Model QLTX

Lightning Detection Sensor

PRODUCT MANUAL

QLTX/Rev C

ADB SAFEGATE

A.0 Disclaimer / Standard Warranty

CE certification

The equipment listed as CE certified means that the product complies with the essential requirements concerning safety and hygiene. The European directives that have been taken into consideration in the design are available on written request to ADB SAFEGATE.

ETL certification

The equipment listed as ETL certified means that the product complies with the essential requirements concerning safety and C22.2 No.180:13 (R2018) regulations. The CSA directives that have been taken into consideration in the design are available on written request to ADB SAFEGATE.

All Products Guarantee

ADB SAFEGATE will correct by repair or replacement per the applicable guarantee below, at its option, equipment or parts which fail because of mechanical, electrical or physical defects, provided that the goods have been properly handled and stored prior to installation, properly installed and properly operated after installation, and provided further that Buyer gives ADB SAFEGATE written notice of such defects after delivery of the goods to Buyer. Refer to the Safety section for more information on Material Handling Precautions and Storage precautions that must be followed.

ADB SAFEGATE reserves the right to examine goods upon which a claim is made. Said goods must be presented in the same condition as when the defect therein was discovered. ADB SAFEGATE furthers reserves the right to require the return of such goods to establish any claim.

ADB SAFEGATE's obligation under this guarantee is limited to making repair or replacement within a reasonable time after receipt of such written notice and does not include any other costs such as the cost of removal of defective part, installation of repaired product, labor or consequential damages of any kind, the exclusive remedy being to require such new parts to be furnished.

ADB SAFEGATE's liability under no circumstances will exceed the contract price of goods claimed to be defective. Any returns under this guarantee are to be on a transportation charges prepaid basis. For products not manufactured by, but sold by ADB SAFEGATE, warranty is limited to that extended by the original manufacturer. This is ADB SAFEGATE's sole guarantee and warranty with respect to the goods; there are no express warranties or warranties of fitness for any particular purpose or any implied warranties of fitness for any particular purpose or any implied warranties other than those made expressly herein. All such warranties being expressly disclaimed.

Standard Products Guarantee

Products manufactured by ADB SAFEGATE are guaranteed against mechanical, electrical, and physical defects (excluding lamps) which may occur during proper and normal use for a period of two years from the date of ex-works delivery, and are guaranteed to be merchantable and fit for the ordinary purposes for which such products are made.

NOTE

See your applicable sales agreement for a complete warranty description.

Replaced or repaired equipment under warranty falls into the warranty of the original delivery. No new warranty period is started for these replaced or repaired products.

FAA Certified products manufactured by ADB SAFEGATE

ADB SAFEGATE L858 Airfield Guidance Signs are warranted against mechanical and physical defects in design or manufacture for a period of 2 years from date of installation, per FAA AC 150/5345-44 (applicable edition).

ADB SAFEGATE LED products (with the exception of obstruction lighting) are warranted against electrical defects in design or manufacture of the LED or LED specific circuitry for a period of 4 years from date of installation, per FAA EB67 (applicable edition). These FAA certified constant current (series) powered LED products must be installed, interfaced and powered with and through products certified under the FAA Airfield Lighting Equipment Program (ALECP) to be included in this 4 (four) year warranty. This includes, but is not limited to, interface with products such as Base Cans, Isolation Transformers, Connectors, Wiring, and Constant Current Regulators.

Revision History

Revision	Date	Summary of Changes
A	2023 Aug 15	Initial release
B	2024 Oct 10	Added 1192 DCP connections
C	2025 Apr 1	ADB SAFEGATE (ECP#ADBSG-0001)

Contents

1. Overview

The QLTX Lightning Detection Sensor is a combined crossed-loop and sense antenna, which correlates the electric and magnetic signatures of lightning strikes. The antenna has been designed to filter out pulsed noise from sources other than lightning discharges. The antenna detects the electrical and magnetic fields generated by intra-cloud, inter-cloud, or cloud-to-ground electrical discharges, and sends the resulting "discharge signals" to the processor.

The QLTX lightning-location processor incorporates data acquisition electronics and software to process lightning strike data and provide it the AWOS Data Collection Platform (DCP) in real time. The DCP communication is via an RS-485 serial link. The lightning-location processor digitizes, analyzes, and converts the discharge signals into range and bearing data, then stores the data in memory.

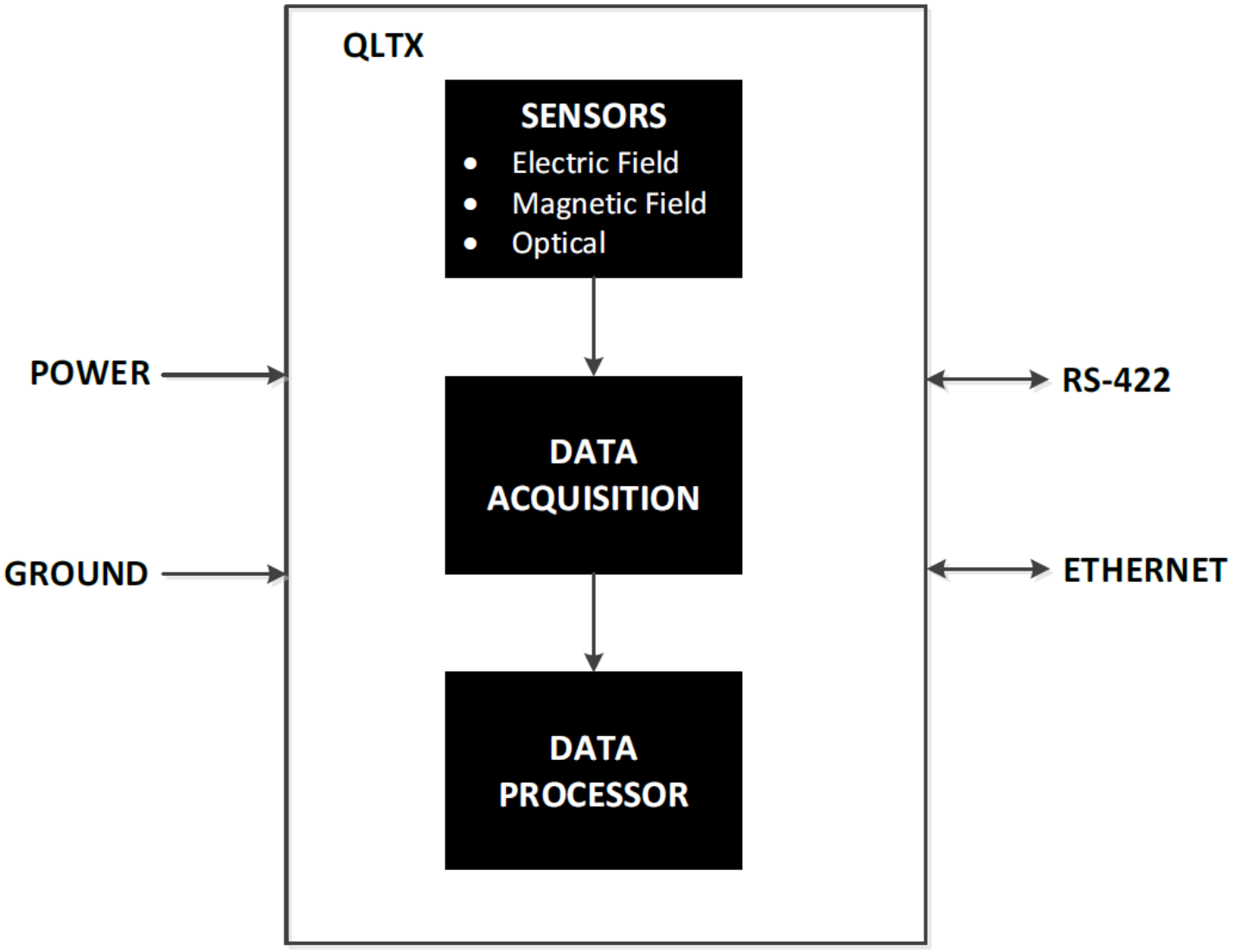


Figure 1. QLTX Block Diagram

The QLTX Lightning Detection Sensor is designed for use with a standalone Model 1192 Data Collection Platform (DCP) or as part of an F1 STA AWOS.

2. Theory Of Operation

2.1 Lightning Detection

The QLTX has two orthogonal horizontal magnetic-field sensors and a vertical electric-field sensor. It also integrates an optical sensor to confirm nearby lightning strikes. The sensors detect the electrical and magnetic fields generated by intra-cloud, inter-cloud, and cloud-to-ground electrical discharges that occur within a 200 nautical mile radius of the antenna and sends the resulting "discharge signals" to the processor. The processor digitizes, analyzes, and converts the discharge signals into range and bearing data, then sends data through an RS-485 serial communication link.

2.2 Data Processing

The QLTX processor is housed inside the sensor enclosure along with the interface connections. The processor transmits a data string consisting of strike data and status information.

2.3 Data Reporting

The QLTX detects the presence of a lightning event within 200 nautical miles from the point of installation; activity occurring within a 30 nautical mile radius of the point of installation would be selected for display in an AWOS. The sensor detects lightning and therefore locates thunderstorms, providing the data as part of the standard AWOS message.

1. Range and Direction

   Reports thunderstorms/lightning within a 200 nautical mile radius from the installation point. Direction is expressed in compass octants for distances from 10 to 30 nautical miles.

2. Resolution

   The location of a thunderstorm is reported to a resolution of ±1 nautical mile.

3. Accuracy from Installation Point

   Within 10 nautical miles of installation:

   - Detection: 90% of all thunderstorms
   - Location: does not exceed 3 nautical miles (RMS)

   Between 10 nautical miles and 30 nautical miles of installation:

   - Detection: 80% of all thunderstorms
   - Location: does not exceed 6 nautical miles

3. Installation And Checkout

NOTE

Installation and checkout of the QLTX may only be performed by qualified personnel trained in the theory of operation of the QLTX and site preparation requirements.

The QLTX mounts to a 2½" pipe (2.875" O.D.) using mounting struts. A standard galvanized steel pipe can be used with no drawbacks or special adaptation. Refer to the site preparation instructions and applicable drawings for foundation, grounding, conduit, and junction box installation details.

CAUTION

The QLTX ground plane extends well beyond the edges of the sensor enclosure. Be aware that the QLTX should be mounted with the upper mounting strut as close as possible to the top of the mast so the mast will not be in the line of sight for the internal antennas.

3.1 RFI/EMI Precautions

The QLTX antenna is sensitive to static charges, so care must be taken to ensure that the antenna and ground plane are kept as far away as possible from composite materials (e.g., plastic materials or fiberglass), since these materials may build up a static charge. The sky immediately above the antenna must be unobstructed.

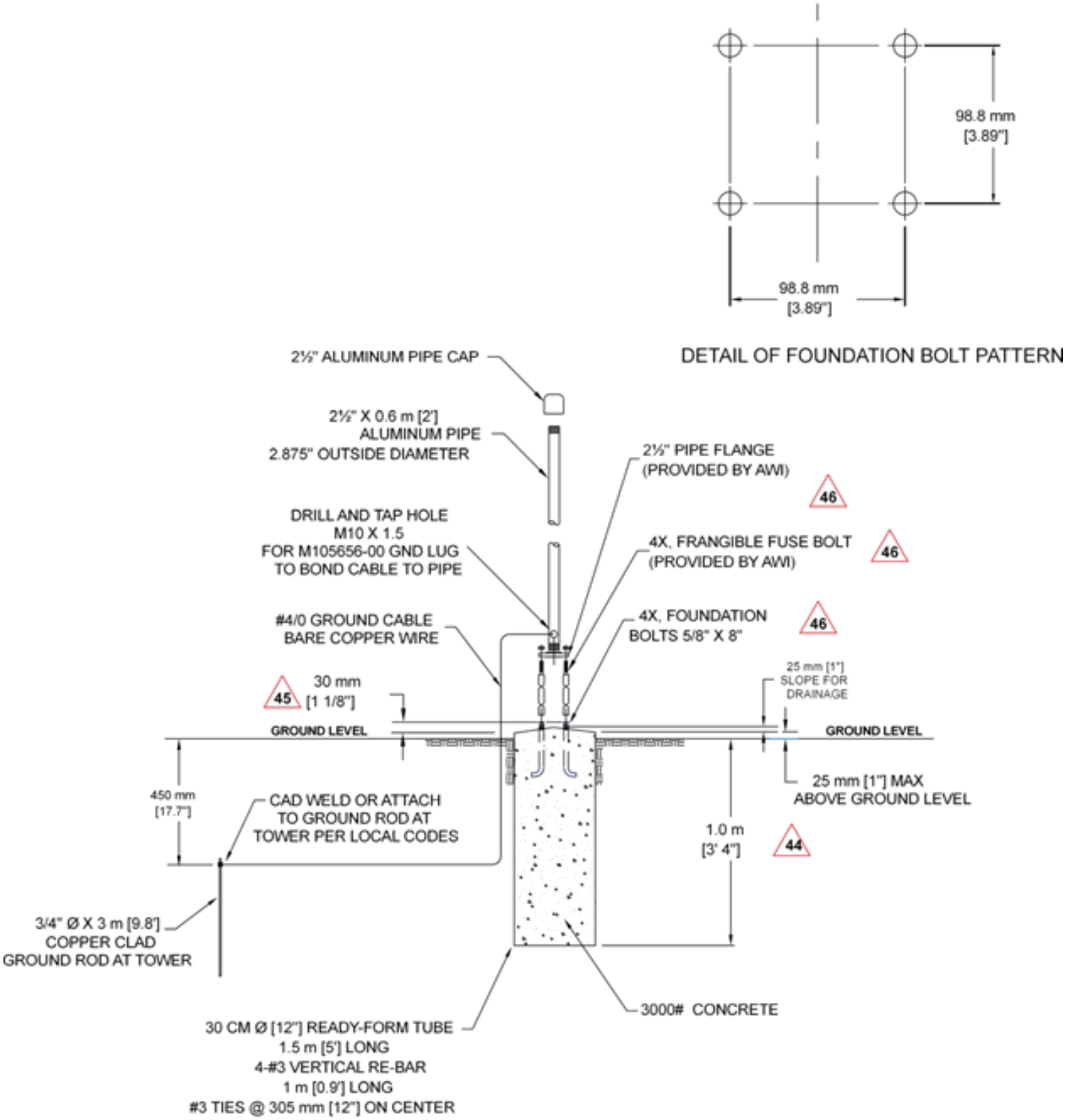
The sensor should be mounted as far as possible from devices that emit high levels of radio- frequency interference (RFI) and electromagnetic interference (EMI), such as VHF and UHF radios, RF modems, fluorescent lamps, and ballasts, air conditioner and heater blowers, as well as any current-carrying cables. Pay attention to these general clearance guidelines.

- Strobe lamps and power supplies — 1.5 m (5 ft)
- Fluorescent lamps and ballasts — 1.5 m (5 ft)
- Air conditioners and heater blowers — 5 ft. (1.5 m)
- Telephone antennas — 1.2 m (4 ft)
- VHF/UHF communication antennas — 0.3 m (1 ft)
- Any current-carrying cable — 0.6 m (2 ft)

In addition to the above restrictions, there are also RFI/EMI considerations. If RFI/EMI is expected to exist, standard RFI measuring equipment can be used to identify locations that will minimize interference from RFI/EMI sources can be enhanced by the use of. The recommended equipment for monitoring the proposed installation area is a typical spectrum analyzer with a broadband conical antenna. The spectrum analyzer should be set up to scan the frequencies of concern (100–500 MHz) for typical VHF and UHF radio links near the installation. Once it has been determined that there is significant interference, it is imperative that the lightning sensor be moved to a location as far from the interfering device as possible. *Under no circumstances should the lightning sensor antenna and ground plane be placed within 0.3 m (1 ft) of either a VHF or UHF transmitting antenna.*

3.2 Site Preparation

Figure 2 shows the foundation and mounting pole specifications for the Lightning Detector to be mounted inside a frangible area.



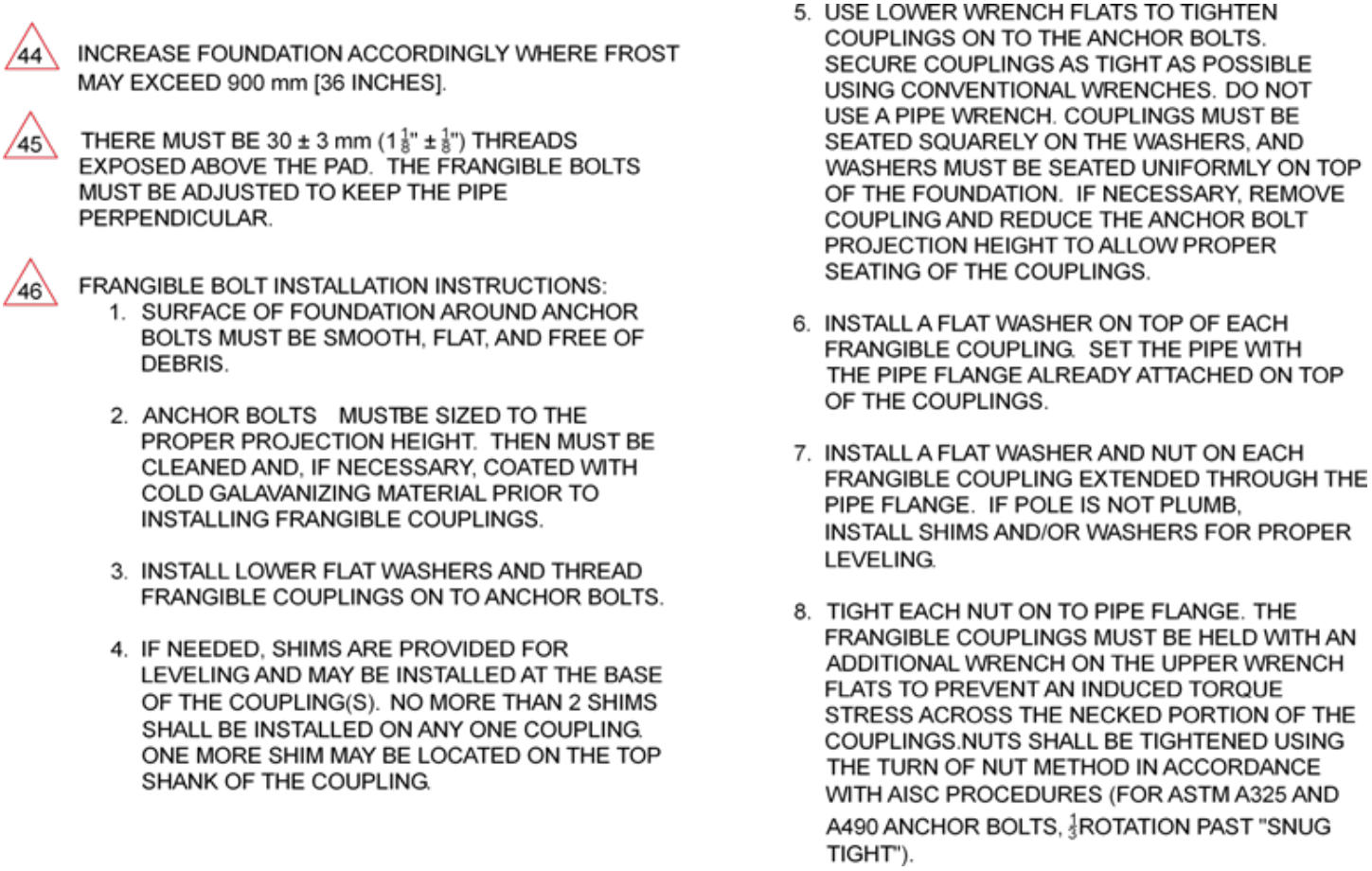


Figure 2. Foundation and Mounting Pole in Frangible Area

Figure 3 shows the foundation and mounting pole specifications for the Lightning Detector to be mounted inside a frangible area.

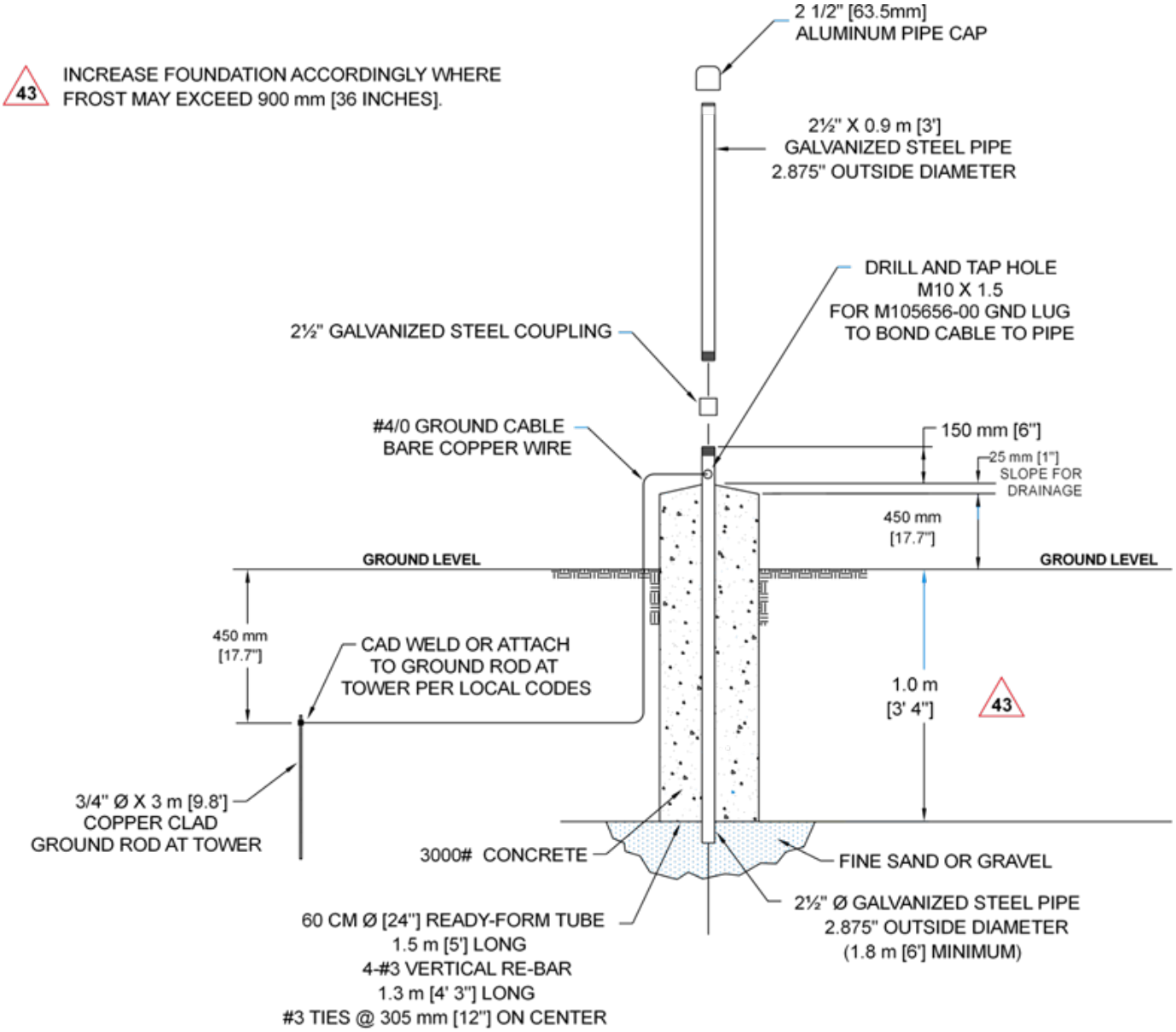


Figure 3. Foundation and Mounting Pole Outside Frangible Area

3.3 Sensor Installation

After installing the mast and junction box, follow the instructions below for assembling and installing the sensor.

Installation Protocol

Do not remove the nuts holding the mounting struts to the sensor enclosure (Figure 4) These are indicated by green squares.

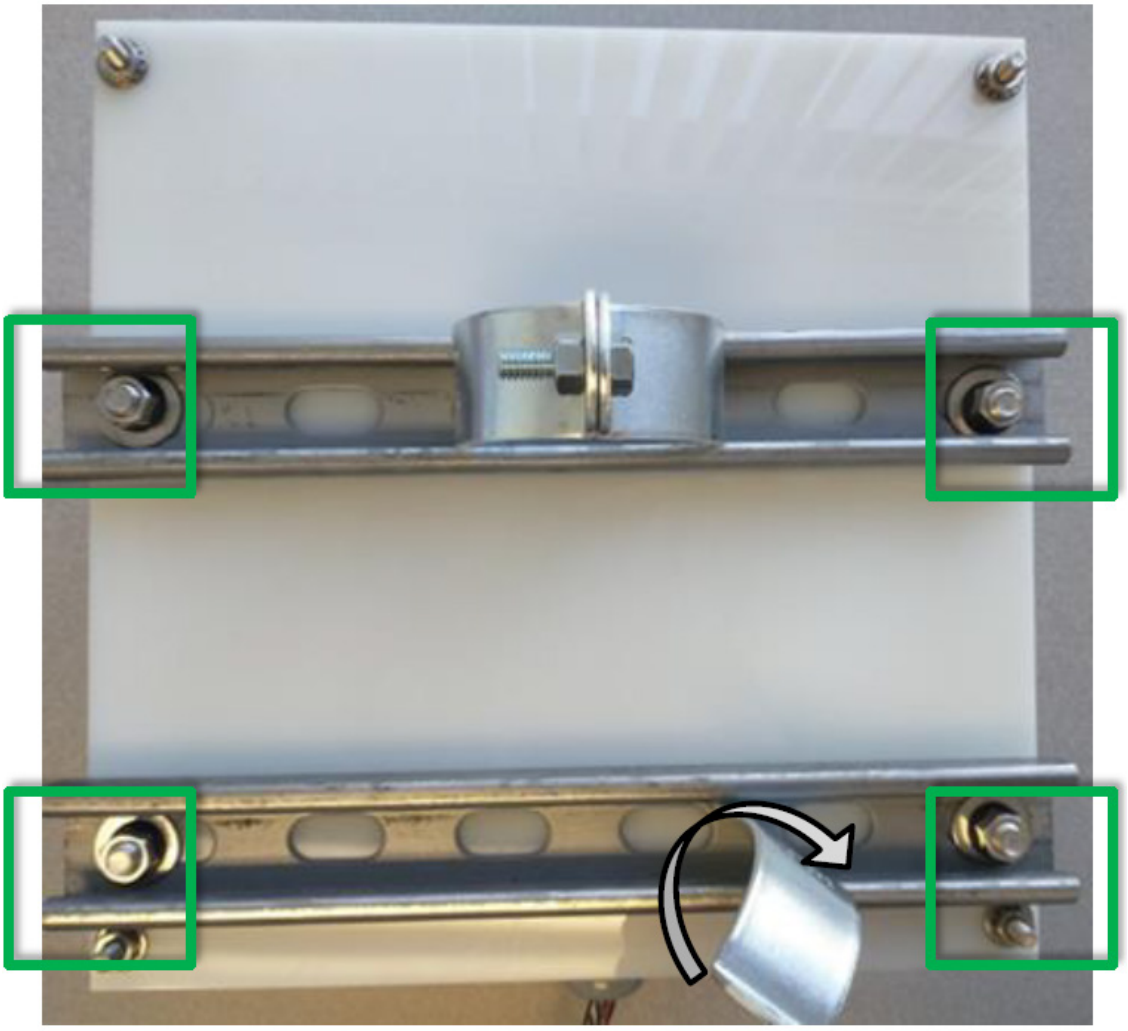


Figure 4. Mounting Struts and Clamps

1. Install a strut clamp directly in the strut to secure the QLTX to a mast. The lower strut is shown with half a clamp being inserted, with an arrow showing how to twist it into place. When finished, the clamp should look like the one in upper strut.
2. Insert both mounting clamp halves into each strut channel, between the nuts marked in Figure 4 by green squares. Twist the mounts to insert them into the strut channel, then twist them back to lock them in place.
3. Secure the mounting struts loosely to the mast by tightening the clamps with a ½" wrench. The QLTX is installed on a mast so that the internal antenna plane is above the top of the mast as shown in Figure 5.

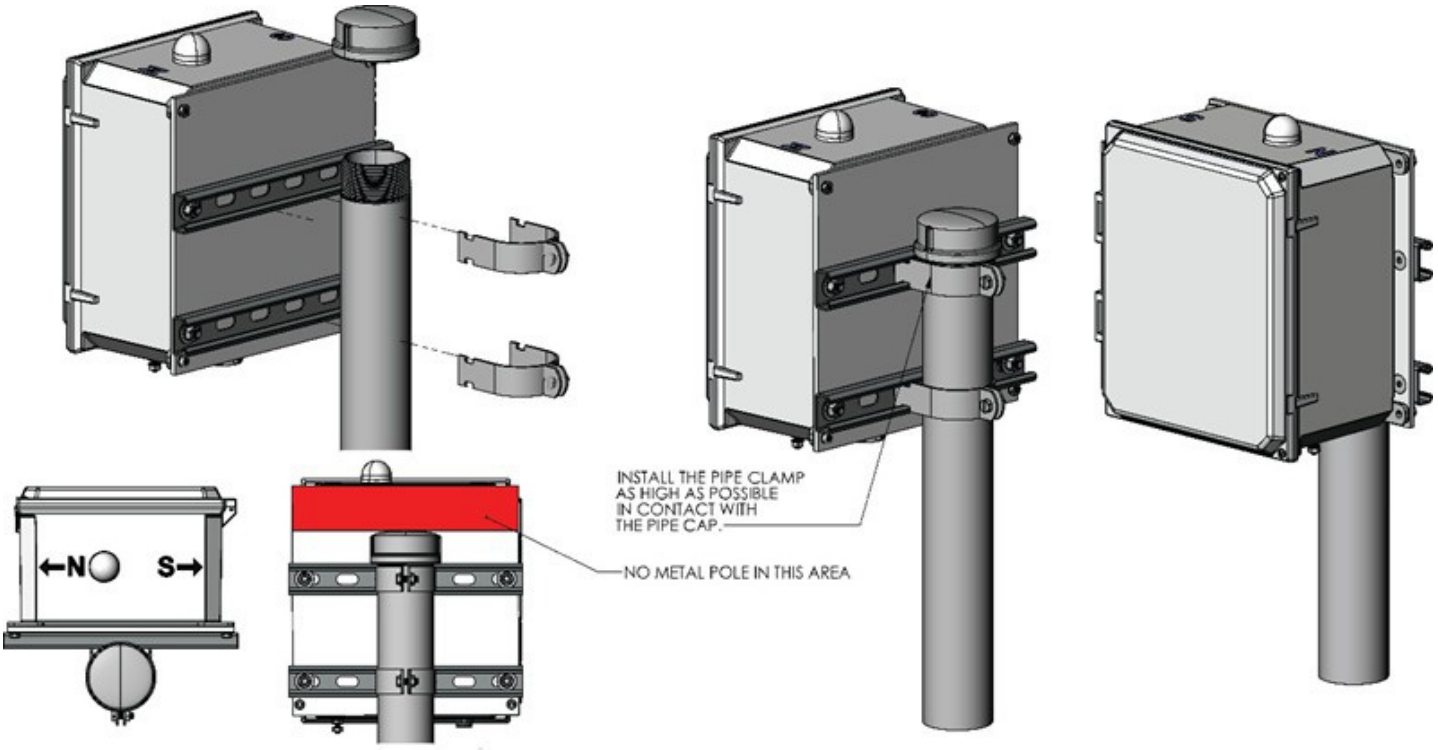


Figure 5. QLTX Mounted to Mast

4. Rotate the QLTX on the mast to align the N and S ends with their respective geographic bearings (true North).

Figure 6. Align the N-S Axis with Actual Geographic Bearings

5. Tighten the mounting clamps.

6. Connect a ground cable to the nut labeled GND at the bottom edge of the enclosure (Figure 4).

Figure 7. Bottom Side of QLTX Enclosure

7. Route the ground cable to the ground lug at the bottom of the mast and then to the ground rod as shown in Figure 8.

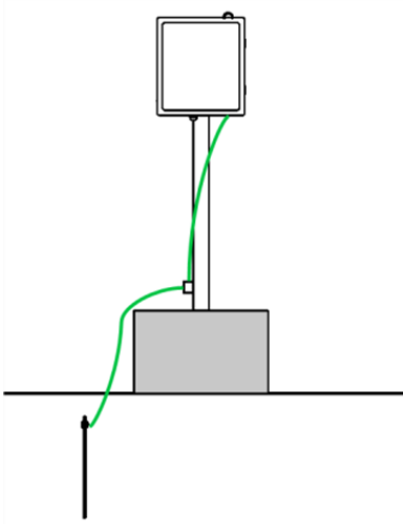


Figure 8. Ground Cable Connection to Ground Rod

8. Unscrew the conduit, remove the gasket, and feed serial, power cables through the gasket and then back into the conduit. The cable provided with the Lightning Detector has seven conductors for both the serial and power connections. Leave enough length inside the enclosure to ensure the cable reaches into the terminal blocks in the bottom left of the enclosure.

Figure 9. Passing Cables through the Conduit

9. Connect the wires to the terminal blocks based on the wiring diagram in Figure 10.

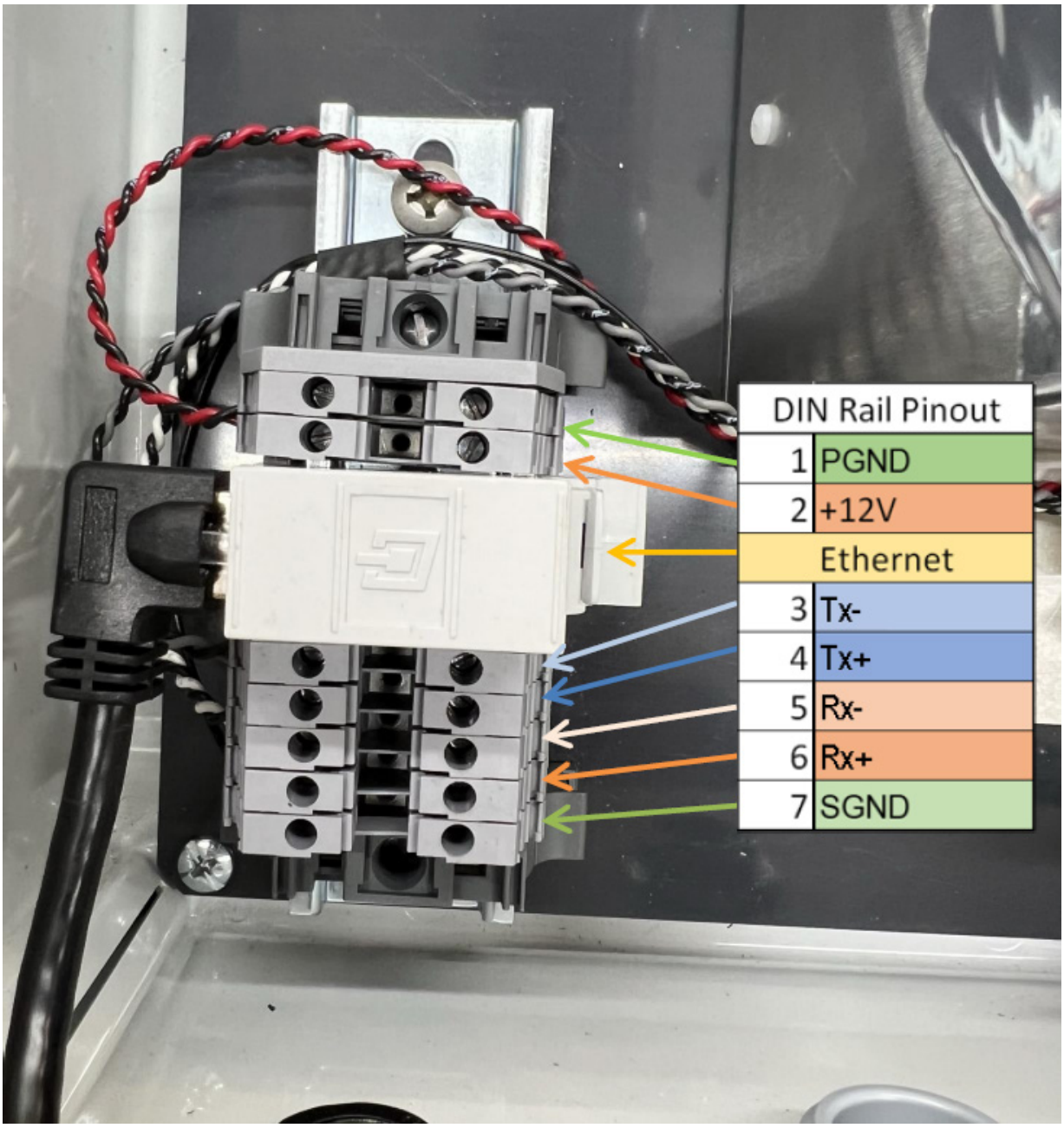


Figure 10. Terminal Block Reference Table

10. The same table is attached to the inside of the front panel of the QLTX enclosure (Figure 7).

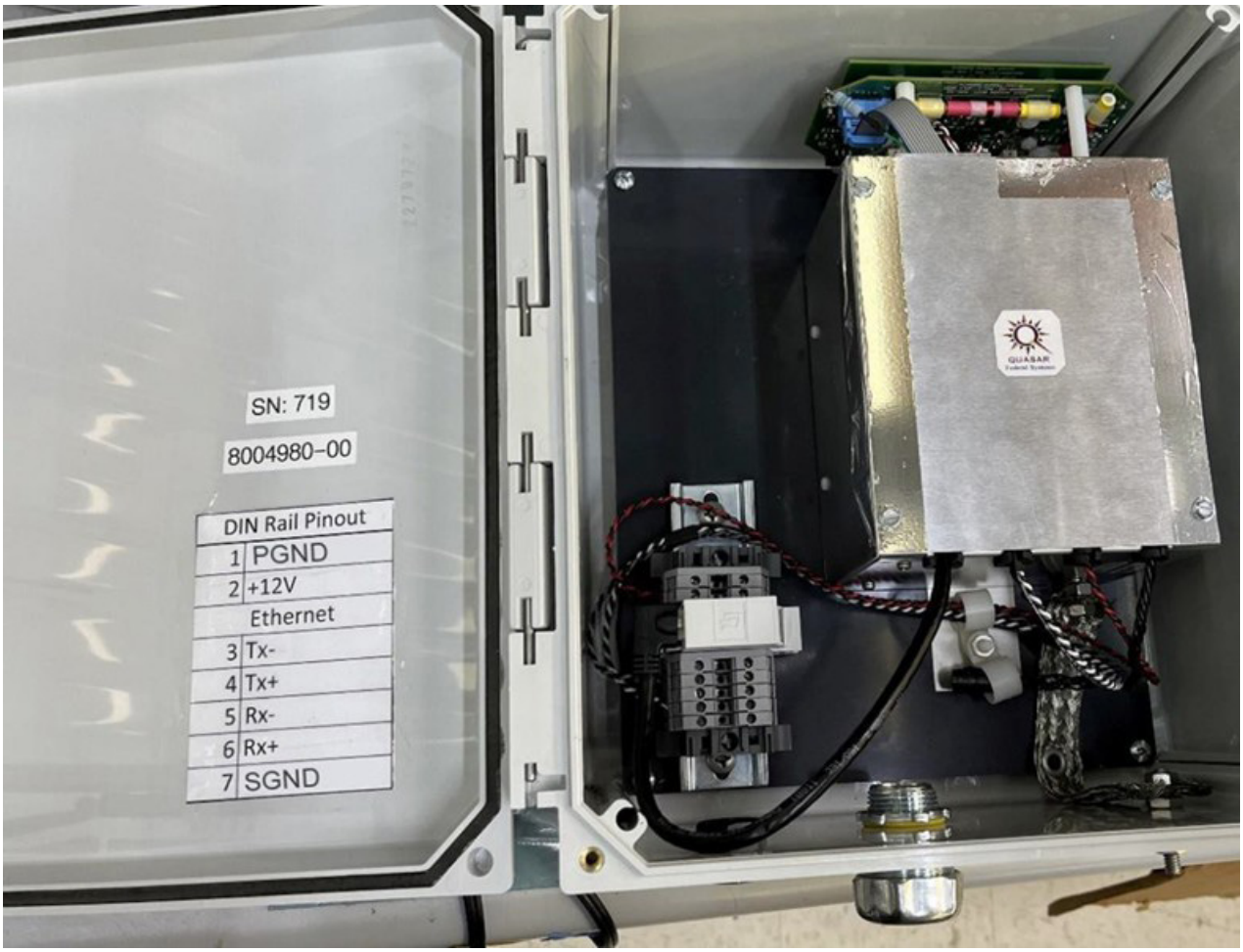


Figure 11. Inside QLTX Enclosure

11. Connect power.
    - Attach the black wire from the power cable to the negative terminal of the power supply.
    - Attach the red wire from the power cable to the +12 V terminal of the power supply.
12. Connect the serial lines.

Pin	Wire Color	Signal
3	BLU	Tx–
4	ORG	Tx+
5	BRN	Rx–
6	YEL	Rx+
7	GRN	SGND

The connections to the 1192 DCP are provided in Section 3.3.1.

The system is running if data strings are being transmitted serially. Use the connected device to check whether if it is receiving valid serial data. For example, if the RS-485 line polarity is reversed, the data will be garbled. It is easiest to look for the OK in the data string.

The Ethernet port is reserved for factory and technician use. Use a shielded CAT5/6 cable when connecting to the Ethernet port.

3.3.1 1192 DCP Connections

Connect the power and signal wires to the 1192 DCP according to Figure 12.

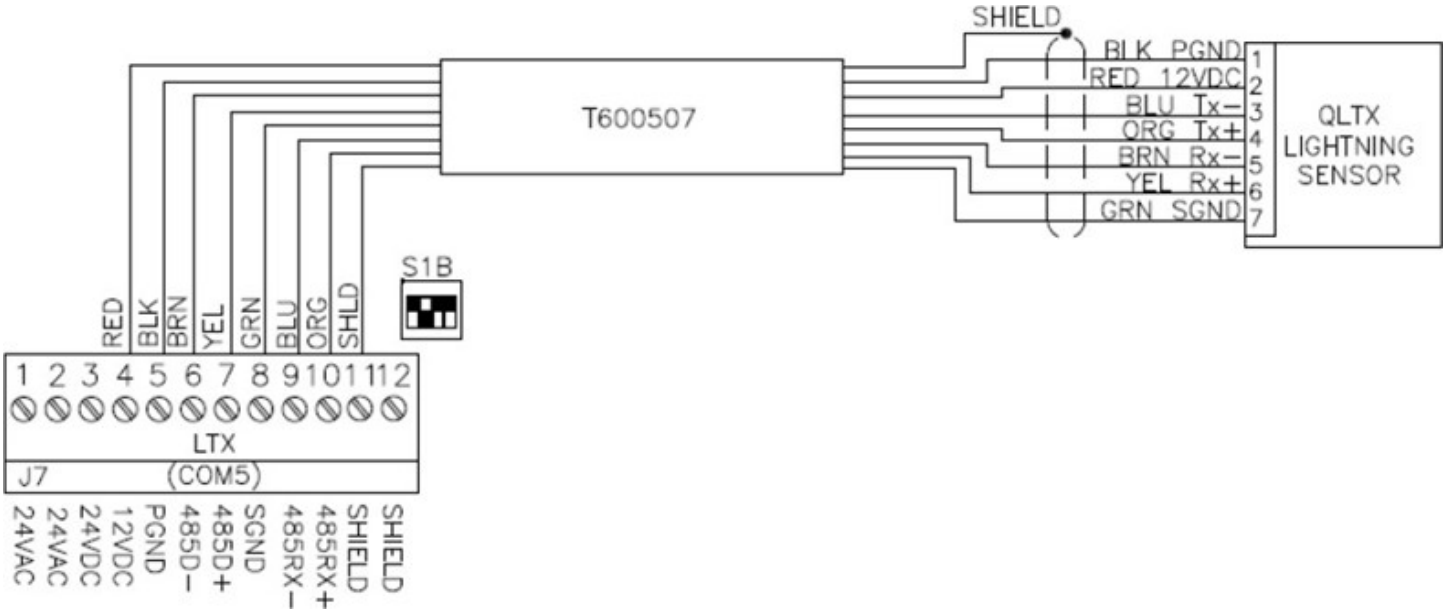


Figure 12. Summary of QLTX to 1192 DCP Connections

3.4 Checkout

Required Equipment

- RS-485 serial adapter to communicate serially with the QLTX using a computer or optionally an Ethernet cable
- Computer
- Power drill capable of simulating lightning strikes
- Power supply capable of providing 2 A at 12 V DC

3.4.1 Boot the QLTX Processor

Connect the RS-485 cable from the QLTX into the serial adapter and configure the serial settings on the computer as follows.

Data bits:	8
Stop bits:	1
Parity bits:	none
Flow control:	none
Baud rate:	9600

Upon booting, the QLTX should send “BOOTUP” then the “DATE” stored in the processor over serial.

Approximately 10 seconds later a status message is sent.

4. Lightning Sensor Data Format

The QLTX Lightning Detection Sensor interfaces over an RS-485 serial connection. The QLTXs serial communication is set to 9600 bps, eight data bits, no parity, one stop bit. There are several commands that may be sent serially to control the QTLX coordinate and time settings.

4.1 Serial Communication Format

The setup and format of serial communication format is compatible with the WX-500. The WX-500 weather radar system has an established communication protocol. Upon sending a successful BOOTUP and DATE: message, the program will send a WX-500 compliant OK status message serially. The program will continue to send an OK periodically every 10 seconds to indicate the program is still running. When events are detected, a WX-500 compliant message will be sent with the range and bearing of the strike. The QLTX has a bidirectional serial port that communicates at 9600-8N1. The QLTX accepts configuration commands (Table 1) and produces messages (Table 2).

Strike and state (OK) messages from the QLTX are wrapped in a frame and contain a checksum. The frame starts with the STX (ASCII start of text character) and ends with the ETX (ASCII end of text character). Each frame can contain multiple commands or multiple messages. The QLTX does not support all WX-500 messages.

The messages and commands have the following format.

<STX><ddd><CR>.<cc><ETX>

STX	is the ASCII start-of-text character (0x02)
ddd	Is the value of the data item (see Table 2)
CR	Is the ASCII carriage return character (0x0D)
cc	Is a two-character ASCII uppercase hexadecimal checksum derived by summing all characters after the STX and before the '.' And them masking all but the lower 8 bits
ETX	Is the ASCII end-of-text character (0x03)

Table 1. WX-500 Command Format

Item Designator	Item Format	Field Width (bytes)	Item Description
%I	dmch	4	System Status, where d is "F" = fatal fault "P" = OK
%S	cccbbbrrr	9	ccc = Range to strike ("001" - "200" NM) Cell mode (a value of 201 indicates invalid) bbb=Bearing to strike, clockwise in degrees "000" - "359" deg) rrr = Range to strike ("001 – "200" NM) Strike mode This Item Designator may appear from 0 to 40 times per message depending on thunderstorm activity. Invalid Cell mode range indicates the strike is not displayed in Cell mode view.
%H	dddd	4	Aircraft heading x10 (0000 - 3599). Heading outside valid range indicates heading not available or "flagged" (e.g., 9999).
%E	dd	2	dd is ERR_DAQ_NOT_FOUND = 20 ERR_DAQ_NO_CONNECT = 21 ERR_DAQ_NO_RESPONSE = 22

Table 2. WX-500 Messages

4.2 Error Codes

The error codes are represented by two numerical digits preceded by an E. The following table shows all the error codes with their probable causes.

Number	Error	Reason
00	No errors	—
20	ERR_DAQ_NOT_FOUND	DAQ board not found
21	ERR_DAQ_NO_CONNECT	DAQ board not connected
22	ERR_DAQ_NO_RESPONSE	DAQ board not responding

5. Maintenance

The routine maintenance described in this chapter must be performed triannually.

5.1 Maintenance Schedule

Maintenance for the QLTX should be performed triannually (every four months). There are no additional annual maintenance procedures.

Equipment Required

The following equipment is required for the QLTX maintenance procedures.

- Soft cloth, mild soap, and water.
- ½", 7/16" and 9/16" socket wrenches for nuts on respectively, pipe clamps, ground lug, and bolts holding the housing to the metal struts.

5.1.1 Triannual Maintenance

- Check the antenna dome and sensor housing for dents, cracks, or punctures.
- Remove all dirt and grease from surface areas using a soft cloth moistened with mild soap and water.
- Check the ground connection and ensure it is solid.
- Check all hardware for corrosion and ensure that all bolts and connectors are tight.
- Ensure that the cable connections are sound between the sensor and the external data device.

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