

SECTION V. MAINTENANCE

16.5.1 INTRODUCTION

This section provides preventive and corrective maintenance procedures for the thunderstorm sensor. Preventive maintenance consists of sensor inspection, cleaning (if necessary), and desiccant replacement. Corrective maintenance consists of fault isolation using the ASOS thunderstorm screen and removing and replacing sensor field replaceable units (FRUs) or removing and replacing the sensor.

16.5.2 PREVENTIVE MAINTENANCE

The thunderstorm sensor is inspected and cleaned every 90 days. Sensor desiccant is replaced annually. Table 16.5.1 provides the procedure for sensor inspection, cleaning, and desiccant replacement.

16.5.3 CORRECTIVE MAINTENANCE

Thunderstorm sensor corrective maintenance consists of troubleshooting failures and sensor FRU removal and replacement. The technician can review the sensor's test data via Thunderstorm sensor Screen on the OID. For most failures, the diagnostic identifies the faulty field replaceable unit (FRU). The technician can also communicate with the sensor directly by connecting a laptop computer to the sensor.

16.5.3.1 Using the Laptop Computer With the Thunderstorm Sensor. In order to communicate with the sensor, the maintenance technician must use the laptop computer. Table 16.5.2 provides the procedure to set up the laptop computer to communicate with the sensor. Section IV, paragraph 16.4.3 provides detailed descriptions of individual sensor commands.

16.5.3.2 Troubleshooting. The OID Thunderstorm sensor maintenance screen is the primary troubleshooting tool. Although diagnostic commands can be issued directly from the laptop computer, these commands provide no additional information other than what is displayed on the OID. Table 16.5.3 provides a summary of troubleshooting actions for different failure indications. Remove and replace the sensor when fault isolation identifies the antenna or electronics module as the source of the failure.

16.5.4 CALIBRATION.

There are no procedures for calibrating the thunderstorm sensor. The sensor must be returned to the authorized repair facility for calibration

16.5.5 FRU REMOVAL AND INSTALLATION

The thunderstorm sensor consists of an electronics enclosure and three FRUs; Antenna module, electronics module, and power/comm module. Removal and installation procedures identified on the following chart by table number are provided to facilitate safe and efficient removal of sensor FRU's.

<u>Unit to be replaced</u>	<u>Table</u>
Antenna Module	16.5.4
Electronics Module	16.5.5
Power/Comm Module	16.5.6
Fiberoptic Module	16.5.7

Table 16.5.1. Thunderstorm Sensor Inspection and Cleaning

Step	Procedure
	<p>Tools and Materials Required:</p> <ul style="list-style-type: none"> 1" Wrench Soft cotton cloth Large flat-tipped screwdriver No. 2 Phillips screwdriver <p style="text-align: center;"><u>WARNING</u></p> <p>Death or severe injury may result if power is not removed from sensor prior to maintenance activities. Ensure that circuit breakers (located inside DCP or SCA equipment cabinet) supplying power to sensor are set to off (right) position.</p>
1	Set circuit breakers on thunderstorm sensor circuit breaker module inside DCP (SCA) equipment cabinet to off (right) position. The thunderstorm sensor circuit breaker module is labeled.
2	At thunderstorm sensor, ensure that ground wires and connections are short, direct, and electrically continuous. Grasp wire near ground clamps and pull slowly and firmly to verify attachment. Repeat on ground rod end of wire. If connection is loose, tighten it using appropriate tools. Ensure that all grounding hardware and ground connections are free of corrosion. Replace grounding hardware that shows any signs of corrosion.
3	Inspect two sensor enclosure lid hold-down clamps. Verify that each is securely in place on edge of lid. Inspect all enclosure-to-mast mounting hardware for corrosion and replace weakened fasteners. Tighten any loose mounting hardware screws.
4	Wipe dust off optical sensor at tip of antenna with a damp, soft cloth.
5	Inspect all electronic components in sensor enclosure and electronics module that are easily visible. Check for cracked, discolored, charred, or broken components and for darkening of the printed circuit boards, especially under components mounted directly on a board.
6	Verify that transient suppressors (MOVs) on power line (CR1, CR2, CR3, and CR4 in figure 16.3.1) on power/comm module are not damaged. Burn marks, cracking, and/or external carbon are evidence of failure. Slight damage to these devices is cumulative as they shunt brief transients to ground. A prolonged surge will blow power input circuit fuse. Eventually, transient suppressors lose heat dissipation and recovery properties and will fail (short) and open the fuse after shunting a transient.
7	If desiccant has not been replaced for a year, replace desiccant, and properly reseal enclosure. New desiccant bag must be removed from airtight outer packaging (DO NOT open desiccant bag containing desiccant granules) and flattened by shaking and patting to evenly distribute contents and place on top of the electronics module. Ensure that desiccant bag does not interfere with door or other internal assemblies.

Table 16.5.2. Using the Laptop Computer With the Thunderstorm Sensor

Step	Procedure
INITIAL SETUP PROCEDURE	
	<p>Tools Required:</p> <ul style="list-style-type: none"> Laptop computer with PROCOMM Plus installed Laptop interface (Y-shaped) cable Laptop null cable Large flat-tipped screwdriver No. 1 Phillips screwdriver No. 2 Phillips screwdriver <p style="text-align: center;"><u>WARNING</u></p> <p>Death or severe injury may result if power is not removed from sensor prior to maintenance activities. Ensure that circuit breakers (located inside DCP or SCA equipment cabinet) supplying power to sensor are set to off (right) position.</p>
1	At DCP (SCA) equipment cabinet, set thunderstorm sensor circuit breaker module to off (right) position.

Table 16.5.2. Using the Laptop Computer With the Thunderstorm Sensor -CONT

Step	Procedure
2	Using No. 2 Phillips screwdriver, loosen two captive bolts securing hinged sensor access door and open door.
3	Using No. 1 Phillips screwdriver, disconnect DB-9 connector J4 from power/comm P4.
4	Using laptop computer null cable and interface (Y-shaped) cable, connect RS-232C (COM1) port of laptop computer to DB-9 connector removed from fiberoptic module.
5	Turn on laptop computer and initialize PROCOMM Plus program. After program initializes, press any key to enter terminal mode (blank) screen.
6	Using ALT-S command (setup facility), set up the following terminal options: <ul style="list-style-type: none"> a. Terminal emulation: VT220 b. Duplex: FULL c. Soft flow control (XON/XOFF): OFF d. Hard flow control (CTS/RTS): OFF e. Line wrap: OFF f. Screen scroll: ON g. CR translation: CR h. BS translation: NON-DESTRUCTIVE i. Break length (milliseconds): 035 j. Enquiry: OFF k. EGA/VGA true underline: OFF l. Terminal width: 80 m. ANSI 7 or 8 bit commands: 8 BIT
7	Press ESC key to exit to terminal mode (blank) screen.
8	Using ALT-P command (line/port option), set current settings as follows: <ul style="list-style-type: none"> a. Baud rate: 9600 b. Parity: NONE c. Data bits: 8 d. Stop bits: 1 e. Port: COM1
9	Press ESC key to exit to terminal mode (blank) screen
10	Set laptop computer CAPS LOCK to ON.
11	Set circuit breakers on thunderstorm sensor circuit breaker module inside DCP (SCA) equipment cabinet to on (left) position
	NOTE Bad, spurious, erroneous, or false data may be transmitted from sensor when power is turned on or off. Ignore all data transmissions from sensor that occur at power on or power off.
12	The thunderstorm sensor is now available for legal commands from the laptop computer. Refer to paragraph 16.4.3 for detailed descriptions of sensor commands and for specific restrictions on their use.
TEARDOWN	
1	At laptop computer, press ALT-X (exit) to exit PROCOMM Plus.
2	Turn off laptop computer.
3	At DCP (SCA), set thunderstorm sensor circuit breakers on circuit breaker module to off (right) position.
4	Disconnect cables between laptop computer and thunderstorm sensor.
5	Using No. 1 Phillips screwdriver, connect DB-9 connector J4 to power/comm P4.
6	Using No. 2 Phillips screwdriver, close and secure thunderstorm sensor access door.
7	At DCP (SCA), set thunderstorm sensor circuit breakers on circuit breaker module to on (left) position.

Table 16.5.3. Thunderstorm Sensor Troubleshooting

Symptom	What to Do
Sensor does not respond (communications failure)	<p>If TXD LED (figure 16.3.1) and RXD LED on electronics module processor board are not active, electronics module is bad. Replace sensor.</p> <p>If the TXD LED and RXD LED on power/comm module are not active, but the TXD LED and RXD LED on the processor board in the electronics module are active, the power/comm module is bad or the DC cable is bad. Replace the power/comm module first; if the TXD LED and RXD LED are still not active, replace the DC cable.</p> <p>If both sets of LEDs are active, the fiberoptic modem or cable is bad. Replace fiberoptic modem or cable.</p>
Electronics module Processor Board Enable signal (ENA LED, figure 16.3.1) shows unusual activity (e.g., the ENA LED is lit when there is no lightning activity or is not lit when there is lightning activity)	<p>Disconnect antenna to see if abnormal enable signal activity is internally caused or externally caused. If activity persists when antenna is disconnected, cause is internal, and electronics module is bad. Replace sensor.</p> <p>If the activity does not persist when antenna is disconnected, cause is external (external electric field problem), and site must be changed or fixed. Change or fix site.</p>
Fuse failure	Indicates a power supply or a transient suppression circuit problem. Replace power/comm module.
Lightning is not detected but self-tests are passed	Check optical sensor for opaque covering such as dirt, mud, bird droppings, etc. Clean optical sensor.
Electronics module Processor Board Optical signal (OPT LED (figure 16.3.1) shows unusual activity (e.g., the OPT LED is lit when there is no lightning activity or is not lit when there is lightning activity)	Place a cover over optical sensor. If activity stops, problem is external. If activity persists, cause is probably internal or may be an external electric field problem. An external electric field problem usually causes unusual activity on the enable signal (ENA LED) on electronics module processor board as well. Replace sensor or change/fix site.
Electronics Module Processor board RUN LED (figure 16.3.1) blinks or is not lit but power supplies are OK	Indicates an electronics module problem. Replace sensor.
Self-test failure (failed self-test result)	Indicates an electronics module problem. Replace sensor.
Self-test failure (no self-test performed)	Indicates an Antenna Module or electronics module problem. Replace sensor.
Voltage failure (5 VDC or 10 VDC)	Indicates an electronics module problem. Replace sensor.
Voltage failure (12 VDC measures below 11 VDC or above 13 VDC)	Indicates a power supply problem if input voltage is OK. Replace power/comm module if input AC power is OK; otherwise, determine cause of AC failure.

Table 16.5.4. Electro-optical Antenna Removal and Installation

Step	Procedure
REMOVAL	
Tools Required: No. 2 Phillips screwdriver	
<u>WARNING</u> Death or severe injury may result if power is not removed from sensor prior to maintenance activities. Ensure that circuit breakers (located inside DCP or SCA equipment cabinet) supplying power to sensor are set to off (right) position.	
1	At DCP (SCA) equipment cabinet, set thunderstorm sensor circuit breaker module to off (right) position.
2	At thunderstorm sensor, use No. 2 Phillips screwdriver to loosen two captive bolts securing hinged sensor access door and open door.
3	Disconnect plug P104 from electronics module J104.
4	Disconnect ground spade lug from bottom of coupler.
5	Loosen hex nut on liquid tight coupler.
6	Remove antenna from enclosure.
INSTALLATION	
Tools Required: No. 2 Phillips screwdriver	
<u>WARNING</u> Death or severe injury may result if power is not removed from sensor prior to maintenance activities. Ensure that circuit breakers (located inside DCP or SCA equipment cabinet) supplying power to sensor are set to off (right) position.	
1	At thunderstorm sensor, arrange antenna cable to hang freely from bottom of antenna housing. Carefully feed connector end of cable into liquid-tight coupler and pull cable through to inside of enclosure and guide antenna end into opening in liquid-tight coupler. While holding antenna perpendicular to top of enclosure, slowly and gently push antenna into liquid-tight coupler until fully seated as shown in figure 16.2.2.
<u>CAUTION</u> Failure to properly tighten the nut on the liquid-tight coupler will result in moisture damage to the sensor.	
2	Hand tighten hex nut on liquid-tight coupler.
3	Route antenna cable under clamps and connect J104 to electronics module P104 as shown in figure 16.2.3.
4	Connect spade lug to ground terminal located below the antenna mounting coupler.
6	Using No. 2 Phillips screwdriver, close and secure thunderstorm sensor access door.
7	At DCP (SCA), set thunderstorm sensor circuit breakers on circuit breaker module to on (left) position.

Table 16.5.5. Electronics Module Removal and Installation

Step	Procedure
REMOVAL	
Tools Required: No. 2 Phillips screwdriver	
<u>WARNING</u>	
Death or severe injury may result if power is not removed from sensor prior to maintenance activities. Ensure that circuit breakers (located inside DCP or SCA equipment cabinet) supplying power to sensor are set to off (right) position.	
1	At DCP (SCA) equipment cabinet, set thunderstorm sensor circuit breaker module to off (right) position.
2	At thunderstorm sensor, use No. 2 Phillips screwdriver to loosen two captive bolts securing hinged sensor access door and open door.
3	Remove J103 and J104 from electronics module connectors P103 and P104.
4	Disconnect electronics module chassis ground strap from spade lug near door hinge.
5	Slide clamps at top of electronics module securing module to front cover and remove module.
INSTALLATION	
Tools Required: No. 2 Phillips screwdriver	
<u>WARNING</u>	
Death or severe injury may result if power is not removed from sensor prior to maintenance activities. Ensure that circuit breakers (located inside DCP or SCA equipment cabinet) supplying power to sensor are set to off (right) position.	
1	At thunderstorm sensor, position electronics module on front cover and slide top clamps to secure module.
2	Connect electronics module chassis ground strap to spade lug near door hinge.
3	Route antenna cable under clamps as shown in figure 16.2.3.
4	Connect J103 and J104 to electronic module connectors P103 and P104.
5	Using No. 2 Phillips screwdriver, close and secure thunderstorm sensor access door.
6	At DCP (SCA), set thunderstorm sensor circuit breakers on circuit breaker module to on (left) position.

Table 16.5.6. Power/Comm Board Removal and Installation

Step	Procedure
REMOVAL	
<p style="text-align: center;">Tools Required: Large flat-tipped screwdriver No. 2 Phillips screwdriver</p>	
<u>WARNING</u>	
<p style="text-align: center;">Death or severe injury may result if power is not removed from sensor prior to maintenance activities. Ensure that circuit breakers (located inside DCP or SCA equipment cabinet) supplying power to sensor are set to off (right) position.</p>	
1	At DCP (SCA) equipment cabinet, set thunderstorm sensor circuit breaker module to off (right) position.
2	At thunderstorm sensor, use No. 2 Phillips screwdriver to loosen two captive bolts securing hinged sensor access door and open door.
3	At power/comm board, loosen four thumb screws securing plexiglass shield over power strip P1 and remove shield.
4	Tag and disconnect five 115V ac power connectors from P1.
5	Disconnect cables J4, J3, and J2 from connectors P4, P3, and P2.
6	At power/comm module, using ccw rotation, remove two fiberoptic cables from bottom of fiberoptic module. Install plastic protective covers over board connectors.
7	Loosen four captive screws and remove power/comm board from power/comm module.
INSTALLATION	
<p style="text-align: center;">Tools Required: Large flat-tipped screwdriver No. 2 Phillips screwdriver</p>	
<u>WARNING</u>	
<p style="text-align: center;">Death or severe injury may result if power is not removed from sensor prior to maintenance activities. Ensure that circuit breakers (located inside DCP or SCA equipment cabinet) supplying power to sensor are set to off (right) position.</p>	
1	At thunderstorm sensor, position power/comm board on power/comm module and tighten four captive screws securing board to module.
2	Connect cables J4, J3, and J2 to connectors P4, P3, and P2.
3	Connect five 115V ac power connectors to P1.
4	Position plexiglass shield over power strip P1 and secure by tightening four thumb screws.
5	Remove any protective covers from fiberoptic connectors and install the receive (RX) and transmit (TX) connectors on fiberoptic module. RX cable mates with fiberoptic connector nearest DB-9 electrical connector.
6	Using No. 2 Phillips screwdriver, close and secure thunderstorm sensor access door.
7	At DCP (SCA), set thunderstorm sensor circuit breakers on circuit breaker module to on (left) position.

Table 16.5.7. Fiberoptic Module Removal and Installation

Step	Procedure
REMOVAL	
<p style="text-align: center;">Tools and Materials Required: Flat-tipped screwdriver Small flat-tipped screwdriver No. 1 Phillips screwdriver No. 2 Phillips screwdriver</p>	
<u>WARNING</u>	
<p style="text-align: center;">Death or severe injury may result if power is not removed from sensor prior to maintenance activities. Ensure that circuit breakers (located inside DCP or SCA equipment cabinet) supplying power to sensor are set to off (right) position.</p>	
1	At DCP (SCA) equipment cabinet, set thunderstorm sensor circuit breaker module to off (right) position.
2	At thunderstorm sensor, use No. 2 Phillips screwdriver to loosen two captive bolts securing hinged sensor access door and open door.
3	At power/comm module, using ccw rotation, remove two fiberoptic cables from bottom of fiberoptic module. Install plastic protective covers over board connectors.
4	Using No. 1 Phillips screwdriver, remove screws securing fiberoptic module mounting plate to power/comm module.
5	Using small flat-tipped screwdriver, loosen two retaining screws on DB-9 connector located on top of fiberoptic module. Remove DB-9 connector.
6	Using No. 1 Phillips screwdriver, remove screws securing fiberoptic module to mounting plate. Remove fiberoptic module.
INSTALLATION	
<p style="text-align: center;">Tools and Materials Required: Flat-tipped screwdriver Small flat-tipped screwdriver No. 1 Phillips screwdriver No. 2 Phillips screwdriver</p>	
<u>WARNING</u>	
<p style="text-align: center;">Death or severe injury may result if power is not removed from sensor prior to maintenance activities. Ensure that circuit breakers (located in DCP) supplying power to sensor are set to off (right) position.</p>	
1	Position fiberoptic module and gaskets on mounting plate. Using No. 1 Phillips screwdriver, install screws and lockwashers securing fiberoptic module to mounting plate.
2	Install signal cable removed in removal step 5 to DB-9 connector on fiberoptic module and using small flat-tipped screwdriver, tighten two retaining screws.
4	Using No. 1 Phillips screwdriver, secure fiberoptic module mounting plate to power/comm module.
3	Remove any protective covers from fiberoptic connectors and install the receive (RX) and transmit (TX) connectors on fiberoptic module. RX cable mates with fiberoptic connector nearest DB-9 electrical connector.
4	Using No. 2 Phillips screwdriver, close and secure thunderstorm sensor access door.
5	At DCP (SCA), set thunderstorm sensor circuit breakers on circuit breaker module to on (left) position.