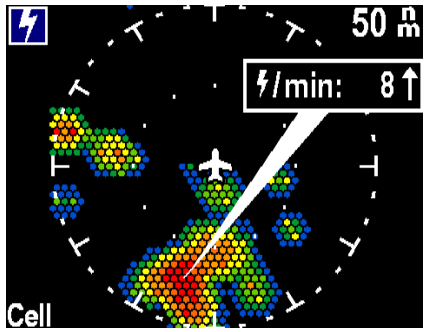
TWX670

Tactical Weather Detection System

Pilot's Operating Handbook



P/N 600-00164-000 Rev 010

AVIDYNE

This handbook contains basic operating instructions for the TWX670 system. The TWX670 processor interfaces to an external display for control and the presentation of thunderstorm data. Refer to your display's handbook for instructions on accessing TWX670 controls on your display.

Document Revisions

Revision	Date	Description of Change
000	08Nov2006	Initial Release
001	10Nov2006	Corrected Part Number Minor Clarifications
002	29Nov2006	Added comment on non-geostabilized operation
003	01Aug2007	Minor corrections.
004	14Feb2008	Added warning to the “Limitations” section. Added discussion of color interpretation.
005	15May2008	Updated the text for the warning conditions.
006	16May2008	Added Legacy Interface.
007	20May2008	Added error codes for Legacy Interface.
008	10June2008	Specify Legacy Interface is for approved legacy devices.
009	19Sep2008	Updated figure A.3 to show the full TWX670 software part number.
010	03Dec2008	Updated Legacy Mode Description

Part Number: 600-00164-000 Document Number: 87-3299

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Table of Contents

CHAPTER 1

General Information

Welcome

Thank you for becoming an owner of the Avidyne Tactical Weather Detection System. Now you can fly with greater confidence and greater peace of mind knowing your aircraft is equipped with the latest technology to identify and avoid thunderstorm related hazards.

This Operating Handbook is intended as a guide to the capabilities and operation of the Avidyne TWX670 to realize the best performance from your investment. It describes the basic operation, modes, and controls of the TWX670. Refer to your display's Handbook for instructions on how to access and use the TWX670 controls, and how to display the TWX670 thunderstorm data in a manner that is most useful to your particular situation.

TSO Information

The TWX670 Tactical Weather Detection System is a passive thunderstorm detection device that meets the requirements of TSO-C110a. Additional related features are provided and portrayed using a compatible display.

Limitations

WARNING: The TWX670 provides information that approximates storm location and strength. This information is advisory only; the aircraft must not be maneuvered based solely by reference to this information.

The system is not to be used for thunderstorm penetration. There is no electronic device made to assist in the penetration of thunderstorms. The TWX670 system does not depict all lightning. The system uses certain electrical discharges associated with all thunderstorms to map the approximate location of the thunderstorm activity so it can be avoided. Thunderstorms change rapidly. The real-time data provided by TWX670 changes as the thunderstorm changes. Exercise extreme caution when operating around thunderstorms. The intensity of the thunderstorms can change

quickly and with little warning. Maintain adequate distance from the thunderstorm activity since conditions dangerous to flight may exist many miles from lightning and thunderstorm activity.

Caution: The TWX670 system is designed to advise the flight crew of nearby thunderstorms. Like any cockpit equipment, it must be checked against other cues to confirm proper operation and must not be solely relied on for thunderstorm avoidance.

NOTE: This manual describes all of the features of the TWX670 processor; however not all compatible display devices will support all of the capabilities of the TWX670 processor. Refer to the display's pilot operating manual for operating instructions and supported capabilities.

Conventions Used In This Document

The TWX670 System detects the electrical discharges associated with thunderstorms to permit the flight crew to evaluate and avoid nearby thunderstorm activity. These discharges are primarily intra-cloud and are often not visible. Other discharges, such as cloud to cloud lightning, are often visible but are not associated with individual thunderstorm cells. Throughout this manual, terms such as electrical discharge activity, strike, and lightning are often used. These terms mean the electrical discharges associated with thunderstorms, rather than the more common general definition of visible lightning.

The TWX670 contains two types of display interfaces and can be connected to most displays that provide an RS-232 interface and are capable of displaying lightning. When you power up the TWX670, it automatically detects the connected displays and uses the appropriate display interface for each connected display. In this document, we refer to the two types of display interfaces as:

- **Native Interface** – This interface is used with displays that are designed to support the TWX670, such as the Avidyne EX500, EX5000, and MHD. These displays may support all TWX670 features. The Native Interface contains advanced signal processing that filters out non-weather related noise.
- **Legacy Interface** – This interface is used with qualified displays that have an RS-232 interface, are capable of displaying lightning from older lightning detection devices, and have been qualified to support the TWX670. Examples include the Garmin 400 and 500 series. The way that you access TWX670 features and the way that the display presents lightning data may be different for your display. Refer to the documentation for your display.

NOTE: The Legacy Interface is similar to first generation lightning detection systems and does not contain the advanced signal processing contained in the Native Interface for filtering non-weather related noise.

For purposes of illustration, descriptions of display usage and graphical depictions used throughout this handbook are presented on an Avidyne 3ATI Multi-Hazard Display (MHD). Many of the display features, such as range selections, and the use of color may be the same for many display types, but there will be some differences between displays, particularly with how to control the TWX670 and how annunciations and lightning data are presented. Refer to your display's handbook for a description of how these functions have been implemented on your display.

Comparison of Thunderstorm Data from Satellite Weather Sources, Onboard Radar and TWX670

The availability of Satellite weather has changed the dynamics of weather avoidance. Satellite weather presents information that enhances safety and efficiency year-round. It is by far the best

strategic tool for aviation, and may be sufficient for casual recreational flying. Satellite data has its limitations, some of which are addressed by onboard weather radar and thunderstorm detection devices like the TWX670. There are several meteorological hazards to flight. Icing, turbulence (especially mountain wave) and low IFR over a large area are all very important. Winds aloft information can assist the flight crew in routing for best efficiency. Satellite weather provides this information very well. It takes time to compile the data, so there is some lag in dissemination. Convective activity and rain is also provided with some time lag that can be significant around thunderstorms. Thunderstorms are a unique phenomenon. Most are short-lived, all are dynamic, and some move quite rapidly across the ground. They have varying intensities which sometimes permit operations closer to the storm than at other times.

Thunderstorms by definition generate lightning, though this is the least of the hazards of thunderstorms. Thunderstorms can contain icing, hail, heavy rain, turbulence, wind shear, microbursts and tornadoes. Low level thunderstorm encounters are particularly dangerous since a vertical recovery from a severe downdraft may not be possible. Thunderstorms build, change and dissipate quickly. They often contain free convective vertical drafts that can exceed the capability of any aircraft. The downdrafts and resulting outflow winds can exceed hurricane velocities. Not all of these storms have precipitation. None have precipitation uniformly throughout the storm, though the gradient of the rainfall is a good indicator of an area to avoid. Lightning is also not uniformly distributed, though intra-cloud lightning is a good indicator of thunderstorm severity. Cloud to ground lightning is an excellent indicator of convective activity, but only a small percentage of lightning is cloud to ground. Radar is comparable to a light beam shining on the precipitation. The more reflective the rain, the more intense the color. Thunderstorms change quickly. Satellite weather information is often not sufficient for avoiding individual thunderstorm cells. Real-time, aircraft based information is best for this activity. Thunderstorms are safely circumnavigated by clearing the activity by twenty miles or more. The Tactical Weather Detection System is an essential complement to Satellite weather that delivers real-time, aircraft-based severe thunderstorm information to the pilot.

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CHAPTER 2

Introduction

Product Description

The Avidyne Tactical Weather Detection System (TWX670) consists of a directional antenna and a receiver/processor unit (referred to simply as the processor) and a compatible display.

The antenna/processor system receives electromagnetic energy emitted by thunderstorms. The strike data is analyzed to determine range and bearing. Multiple strikes are clustered into thunderstorm cells and the data is presented to the flight crew.

Your display operating handbook will explain the TWX670 features it supports. The Avidyne 3ATI Multi-Hazard Display supports all TWX670 features.

Most systems are configured for audio call-outs of nearby lightning, providing an additional warning of nearby thunderstorm hazards.

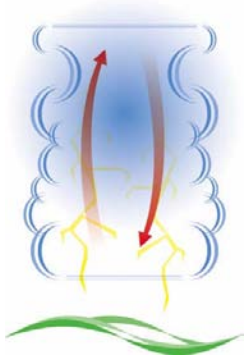
Severe Weather Detection

Since early flight, science has searched for methods to safely guide aircraft around the perils of atmospheric storms. The two most successful methods for doing this have been by identifying precipitation and by identifying lightning (intra-cloud and cloud to ground electrical discharges). Both are associated with storm activity, but in different ways.

Identifying precipitation has been a successful means for storm detection. Clouds formed by precipitation are visible to the sight, providing the flight crew with evidence of storms. Weather radar extends this capability by illuminating the water droplets. Identification of lightning, both visually and electronically, has also been a successful means for storm detection.

Extreme Weather

The thunderstorm is the heart of extreme weather. Micro-bursts, gust fronts and tornados are all products of the thunderstorm. Other hazardous conditions such as hail, lightning, turbulence and wind shear are further consequences of the thunderstorm. The Avidyne TWX670 tactical weather technology is the result of research into the use of lightning signals for the identification of real-time extreme weather conditions.



All thunderstorms contain violent updrafts which are fueled by the forming of water droplets through condensation. This is why the identification of precipitation is an effective means for thunderstorm detection. The rising air currents are often carried away in the upper atmosphere, or descend without danger over a wide area. However, extreme forms of weather consist of not only violent updrafts, but are accompanied by powerful downdrafts. The downdrafts are fueled by the evaporation of water. While precipitation is associated with updrafts, it is the evaporation of water that powers downdrafts. Precipitation vanishes in the downdraft due to evaporation, and as a result radar echoes can become ineffective for the identification of regions of extreme weather with hazardous downdrafts.

Microbursts

From the Aeronautical Information Manual, 2006, Section 7:

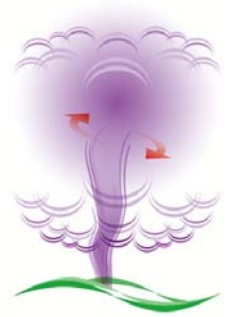
> *"Microbursts are small scale intense downdrafts which, on reaching the surface, spread outward in all directions from the downdraft center. This causes the presence of both vertical and horizontal wind shears that can be extremely hazardous to all types and categories of aircraft, especially at low altitudes. Due to their small size, short life span, and the fact that they can occur over areas without surface precipitation, microbursts are not easily detectable using conventional weather radar or wind shear alert systems."*

The fuel for the microburst is the evaporation of water, which can cause areas of precipitation to appear deceptively benign. On the other hand, lightning activity associated with the microburst can be intense. Lightning is in part created by accelerated vertical air currents, making the microburst a factory for lightning. Since the extreme conditions of the microburst extend out for only a few miles, and are short lived, Avidyne's tactical weather technology has been designed for both short-range and long-range performance.

Gust Fronts

The gust front forms at the leading edge of a thunderstorm, and is typified by dangerous outflow of swirling air currents. It is the same downdraft mechanism that powers the outflow of air currents—the evaporation of water. Lightning activity gives important clues as to the existence and severity of this type of weather.

Tornados



The tornado is a terrifying appendage of a thunderstorm. This phenomenon is still under study by scientists, but the latest research points to the existence of both extreme updrafts and extreme downdrafts. The downdraft, along with the updraft, is required to create the spinning tube of air that develops into a tornado. Experience has demonstrated that a remarkable level of lightning activity is associated with the tornado.

Theory of Operation

Lightning is closely associated with extreme weather conditions, and the more violent the weather, the greater the lightning activity. In fact, lightning detection is often more reliable than visually observing the storm clouds or detecting the storm's precipitation. As stated in the Aeronautical Information Manual, 2006, Section 7:

> *"There is no useful correlation between the external visual appearance of thunderstorms and the severity or amount of turbulence or hail within them. The visible thunderstorm cloud is only a portion of a turbulent system whose updrafts and downdrafts often extend far beyond the visible storm cloud..."*

The Avidyne TWX670 detects the radio frequency interference radiated from lightning. The system uses a directional antenna to determine the bearing to the strike, while the range to the strike is determined by measurement of such signal characteristics as amplitude and spectral content.

The Avidyne TWX670 is designed to detect lightning from zero to 200 miles. An aircraft making an approach to landing or after takeoff is the most vulnerable to severe air currents, and the flight crew must know if threatening weather conditions are close to the anticipated flight path. Wind shears generated by the microburst are particularly hazardous. Should radar echoes fail to indicate the severity of the weather; lightning activity can give valuable warning as to the existence of the extreme hazards associated with thunderstorms.

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CHAPTER 3

Presentation of Thunderstorm Data

General

The display of thunderstorm data may vary somewhat, depending on your display's manufacturer and model number. Generally speaking, your display will behave similarly to that which is described in this chapter. Refer to your display's operating handbook for usage instructions specific to your display model.

Some display features are essential and are implemented in all compatible display models. Other features are considered optional and may not be implemented in all displays. The display features described in this chapter are annotated to indicate whether they are required or optional.

Colors

The TWX670 uses color to convey thunderstorm intensity. Since hazardous conditions may be present some distance from the center of lightning activity, it is possible that the cell mode depiction may show color where no lightning was actually detected. The lack of detected lightning in an area does not indicate less severe conditions.

Lightning is a good indicator of instability in the atmosphere, and is typically associated with conditions that can be hazardous to flight. Colors on the TWX670 are derived from the intensity of the lightning activity detected by the system, and therefore; are representative of turbulence and other severe weather phenomenon associated with lightning. Table 1, on the next page, describes the colors displayed by the TWX670.

Color	Interpretation
Red	**Intense thunderstorm activity – presence of hazardous atmospheric conditions is certain.**
Orange	Weather conditions are approaching intense thunderstorm activity (approaching red).
Yellow	**Heavy thunderstorm activity – high likelihood of hazardous atmospheric conditions.**
Green-Yellow	Weather conditions are approaching heavy thunderstorm activity (approaching yellow).
Green	**Moderate thunderstorm activity – severe turbulence and unsettled atmospheric conditions likely.**
Blue-Green	Weather conditions are approaching moderate thunderstorm activity (approaching green).
Blue	**Light thunderstorm activity – atmospheric instability and moderate turbulence is likely.**

Table 1: Interpretation of colors on a TWX670 display.

WARNING: Colors representing less intense weather conditions do not imply that it is acceptable or safe to fly in those areas. **Always try to avoid areas of activity displayed by the TWX670, regardless of the color displayed.**

Strike Display Mode

Strikes are shown as individual dots on the screen at the appropriate range and bearing relative to the nose of the aircraft. Individual strikes will be displayed for a maximum of 3 minutes.

If supported by the display, strikes are normally displayed in color corresponding to the rate of discharge activity in the area. Strike intensity is displayed with 7 different color shades ranging from red to blue. A strike displayed in red indicates an area of very high intensity, while a strike displayed in dark green indicates an area of low intensity. See Figure 3.1.

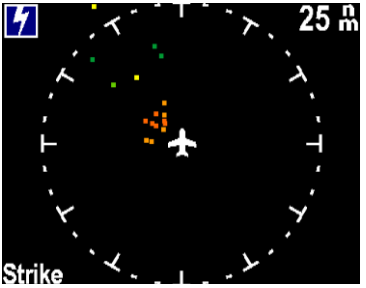

FIGURE 3.1
Strike color identifies regions of high strike intensity

Cell Display Mode (optional)

The use of color to depict storm cells permits the flight crew to evaluate the thunderstorm intensity at a glance. In Cell mode, the effects of individual strikes in the same vicinity are integrated to show the relative storm intensity over an area, consistent with actual thunderstorm behavior.

Cell mode also uses the color scheme. Red indicates areas of very high storm intensity; blue indicates areas of relatively low storm intensity. Figure 3.2a shows a typical cell mode display showing an aircraft on the ground while a thunderstorm is moving across the airport. Figure 3.2b shows the individual strikes that make up the cell presentation.

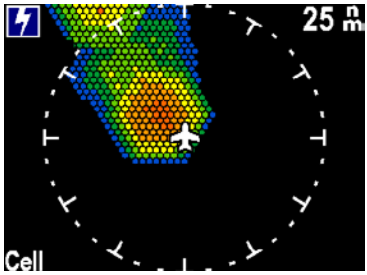

FIGURE 3.2A

Cell color highlights regions of severe storm intensity

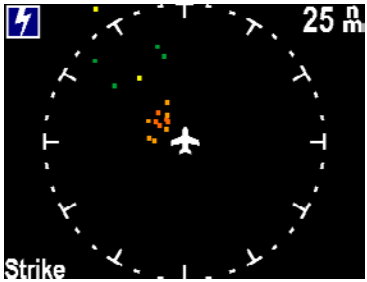

FIGURE 3.2B

The individual strikes making up the Cell mode display

The individual strikes that make up the Cell mode presentation are maintained for 3 minutes. Over time, the storm cell will either be maintained (or grow) with the addition of newer strikes, or it will diminish as older strikes are discarded.

The TWX670 treats lightning as indicative of a region of thunderstorm activity since dangerous conditions can exist for some distance from the actual lightning discharge. Because of this a small number of strikes can create a sizeable cell indication. This can also lead to sizeable cell indications appearing to dissipate suddenly if all of the contributing strikes occurred at nearly the same time, because the strikes will also age out at nearly the same time. This would typically be associated in areas of light to moderate lightning activity; however a pilot should always seek to avoid any location that the TWX670 indicates may have activity.

Combined Strike and Cell Display Mode (optional)

When strikes are overlaid on the cell data, then it is possible to see what is generating the cell data, which is very useful at lower ranges. An example of such a display is shown in Figure 3.3.

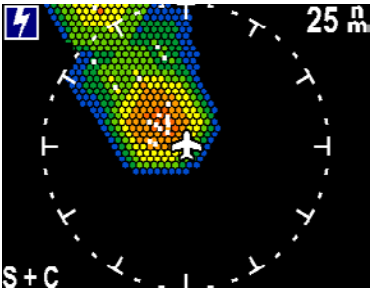

FIGURE 3.3

Combining Strike and Cell modes provides a better view of the storm's makeup

Display of Region Data (optional)

The TWX670 has the ability to display the strike intensity of the active regions shown on the display. Region data consists of the average strike rate (in strikes per minute) within a defined region, as well as its trend (growing, diminishing, or unchanging).

For display purposes, a region is defined as a continuous area of cells consisting of dark green elements all the way up to red elements (excluding blue elements, the lowest intensity component of a cell)

See Figure 3.4 for an example of how region data is displayed. The display shows a region with an average strike rate of 8 strikes per minute, and the rate is increasing. In this particular display implementation, the user can sequence through each region of interest to retrieve the data for those regions.

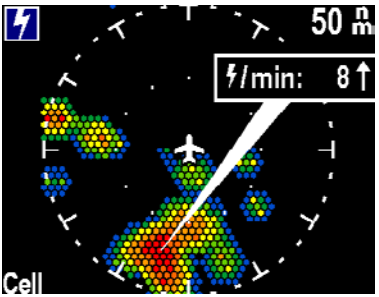

FIGURE 3.4

Viewing the Region Data provides insight into the storm's severity and its trend

NOTE: Region statistics only apply to that portion of the storm that is presented on the display, and thus may differ with different range selections. To examine a region that is greater than your display range, go to the next highest range setting.

Display Stabilization (optional)

Geographical Stabilization

The TWX670 system is stabilized in range and bearing. This means the discharges reposition on the display with respect to the aircraft movement. This is especially important at low ranges in higher-speed aircraft.

The TWX670 is normally installed with a GPS, but GPS is not required. If the installation on your aircraft is not geo-stabilized the thunderstorm activity may be closer and more intense than what appears on the display. This is especially important in higher-speed aircraft heading toward storm activity.

Stabilization can be disabled if necessary. See the Section, *Configuration Settings* on page 43.

Audio Callouts (optional)

Nearby lightning can be an important indicator of nearby severe weather. Lightning detected within five miles normally indicates the aircraft is in an extremely hazardous location and immediate steps should be taken to get away from the area.

Audio callouts are rare. The following narrative describes the announcements and the steps taken to minimize nuisance alerts.

When lightning is detected within 5 nm of your aircraft, the system will generate audio callouts describing the direction of the strike. Audio callouts will be of the form:

"*Lightning! Eleven O'clock*"

When a second strike is detected in the same quadrant (forward, right, left, or rear) within a minute of the first strike, the second callout will be of the form:

"*Frequent Lightning Ahead!*"

After the second audio callout within a 1 minute timeframe, further audio callouts *for that quadrant (ahead, right, left, behind)* will be suppressed for 3 minutes. Other quadrants will continue to generate callouts when nearby lighting is detected.

When the system is generating callouts in multiple quadrants, it will suppress all callouts for 3 minutes after the sixth callout in a 2 minute timeframe. In this case, the last callout given will be:

"*Frequent Lightning, All Quadrants!*"

Audio callouts can be temporarily disabled from your display by pressing the Mute button (See "Audio Mute", page 44). Audio callouts will be muted for 3 minutes. Your display may also allow you to adjust the audio volume (See "Audio Volume", page 7).

CHAPTER 4

Controlling the TWX670 System

General

The control interface to the Avidyne TWX670 will depend on your particular display model. Generally speaking, the display will implement the control features described in this chapter. Refer to your display's operating handbook for usage instructions specific to your display model.

Some display controls are essential; these controls are required to be implemented in all compatible display models. Other controls are considered optional; they may or may not be implemented in your specific display. The TWX670 controls described in this chapter are annotated to indicate whether they are required or optional

Range Selection

Your display will allow you to select the viewing range of the TWX670. The TWX670 supports ranges of 10, 25, 50, 100, and 200 nm. Your display may or may not support all viewing range selections.

Mode Selection

Your display will allow you to switch between Strike mode and Cell mode. Depending on its implementation, it may also allow the selection of a combined Strike and Cell mode.

Region Data

Your display may allow you to retrieve additional data on various regions of thunderstorm activity (see "Display of Region Data" on page 24). If this optional display feature is implemented, a means to activate it and switch between regions will be available to you.

Display Clear and Restore

Your display will provide the ability to clear all current active strikes. This will have the additional effect of clearing the cells which are made up of those strikes. The Restore function restores the data as if the clear button had never been pressed. Clearing the data can be helpful when evaluating the severity of the thunderstorm; however it can take some time for the activity to build into a usable display. Restore permits the activity to be displayed immediately.

System Test Mode

The TWX670 performs system tests during startup and normal operation. Refer to “Automatic Self Test”, page 32, for a discussion of these built in test features.

You can also place the TWX670 into the system test mode to more fully evaluate system operation. In the system test mode, the rate of generation for internal test strikes by special test circuitry is increased so you can verify that strike detection and processing is behaving normally.

Figure 4.1 shows a typical system test screen. Test strikes will normally be displayed in the four boxes around the center of the screen. Test strikes occasionally falling outside the boxes is normal and tends to be caused by external noise and interference sources. Test strikes consistently falling outside the boxes may be an indication of a processor problem.

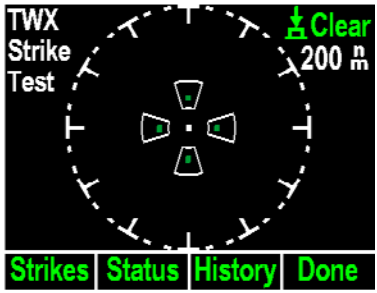

FIGURE 4.1

Viewing internal test strikes in the system test mode

NOTE: When displaying test strikes, strikes from actual storms continue to be displayed on the screen.

NOTE: If the TWX670 is placed in Test Mode (not Strike Test Mode) from a display connected via the Legacy Interface, you will not see a “Test” annunciation on other displays; however, the other displays will continue to operate normally while the Legacy Interface display is in Test Mode.

NOTE: If the TWX670 is placed in Strike Test mode from a display connected via the Legacy Interface, a TEST annunciation as well as the actual strike test data will appear on all connected displays; however, in this configuration, test boxes will not be drawn around lightning strikes on the other displays. Also, strikes from actual storms may display when in Strike Test mode.

NOTE: If the TWX670 is placed in Strike Test mode, the TWX670 displays test strikes at the four cardinal positions. On displays using the Legacy Interface the test strikes appear only at the 45 degree location. The TWX670 automatically remaps its test strikes for displays using the Legacy Interface so that the test strike indications are consistent with other known displays. This may lead to confusion if you are using a Native Interface display as well as a Legacy Interface display. It is OK for the two types of displays to show test strikes in different positions. Evaluate each display on its’ own.

CHAPTER 5
System Operation

Power

The Avidyne TWX670 is designed to power up automatically.

Automatic Self Test

When power is applied to the system, the system performs a number of system tests. All tests are passed when the system starts.

Operation

Operation of TWX670 is simple. Stay away from extreme activity. Avoid areas of thunderstorms. Any activity should be avoided and activity that exceeds 1 discharge per minute should be avoided by a generous margin. The hazards associated with thunderstorms are not limited to the visible part of the thunderstorm. The best avoidance is conservative avoidance.

The thunderstorm activity is dynamic, and the cell display shows the dynamic nature. The storm can build very quickly, and the image will grow and change with it. Figures 5.1 through 5.4 show nearby thunderstorm activity. Figure 5.5 illustrates the region data function.

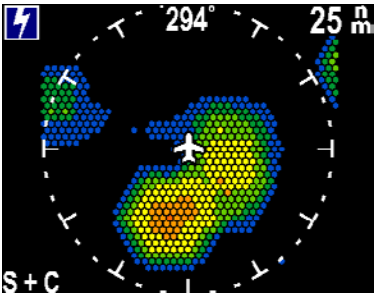

Figure 5.1 Thunderstorm activity behind and to the right. The activity behind is more intense.

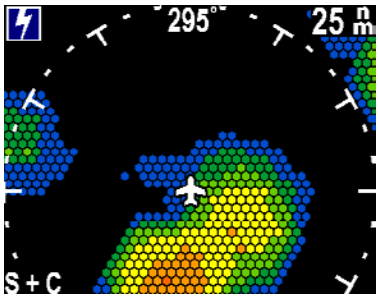

Figure 5.2 Thunderstorm activity behind and to the right. The aircraft is moving forward away from the activity. Notice the two cells are beginning to merge.

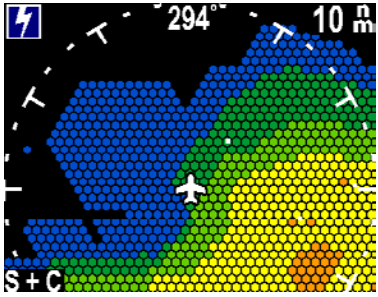

Figure 5.3 On the ten mile range the cell on the right is predominant. Notice it is increasing in intensity.

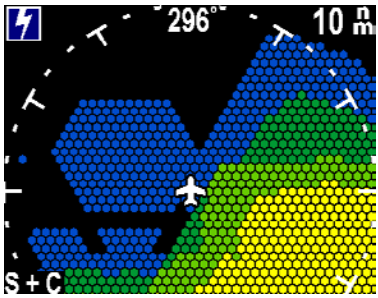

Figure 5.4 Continuing to move away from the activity. Blue areas indicate regions of less intensity, but it can build.

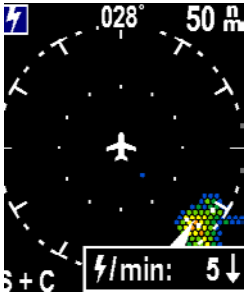

Figure 5.5 Five discharges per minute in the contiguous cell, and decreasing in rate. Blue dots indicate minimal activity.

CHAPTER 6

Specifications, Warranty and Disclaimer

Specifications

FIGURE 6.1
TWX670
Specifications

Weight:	1.4 lbs. (635 g.)
Cooling	Convection
Installation Dimensions	7.869 inches (199.87 mm) x 2.48 (62.99 mm) x 4.0 inches (101.6 mm)
Operating Voltage:	10 - 30 Volts DC
Current:	0.8A @ 14VDC, 0.4A @ 28VDC

Parts and Service Warranty

The Avidyne TWX670 is warranted against defects in materials and manufacturing for 18 months from date of shipment to an authorized dealer or one year from the date of original installation, whichever occurs first. The obligation of Avidyne Corporation is limited to the repair or replacement, at the option of Avidyne Corporation, of products that prove to be defective during the warranty period. No other warranty is expressed or implied. Proper installation of the Avidyne TWX670 is the responsibility of the installing agency and is not part of this warranty. Avidyne Corporation is not liable for consequential damages. Warranty protection is ensured only when your Avidyne TWX670 is installed and serviced by an authorized dealer.

DISCLAIMER

The Avidyne TWX670 System has been meticulously designed to provide warning of thunderstorms. As with any device, there are significant limitations. The TWX670 System does not detect all weather hazards. We must declare in the strongest of terms that the TWX670 System is not foolproof, and will not in itself prevent thunderstorm penetration. The pilot must make the avoidance decisions. We do claim that the TWX670 System is a very useful device that can help the pilot to save the aircraft and occupants from

disaster. The TWX670 System is an aid thunderstorm avoidance and does not replace the common sense and good judgment of the pilot. As a pilot, you must be relied upon for a certain level of competence and a high standard of knowledge about the airspace, aerodynamics, regulations, and the TWX670. This includes knowledge of the limitations as well as the capabilities of the TWX670 system. This equipment is designed to increase the pilot's awareness of nearby thunderstorms. It does not directly detect turbulence. It is not designed to replace the responsibility of the pilot to become familiar with all available information concerning the flight, or the ATC responsibility in the IFR environment.

The pilot in command of an aircraft is directly responsible for, and is the final authority as to, the operation of that aircraft.

Customer Support

We appreciate the confidence you have placed in Avidyne Corporation, and in your avionics dealer. We trust that both the Avidyne TWX670 and your dealer have met your expectations. For questions or comments, contact Customer Service at:

1-800-877-0048 (USA and Canada)

1-614-885-3303 (International)

support@avidyne.com

Record of Purchase

The following information will be required when you contact Avidyne Corporation for service or support. For your convenience, we recommend that you record the information here for future reference.

TWX670 S/N:	
Date of Purchase:	
Dealer Name:	

CHAPTER 7

Appendices

Faults and Warnings

The TWX670 may display the following faults or warnings. The exact wording may vary depending on your display model, but warning and fault conditions fall under the following categories.

Displays using the Legacy Interface identify failure and warning conditions with an error code. The Legacy Interface error code for each failure or warning is identified in parentheses. See the following failure and warning tables.

Failure Annunciation	Indication
Horizontal Loop Antenna Failure (Legacy Interface error #17)	The TWX670 has detected a failure of the horizontal loop antenna. The lighting display cannot be trusted. The TWX670 should be turned off and your installation should be checked by qualified service personnel at the first opportunity.
Vertical Loop Antenna Failure (Legacy Interface error #17)	The TWX670 has detected a failure of the vertical loop antenna. The lighting display cannot be trusted. The TWX670 should be turned off and your installation should be checked by qualified service personnel at the first opportunity.
Sense Antenna Failure (Legacy Interface error #17)	The TWX670 has detected a failure of the sense antenna. The lighting display cannot be trusted. The TWX670 should be turned off and your installation should be checked by qualified service personnel at the first opportunity.
Receiver Failure (Legacy Interface error #44)	The TWX670 Processor has detected a receiver failure. The TWX670 Processor should be returned for service.

Failure Annunciation	Indication
Microphone Stuck Failure (Legacy Interface error #24)	The TWX670 disables lightning detection when the microphone is keyed to eliminate transmitter induced noise. When the microphone remains keyed for 2 minutes or longer, this failure will be annunciated. It will clear if the Microphone Inhibit Input goes inactive. If the microphone stuck failure indication does not clear as expected, then the TWX670 should be turned off and your installation should be checked by qualified service personnel at the first opportunity.
TWX Antenna Config (Legacy Interface error #16)	The TWX670 antenna configuration pins are not connected properly to identify whether a top or bottom mounted antenna is being used. The TWX670 installation should be checked by qualified service personnel at the first opportunity.

Warning Annunciation	Indication
Wx data inaccurate (noise warning) (Legacy Interface error #18)	Excessive noise has been detected in the system. Range and Bearing estimates may be degraded. System sensitivity may be degraded. You may be near an external noise source; moving away may eliminate the noise. If the problem persists, get your system checked by qualified service personnel at the first opportunity. Excessive noise can substantially affect the performance of the TWX system.
Track & position invalid (GPS device not found) (Legacy Interface error #23)	The system is configured to interface with a position source, but it is not communicating with it. Position stabilization of storm data is not possible. If track data from the position source was used for heading stabilization, then heading stabilization is not possible. Make sure the position source is turned on and is operating. If the problem persists, get your system checked by qualified service personnel at the first opportunity.

Warning Annunciation	Indication
Track & position invalid (GPS data invalid) (Legacy Interface error #23)	The TWX670 is communicating with a position source, but there is no valid position data. Position stabilization of the storm data is not possible. If track data from the position source was used for heading stabilization, then heading stabilization is not possible. If you are on the ground, make sure the GPS antenna is not obstructed. Make sure your GPS receiver is locked and tracking.
Heading invalid (Legacy Interface error #23)	The system is configured to use a heading source for stabilization and there is no valid heading data. If your system has a position source providing valid track data, then the TWX670 will use track data for heading stabilization while heading data is unavailable. Make sure the heading source is turned on and is operating. If the problem persists, get your system checked by qualified service personnel at the first opportunity.

NOTE: If the TWX670 is connected to displays using both the Native Interface and the Legacy Interface, and you disable Heading Stabilization on the Legacy Interface display, the Native Interface display will continue to display heading. The heading must be disabled on both to assure that no displays are using heading information.

Configuration Settings

Audio Volume

If your TWX670 is configured for audio call-outs, your display may allow you to set the audio volume of the TWX670 call-outs. As you change the volume setting, the TWX670 will play the word "Volume" through the audio system at the selected volume.

Audio volume settings are retained when the system has been turned off.

Stabilization Disable

Several stabilization settings are made available to you during normal operation. These settings affect the use of external position and heading sources to stabilize the thunderstorm data presented on the display. (See "Display Stabilization", page 25). Normally, there is no need to access these settings. But occasionally, erratic or erroneous operation of interfacing equipment may negatively affect the operation of the TWX670. The settings are as follows:

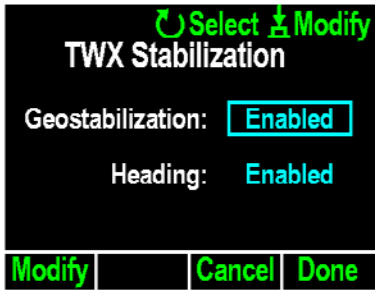

FIGURE A.1
User Accessible Configuration Settings

Configuration Setting	Description and Usage
Geostabilization Disable	Disables the use of position data for stabilization. Position stabilization will not function. If your system is relying on aircraft track for heading stabilization, then heading stabilization will not function as well. Disable Geographical Stabilization if you have reason to believe your position source is malfunctioning. If the installation on your aircraft is not geo-stabilized the thunderstorm activity may be closer and more intense than what appears on the display. This is especially important in higher-speed aircraft heading toward storm activity.
Heading Stabilization Disable	Disables the use of the heading input data for heading stabilization. If your system is connected to a position source, it will automatically revert to using aircraft track to stabilize the display. Disable the Heading Stabilization if you have reason to believe your heading source is malfunctioning.

NOTE: The pilot accessible stabilization disable settings are NOT retained when the system is turned off. These settings allow the pilot to temporarily disable the use of data from a malfunctioning device and will revert to their default settings when the system is turned back on. The malfunctioning device should be serviced or permanently disabled in the installation configuration menus (refer to the TWX670 Installation Manual).

Audio Mute

It is normally possible to mute the audio output. Pressing the mute button will silence the callouts for 3 minutes. Pressing the mute button again unmutes the system. When muted, the mute status will be shown on your display.

See “Audio Callouts”, page 25 for more information on the use of audio by the TWX670.

System Information

TWX670 Configuration

Your display may be able to provide information regarding the internal configuration of your TWX670. This information will include hardware and software part numbers, version numbers, release dates, and other information pertinent to your system. The system configuration information is useful when requesting technical support for your system. See Figure A.3 for an example of the system information display (to view all of the information, scroll through the list of entries).

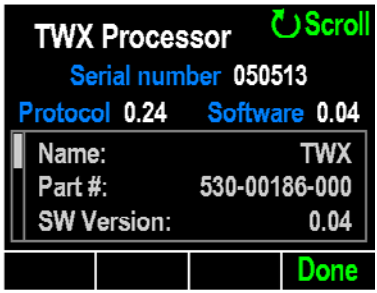

FIGURE A.3
Viewing internal system configuration information

Port Assignments

You can view the ports assignments within the TWX670 processor. This information is useful when troubleshooting your system. See Figure A.4 for an example of the port assignment display (to view all of the information, scroll through the list of entries).

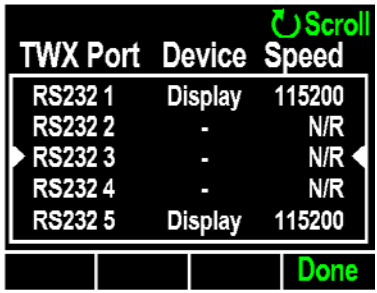

FIGURE A.4
Viewing the TWX670 Port Assignments

Acronyms

GPS	Global Positioning System
MHD	Multi-Hazard Display
nm	nautical mile
S/N	Serial Number
TSO	Technical Standard Order
TWX670	Tactical Weather Detection System

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This document is applicable to the TWX670 Part Number 700-00033-000.

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P/N 600-00164-000 Rev 010, December 3, 2008