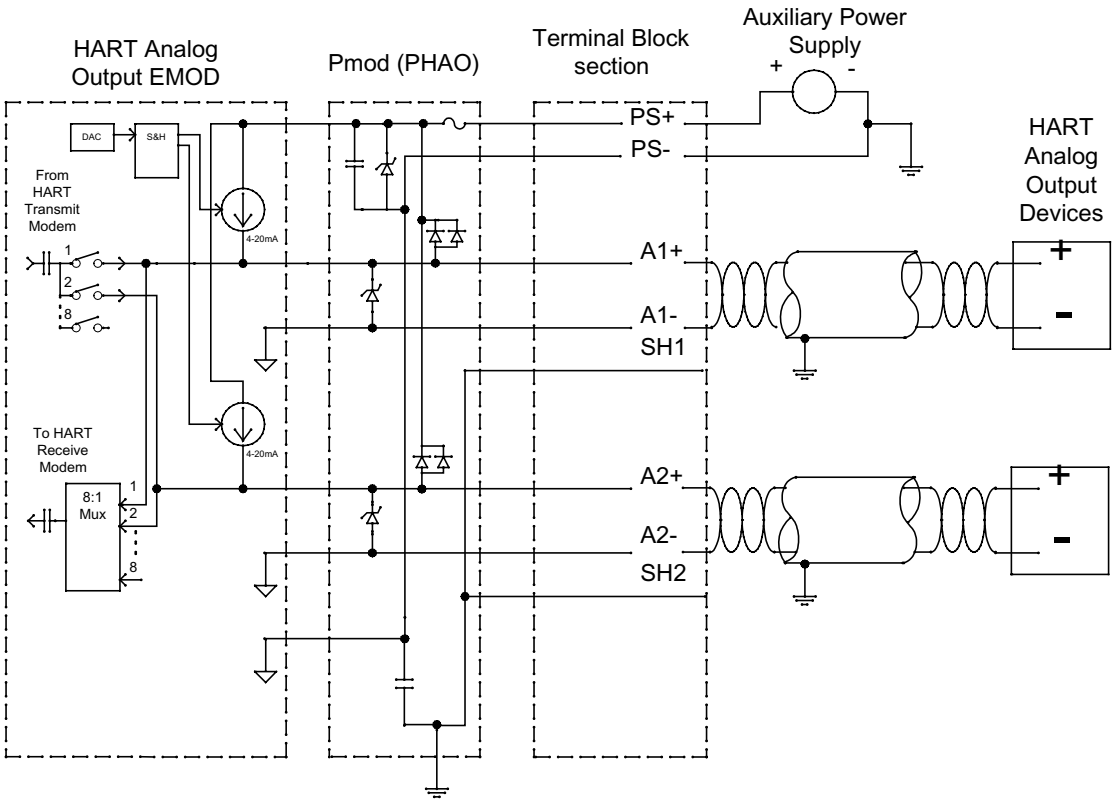


Figure 11-7. HART Analog Output Module Field Wiring (Non-CE Mark)
(2 of 8 channels depicted)



Note

All field wiring must be braid-shielded and grounded at the point of entry of the cabinet using the recommended hardware (refer to “Cable Guidelines” in U3-1000 or U3-1005)

Figure 11-8. HART Analog Output Module Field Wiring (CE Mark) (2 of 8 channels depicted)

11-1.7. Field Wiring Cable Requirements

Table 11-9. Cable Requirements

Cable Length	Cable Size	Cable Type
Less than 5,000 feet (1524 meters)	24 AWG (minimum)	Single or multiple twisted-pair [1] with over -all shield.
Greater than 5,000 feet, but less than 10,000 feet (3048 meters)	20 AWG (minimum)	Single twisted-pair with over-all shield.
[1] If multiple twisted-pair cable with over-all shield is used, the shield must be connected to earth ground in the Ovation cabinet.		

Refer to the HART FSK Physical Layer Specification (HFC_SPEC-54) for additional cabling information.

11-1.8. HART Analog Output Address Locations

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 11-10. HART Analog Output Configuration/Status Register (Address 13 or D in Hex)

Bit	Data Description - (Write)	Data Description - (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	Communication Timeout bit 0	
3	Communication Timeout bit 1	
4	Communication Timeout bit 2	
5	Timeout Action (see Table 11-12)	
6	Reserved for Factory Test (must always be set to 0)	
7	Reserved for Factory Test (must always be set to 0)	
8		Hardware Error
9	Not Used	Not Used
10	Not Used	Not Used
11	Not Used	Not Used
12	Not Used	Not Used
13	Not Used	Not Used
14		Field power failed
15	Reserved	Reserved

Bit 0: Configures the module (write) or indicates the configuration state of the module (read). “1” indicates that the module is configured. Until module is configured, addresses 0 through 11 will produce an attention status.

Bit 1: This bit (write “1”) forces the module into its error state causing the Internal Error LED to light.

Bits 2-4: These bits are used to select the controller communications timeout period.

Bit 5: If this bit is set and the controller times out, the module will continue to output the last value received. If the bit is cleared and the controller times out, the module will output zero to the DAC for each channel, yielding 0 mA on the outputs after the time out period defined by bits 2-4.

Bits 6-7: Reserved for use by the Factory Test. These bits must always be set to 0.

Bit 8: When set, this indicates one or more of the following conditions are true:

- The FPGA did not program correctly upon startup.
- The EE memory checksum is incorrect.
- The PROM checksum test has failed.
- Internal memory diagnostic has failed.

Bits 9-13: Not Used.

Bit 14: Field power failed.

Bit 15: Reserved.

Table 11-11. HART Analog Output Communication Timeout Settings

Timeout Bit 2	Timeout Bit 1	Timeout Bit 0	Timeout Period
0	0	0	16 seconds
0	0	1	4 seconds
0	1	0	2 seconds
0	1	1	1 second
1	0	0	500 milliseconds
1	0	1	250 milliseconds
1	1	0	125 milliseconds
1	1	1	62 milliseconds
Time-outs have a tolerance of +/- 35%. 16 seconds is the default after a power-up.			

Open Loop Detect Register

If one of these bits is set, the channel readback diagnostic indicates the difference between the desired value and the actual value exceeds the accepted deadband. This bit signifies an open loop condition.

Table 11-12. HART Analog Output Pass/Fail per Channel Register (Address 12 or C in Hex)

Bit	Data Description - Configuration Register (Write)	Data Description - Status Register (Read)
0	Not Used	Channel 1 bad
1	Not Used	Channel 2 bad
2	Not Used	Channel 3 bad
3	Not Used	Channel 4 bad
4	Not Used	Channel 5 bad
5	Not Used	Channel 6 bad
6	Not Used	Channel 7 bad
7	Not Used	Channel 8 bad
8	Not Used	Not Used
9	Not Used	Not Used
10	Not Used	Not Used
11	Not Used	Not Used
12	Not Used	Not Used
13	Not Used	Not Used
14	Not Used	Not Used
15	Not Used	Not Used

Table 11-13. HART Analog Output Enable Register (Address 14 or E in Hex)

Bit	Data Description - Configuration Register (Write)	Data Description - Status Register (Read)
0	Not Used	Not Used
1	Not Used	Not Used
2	Not Used	Not Used
3	Not Used	Not Used
4	Not Used	Not Used
5	Not Used	Not Used
6	Not Used	Not Used
7	Not Used	Not Used
8	HART Enabled - Channel 1	Not Used
9	HART Enabled - Channel 2	Not Used
10	HART Enabled - Channel 3	Not Used
11	HART Enabled - Channel 4	Not Used
12	HART Enabled - Channel 5	Not Used
13	HART Enabled - Channel 6	Not Used
14	HART Enabled - Channel 7	Not Used
15	HART Enabled - Channel 8	Not Used

Bits 0 through 7: Not used.

Bits 8 through 15: A “1” in any of these bits indicate that a HART compliant device exists on the corresponding channel.

To avoid a HART communication error message, set each bit at “0” when connecting a non-HART output device.

11-1.9. Diagnostic LEDs

Table 11-14. HART Analog Output LEDs

LED	Description
P (Green)	Power OK LED. Illuminated when the +5V power is OK.
C (Green)	Communications OK LED. Illuminated when the Controller is communicating with the module.
E (Red)	**External Error LED**. Illuminated upon loss of external auxiliary (field) power, as indicated by the loss of normal transitions of the EOC (end-of-convert) signal.
I (Red)	**Internal Error LED.** Illuminated whenever there is any type of error within the module except for a loss of external auxiliary power. Possible causes are: - The Controller sets the module's Force Error bit. - Communications with the Controller is lost. - EPROM, EE memory or RAM diagnostic failure.
1-8 (Green)	After module configuration, the bank of eight channel LEDs (LEDs 1 through 8) is used to indicate HART communication activity. When a HART message is sent, the LED for that particular channel is illuminated. When the HART response is received correctly, the LED is extinguished. Therefore, when all is normal, that is, messages and responses are properly exchanged, a single LED blink will be observed on the module's front cap. If a HART message is sent and no response is received, the HART Analog Output module exclusive-OR's the channel LED display with hex code 0xFF. This results in all channel LEDs being illuminated except for the selected channel. For example, if the HART Analog Output module sent a HART module to a device on channel 2, but the device was not connected to channel 2, the module would first illuminate LED 2 (all seven other channel LEDs extinguished). The module would then extinguish LED 2 and flash the other seven channel LEDs. This status indicates that the module sent a HART message on channel 2 and did not receive a valid response message after the initial message attempt or after any of the subsequent message retries.

Replace Module Group Numbers in Table 24-1. Changes are marked in bold.
Page 24-5.

Table 24-1. MAU Subsystem

Electronic Module	Personality Module	Length of Optical Link[1]	Channels	Optics
1C31179G01	1C31181G01	Up to 2 kilometers (6,560 ft)	2	850 nm
1C31179G02	1C31181G02	Up to 2 kilometers (6,560 ft)	4	850 nm
1C31179G01	1C31181G03	Up to 4 kilometers (13,120 ft)	2	1300 nm
1C31179G02	1C3118G04	Up to 4 kilometers (13,120 ft)	4	1300 nm

1 In order not to be required to select extended PCRR time-out periods, it is recommended that you do NOT exceed an optical length of 3.7 km.

Add Module Group Numbers for the Remote Node Controller Module.
Page 24-10.

— Remote Node Electronics Module **(1C31203G01)** - Houses the Remote Node Logic Board (LND) and the Remote Node Field Board (FND). The electronics module prepares messages received from the remote I/O controller for the local I/O modules at the remote node. When an I/O module responds to the message, the module prepares the response to be sent back to the Controller over the fiber-optic media. The LND provides +5V power for the module.

— Remote Node Controller Base **(1C31205G01)** - This unique base holds a maximum of two Remote Node Modules and interfaces directly to two I/O branches. It provides a rotary switch for node addressing and a D-connector for interfacing to as many as six additional I/O branches using a local I/O communications cable. The RNC base unit is connected to the Remote Node Transition Panel described below.

Replace Appendix C:
Page C-1

Appendix C. CE Mark Specifications

The CE Mark Certified Ovation system uses special EMC cabinets, supplementary internal filtering, and exacting requirements on field wiring and grounding to ensure compliance with specific European Electromagnetic Emissions/Immunity and Low voltage safety.

The CE Mark Certified Ovation Controller cabinet assembly, extended I/O cabinet assembly, and Remote I/O cabinet assembly are certified for operation in the Industrial Environment as documented in the EMC Technical Construction File for Ovation (5A16444) and the Low Voltage Safety Technical File for Ovation (5A26443).

For I/O modules utilized within the prescribed CE Mark Certified system, the following additional accuracy specification applies for all analog I/O unless otherwise noted:

The absolute accuracy specification for all analog inputs shall be increased to 1% of span over EMC conditions.

The absolute accuracy specification for all analog outputs shall be increased to 2.5% of span over EMC conditions.

The specific requirements for the CE Mark Certified Systems can be located in the following:

- **Drawing 5A26418** - This drawing contains a baseline listing of all components applicable for the CE Mark Certified System.
- **Drawing 5A26370** - This drawing contains a baseline listing of workstation and peripheral components applicable for the CE Mark Certified System.
- **U3-1000 and U3-1005** Users Guides - “Planning and Installing Your Ovation System” provides information about CE Mark requirements for an Ovation system.