SiloPatrol® / RadarRight™
Inventory Monitoring Systems

SiloTrack™ *CLOUD* Gateway
(6-87xx-xxx)

Shown with standard antenna

Gateway

NOTE:
User Manuals for
SiloTrack™ *CLOUD*
are available through
the application at:
www.mysilotrackcloud.com

Thank you for purchasing a quality product from Monitor Technologies LLC. We realize that you do have a choice of vendors when procuring level measurement equipment and we sincerely appreciate your business!

⚠ This manual contains the information necessary to ensure a safe and successful installation. Please read and comply with the section of this manual pertaining to SAFETY. Doing so will ensure proper operation of the equipment and the safety of all personnel.

🛑 Before discarding shipping container, please inspect it thoroughly and verify that all parts ordered are accounted for. Sometimes smaller parts become stuck under carton flaps and other packaging materials.

In the event that information contained herein does not completely satisfy your requirements or answer your questions, you may contact Technical Support on our website www.monitortech.com, by telephone at 800-766-6486 (630-365-9403), or by e-mail at techsupport@monitortech.com. If your product ever requires service either in or out of warranty, please contact us and obtain an RMA (Return Material Authorization) number prior to shipping the unit to us.

MONITOR®

ATTENTION:

USE OF VOLUME &
WEIGHT CALCULATIONS

The **SiloTrack**™ *CLOUD* Inventory Management Software can perform calculations to display the volume and weight of material in each vessel. When utilizing this capability, the **SiloTrack**™ *CLOUD* software will calculate the volume and weight based upon the distance measurement made by a **SiloPatrol**® SMU or **RadarRight**™ sensor, the vessel dimensions, and the material bulk density entered during configuration.

The calculated volume and weight values are affected by variations in actual vessel dimensions, angle of repose, fluctuation in material bulk densities, material flow properties (rat holes, bridging, etc.), vessel inlet/discharge location(s) and location of the sensor on the vessel. The direct distance measurement made by the SMU is from the bottom of the SMU mounting flange to the point on the plumb bob. The direct distance measurement made by the **RadarRight**™ is from the base of its cone to the material surface.

Prior to equipment installation, please consult the factory to discuss the application details if the volume/weight calculation is of critical importance.

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INTRODUCTION

We at Monitor Technologies LLC are pleased to provide you this quality instrumentation system. We are confident that you will be pleased with the operation of this product. Please do not hesitate to call the factory for any technical assistance, suggestions, or comments.

The **SiloTrack**™ *CLOUD* Gateway is equipped with a RS-485 communication network capable of interfacing with up to 32 sensors, any combination of **SiloPatrol**® SMU & **RadarRight**™ sensors that are allowed on the network.

The **SiloTrack**™ *CLOUD* Gateway continuously monitors the status of each sensor via a multi-dropped RS-485 communication link. Each sensor has to be uniquely addressed with a value from 1~247, though we recommend using 1-32 for simplicity of the overall installation. Communication failures on the RS485 network and other sensor Status Alarms are detected and indicated on the Gateway for any sensor declared active. When prompted, either manually from an operator or automatically by the Gateway's programmable time interval, a **SiloPatrol**® SMU sensor takes a measurement. The latest measurement value is communicated to the **SiloTrack**™ *CLOUD* Gateway. **RadarRight**™ sensors periodically read automatically, and no prompting is required. The distance measurement (i.e. the distance from the sensor to the material surface) is the basis for various user-selected calculations that are performed within the software and made available for viewing within the mobile/web application.

2.1 Pre-Installation Considerations

Choosing a Location for the **Silo**Track™ *CLOUD* Gateway:

1) Environment: This **Silo**Track™ *CLOUD* Gateway product is suitable for non-hazardous classified locations only. It can be used indoors or outdoors, and any possible protection from direct precipitation is advisable. Note the temperature limits in the specifications.

2) Placement: The hardened communication network used to interconnect the **Silo**Patrol® SMU & **Radar**Right™ sensors permits the RS-485 network to be extended as far as 3,300ft (1000m) end-end. This permits placement of the particular product in the area best suited.

3) Connectivity: Also the method to connect the **Silo**Track™ *CLOUD* Gateway to the cloud/internet should be considered when selecting a mounting location.

    a) Ethernet: If you plan to use the RJ45 port to connect to your existing Ethernet, the **Silo**Track™ *CLOUD* Gateway will have to be within acceptable wiring distance from the internet server. You will also have to open ports 3197 and 3199 on your firewall for the Gateway to communicate with the Cloud. The "Destination" for the firewall rule can be 'my.devicecloud.com' if needed.

    b) Cellular: If you plan to use the cellular connection method, the **Silo**Track™ *CLOUD* Gateway's position is more flexible. However, cell tower signal strength and the site proximity to a cell tower should be taken into consideration. Position the **Silo**Track™ *CLOUD* Gateway such that there is direct line of sight to the tower for regions with weak cell service, and avoid mounting inside metal buildings. Elevated locations are recommended for weak signal strength situations.

2.2 Mechanical Installation

SiloTrack™ *CLOUD* Gateway Mounting: (See Figure 1)

1) Location: Select a mounting location in accordance with the Pre-Installation Considerations.

2) Empty the Enclosure: Open the enclosure door. Disconnect the two co-axial cables that connect the antenna to the router. Remove the (4) screws retaining the back panel. Now lift out the back panel assembly and set aside.

3) Preparation: Locate the (4) mounting brackets and screws that are provided with the **Silo**Track™ *CLOUD* Gateway. Mount these to the rear of the **Silo**Track™ *CLOUD* Gateway's enclosure using screws provided. The brackets can be positioned vertically or horizontally to accommodate your mounting condition. You can use the enclosure as a template to mark the locations of the four corner mounting points. (See Figure 1)

4) Cable Entries: Before mounting to the wall, determine where the cable entries will be located. The most preferred location is along the bottom of the enclosure to minimize the chance of any moisture from entering the enclosure. The next best position is on the side, but very low. Make sure the door will open freely and not interfere with the cable fitting location. The optimum is at least (2) entries, one for power mains, and one or more for the RS-485 data lines. **NOTE:** Conduit entry or cable gland fittings should be rated NEMA 4X and or IP65 in order to maintain the NEMA 4X and IP65 rating of the enclosure.

5) Cable Entry Machining: Machine cable entries into the enclosure's exterior where desired. The recommended method is with a hole-punch sized for the desired fitting. A hole-saw or drill bit can also be used.

6) Mounting: Secure the enclosure to the wall with size #10 fasteners thru the slotted holes in the mounting brackets. (See Figure 1)

7) Re-install the Back Panel Assembly: Install the back panel assembly into the enclosure, with the router in the upper most position, and secure with (4) corner screws. Re-attach the antenna co-axial cables.

2.3 Electrical Installation (See Figure 2 and Figure 3)

1) ⚠ Permanently Connected Equipment - It is recommended that disconnect devices be included in the system installation. In installations where multiple circuits are used (i.e. independent circuits for the **Silo**Patrol® SMU's power input, relay connections, and sound), individual disconnects are required. The disconnects shall be within close proximity of the equipment, accessible to operators, and marked appropriately as the disconnect for the associated circuit. Ensure the disconnect ratings are appropriately sized for the circuit protected. (See Specifications Section)

2) Field Terminations - All of the in-field connections to the **Silo**Track™ *CLOUD* Gateway are to be made to right side of the DIN rail mounted terminal blocks. These are labeled well and easy to access; there is no reason to make connections to any other points within the **Silo**Track™ *CLOUD* Gateway. Connecting to any points other than the DIN rail mounted terminals or altering the factory wiring may result in permanent damage and/or create a shock hazard.

3) Circuit Separation - Two cable entry locations are recommended to aid in maintaining separation of "hazardous live" (typically mains voltages such as 115VAC and 230VAC) and limited circuits (typically control voltages less than 30Vrms or 42.4VDC). However, since the Gateway single wiring compartment cannot absolutely protect against physical contact between multiple circuits, it is required that all wiring have an insulation rating of 300V minimum, and a temperature rating of 176°F (80°C) minimum.

4) ⚠ Protective Earthing - The Gateway is provided with a "protective conductor terminal" earth ground potential. This terminal shall be used to eliminate shock hazard in the unlikely event of internal insulation break down. Select wire size that can carry in excess of the sum of all circuit's maximum amperage.

5) Power Input - The AC version of the **Silo**Track™ *CLOUD* Gateway is designed to accept 100 to 240 VAC. Connect power as shown to "L1" and "N" of the DIN rail mounted terminal blocks.

6) Communications Link - The communications line from the **Silo**Track™ *CLOUD* Gateway and the **Silo**Patrol® SMU or **Radar**Right™ sensors is via a RS-485 network cable with +D, -D, and shield (0V) terminals, using Modbus RTU protocol. Basic Modbus protocol requires all (3) connections to be utilized at all of the devices on the RS-485 network. The RS-485 network will be connected to earth ground within the **Silo**Track™ *CLOUD* Gateway, but will be isolated at the **Silo**Patrol® SMU or **Radar**Right™ sensors.

Interconnection of the network can be performed by a 2-conductor shielded cable (such as Belden 9322 or similar). All devices are to be interconnected in a daisy chain, multi-drop configuration. The RS-485 network connection within the **SiloTrack**™ *CLOUD* is provided with two redundant terminals that provide for easier connections when the RS-485 network is passing through the enclosure (**SiloTrack**™ *CLOUD* is in the middle of the network). For example, a network cable extending to the right bank of sensors can connect to one terminal block, and the left bank of sensor connects to the other terminal block. Network Order of connection relative to the sensor RS-485 address is not important; use shortest cables as possible while avoiding "T's" and star configuration in your wiring. Communication networks such as this operate best when the interconnection has only two ends. Observe polarity when making the communication interconnection D+ and D- as this system does not have auto adjusting polarity functions. Attach cable shield in terminal provided (0V).

7) Master Device - The **SiloTrack**™ *CLOUD* Gateway serves as the master device on the RS-485 network to query the sensors. No other master devices (HMI2, PLC, **SiloTrack**™ PC, etc.) can be permitted on the same RS-485 network. If more than one master device is installed on the RS-485 network there will be contention and data will not be communicated properly.
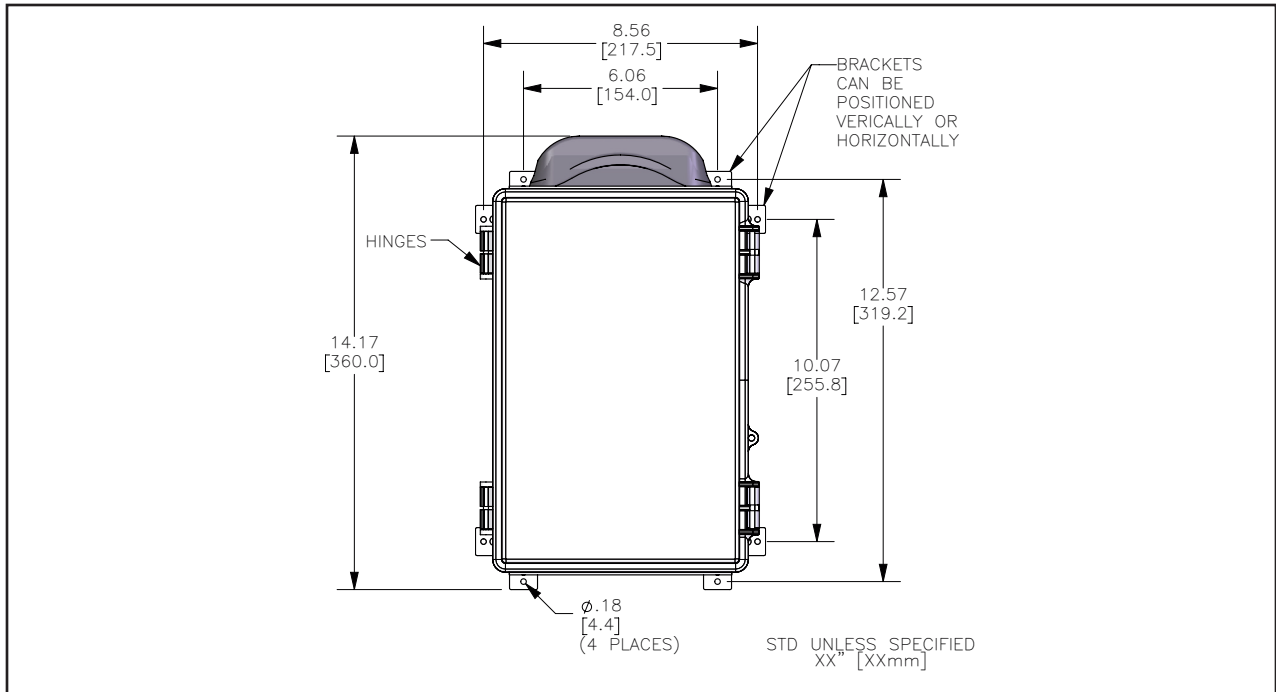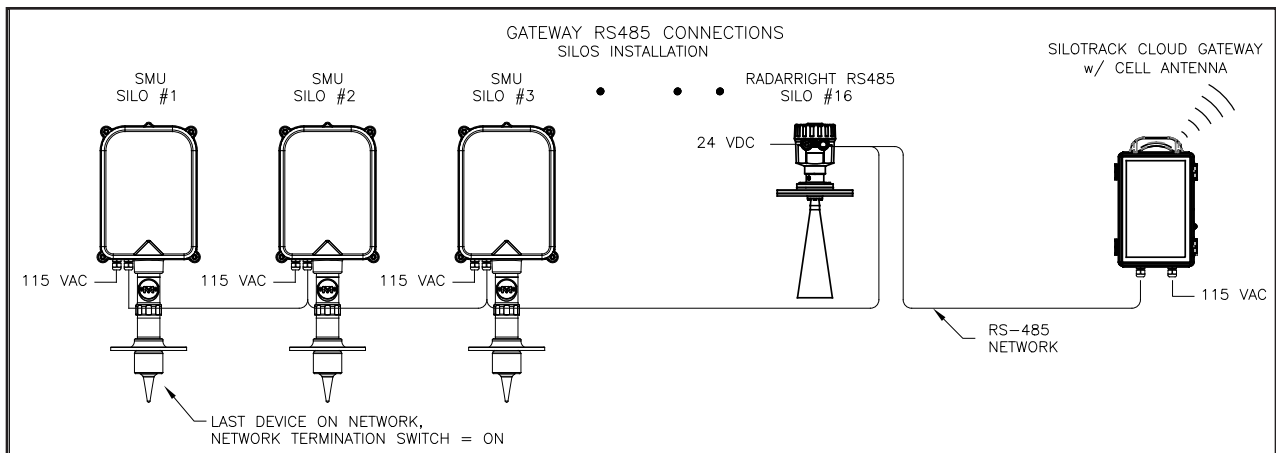

Figure 1 - Wall Mounting

Figure 2 - Gateway RS-485 Connections

3.1 Gateway Network Load Termination (See Figure 3)

For optimum performance, the two devices positioned at the ends of the RS-485 network system should have their termination switches "on". The rest of the devices on the network should have their termination switches "off". It is also commonplace to set the BIAS switches at the ends of the RS-485 network to "on", and the device in the middle have the bias switches set to "off". The **SiloTrack**™ *CLOUD* Gateway does not have to be positioned at an end of the RS-485 network, it can be placed somewhere in the middle. Just follow the rule of thumb that the end positions are "on" and the middle positions are "off", whether the device is a master or slave type of device. Refer to the specific sensor manuals or consult the factory for network termination information.
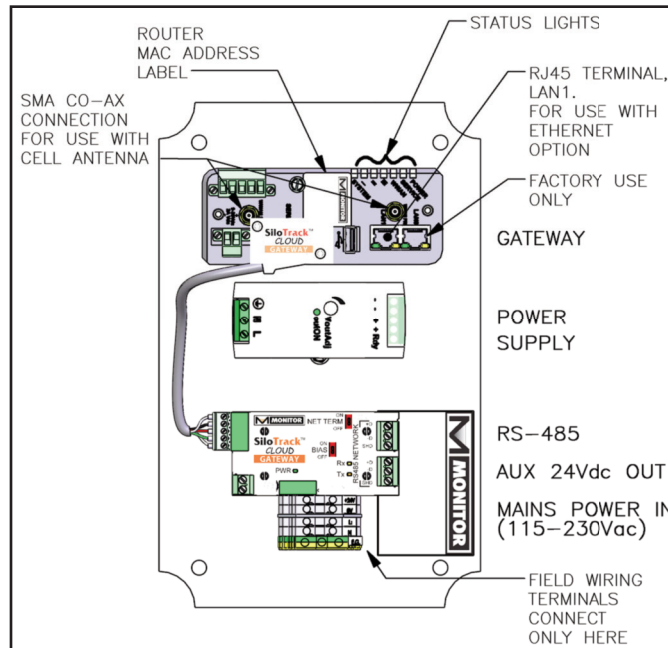

Figure 3 - Gateway Assembly

3.2 Status LED's on Router (See Figure 4)

POWER LED (power status):
  LED OFF: no power applied to router
  LED ON: power applied to router

SERVICE LED (WWAN network status):
  LED OFF: no WWAN network connection
  LED ON: WWAN network connected
  LED FLASHING: WWAN traffic being transmitted or received

SIGNAL LED (RF Cellular strength):
  ($\equiv$) 3 LED's: excellent
  ($=$) 2 LED's: good
  ($-$) 1 LED: fair
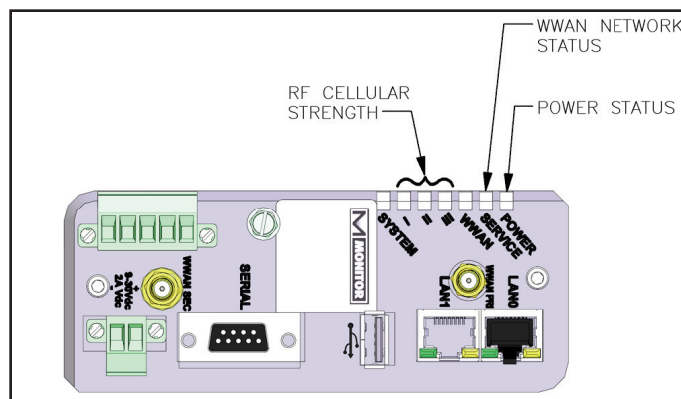   0 LED's: poor or no signal

Figure 4 - Router Status LED's

3.3 SiloPatrol® SMU or RadarRight™ Sensor Configuration

In order for the silo monitoring sensors to be able to communicate to the Cloud, they must be configured. (Sensors which are supplied on the same order as the Gateway will be pre-configured at the factory and minimal setup in this scenario will be required. Contact factory with any questions.)

1) **SiloPatrol**® SMU - Access the SiloPatrol's internal configuration using the Android app over Bluetooth (See Manual 344A, Pg. 8). Change the "RS-485" protocol to "Modbus RTU". Ensure the sensor has the correct "Device Address" set.

2) **RadarRight**™ - The RadarRight already speaks Modbus so no changes are necessary. However, it is important that each sensor has the correct Modbus Address on setting 4.6 (See Manual 364A, Pg. 31).

4.1 General Operational Guidelines - All Sensors

1) Operation duty cycle - Although the **SiloPatrol**® SMU has passed tests that have accumulated over 150,000 operations, it is recommended that the SMU be utilized as a periodic measurement device only. Applications requiring measurement more than fifty times in a 24 hour period are not recommended, as this is an electro-mechanical device; unnecessary/excessive operation can affect optimum performance and/or useful life. However, there are no physical limitations to the number of operations which can occur in one hour (i.e. the motor can run continuously and not overheat). For a fully continuous measurement device, consult the factory regarding other technologies such as **RadarRight**™ non-contact radar sensor.

2) Measurement rate - The average measurement rate of a **SiloPatrol**® SMU is influenced by the amount of cable on the storage reel. The speed of the plumb bob descent and ascent is faster when more cable is wound on the storage reel. As a result the rate of plumb travel can range from 1.0-1.5ft/sec (300-450mm/sec). There is no discernable rate of measurement for various distances for the **RadarRight**™.

3) Application restrictions - The **SiloPatrol**® SMU is equipped with a motor and spring tension system which is designed to maximize the pull out capacity in the event that a plumb bob becomes entangled or buried. The SMU has been successfully tested for operation in silo filling cycles and free flowing material applications. In applications where severe bridging or clinging occurs, it is not recommended to operate during a filling operation. A functional electrically activated lock out circuit properly utilized prohibits both automatic and manual measurements when energized. Consult the **SiloPatrol**® SMU installation/operation manual (Bulletin #344A) or the factory for additional recommendations.

CONFIGURING GATEWAY

5.1 Application

To begin the process of assessing your application for a **SiloTrack**™ *CLOUD* Gateway, the #396A, #396B and #396C Application Questionnaire form(s) will need to be filled out. This information will help evaluate your application for the **SiloTrack**™ *CLOUD* Gateway, as well as the vessel configuration. Go to the Monitor Technologies website (www.monitortech.com) or consult the factory to acquire these forms and to get started.

5.2 Router Configuration

The **SiloTrack**™ *CLOUD* Gateway will arrive pre-configured from the factory based on the information provided on the Application Questionnaires (mentioned above).

Subsequent configuration adjustments to the router (such as addition of a silo, sensor address and measurement frequency) must be performed by the Monitor technical support department. **NOTE**: The router will have to be powered, and have internet connection. The Monitor technical support department can then access the router to make the appropriate adjustments. Please call the factory for assistance.

5.3 How to Use the Website Software

For directions on how to perform required setup steps (ex. for user profiles and silo configuration), to configure reports and notifications, and to use the supporting website, please see these documents:
- Bulletin #394C **SiloTrack**™ *CLOUD*, Software/App, Manager's User Manual
- Bulletin #394D **SiloTrack**™ *CLOUD*, Software/App, Technician's User Manual
[Go to the **SiloTrack**™ *CLOUD* Software/App or consult the factory to acquire these documents.]

TROUBLESHOOTING

PROBLEM: SiloTrack™ *CLOUD* **Gateway reports an "Offline" alert on a specific channel**
CAUSE/SOLUTION:
1) This error is typically caused by a lack of power to the Gateway.
2) Verify that power connections to the gateway are intact.
3) Verify that there is actually electrical power being delivered to said connections.
4) (Ethernet Connection) Ensure ports 3197 and 3199 are open on the firewall and Ethernet cable is connected to LAN 1 on Gateway. (Cellular Connection) Ensure Gateway is located in a location with strong cellular service/signal. Consult Signal Strength LED's on Gateway for visual verification.
5) Consult factory as needed.

PROBLEM: SiloTrack™ CLOUD Gateway reports a "Com Error" on a specific channel

CAUSE/SOLUTION:
1) This error is caused by the inability of the Gateway to receive a return response from a sensor.
2) Verify that each sensor on a given network has a unique sensor address selection. Data collision will occur otherwise.
3) Verify electrical power is connected to the sensor.
4) Verify the SMU sensor at the errant channel # is configured for the protocol Modbus RTU. This is the only protocol recognized by the gateway.
5) Verify polarity of the communication connections +D, -D, & 0V (RS-485 network).
6) Verify the network configuration – all components on the network are in line (no "T's"), devices on each end have their network termination switches = ON, all other devices have their switches = OFF
7) Consult factory to determine if there is an active sensor on the channel in question.
8) Consult factory to determine if the sensor type is accurate for the actual sensor in place.

PROBLEM: SiloTrack™ CLOUD Gateway reports a "Com Error" on all channels

CAUSE/SOLUTION:
1) Clear all problems from the previous CAUSE/SOLUTION.
2) Observe on the RS-485 booster circuit on the DIN rail within the enclosure that the green "PWR" indicator is lite.
3) Periodically the orange "Tx" transmit indicator should flash. Shortly afterwards the yellow "Rx" receive indicator should also flash, indicating that the sensor just queried is responding.
4) If there is no green, yellow, or orange indicator, confirm the green indicators on the router device are lite. If not, confirm power is applied to the enclosure.
5) If the orange "Tx" lights, but not the yellow "Rx" lights, check the state of the sensors and the network wires that interconnect them.

PROBLEM: SiloTrack™ CLOUD Gateway reports a "Return Error" on a specific channel

CAUSE/SOLUTION:
1) This error is caused by the measurement distance of downward travel of a **SiloPatrol**® SMU plumb bob being greater than the upward distance of travel.
2) Determine if the error is repeatable by taking multiple measurements. If a "Motion Error" is subsequently detected, see "Troubleshooting" regarding such. Otherwise, continue on below.
3) Observe the actual motion of the plumb bob. Ensure no physical objects are impeding full return.
4) If travel of plumb bob is normal, the interrupters on the encoder PCB could be contaminated, call factory.
5) If travel of plumb bob does not permit return to home position, verify that the wiper seal is not fouled with material. Excessive drag on cable can cause premature cycle stoppage.

PROBLEM: SiloTrack™ CLOUD Gateway reports an "Index Error" on a specific channel

CAUSE/SOLUTION:
1) This error is caused by the measurement of upward travel distance of an **SiloPatrol**® SMU plumb bob being greater than the downward travel distance.
2) Determine if error is repeatable by taking multiple measurements. It is fairly unlikely that "Index Errors" will occur back-to-back. These errors will normally be in tandem with "Return Errors".
3) Observe the actual motion of the plumb bob. Ensure no physical obstruction prevents the plumb bob from seating properly against the flange.
4) If travel of plumb bob is normal, the interrupters on the encoder PCB could be contaminated or the screw securing the toothed code wheel is loose.

PROBLEM: SiloTrack™ CLOUD Gateway reports a "Motion Error" on a specific channel.

CAUSE/SOLUTION:
1) This error is caused by the inability of the plumb bob to move when requested by the **SiloPatrol**® SMU.
2) Determine if error is repeatable by taking multiple measurements. Error could be caused by a broken cable, stuck plumb bob in material, frozen plumb bob to flange, material packed immediately below the plumb bob (an overfilled or completely filled silo), or some damaged electronic circuitry in the motor driver region. Resolve obvious problem or consult factory for electronic troubleshooting or replacement.
3) Observe the actual motion of the plumb bob. Verify that the wiper seal is not fouled with material. Excessive drag on cable can cause premature plumb bob reversing and cycle stoppage.

PROBLEM: Measurement readings continuously indicate an incorrect, repeatable distance

CAUSE/SOLUTION:
1) Verify cable length installed on the **SiloPatrol**® SMU. A cable which is too short will cause automatic reversing of SMU prior to contact with material. Replace cable with a longer more suitable length if necessary.
2) Cable may not be passing freely through cable wiper seal assembly due to imperfection in cable (such as a cut in jacketing or kink in cable). Could also be caused by fouling of cable with material. Inspect cable and clean, repair or replace as needed.
3) Verify CYCLE LIMIT in your SMU is set to a value that makes sense for the height of your vessel. If the CYCLE LIMIT value is too small, this will cause an automatic reversing of SMU prior to contact with material.

PROBLEM: RadarRight™ sensor is having difficulty obtaining a measurement

CAUSE/SOLUTION:
1) See Bulletin #364A for the calibration process of a **RadarRight**™ sensor.

SAFETY

⚠️ **General Safety**

CAUTION: It is essential that all instructions in this manual be followed to ensure proper operation of the equipment and safety of operating personnel. The use of this symbol is used throughout this manual to highlight important safety issues. Please pay particular attention to these items.

⚠️ **Electrical Shock Caution**

The **SiloTrack**™ *CLOUD* Gateway is powered with HIGH VOLTAGE. No operator serviceable parts are inside. All servicing is to be performed by qualified personnel. Each **SiloTrack**™ *CLOUD* Gateway is provided with a "protective conductor terminal" ⏚ which shall be terminated to earth ground potential. (See "Electrical Installation" section)

WARRANTY

Monitor Technologies LLC warrants each **SiloTrack**™ *CLOUD* Gateway it manufactures to be free from defects in material and workmanship under normal use and service for two (2) years from the date of purchase. The purchaser must notify Monitor of any defects within the warranty period, return the product intact, and prepay transportation charges. The obligation of Monitor Technologies LLC under this warranty is limited to repair or replacement at its factory. This warranty does not apply to any product which is repaired or altered outside of Monitor Technologies′ factory, or which has been subject to misuse, negligence, accident, incorrect wiring by others, or improper installation. Monitor Technologies LLC reserves the right to change the design and/or specifications without prior notice.

SPECIFICATIONS

SiloTrack™ Cloud Gateway

Power Requirements	
AC Verson:	115-230VAC ± 15%, 50/60 Hz
DC Version:	24VDC ± 15%
Power Consumption	
AC Verson:	70W
	(1.5A max @ 115VAC)
DC Version:	18W max
AUX 24VDC Output:	1.7A max (AC Version Only)
Ambient Operating Temp:	-30° F to 149° F (-34° C to 65° C)
Sensor Communication:	RS-485 half-duplex,
	non-isolated,
	Modbus RTU protocol
	9600/8/N/1
	Max. 3,300ft (1000m) @ 9600 Baud
Sensor Channels:	One (1) 32-channel network
	(32 channels total)
Cellular Wireless	LTE CAT 4:
Interface:	700(B12,13)/850(B5)/AWS(B4)/1900(B2)
[LTE - North America (M5)]	3G HSPA+: 850/1900 MHz
	Transfer rate (max):
	150 Mbps down, 50 Mbps up
FCC ID:	R17LE910NA V
Emissions / Immunity:	CE, FCC Part 15 Class B, AS/NZS
	CISPR 22, EN55024, EN55022 Class B
Indicators	
Router:	7 LED's
	(Power, Service, WWAN, 3x Signal
	Strength, System - Not Used)
RS-485 Booster:	3 LED's
	(Power, Transmit, Receive)
Firewall Ports:	3197, 3199
(Ethernet Only)	
Enclosure Material:	PBT / PC
Enclosure (HxWxD):	12" x 8" x 6.4"
	(305mm x 203mm x 163mm)
Environmental Protect:	ENCLOSURE TYPE 4X, IP65
Approvals	
Power Supply:	UL Listed (US and Canada)
Router:	UL Listed (US and Canada)

BULLETIN
394A