

2103 LTE/Gi Modem Module

Installation and Operation Guide



Part #69-2003-637 of Assembly #60-2004-637
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Foreword - Water and Wastewater Products

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 a problem persists, call or e-mail Teledyne ISCO technical support for assistance. Simple difficulties can often be diagnosed over the phone. For faster service, please have your serial number ready.

If it is necessary to return the equipment to the factory for service, please follow the shipping instructions provided by technical support, including the use of the Return Merchandise Authorization (RMA) 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

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(402) 464-0231 (Outside North America)

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Technical Support

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Email: iscowatersupport@Teledyne.com

Return equipment to: 4700 Superior Street, Lincoln, NE 68504-1398

Other Correspondence

Mail to: P.O. Box 82531, Lincoln, NE 68501-2531

Warranty and Operation Manuals can be found on our website at:

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2103 Modem Module

Table of Contents

Section 1 Introduction

1.1 Product Description	1-1
1.2 2103 LTE/Gi Module Components	1-2
1.3 Battery Module Components	1-4
1.4 Technical Specifications	1-6
1.5 Safety Symbols and Hazard Alerts	1-9
1.6 Technical Service	1-9

Section 2 Preparation and Installation

2.1 Unpacking Instructions	2-1
2.2 System Power	2-2
2.3 Installation Preparation	2-3
2.3.1 Latches - Locking and Unlocking	2-3
2.3.2 Communication Connectors	2-5
2.3.3 Installing the Batteries	2-6
2.4 Stacking Modules	2-7
2.5 Connecting to Flowlink	2-8
2.6 Modem Site Connection	2-12
2.7 Power Conservation (cellular modules)	2-14
2.8 Setting Up Text Alarms (cellular modules)	2-16
2.9 Pushed Data Capability (cellular modules)	2-18

Section 3 2103 LTE Cellular Modem Module

3.1 Overview	3-1
3.1.1 Data Retrieval	3-1
3.1.2 Text Messaging	3-1
3.1.3 Stacking / Compatibility	3-1
3.2 SIM Card	3-2
3.3 Magnetic Mount Antenna	3-4
3.3.1 Antenna Placement	3-4
3.3.2 Modem Frequency Bands	3-5

Section 4 2103Gi Cellular Modem Module

4.1 Overview	4-1
4.1.1 Data Retrieval	4-1
4.1.2 Text Messaging	4-1
4.1.3 Stacking / Compatibility	4-1
4.2 SIM Card	4-1
4.3 Antenna Options	4-4
4.3.1 Magnetic Mount Antenna	4-4
4.3.2 In-Street Antenna	4-4
4.3.3 Manhole Lid-Mount Antenna	4-5

Section 5 Modbus Protocol

5.1 Introduction	5-1
5.2 Operation	5-1
5.2.1 Establishing Communication	5-2
5.2.2 Module Addressing	5-2
5.3 Configurations	5-3
5.4 Glossary of Terms	5-4
5.5 Common Acronyms	5-5
5.6 Register Specifications - 2100 Output	5-5
5.6.1 Register Addresses	5-6

Section 6 Maintenance

6.1 Overview	6-1
6.1.1 Cleaning	6-1
6.2 Desiccant	6-1
6.2.1 Replacing the Desiccant	6-2
6.2.2 Reactivating the Desiccant	6-2
6.3 Hydrophobic Filter	6-3
6.4 O-Rings	6-3
6.5 How to Obtain Service	6-3

Appendix A Replacement Parts List

A.1 Replacement Parts Diagrams and Listings	A-1
A.2 2103 LTE/Gi Module	A-2
A.3 LTE Magnetic Mount Antenna	A-6
A.4 2103 LTE/Gi Buried Antenna	A-8
A.5 2191 Battery Module	A-10

Appendix B Accessories

B.1 How to Order	B-1
B.2 General Accessories	B-1

Appendix C Material Safety Data Sheets

C.1 Overview	C-1
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List of Figures

1-1 2103 LTE/Gi Components - top view	1-2
1-2 2103 LTE/Gi Components - bottom view	1-3
1-3 Battery module components, top view	1-4
1-4 Battery Module Components, Bottom View	1-5
1-5 2103 LTE/Gi Communication connector pins	1-7
1-6 Specification drawing: 2103 LTE/Gi Cellular module	1-7
1-7 Specification drawing: 2103 LTE/Gi with 2191 battery module	1-8
2-1 Unlocking the latch	2-4
2-2 Locking the latch	2-4
2-3 Loading the 2191 Battery module	2-6
2-4 Unlock latch and stow the cap	2-7
2-5 Aligning the modules	2-7
2-6 Flowlink connect screen	2-8
2-7 Site resolution screen	2-9
2-8 Site Information screen	2-10

2-9	Devices screen - connected to site	2-11
2-10	Modem screen - configuring the cellular modem	2-12
2-11	Devices screen - configuring for Serial-Over-IP communication	2-13
2-12	Wireless power control window with no program scheduled	2-14
2-13	Wireless power control window with legacy configuration	2-15
2-14	Setting up text messaging and alarm conditions	2-16
2-15	Data tab	2-18
3-1	Types of SIM cards	3-2
3-2	Accessing the SIM card on the bottom of the module	3-2
3-3	SIM card extender and Micro SIM adapter	3-3
3-4	Inserting the SIM card	3-3
3-5	SIM card placed	3-3
3-6	Using the Micro SIM adapter	3-4
3-7	Micro SIM adapter inserted into the extender	3-4
3-8	2103Ci and LTE magnetic mount antenna	3-5
4-1	Types of SIM cards	4-2
4-2	Accessing the SIM card on the bottom of the module	4-2
4-3	SIM card extender and Micro SIM adapter	4-3
4-4	Inserting the SIM card	4-3
4-5	SIM card placed	4-3
4-6	Using the Micro SIM adapter	4-4
4-7	Micro SIM adapter inserted into the extender	4-4
4-8	2103Gi magnetic mount antenna	4-5
4-9	Buried-in-street antenna	4-5
4-10	Manhole lid-mount antenna	4-6
4-11	Manhole lid-mount antenna: Installation	4-6
5-1	Configuration example (direct connection shown)	5-3

List of Tables

1-1	2103 LTE/Gi Modem Modules Components - Top View	1-2
1-2	2103 LTE/Gi Modem Module Components - Bottom View	1-3
1-3	Battery Module Components - Top View	1-4
1-4	Battery Module Components - Bottom View	1-5
1-5	2103 LTE/Gi Modem Modules Technical Specifications	1-6
1-6	Specifications – 2191 Battery Module	1-6
1-7	2103 LTE/Gi Communication Connector Pins	1-7
2-1	Voltage Specifications for 2100 System Components	2-2

2103 LTE/Gi Modem Modules

Section 1 Introduction

This instruction manual is designed to help you gain a thorough understanding of the operation of the 2103 LTE, and 2103Gi Modem Modules. Teledyne ISCO recommends that you read this manual completely before placing the equipment into service.

Information in this manual pertains to the 2103 LTE/Gi cellular modem modules. Specific differences between the modules are identified wherever they occur.

Part numbers for ordering associated equipment and accessories can be found in Appendices A and B, near the end of this manual.

1.1 Product Description

The 2103 LTE/Gi Modems are a data communications unit designed to transmit data from ISCO's 2100 Series flow modules, which measure parameters of open channel flow streams. It works in conjunction with ISCO's *Flowlink* software.

The 2103 LTE/Gi Modems can be located anywhere within a stack of up to three other 2100 Series networked modules, using the same locking mechanism that connects the 2100 Series modules to each other. The 2103 LTE/Gi are compatible with ISCO's 2150 Area Velocity flow module, 2110 Ultrasonic flow module, 2160 LaserFlow module, 2101 Field Wizard, and 2102 wireless module. It is powered by ISCO's 2191 battery module.

All enclosures are rated NEMA 4X, 6P(IP68). The permanently sealed enclosures are designed to meet the environmental demands of many sewer flow monitoring applications. All connections between modules, sensors, and communication cables lock in place. The locking mechanisms strongly secure the components and ensure a watertight seal.

1.2 2103 LTE/Gi Module Components

Figures 1-1 and 1-2 identify the key components of the 2103 LTE/Gi Modem Module.

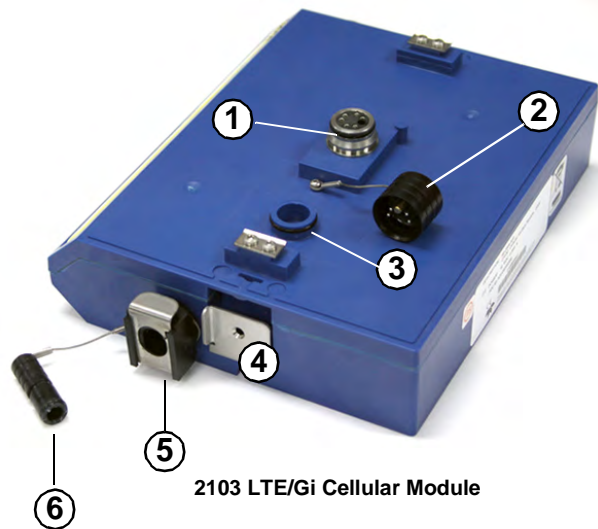


Figure 1-1 2103 LTE/Gi Components - top view

Table 1-1 2103 LTE/Gi Modem Modules Components - Top View		
Item No.	Name	Description
1	Communication Connector	This port is used to connect other modules in a stack, or to a computer using an RS232 cable.
2	Connector Cap	Install on the communication connector when it is not in use to protect the connector from moisture damage. When the connector is in use, store the connector cap on the cap holder.
3	Cap Holder	Stores the connector cap when the communication connector is in use.
4	Latch Release	Push in to unlock the module from a stack.
5	Antenna Cable Connector (2103 LTE/Gi)	Used to connect the modem to the magnetic mount antenna.
6	Antenna Cable Connector Plug (2103 LTE/Gi)	Insert into the antenna cable connector when the connector is not in use to protect it from damage.

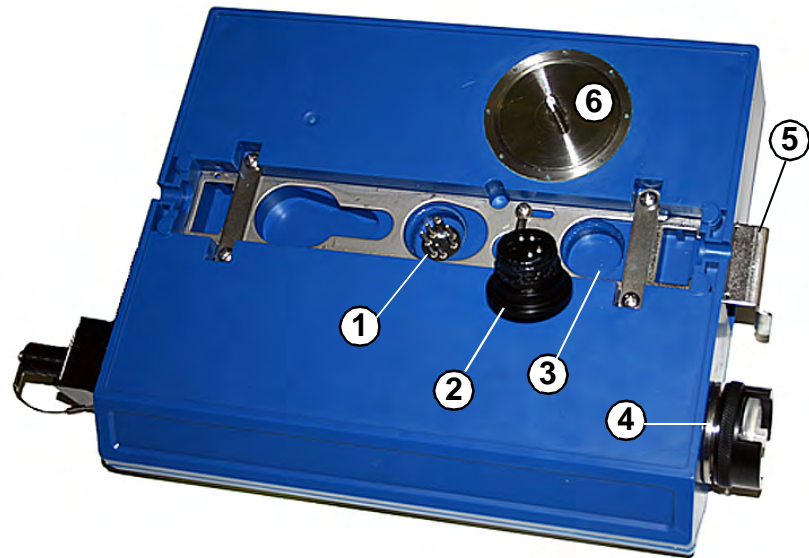


Figure 1-2 2103 LTE/Gi Components - bottom view

Table 1-2 2103 LTE/Gi Modem Module Components - Bottom View		
Item No.	Name	Description
1	Communication and Power Connector	This connects the 2103LTE/Gi to other 2100 Series modules in the stack and is used to transfer data and/or receive power.
2	Connector Plug	Insert into the communication connector when not in use to protect the connector from moisture damage. When the connector is in use, store the connector cap in the cap holder.
3	Plug Holder	Stores the connector plug when the communication connector is in use.
4	Desiccant Cartridge and Hydrophobic Filter	Prevents moisture from entering the unit.
5	Latch	Push in to lock the module in a stack.
6	SIM Card Compartment Cover	Remove this cover to access the SIM card for replacement (see Section 3 or 4).

1.3 Battery Module Components

Figures 1-3 and 1-4 identify key components of the 2191 Battery Module.

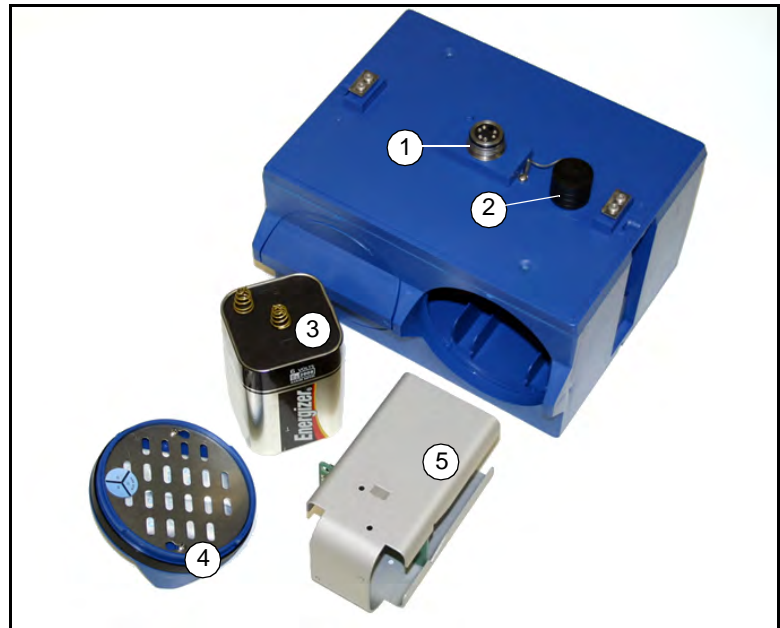


Figure 1-3 Battery module components, top view

Table 1-3 Battery Module Components - Top View		
Item No.	Name	Description
1	Communication Connector	Connects the modules in the stack, transfers power and data.
2	Connector Cap (Stowed on Cap Holder)	Insert into the communication connector when not in use to protect the connector from moisture damage. When the connector is in use, store the connector cap on the cap holder.
3	Lantern Battery (Alkaline shown)	6V alkaline or rechargeable lead-acid battery, quantity of 2.
4	Door	Two circular doors contain the desiccant bags, hold the battery carriers in place, and seal the module case.
5	Battery Carrier	Holds batteries in place and transfers power to the connectors.

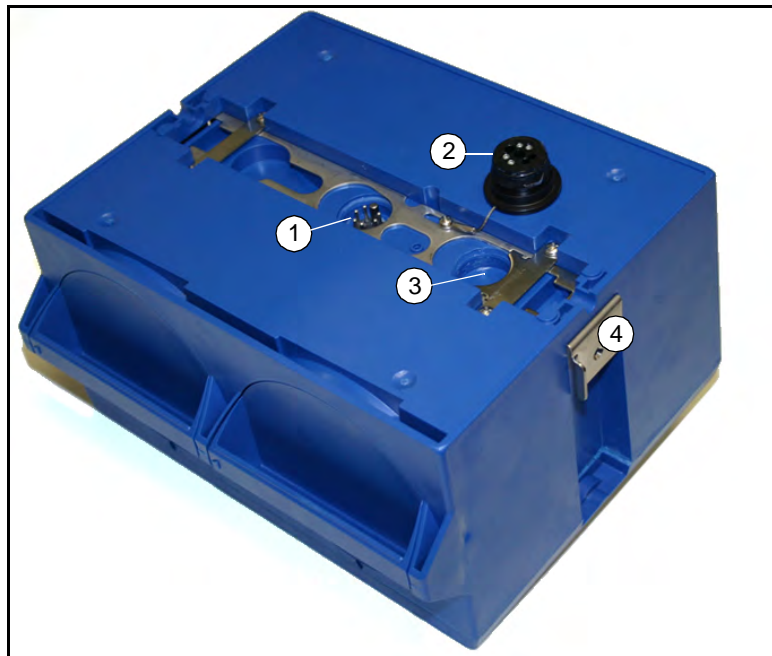


Figure 1-4 Battery Module Components, Bottom View

Table 1-4 Battery Module Components - Bottom View		
Item No.	Name	Description
1	Communication Connector	Connects the modules in the stack, transfers power and data.
2	Connector Plug	Insert into the communication connector when not in use to protect the connector from moisture damage. When the connector is in use, store the connector cap in the cap holder.
3	Plug Holder	Stores the connector plug when the communication connector is in use.
4	Latch	Push in to lock the module in a stack.

1.4 Technical Specifications

Technical specifications for the 2103 LTE/Gi Modem Modules are given in Table 1-5. Technical specifications for the 2191 Battery Module are given in Table 1-6.

Following the specification tables are dimensional drawings to assist in planning your installation.

Table 1-5 2103 LTE/Gi Modem Modules Technical Specifications

Dimensions (H x W x D)	2.9 x 10.5 x 7.5 in.	7.4 x 26.7 x 19.1 cm
Weight	2 lbs. (.9 Kg)	
Material	High-impact molded polystyrene	
Enclosure	NEMA 4X, 6P, IP68	
Power	6.6 to 16.6 VDC, 141 mA typical at 12 VDC, 0.41 mA standby	
Operating Temperature	-4° to 140°F (-20° to 60°C)	
Storage Temperature	-40° to 140°F (-40° to 60°C)	
Typical Battery Life	Up to 254 days*	
Serial Port Communication Speeds (not phone or modem)	Up to 38,400 bps	
Optional Cellular Communication	Serial Over IP (SOIP): LTE (2103 LTE), HPSA+ (2103Gi)	
Error Correction Standards Supported	V.42 LAPM, MNP-2, MNP-4, MNP-10	
Data Compression Standards Supported	V.42 bis, MNP-5	
* Actual battery life will vary depending upon configuration. The figure given assumes interrogation with Flowlink once a week, with a site configuration of a 2103 LTE/Gi, 2150, and 2191 (using 6 volt 25 Ah alkaline lantern batteries) and a connection speed of 33600 baud. The 2150 was configured to record level, velocity, flow rate every 15 minutes, total flow, and battery voltage every 24 hours.		

Table 1-6 Specifications – 2191 Battery Module

Dimensions (H x W x D)	6.0 x 9.6 x 7.5 in.	15.2 x 24.4 x 19.1 cm
Weight (<i>without batteries</i>)	3.2 lbs.	1.4 kg
Materials	ABS plastic, stainless steel	
Enclosure (<i>self-certified</i>)	NEMA 4X, 6P	IP68
Batteries	6V alkaline lantern or lead-acid lantern, quantity 2	
Capacity		
Alkaline Lantern Batteries	25 Ahrs	
Lead-acid Lantern Batteries	5 Ahrs	

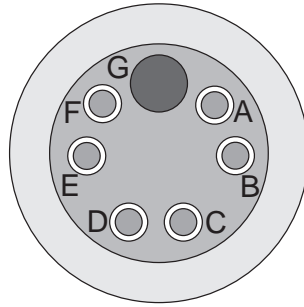


Table 1-7 2103 LTE/Gi Communication Connector Pins		
Pin	Name	Description
A	LONA	Neuron differential transceiver Data A
B	LONB	Neuron differential transceiver Data B
C	VIN+	Positive power supply voltage input (+12 VDC nominal)
D	VIN-	Negative power supply voltage input (0 VDC nominal)
E	RCVUP	PC data receiver inverted input
F	XMTUP	PC data transmit inverted output
G	Key	Aligns connector pins

Figure 1-5 2103 LTE/Gi Communication connector pins

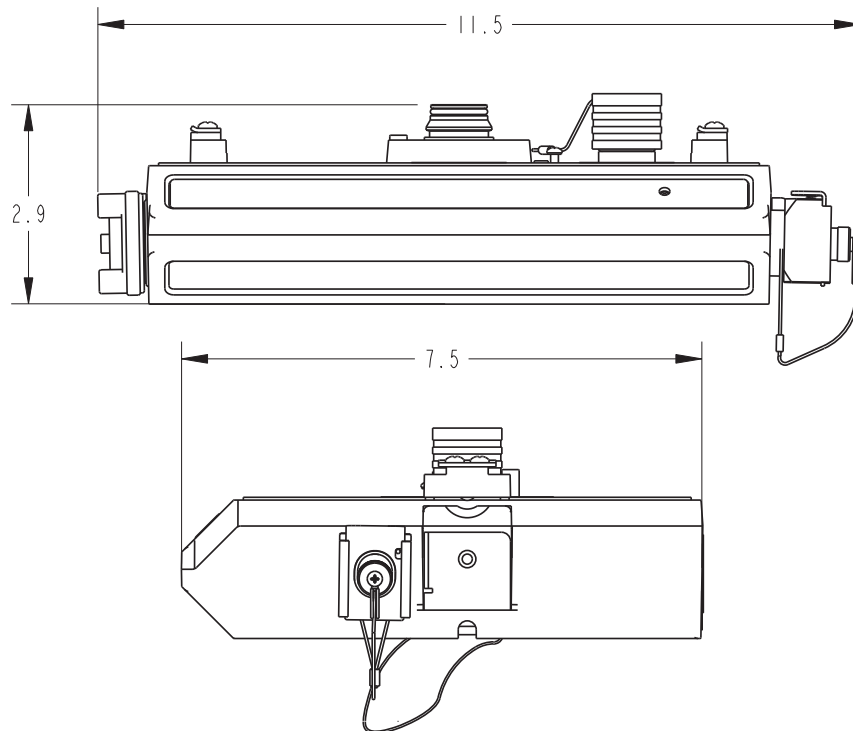


Figure 1-6 Specification drawing: 2103 LTE/Gi Cellular module

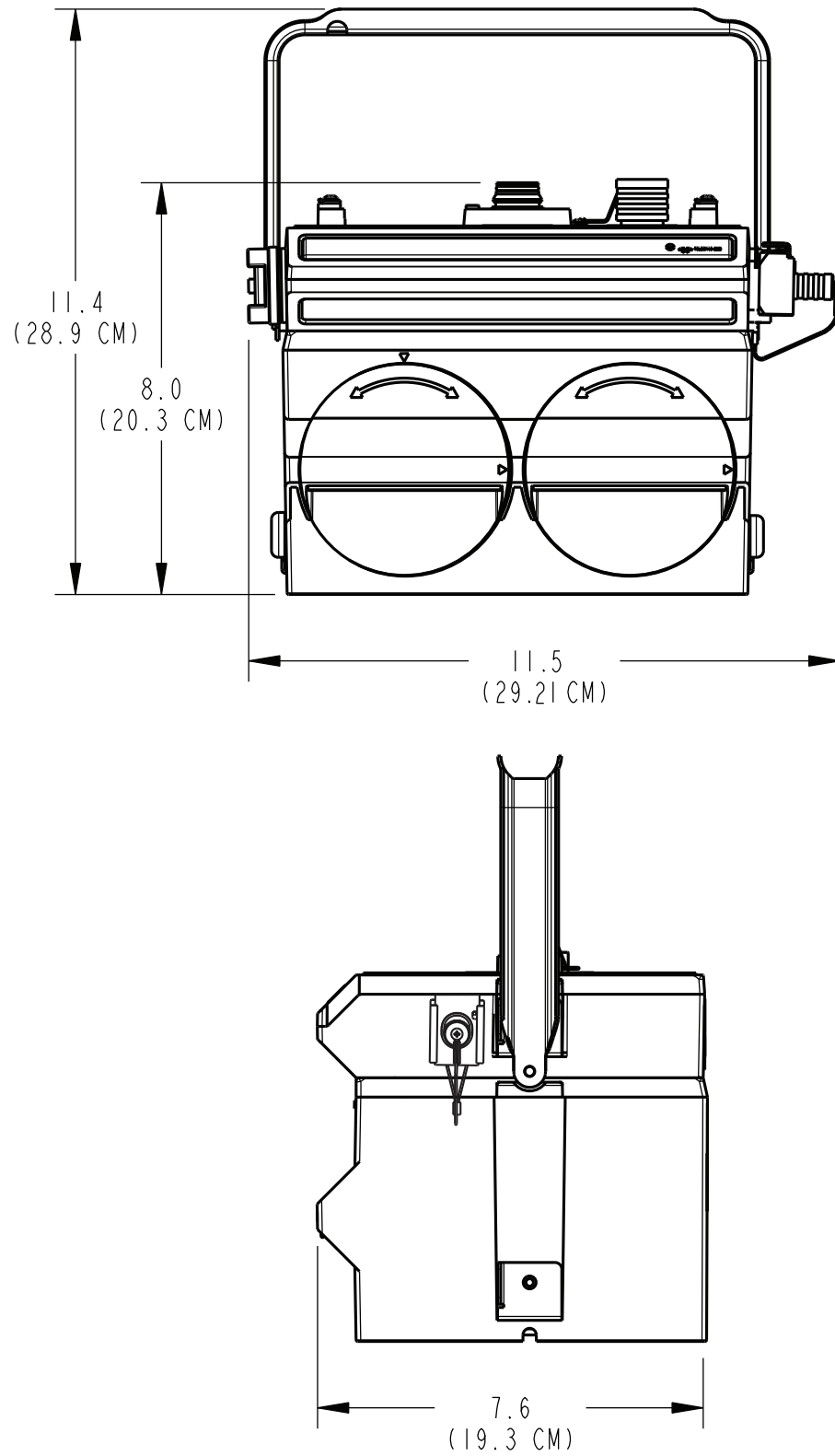


Figure 1-7 Specification drawing: 2103 LTE/Gi with 2191 battery module

1.5 Safety Symbols and Hazard Alerts



This icon identifies a general hazard and is accompanied with details about the hazard. The instruction manual identifies the hazardous condition and any steps necessary to correct the condition. The manual presents this information in one of two ways:

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 indicate potentially hazardous conditions. If you do not avoid these risks, they could cause you death or serious injury.

1.6 Technical Service

Although Teledyne ISCO designs reliability into all of its equipment, you can use this manual to help in diagnosing and resolving many issues. If a problem persists, call or write the Teledyne ISCO Technical Service Department for assistance:

Teledyne ISCO
Technical Service Department
P.O. Box 82531
Lincoln, NE 68501
866-298-6174 or 402-464-0231
FAX: 402-465-3001
e-mail: IscoService@teledyne.com

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 Technical 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.

2103 LTE/Gi Modem Module

Section 2 Preparation and Installation

2.1 Unpacking Instructions

When the system arrives, inspect the contents for any damage. If there is damage, contact the delivery company and Teledyne ISCO (or its agent) 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.

Teledyne ISCO
Customer Service Dept.
4700 Superior St
Lincoln, NE 68504-1394 USA

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

FAX: (402) 465-3022

E-mail: iscowatersupport@Teledyne.com

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. In addition to the main packing list, there may be other packing lists for various sub-components.

It is recommended that you retain the shipping cartons as they can be used to ship the unit in the event that it is necessary to transport the system.

Please complete the registration card and return it to Teledyne ISCO.

2.2 System Power

Table 2-1 lists the maximum voltages for all ISCO 2100 instrumentation. Regardless of the capabilities of other components, **never** attempt to connect a module or cable to a system using a power source that exceeds its stated operating range.

Table 2-1 Voltage Specifications for 2100 System Components			
Module or Cable	Earlier Voltage Range	Current Voltage Range	Date of Change
2160	N/A	7-16.6 VDC	N/A
2150	7-16.6 VDC	7-26 VDC	March 2005
2110	7-16.6 VDC		N/A
2101			
2103 LTE.Gi			
2102			
2108	10.2-16.6 VDC		N/A
2105	7-26 VDC		
2105	7-26 VDC		
RS-232 DB9 Cable	7-16.6 VDC	7-26 VDC	January 2009
RS-232 USB Cable	7-26 VDC		N/A
Sampler Interface Cable	12VDC (from sampler)		N/A (Cable is powered from sampler.)

 **WARNING**

Injury and/or equipment damage can result from connecting modules or cables to a power source exceeding the specified operating voltage range. Check labeling on all modules and cables for voltage ranges.

 **Note**

All connected system components should share a common supply ground.

2.3 Installation Preparation

The 2100 Series components are often installed in confined spaces. Some examples of confined spaces include manholes, pipelines, digesters, and storage tanks. These spaces may become hazardous environments that can prove fatal for those unprepared. These spaces are governed by OSHA 1910.146 and require a permit before entering.

 **WARNING**

Avoid hazardous practices! If you use these instruments in any way not specified in this manual, the protection provided by the instruments may be impaired; this will increase your risk of injury.

 **WARNING**

The installation and use of this product may subject you to hazardous working conditions that can cause you serious or fatal injuries. Take any necessary precautions before entering a worksite. Install and operate this product in accordance with all applicable safety and health regulations, and local ordinances.

Follow the instructions below to install your 2103 LTE/Gi modules.

2.3.1 Latches - Locking and Unlocking

Latches must be operated to stack and unstack the modules, and to gain access to the vent screw. The latch is normally locked, but you must unlock it to install the module on top of another module in a stack.

To unlock the latch, push in the latch release on the connector side of the module (Figure 2-1).

To lock the latch, push in the latch on the desiccant side of the module (Figure 2-2).

 **CAUTION**

The latch can be damaged by applying too much force. Never press on both sides at the same time. Do not force the latch if it is obstructed. While some degree of pressure must be applied to slide the latch, the ends of the latches should never be bent.



Figure 2-1 Unlocking the latch

Latches will “click” when they are fully locked and unlocked.

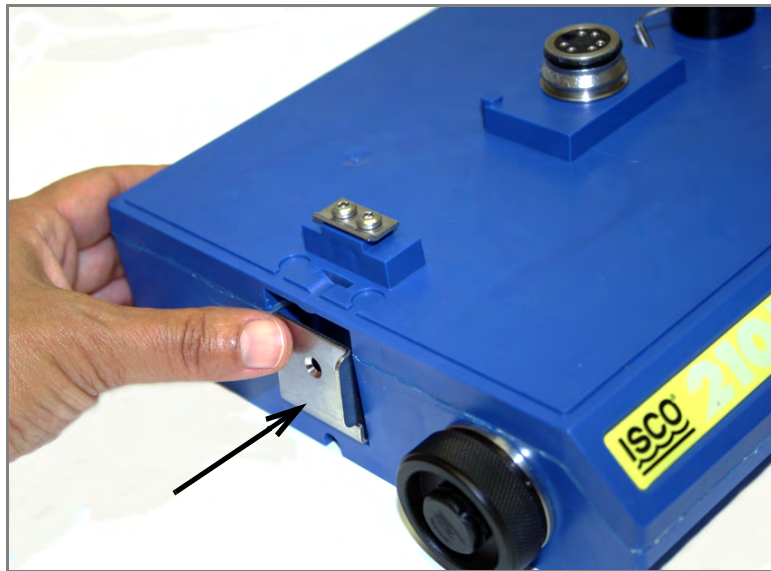


Figure 2-2 Locking the latch

2.3.2 Communication Connectors

When a communication connector is not in use, the connector should always be capped. The cap seals the connector to prevent corrosion, prevent moisture from entering the unit, and improve communications.

When a communication connector is in use, store the cap on the holder next to the connector. The communication connector will be sealed by its mating connector.

 **CAUTION**

Caps **PUSH ON** and **PULL OFF**. Do not rotate the caps to remove them from the connectors.

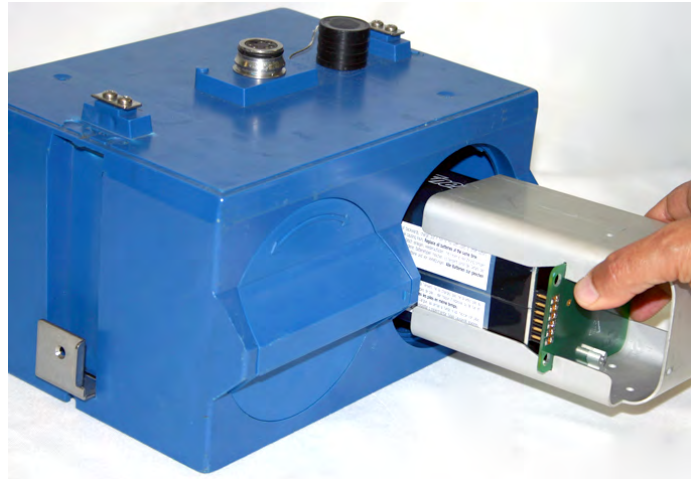
 **Note**

For modules to correctly stack and lock together, protective caps between the modules must be stored on the holders.

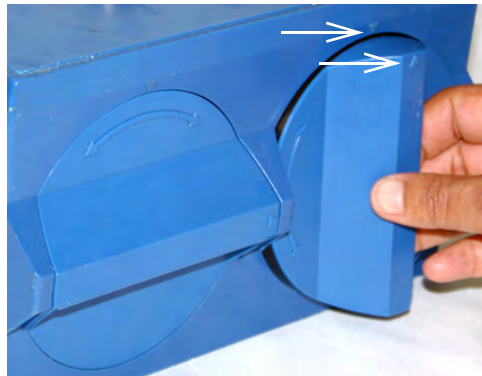
- 2.3.3 Installing the Batteries** The 2191 battery module requires two lantern batteries. The figures below show a 6 VDC alkaline battery. Rechargeable 6 VDC lead-acid batteries are also available from Teledyne ISCO. To install the batteries, follow the instructions in Figure .2-3.



1. Load the lantern battery into the carrier.



2. Insert the carrier and battery into the module. Note the position of the carrier's connector; it must be aligned toward the center of the module.



3. Align the marks indicated and insert the door.



4. Rotate the door $\frac{1}{4}$ turn clockwise. Repeat this procedure to install the second battery.

Figure 2-3 Loading the 2191 Battery module

Note

The batteries should always be replaced as a pair. Never mix old and new batteries.

2.4 Stacking Modules

The 2103 LTE/Gi can be located anywhere within a stack of up to four 2100 Series networked modules. It will draw its power from the same source as the rest of the stack.

To connect the 2103 LTE/Gi with another 2100 Series module:

1. On the top of the 2100 Series module, remove the cap and stow it on the holder. This exposes the communication connector on the module.
2. Inspect the module's communication connector. It should be clean and dry. Damaged O-rings must be replaced.
3. If you are using the metal carrying handle, insert it between the top two modules, with the handle turned toward the rear of the stack (opposite the yellow labels).
4. Unlock the 210Ci/Gi's latch by pressing in on the latch release.
5. Underneath the 2103 LTE/Gi, remove the cap from the lower communication connector and stow it in the holder.



Figure 2-4 Unlock latch and stow the cap

6. Gently press the modules together and lock the 2103 LTE/Gi's latch (desiccant side). The red LED on the front of the unit will blink during the start-up routine to indicate the 2103 LTE/Gi is operating.

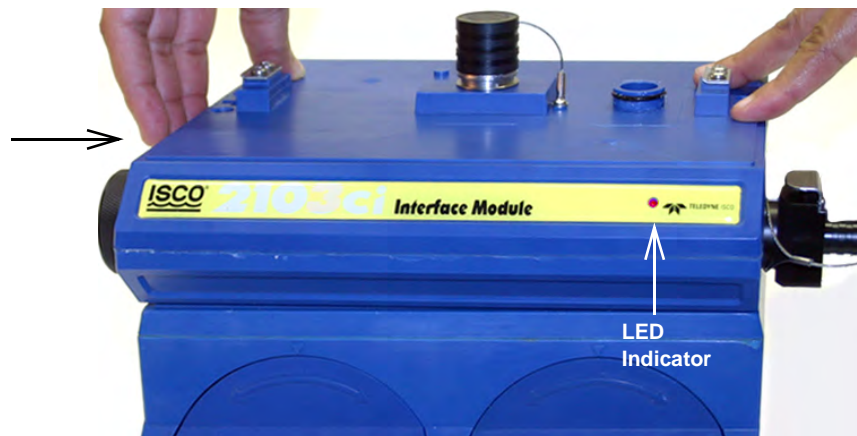


Figure 2-5 Aligning the modules

2.5 Connecting to Flowlink

Once the system is installed, you will configure it in a new or existing site using ISCO's Flowlink software.

Note

The 2103 LTE/Gi Modules require Flowlink 5.12.052 or later.

The first time you connect to the site, you must connect your computer directly to the stack using ISCO's RS232 connect cable or USB port connect cable. Open Flowlink and go to the Connect screen (Figure 2-6) by either selecting it from the pull down menu or clicking on the Quick Connect icon.

Make sure the connection Type is **Direct**, and click on the 2100 Instrument icon to connect. Upon initial connection, Flowlink creates a site file and adds it to the database. If the system detects the addition of a new module to an existing site, it will display the Site Resolution screen (Figure 2-7). Otherwise, it will display the Site Info screen (Figure 2-8).

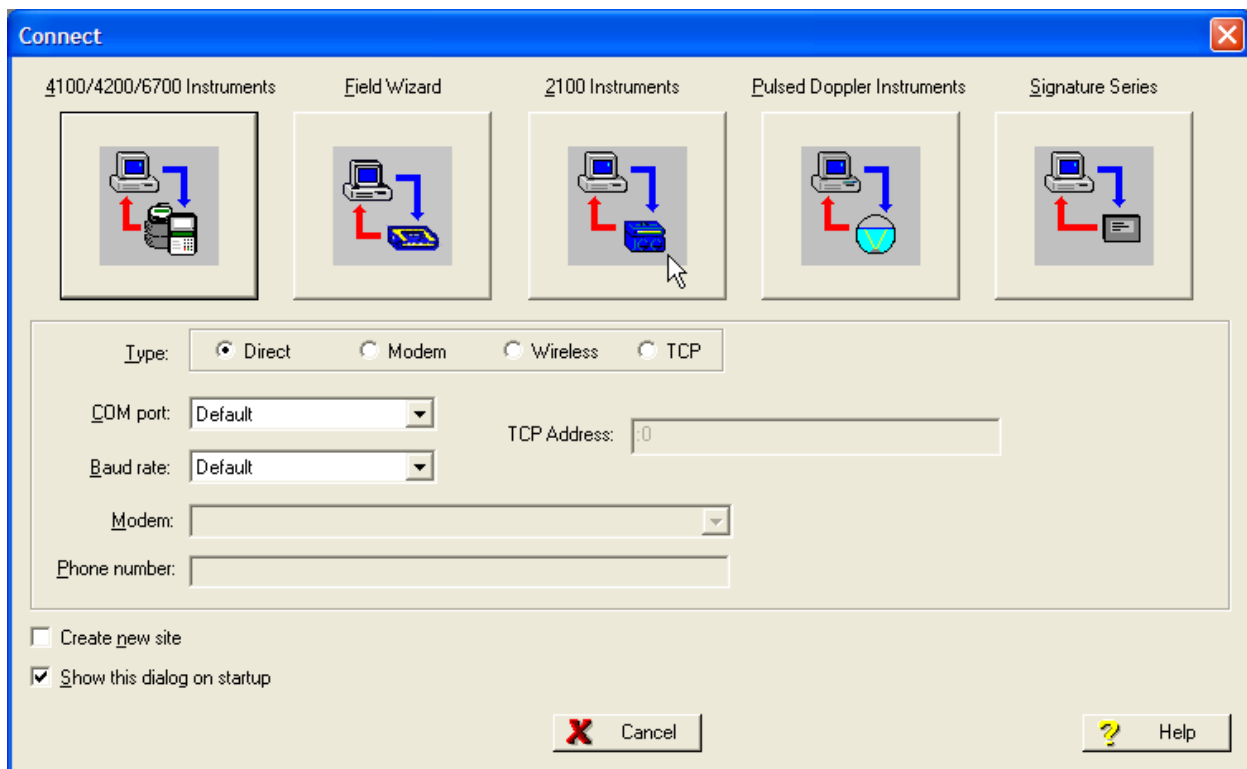


Figure 2-6 Flowlink connect screen

To add the new module to an existing site, select the appropriate site and click OK. To create a new site, select Create a New Site. Click in the name field, enter the name for the site, and click OK. Upon connection, the Site Info tab will appear.

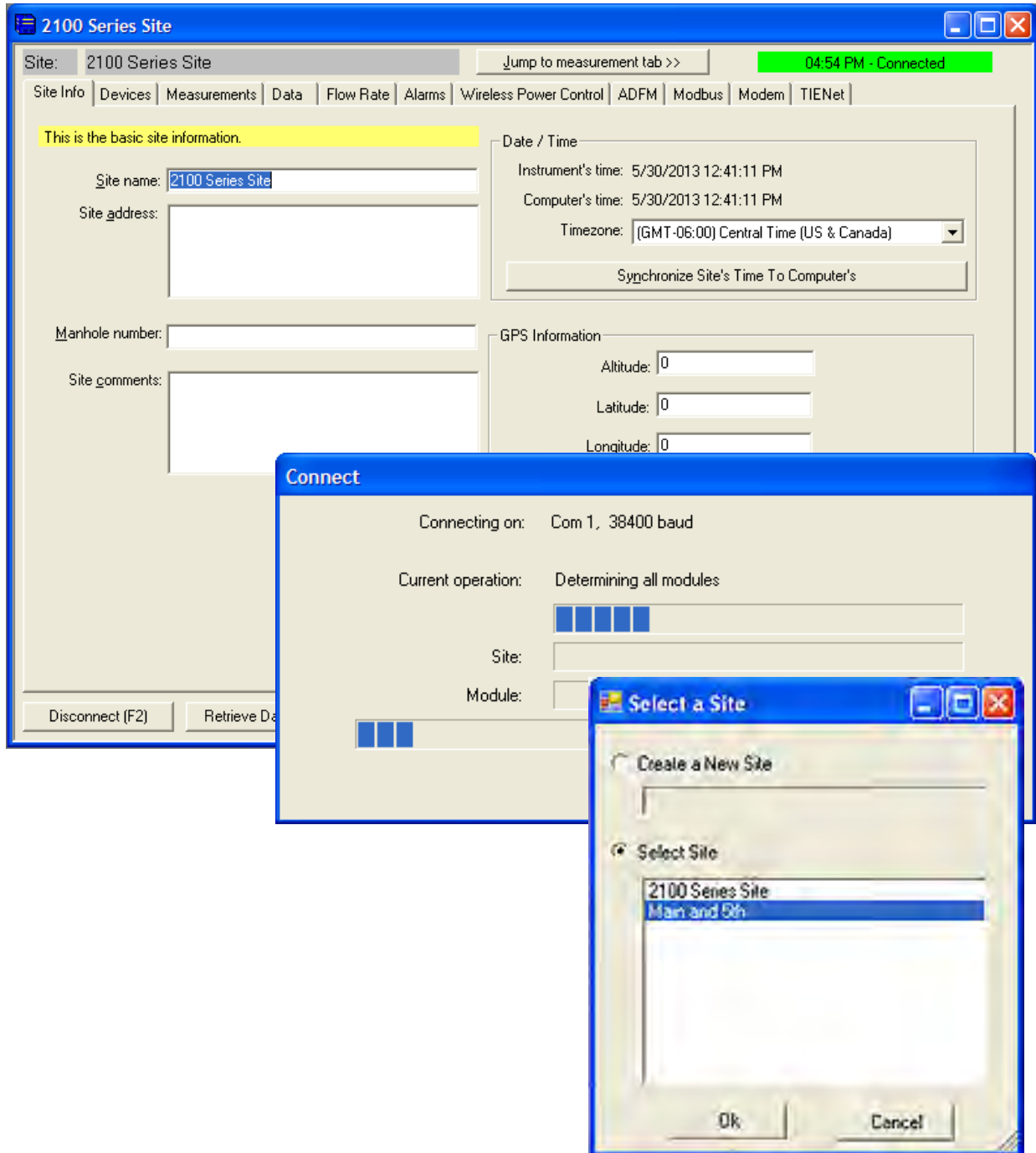


Figure 2-7 Site resolution screen

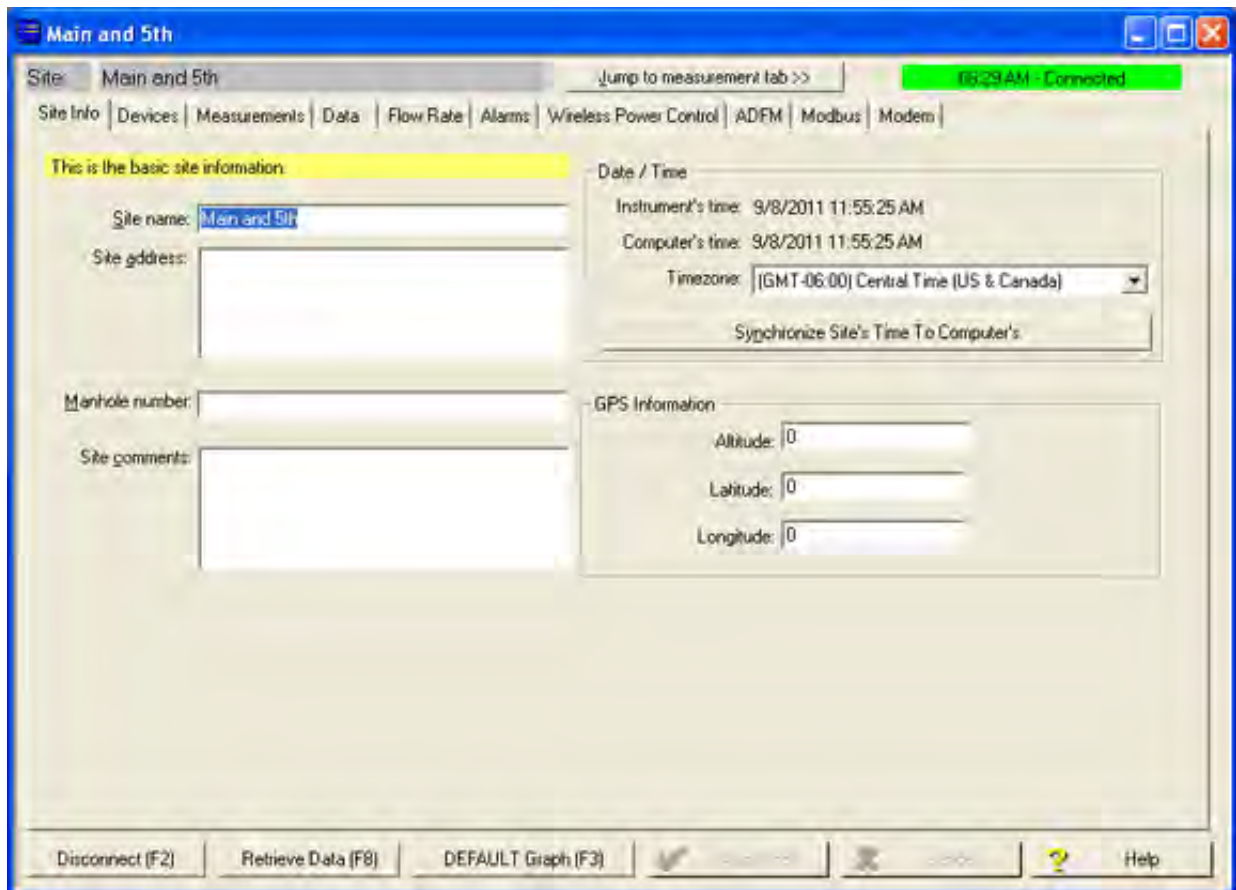


Figure 2-8 Site Information screen

When the module has been added to the system, you will see the Devices screen.

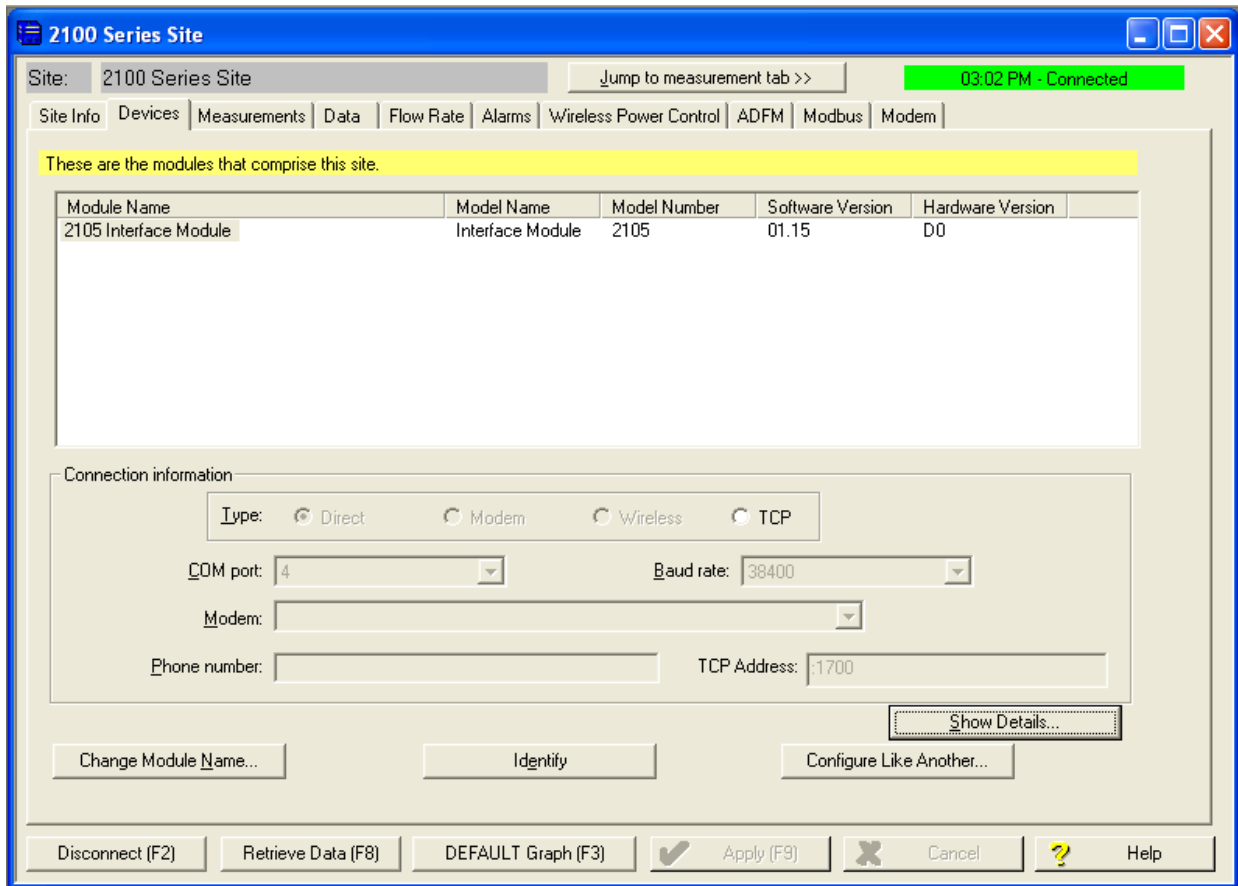


Figure 2-9 Devices screen - connected to site

This window displays all of the modules connected to the site.

2.6 Modem Site Connection

To begin using the 2103 LTE/Gi's cellular modem, you must set up the modem's operation on the **Modem** screen.

The digital cellular modem provides Serial Over IP (IP) communication. This mode of communication is much faster, and does not require analog infrastructure. Phone service with a static IP address, rather than a land line, provides efficient communication.

Note

CSD communication is being phased out by Verizon. As of July 2012, no new CSD lines can be added, and all CSD service is scheduled to end in 2014.

The default TCP port is 1700, but you can change the port number if necessary.

You must enter the Access Point Name (APN) information provided by your cellular service carrier. The Outbound box will only become active if you are using Flowlink Pro software and have set up the pushed data function (refer to *Pushed Data Capability (cellular modules)*, Section 2.9).

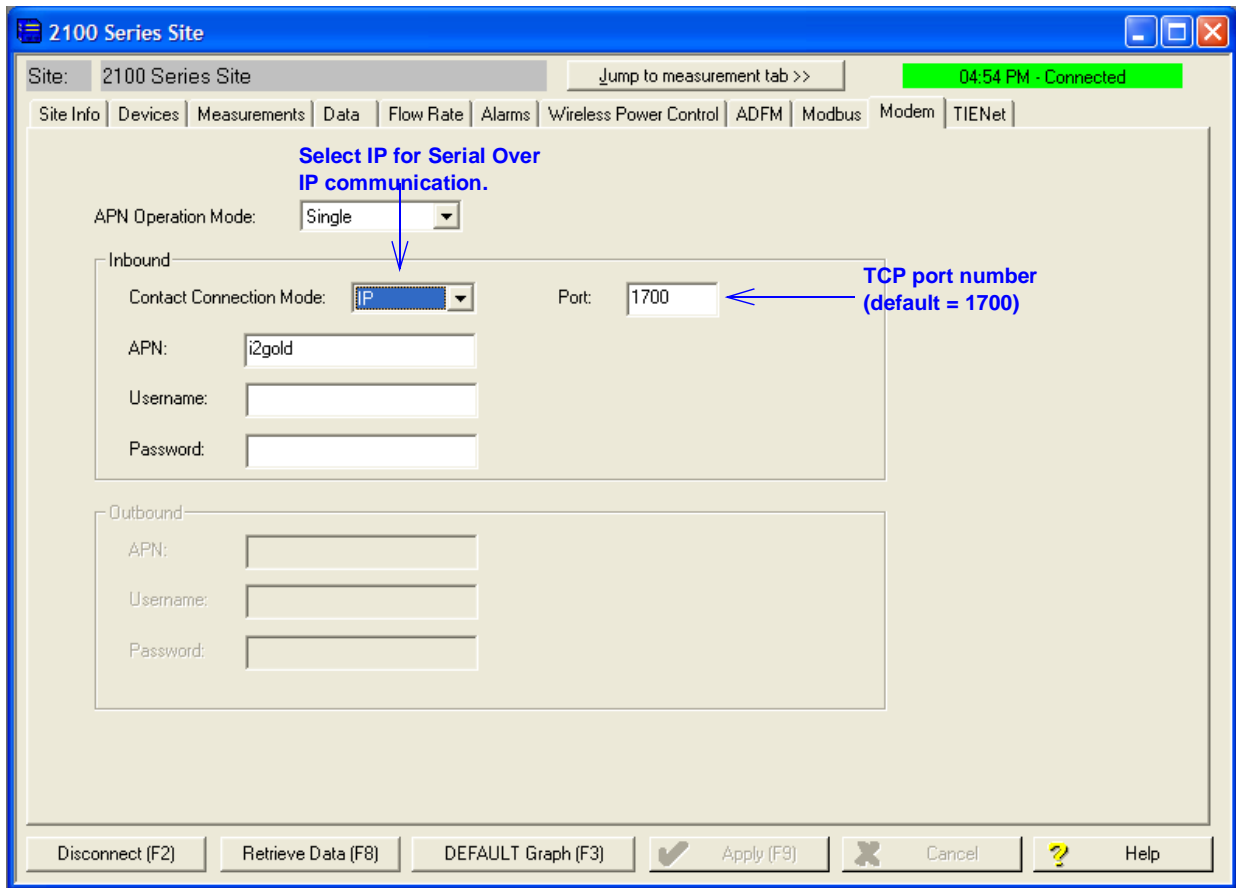


Figure 2-10 Modem screen - configuring the cellular modem

Connection Information for the site is set up on the **Devices** screen. Click the Disconnect button to activate the fields.

Serial over IP connection

To set up a serial-over-IP connection, select the “TCP” radio button on the Devices tab. In the TCP address field, to the left of the colon, enter the modem’s IP address obtained from your carrier. The default TCP port is 1700, but can be edited if necessary. Click Apply to save your settings.

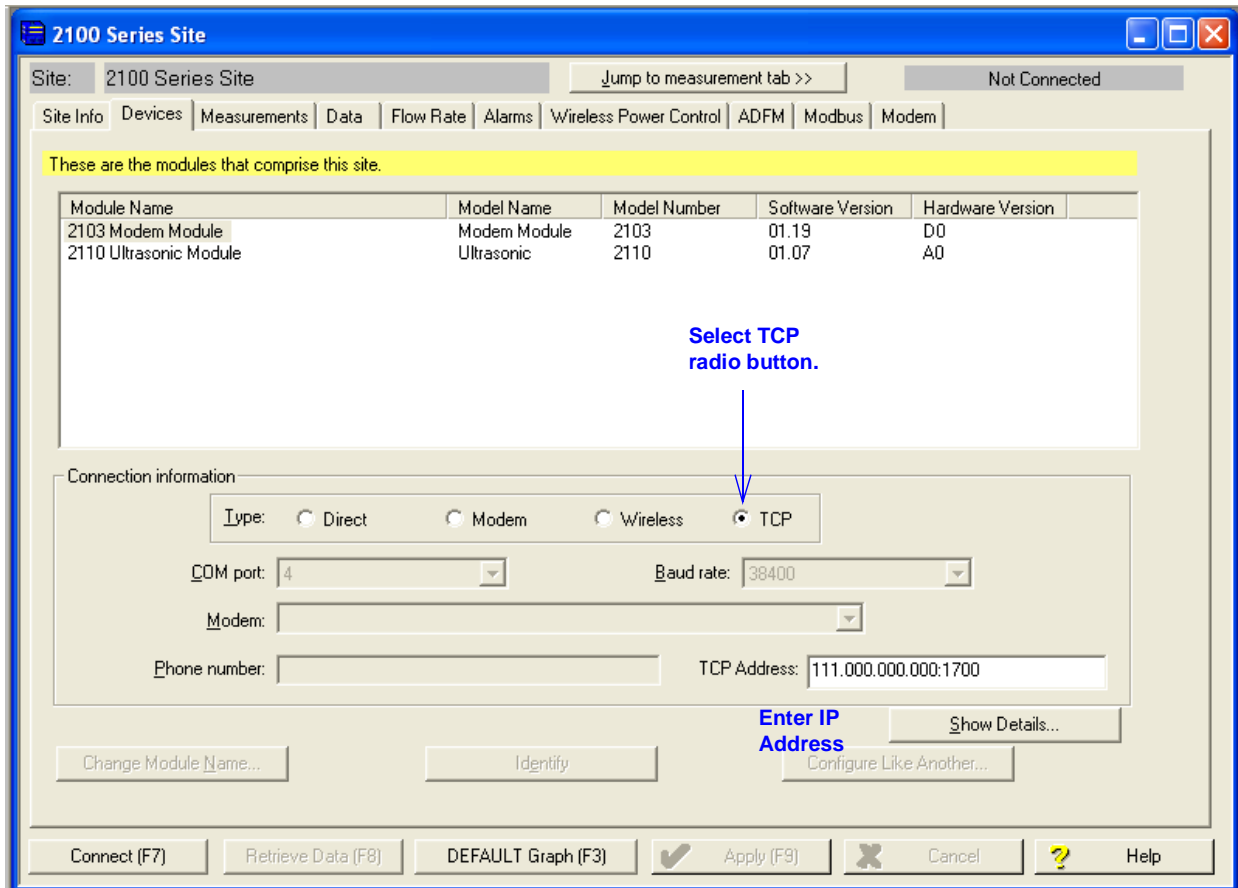


Figure 2-11 Devices screen - configuring for Serial-Over-IP communication

If your cellular service is set up and ready for use through your service provider, you can now connect to your interface module via cellular connection.

For systems using the cellular modem, a Power Control method is highly recommended to conserve battery power (refer to Section 2.7).

2.7 Power Conservation (cellular modules)

If you are using a cellular module, you may want to conserve battery power by setting up a Power Control method using the equation builder. Rather than have the internal modem continuously enabled, you can specify conditions for when it is powered up. To begin configuring the power settings, click the Wireless Power Control tab. Then click on Configure Power Control.

Note

Power Control applies only to the **internal modem**, not the module itself. However, during the specified periods when the modem is disabled, you will only be able to communicate with the module via direct connection.

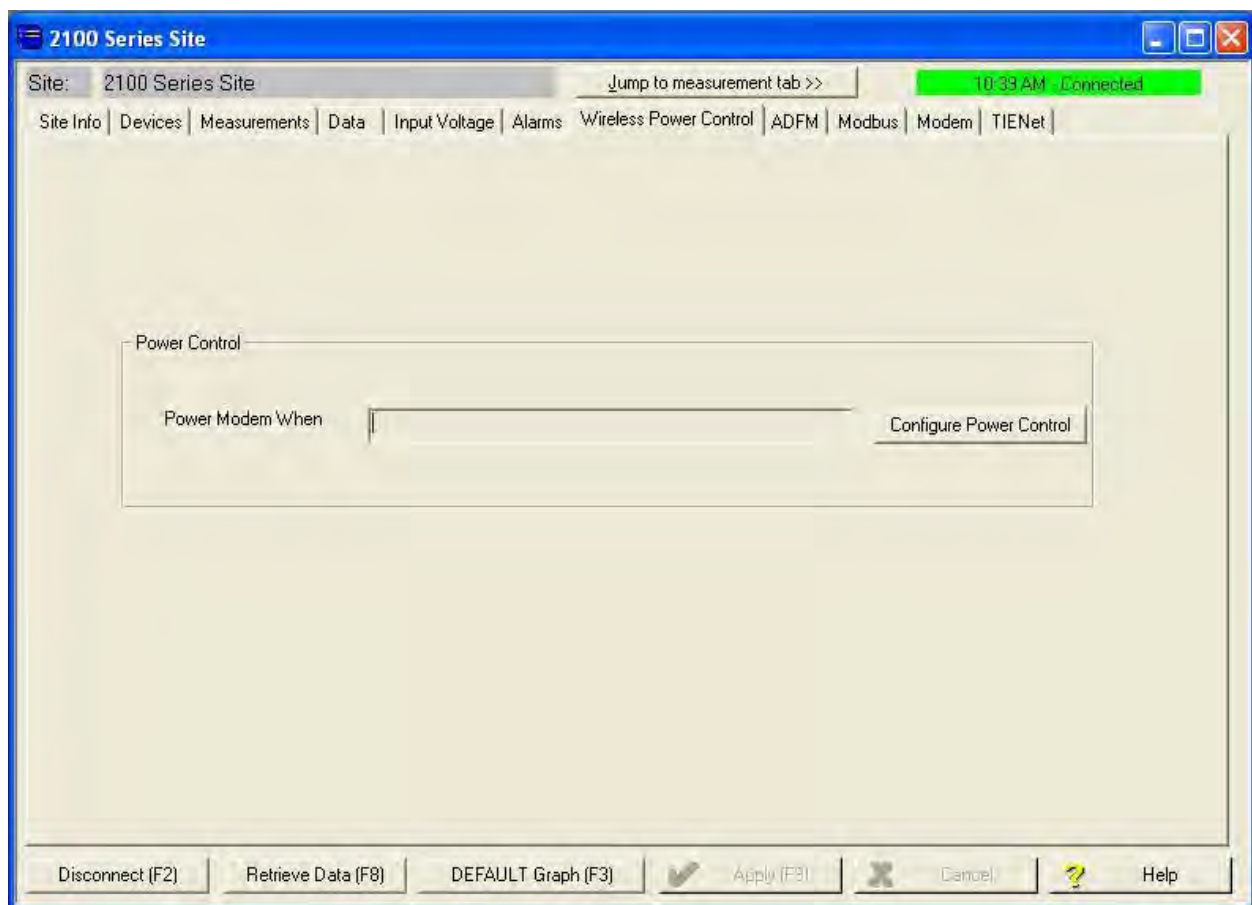


Figure 2-12 Wireless power control window with no program scheduled

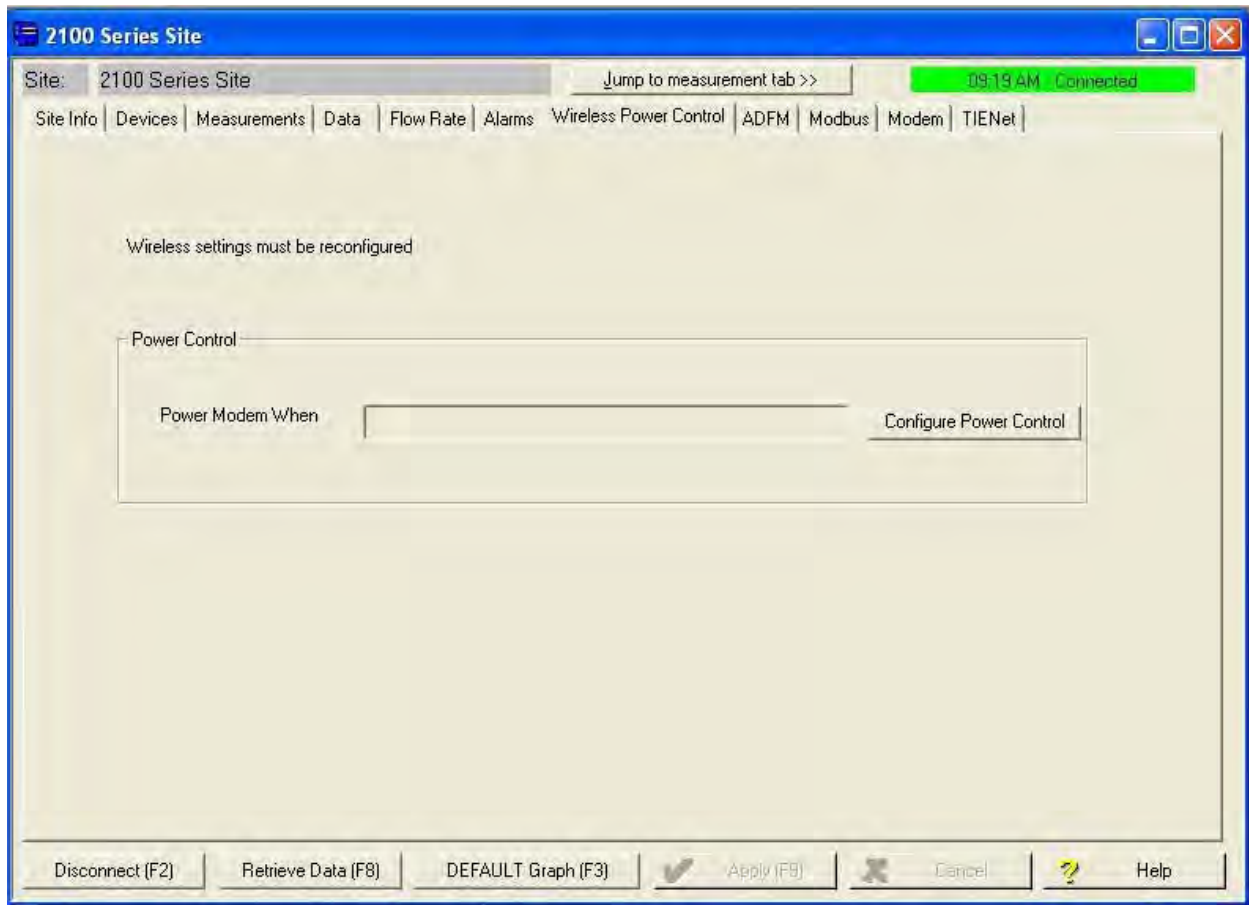


Figure 2-13 Wireless power control window with legacy configuration

2.8 Setting Up Text Alarms (cellular modules)

The 2105Ci/Gi is capable of digital text messaging to up to 5 text capable cellular phones when a programmed alarm condition occurs. To program the module for text messaging, you must have the Short Message Service (SMS) and parameter settings of your cell phones.

1. Make sure you are connected to the site, and select the Alarms tab (Figure 2-14).

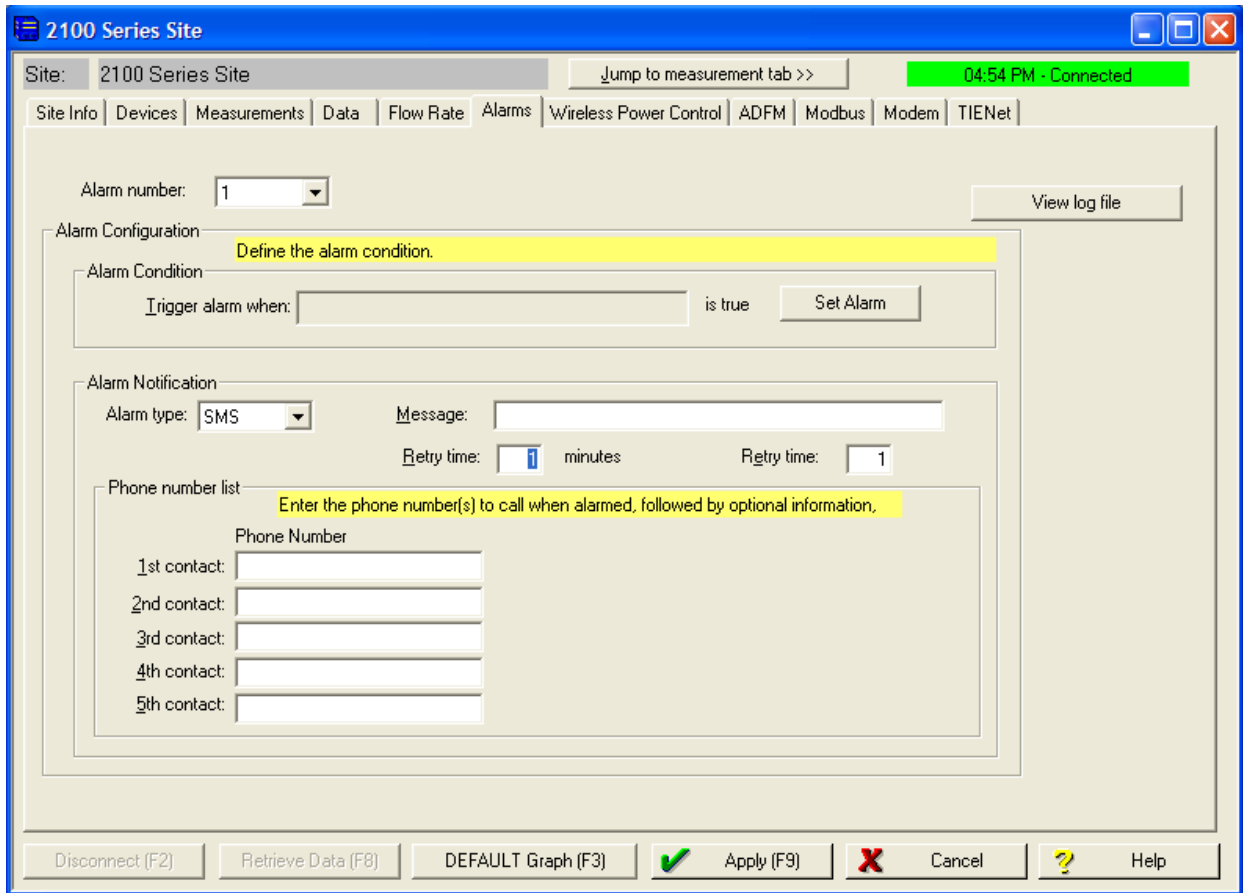


Figure 2-14 Setting up text messaging and alarm conditions

2. Under Alarm Notification, select the Alarm type SMS.

Note

The Server option (SVR) pushes the alarm to a server, which then emails the alarm message to a selected notification group. This capability requires Flowlink Pro client software. For complete information about server alarms, refer to the Flowlink Help windows or software manual.

Note

The Telocator Alphanumeric Protocol option (TAP) has been retained for legacy systems; you may be unable to obtain a number or service.

3. In the Phone Number list box, type the contact telephone numbers. These must be valid SMS phone numbers. You must enter at least one number; you can enter as many as five. When an alarm condition is triggered, the system will try calling each number in the list.
4. You must enter a message to be sent to the phone. In the field labeled Message, type the outgoing text message (maximum of 32 characters).
5. Under “Alarm condition,” select the retry number and interval, and define the alarm condition using the Equation Builder. Defined alarm conditions will appear on the pull-down list.
6. Click the Apply button or press F9 when you are done, to update the module’s settings.

2.9 Pushed Data Capability (cellular modules)

The 2103 LTE/Gi can automatically send data to a designated server running ISCO Flowlink Pro software. The user-specified primary data transmission interval (5 minutes to 24 hours) can automatically change to a secondary interval when specific site conditions occur at the monitoring site. An Oracle® or Microsoft® SQL database is required to use this feature. Contact the factory for additional information.

To use the data push capability, connect to the interface module and select the Data tab.

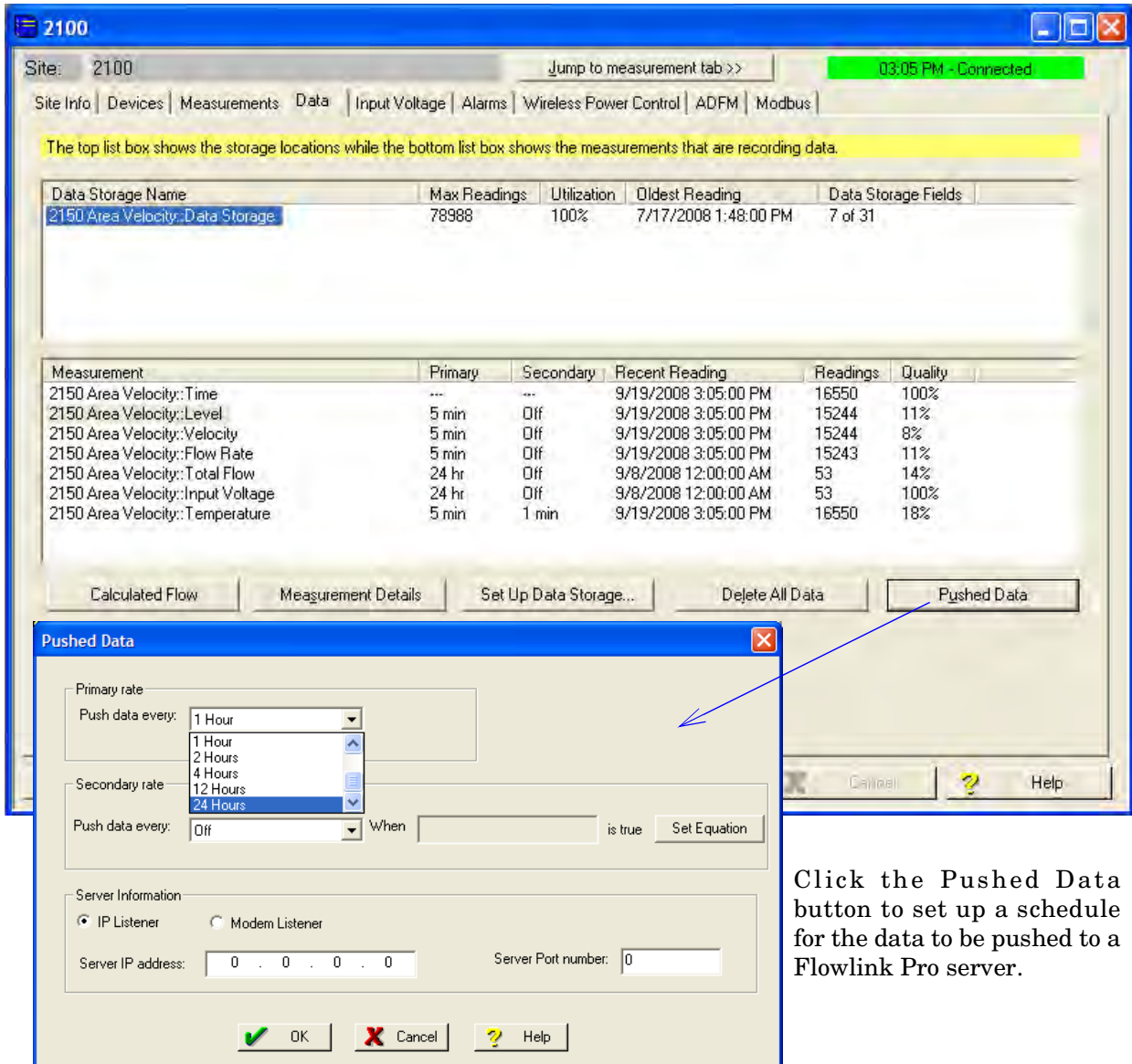


Figure 2-15 Data tab

Click the Pushed Data button to set up a schedule for the data to be pushed to a Flowlink Pro server.

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 its *Help* button or by pressing F1 on your computer's keyboard. You can also access Help topics by selecting Help from the Flowlink menu.

2103 LTE Modem Module

Section 3 2103 LTE Cellular Modem Module

3.1 Overview

The 2103 LTE Modem Module contains a cellular modem equipped with Long-Term Evolution (LTE) technology. The 2103 LTE has 4G LTE capability where this service is available.

After the module is installed, you must establish that there is a modem at the site by configuring the module via direct connection with Teledyne ISCO's Flowlink software (see Section 2.5).

3.1.1 Data Retrieval

Using a computer running Flowlink, you can call up your monitoring site to configure the flow module settings and retrieve flow data.

Detailed operating instructions are available in Flowlink in a Windows Help format, and in the flow module's Installation and Operation Guide.

3.1.2 Text Messaging

Using LTE technology, and with the appropriate Subscriber Identity Module (SIM) card, the 2103 LTE is capable of digital text messaging to up to 5 text capable cellular phones when a pre-programmed alarm condition occurs.

Consult the Flowlink Help files and manual for details on programming alarm conditions.

3.1.3 Stacking / Compatibility

The 2103 LTE can be located anywhere within a stack of 2100 Series modules, or used remotely, powered by an ISCO 2191 battery module. The 2103 LTE is compatible with Teledyne ISCO's 2150 Area Velocity flow module, 2110 Ultrasonic flow module, 2160 LaserFlow module, 2101 Field Wizard, 2102 Wireless module.

 CAUTION
--

Never use the 2103 LTE module's antenna with a 2103C module.

3.2 SIM Card

The data transmission capabilities of the 2103 LTE are dependent upon the type of service plan you have through your cell phone service provider. The service parameters, or provider, can be changed by simply replacing the SIM card in your 2103 LTE. Check with your service provider to verify what data transmission technologies are available for your use. There are three types of SIM cards, but only the Micro SIM cards will work with the 2103 LTE modems (Figure 3-1).

Note

A Micro SIM card is required for any LTE units including the 2103 LTE.

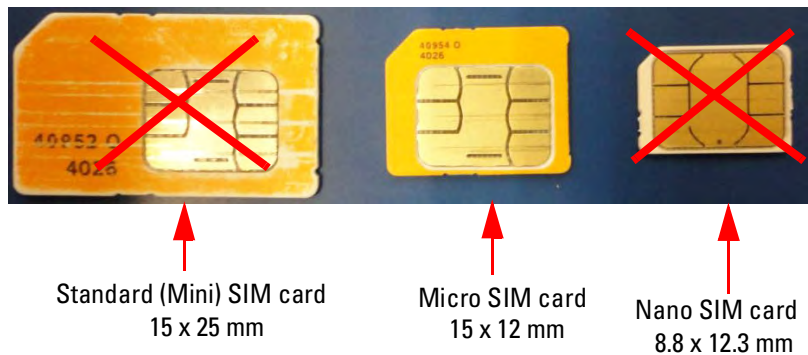


Figure 3-1 Types of SIM cards

To access the SIM card adapter:

1. Turn the 2103 LTE module over. On the bottom is the round metal cover of the compartment giving access to the card. The cover is most easily removed by placing a coin in the center slot and turning counterclockwise (Figure 3-2).



Figure 3-2 Accessing the SIM card on the bottom of the module

The SIM card is held in the SIM card extender which is attached to the circuit board with hook and loop fasteners.

2. Pull up on the adapter and pull the ribbon cable out through the hole (Figure 3-3).

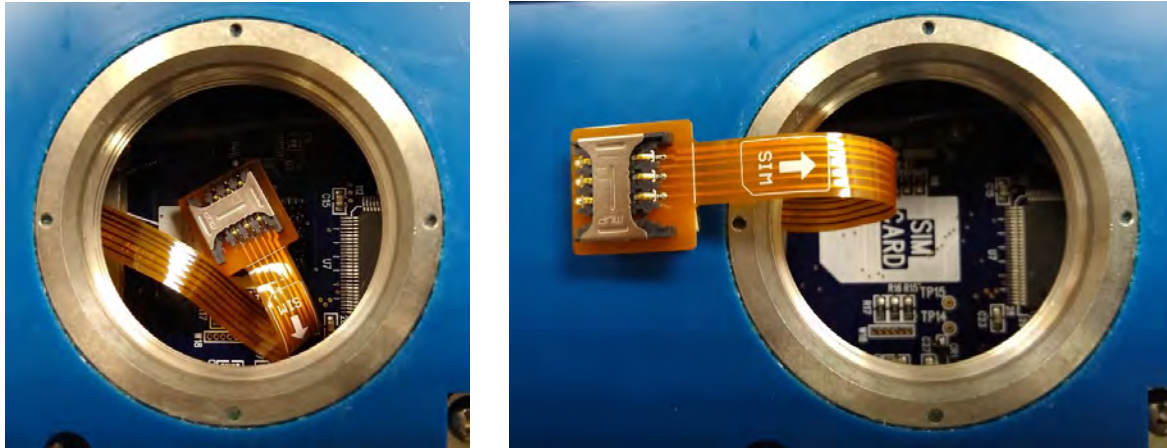


Figure 3-3 SIM card extender and Micro SIM adapter

3. Insert the SIM card into the SIM extender (Figure 3-4).

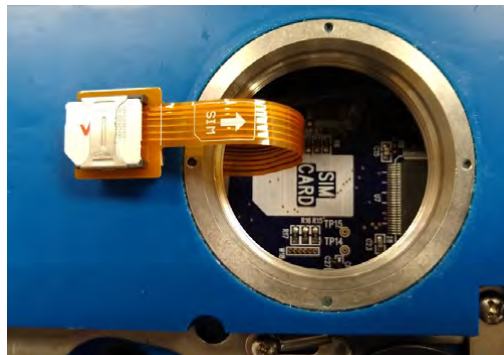


Figure 3-4 Inserting the SIM card

4. Press the SIM extender back down on the hook and loop fastener to keep it in place (Figure 3-5).



Figure 3-5 SIM card placed

3.3 Magnetic Mount Antenna

The magnetic-mount antenna, included with your system, has a 10-foot cable, and should be mounted pointing up. This antenna is for general use, and is especially desirable when the system is housed within an enclosure.

Note

When any communication connector is not in use, it should always be capped. The cap will seal the connector to prevent corrosion, prevent moisture from entering the unit, and improve communications.

Note

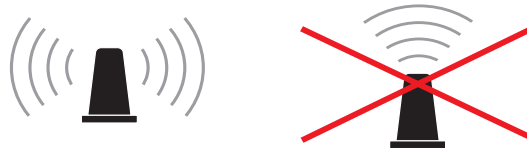
For the transmitter to comply with FCC Maximum Permissible Exposure (MPE) regulations, the antenna must be located a minimum of 30 centimeters (12 inches) from the human body.



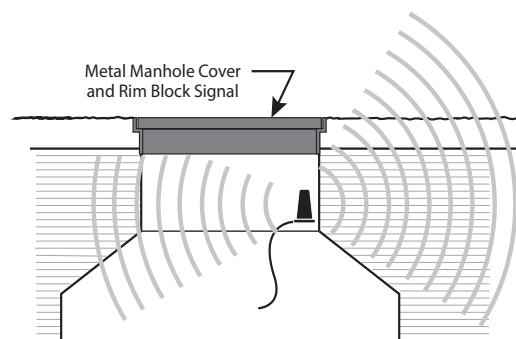
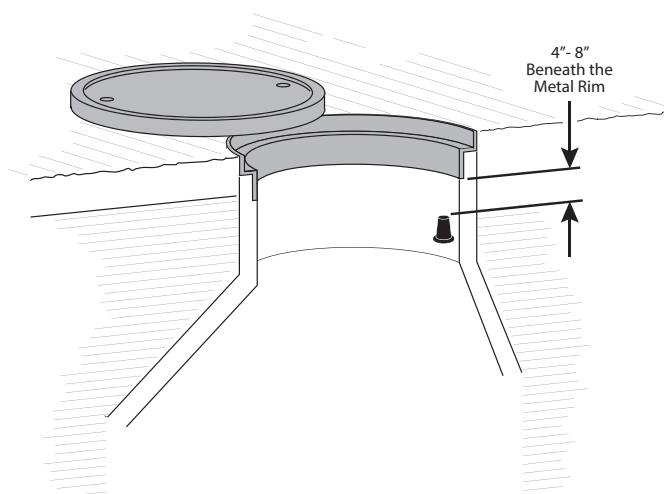
Figure 3-6 2103 LTE and magnetic mount antenna

3.3.1 Antenna Placement

1. Antenna needs to be placed in Vertical orientation. It does NOT radiate out of the ends of the antenna.



2. The best performance will be with the antenna placed on a large metal ground plane, above ground and without large obstructions between the antenna and the tower. This is not always possible but in instances where signal strength is low, this may be necessary.
3. Any metal surrounding the antenna will degrade performance! Placing the antenna 4 -8" lower than the metal ring the manhole cover sits on will provide better signal quality. Dirt and concrete lower signal strength less than metals which cause the signal to attenuate.



4. **Do NOT kink the coax!** The coaxial cable that feeds the antenna should never be in a loop tighter than the size of a fist. A coax that has been kinked will degrade the signal even after being straightened back out.
5. Antennas near strong radio towers or other sources of RF interference can jam the signal even though it is on a different frequency.

3.3.2 Modem Frequency Bands

The following frequency chart shows the frequency bands of each Teledyne ISCO modem. The user must ensure that the frequency band of the service plan matches the frequency band of the modem being used.

ISCO Part Number	Type	4G LTE Bands	Fallback	Applicable Networks	Location
602004617	Cat 4	LTE-FDD: B2, B4, B5, B12, B13, B14, B66, B71	3G HSPA+: B2, B4, B5	AT&T, Verizon, Bell, Telus and Rogers	North America and others depending on supported frequency bands
602004619	Cat 4	LTE-FDD: B1, B3, B7, B8, B20	3G: B1, B8 2G: GSM 900, DCS 1800	Orange, Telstra, Telus, Vodafone and More	Europe and others depending on supported frequency bands

2103Gi Modem Module

Section 4 2103Gi Cellular Modem Module

4.1 Overview

The 2103Gi Modem Module contains a cellular modem equipped with Global System Mobile (GSM) communication technology, with HSPA+ service capability.

After the module is installed, you must establish that there is a modem at the site by configuring the module via direct connection with Teledyne ISCO's Flowlink software (see Section 2.5).

4.1.1 Data Retrieval

Using a computer running Flowlink, and the appropriate cellular service, you can call up your monitoring site to configure the flow module settings and retrieve flow data.

Detailed operating instructions are available in Flowlink in a Windows Help format, and in the flow module's Installation and Operation Guide.

4.1.2 Text Messaging

Using LTE technology, and with the appropriate Subscriber Identity Module (SIM) card, the 2103Gi is capable of digital text messaging to up to five text-capable cellular phones when a pre-programmed alarm condition occurs.

Consult the Flowlink Help files and manual for details on programming alarm conditions.

4.1.3 Stacking / Compatibility

The 2103Gi can be located anywhere within a stack of 2100 Series modules, or used remotely, powered by an ISCO 2191 battery module. The 2103Gi is compatible with Teledyne ISCO's 2150 Area Velocity flow module, 2110 Ultrasonic flow module, 2160 LaserFlow module, 2101 Field Wizard, and 2102 Wireless module.

4.2 SIM Card

The data transmission capabilities of the 2103Gi are dependent upon the type of service plan you have through your cell phone service provider. The service parameters, or provider, can be changed by simply replacing the SIM card in your 2103Gi. Check with your service provider to verify what data transmission technologies are available for your use. There are three types of SIM cards, but only the Micro SIM cards will work with the 2103Gi modems (Figure 4-1).

 **Note**

A Micro SIM card is required for any GSM units including the 2103Gi.

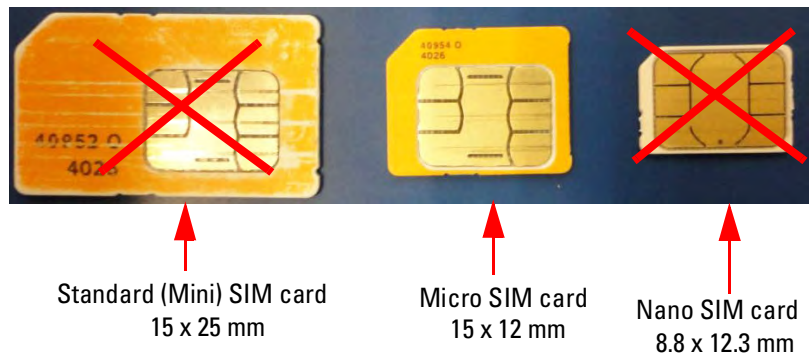


Figure 4-1 Types of SIM cards

To access the SIM card adapter:

1. Turn the 2103Gi module over. On the bottom is the round metal cover of the compartment giving access to the card. The cover is most easily removed by placing a coin in the center slot and turning counterclockwise (Figure 4-2).



Figure 4-2 Accessing the SIM card on the bottom of the module

The SIM card is held in the SIM card extender which is attached to the circuit board with hook and loop fasteners.

2. Pull up on the adapter and pull the ribbon cable out through the hole (Figure 4-3).

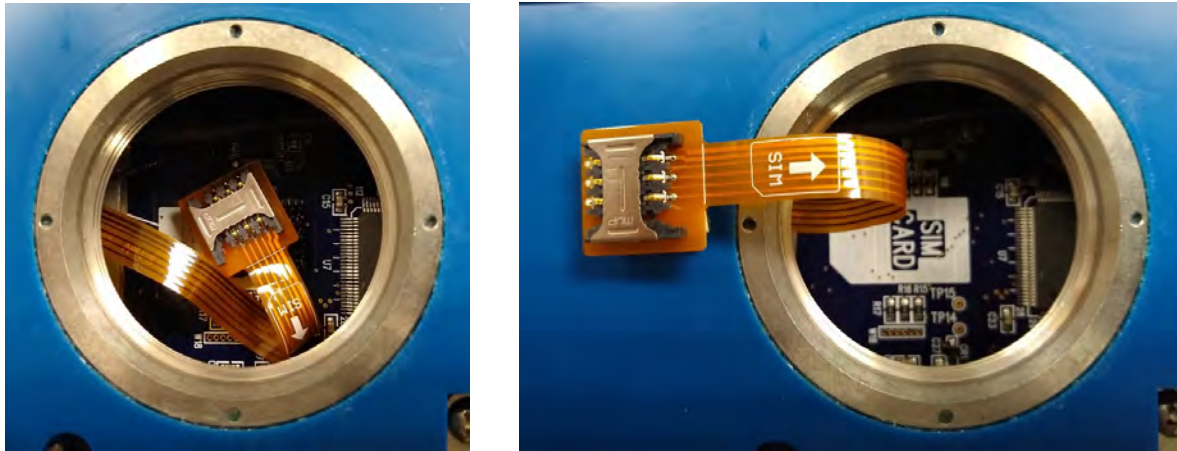


Figure 4-3 SIM card extender and Micro SIM adapter

3. Insert the SIM card into the SIM extender (Figure 4-4).

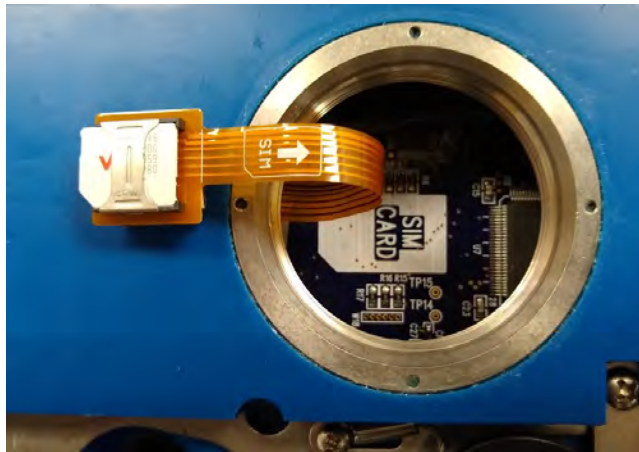


Figure 4-4 Inserting the SIM card

4. Press the SIM extender back down on the hook and loop fastener to keep it in place (Figure 4-5).



Figure 4-5 SIM card placed

4.3 Antenna Options

One of three antenna types is included with your system, specified when ordering: the magnetic mount antenna, the in-street antenna, or the manhole lid-mount antenna.

Note

For the transmitter to comply with FCC Maximum Permissible Exposure (MPE) regulations, the antenna must be located a minimum of 30 centimeters (12 inches) from the human body.

4.3.1 Magnetic Mount Antenna

The magnetic-mount antenna with a 10-foot cable, is included with your system. It should be mounted pointing up. This antenna is for general use, and is especially desirable when the system is housed within an enclosure. The antenna's shape may vary with older units.



Figure 4-6 2103Gi magnetic mount antenna

4.3.2 In-Street Antenna

This antenna is 4 inches in diameter and 1.75 inches tall, with a 10 foot cable. It is used primarily in manhole applications.

The antenna can be buried next to the manhole, in a hole bored into the pavement, at a depth leaving the top of the antenna flush with the street. A connecting hole is drilled through the manhole collar for the antenna's cable. To complete the installation, fill the holes in with cement.



Figure 4-7 Buried-in-street antenna

4.3.3 Manhole Lid-Mount Antenna

This antenna is 6 inches in diameter and 0.705 inches tall (4.575 inches tall with manhole and mounting shank included), with a 10-foot cable.

A hole is drilled into the manhole cover to accommodate the $\frac{3}{4}$ " by 4" shank, then the antenna is inserted, cable first, into the hole and fastened in place using the special tool provided with the antenna.

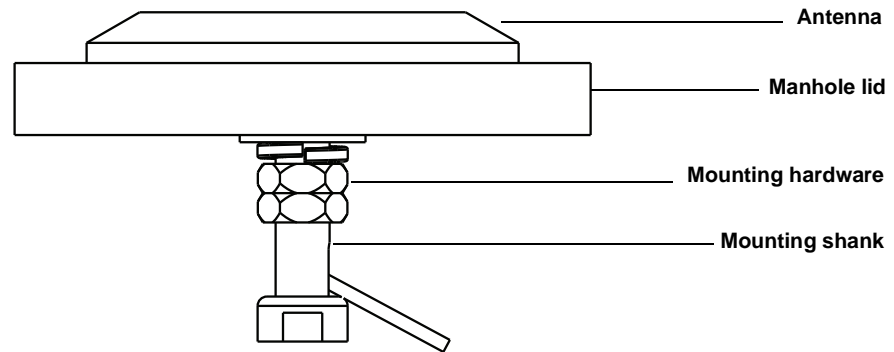


Figure 4-8 Manhole lid-mount antenna

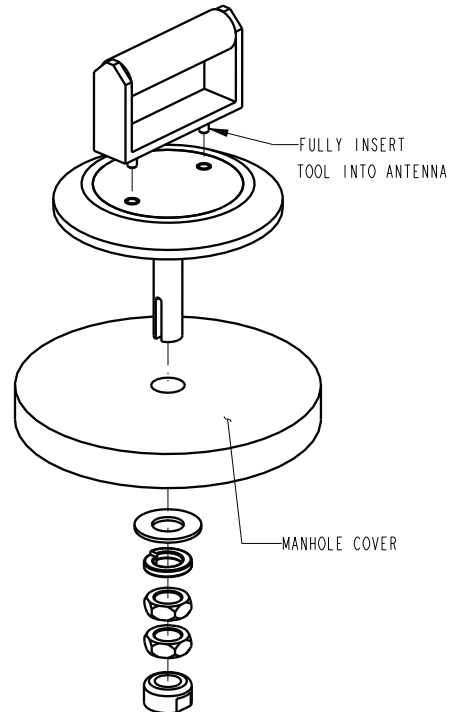


Figure 4-9 Manhole lid-mount antenna: Installation

Note

When any communication connector is not in use, it should always be capped. The cap will seal the connector to prevent corrosion, prevent moisture from entering the unit, and improve communications.

2103 LTE/Gi Modem Modules

Section 5 Modbus Protocol

Sections 5.1 through 5.5 give an overview of the basic capabilities and operation of Modbus protocol as it applies to Teledyne ISCO 2100 Series flow modules.

For a Glossary of Terms and Common Acronyms, see Sections 5.4 and 5.5.

5.1 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. For data output, the ISCO 2100 Series devices use Modbus ASCII protocol, the method discussed in this section. Modbus ASCII has more liberal 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 output 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.

5.2 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.

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. For register definitions for individual modules, including read/write designation, contact Teledyne ISCO.

5.2.1 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.

Modbus Protocol Setup

The communication settings for Modbus protocol are as follows:

Baud: 9600

Bits: 8

Parity: None

Stop Bits: 1

5.2.2 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

5.3 Configurations

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

In the example shown in Figure 5-1, you are direct-connecting a server PC to two individual 2100 sites through Modbus, using the COM ports on the OPC Server, which are directly connected to the remote sites.

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 5-1, the OPC Server PC must have two COM ports. Modbus requires one COM port each, for direct connection of each site.

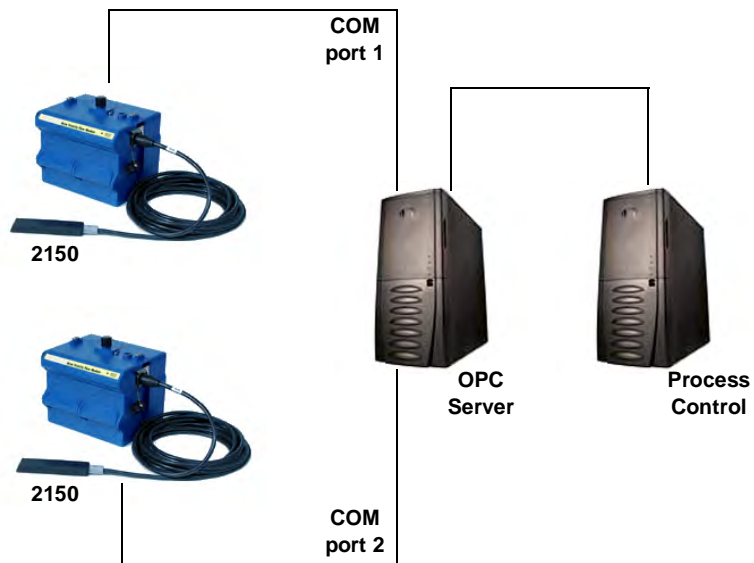


Figure 5-1 Configuration example (direct connection shown)

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.

5.4 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. For output, 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.

5.5 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

5.6 Register Specifications - 2100 Output

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 the module in the stack (N) minus 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.

5.6.1 Register Addresses

For a table of Modbus output registers for this instrument, please contact Teledyne ISCO.

Teledyne ISCO
Technical Service Department 4700 Superior St
Lincoln, NE 68504-1328

866-298-6174 or 402-464-0231

FAX: 402-465-3001

e-mail: iscowatersupport@Teledyne.com

<input checked="" type="checkbox"/> Note

In a system consisting of more than one module, the “top” module (the one being queried) is holding the Modbus data for the entire system. Although most registry locations are the same for all 2100 Series modules, some will be determined by the specific module being interrogated, and its firmware version.

2103 LTE/Gi Interface Module

Section 6 Maintenance

6.1 Overview

The 2103 LTE/Gi are designed to perform reliably in adverse conditions with a minimal amount of routine service requirements. To keep your system working properly, you should check the desiccant and channel conditions at regular intervals.

Maintenance intervals are affected by many variables. Humidity levels obviously affect the service life of the desiccant, and the amount of debris in the stream can drastically alter the channel conditions.

Experience is often the best tool to use when establishing minimum maintenance intervals for your system. Until you have gained an understanding of the module's operation under differing environmental conditions, a weekly maintenance interval is recommended.

6.1.1 Cleaning

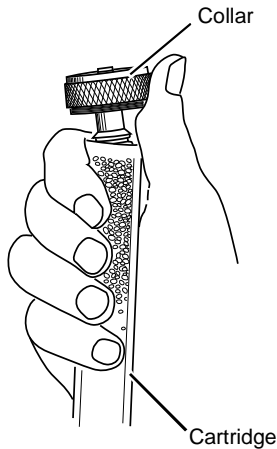
The module case may be cleaned using a soft cloth, warm water, and a mild detergent. Do not use an abrasive cleanser, or you might scratch the surface of the case.

Before cleaning, make sure that all the protective connector caps are in place to avoid damage to any of the connectors. You should also ensure that no water or cleanser enters the desiccant unit.

6.2 Desiccant

The 2103 LTE/Gi uses desiccant to protect the internal components from moisture damage. The cartridge is filled with indicating silica gel, which is blue or yellow when dry. As the desiccant becomes saturated, the color changes from blue to pink, or from yellow to green. Replace the desiccant before the entire length of the cartridge turns pink or green.

6.2.1 Replacing the Desiccant



The desiccant is contained in a cartridge located on the side of the 2103 LTE/Gi. To remove the cartridge, unscrew the collar and slide the cartridge out of the 2103 LTE/Gi. The clear tube reveals the silica gel desiccant inside.

To replace the silica gel desiccant:

1. Hold the cartridge upright with the collar at the top.
2. As shown in the margin, push the collar off the cartridge.
3. Empty the saturated silica gel beads or granules.
4. Fill the tube with new 3 or reactivated (see Section 6.2.2) silica gel desiccant.
5. Press the collar onto the tube.
6. Slide the cartridge into the module. Tighten the collar to seal the cartridge in place.

6.2.2 Reactivating the Desiccant

Silica gel beads and granules of desiccant can be reactivated.

 CAUTION
--

Desiccant may produce irritating fumes when heated. Observe the following precautions:

- Use a vented oven in a well ventilated room.
- Do not remain in the room while the regeneration is taking place.
- Use the recommended temperature. Avoid heating the desiccant at higher than recommended temperatures.

There is the potential of irritating fumes coming from the desiccant during reactivation. Because of this, we urge you to use caution, and to heat the desiccant in a well ventilated room. Material Safety Data Sheets are in the back of this manual.

The desiccant's ability to remove moisture may lessen with each saturation/reactivation cycle, resulting in a need for more frequent service. After several cycles, the desiccant may no longer be effective as it saturates too quickly. At this point, replace the desiccant.

Silica gel

To reactivate the silica gel desiccant, pour the spent desiccant into a heat resistant container. Never heat the cartridge assembly; it will melt. Heat the silica gel in a *vented convection oven* at 212° to 350°F (100° to 175°C) for two to three hours, or until the blue or yellow color returns. Allow the desiccant to cool and store it in an airtight container until ready for use.

6.3 Hydrophobic Filter



If the 2103 LTE/Gi is in a humid location or submerged, a hydrophobic filter prevents water from entering the desiccant cartridge. Any amount of water will plug the filter and it must be rinsed with clean water and allowed to dry, or replaced to prevent internal damage to the module.

Remove the hydrophobic filter with a $\frac{5}{8}$ " or 16mm socket. Gently screw in the replacement filter.

If the hydrophobic filter frequently requires replacement, consider relocating the modules so that they are better protected.

6.4 O-Rings

The communication connectors on the 2103 LTE/Gi contain O-rings that need periodic treatment with silicone lubricant and replacement.

Whenever you replace the O-rings, or have removed them from the connectors for some reason, you should lubricate the O-rings by applying lubricant around the circumference of the ring.

<input checked="" type="checkbox"/> Note

Do not use petroleum-based lubricants. Petroleum-based lubricants will cause the O-ring to swell and eventually deteriorate. Aerosol silicone lubricant sprays often use petroleum based propellants. If you are using an aerosol spray, allow a few minutes for the propellant to evaporate before proceeding.

6.5 How to Obtain Service

The internal components of the 2103 LTE/Gi are not user-serviceable. The case is completely sealed to protect the internal components. To repair the unit, the case must be broken open and replaced. If you think your module requires repair, contact ISCO's Technical Service Department.

Corresponding with a Teledyne ISCO Technical Service Representative can often resolve the problem without the need to return the item. If the difficulty cannot be resolved you will be issued a Return Authorization Number (RAN) and information on returning it to the factory.

Teledyne ISCO
Technical Service Department 4700 Superior St
Lincoln, NE 68504-1328

866-298-6174 or 402-464-0231
FAX: 402-465-3001

e-mail: iscowatersupport@Teledyne.com

2103 LTE/Gi Modem Module

Appendix A Replacement Parts List

A.1 Replacement Parts Diagrams and Listings

Replacement parts are called out in illustrations in this section. Reference the call-outs in the accompanying tables to determine the part number for the item.

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

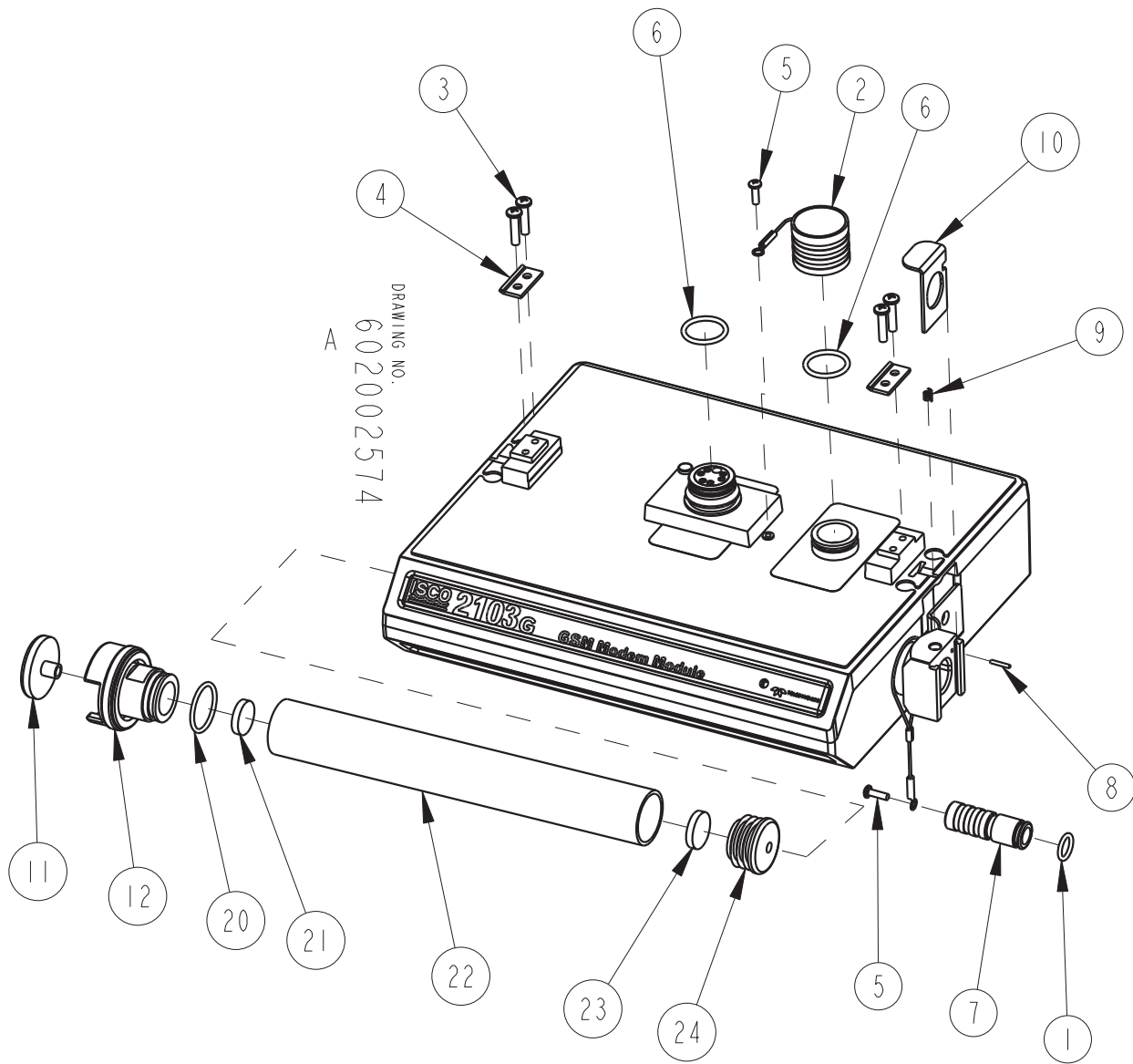
Teledyne ISCO

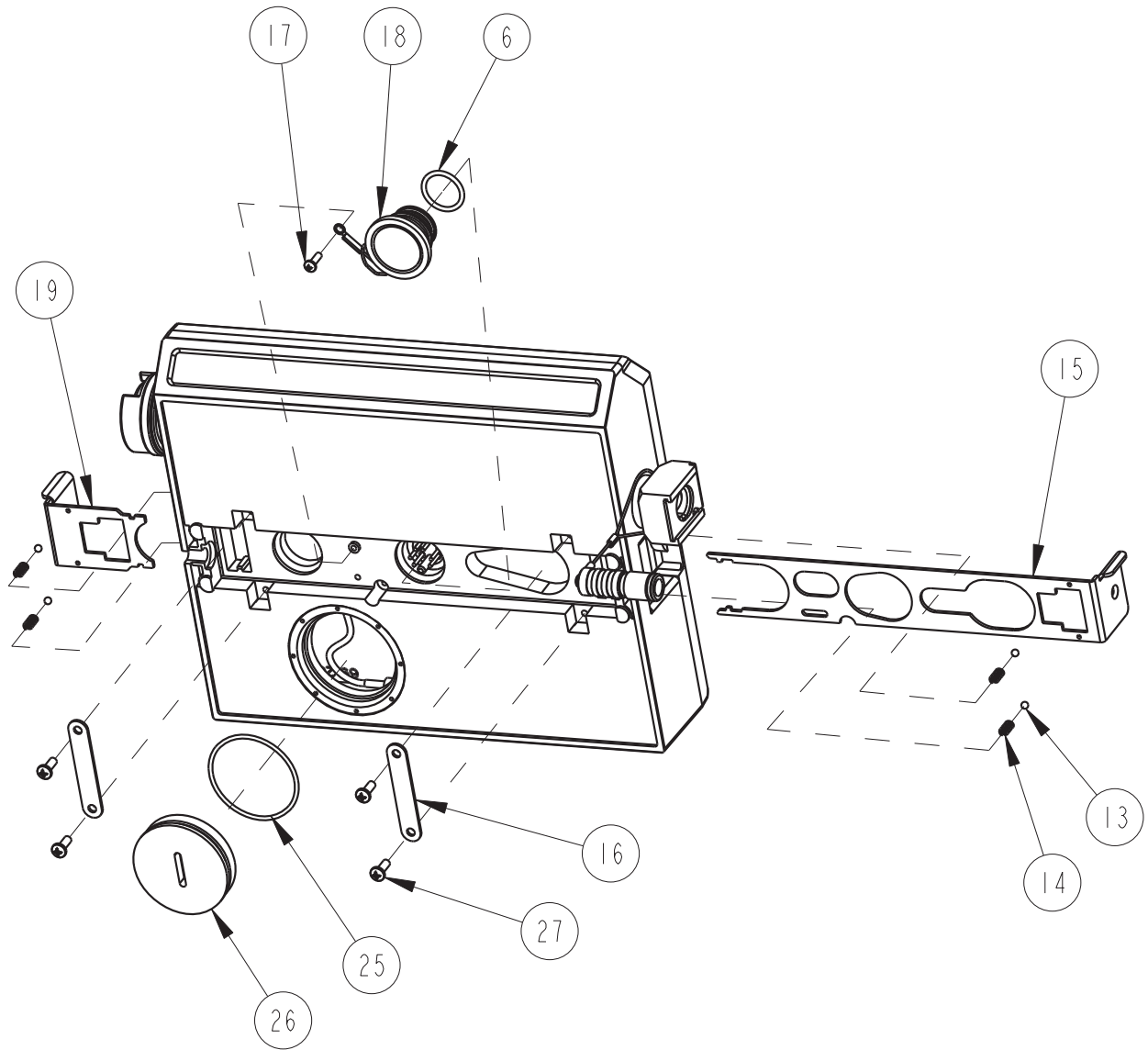
Customer Service Department
P.O. Box 82531
Lincoln, NE 68501 USA

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

E-mail: iscowatersupport@Teledyne.com

A.2 2103 LTE/Gi Module

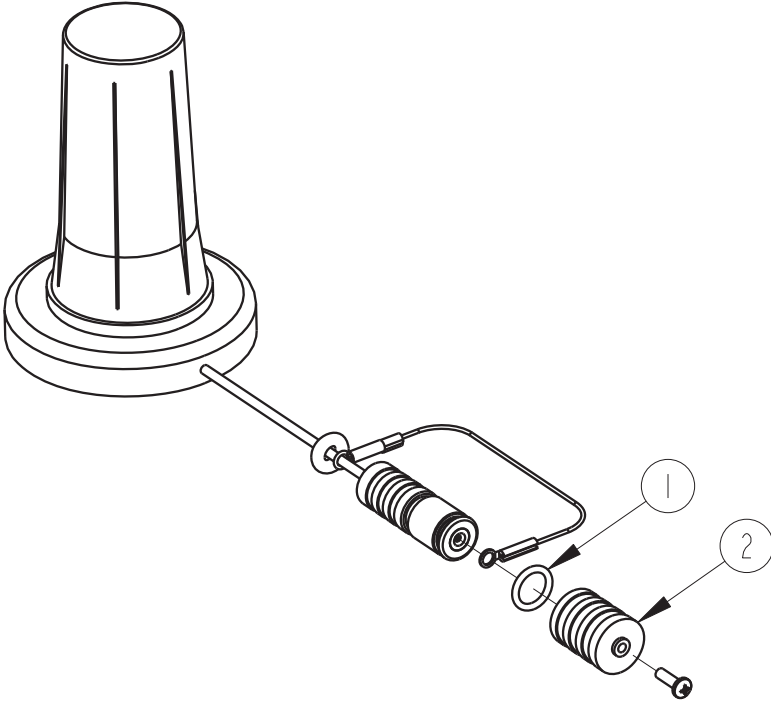




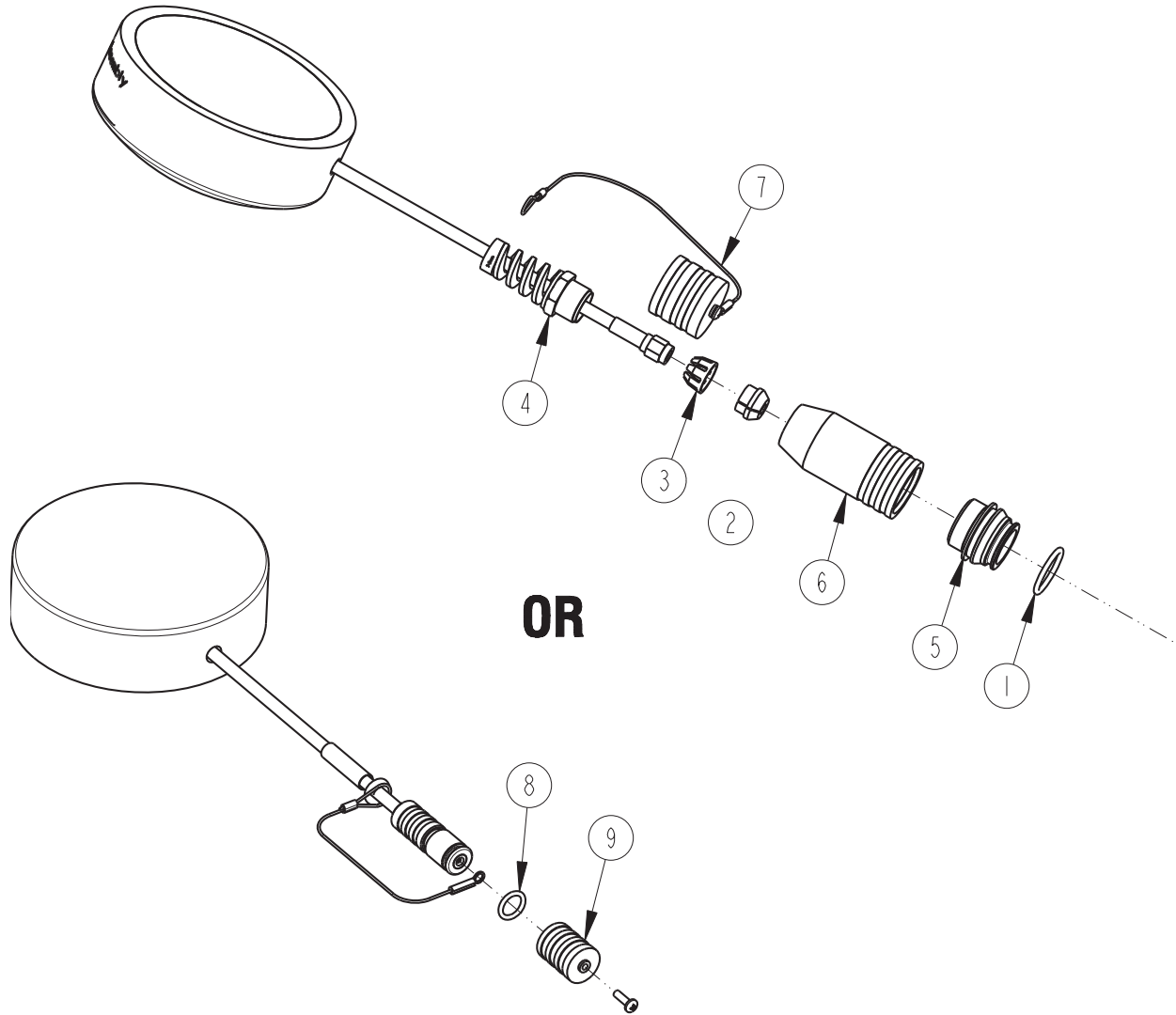
REPLACEMENT PARTS LIST		
TELEDYNE ISCO, INC.		
ITEM	PART NUMBER	DESCRIPTION
1	202307012	O RING, .364 ID .070 XSECT, VITON
2	602004012	CAP ASSY, MALE CONNECTOR
3	231514920	SCREW, PAN HEAD, SELF TAP, #6-19 X 5/8 SST
4	602003019	CLIP, NODE
5	231310140	SCREW, PAN HEAD, SELF TAP, #4 X 3/8 SST
6	202100669	O RING, .669 ID .079 XSEC, BUNA-N
7	602003568	PLUG FEMALE ANTENNA
8	236410406	PIN, SPRING .06 X .38 LONG SST
9	203011105	COMPRESSION SPRING, .026 \varnothing WIRE, SST
10	602003565	ANTENNA CONNECTOR CLIP
11	602005003	FILTER, INLINE AIR, FOR 25mm TUBING
12	602004264	DESICCANT CAP ASSEMBLY
13	201900102	BALL, .125 \varnothing 316 SST
14	203011602	SPRING, .022 \varnothing WIRE, SST, .31 FREE LENGTH
15	692003190	LATCH, LARGE
16	602003022	HOLD, LATCH
17	231611108	SCREW, PAN HEAD, SELF TAP, #4 X 1/2 SST
18	602004013	PLUG ASSY, FEMALE CONN (INCLUDES ITEM 6)
19	692003189	LATCH, SMALL
20	202500017	O RING .676 ID .070 XSECT, BUNA-N
21	692203300	FRIT, .620 \varnothing X .125 THICK
22	602003086	DESICCANT TUBE, 4.1 LONG
23	692203301	FRIT, .670 \varnothing X .125 THICK
24	602003074	CAP PLUG MODIFICATION, DESICCANT
25	202307030	O RING 1.614 ID .070 XSECT, VITON
26	602003576	PLUG, MALE
27	231311206	SCREW, PAN HEAD, SELF TAP, #6-18 X 3/8, SST
NOTE: 1. For current prices and quotations on parts, contact Isco Service Department. 2. This list is subject to change without notice.		

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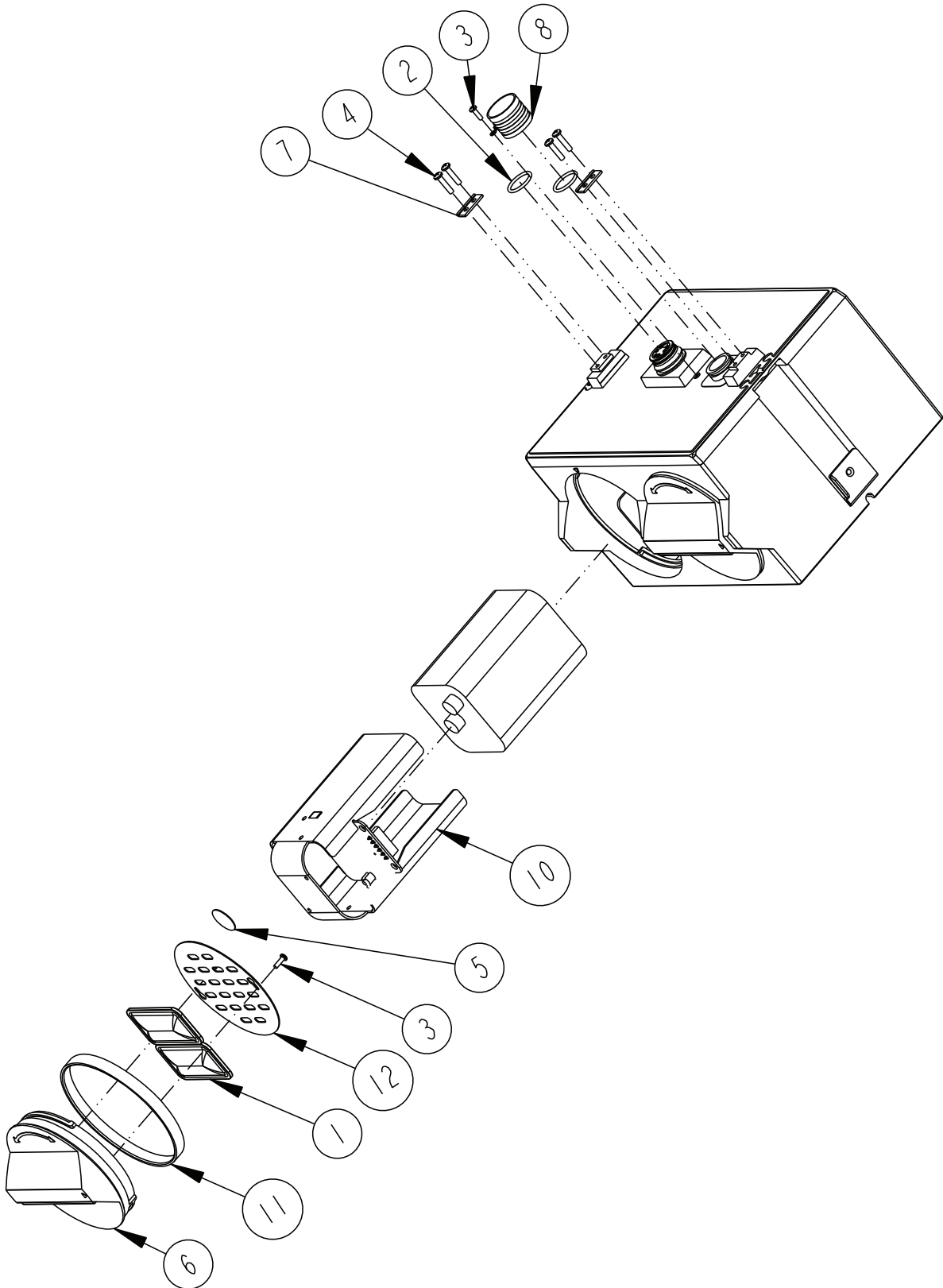
A.3 LTE Magnetic Mount Antenna



A.4 2103 LTE/Gi Buried Antenna (Old style of connector is shown.)



A.5 2191 Battery Module



2103 LTE/Gi Modem Module

Appendix B Accessories

B.1 How to Order

Accessories can be purchased by contacting Teledyne ISCO's Customer Service Department.

Teledyne ISCO

Customer Service Dept. 4700 Superior St
Lincoln, NE 68504-1328 USA

Phone: (800) 228-4373 (402) 464-0231

FAX: (402) 465-3022

E-mail: iscowatersupport@Teledyne.com

B.2 General Accessories

2103 LTE/Gi Instruction manual	69-2003-637
Alkaline Lantern Battery	340-4060-00
Rechargeable 6V Lead-acid Lantern Battery	60-2004-041
Charging Adapter for 6V Lead-acid Lantern Battery	60-2004-040
Flowlink and Flowlink Pro Software	(call factory)
Teledyne ISCO Open Channel Flow Measurement Handbook	60-3003-041
LTE Magnetic Mount Antenna for 2103 LTE/Gi	60-4804-035
Buried-In-Street Antenna	60-2004-672
Manhole Lid Antenna	60-5314-820
2103 LTE/Gi Maintenance Kit	60-2009-004

2103 LTE/Gi Modem Modules

Appendix C Material Safety Data Sheets

C.1 Overview

This appendix to the manual provides Material Safety Data Sheets for the desiccant used by the 2103 LTE/Gi Modem Modules.

Teledyne ISCO cannot guarantee the accuracy of the data. Specific questions regarding the use and handling of the products should be directed to the manufacturer listed on the MSDS.



MATERIAL SAFETY DATA SHEET

Effective Date March 8, 2005
MSDS Number M163

Section 1 – Product and Company Information

Product Name: Silica gel, indicating, yellow

Product Use: Desiccant, absorbent

Grades: Silica gel, indicating

Synonyms: Amorphous silica gel, SiO₂, silicon dioxide (amorphous)

Company: Multisorb Technologies, Inc.

Street Address: 325 Harlem Road

City, State, Zip, Country: Buffalo, NY 14224-1893 USA

Telephone Number: (716) 824 8900 [USA] Monday - Friday (8:00 - 5:00 EDT)

Fax Number: (716) 824 4091 [USA]

Website / E-Mail : multisorb.com

Section 2 – Composition / Information on Ingredients

Component Name	CAS Number	% by Weight
Synthetic amorphous silica gel (SiO ₂)	112926-00-8	100
Phenolphthalein	77-09-08	100 ppm

While this material is not classified, this MSDS contains valuable information critical to the safe handling and proper use of this product. This MSDS should be retained and available for employees and other users of this product.

Section 3 – Hazard Identification

Emergency Overview: A yellow bead or granular material that poses little or no immediate hazard. This material is not combustible.

Potential Health Effects:

Eyes: Dust and or product may cause eye discomfort and irritation seen as tearing and reddening.

Skin: The product dust may cause drying of the skin. Silica gel may get hot enough to burn skin when it adsorbs moisture rapidly. Use an excess of water to cool the silica gel.

Ingestion: Material is not toxic and will pass through the body normally.

Inhalation: Slight irritation is possible but none is expected.

Medical Effects Generally Aggravated by Exposure: Respiratory ailments.

Chronic Effects/Carcinogenicity: May cause eye, skin and mucous membrane irritation and drying.

Section 4 – First Aid Measures

- Eyes:** Rinse the eyes well with water while lifting the eye lids. If irritation persists, consult a physician.
- Skin:** Wash affected area with soap and water.
- Ingestion:** Ingestion is unlikely, this material will pass through the body normally.
- Inhalation:** Remove the affected person to fresh air and get medical attention if necessary.
- Notes to Physician:** Not applicable

Section 5 – Fire Fighting Measures

- Flammable Properties:** Not flammable
- Flash Point:** Not applicable **Method:** Not applicable
- Flammable Limits:** Not flammable
- Lower Flammability Limit:** Not applicable
- Upper Flammability Limit:** Not applicable
- Autoignition Temperature:** Not applicable
- Hazardous Combustion Products:** Not applicable
- Extinguishing Media:** Use extinguishing media that is appropriate for the surrounding fire. Silica gel is not combustible.
- Fire Fighting Instructions:** Not combustible
- Unusual Fire and Explosion Hazards:** None

Section 6 – Accidental Release Measures

- Spill:** Sweep or vacuum up and place the spilled material in a waste disposal container. Avoid raising dust. Wash with soap and water after handling.

Section 7 – Handling and Storage

- Handling:** Avoid raising dust and minimize the contact between worker and the material. Practice good hygienic work practices.
- Storage:** Store in a cool, dry location. Keep in sealed containers away from moisture. The silica gel will readily adsorb moisture.

Section 8 – Exposure Controls/Personal Protection

- Engineering Controls:** Use exhaust ventilation to keep the airborne concentrations below the exposure limits.
- Respiratory Protection:** Use NIOSH approved respirator when the air quality levels exceed the TLV's.
- Skin Protection:** Light gloves will protect against abrasion and drying of the skin.
- Eye Protection:** Safety glasses.

Component Name	Exposure Limits		
	OSHA PEL	ACGIH TLV	Other Recommended Limits
Silica gel	TWA 20 mppcf (80 mg / m ³ % SiO ₂)	TWA 10 mg / m ³	NIOSH REL TWA 6 mg / m ³ IDLH 3000 mg / m ³
Phenolphthalein	Not Applicable	Not Applicable	Not Applicable

Section 9 – Physical and Chemical Properties

- | | |
|---|---|
| Appearance: Yellow beads or granules | Vapor Density: Not applicable |
| Odor: None | Boiling Point: 4046° F (2230° C) |
| Physical State: Solid bead | Melting Point: 3110° F (1710° C) |
| PH: Not applicable | Solubility: Insoluble in water |
| Vapor Pressure: Not applicable | Specific Gravity: 2.1 |

Section 10 – Stability and Reactivity

- Stability:** Stable
- Conditions to avoid:** Moisture and high humidity environments.
- Incompatibility:** Water, fluorine, oxygen difluoride, chlorine trifluoride
- Hazardous Decomposition Products:** None
- Hazardous Polymerization:** Will not occur

Section 11 – Toxicological Information

This product and its components are not listed on the NTP or OSHA Carcinogen lists.

Animal Toxicology Tests for DOT Hazard classification
(Tests Conducted on finely ground silica gel)
1 - hour LC₅₀ (rat) > 2 mg / l
48 - hour oral LD₅₀ (rat) est. > 31,600 mg / kg
48 - hour dermal LD₅₀ (rabbit) est. > 2,000 mg / kg
Considered an ocular irritant

Human Toxicology Silica gel is a synthetic amorphous silica not to be confused with crystalline silica. Epidemiological studies indicate low potential for adverse health effects. In the activated form, silica gel acts as a desiccant and can cause a drying irritation of the mucous membranes and skin in cases of severe exposure. Multisorb Technologies Inc. knows of no medical conditions that are abnormally aggravated by exposure to silica gel. The primary route of entry is inhalation of dust.

Section 12 – Ecological Information

Not known to have any adverse effect on the aquatic environment. Silica gel is insoluble and non-toxic.

Section 13 – Disposal Information

Disposal Information If this product as supplied becomes a waste, it does not meet the criteria of a hazardous waste as defined under the Resource Conservation and Recovery Act (RCRA) 40 CFR 261. Materials of a hazardous nature that contact the product during normal use may be retained on the product. The user of the product must identify the hazards associated with the retained material in order to assess the waste disposal options. Dispose according to federal, state and local regulations.

Section 14 – Transportation Information

U.S. Department of Transportation Shipping Name: Not classified as a hazardous material. Not regulated.

Section 15 – Regulatory Information (Not meant to be all inclusive - selected regulations represented)

TSCA Listed: Yes

DSL/NDSL (Canadian) Listed: Yes

OSHA: TWA 20 mppcf (80 mg / m³ % SiO₂) for Silica gel

NIOSH: REL TWA 6 mg / m³ IDLH 3,000 mg / m³ for silica gel
Animal tests conducted in 1976 - 1978. 18 month exposure at 15 mg / m³ showed silica deposition in respiratory macrophages and lymph nodes, minimum lung impairment, no silicosis.

ACGIH: TLV - 10 mg / m³ for Silica gel

DOT: Not classified as a hazardous material.

2103 LTE/Gi Modem Modules

Index

A

- accessories, B-1
- alarms, 2-16
- antenna options
 - 2103Ci, 3-5
 - 2105Gi, 4-5

B

- battery module
 - batteries, 2-6
 - components, 1-4

C

- CDMA modem module, 3-1
- components
 - 2191 battery module, 1-4
 - bottom view, 1-3
 - identification, 1-2
 - top view, 1-2
- connector
 - 2103 pinout, 1-7
- connectors, 2-5
 - analog modem communication, 1-7
- contact information, 2-1, A-1, B-1
 - technical service, 1-9

D

- desiccant, 6-1
- dimensional drawings, 1-7

F

- filter, 6-3
- Flowlink
 - adding a module, 2-9
 - connection, 2-8
 - initial connection, 2-8
 - modem screen, 2-12
 - power conservation, 2-14
 - pushed data, 2-18
 - text messaging, 2-16

G

- GSM modem module, 4-1

I

- installation, 2-3
 - batteries, 2-6

- connectors, 2-5
 - latches, 2-3
- IP connection, 2-13

L

- latches, 2-3
 - stacking modules, 2-7

M

- maintenance, 6-1
- Modbus
 - registers, 5-5
- Modbus output, 5-1
- modem connection
 - serial over IP, 2-13
- modem module
 - 2103Ci, 3-1
 - 2103Gi, 4-1
 - pushed data, 2-18
 - text messaging, 2-16
- modem setup screen, 2-12
- MSDS, C-1

O

- o-rings, 6-3

P

- parts, A-1, B-1
- power, 2-2
- power conservation, 2-14
- pushed data, 2-18

R

- replacement parts, A-1

S

- safety information, 1-9, C-1
- service, 6-3
- SIM card, 4-5
- specifications, 1-6
- stacking, 2-7

T

- TCP connection, 2-13
- technical specifications, 1-6
- text messaging, 2-16

DECLARATION OF CONFORMITY



Application of Council Directive: 2014/30/EU – The EMC Directive
2014/35/EU – The Low Voltage Directive
2011/65/EU – The RoHS Directive

Manufacturer's Name: Teledyne Isco
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: 2191 Battery Module

Year of Issue: 2017

Standards to which Conformity is Declared: EN 61326-1:2013 EMC Requirements for Electrical Equipment for
Measurement, Control, and Laboratory Use
EN 61010-1:2010 Safety Requirements for Electrical Equipment for
Measurement, Control, and Laboratory Use

I, the undersigned, hereby declare that the design of the equipment specified above conforms to the above Directives and Standards as of October 16, 2017.

Edward J. Carter
USA Representative



Edward J. Carter
Director of Engineering
Teledyne Isco, Inc.
4700 Superior Street
Lincoln, Nebraska 68504

Phone: (402) 464-0231
Fax: (402) 464-3799

60-2002-158
Rev B

DECLARATION OF CONFORMITY



Application of Council Directives*: 2004/108/EC – The EMC Directive
2012/19/EC– The WEEE Directive
1999/5/EC-R&TTE Directive*

Manufacturer's Name: Teledyne Isco
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: 2103Gi 3G
Year of Issue: 2015

Standards to which Conformity is Declared: EN 61326-1:2006 EMC Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use

Standard	Description	Severity Applied	Performance Criteria
EN 61000-4-2:2008	Electrostatic Discharge	Level 2 - 4kV contact discharge Level 3 - 8kV air discharge	A
EN 61000-4-3:2006 /A1:200 /A2:2010	Radiated RF Immunity	10V/m, 80 MHz to 1GHz 80% AM at 1kHz 3V/m, 1.4GHz to 12GHz 80% AM at 1kHz 1V/m, 2 GHz to 2.7GHz 80% AM at 1kHz	A A A
EN 61000-4-4:2012	Electrical Fast Transient (EFT) on Mains and I/O	Level 2 – 1kV on AC lines	A
EN 61000-4-6:2013	Conducted RF on Mains and I/O lines	150 kHz to 80 MHz, 3V rms, 80% modulated	A
EN 55011:2009/A1:2010	RF Emissions Radiated, below 1 GHz and Conducted, AC Mains	Group 1, Class A Industrial, Scientific, and Medical Equipment	PASS

*Novatel Declaration of Conformity for Model CNN0402 most accompany this Declaration of Conformity

We, the undersigned, hereby declare that the design of the equipment specified above conforms to the above Directive(s) and Standards as of June 3, 2015.

USA Representative

Vikas V. Padhye Ph. D.
Executive Vice President

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Lincoln, Nebraska 68504
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Fax: (402) 464-0318



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