## CONTENTS

Introduction ................................................................................................................... 1

Sensor Theory of Operation .......................................................................................... 2
  Detection .................................................................................................................... 2
  Processing ................................................................................................................. 2
  Reporting ................................................................................................................... 2

Sensor Installation & Checkout ...................................................................................... 3
  RFI/EMI Precautions ............................................................................................... 3
  Sensor Installation ................................................................................................... 3
  Checkout .................................................................................................................... 7

Graphic Display ............................................................................................................ 8
  Zooming In and Out ................................................................................................. 9
  Map Key ................................................................................................................... 9

Menus .......................................................................................................................... 10
  File Menu ............................................................................................................... 10
  Edit Menu ............................................................................................................... 11
  Group and User Authorizations .............................................................................. 11
  Configuration .......................................................................................................... 16
  Port Configuration .................................................................................................. 21
  Points of Interest .................................................................................................... 22
  Logs Menu .............................................................................................................. 23

Data Format ................................................................................................................ 24

Error Messages and Troubleshooting ........................................................................... 26
  Processor LEDs ....................................................................................................... 29

Maintenance ................................................................................................................ 30
  Periodic Maintenance .............................................................................................. 30

Specifications .............................................................................................................. 30

Warranty ..................................................................................................................... 31
Introduction
The Model 6502 Thunderstorm/Lightning Sensor detects electrical discharges associated with thunderstorms within a 200 nautical mile (nm) radius of the system. The Model 6502 is a passive sensor that listens for electromagnetic signals with a receiving antenna. There is no transmitter, and so no harmful transmissions.

The entire package (consisting of an antenna mounted to a 28" x 32" ground plane, and a processor and interface board housed in a NEMA 4X enclosure) mounts simply to a 2½" pipe (2.875" O.D.) using two U-bolts.

The Graphic Display shows detected strikes overlaid onto a map of the monitored area. A set of pull-down menus allows the user to configure the display and to add labeled locations to the map.
Sensor Theory of Operation

Detection
The Model 6502’s antenna is a combined crossed-loop and sense antenna, which can correlate the electric and magnetic signatures of lightning strikes better than other systems due to its patented sense channel technology. The antenna has been designed to help filter out pulsed noise from sources other than atmospheric electrical discharges.

The antenna detects the electrical and magnetic fields generated by intra-cloud, inter-cloud, or cloud-to-ground electrical discharges that occur within a 200 nm 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 stores the data in memory.

Processing
The Model 6502’s processor is housed inside the sensor enclosure along with the Interface Board. The processor includes data acquisition circuitry and circuitry to process strike data. The Interface Board provides a data buffer and handles communication.

The sensor transmits a data package consisting of strike data and status information every five seconds. When errors are detected, the errors are recorded in an error log.

Reporting
The Model 6502 detects the presence of a thunderstorm or lightning event within 200 nm from the point of installation.

1. Range and Direction
   Reports thunderstorms/lightning within a 200 nm radius from the installation point.

2. Resolution
   Location of thunderstorm is ±1nm from actual location of the thunderstorm/lightning.

4. False Reports
   Not more than 2%.
Sensor Installation & Checkout

The Thunderstorm/Lightning Sensor package (consisting of an antenna mounted to a 28" x 32" ground plane and a processor housed in a NEMA 4X enclosure) mounts to a 2½" pipe (2.875" O.D.) using two U-bolts. A section of 2.5" (64 mm) I.D. standard galvanized steel pipe can be used as a mast 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 Thunderstorm/Lightning Sensor's ground plane extends well beyond the edges of the sensor enclosure. Be aware of this hazard when working around the sensor.

RFI/EMI Precautions

The Model 6502's antenna is sensitive to static charges, so care must be taken to ensure that the antenna and ground plane are as far removed as possible from composite materials (e.g., plastic materials or fiberglass), since these materials have a tendency to build up static charge.

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. General clearance guidelines are:

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

In addition to the above restrictions, certain site installations may have to be scrutinized more carefully from an RFI/EMI perspective. Finding locations to mount the ground plane and antenna that will minimize interference from RFI/EMI sources can be enhanced by the use of standard RFI measuring equipment. 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 the 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 one foot of either a VHF or UHF transmitting antenna.

Sensor Installation

After installing the mast, conduit, and junction box, follow the instructions below for assembling and installing the sensor.
1 If the signal and power cables have not already been installed between the signal and power distribution boxes and the sensor pad, pull the required lengths of cable through conduit to the junction boxes at the sensor pad.

2 (See **Figure 1**). The mounting bracket attaches to the underside of the 6502 enclosure with 4 bolts. Position the bracket against the underside of the enclosure so that the mounting holes in the bracket and enclosure align.

3 Apply RTV 162 to the threads of the four 5/16" hex mounting bolts.

4 Fasten the bracket to the enclosure with the four 5/16" hex bolts, flat washers, and lock washers.

5 Tighten the bolts.

---

6 Set the sensor package (antenna, ground plane, enclosure, and bracket) on the mast, and fasten loosely with two U-bolts, lock washers, and flat washers as shown in **Figure 2**.

---

7 Align the antenna to **True North**.

8 Tighten the two U-bolts.
9 Open the sensor enclosure by loosening the four countersunk bolts shown in Figure 3. Do not remove the six bolts holding the ground plane to the enclosure lid.

![Figure 3. Opening the sensor enclosure](image)

10 The sensor enclosure lid is equipped with hinged bolts (see Figure 4) to allow the box to be opened with the ground plane attached. Grasp both sides of the ground plane and lift straight up as far as possible (about 3”), then tilt the ground plane and lid over carefully to gain access to the enclosure interior. When fully open, the ground plane will rest against the side of the enclosure.

![Figure 4. Enclosure hinges](image)

11 Connect the incoming AC power wires to the AC interface board inside the enclosure (Figure 5) according to Table 1.

12 Close the enclosure lid and tighten the four countersunk bolts.

13 Fasten a ground wire between the ground cable installed during site preparation and the ground clamp on the underside of the enclosure (see Figure 1).
Table 1. Lightning detector power wiring.

<table>
<thead>
<tr>
<th>AC Interface Board TB1 Pin</th>
<th>Function</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>HOT</td>
<td>BLACK or BROWN</td>
</tr>
<tr>
<td>2</td>
<td>NEUTRAL</td>
<td>WHITE or BLUE</td>
</tr>
<tr>
<td>3</td>
<td>GROUND</td>
<td>GREEN</td>
</tr>
</tbody>
</table>

Or

<table>
<thead>
<tr>
<th>AC Interface Board TB1 Pin</th>
<th>Function</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>HOT (BLACK or BROWN)</td>
<td>220V</td>
</tr>
<tr>
<td>2</td>
<td>NEUTRAL (WHITE or BLUE)</td>
<td>Neutral</td>
</tr>
<tr>
<td>3</td>
<td>GND (GREEN)</td>
<td>Ground</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>AC Interface Board TB1 Pin</th>
<th>Function</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>HOT (BLACK or BROWN)</td>
<td>110V</td>
</tr>
<tr>
<td>2</td>
<td>NEUTRAL (WHITE or BLUE)</td>
<td>110V</td>
</tr>
<tr>
<td>3</td>
<td>GND (GREEN)</td>
<td>Ground</td>
</tr>
</tbody>
</table>
Checkout
To verify the sensor is working properly, power the sensor up and verify that, after one minute of operation, data is reported from the sensor. (*Bear in mind that, in the absence of lightning in the measuring area, the data screens will report no strikes.*)
Graphic Display

Lightning data is viewed on a graphic display that shows detected strikes overlaid onto a map of the monitored area (Figure 6). A set of pull-down menus allows the user to configure the display and to specify areas of interest for display on the map.

The graphic display provides a strike locator overlaid on a map of the area being monitored. The strike locator indicates both distance and direction of strikes using a grid of four concentric rings (representing distance ranges from the center point) combined with directional octants. The center point of the locator is normally the site of the lightning sensor, and is entered by the user through the Lightning tab on the Edit>Configuration menu.

Each distance ring represents an increased distance from the locator’s center point of 50 nautical miles:

- The innermost ring of the locator shows strikes detected within 50 nautical miles of the center point.
- The next ring out shows strikes within 100 nautical miles of the center point.
- The third ring out shows strikes within 150 nautical miles of the center point.
- The outermost ring shows strikes within 200 nautical miles of the center point.
The directional octants divide the strike locator into eight distinct compass directions, making it simple to quickly identify the direction and distance of detected lightning strikes.

**Zooming In and Out**
The zoom icons in the upper right of the display allow you to zoom the map view in and out.

- Click the icon to zoom in to view a smaller area of the map.
- Click the icon to zoom out for a wider picture.

**Map Key**
Once a strike has been detected, it remains visible on the screen for the length of time specified in the **Decay Time** option on the **Configuration** menu (see page 18). In order to provide a graphic view of strikes over time, the color of the strike changes as it ages. As the **Map Key** in the lower right corner of the display shows, new strikes are shown in red. As they age, they become progressively lighter in color, changing to orange, then yellow, until they finally disappear from the map. In the example, the decay time has been set to 15 minutes.

The **Scale** indicator at the bottom of the key shows the distance scale for the currently displayed map.
**Menus**

**File Menu**

The *File* menu contains options for logging in and out, printing, and window control.

<table>
<thead>
<tr>
<th>Login ...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Logout</td>
</tr>
<tr>
<td>Print ...</td>
</tr>
<tr>
<td>Print Preview ...</td>
</tr>
<tr>
<td>Page Setup ...</td>
</tr>
<tr>
<td>Minimize</td>
</tr>
<tr>
<td>Exit</td>
</tr>
</tbody>
</table>

**Login**

The *Login* option is used to log in to the system as a User. Each User has access to specific screens and functions, as set by the administrator through the *User Authorizations* and *Group Authorizations* options on the *Edit* menu. The use of these options is explained in detail in the next section.

- To log in, select a User from the pull-down menu.
- Enter your password in the *Password* field, then click **OK**.
- The User name under which you are logged in will be shown in parentheses at the top of the screen, and all applicable menu options will now be available.

Use the area below to record your system’s username and password:

**Username** __________________________________________

**Password** __________________________________________

**Logout**

To log out of the current group, click **Logout**. All menu options requiring login will be grayed out.

**Print**

The *Print* option lets you print the current lightning display. When you click *Print*, the standard Windows print screen will be displayed.

**Print Preview**

The *Print Preview* option lets you see a preview before printing of what the *Print* command will output to the printer.

**Page Setup**

The *Page Setup* option lets you set printing preferences. Clicking *Page Setup* will call up the standard Windows printing options screen.
Minimize

Click the *Minimize* option to minimize the display. The software will continue running when minimized. To restore the display to full screen, click the *AWI MetObserver* icon on the application toolbar at the bottom of the screen.

Exit

Click the *Exit* option to close the software. After exiting, the software will continue to run as normal.

Edit Menu

The *Edit* menu contains options for setting up group and user authorizations, configuring the display, configuring ports, and setting “points of interest”.

Group and User Authorizations

The display software is highly configurable through a series of user menus. Often, though, configuration changes may best be restricted to authorized users. The Group and User structure of the software allows permission to be allocated as required to control access and maintain the integrity of system operations. Authorization menus are generally only available to Administrators, though those permissions can be given to other groups as well.

- **Group Authorizations** allow administrative functions to be enabled or disabled, and access to the three data views to be assigned.

- **User Authorizations** grant group membership to individual users. A user can belong to one or more groups. On logging in, the user will be granted access to all the functions allowed for each group in which he has membership.

- Authorization changes take effect immediately on exiting a configuration dialog and returning to the main display.
Group Authorizations

The Group Authorizations... option allows administrators to set group permissions.

- To configure group permissions, log on as an authorized user with Admin rights and select Edit>Group Authorizations to call up the screen shown in Figure 7.

![Group Authorizations Screen]

The Group Authorizations screen lists all current groups and the authorized features available to each. The Authorization Name shows the name of the group, followed by a series of checkboxes that shows the functions a group is authorized to access. A function is accessible when it is checked. The table below explains each of the functions.

<table>
<thead>
<tr>
<th>Function</th>
<th>When Checked</th>
</tr>
</thead>
<tbody>
<tr>
<td>Admin</td>
<td>Gives the group administrative privileges, including Group and User Authorization</td>
</tr>
<tr>
<td>Config</td>
<td>Lets the group change configuration settings (Edit&gt;Configuration)</td>
</tr>
<tr>
<td>Logs</td>
<td>Lets the group view and retrieve data logs (Logs menu)</td>
</tr>
<tr>
<td>Lightning View</td>
<td>Lets the group select the Lightning view from the View menu</td>
</tr>
</tbody>
</table>

Adding a Group

To add a new group, click the New button at the bottom of the screen. The screen shown in Figure 8 will be displayed.
• Enter a name for the group.
• Select all the features from the **Features** panel that you want the group to have access to.
• Select all the views from the **Views** panel that you want the group to have access to.
• Click **Save** to add the group.
• Click **Cancel** to return to the Group Authorizations screen without adding the group.

**Editing a Group**

To edit a group’s authorizations, highlight a group on the list and click the **Edit** button at the bottom of the screen. The screen shown in Figure 9 will be displayed.

![Edit Group Screen](image)

**Figure 9. Edit Group Screen**

• Check or uncheck **Features** and **Views** to enable (check) or disable (uncheck) access.
• Click **Save** to save the changes.
• Click **Cancel** to return to the Group Authorizations screen without saving the changes.

**Deleting a Group**

To delete a group, highlight the group name on the Group Authorizations screen and click the **Delete** button at the bottom of the screen. The group will be deleted immediately.

*Note: You cannot delete a group that has a user associated with it. The **Administrator** group cannot be deleted.*
User Authorizations

The User Authorizations... option allows authorized users to define new users and associate them with the appropriate groups.

- To configure user permissions, log on as an authorized user with Admin rights and select Edit> User Authorizations to call up the screen shown in Figure 10.

![Figure 10. User Authorizations Screen](image)

The User Authorizations screen lists all current users along the left side and all existing groups along the top. The Authorization Name shows the name of the user, followed by a checkbox for each available group. A checkmark beneath a group indicates that the user is a member of that group with access to all the features associated with the group.

Adding a User

To add a new user, click the New button at the bottom of the screen. The screen shown in Figure 11 will be displayed.

![Figure 11. New User Screen](image)

- Enter a name for the user.
- Enter a password for the user.
- To confirm the password, re-enter it in the Retype Password field.
- Select each of the groups in the Groups panel to which the user will belong.
- Click Save to add the user.
- Click Cancel to return to the User Authorizations screen without adding the user.
Editing a User

To change a user’s password or change the groups the user belongs to, highlight the user’s name on the list and click the **Edit** button at the bottom of the screen. A screen similar to that shown in Figure 12 will be displayed.

![Edit User Screen](image)

- To change the user’s password, enter a new password in the **Password** field.
- To confirm the password, re-enter it in the **Retype Password** field.
- Check or uncheck groups in the **Groups** panel to set the groups to which the user will belong.
- Click **Save** to save the changes.
- Click **Cancel** to return to the User Authorizations screen without saving the changes.

Deleting a User

To delete a user, highlight the user’s name on the User Authorizations screen and click the **Delete** button at the bottom of the screen. The user will be deleted immediately.
Configuration
When you select Configuration from the Edit menu, the main configuration screen (Figure 13) appears. This screen contains a series of tabs that provide access to the various configuration functions.

- To access a configuration category, click the appropriate tab at the top of the screen.
- The Airport and Misc categories also provide secondary tabs that group similar options under a common heading.
Airport Tab

The Airport tab (Figure 13) contains two sub-tabs: General and Runways.

General

The Airport>General tab contains several options unique to the airport location.

<table>
<thead>
<tr>
<th>General</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Airport Name</td>
<td>The name entered here will be shown at the top of the display.</td>
</tr>
<tr>
<td>ICAO Identifier</td>
<td>The four-letter ICAO airport identifier or three-digit airport identifier.</td>
</tr>
<tr>
<td>Magnetic Declination</td>
<td>The display map is oriented to True North; this option allows you to enter a site’s magnetic declination, so that the strike locator is oriented to Magnetic North. When a value is entered here, the strike locator will rotate on the screen to a Magnetic North orientation. When entering a magnetic declination, you must also specify East or West declination by selecting the East or West button.</td>
</tr>
</tbody>
</table>

Runways

The Airport>Runway tab (Figure 14) contains a single field for specifying the ID of the runway where the lightning sensor is installed.

![Figure 14. Airport Runway Tab](Configuration.png)

<table>
<thead>
<tr>
<th>Runways</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Runway</td>
<td>Enter the number/designation of the runway associated with the lightning sensor. The value can consist of a 2-digit number from 1-36, or up to four text characters. When a numeric value is entered, it can be followed by an optional auxiliary designator (R or L, for example).</td>
</tr>
</tbody>
</table>
Map Tab
The Map tab (Figure 15) lets you specify the center point of the lightning display and set the decay time for strikes.

![Figure 15. Lightning Tab](image)

- In the Center Point panel, enter the latitude and longitude of the location you would like to set as the center of the lightning map.
- In the Decay Time field, enter the number of minutes for a strike indicator to remain on the screen. As the strike ages over this time period, it will change color. When the decay time period has elapsed, the strike will be erased. The value entered here will be reflected in the map key.
- When done, click OK.
**Misc Tab**

The Misc tab lets you specify the number of days to retain logs in the system before deleting them, and set the system time.

**General Tab**

In the text box under the General tab (Figure 16), enter the number of days the system should maintain log files before overwriting them. The value can be anywhere in the range of 4 days to 999 days.

![Figure 16. Logs Tab](image)
Time Tab

Use the Time tab (Figure 17) to set the GPS receiver as the time source for the software or to manually enter the time and date. Use GPS Time should be selected in normal operation; disable only if the GPS Receiver fails or is not installed.

- Select Use GPS Time to obtain time and date data from the GPS Receiver.
- To specify the time and date manually, uncheck the Use GPS Time box and enter the date and time in the corresponding fields. To change the date, click the calendar icon to call up a monthly calendar, then click the appropriate date. To change the time, click within each time field and manually enter a value. This option will use the computer’s built-in clock, which is less accurate than the GPS Receiver.

Figure 17. Time Tab
Port Configuration

The Port Configuration option (Figure 18) is used to specify the communication ports used by the lightning sensor and GPS. It also provides the option of scanning a range of ports periodically.

- In the Lightning Sensor Port field, enter the number of the port the lightning sensor is connected to. Enter only the number; if the sensor is connected to COM 1, for instance, enter “1”.
- In the Port field of the GPS panel, enter the number of the port the GPS is connected to. This is a USB port, so the number is assigned automatically by the operating system and will always be at least 1 greater than the number of physical ports. To see the assigned port number, follow the steps below with the GPS connected:
  - Go to Start>Control Panel>Performance and Maintenance>System, select the Hardware tab, then click Device Manager.
  - On the device list, click the + sign beside the Ports (COM & LPT) heading to expand it and show the list of serial ports.
  - Note the port number for the GPS.
- The Scan Ports option initiates a periodic scan of serial ports to detect the GPS if its port number has changed. This can happen if the GPS has been plugged into a different USB port or if another USB device has been connected. In the Scan Start Port field, enter the lowest USB port number (1 greater than the number of physical ports). In the Scan End Port, enter the highest port number to scan. The maximum is 255.
- When done, click OK to save the settings.

![Port Configuration](image-url)
**Points of Interest**

The **Points of Interest** option (Figure 19) on the *Edit* menu lets you add reference locations to the map on the main display. Once entered, the names of the points of interest will be shown on the main display at their specified locations.

![Points of Interest Option](image)

**Figure 19. Points of Interest Option**

**Adding a Point of Interest**

To add a point of interest, click the *Add* button at the bottom of the *Points of Interest* dialog. The screen shown in Figure 20 will be displayed.

![Add Point of Interest Dialog](image)

**Figure 20. Add Point of Interest Dialog**

1. Enter the latitude of the desired reference point in degrees, minutes, and seconds in the **Latitude** text boxes.
2. Enter the longitude of the desired reference point in degrees, minutes, and seconds in the **Longitude** text boxes.
3. Enter a name for the point of interest in the **Name** text box. This is the name that will appear on the main display.
4. Click **OK** to save the point of interest, or click **Cancel** to exit the dialog without saving the point of interest.
**Editing a Point of Interest**
To edit a point of interest:
1. On the list of points of interest, highlight the name of the location you want to edit.
2. Click the **Edit** button at the bottom of the screen. The **Add Item** screen (Figure 20) will be displayed.
3. Adjust the latitude, longitude, and name as needed.
4. Click **OK** to save the new values, or click **Cancel** to exit the dialog without saving the changes.

**Removing a Point of Interest**
To remove a point of interest, highlight its name on the list and click **Remove**. The point of interest will be deleted.

**Logs Menu**
The Lightning Display software records each strike detected, and stores the complete data for one day in a daily strike log. If no lightning is detected, no log will be generated for that day. The length of time that log files are maintained is set by the user via the Edit>Configuration>Misc>Logs menu option. Log files older than the time set through that screen are automatically deleted.

**Viewing Logs**
Clicking **Daily** on the **Logs** menu calls up an **Open Log** screen such as the one shown in Figure 21.

![Figure 21. Open Log Screen Example](image)

Log files use the naming format: **DLYStrike.yyyymmdd.log**, where **yyyymmdd** represents the date the data was recorded. In the example above, for instance, the file **DLYStrike.20090414.log** contains strike data for April 14, 2009.

1. To open a log file, click the desired file to highlight it, then click **Open**.
2. You can view the file on-screen, or select **Print** to print the data log. When done, click **OK** to close the window.
## Data Format
The lightning sensor data format is described below.

Communications is RS232 9600 8N1
Output data format is: `<STX><i d><ddd><CR>(<id><ddd><CR>) . <cc ><ETX>`
- **STX:** is the ASCII Start-of-Text Character (02h)
- **id:** is the item designator from the table below
- **ddd:** is the value of the data item in the Item Format column in the table below
- **CR:** Carriage Return
- **cc:** checksum - summing all data between STX and “.”, then masking all but the lower 8 bits.
- **ETX:** is the ASCII End-of-Text Character (03h)

<table>
<thead>
<tr>
<th>Item Designator</th>
<th>Item Format</th>
<th>Field Width (bytes)</th>
<th>Item Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>%I</td>
<td>dmch</td>
<td>4</td>
<td>System Status, where d is “F” = fatal fault, “R” = recoverable fault, “P” = O.K. Display Mode m is transmitted as follows: “A” Weather “B” Noise Monitor “C” Strike Test “D” Demo “E” Pilot Initiated Self-Test Configuration data c is sent as 010:B4:B3:B2:B1:B0 where Heading.CONFIG Remath Stepper Serial None B4 HdgFormat1.Input 1 0 1 0 B3 HdgFormt2.Input 0 1 1 0 B2 Heading Flag Input Sense; 0 if a High level signal on Heading Flag+ (pin P2-24) with respect to Heading Flag- (pin P2-25) indicates Valid Heading B1 Antenna. Mount 0=Bottom, 1=Top B0 Spare Heading Flag h is sent as 010:B4:B3:B2:B1:B0 where B4 Heading Stabilization 1=Enabled B3 Heading Flag Input 1=Valid B2 Heading Valid 1=Valid B1 Synchro Reference Flag 1=Valid B0 Synchro Angle Flag 1=Valid Heading Stabilization state defaults to last state when powered up. Synchro Reference Flag and Synchro Angle Flag will be zero when configured for Stepper or Serial heading input. Transmitted once per message.</td>
</tr>
<tr>
<td>%S</td>
<td>cccbbbr</td>
<td>9</td>
<td>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. In Noise Monitor Mode, ccc will always indicate 201 and rrr will have a range of 001 – 400.</td>
</tr>
<tr>
<td>%A</td>
<td>rrrb</td>
<td>6</td>
<td>Test strike range and bearing. rrr=Range to strike (“001” - “200” NM); bbb=Bearing to strike, degrees clockwise(“000” - “359” deg). Transmitted once per message block. Only transmitted when in Strike Test Mode.</td>
</tr>
</tbody>
</table>
A message is sent from the sensor once every two seconds. Each message includes at least the sensor orientation and status. If strikes are detected, they are shown between the orientation data and the status data. Up to 40 strikes may be included in a single two-second message. If errors are detected, they will be included in the message as well.

Below is a sample of the sensor output data stream that includes a description of the data immediately following the data.

```
%VB1.03 (Software Version, sent at least twice per minute)
%IPAG@ (Status = OK, Weather Mode)
------------------------ 2 seconds ------------------------
%H0000 (Sensor Orientation 0 - North)
%IPAG@ (Status = OK, Weather Mode)
------------------------ 2 seconds ------------------------
%H0000 (Sensor Orientation 0 - North)
%S026276026 (Lightning Strike = 26NM, 276 degrees)
%S026278026 (Lightning Strike = 26NM, 278 degrees)
%S027277027 (Lightning Strike = 27NM, 277 degrees)
%S025279025 (Lightning Strike = 25NM, 279 degrees)
%S027279027 (Lightning Strike = 27NM, 279 degrees)
%S201279031 (Invalid Lightning Strike = 31NM, 279 degrees; “201” indicates an invalid strike)
%IPAG@ (Status = OK, Weather Mode)
------------------------ 2 seconds ------------------------
%E16 (Error 16 – Antenna Fault)
```
Error Messages and Troubleshooting
The Model 6502 continuously runs a series of self-tests to check sensor operation and returns error messages when a fault is detected. Any detected errors are identified by "E" and a two-digit number ("E00" during normal operation) in the sensor’s raw data output. Table 2 lists all the possible error codes, along with the probable cause of the fault and possible corrective action. In many cases, a persistent error will require returning the sensor to All Weather Inc. for service.

Table 2. Model 6502 error codes

<table>
<thead>
<tr>
<th>ERROR</th>
<th>PROBABLE CAUSE</th>
<th>CORRECTIVE ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERROR 01. Processor Fault.</td>
<td>Main processor</td>
<td>Continued operation is not possible.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Contact Field Service.</td>
</tr>
<tr>
<td>ERROR 05. Processor Fault.</td>
<td>Main processor memory</td>
<td>Continued operation is not possible.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Contact Field Service.</td>
</tr>
<tr>
<td>ERROR 06. Processor Fault.</td>
<td>Main processor memory</td>
<td>Continued operation is not possible.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Contact Field Service.</td>
</tr>
<tr>
<td>ERROR 07. Processor Fault.</td>
<td>Main processor memory</td>
<td>Continued operation is not possible.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Contact Field Service.</td>
</tr>
<tr>
<td>ERROR 08. Processor Fault.</td>
<td>Main processor memory</td>
<td>Continued operation is not possible.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Contact Field Service.</td>
</tr>
<tr>
<td>ERROR 09. Processor Fault.</td>
<td>DSP processor memory</td>
<td>Continued operation is not possible.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Contact Field Service.</td>
</tr>
<tr>
<td>ERROR 10. Processor Fault.</td>
<td>DSP processor memory</td>
<td>Continued operation is not possible.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Contact Field Service.</td>
</tr>
<tr>
<td>ERROR 11. Processor Fault.</td>
<td>DSP processor memory</td>
<td>Continued operation is not possible.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Contact Field Service.</td>
</tr>
<tr>
<td>ERROR 12. Processor Fault.</td>
<td>DSP processor memory</td>
<td>Continued operation is not possible.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Contact Field Service.</td>
</tr>
<tr>
<td>ERROR 14. Processor Fault.</td>
<td>DSP processor</td>
<td>Continued operation is not possible.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Contact Field Service.</td>
</tr>
<tr>
<td>ERROR 15. Processor Fault.</td>
<td>DSP processor</td>
<td>Continued operation is not possible.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Contact Field Service.</td>
</tr>
<tr>
<td>ERROR 16. Antenna Fault.</td>
<td>Antenna or antenna wiring</td>
<td>Weather mapping is inhibited.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>a. Check antenna wiring for opens and shorts.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>b. Contact Field Service.</td>
</tr>
<tr>
<td>ERROR 17. Processor Fault.</td>
<td>No test strikes, antenna in noisy location, or faulty antenna</td>
<td>Weather mapping is inhibited.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>a. Check antenna wiring for opens and shorts.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>b. Fault will clear automatically if interference subsides.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>c. Contact Field Service.</td>
</tr>
</tbody>
</table>
Table 2. Model 6502 error codes

<table>
<thead>
<tr>
<th>ERROR</th>
<th>PROBABLE CAUSE</th>
<th>CORRECTIVE ACTION</th>
</tr>
</thead>
</table>
| ERROR 18. Processor Fault. | Invalid test strikes, antenna in noisy location, or faulty antenna            | Weather mapping is inhibited.  
  a. Check antenna wiring for opens and shorts.  
  b. Fault will clear automatically if interference subsides.  
  c. Contact Field Service. |
| ERROR 19. Processor Fault. | Main Processor or Antenna in noisy location                                  | Weather mapping is inhibited.  
  a. Fault will clear automatically if interference subsides.  
  b. Contact Field Service. |
| ERROR 20. Configuration Changed. | Antenna location (top/bottom, determined by processor wiring) changed since system was last powered up. | This may occur the first time the system is powered on in a new installation. Power the sensor off and back on again. If the error persists, contact Field Service. |
| ERROR 21. Processor Fault. | Main processor                                                                | Continued operation is not possible.  
  Contact Field Service. |
| ERROR 22. Invalid XYZ Input. | n/a                                                                          | n/a                                                                               |
| ERROR 23. Invalid Heading Ref. | n/a                                                                          | n/a                                                                               |
| ERROR 24. MIC KEY STUCK.   | Mic key (inhibit line) has been asserted for at least 60 seconds              | Weather mapping is inhibited.  
  a. Contact Field Service. |
| ERROR 25 - 34. Processor Fault. | Main processor                                                               | Continued operation is not possible.  
  Contact Field Service. |
| ERROR 35. Processor Fault. | Main or DSP processor                                                         | Continued operation is not possible.  
  Contact Field Service. |
| ERROR 36. Processor Fault. | Main or DSP processor                                                         | Continued operation is not possible.  
  Contact Field Service. |
| ERROR 40. Processor Fault. | Main processor                                                                | Continued operation is not possible.  
  Contact Field Service. |
| ERROR 41. Processor Fault. | Main or DSP processor                                                         | Continued operation is not possible.  
  Contact Field Service. |
| ERROR 42. Processor Fault. | Main processor                                                                | Continued operation is not possible.  
  Contact Field Service. |
| ERROR 43. Invalid request. | n/a                                                                          | Message error will clear once processed  
  a. Excessive noise on communication lines, check wiring.  
  b. If error occurs frequently, contact Field Service |
### Table 2. Model 6502 error codes

<table>
<thead>
<tr>
<th>ERROR</th>
<th>PROBABLE CAUSE</th>
<th>CORRECTIVE ACTION</th>
</tr>
</thead>
</table>
| ERROR 44 - 49. Serial Communication. | n/a | Message error will clear once processed  
  a. Improper baud rate.  
  b. Excessive noise on communication lines, check wiring.  
  c. If error occurs frequently, contact Field Service. |
| ERROR 50. Illegal Serial Heading Value. | n/a | Message error will clear once processed  
  a. Excessive noise on communication lines, check wiring.  
  b. If error occurs frequently, contact Field Service. |
| ERROR 51. Invalid Message. | n/a | Message error will clear once processed  
  a. Excessive noise on communication lines, check wiring.  
  b. If error occurs frequently, contact Field Service. |
| ERROR 52. Invalid Antenna Change Request. | n/a | Message error will clear once processed  
  a. A request was received to change the antenna mount to a location that does not match the configuration jumpers. Request is ignored.  
  b. If error occurs frequently, contact Field Service. |
| ERROR 53 - 54. Communications Buffer Overload. | n/a | Message error will clear once processed  
  a. Excessive noise on communication lines, check wiring.  
  b. If error occurs frequently, contact Field Service. |

Table 3 lists some common problems that may arise and the corrective action to take.

### Table 3. Troubleshooting

<table>
<thead>
<tr>
<th>PROBLEM</th>
<th>CORRECTIVE ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer will not run</td>
<td>Check power cable to computer; make sure power switch is ON.</td>
</tr>
<tr>
<td>Computer runs, but no display</td>
<td>Check cables to display; make sure display power switch is ON</td>
</tr>
<tr>
<td>Display software does not start automatically</td>
<td>Double-click AWI Lightning Display icon on desktop OR restart computer</td>
</tr>
</tbody>
</table>
| Application runs, but no lightning data | Check all connections  
  Check radio status (refer to radio manual)  
  Check power to the lightning sensor  
  At lightning sensor:  
  Check lightning sensor status LEDs;  
  check radio lights inside lightning sensor cabinet  
  check AC power board, replace if faulty |

If the problem persists, contact your local representative or AWI Customer Service.
Processor LEDs

The processor (housed within the enclosure) is equipped with a series of LEDs on its front panel (see Figure 22) that can be used to monitor certain basic functions. Table 4 explains how to interpret the LEDs.

![Figure 22. Processor front panel LEDs](image)

<table>
<thead>
<tr>
<th>COMMUNICATION</th>
<th>LED</th>
<th>NORMAL OPERATION</th>
<th>FAILED OPERATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>DSP 1 ON</td>
<td>OFF</td>
<td>Toggles ON/OFF when strike detected</td>
<td>Does not toggle ON/OFF when strike detected</td>
</tr>
<tr>
<td>MAIN 6 OFF</td>
<td>ON</td>
<td>Toggles ON/OFF once per second</td>
<td>Stays ON or OFF (does not toggle)</td>
</tr>
<tr>
<td>RX RX RX RX RX</td>
<td>OFF</td>
<td>Stays OFF or ON (does not pulse)</td>
<td>Stays OFF or ON (does not pulse)</td>
</tr>
</tbody>
</table>

* Serial communication occurs every 2 seconds, causing LEDs to pulse rapidly. Due to transmission speed, LEDs may appear not to change conditions during TX/RX operation.
Maintenance

Periodic Maintenance

Equipment Required
Equipment required for periodic maintenance of the Model 6502 consists of:

- RTV 162 (as necessary)

Monthly Maintenance
No monthly maintenance is required with this sensor.

Triannual Maintenance
Perform the following maintenance tasks three times per year:

- Check the antenna 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 sealant around the antenna base and mounting bolts, and reapply as necessary (use RTV 162).
- 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 display station.

Annual Maintenance
Annual maintenance consists of performing the quarterly maintenance tasks.

Specifications

Measuring Range: 0-200 nautical miles
Internal Voltage: 11-32 volts dc
Current: 0.82 A (maximum) @ 12 volts dc
0.38 A (maximum) @ 28 volts dc
Operating Temperature: -60 to +70° C
Relative Humidity: up to 100%
Communication: RS-485, 4800 baud
Mounting: 2½" pipe (2.875" O.D.)
Weight: 40 lbs. (18 kg)
Warranty

Unless specified otherwise, All Weather Inc. (the Company) warrants its products to be free from defects in material and workmanship under normal use and service for one year from date of shipment, subject to the following conditions:

(a) The obligation of the Company under this warranty is limited to repairing or replacing items or parts which have been returned to the Company and which upon examination are disclosed, to the Company’s satisfaction, to have been defective in material or workmanship at time of manufacture.

(b) The claimant shall pay the cost of shipping any part or instrument to the Company. If the Company determines the part to be defective in material or workmanship, the Company shall prepay the cost of shipping the repaired instrument to the claimant. Under no circumstances will the Company reimburse claimant for cost incurred in removing and/or reinstalling replacement parts.

(c) This warranty shall not apply to any Company products which have been subjected to misuse, negligence or accident.

(d) This warranty and the Company’s obligation thereunder is in lieu of all other warranties, express or implied, including warranties of merchantability and fitness for a particular purpose, consequential damages and all other obligations or liabilities.

No other person or organization is authorized to give any other warranty or to assume any additional obligation on the Company’s behalf, unless made in writing and signed by an authorized officer of the Company.
M404802
AC POWER INTERFACE BOARD

M438152
POWER SUPPLY

M460104
STORM SCOPE (ITEM-9)

M489140-00
SPREAD SPECTRUM RADIO

ANTENNA (PART OF IT-9)

EXCEPT AS MAY OTHERWISE BE SPECIFIED BY CONTRACT,
THIS DOCUMENT AND THE DATA DISCLOSED HEREIN
AND HEREBY, IS NOT TO BE USED, REPRODUCED OR
DISCLOSED, IN WHOLE OR IN PART, TO ANYONE WITHOUT
THE WRITTEN PERMISSION OF ALL WEATHER INC.
SITE LAYOUT, TRENCHING AND GROUNDING FOR LIGHTNING SENSOR

NOTES: UNLESS OTHERWISE SPECIFIED;

⚠️ DO NOT BEND GROUNDING CABLE TO LESS THAN 8 INCH (203 MM) RADIUS.

LIGHTNING SENSOR PAD

3/4" X 10' [19mm X 3.05 m] GROUND ROD
3/4" [19mm] CONDUITS IN TRENCH
3/4" X 10' [19mm X 3.05 m] GROUND ROD
#4 COPPER GROUND WIRE

TRENCH
JUNCTION BOX

CLEAN FILL
4 COPPER GROUND WIRES CLAMPED OR GANGED

24" [600mm]

SIGNAL
CONDUIT

POWER
CONDUIT

5" [127mm]
FINE SAND OR GRAVEL

3/4" X 10' [19mm X 3.05 m] COPPER CLAD GROUND ROD

TYPICAL TRENCH DETAIL

EXCEPT AS OTHERWISE SPECIFIED BY CONTRACT,
THIS DOCUMENT AND THE DATA DISCLOSED HEREIN
AND HEREBY IS NOT TO BE USED, REPRODUCED OR
DISCLOSED IN WHOLE OR IN PART, TO ANYONE WITHOUT
THE WRITTEN PERMISSION OF ALL WEATHER INC.

AWOS SITE PREPARATION
DOCUMENT FOR
NIGERIA LIGHTNING DISPLAY

D 653761-007
2. All conduit shown is 3/4" [19mm] Rigid Galvanized Steel or UV Resistant, Schedule 80 PVC if allowed by local codes or equivalent.

3. Install per local building codes.

4. Attach conduit to concrete with rigid conduit straps in 2 locations.

5. Install pull boxes in each signal conduit. All Weather, Inc. to install signal cables.

6. For land line data links to the indoor equipment, install junction box and conduit or use direct burial & conductor steel cable and terminate with a junction box at the indoor location.

7. Install 12 and Thhn Ac power wires or equivalent from power distribution box to ac power junction boxes.

8. Weather tight junction boxes. Appleton CT5-M with cover KT5-CM and rubber gasket KT5-M or equivalent. 1 required.

9. It is assumed the sensor site ground level is approximately the same elevation as the primary runway. If the sensor site ground level is significantly different than the runway elevation, the value should be adjusted to obtain the correct sensor height above the runway level.

Electrical Conduit Layout/Installation
Lightning Sensor
NOTES: CONT'D

1. INCREASE FOUNDATION ACCORDINGLY WHERE FROST MAY EXCEED 36 INCHES [914mm].

### 220VAC 60Hz 1PH

<table>
<thead>
<tr>
<th>Sensor Site</th>
<th>Location</th>
<th>Load</th>
<th>Breaker Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lightning Sensor</td>
<td>400 VA Max.</td>
<td>10A</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Central Data Processor</th>
<th>Location</th>
<th>Load</th>
<th>Breaker Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central Data Processing Equipment</td>
<td>600VA Max.</td>
<td>10A</td>
<td></td>
</tr>
</tbody>
</table>

**Power Requirements**