

Section 8. Contact Input Module

8-1. Description

The Contact Input Module, comprised of an Electronics module and Personality module, provides 16 contact input current detecting channels with common returns. The field side circuitry and terminal connections for three of these channels are shown in [Figure 8-2](#).

A +48V on-board power supply provides current limited contact wetting voltage if the contact is open. If the contact closes, current is drawn from the +10V supply which turns on the associated opto-isolator; thereby, relaying a closed contact state to the I/O bus. The opto-isolators and the isolation provided by the 10V and 48 Volt power supply provide high dielectric isolation between the field side and the logic or I/O bus side.

There are two methods of wiring field devices to the Contact Input Module termination block, as shown in [Figure 8-2](#). Each field contact may have a separate input and return line as shown for channel 1. Alternatively, field contacts wired to the same Contact Input Module may share a return line as shown for channels 2 and 3. For either wiring method, **do not** tie the contact return line to earth ground or a ground fault condition will occur as well as a degradation of the common mode surge protection.

Debouncing of a contact input signal is done by an RC filter and digital debouncer on the logic side. If a contact changes state for less than 3 msec, the change of state will always be rejected. If the Contact changes state for more than 7 msec, the change of state will always be accepted.

Ground fault detection circuitry on a Contact Input Module activates when an input or return line for any channel finds a low impedance (<5 K ohms) path to earth ground. A single ground fault wire will not cause an error in the point data, but multiple ground faults (if they include input and return lines) could cause faulty data (that is, channels appearing as if contacts are closed when they are really open).

When a ground fault occurs, the external error LED lights, and the GND Fault bit in the Status Register ([Section 8-7](#)) is set. If the GND Fault Attention Enable bit is set in the Configuration Register ([Section 8-7](#)), a ground fault is seen as a catastrophic error causing an attention status to be sent back to the Controller. See [Figure 8-2](#) for ground fault detection circuitry. The Contact Input Module is applicable for CE Mark Certified Systems.

Note

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

8-2. Module Groups

8-2.1. Electronics Module

There is one Electronics module group for the Contact Input Module:

- 1C31142G01 provides 48 VDC on-card auxiliary power for 16 contact inputs with common return.

8-2.2. Personality Module

There is one Personality module group for the Contact Input Module:

- 1C31110G03 contains surge-protection components for 16 inputs.

Table 8-1. Contact Input Subsystem

Range	Channels	Electronic Module	Personality Module
48 VDC On-Card wetting supply	16	1C31142G01	1C31110G03

All Configurations are CE Mark Certified.

8-3. Specifications

Electronics Module (1C31142)
Personality Module (1C31110)

Table 8-2. Contact Input Module Specifications

Description	Value
Number of channels	16
On board auxiliary power supply	42 V minimum 55 V maximum
Propagation delay	7 mSec maximum
Contact bounce rejection Always rejects contact change of state Always accepts contact change of state	< 3 mSec > 7 mSec

Table 8-2. Contact Input Module Specifications

Description	Value
Closed contact output current	4 mA minimum 8 mA maximum
Diagnostics	Internal module operating faults Ground Fault Detection
Dielectric isolation: Channel to logic	1000 V AC/DC
Module power	4.56 W typical 4.75 W maximum
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%

8-4. Contact 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 diagram for the contact input Personality module (also known as digital input) is illustrated in [Figure 8-1](#). The following table lists and defines the abbreviations used in this diagram.

Abbreviation	Definition
1+ through 16+	Contact input positive terminal connection
1- through 16-	Contact input negative terminal connection
	Earth ground terminals
PS+, PS-	Auxiliary Power Supply terminals
RSV	Reserved terminal. No connection allowed on these terminals

Note

Do **not** use terminal block locations marked RSV.

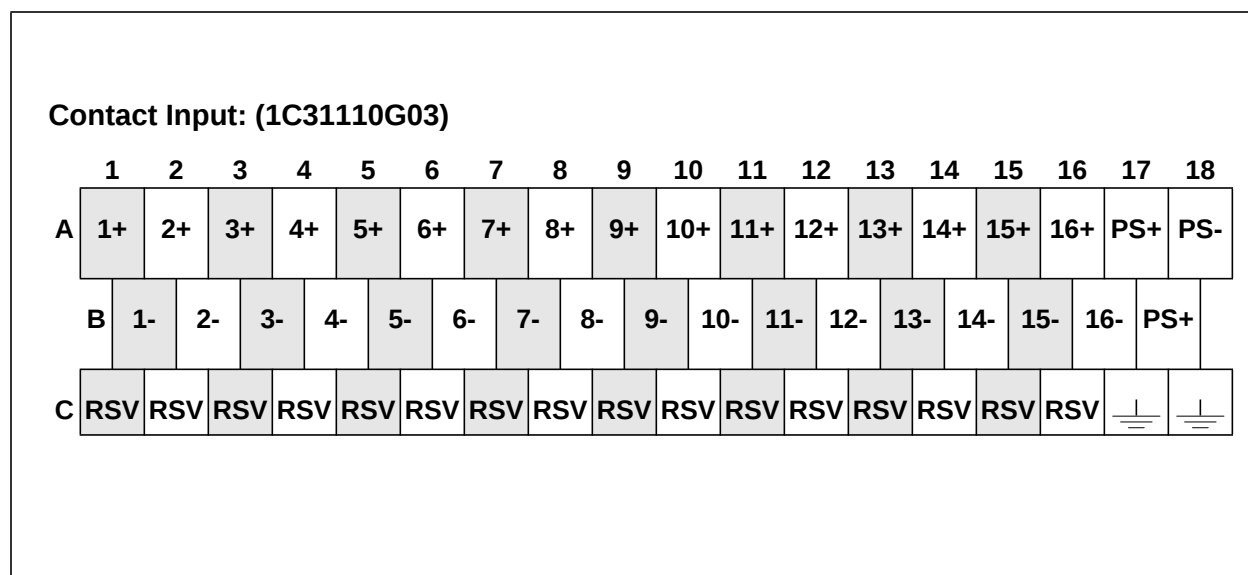


Figure 8-1. Terminal Block Connections for the Contact Input Personality Modules

8-5. Contact Input Field Wiring Information

8-5.1. Field Wiring Restrictions:

The following definitions apply to the restrictions listed below:

- R_{shunt} = contact shunt resistance
- R_{contact} = resistance associated with a closed contact
- R_{return} = resistance of the common return line
- R_{line} = resistance of the non-common cable length to and from the contact
- $R_{\text{wiring}} = R_{\text{contact}} + R_{\text{line}} + 16R_{\text{return}}$
- R_{fault} = resistance from either line to ground which causes a ground fault

Figure 8-3 shows possible cable resistances that affect contact input performance. The following restrictions apply:

- Under no-ground-fault conditions or if the channel return (low) line has a ground fault:
 - R_{shunt} across contact must be $\geq 10\text{k ohms}$ to always recognize an open contact as open.
 - R_{shunt} across contact must be $\geq 50\text{k ohms}$ to maintain the high level contact-wetting voltage.
- If the input connection from a channel has a ground fault with the contact open:
 - R_{shunt} across contact must be $\geq 150\text{k ohms}$ to guarantee ground fault is detected.
- For a ground fault on the input or return connection to a channel:
 - R_{fault} from either line to ground must be $\leq 5\text{K ohms}$ to guarantee detection of the ground fault.
- With or without ground fault conditions:
 - R_{wiring} through field wiring to contact must be $< 100\text{ ohms}$ to always recognize a closed contact as closed.

8-5.2. Field Wiring Cable Lengths

The following two tables list the maximum cable lengths for field wiring to the contacts. For both, assume R_{contact} is 0 ohms.

Table 8-3 applies when there are individual common return lines brought to the card edge. This implies that R_{return} is 0 ohms.

Table 8-3. Maximum Cable Length for 16 Individual Common Returns

Wire Gauge	Ohms per Thousand Feet (Solid Copper Wire)	Maximum Cable Length (Thousands of Feet)
18	6.64	7.5
20	10.2	4.9
22	16.2	3.0

Table 8-4 applies when all 16 channels share a common return line. In both tables, the Maximum Cable Length is the length of the cables from the termination block to the contacts in the field.

Table 8-4. Maximum Cable Length for a Single Common Return for All 16 Inputs

Wire Gauge	Ohms per Thousand Feet (Solid Copper Wire)	Maximum Cable Length (Thousands of Feet)
12	1.66	3.54
14	2.27	2.59
16	4.18	1.40
18	6.64	0.89

8-6. Contact Input Field Connection Wiring Diagrams

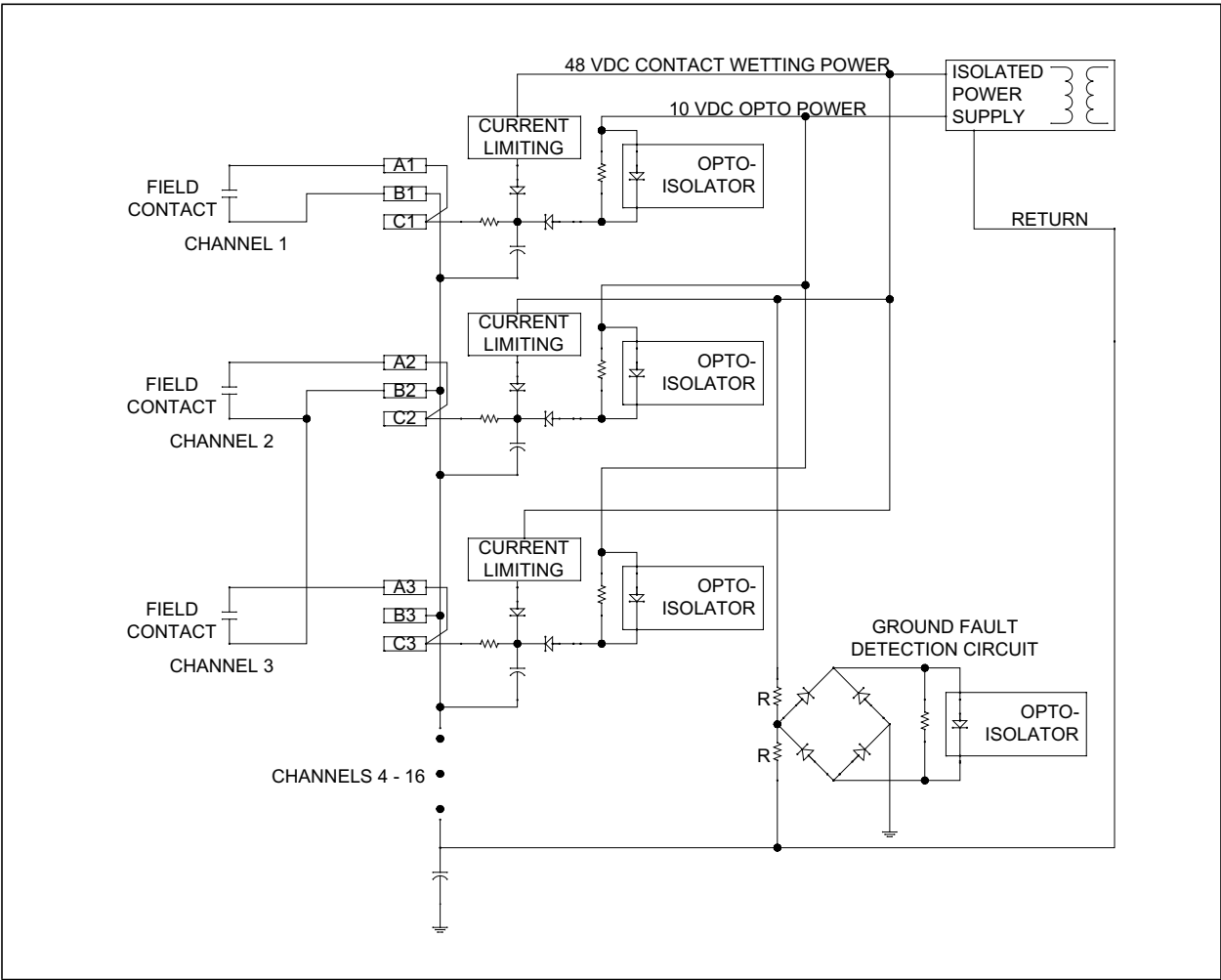


Figure 8-2. Contact Input Module Front End

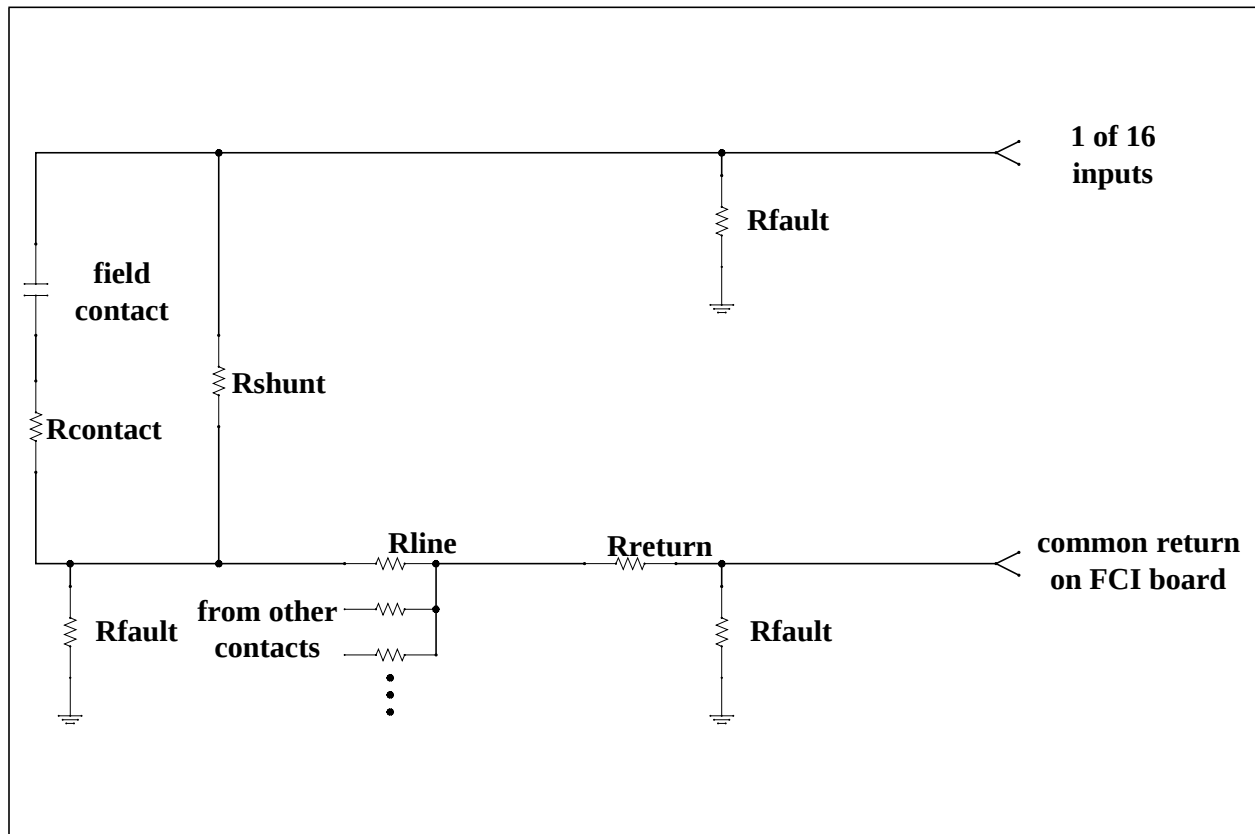


Figure 8-3. Cable Impedances in Field Wiring

Non-CE Mark Certified Systems

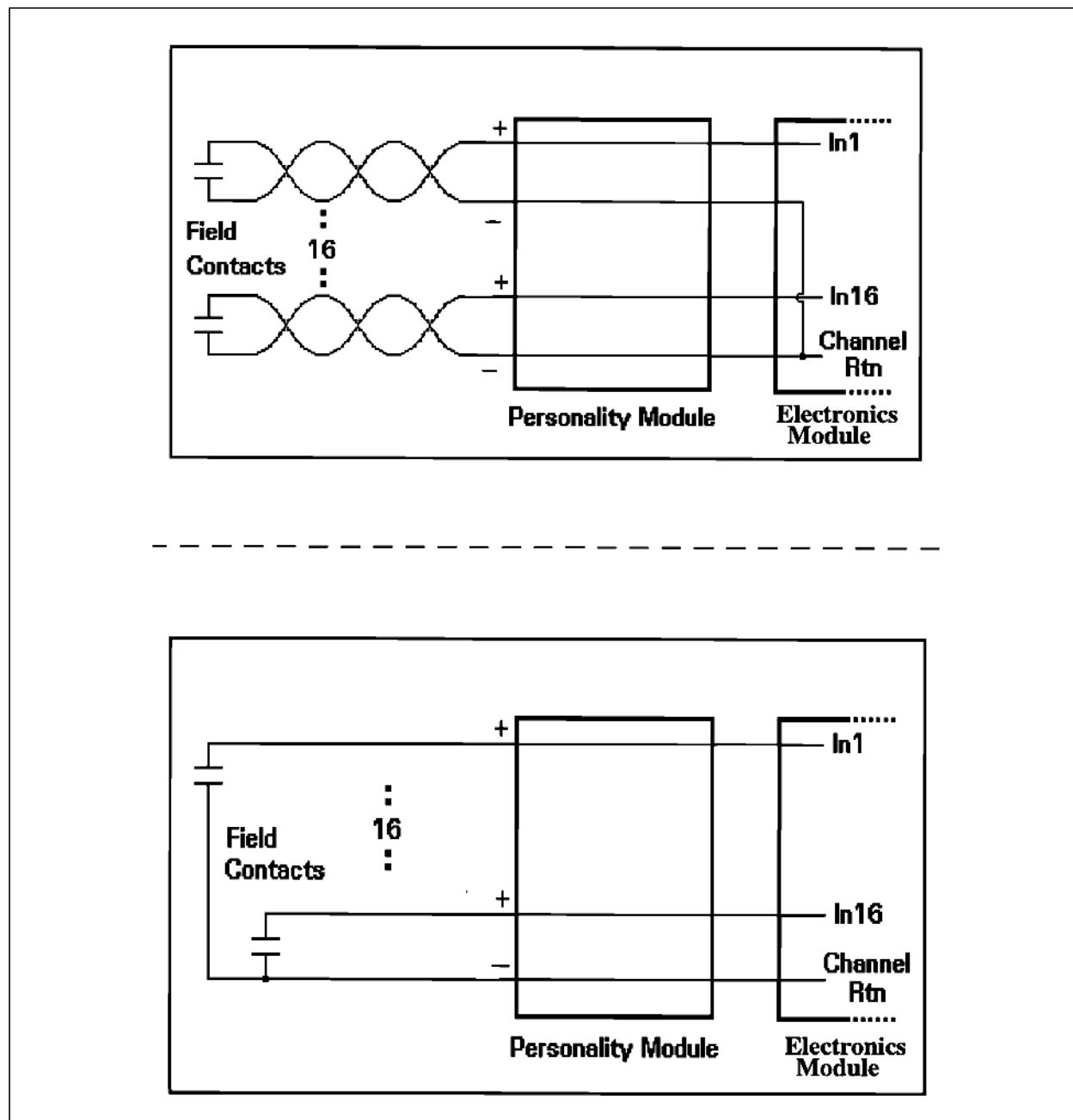
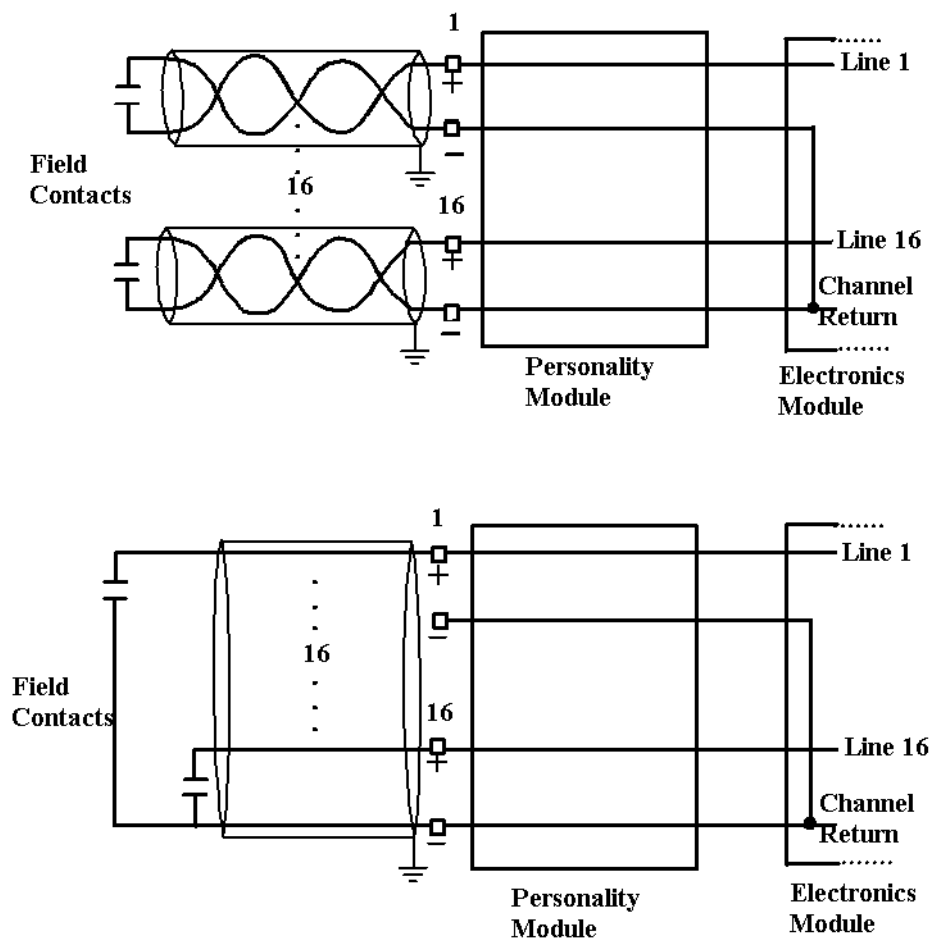


Figure 8-4. Field Connection for the Contact Input Personality Module (Non-CE Mark)

CE Mark Certified Systems

**Note**

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 8-5. Field Connection for the Contact Input Personality Module (CE Mark)

8-7. Contact Input 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 8-5. Contact Input Configuration/Status Register (Address 13 or D in Hex)

Bit	Data Description - Configuration Register (Write)	Data Description - Status Register (Read)
0	Configure Module (1 = configure; 0 = unconfigure, causing an attention status)	Module Configured (1 = configured; 0 = unconfigured)
1	Force Error (1 = force an attention status to be read by Controller; 0 = no forced error)	Forced error (1 = forced error set by Controller; 0 = no forced error)
2	Not defined	Not defined (1)
3	Not defined	Not defined (1)
4	Not defined	Not defined (1)
5	Not defined	Not defined (1)
6	Reserved	Reserved
7	Not defined	Reserved
8	Not defined	Auxiliary Voltage Failure. (1 = +48V auxiliary Voltage Failed; 0 = +48V auxiliary Voltage OK.
9	Ground Fault Attention Enable (1 = configure GND fault to cause an attention status; 0 = configure GND fault to not cause an attention status)	Ground Fault Attention Enable (1 = GND fault causes attention status 0 = GND fault does not cause an attention status)
10	Not defined	Ground Fault (1 = field wiring has a ground fault; 0 = field wiring does not have a ground fault)
11	Not defined	Not defined (1)
12	Not defined	Not defined (1)
13	Not defined	Not defined (1)
14	Not defined	Not defined (1)
15	Not defined	Not defined (1)

Bit 0: After the Contact Input Module power is cycled, this bit is “0.” A “1” must be written to the Configure Module bit. If the module is not configured in this manner, an attention status will be sent to the Controller upon an attempt to read the point data.

The bit may be read back through the Status Register.

Bit 1: The Force Error bit is “0” after the Contact Input module power is cycled. If the Controller sets the Force Error bit, an attention status is issued.

The bit may be read back through the Status Register.

Bits 2-5: These bits are not defined in the Configuration register and will be read as high in the Status register. These bits cannot be accessed by the Controller during a write to the module.

Bit 6: This bit is reserved.

Bits 7-8: These bits are not defined in the Configuration Register. These bits cannot be accessed by the Controller during a write to the module.

Bit 7: This bit is reserved.

Bit 8: This bit is set in the Status Register if the +48V supply on the FCI board fails.

Bit 9: The GND Fault Attention Enable bit is “0” after the Contact Input module power is cycled. This bit must be set by the Controller if a ground fault is to be treated as a catastrophic failure. If Bit 9 is set, a ground fault will cause an attention status to be returned to the Controller upon accessing the module, and no point data can be read. If the bit is not set, a ground fault will not inhibit the Controller from reading point data. In the latter case, if more than one ground fault occurs on the field wiring to a Contact Input Module, false point data may possibly be read on channels with open contacts.

Bits 10-15: These bits are not defined in the Configuration register. These bits cannot be accessed by the Controller during a write to the module.

Bit 10: This bit is set in the Status Register if a ground fault occurs in the field wiring.

Bits 11-15: These bits are not defined in the Status Register and will always be read as high in the Status register.

8-8. Diagnostic LEDs

Table 8-6. Contact 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.
E (Red)	External Fault LED. Lit when GND Fault bit (Bit 10) of the Status Register is set (see Table 8-5). This indicates that a ground fault has occurred in the field wiring. An attention status is generated when the External Fault LED is lit only if the GND Fault Attention Enable bit (Bit 9) is set.
I (Red)	Internal Fault LED. Lit whenever the Force Error bit (Bit 1) of the Configuration Register (see Table 8-5) is set or when the on-board +48V/+10V auxiliary power supply fails. Also lit when a timeout of the watchdog timer occurs when Controller stops communicating with module. An attention status is always generated when the LED is lit.
CH1 - CH 16 (Green)	Point Status LED. Lit when the input contact of the LED's corresponding channel is closed.