

ROC364 I/O CARD
Instruction Manual Supplement

Form A6097
May 2000

Revision Tracking Sheet

May 2000

This manual may be revised from time to time to incorporate new or updated information. The revision level of each page is indicated at the bottom of the page opposite of the page number. A change in revision level to any page also changes the date of the manual which appears on the front cover. Listed below is the revision level of each page that corresponds to the front cover date.

<u>Page</u>	<u>Revision</u>
All	5/00

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About this Supplement

This document, Form A6097, contains supplemental pages for the ROC364 Remote Operations Controller Instruction Manual (Form A4193). These pages contain a new section (Section 6) for Form A4193 to document the 32-channel ROC364 I/O Card.

If you have a loose-leaf ROC364 manual and want to combine this supplement into that manual, simply place the following pages between Section 5 and Appendix A. You may also want to indicate the new section in the main Table of Contents on page vi of the ROC364 manual.

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Section: 6. — ROC364 I/O Card

6.1 SCOPE

This section describes the 32-point Input/Output (I/O) Card used with the ROC364 Remote Operations Controller. This section contains the following information.

Information	Section	Page Number
Product Description	6.2	6-1
Initial Installation and Setup	6.3	6-3
Configuration and Calibration	6.3.1	6-3
Connecting the I/O Channels to Wiring	6.4	6-4
Analog Input Channels	6.4.1	6-4
Analog Output Channels	6.4.2	6-6
Discrete Input Channels	6.4.3	6-6
Discrete Output Channels	6.4.4	6-8
Pulse Input Channels	6.4.5	6-8
Troubleshooting and Repair	6.5	6-10
Analog Input Channels	6.5.1	6-11
Analog Output Channels	6.5.2	6-12
Discrete Input Channels	6.5.3	6-12
Discrete Output Channels	6.5.4	6-13
Pulse Input Channels	6.5.5	6-13
Replacement Procedure	6.6	6-14
Impact on I/O Point Configuration	6.6.1	6-14
Replacing the I/O	6.6.2	6-14
I/O Card Specifications	6.7	6-16

6.2 PRODUCT DESCRIPTION

The ROC364 I/O (Input/Output) Card, shown in Figure Section: 6-1, provides 32 fixed inputs and outputs for monitoring and control applications. It is used in conjunction with a ROC364 Master Controller Unit (MCU) that has a FlashPAC (version 2.10C or later) installed.

The card can be used in place of the I/O modules and module racks that are normally used with the ROC364 MCU. Only one I/O card can be used with an MCU, and an I/O module rack should not be used between the I/O card and the MCU.

The ROC364 I/O Card provides these I/O channels:

- ◆ 12 Discrete Inputs – DIs.
- ◆ 4 Pulse Inputs – PIs.
- ◆ 8 Analog Inputs – AIs.
- ◆ 6 Discrete Relay Outputs – DOs.
- ◆ 2 Analog Outputs – AOs.

The characteristics (called parameters) of the I/O channels are configured using the ROCLINK Configuration Software, which is documented in user manual A6051.

Light-emitting diodes (LEDs) provide a visual indication as to the state of the discrete inputs, pulse inputs, and discrete outputs. A Status LED blinks slowly to indicate normal communications with the MCU.

The I/O card uses a microprocessor to handle the transfer of data and information between external devices connected to the I/O channels, and the MCU. Each I/O channel has a removable plug-in terminal block for field wiring connections. Optional Lighting Protection Modules can be used with any or all of the I/O channels.

Power for the I/O card, and source power for I/O devices such as transmitters, is provided by the MCU. Refer to Section 2 of the ROC364 instruction manual for additional information about the MCU.

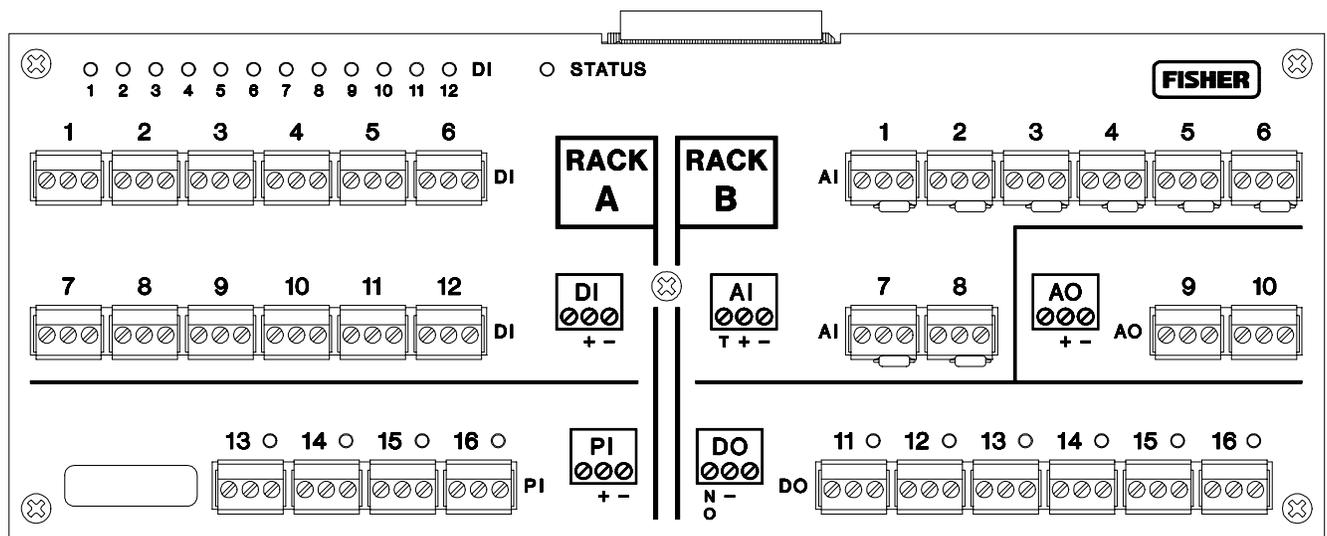


Figure Section: 6-1. ROC364 I/O Card



6.3 INITIAL INSTALLATION AND SETUP

If the I/O Card is not already installed onto a ROC364 MCU, use may use the following procedure. Note that this procedure is for a ROC that is not in service. For an in-service ROC, refer to Section 6.6.2 on Page 6-14.

CAUTION

Failure to exercise proper electrostatic discharge precautions (such as wearing a grounded wrist strap) may reset the processor or damage electronic components, resulting in interrupted operations.

CAUTION

When preparing a unit for installation into a hazardous area, change components in an area known to be non-hazardous.

1. Make sure the MCU has a FlashPAC version 2.10C or later installed.
2. If one or more I/O Module Racks are currently installed, remove them. Each I/O Module Rack is removed by taking out the four screws securing it to the backplane, and then pulling it down to unplug the connector at the top of the rack.
3. Install the I/O Card by aligning the connector at the top of the card with the connector on the bottom of the MCU and push firmly in an upward direction.
4. Insert and tighten the four screws through the card to secure it to the backplane. Extra rack positions (if any) on the backplane may be left unused.
5. If a Lightning Protection Module is to be installed for certain I/O channels, refer to Appendix A of the ROC364 instruction manual.

6.3.1 Configuration and Calibration

After an I/O Card is installed, configure and calibrate the I/O channels as needed by using the ROCLINK Configuration Software. As labelled on the I/O Card itself, the I/O channels are identified in the ROCLINK software as the following points:

- Discrete Inputs (DIs) 1 through 12 Points A1 through A12
- Pulse Inputs (PIs) 1 through 4..... Points A13 through A16
- Analog Inputs (AIs) 1 through 8..... Points B1 through B8
- Analog Outputs (AOs) 1 and 2 Points B9 and B10
- Discrete Outputs (DOs) 1 through 6 Points B11 through B16

6.4 CONNECTING THE I/O CHANNELS TO WIRING

Each I/O channel on the I/O Card is electrically connected to field wiring by a separate plug-in terminal block. In addition, the ROC enclosures provide a ground bus bar for terminating the sheath on shielded wiring. The following paragraphs provide information on wiring field devices to each type of I/O channel.

CAUTION

The sheath surrounding shielded wiring should never be connected to a signal ground terminal or to the common terminal of an I/O channel. Doing so makes the I/O channel susceptible to static discharge, which can permanently damage the channel. Connect the shielded wiring sheath to a suitable earth ground only.

6.4.1 Analog Input Channels

Analog inputs (AIs) monitor current loop and voltage input devices. Each of the I/O Card analog inputs supply source voltage for powering a transmitter, typically in a current loop installation. The signal input range is from 1 to 5 volts. Current inputs of 4 to 20 milliamps can be used with the addition of a 250-ohm resistor across the input terminals.

The analog inputs provided on the ROC364 I/O Card are designated Point Number B1 through Point Number B8. The terminals for connecting wiring are as follows:

- T Current-limited positive battery voltage for transmitter power
- + Positive Input
- Negative Input (Common)

The analog inputs have three field terminals per channel. If an I/O Converter Card is installed in the ROC364 MCU, the “T” terminal provides power for loop-powered devices at 24 volts; otherwise, the source power at the “T” terminal is the same as the 12 or 24 Vdc power supplied to the MCU. A 250-ohm scaling resistor is supplied for use between the “+” and “-” analog input terminals.

The “+” terminal is the positive signal input and the “-” terminal is the signal common. These terminals accept a voltage signal in the 1 to 5 volt range. Since the “-” terminal is internally connected to common, the analog input channels function as single-ended inputs only. Note, however, that terminal “-” is connected to an isolated analog signal common.

When wiring for a 4 to 20 milliamp current signal, leave the 250-ohm resistor installed between the “+” and “-” terminals. Wire the current loop device “+” lead to the “T” terminal and the device “-” lead to the AI “+” terminal. Figure Section: 6-2 shows the wiring for a typical current signal.



Figure Section: 6-2. Current Signal on Analog Input

When connecting the analog input channel to a voltage device, be sure to remove the 250-ohm resistor from the analog input terminal block. Figure Section: 6-3 shows wiring for a voltage signal input from a self-powered device; Figure Section: 6-4 shows wiring for a 3 or 4-wire voltage transmitter.

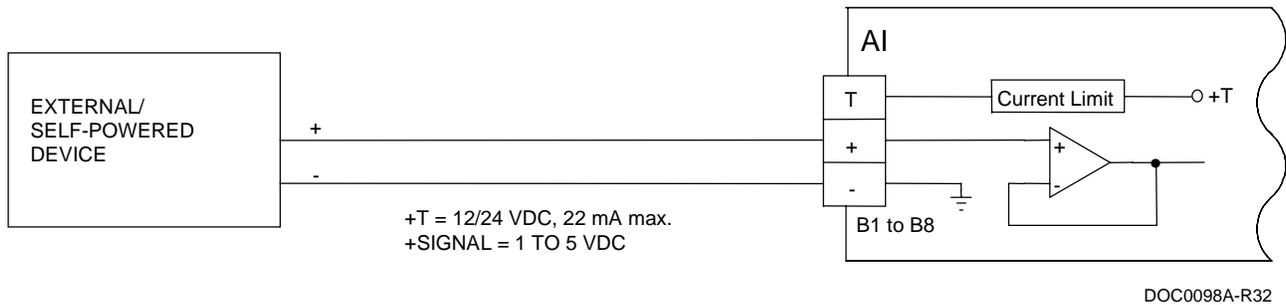


Figure Section: 6-3. Voltage Signal (Self-powered device) on Analog Input

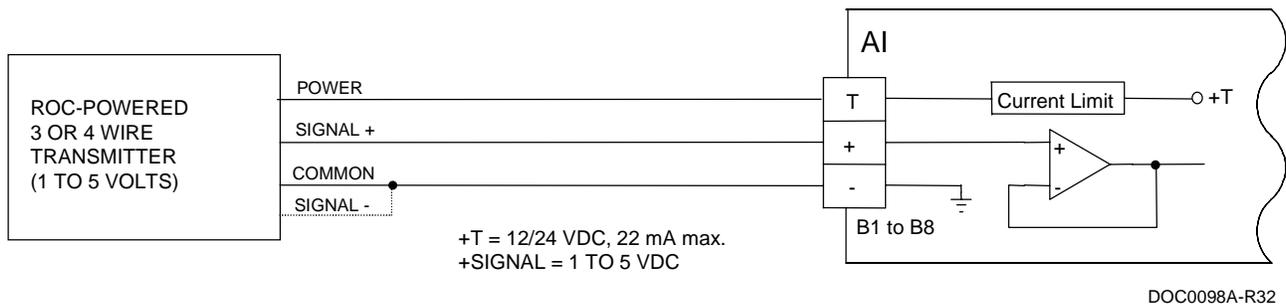


Figure Section: 6-4. Voltage Transmitter on Analog Input

6.4.2 Analog Output Channels

Analog outputs (AOs) provide a current output for powering analog devices. The ROC364 I/O Card analog output is a 4-20 mA loop signal.

Two analog outputs are provided on the I/O Card. They are designated Point Numbers B9 and B10. The second and third terminal positions are connected as follows:

- + Positive load
- Negative load

A schematic representation of the field wiring connections to the analog output channel is shown in Figure Section: 6-5. The AO provides loop current (4- to 20 mA) from the “+” terminal to non-powered field devices. If an I/O Converter Card is installed in the ROC364 MCU, the “+” terminal provides power for loop-powered devices at 24 volts; otherwise, the source power at the “+” terminal is the same as the 12 or 24 Vdc power supplied to the MCU. Note that terminal “-” is connected to an isolated analog signal common.

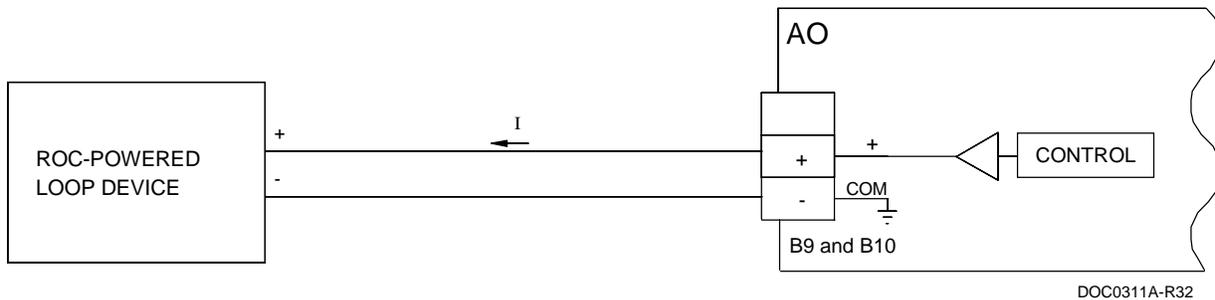


Figure Section: 6-5. Analog Output Wiring for Current Loop Devices

6.4.3 Discrete Input Channels

Discrete inputs (DIs) monitor the status of relays, solid-state switches, an intrusion switch, or other two-state devices. DI functions support discrete latched inputs and discrete status inputs.

The I/O Card discrete inputs acquire power from the ROC power supply. An LED indicator is included for each channel. The signal from the field is coupled through an optical isolator providing isolation from the main circuit board.

The discrete inputs provided on the I/O Card are configured as Point Number A1 to Point Number A12. They are connected using the second and third terminal positions as follows:

- + Positive Discrete Input
- Common

The discrete input operates by providing a voltage across terminals “+” and “-” (see Figure Section: 6-6), which is derived from internal voltage source V_s . When a field device, such as a relay contact, is connected across “+” and “-”, the closing of the contacts completes the circuit, which causes a flow of current between V_s and ground at terminal “-”. This current flow activates the LED and is sensed in the DI circuitry which, in turn, signals the MCU electronics that the relay contacts have closed. When the contacts open, current flow is interrupted and the DI circuit signals this to the electronics.

CAUTION

The discrete input is designed to operate only with non-powered discrete devices such as “dry” relay contacts or isolated solid state switches. Use of the DI channel with powered devices may cause improper operation or damage to occur.

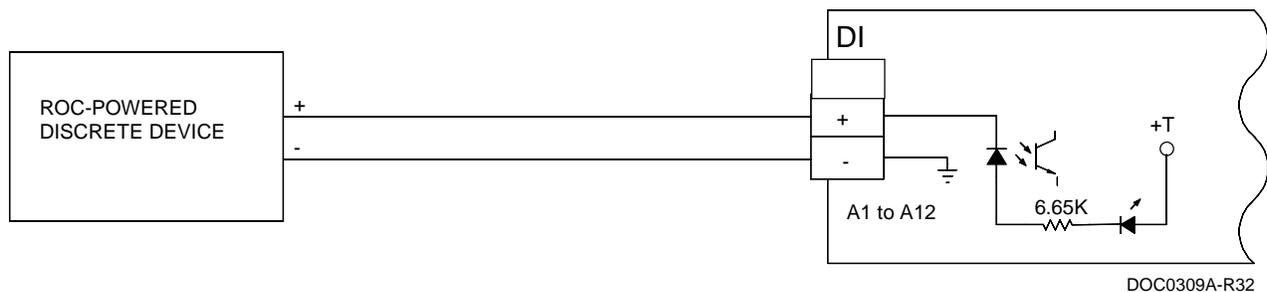


Figure Section: 6-6. Discrete Input Wiring

6.4.4 Discrete Output Channels

The discrete output channels are normally-open, single-pole, single-throw (SPST) relays. The relay contacts have a 5 amp rating. An LED lights next to the terminal block when the relay coil is energized. The channels are configured as Point Number B11 to Point Number B16. They can be software-configured as latched outputs, toggled outputs, or momentary timed outputs.

Use the first and second terminal position for wiring; the third position has no connection. Figure Section: 6-7 shows a typical discrete output wiring diagram.

NOTE

The Discrete Output channels are designed to operate only with discrete devices having their own power source. The channels will be inoperative with non-powered devices.

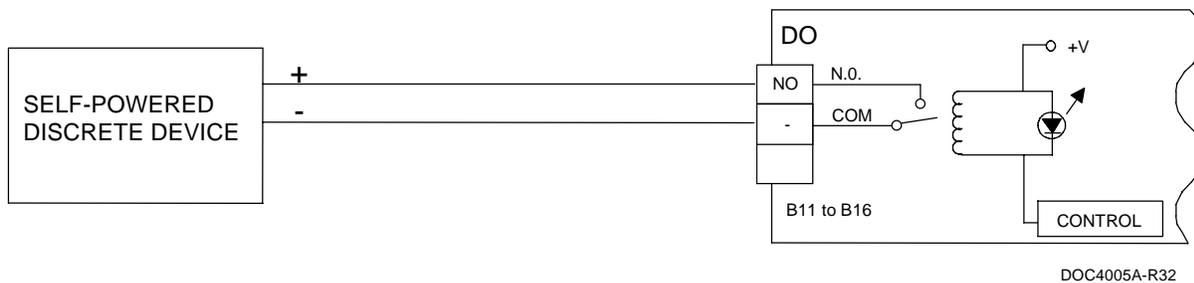


Figure Section: 6-7. Discrete Output Wiring

6.4.5 Pulse Input Channels

Pulse input (PI) channels are used for counting pulses from pulse-generating devices. Each pulse input is optically isolated from the board electronics and sources power from the +T line of the MCU. LED indicators monitor the status of each channel.

The I/O Card pulse input circuits are similar to the discrete inputs. The difference is that the pulse input signal is routed to a pulse accumulator, where the pulses are counted and accumulated.

The pulse inputs provided on the ROC364 I/O Card are configured as Point Numbers A13 through A16. The pulse inputs can operate at up to 10 kHz.

Each PI channel uses two field terminals, located at the second and third positions of the terminal block. One terminal is a positive source voltage; the other is the signal return. The terminals are designated as follows:

- + Positive Pulse Input (Sourced)
- Common

To wire a pulse input channel (shown in Figure Section: 6-8), connect the “+” and “-” field wires to terminals “+” and “-” on the I/O Card pulse input channel. When the field device completes the circuit between the “+” and “-” terminals, an LED indicator next to the terminal block lights to show activity, and the optical circuitry is triggered, producing a signal to the ROC accumulator.

CAUTION

The Pulse Input Source channel is designed to operate only with non-powered discrete devices such as “dry” relay contacts or isolated solid-state switches. Use of the channel with powered devices may cause improper operation or damage.

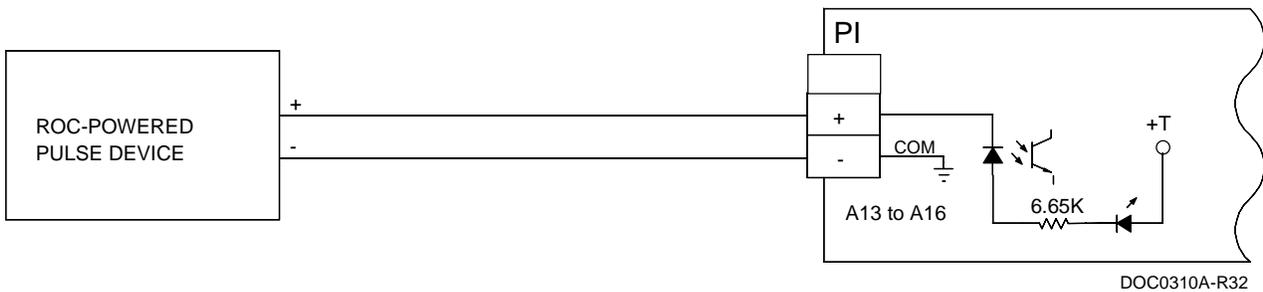


Figure Section: 6-8. Pulse Input Wiring

6.5 TROUBLESHOOTING AND REPAIR

If multiple I/O channels do not appear to be working, check the STATUS LED on the ROC364 I/O Card. This LED should be blinking slowly (cycles about 2 seconds long) to indicate normal communications with the MCU. If it stays off, check for power to the I/O Card. If power is okay, then the I/O communications is bad due to a problem with the connection to the card, the card itself, or the MCU. If the MCU appears to be normal, unplug the I/O Card, check the connector, and plug it in again. If the STATUS is still bad, replace the I/O Card.

In general, to troubleshoot an I/O channel, first check to see how the channel is configured using the ROCLINK Configuration Software. If the configuration looks correct, then simulate an input (within the range of the input) or force an output to be produced by using ROCLINK. If an input channel is in question, you may be able to use one of the outputs on the I/O Card (known to be in working order) to simulate the needed input. Likewise, if an output channel is in question, you may be able to connect it to a working input channel and check the results.

There are no field repair or replacement parts available for the I/O Card. If the card appears to be faulty, return it to your Fisher Representative for repair or replacement.

If an I/O point does not function correctly, first determine if the problem is with the field device or the I/O Card as follows:

CAUTION

Failure to exercise proper electrostatic discharge precautions (such as wearing a grounded wrist strap) may reset the processor or damage electronic components, resulting in interrupted operations.

1. Isolate the field device from the ROC by disconnecting it at the I/O terminal block.
2. Connect the ROC to a computer running the ROCLINK configuration software.
3. Perform the appropriate test procedure described in the following paragraphs.

A channel suspected of being faulty should be checked for a short circuit between its input or output terminals and the ground screw on the termination card. If a terminal not directly connected to ground reads zero (0) when measured with an ohmmeter, the channel is defective and must be replaced.

NOTE

In the following procedures, references to Terminal B mean the second (middle) position of the terminal wiring block and references to Terminal C mean the third (counting left to right) position.



6.5.1 Analog Input Channels

Equipment Required: Multimeter

To determine if an Analog Input channel is operating properly, its configuration must first be known. Table Section: 6-1 shows typical configuration values for an analog input:

Table Section: 6-1. Analog Input Channel Typical Configuration Values

PARAMETER	VALUE	CORRESPONDS TO:
Adj. A/D 0 %	800	1 volt dc across R_s (scaling resistor R1)
Adj. A/D 100 %	4000	5 volts dc across R_s
Low Reading EU	0.0000	EU value with 1 volt dc across R_s
High Reading EU	100.0	EU value with 5 volts dc across R_s
Filtered EUs	xxxxx	Value read by AI channel

When the value of Filtered Engineering Units (EU) is -25% of span as configured above, it is an indication of no current flow (0 mA), which can result from open field wiring or a faulty field device.

When the value of Filtered EUs is in excess of 100% of span as configured above, it is an indication of maximum current flow, which can result from shorted field wiring or a faulty field device.

When the value of Filtered EUs is between the low and high readings, you can verify the accuracy of the reading by measuring the voltage across scaling resistor R_s (V_{rs}) with the multimeter. To convert this reading to the Filtered EUs value, perform the following:

$$\text{Filtered EUs} = [((V_{rs} - 1)/4) \times \text{Span}] + \text{Low Reading EU},$$

where Span = High Reading EU - Low Reading EU

This calculated value should be within one-tenth of one percent of the Filtered EUs value measured by the ROC. To verify an accuracy of 0.1 percent, read the loop current with a multimeter connected in series with current loop. Be sure to take into account that input values can change rapidly, which can cause a greater error between the measured value and the calculated value.

If the calculated value and the measured value are the same, the AI channel is operating correctly.

6.5.2 Analog Output Channels

The Analog Output channel is used for current loop devices. Use the following procedure to check current loop installations.

Equipment Required: Multimeter
 Personal Computer running ROCLINK Software

1. Taking appropriate precautions, disconnect the field wiring going to the AO channel terminations.
2. Connect a multimeter between the B and C terminals of the channel and set the multimeter to measure current in milliamps.
3. Using the ROCLINK software, put the AO point associated with the channel under test in Manual mode (scanning disabled).
4. Set the output to the high EU value.
5. Verify a 20-milliamp reading on the multimeter.
6. Calibrate the analog output high EU value as needed by increasing or decreasing the “Adj D/A 100% Units”.
7. Set the output to the low EU value.
8. Verify a 4-milliamp reading on the multimeter.
9. Calibrate the analog output low EU value by increasing or decreasing the “Adj D/A 0% Units” as needed.
10. Enable scanning for the AO point, remove the test equipment, and reconnect the field device.
11. If possible, verify the correct operation of the AO channel by setting the high and low EU values as before (scanning disabled) and observing the field device.

6.5.3 Discrete Input Channels

Equipment Required: Jumper wire

Place a jumper across terminals B and C. The LED associated with the channel (located on top left of I/O Card) should light and the status as read by the ROCLINK software should change to “1”. With no jumper on terminals B and C, the LED should not be lit and the status should be “0”.

6.5.4 Discrete Output Channels

Equipment Required: Multimeter
 Personal Computer running ROCLINK Software

Place the Discrete Output in manual mode using the ROCLINK configuration software. Set the output status to “0” and measure the resistance across terminals B and C. A reading of 0 ohms should be obtained. Set the output status to “1” and measure the resistance across terminals B and C. No continuity should be indicated.

6.5.5 Pulse Input Channels

Equipment Required: Pulse Generator
 Voltage Generator
 Frequency Counter
 Jumper wire

For both types of channels, there are two methods of testing. One method tests high-speed operation, and the other method tests low-speed operation.

NOTE

When checking the operation of the Pulse Input channels, ensure the scan rate for the pulse input is once every 6.5 seconds or less as set by the ROCLINK software.

To verify high-speed operation, connect a pulse generator having sufficient output to drive the channel to terminals B and C. Connect a frequency counter across terminals B and C. Set the pulse generator to a value equal to, or less than 10 KHz, and set the frequency counter to count pulses. Verify the count read by the counter and the count read by the ROC are the same using the ROCLINK software.

To verify low-speed operation, alternately jumper across terminals B and C. The channel LED should cycle on and off, and the accumulated count should increase.

6.6 REPLACEMENT PROCEDURE

6.6.1 Impact on I/O Point Configuration

When an I/O Card is replaced with another I/O Card, it is not necessary to reconfigure the ROC.

If any points or their parameters need to be changed, you can use the ROCLINK configuration software to make the changes off-line or on-line. If you want to minimize “down time,” before you replace the card, you can make the needed changes (except for ROC display and FST changes) off-line by first saving the ROC configuration to disk. Modify the disk configuration, replace the card, and then load the configuration file into the ROC.

To make changes on-line, replace the card, proceed directly to the configuration display for the affected points, and modify parameters as needed.

CAUTION

If one or more FSTs, or higher-level points such as a PID loop or AGA Flow, are configured in the ROC, be sure to reconfigure them according to the changes in I/O points. Operational problems will occur if you do not reconfigure the ROC.

6.6.2 Replacing the I/O Card

Use the following procedure to replace the I/O Card. The procedure requires using the ROCLINK Configuration Software.

CAUTION

There is a possibility of losing the configuration and historical data held in RAM while performing the following procedure. As a precaution, save the current configuration and historical data to permanent memory as instructed in Section 2.5.2.

CAUTION

When working on units labeled for service in hazardous areas, ensure that the working environment is currently non-hazardous.

CAUTION

Failure to exercise proper electrostatic discharge precautions (such as wearing a grounded wrist strap) may reset the processor or damage electronic components, resulting in interrupted operations.

CAUTION

During this procedure all power will be removed from the ROC and devices powered by the ROC. Ensure that all connected input devices, output devices, and processes remain in a safe state when power is removed from the ROC and when power is restored.

1. Refer to Section 2.5.2 concerning RAM backup procedures.
2. Disconnect the input power, such as by unplugging the 5-terminal power connector.
3. To remove an existing I/O Card, take out the four screws securing the card to the backplane and the remove the card by pulling it straight down.
4. To install a new or replacement I/O Card, insert the top-edge connector into the MCU socket. Push the card upward, seating it firmly. Insert and tighten the four screws.
5. After the card is installed, reconnect the input power.
6. Check the configuration data (including ROC displays) and FSTs, and load or modify them as required. Load and start any user programs as needed.
7. Verify that the ROC performs as required.
8. If you changed the configuration, save the configuration data to permanent memory.
9. If you changed the configuration, including the history database, FSTs, and ROC displays, save them to disk. See Section 2.5.2 for more information on saving files.



6.7 I/O CARD SPECIFICATIONS

Specifications

POWER

Input: Uses 0.57 W (supplied by MCU), excluding power consumed by I/O channels connected to field devices.

Analog Loop: +T voltage from MCU (24 Vdc when I/O Converter Card is installed; otherwise, same as 12 or 24 Vdc power to the MCU). Available at "+T" terminal on each analog input channel.

DISCRETE INPUTS

Quantity/Type: 12 sourced discrete inputs.

Field Wiring Terminals: "+" positive source voltage, "-" negative input (common).

Signal Current: 0.5 to 3.5 mA in the active (on) state, 0 to 0.2 mA in the inactive (off) state.

PULSE COUNTER INPUTS

Quantity/Type: Four sourced pulse counter inputs.

Field Wiring Terminals: "+" positive source voltage, "-" negative input (common).

Signal Current: 0.5 to 3.5 mA in the active (on) state, 0 to 0.2 mA in the inactive (off) state.

Frequency: 10 kHz maximum.

ANALOG INPUTS

Quantity/Type: Eight, single-ended voltage-sense (current loop if supplied scaling resistor is used).

Field Wiring Terminals: "T" loop power, "+" positive input, "-" negative input (common).

Voltage: 1 to 5 Vdc, software configurable. 4 to 20 mA, with 250Ω resistor (supplied) installed across terminals "+" and "-".

Accuracy: 0.1% over a -40 to 65 °C (-40 to 149 °F) range.

Impedance: One MΩ.

Filter: Double-pole, low-pass.

Resolution: 12 bits.

DISCRETE OUTPUTS

Quantity/Type: Six dry-contact SPST relay outputs.

Field Wiring Terminals: "NO" normally-open contact; "COM" common.

DISCRETE OUTPUTS (Continued)

Contact Rating: 30 Vdc, 5 A maximum.

Isolation: 1500 volts.

ANALOG OUTPUTS

Quantity/Type: Two current loop outputs.

Field Wiring Terminals: "+" positive output and "-" common.

Range: 4-20 mA with 0 to 22 mA overranging.

Loop Resistance: 300 ohms maximum when +T is 12 Vdc; 600 ohms maximum when +T is 24 Vdc.

Resolution: 12 bits.

Accuracy: 0.1% of full-scale output.

Settling Time: 100 μs maximum.

Reset Action: Output goes to zero percent output or last value (software configurable) on power-up (warm start) or on watchdog timeout.

DIMENSIONS

0.5 in. D by 5 in. H by 12 in. W (13 mm by 127 mm by 305 mm).

WEIGHT

1.75 lb. (0.8 kg) nominal.

ENVIRONMENTAL

Operating Temperature: -40 to 70 °C (-40 to 158 °F).

Storage Temperature: -50 to 85 °C (-58 to 185 °F).

Operating Humidity: To 95%, non-condensing.

Vibration: Designed to meet SAMA 31.1, Cond. 3.

Radiated/Conducted Transmissions: Complies with FCC Part 15 Class A.

Voltage Surge Immunity: Designed to meet IEC 801-4 and EN 61000-4-5.

APPROVAL RATING

Approved by CSA for hazardous locations Class I, Division 2, Groups A, B, C, and D.