BULLETIN

344H

INSTALLATION & OPERATION

SiloPatrol® Wireless Communication Interface

Standard Antenna

Thank you for purchasing a quality product manufactured by Monitor Technologies LLC. We realize that you do have a choice of vendors when buying instrumentation and we sincerely appreciate you business!

This manual contains the information necessary to ensure a safe and successful installation. Please read and comply with the section on page 10 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 or the internal packing materials, please inspect the packaging thoroughly and verify that all parts are accounted for. This product is shipped with the antenna, and mounting plate (with its fasteners) detached from the Wireless Communication Interface (radio module).

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 fax at 630-365-5646. If your SiloPatrol Wireless Communications Interface ever requires service either in or out of warranty, please contact us and obtain an RMA number prior to shipping the unit to us.

The **SiloPatrol**® inventory monitor "smart" sensors (Refer to Bulletin 343A) can be used in conjunction with the **SiloTrack**™ Inventory Management PC-Based Software (Refer to Bulletin 343B). Communication between the Model SMU "smart" sensors and the **SiloTrack** software is accomplished via 2-wire RS-485 communication format. The **SiloPatrol** Wireless Communication Interface can be used to replace the RS-485 wiring between the "smart" sensors and the PC. With reliable and affordable technology, the **SiloPatrol** Wireless Communication Interface can be used to lower the cost of installation and to overcome obstacles that make hardwiring impractical or impossible.

PRE-INSTALLATION CONSIDERATIONS

Choosing a location: (See Figure 1)

1) **Anticipated Range:** Plan installation to stay within the range of the antenna selected. Monitor's standard antenna (small rubber duck style) can achieve distances of 5000 ft (1 mile) or greater in ideal conditions. Longer transmission distances can be achieved with higher performance antennas.
2) **Idealizing Range:** The 900MHz frequency band is capable of propagating around obstacles. However, optimum performance is achieved when antennas are positioned in the line of sight of each other. Whenever possible, select antenna locations that are elevated and where the signal can travel without being impeded by large steel obstacles (such as the steel buildings). An example of an ideal installation is as follows: One Wireless Communication Interface (radio/antenna) is on an office roof wired to the control system (i.e. **SiloTrack**™ system) and the second Wireless Communication Interface (radio/antenna) is on the top of the silo attached to a safety railing wired to the sensors.
3) **Cabling effects:** Due to the low transmission power of the radio, it is preferable to keep the antenna as close to the Wireless Communication Interface (radio module) as possible. Whenever possible mount the antenna directly to the Wireless Communication Interface (radio module). In some challenging applications, it maybe necessary to install a higher performance antenna that requires co-axial cabling between the radio and the antenna. The co-axial cable introduces loss into the system thereby negating some benefit of the better antenna. In these applications, keep the coaxial cable as short as possible. Monitor's standard length is three feet (perhaps just long enough to reach past/through a metal barrier). It is always preferable to use the hardwired medium (RS-232/RS-485) to span the distance from the control system/sensors to the Wireless Communication Interface (radio module) than to use extended lengths of coaxial cable to span the distance between the Wireless Communication Interface (radio module) and the antenna.

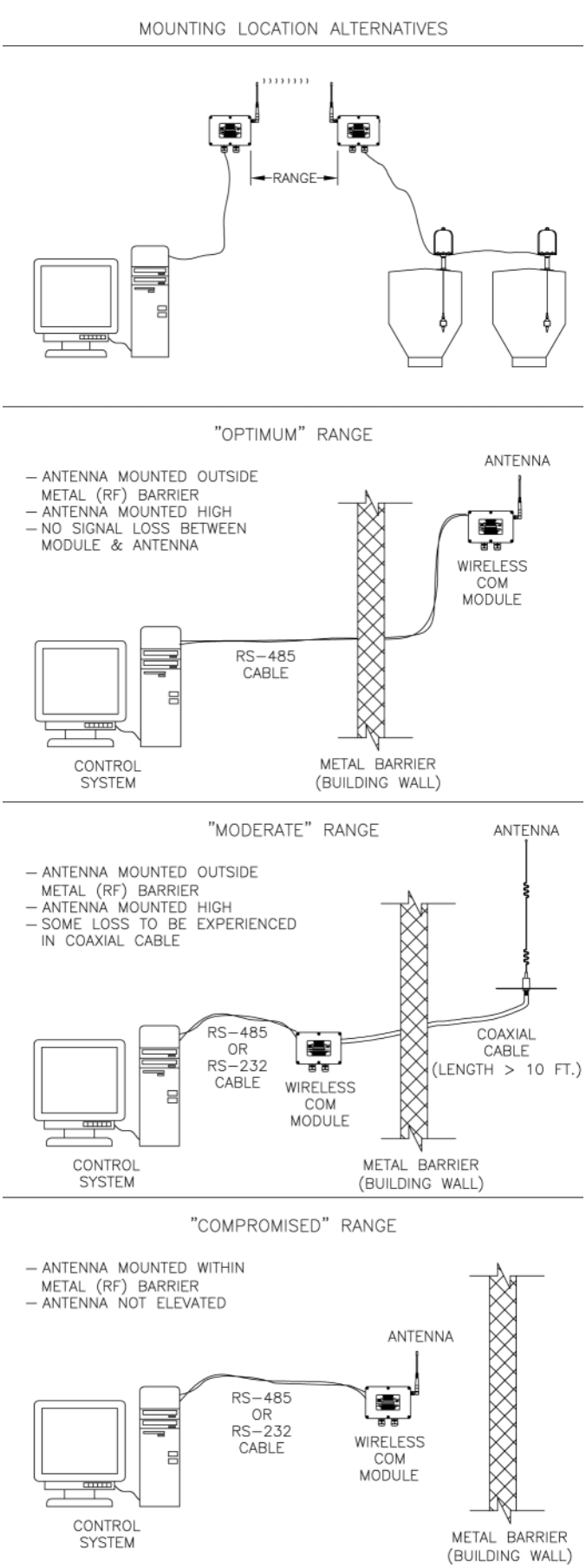

Figure 1

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MECHANICAL INSTALLATION

Communication Interface (Radio Module) Mounting:

1) **Desk Top:** The unit is packaged such that it can simply rest on a desktop next to the control system (i.e. **SiloTrack**).
2) **Wall mount:** A universal mounting plate supplied with each Wireless Communication Interface can be attached to the back of the enclosure with the two screws provided. Secure plate to the wall using the holes in the mounting plate that best suit the installation. Do not modify the enclosure in any way as its weatherproofing and the internal electronics may be compromised. Instead, make any modifications to mounting plate.
3) **Rail mounting:** (See Figure 2 & 3) It is anticipated that the Wireless Communication Interface will be mounted to conduits or railings located on the top of the silo. The universal mounting plate supplied with each unit can be attached to the back of the enclosure with the two screws provided. Determine the piping diameter, source suitable conduit clamps (not provided due to so many possible sizes) then clamp the mounting plate to the conduit/railing. Various hole patterns are provided in the plate to permit optimum clamp sizing. Do not modify the enclosure in any way as weatherproofing and internal electronics may be compromised. Instead, make any modifications to mounting plate.
4) **Cable entrance positioning:** In outdoor applications, mount the box with the conduit openings facing downwards. If installing with conduit, be sure to provide a drip loop (i.e. a section of conduit that is more then 6" lower then the box, with a means to disperse any accumulated water in the conduit so that water does not pour into the box). Likewise, if installing with cable and the cord connectors provided, position a drip leg in the cable (i.e. a portion of cable that is more then 6" lower then the box so that water will tend to run down and away from the box entries).

Antenna Mounting: (See Figure 4)

1) **Direct attachment to Wireless Communication Interface:** The standard antenna (rubber ducky style) from Monitor has a right angle fitting that attaches directly to the side of the Wireless Communication Interface (radio module) enclosure. Once screwed in place, the antenna can be rotated as desired.
2) **Attached through coaxial cable to Wireless Communication Interface:** Higher performing antennas (Monitor's extended range antenna or similar) must be connected to the Wireless Communication Interface (radio module) enclosure with a coaxial cable. Since the cable restricts the effective range of the radio signals, it's recommended that the cable be kept as short as possible. In these cases the antenna should be mounted to a supporting structure using its own mounting bracket. Then the cable can be connected as a bridge between the antenna and the side of the Wireless Communication Interface enclosure.

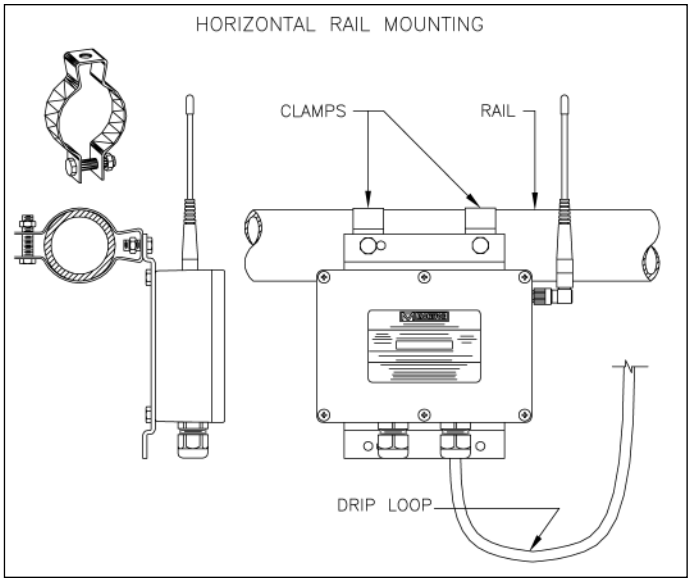

Figure 2

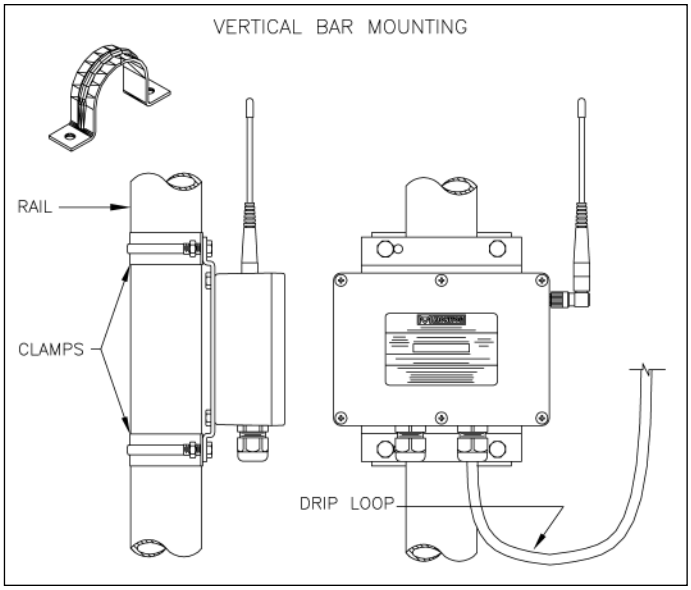

Figure 3

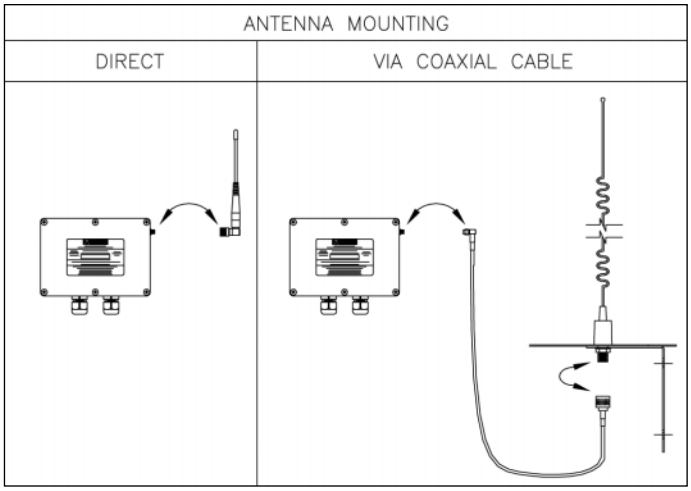

Figure 4

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ELECTRICAL INSTALLATION

Permanently Connected Equipment:
Disconnecting devices shall be included in the system installation. The disconnects shall be within close proximity of the equipment, accessible to operators, and marked appropriately as the disconnect for the associated circuit. Assure the disconnect ratings are appropriately sized for the circuit protected (See Specifications).

Circuit Separation:
Two cable entry locations are provided 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 such as the data communication signals). However, since the Wireless Communication Interface's single wiring compartment can not absolutely protect against physical contact between multiple circuits, it is required that all wiring used must have an insulation rating of 300v minimum, and a temperature rating of 176˚F (80˚C) minimum.

Protective Earthing:
Each Wireless Communication Interface is provided with a "protective conductor terminal"⏚ which shall be terminated to the local earth ground potential. This terminal shall be used to eliminate shock hazard in the unlikely event of internal insulation breakdown. Select wire size that can carry in excess of the sum of all circuit's maximum amperage.

EMI Optimizing: (See Figure 5)
Ferrite beads are provided for installation in the wiring to minimize affects of EMI. Wrap the large ferrite bead with the incoming power wires (including protective earth conductor) two to four full turns through the bead’s core. Wrap small ferrite bead with incoming data wires (RS-232 or RS-485) two to four full turns through the bead’s core. Position each bead immediately inside the cable entrance of the enclosure.

Power Input:
1) **115 or 230VAC Source:** (See Figure 6) Verify the intended voltage supply is compatible with the voltage configuration indicated on the electronics and the external nameplate. Standard mains supply voltage (115VAC or 230VAC as ordered) can be connected to the unit's L1 and N terminals.
2) **12VAC Source:** (See Figure 7) A dedicated, isolated 12VAC supply voltage can be connected to the +L and -L terminals. This feature allows for a more convenient means to power the unit without the concerns of supplying high voltage. This source could be a wall transformer or flange mount transformer, with 12VAC output, 5~10VA rating (reference Stancor #STA-4112A (wall, plug-in) or Stancor #P-8392 (chassis mount)).

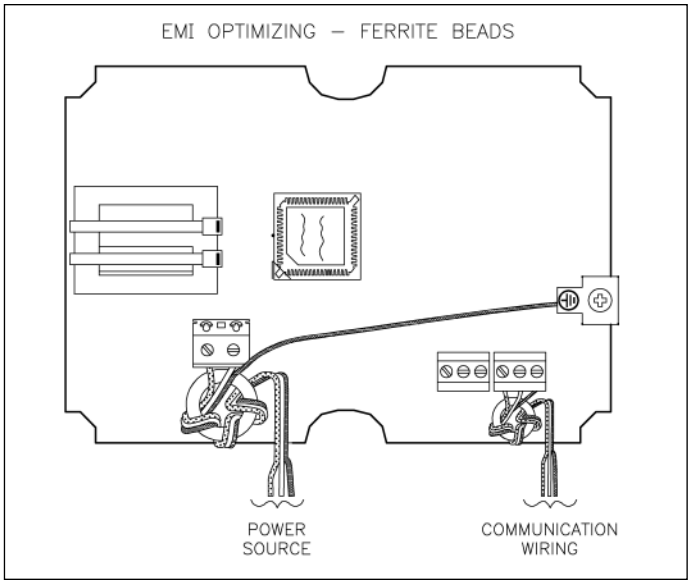

Figure 5

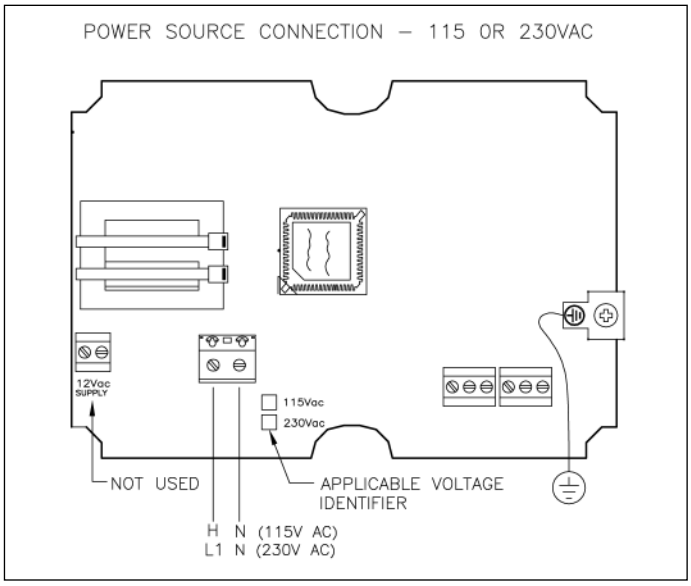

Figure 6

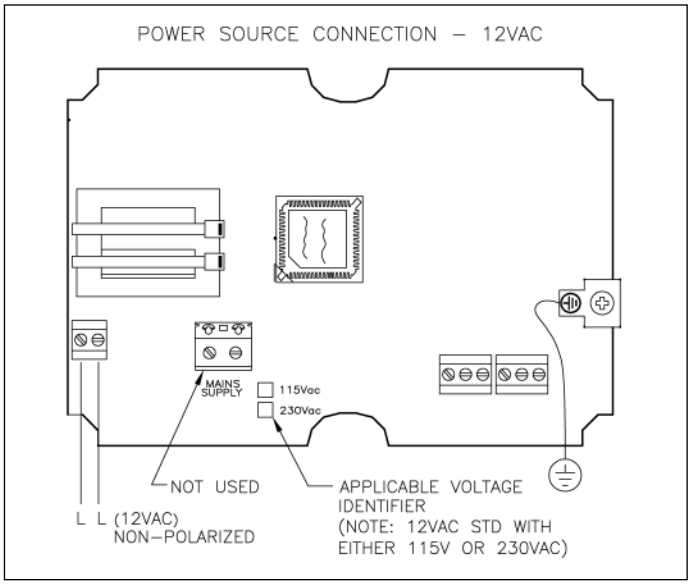

Figure 7

Data Communications:
The Wireless Communication Interface can receive data communications through one of two wiring media: either RS-485 half-duplex or RS-232. Before wiring, determine which data communication wiring medium is to be tied to the Wireless Communication Interface and proceed as follows (Refer to Setup section for further explanation).

1) RS-232 Connection (if applicable): (See Figure 8) A single network **SiloTrack**/PC system can be connected directly to the Wireless Communication Interface using the PC's RS-232 serial port. RS-232 is intended for use in office environments where interconnection distances are short (less than 12 feet) and where heavy electrical circuits (motors, contactors, etc.) are not present. The interconnection must be done point-to-point (no multi-dropping or networking) with a 3-conductor cable (such as Belden 9533 or Alpha 6303). Determine the type of connector on the PC, source a suitable mating connector (See Table 1) then interconnect as described in Table 2.

CONNECTOR TYPE	AMPHENOL	NORCOMP
9-pin D-sub, male con	17-DE09P	172-009-101-001
9-pin D-sub, female con	17-DE09S	172-009-201-001
9-pin D-sub back shell	17-1724-1	972-009-010-011
25-pin D-sub, male con	17-DB25P	172-025-101-001
25-pin D-sub, female con	17-DB25S	172-025-201-001
25-pin D-sub back shell	17-1726-1	972-025-010-011

Table 1

PC PORT			WIRELESS COMMUNICATION INTERFACE
	DB-25	DB-9	Terminal Block
Transmit	2	3	Rx
Receive	3	2	Tx
Signal ground	7	5	GND
Chassis ground	1	N/A	Shield

Table 2

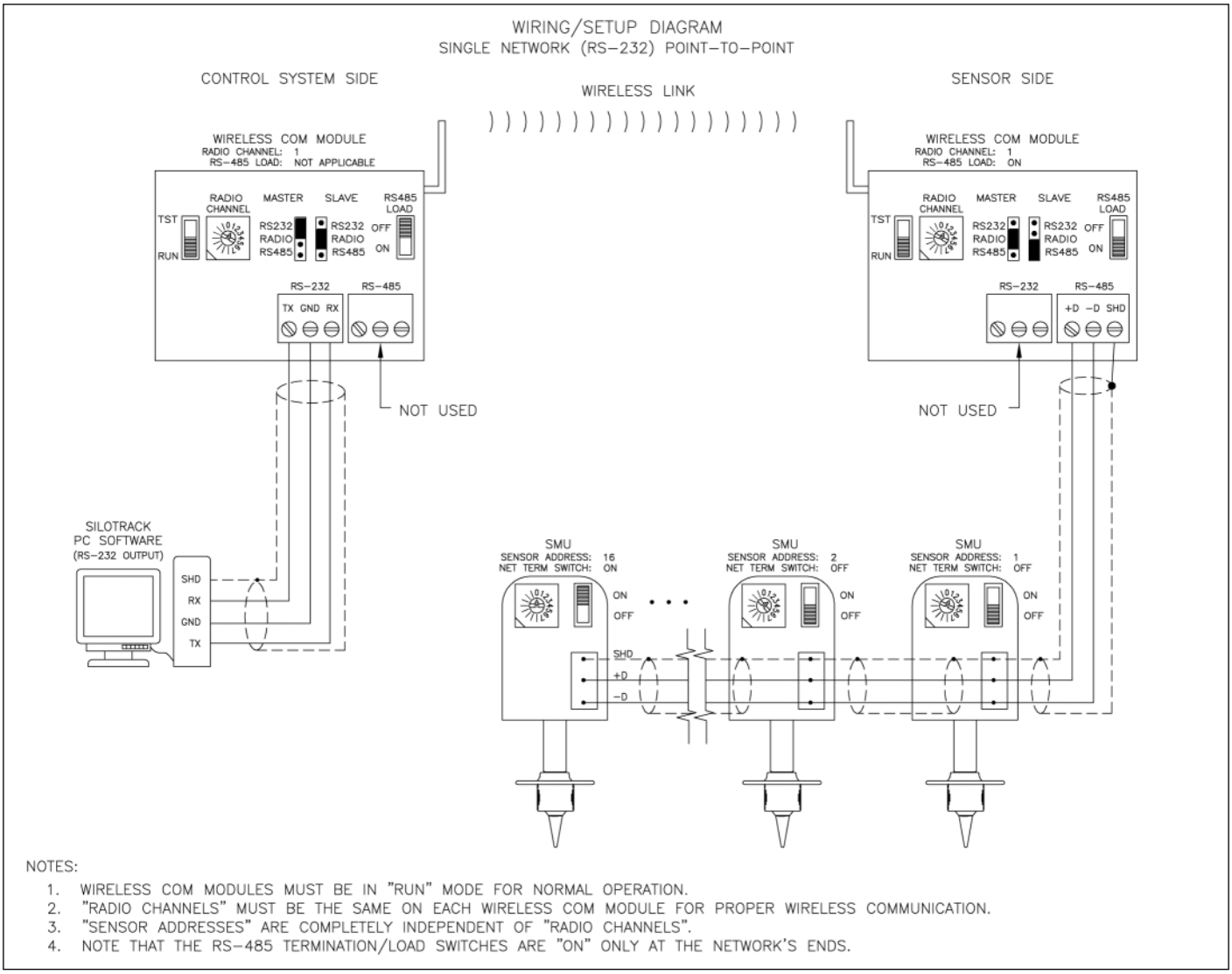

Figure 8

2) RS-485 Connection: (See Figure 9) The RS-485 protocol permits network interconnection of multiple devices such as the control system (**SiloTrack**), sensors (SMUs), Auxiliary Output Enclosures (AOEs), Remote Display Units (RDUs) and Wireless Communication Interfaces. Devices on this "network" are interconnected in a daisy chain, multi-drop configuration using a 2-conductor shielded cable (such as Belden 9322 or Alpha 6302). Order of connection is not important (i.e.the Wireless Communication Interface can be connected between SMUs if necessary). The Wireless Communication Interface creates a "wireless link" that replaces a section of the RS-485 wiring. This break in the wiring results in two wired circuits:

a) The wired circuit connecting the control system (**SiloTrack**) and the Wireless Communication Interface,

b) The wired circuit connecting the second Wireless Communication Interface and the sensors (SMUs in the field).

Each wired circuit operates most effectively when the interconnection has only two ends. "T"s should be avoided whenever possible. Observe polarity when making the communication interconnection (D+ and D-). Attach the cable shield to the "SHD".

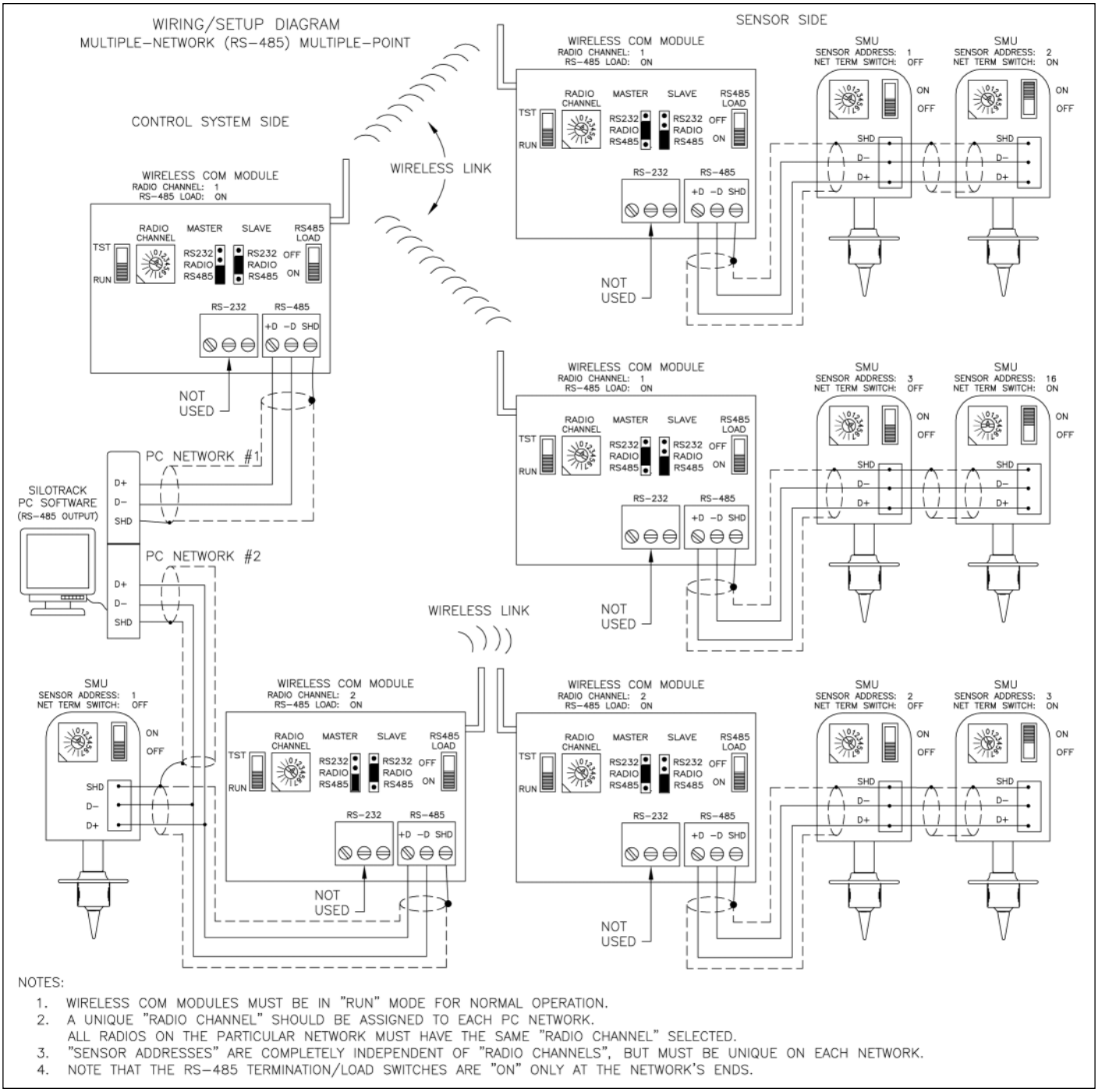

Figure 9

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SETUP

Initial Setup: (5 setup selections required before use)

1) Radio channel: The **SiloPatrol**® communication system only allows 16 sensors per network. In single network (16 or less sensors) applications, a single radio channel is sufficient. All Wireless Communication Interfaces expected to be on the same network of 1-16 SMUs must be set on the same radio channel. The rotary switch (See Figure 8 or 9) will select the RF radio channel that you wish to operate on (selections 1-7, others are invalid). In applications with greater than 16 sensors, multiple networks are needed. When multiple networks are required and Wireless Communication Interfaces are used, different radio channels are needed for each network to assure data from one control system network does not collide with data from a different control system network. (*Note: For clarity and convenience, when using a* **SiloTrack** *system, it may be desirable to match the radio channel with the network number. This should not be confused with the SMU sensor address.*)

2) Master: (See Figure 8 or 9) This selects the medium that the control system (**SiloTrack**) will use to communicate to the Wireless Communication Interface. A jumper clip is provided for selection. Position jumper clip on the two pins associated with one of three possible selections:

RS232: Select this if the signal from the control system (**SiloTrack**/PC system) is delivered to the Wireless Communication Interface via RS-232 medium. This implies that the Wireless Communication Interface is on the control system side of the "wireless link".

RADIO: Select this if the signal from the control system (**SiloTrack**) is delivered to the Wireless Communication Interface via the "wireless link". This implies that the Wireless Communication Interface is on the sensor side of the "wireless link".

RS485: Select this if the signal from the control system (**SiloTrack**/PC system) is delivered to the Wireless Communication Interface via RS-485 medium. This implies that the Wireless Communication Interface is on the control system side of the "wireless link".

3) Slave: (See Figure 8 or 9) This selects the medium that the slave sensors (SMUs) will use to communicate to the Wireless Communication Interface. A jumper clip is provided for selection. Position jumper clip on the two pins associated with one of three possible selections:

RS232: Not used (never an appropriate selection for a slave).

RADIO: Select this if the signal from the sensors (SMUs) is delivered to the Wireless Communication Interface via the "wireless link". This implies that the Wireless Communication Interface is on the control system side of the "wireless link".

RS485: Select this if the signal from the sensors (SMUs) is delivered to the Wireless Communication Interface via RS-485 medium. This implies that the Wireless Communication Interface is on the sensor side of the "wireless link".

4) RS485 load: (See Figure 8 or 9) This switch is used to terminate the RS-485 link to achieve maximum communication reliability. If no RS-485 communications is to be used, simply turn "off" this switch. If there is to be RS485 communications, then you must determine if the Wireless Communication Interface is physically on the end of the RS-485 wiring circuit. If so, then the load switch should be turned "on". If the Wireless Communication Interface is not at the end of the wiring circuit (i.e. two wire pairs branch off in two different directions) then this switch should be turned "off". This evaluation should be conducted for every device on the RS-485 network.

5) SiloTrack Timeout: When using the Wireless Communciation module, the **SiloTrack** "Timeout" must be set for 200ms. Time out is defined as the amount of time between each SMU query by **SiloTrack**. The default for **SiloTrack** is 100ms. To accommodate the time required for the "radio link", change setting to 200ms as follows on Windows-based PCs:

- **a)** "Click" Start
- **b)** "Click" Run
- **c)** Open REGEDIT (type in); "Click" OK
- **d)** Select/expand following folders by "clicking" on + symbol
  - HKEY_CURRENT.USER
  - Software
  - Monitor Technologies
  - STCOMDRIVER
  - Communications
- **e)** "Click" TIMEOUT (within Communications)
- **f)** Change "Value Data" to "200" (decimal).
- **g)** Close registry editor
- **h)** Reboot computer to engage new TIMEOUT

Indicators: (See Figure 10)
(Four provided for reporting status)

1) Power: The green POWER indicator will light when power is applied to the unit.

2) Query: The red QUERY light strobes when the control system (**SiloTrack**) is querying the SMU sensors. This is normally a continuously repeating action occurring about every 1/4 second.

3) Reply: The red REPLY light will strobe when the Wireless Communication Interface sees a response from the SMU sensors. This will only occur when sensors with valid addresses are connected.

4) Error: The red ERROR light will flash when:

- **a)** An illegal radio channel was selected (other than 1-7)
- **b)** An illegal master/slave combination has been made. This could be if the same medium was chosen for both the slave and master or if radio was chosen for a medium, but a radio was not installed
- **c)** A check sum error was detected

Support Functions: (See Figure 10)

1) RUN/TEST switch: This slide switch determines mode of operation:

RUN: For normal operation of the Wireless Communication Interface, set switch in this position.

TEST: Use this selection for testing the radio link between Wireless Communication Interfaces. Testing can be conducted with or without connection of the actual control system (**SiloTrack**) or sensors (SMUs). At the Wireless Communication Interface on the control system (**SiloTrack**) side of the "wireless link", set the switch to "TEST". At the Wireless Communication Interface on the sensor (SMU) side of the "wireless link", leave switch in RUN position. This will force the control side radio module to emit a test signal to the radio. When the sensor side radio receives the signal, it will reply back to the control side with a confirming test signal. The visual effect of a good link is when both units indicate a QUERY blink, followed immediately by a REPLY blink. This will cycle about every 0.5 seconds. If the REPLY does not blink, then wireless link is bad. The error light will flash briefly if a test signal is received, but does not have a proper check sum, thus indicating that the content and integrity of the signal is suspect. (*Note: for a valid check of the radio link, only one Wireless Communication Interface on the sensor side of the "wireless link" (with same radio channel selection*) *can be active/powered during testing. Apply power only to the sensor side Wireless Communication Interface that you wish to test.*)

2) RESET switch: This push button switch will induce the Wireless Communication Interface to re-initialize the entire system's operational software.

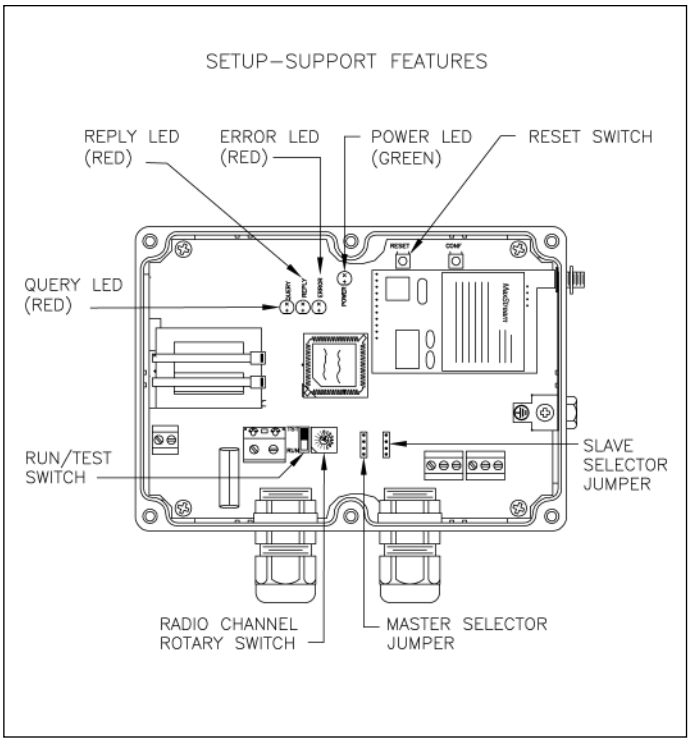

Figure 10

MAINTENANCE

Fuse Replacement:

The fuse incorporated into the Wireless Communication Interface SMU PCBs is not intended for operator replacement. A qualified technician can replace the applicable fuse according to the following specifications. If necessary, consult the factory for additional technical assistance or for return of the Wireless Communication Interface.

115VAC
F1: 5x20mm, 0.125A Time Lag (Slo-Blo), 250VAC
LittelFuse #218.125
Bussmann #GDC-125mA

230VAC
F1: 5x20mm, 0.063A Time Lag (Slo-Blo), 250VAC
LittelFuse #218.063
Bussmann #GDC-63mA

Preventive Maintenance:

The Wireless Communication Interface is virtually maintenance free. In typical applications, once the apparatus is properly setup, it will operate without any further attention. The electronics are housed in a weatherproof enclosure. In addition the PCBs are conformal coated with a silicone-based material to further prevent electrical influence by condensation. The electronics should periodically be observed for any signs of contamination caused by improper enclosure protection (i.e. insure cover is fully engaged, and that wire entries are properly sealed.)

Cleaning Requirements:

In the event that the antenna is fouled by external contamination, reliable communication of the RF wireless signal may be degraded. In these cases, clean antenna with a soft damp towel.

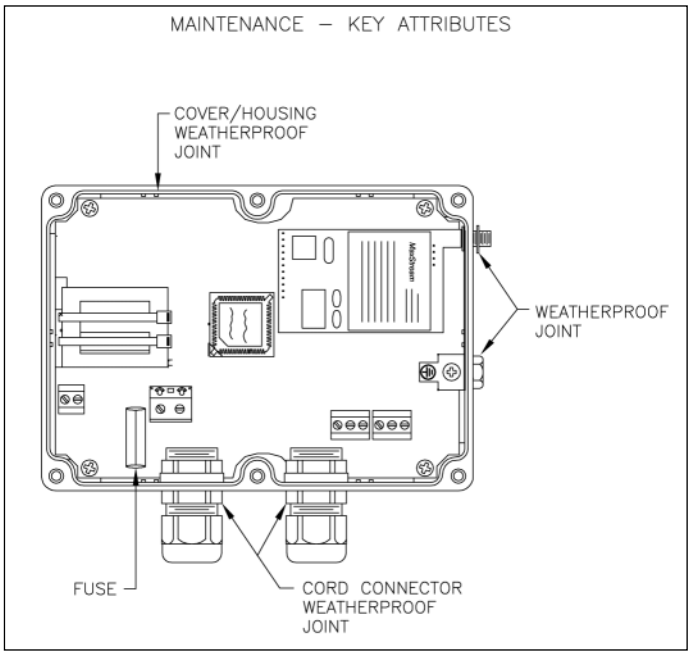

Figure 11

TROUBLESHOOTING

PROBLEM: SiloTrack™ occasionally displays a "COM error" for a specific vessel

CAUSE/SOLUTION:

1) This error is caused by the inability of **SiloTrack** to continuously receive a return response from a SMU. Brief dropouts of communication can be expected in wireless radio links, especially during periods of severe weather. If dropouts are unacceptable, see alternate suggestions below.

2) Confirm that there are no other Wireless Communication Interfaces on the control side of the "wireless link" set to the same radio channel.

3) Verify proper termination of the RS-485 wiring.

4) Consider altering radio installation positions for best line-of-sight, highest elevation, and no obstructions (especially metallic).

5) Consider installing a higher performance antenna.

PROBLEM: SiloTrack continuously displays a "COM error" for a specific vessel

CAUSE/SOLUTION:

1) This error is caused by the inability of **SiloTrack** to ever receive a return response from the SMU. This can be caused by a variety of issues, many not related to the Wireless Communication Interface.

2) Verify the SMU's sensor address corresponds to the **SiloTrack** node (channel) number.

3) Verify that each SMU on the network has a unique sensor address selection.

4) Verify electrical power is connected to the SMU.

5) Verify polarity of the communication connection.

6) Verify proper termination of the RS-485 wiring.

7) Verify RUN/TEST switch on each Wireless Communication Interface is set to "RUN".

8) Verify that **SiloTrack** TIMEOUT is set for 200ms.

9) Verify that SMU software is revision V1.01 or greater.

10) Proceed to the following PROBLEM/SOLUTIONS pertaining to the Wireless Communication Interface. Continue to proceed down the items until problem is solved. Some may not apply.

PROBLEM: The green power LED does not light

CAUSE/SOLUTION:

1) This error is caused by the lack of power connected to the Wireless Communication Interface.

2) Verify electrical power is connected, that it is the proper voltage as indicated on the nameplate, and that the magnitude is within the specified limits.

3) Verify status of fuse F1. If blown, examine the connections and environment in an attempt to determine why fuse blew before replacing.

PROBLEM: The error LED flashes

CAUSE/SOLUTION:

1) This error is normally caused by improper setup of key selections. In some cases the flash may signify that the wireless data link is being influenced (See above regarding "occasional" COM error).

2) Verify radio channel selection (Only 1-7 are valid).

3) Verify the master/slave selection settings. These settings can not be identical.

4) Verify that the radio module is installed. If a radio is not plugged into the main PCB, a "radio" setting for master or slave will not be accepted.

PROBLEM: The query LED is not strobing

CAUSE/SOLUTION:

1) This error is caused by the Wireless Communication Interface not receiving the commands from the control system (**SiloTrack**). Identify if the Wireless Communication Interface in question is on the control side (**SiloTrack**) or sensor (SMU) side of the "wireless link". Then:

Control side of "wireless link":

2) Verify electrical connection and polarity between **SiloTrack** and Wireless Communication Interface.

3) Verify that the "master" selection on the Wireless Communication Interface matches the communication media (RS-232 or RS-485) used to deliver signals from the **SiloTrack** to the Wireless Communication Interface.

4) Verify that the "slave" selection on the Wireless Communication Interface is set for "Radio".

Sensor side of "wireless link":

5) Verify that the Wireless Communication Interface on control side of "wireless bridged link" is indicating "query" by a strobing LED. If not, check steps 2-4 above then continue.

6) Verify that the radio channel selections made on the two Wireless Communication Interfaces forming the "wireless link" are on the same channel number.

7) Verify that the "master" selection on the Wireless Communication Interface is set for "Radio".

8) Verify performance of the "wireless link". It is possible that the radio installation position and/or the antenna performance are insufficient to successfully achieve a wireless link. See above regarding "occasional" COM error. The RUN/TEST switch (See Setup) can be useful in determining if a successful "wireless link" can be established.

PROBLEM: The reply LED is not strobing

CAUSE/SOLUTION:

1) This error is caused by the Wireless Communication Interface not receiving responses from the SMU sensors. **IMPORTANT:** Before proceeding with these steps, make sure the "query" LED is strobing on both Wireless Communication Interfaces performing the "wireless link". If not, proceed with steps as described above "query LED is not strobing".

2) Verify that the "slave" selection on the Wireless Communication Interface on the sensor side of the "wireless link" is set for "RS-485".

3) Verify electrical connection and polarity between the Wireless Communication Interface and the SMU sensors.

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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 manual to highlight important safety issues. Please pay particular attention to these items.

Electrical Shock Caution:

Certain Wireless Communication Interfaces are powered with HIGH VOLTAGE. No operator serviceable parts are inside. All servicing is to be performed by qualified personnel. Each Wireless Communication Interface is provided with a "protective conductor terminal" which shall be terminated to earth ground potential (See Electrical Installation). This product's design complies with EN61010-1 overvoltage category II and pollution degree 2. When installing certain high performance antennas, it is critically important that the antenna not come in contact with overhead power lines. Doing such may put operators at risk of electrical shock that may be harmful or fatal.

Electromagnetic Compatibility (EMC):

The Wireless Communications Interface contains transmitter module FCC ID: OUR9XTREAM. This enclosed device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions.

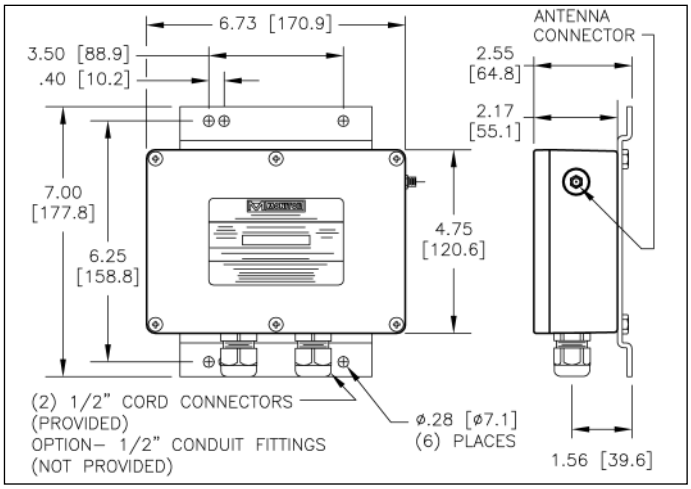
1. This device may not cause harmful interference
2. This device must accept any interference received, including interference that may cause undesired operation.

WARRANTY

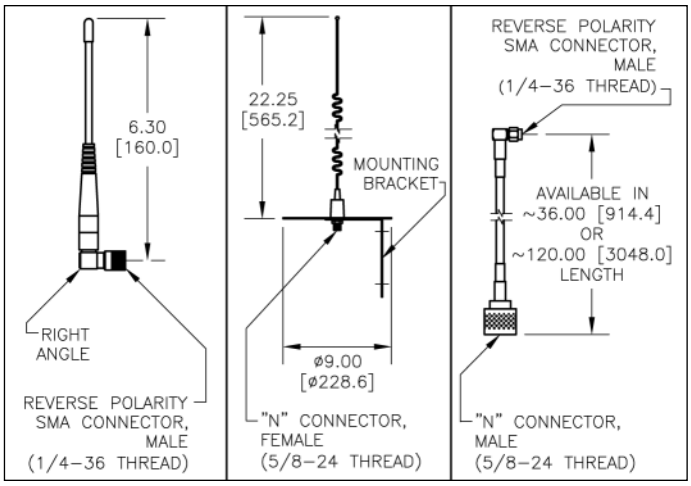
Monitor Technologies LLC warrants each **SiloPatrol**® Wireless Interface it manufactures to be free from defects in material and workmanship under normal use and service for two (2) years from the date of purchase. The purchaser must notify Monitor of any defects within the warranty period, return the 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.

MECHANICALS

DIMENSIONS ARE SHOWN IN INCHES WITH MILLIMETER EQUIVALENT IN BRACKETS



Wireless Communication Interface



Left: Standard Antenna
Center: High Gain Antenna
Right: N to RP-SMA Cable

SPECIFICATIONS

Power Requirements:	115/12 VAC (±15%); 7VA; 50/60Hz 230/12 VAC (±15%); 7VA; 50/60Hz
Ambient Operating Temp:	-40° to +150° F (-40° to +65° C)
Data Input Signal:	RS-485 half-duplex, isolated, proprietary protocol
Alt. Data Input Signal:	RS-232
Wiring Distance:	4,000 ft. (1,220 m)
Radio Output:	900MHz (North America); 100mw
Radio Sensitivity:	-110dBm
Conduit Entry:	Two (2) 0.88in (22.4mm) dia. holes
Indicators:	Red LEDs: Query, Reply and Error Green LED: Power
Housing:	Powder coated die cast aluminum, IP66 NEMA 4
Mounting:	Desk, wall or pipe/rail