2108 Analog Output Module

Installation and Operation Guide

TELEDYNE ISCO
A Teledyne Technologies Company

Foreword

This instruction manual is designed to help you gain a thorough understanding of the operation of the equipment. Teledyne Isco recommends that you read this manual completely before placing the equipment in service.

Although Teledyne Isco designs reliability into all equipment, there is always the possibility of a malfunction. This manual may help in diagnosing and repairing the malfunction.

If the problem persists, call or e-mail the Teledyne Isco Technical Service Department for assistance. Simple difficulties can often be diagnosed over the phone.

If it is necessary to return the equipment to the factory for service, please follow the shipping instructions provided by the Customer Service Department, including the use of the **Return Authorization Number** specified. **Be sure to include a note describing the malfunction.** This will aid in the prompt repair and return of the equipment.

Teledyne Isco welcomes suggestions that would improve the information presented in this manual or enhance the operation of the equipment itself.

Teledyne Isco is continually improving its products and reserves the right to change product specifications, replacement parts, schematics, and instructions without notice.

Contact Information

Customer Service

Phone:	(800) 228-4373	(USA, Canada, Mexico)
	(402) 464-0231	(Outside North America)
Fax:	(402) 465-3022	
Email:	IscoCSR@teledyne.com	

Technical Service

Phone:	(800) 775-2965	(Analytical)
	(800) 228-4373	(Samplers and Flow Meters)
Email:	IscoService@teledyne.com	
Return equipment to:	4700 Superior Street, Lincoln, NE 68504-1398	

Other Correspondence

Mail to:	P.O. Box 82531, Lincoln, NE 68501-2531
Email:	IscoInfo@teledyne.com
Web site:	www.isco.com

General Warnings

Before installing, operating, or maintaining this equipment, it is imperative that all hazards and preventive measures are fully understood. While specific hazards may vary according to location and application, take heed in the following general warnings.

This product is often installed in confined spaces. Some examples of confined spaces are manholes, pipelines, digesters, and storage tanks. These spaces may become hazardous environments that can prove fatal for those unprepared. These spaces are governed governed by OSHA 1910.146 and require a permit before entering.

Hazard Severity Levels

This manual applies *Hazard Severity Levels* to the safety alerts, These three levels are described in the sample alerts below.

⚠ CAUTION

Cautions identify a potential hazard, which if not avoided, may result in minor or moderate injury. This category can also warn you of unsafe practices, or conditions that may cause property damage.

⚠ WARNING

Warnings identify a potentially hazardous condition, which if not avoided, could result in death or serious injury.

⚠ DANGER

DANGER – limited to the most extreme situations to identify an imminent hazard, which if not avoided, will result in death or serious injury.

Hazard Symbols   The equipment and this manual use symbols used to warn of hazards. The symbols are explained below.

Hazard Symbols	
Warnings and Cautions	
	The exclamation point within the triangle is a warning sign alerting you of important instructions in the instrument's technical reference manual.
	The lightning flash and arrowhead within the triangle is a warning sign alerting you of "dangerous voltage" inside the product.
Symboles de sécurité	
	Ce symbole signale l'existence d'instructions importantes relatives au produit dans ce manuel.
	Ce symbole signale la présence d'un danger d'électocution.
Warnungen und Vorsichtshinweise	
	Das Ausrufezeichen in Dreieck ist ein Warnzeichen, das Sie darauf aufmerksam macht, daß wichtige Anleitungen zu diesem Handbuch gehören.
	Der gepfeilte Blitz im Dreieck ist ein Warnzeichen, das Sei vor "gefährlichen Spannungen" im Inneren des Produkts warnt.
Advertencias y Precauciones	
	Esta señal le advierte sobre la importancia de las instrucciones del manual que acompañan a este producto.
	Esta señal alerta sobre la presencia de alto voltaje en el interior del producto.

2108 Analog Output Module

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2108 Analog Output Module

Section 1 Introduction

1.1 Overview

The 2108 Analog Output Module converts digital data from an Isco 2150, 2110, 2151, or 2151P Flow System module to analog output. The data can then be read by a SCADA (Supervisory Control and Data Acquisition), DCS (distributed control system) or other control system instrument. The 2108 is designed to output three 2100 series measurement parameters, typically flow, level, and velocity data.

The 2108 is an ABS, NEMA 1 box (see Figure 1-1) with a DIN rail mount on the back (Figure 1-2). This allows for easy installation in an equipment box/panel or a control room.

A six-pin network connector on the front of the unit is used to configure the module using Isco's Flowlink software, and can also be used to retrieve data using a Flowlink or Isco's Field Wizard.

Figure 1-1 2108 Analog Output Module - Front View

The terminal strip on the front of the 2108 provides connections to a customer supplied external power supply, network connections for transmission of digital data from a 2150, 2151, or 2151P module, and three analog channel pairs which can be connected to a SCADA system or other secondary instrument.

The front of the unit also contains an LED, which identifies the module when connected to Flowlink or a Field Wizard. It also indicates network activity.
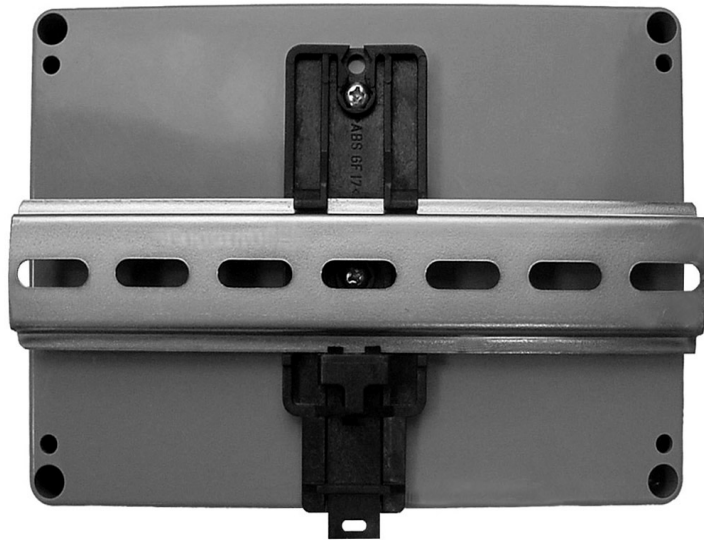
Figure 1-2   2108 Analog Output Module - Back View

There are three connection cables that are used with the 2108. A power/communication cable (P/N 60-2004-219) attaches to the 2100 series module and to the network terminal strip on the 2108. The connector on the front of the 2108 is used to connect to a laptop computer (using RS-232 communication cable P/N 60-2004-046) or a Field Wizard (using communication cable P/N 60-2004-056).

Connections are described in Section 2, which provides more detailed installation and operation instructions.

1.2 Technical Specifications

This section lists the technical specifications for the 2108.

Table 1-1 2108 Analog Output Module Specifications	
Dimensions	Depth = 2.165 inches (55 mm)
	Width = 6.732 inches (171 mm)
	Height = 4.764 inches (121 mm)
Weight	1.3 pounds (0.6 kg)
Material	ABS
Enclosure	NEMA 1, IP20

Power Requirements	Supply DC Voltage Range
	    nominal operating voltage: 12 volts
	    maximum absolute voltage: 26 volts **(2108 only; voltage to other connected 2100 modules must not exceed 16 VDC)**
	    minimum operating voltage: 6.6 volts
	
	Supply DC Ampere Range
	    typical operating current: 300 mA @ 12 volts
	    maximum standby current: 280 mA @ 12 volts
	    maximum operating current: 580 mA @ 7.0 volts

Analog Output Channels	Number of channels 3
	Output Range 4-20 mA outputs
	Maximum Load 600Ω
	Isolation: Output galvanically isolated from DC power, from the network and from other outputs
	
	Accuracy:
	    Integral Nonlinearity: ±0.012% max
	    Offset (0 mA or 4 mA) (Ta = 25°C): ±0.05%max
	    Offset Drift: 50 ppm/°C max
	    Total Output Error (20 mA or 24 mA)(Ta = 25°C): ±0.15% max
	    Total Output Error Drift: 50 ppm/°C max
	     PSRR: 10 µA/V max
	
	Resolution: 16 bits, 244 nA, 0.0015% of 16 mA span

Operating Temperature	-22°F to 140°F (-30°C to 60°C)
Storage Temperature	-40°F to 140°F (-40°C to 60°C)
PC Data Link	RS232 interface, capable of 38.4 Kbits per second
Data Storage	File system memory capacity of 512 Kbytes of data
Setup and Data Retrieval	PC compatible computer with Isco Flowlink for Windows software (version 4.15 or above)
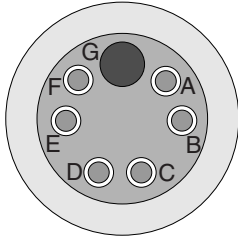
Table 1-2 2108 Communication Connector Pins		
Pin	**Name**	**Description**
A	LONA	Neuron differential transceiver Data A
B	LONB	Neuron differential transceiver Data B
C	VIN+	Positive power supply voltage input/output
D	VIN–	Negative power supply voltage input/output
E	XMTDN	PC data transmit logic level output
F	RCVDN	PC data receiver logic level input
G	Key	Aligns connector pins

Figure 1-3 2108 Communication Connector Pins

2108 Analog Output Module

Section 2 Installation and Operation

2.1 Unpacking Instructions

Teledyne Isco, Inc.
Customer Service Dept.
P.O. Box 82531
Lincoln, NE 68501 USA

Phone: (800) 228-4373
Outside USA & Canada call:
         (402) 464-0231

FAX: (402) 465-3022

E-mail: IscoInfo@teledyne.com

Web site: www.isco.com

When the system arrives, inspect the outside packing for any damage. Then carefully inspect the contents for damage. If there is damage, contact the delivery company and Teledyne Isco (or its authorized representative) immediately.

⚠ **WARNING**
If there is any evidence that any items may have been damaged in shipping, do not attempt to install the unit. Please contact Teledyne Isco (or its agent) for advice.

When you unpack the system, check the items against the packing list. If any parts are missing, contact the delivery company and Teledyne Isco's Customer Service Department. When you report missing part(s), please indicate them by part number.

It is recommended that you retain the shipping carton as it can be used to ship the unit in the event you need to transport it.

2.2 Mounting the 2108

The 2108 is a DIN rail mounted unit. It comes with a 7 inch (17.8 cm) piece of DIN rail (Figure 2-1) which can be used for mounting.

DIN Rail
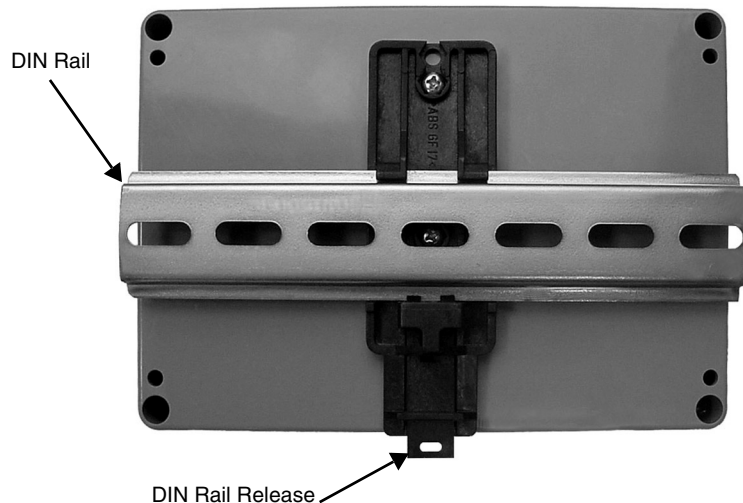
DIN Rail Release

Figure 2-1 Back View of 2108 Module

The 2108 is released from, or attached to, a DIN rail by using the rail release lever (Figure 2-1). Insert an object such as the end of a flat bladed screwdriver into the hole in the rail release and pull down to move the lever.

2.3 Connection to a 2100 Series Flow Module

The 2108 is connected to a flow module (2150 area velocity or 2110 ultrasonic) with a 50 foot (15.2 m) connect cable (P/N 60-2004-219), shown in Figure 2-2. One end of the cable has six wires, which are attached to the terminal strip on the front of the 2108. The other end of the cable is attached to the connector on the underside of the flow module or 2191 battery module, whichever is applicable.

Figure 2-2   2100 Series Connect Cable

2.4 Connecting to the 2108 Terminal Strip

The terminal strip is located on the front of the 2108 (Figure 2-3). There are twelve terminals, two of which are blank (marked "X"). Terminals 1 and 2 are for power; 4 and 5 are for network connections; 7-12 are for connecting up to three analog outputs to a control system. The terminal's screw clamp connections accept wire sizes ranging from 12 to 24 AWG.

To make the connections:

1. Remove the terminal strip by pulling it straight out.

2. Tighten or loosen connections by turning the screw clamps with a small flathead screwdriver.

3. Once the connections are made, push the terminal strip back onto the 2108.

⚠ **WARNING**

Although the 2108 alone supports 7-26 VDC, if the entire system is using a single power supply, it MUST be within the range of 12 to 14 VDC or you risk damaging the 2100 Series flow module. Do NOT connect the terminals to AC power.
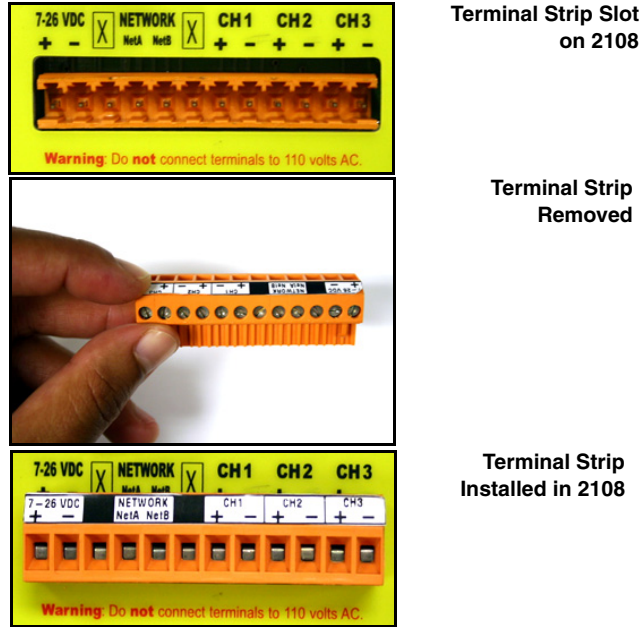
Figure 2-3   Terminal Strip on the Front of the 2108

Connection to the terminal strip on the 2108 will vary, depending on how you are powering the flow module.

If the flow module is powered separately from the 2108:

1. Connect the white-with-green-line (white/green) wire to Network A (terminal 4).

2. Connect the green-with-white-line (green/white) wire to Network B (terminal 5).

3. Insulate the remaining four wires separately from each other; they will not be connected to the terminal strip.

4. You will need to supply power to the 2108 in your equipment cabinet. Connect the DC supply voltage to terminals 1 and 2.

5. Your connections should look like those in Figure 2-4.
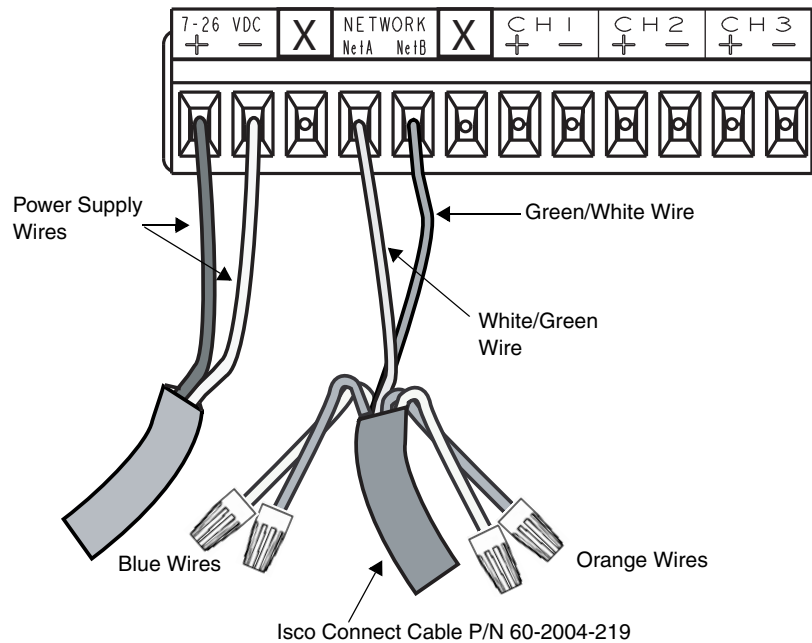
Figure 2-4   Terminal Connections if Flow Module is
Powered Separately

If the flow module and 2108 share the same power source:

1. Connect the white/green wire to Network A (terminal 4).
2. Connect the green/white wire to Network B (terminal 5).
3. Connect the white/blue wire to terminal 1.
4. Connect the blue/white wire to terminal 2.
5. Insulate the two orange wires separate from each other; they will not be connected to the terminal strip.
6. You will need to have a power source in your equipment cabinet that supplies power to the 2108 and flow module. Connect the DC supply voltage to terminals 1 and 2 (the blue wires from the connection cable will also be connected to these terminals, as described in steps 3 and 4 above).
7. Your connections should look like those in Figure 2-5.

Must NOT exceed 14VDC when 2108 shares power source with 2100 flow module.

Power Supply Wires

Green/White Wire

Blue/ White Wire

White/Green Wire

White/Blue Wire

Orange Wires

Isco Connect Cable P/N 60-2004-219
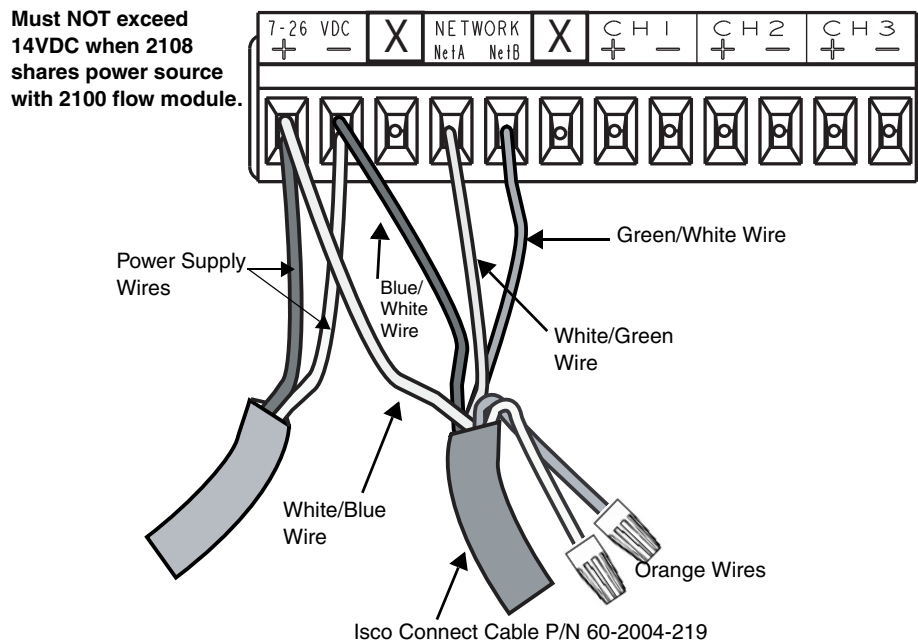
Figure 2-5   Terminal Connections if Flow Module and
2108 Share Same Power Source

⚠ **WARNING**

Although the 2108 alone supports 7-26 VDC, if the entire system is using a single power supply, it MUST be within the range of 12 to 14 VDC or you risk damaging the 2100 Series flow module. Do NOT connect the terminals to AC power.


2.5 Connection to a 2151P Module

The 2108 can be used with Isco's intrinsically safe 2151P area velocity flow system. Details concerning installation of the 2151P can be found in that module's user manual.

2.6 Connection to a Control System

The terminal strip on the 2108 has three analog galvanically isolated output channel pairs that allow for connection to your SCADA, DCS, or other control system.

Each output has a 4-20 mA range by default. If a 0-20 mA range is desired, contact Teledyne Isco to have your 2108 unit configured at the factory.

The load capacity for each output is 600 ohms.

Connect the wires from your control system to terminals 7 through 12 on the terminal strip, as appropriate.

2.7 Configuration in Flowlink

Each analog output needs to be configured with Isco's Flowlink for Windows software.

The 2108 can be connected to a laptop computer or Isco Field Wizard by using the six-pin network connector on the front of the 2108 (refer to Figure 2-6).

For connection to a laptop computer, use Isco's RS-232 communication cable P/N 60-2004-046. For connection to a Field Wizard, use communication cable (P/N 60-2004-056).

Figure 2-6   Network Connector on the Front of the 2108

☑ *Note*

The 2108 requires Flowlink 4.15 or later. Earlier versions do not support 2108 modules.

Flowlink Help

Detailed Flowlink instructions are beyond the scope of this manual. Flowlink's operating instructions are available in a Windows Help format. You can access the help topics for an active window by clicking on its *Help* button or by pressing F1 on your computer's keyboard. You can also access Help topics from a Contents and Index window (HELP>CONTENTS AND INDEX from the Flowlink menu).

To configure the analog outputs in Flowlink, follow the instructions below:

1. Make the necessary connections for Flowlink to communicate with the site. Then, using Flowlink, connect to the site.

2. From the Measurements tab, select Channel 1. The screen shown in Figure 2-7 will be displayed.
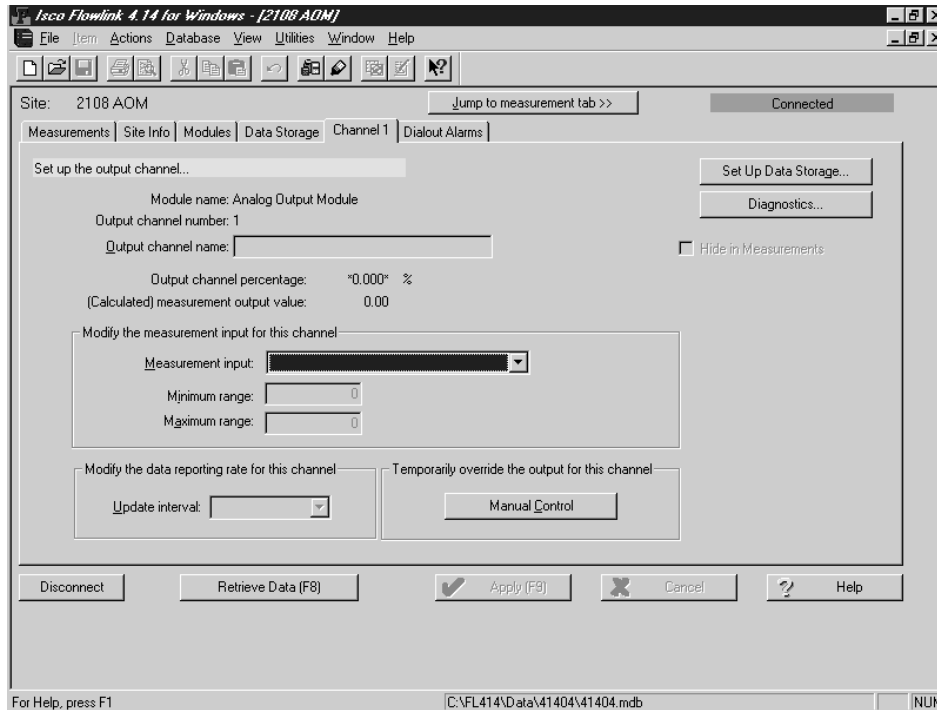
Figure 2-7 Channel 1 Setup Screen in Flowlink

3. From the Channel 1 Setup screen, click the down arrow by Measurement Input.

4. Select the input you want to measure (such as level) and click the Apply F9 button on the bottom of the screen.

5. After you have specified your measurement input, enter the settings for the Output Channel Name, Minimum Range, Maximum Range, and Update Interval.

6. Repeat steps 2 through 5 for Channels 2 and 3 if needed.

If desired, you can store data for your channels, to be retrieved later as data sets that can be used in graphs and tables. When you are setting up a channel, click on the Set Up Data Storage button to display the Data Storage Setup screen. Complete the information requested and click on OK.

2.7.1 Manual Control of Output Percentage

If you need to temporarily override the output for a channel (to calibrate equipment, for example), go to the appropriate Channel Setup screen and click the Manual Control button. You will see the following dialog box:
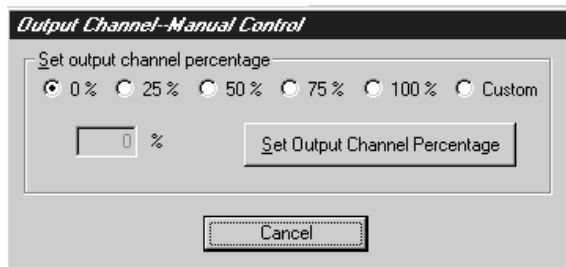
Figure 2-8   Output Channel Manual Control Screen

Set the output channel percentage by selecting the desired percentage or by selecting Custom and entering a percentage amount.

Click the Set Output Channel Percentage button. The output will change to your manual setting, but the dialog box will remain on the screen. It will remain there until you click the Cancel button. Then the output will revert to your previous settings.

2.8 Cleaning

Take care when cleaning the 2108 module. Avoid getting liquids in the terminal connections or the communication connector. Do not immerse the module in any liquids.

⚠ **CAUTION**

Do not immerse the module in a bath for cleaning. The 2108 is not hermetically sealed. If internal components get wet, the module may be permanently damaged.

2108 Analog Output Module

Section 3 Modbus Protocol

Sections 3.1 through 3.5 give an overview of the basic capabilities and operation of Modbus protocol as it applies to Isco 2100 Series flow modules.

For a Glossary of Terms and Common Acronyms, see sections 3.4 and 3.5.

For Modbus technical specifications, turn to section 3.6.

3.1 Introduction

Modbus is a simple command/response mechanism to read from and write to specific memory locations called *registers*. A register is a holding place for a piece of digital information within the equipment. There are three standard protocols for Modbus: Modbus RTU, Modbus TCP/IP, and Modbus ASCII. The Isco 2100 Series devices use Modbus ASCII protocol, the method discussed in this manual. Modbus ASCII has more flexible communication timing requirements. Modbus communication for the Isco 2100 Series provides a standard protocol that can be used to retrieve real-time data from a single module or stack of modules at a site, or multiple sites, over a wide area. The data can be sent to a central computer for display, data collection, or process control.

Modbus implementation is independent of Flowlink and cannot alter the Flowlink-programmed configuration of the module. Modbus cannot be used to retrieve historical data from a module's memory.

Due to the wide variety of configurations that can be made with Modbus, it is impossible to cover every usable application. This section will discuss the overall capabilities and operation of Modbus.

3.2 Operation

There are many standard, third party Modbus drivers and OPC servers that may be used to link a remote Modbus device, such as a 2100 Series module, to SCADA or process control software, such as Wonderware™ or Intellution™. The OPC server communicates with the remote instrumentation and accesses registers. The definition of what information is contained and where (the register number, or address) is decided by the manufacturer (Teledyne Isco).

In a 2100 module, the registers hold, but are not limited to, the current real-time value of the meter's level, velocity, flow, input voltage, temperature, and total flow readings, stored in specified register locations. A list of the 2100 register addresses, and what parameters are held where, is available in section 3.6.

By accessing these registers you can obtain the current value of whatever parameter you desire. The reading(s) can then be displayed or stored wherever you designate as a destination; for example, a process control computer.

☑ *Note*

Level, flow, velocity, and temperature data is stored in metric units only.

Not all registers are limited to read-only data storage. You can also use some registers for control purposes. For example, by writing a "1" value to register 24 ("Identify Module" register), you will tell a 2100 module to light the LED on the front of the module.

3.2.1 Establishing Communication

There are several different communications protocols supported in the 2100 series that require auto-baud rate detection. Because of this, each time a modbus connection is made, the module uses a polling mechanism to repeatedly send a command until a response is received. It may take up to 20 command retries before the module has identified the baud rate and a response is received.

3.2.2 Module Addressing

When connecting to a site via a Modbus OPC server, you use a dedicated line of communication to that module or stack from the OPC server, which can be a dedicated communications cable (direct connection) or a dedicated phone number (modem).

When you are using a direct connection, you are dedicating a specified COM port on the computer, and that COM port determines the site to which you are connecting.

When you are using a modem, the dedicated line is defined by the site's phone number.

If you connect more than one 2100 Series module at a site, the Modbus OPC server, while using the shared communication line for all of the modules within the network, must have some way to differentiate between the modules. When sending a command to a specific module, the command has an address field. This allows the server software to talk to, as well as control, the specified module, while ignoring other modules in the same stack or site.

Each module capable of Modbus Protocol communication will automatically create its own specific ASCII address within the site, using:

- The model numbers of the modules
- The user-defined module names

3.3 Configurations

A variety of configurations can be made with Modbus, either through direct connection or through a modem.

In the example shown in Figure 3-1, you are direct-connecting a server PC to two individual 2150s through Modbus, using the COM ports on the OPC Server, which are directly connected to the remote 2150s.

Connection to the module is made through the RS-232 communication port on the top of the module.

☑ *Note*

For low power operation, we recommend connecting the module(s) to the computer using the straight-through cable (Isco part number 60-5314-529), which consumes less power, instead of our standard interrogation cable.

In Figure 3-1, the OPC Server PC must have two COM ports. Modbus requires one COM port each, for direct connection of each 2150.

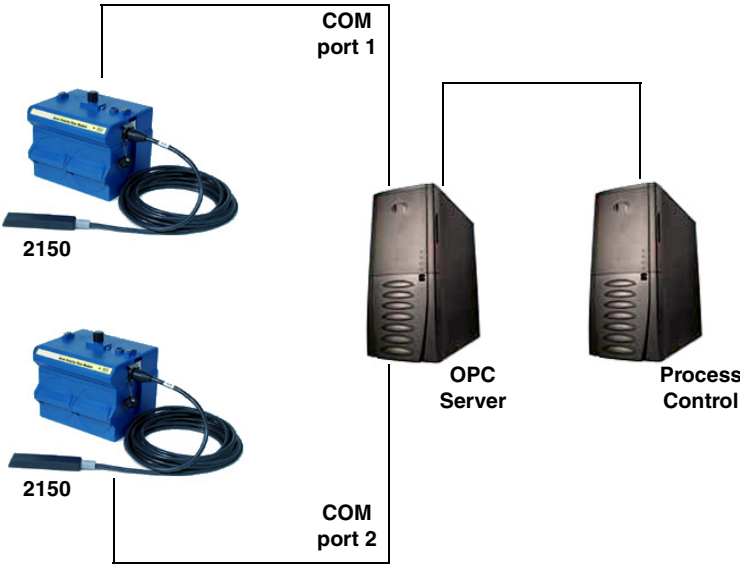*Figure 3-1   Configuration Example (Direct Connection Shown)*

The operation sequence for the example above can be summarized in the following steps:

2150:

1. 2150s take readings from probes.

2. 2150s store readings (level, velocity, flow rate, etc.) in their specified registers.

Process Control:

3. The user requests data through Process Control.

4. Process Control asks the OPC server to gather information.

5. OPC connects to the 2150 stack through the cable (direct connection), takes register data from the specified 2150, and populates the OPC server's holding index.

6. Process Control takes data from the OPC server's holding index and gives data to the user.

Note that Process Control can be either manual or automated in this example, and that the OPC server and Process Control may be located physically on the same computer.

3.4 Glossary of Terms

ASCII – Short for American Standard Code for Information Interchange, ASCII is a code that represents English characters with numbers. Most computers represent text with ASCII code, making it possible for one computer or device to share data with another.

2100 modules support Modbus ASCII protocol.

Dedicated Line – A telecommunications path reserved for communication between two specified points and not shared among multiple points.

Modbus Protocol – Modbus Protocol is a messaging structure used to establish master-slave/client server communications between intelligent devices. Modbus is a simple command/response mechanism to read from and write to registers.

OPC – OPC (OLE for Process Control) means open connectivity via open (free for use) standards. It is a series of software standards specifications that fill a need in automation (like printer drivers did for Windows), acting as a translator for data transmission and process control.

The specification defines a standard set of objects, interfaces, and methods for use in process control and manufacturing automation applications to facilitate interoperability. There are hundreds of OPC Data Access servers and clients.

Registers – Registers are locations in memory that have specific data stored for retrieval or are used for control functions. A register is a holding place for a piece of digital information within the equipment. The definition of what is contained and where (the registry number, or address) is decided by the manufacturer (in this case Teledyne Isco).

SCADA – SCADA (Supervisory Control And Data Acquisition) is a computer system for gathering and analyzing real-time data. SCADA systems are used to monitor and control plant operation, or equipment in industries such as telecommunications, water and waste control, energy, oil and gas refining, and transportation.

The SCADA system transfers the information (for example, where a leak has occurred in a pipeline), back to a central site, alerting the home station of the leak, performing necessary analysis and control (such as determining if the leak is critical), and displaying the information in a logical and organized manner.

SCADA systems can be relatively simple, such as one that monitors the environmental conditions of a small office building, or very complex, such as a system that monitors all the activity in a nuclear power plant or a municipal water system.

3.5 Common Acronyms

ASCII – American Standard Code for Information Interchange

DCS – Distributed Control Systems

MTU – Master Terminal Unit

OPC – Object Linking and Embedding (OLE) for Process Control

PLC – Programmable Logic Controller

RTU – Remote Terminal Unit

SCADA – Supervisory Control And Data Acquisition

TCP/IP – Transmission Control Protocol/Internet Protocol

3.6 Register Specifications

All numbers in the Modbus registers are stored most significant byte first. If the polling device has a byte ordering of least significant byte first (an Intel-based PC, for example), the bytes will need to be reversed after they are received.

The Modbus ASCII address is used to index the data by modules.

Modbus ASCII address 1 contains information related to the site. The first register contains a 16-bit integer count of the number of modules that have data to report. The maximum number of modules that can be supported is 4.

Modbus ASCII addresses 2 through the number of modules plus 1 contain data from the individual modules.

The Modbus ASCII addresses will be sorted by the model number, and then by module name, which is entered by the user through Flowlink. This allows the user to control the ordering of the addresses and easily predict what data will be in specific registers.

Every measured parameter has a corresponding status and measurement time that are updated with each measurement.

The maximum number of supported measurements from all modules in the system is 28.

The Modbus registers are assigned within 30 seconds after the 2100 module is powered up. To conserve power for the users who do not use Modbus communications, no Modbus registers will be updated with sensor readings until a Modbus master communicates with the 2100 module.

The register definitions for the Site Information device (Modbus ASCII address 1) are in Table 3-1 below:

Table 3-1 Modbus ASCII Address 1 Register Definitions				
Register Number(s)	**Name**	**Data type**	**Units**	**Read/Write**
1	Number of modules (N) (1-4)	16 bit integer	None	Read
2-20	Site name	38-byte string	None	Read

The register definitions for the individual modules (Modbus ASCII addresses 2-(N+1)) are in Table 3-1 below:

Register Number(s)	Name	Data Type	Units	Read/Write
Table 3-2 Modbus ASCII Address 2-(N+1) Register Definitions				
1-4	Model number	8-byte string	None	Read
5-23	Module name	38-byte string	None	Read
24[1]	Identify module	16 bit integer	None	Read/Write
25[2]	Take reading flag	16 bit integer	None	Read/Write
26[3]	Update interval	16 bit integer	Seconds	Read/Write
27[4]	Active flag 1	16 bit field	None	Read
28	Active flag 2	16 bit field	None	Read
29	Active flag 3	16 bit field	None	Read
30	Active flag 4	16 bit field	None	Read
40,41	Level	4-byte float	Meters	Read
42	Level status code[5]	16-bit integer		Read
43-52	Level time record	Time[6]		Read
55,56	Velocity	4-byte float	Meters/second	Read
57	Velocity status code	16-bit integer		Read
58-63	Velocity time record	Time		Read
70,71	Flow	4-byte float	Cubic Meters/sec	Read
72	Flow status code	16-bit integer		Read
73-78	Flow time record	Time		Read
85,86	Flow 1	4-byte float	Cubic Meters/sec	Read
87	Flow 1 status code	16-bit integer		Read
88-93	Flow 1 time record	Time		Read
100,101	Volume	4-byte float	Cubic Meters	Read
102	Volume status code	16-bit integer		Read
103-108	Volume time record	Time		Read
115,116	Volume 1	4-byte float	Cubic Meters	Read

Table 3-2 Modbus ASCII Address 2-(N+1) Register Definitions (Continued)

Register Number(s)	Name	Data Type	Units	Read/Write
(1) A write to the Identify module register will cause the module to perform the identify operation which may be a steady LED for a few seconds or a beep in the Field Wizard.				
(2) Setting the Take Reading flag to 1 will cause the module to update the registers with current data readings. It will be set to zero when the readings have all been updated. This may be used to initiate readings and poll for when they are ready to be read. It may take up to 50 seconds to update all the readings, depending upon the flow conditions. Setting the Take Reading flag to 2 causes an automatic, 15 second update of readings when a Modbus master is polling the 2100.				
(3) The Update Interval specifies an interval in seconds that the registers are automatically updated. It defaults to zero, which indicates that no automatic updating will occur.				
(4) The Active Flag (1-4) bit fields specify what fields/registers are active in the list. This provides support for a maximum of 64 fields. For example, if bit 0 of register 27 is set, the Level (registers 40,41) is active. If bit 1 of register 27 is set, then the Velocity (registers 55,56) is active. If bit 0 of register 28 is set, the Analog channel 7 (registers 265,266) is active.				
(5)A non-zero status code indicates a measurement problem.				
(6) Time is represented in a series of registers: Order is from lowest address to highest - Seconds (0-59), Minutes (0-59), Hours (0-23), Days (1-31), Month (1-12) and Year (1977-2099).				
117	Volume 1 status code	16-bit integer		Read
118-123	Volume 1 time record	Time		Read
130,131	Voltage	4-byte float	Volts	Read
132	Voltage status code	16-bit integer		Read
133-138	Voltage time record	Time		Read
145,146	Temperature	4-byte float	Degrees Celsius	Read
147	Temperature status code	16-bit integer		Read
148-153	Temperature time record	Time		Read
160,161	Internal Temp	4-byte float	Degrees Celsius	Read
162	Internal Temp status code	16-bit integer		Read
163-168	Internal Temp time record	Time		Read
175,176	Analog channel 1	4-byte float	0-100 percent	Read
177	Analog channel 1 status code	16-bit integer		Read
178-183	Analog channel 1 time record	Time		Read
190,191	Analog channel 2	4-byte float	0-100 percent	Read
192	Analog channel 2 status code	16-bit integer		Read
193-198	Analog channel 2 time Record	Time		Read
205,206	Analog channel 3	4-byte float	0-100 percent	Read
207	Analog channel 3 status code	16-bit integer		Read
208-213	Analog channel 3 time record	Time		Read
220,221	Analog channel 4	4-byte float	0-100 percent	Read
222	Analog channel 4 status code	16-bit integer		Read
223-228	Analog channel 4 time record	Time		Read
235,236	Analog channel 5	4-byte float	0-100 percent	Read
237	Analog channel 5 status code	16-bit integer		Read

Table 3-2 Modbus ASCII Address 2-(N+1) Register Definitions (Continued)				
Register Number(s)	**Name**	**Data Type**	**Units**	**Read/Write**
238-243	Analog channel 5 time record	Time		Read
250,251	Analog channel 6	4-byte float	0-100 percent	Read
252	Analog channel 6 status code	16-bit integer		Read
253-258	Analog channel 6 time record	Time		Read
265,266	Analog channel 7	4-byte float	0-100 percent	Read
267	Analog channel 7 status code	16-bit integer		Read
268-273	Analog channel 7 time record	Time		Read
280,281	Analog channel 8	4-byte float	0-100 percent	Read
282	Analog channel 8 status code	16-bit integer		Read
283-288	Analog channel 8 time record	Time		Read

Table 3-3 Measurement Parameters by Model Number*			
2103, 2103C	**2108**	**2110**	**2150, 2151**
Voltage	Analog channel 1	Level	Level
	Analog channel 2	Flow	Velocity
	Analog channel 3	Volume	Flow
		Voltage	Flow 1
		Temperature	Volume
			Volume 1
			Voltage
			Temperature
*Subject to change.			

2108 Analog Output Module

Appendix A Replacement Parts

A.1 Replacement Parts

Replacement parts are called out in the following page. Refer to the call-outs in the adjacent table to determine the part number for the item.

Replacement parts can be purchased by contacting Teledyne Isco's Customer Service Department.

Teledyne Isco, Inc.
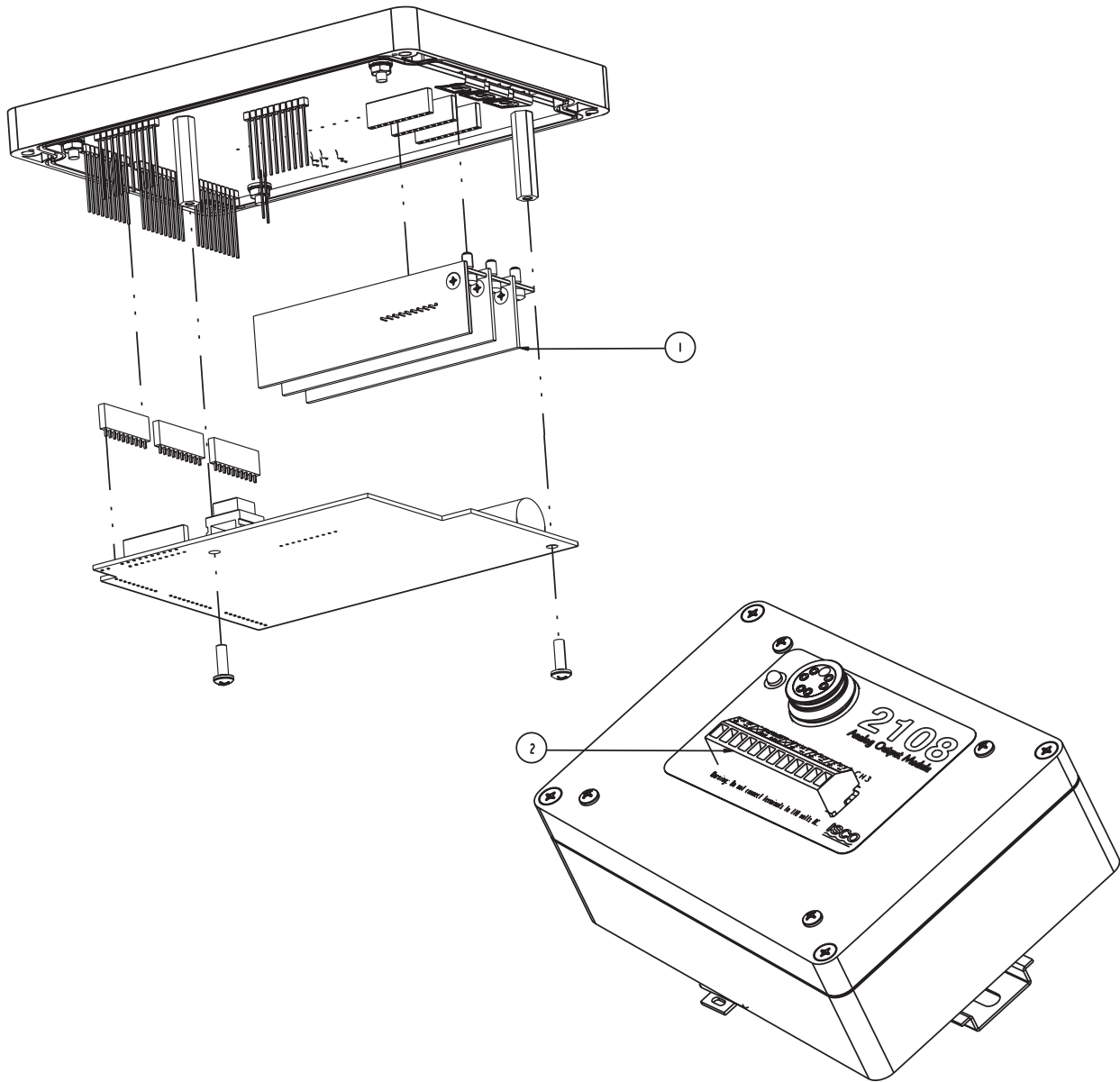Customer Service Department
P.O. Box 82531
Lincoln, NE 68501 USA

Phone: (800) 228-4373
          (402) 464-0231
FAX: (402) 465-3022

E-mail: IscoInfo@teledyne.com

Web site: www.isco.com

REPLACEMENT PARTS LIST		602002224
Isco, Inc.		SHEET: 2 OF 2
		REV: DATE: 02200

ITEM NO.	PART NUMBER	DESCRIPTION
1	601244391	CBA ANLG/4-20mA PMP
2	602004223	TERMINAL BLOCK ASSEMBLY

NOTE: 1. For current prices and quotations on parts, contact Isco Service Department.
2. This list is subject to change without notice.

DECLARATION OF CONFORMITY

CE
ISM1-A
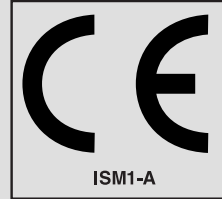
Application of Council Directive:	89/336/EEC – The EMC Directive
	73/23/EEC – The Low Voltage Directive
Manufacturer's Name:	Teledyne Isco, Inc.
Manufacturer's Address:	4700 Superior, Lincoln, Nebraska 68504 USA
	Mailing Address: P.O. Box 82531, Lincoln, NE 68501
Equipment Type/Environment:	Laboratory Equipment for Light Industrial/Commercial Environments
Trade Name/Model No:	2108 Analog Output Module
Year of Issue:	2002
Standards to which Conformity is Declared:	EN 61326-1998 EMC Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use
	EN 61010-1 Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory use.

Standard	Description	Severity Applied	Performance Criteria
EN61000-4-2	Electrostatic Discharge	Level 2 - 4kV contact discharge	A
		Level 3 - 8kV air discharge	A
EN61000-4-3	Radiated RF Immunity	80 MHz to 1000MHz 80% AM at 1kHz	A
		Level 1 – 10V/m	
EN61000-4-4	Electrical Fast Transient	Level 1 – 1kV on I/O lines	A
CISPR11/ EN 55011	RF Emissions	Group 1, Class A Industrial, Scientific, and Medical Equipment	

We, the undersigned, hereby declare that the design of the equipment specified above conforms to the above Directive(s) and Standards as of October 22, 2002.

William Foster

William Foster
USA Representative

TELEDYNE ISCO
A Teledyne Technologies Company

William Foster
Director of Engineering
Teledyne Isco, Inc.
4700 Superior Street
Lincoln, Nebraska 68504

Phone: (402) 464-0231
Fax: (402) 464-4543

60-2002-234
Rev. A

Teledyne Isco One Year Limited Factory Service Warranty *

Teledyne Isco warrants covered products against failure due to faulty parts or workmanship for a period of one year (365 days) from their shipping date, or from the date of installation by an authorized Teledyne Isco Service Engineer, as may be appropriate.

During the warranty period, repairs, replacements, and labor shall be provided at no charge. Teledyne Isco's liability is strictly limited to repair and/or replacement, at Teledyne Isco's sole discretion.

Failure of expendable items (e.g., charts, ribbon, tubing, lamps, glassware, seals, filters, fittings, and wetted parts of valves), or from normal wear, accident, misuse, corrosion, or lack of proper maintenance, is not covered. Teledyne Isco assumes no liability for any consequential damages.

This warranty does not cover loss, damage, or defects resulting from transportation between the customer's facility and the repair facility.

Teledyne Isco specifically disclaims any warranty of merchantability or fitness for a particular purpose.

This warranty applies only to products sold under the Teledyne Isco trademark and is made in lieu of any other warranty, written or expressed.

No items may be returned for warranty service without a return authorization number issued from Teledyne Isco.

The warrantor is Teledyne Isco, Inc. 4700 Superior, Lincoln, NE 68504, U.S.A.

* This warranty applies to the USA and countries where Teledyne Isco Inc. does not have an authorized dealer. Customers in countries outside the USA, where Teledyne Isco has an authorized dealer, should contact their Teledyne Isco dealer for warranty service.

In the event of instrument problems, always contact the Teledyne Isco Service Department, as problems can often be diagnosed and corrected without requiring an on-site visit. In the U.S.A., contact Teledyne Isco Service at the numbers listed below. International customers should contact their local Teledyne Isco agent or Teledyne Isco International Customer Service.

Return Authorization

A return authorization number must be issued prior to shipping. Following authorization, Teledyne Isco will pay for surface transportation (excluding packing/crating) both ways for 30 days from the beginning of the warranty period. After 30 days, expense for warranty shipments will be the responsibility of the customer.

Shipping Address: Teledyne Isco, Inc. - Attention Repair Service
4700 Superior Street
Lincoln NE 68504 USA

Mailing address: Teledyne Isco, Inc.
PO Box 82531
Lincoln NE 68501 USA

Phone: Repair service: (800)775-2965 (lab instruments)
(800)228-4373 (samplers & flow meters)
Sales & General Information (800)228-4373 (USA & Canada)

Fax: (402) 465-3001

Email: iscoservice@teledyne.com   **Web site:** www.isco.com

February 1, 2006 P/N 60-1002-040 Rev C

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