FlightMax™

Flight Situation Display

Pilot's Guide

Part Number: 600-0053
Revision 00

AVIDYNE

55 Old Bedford Road
Lincoln, Massachusetts 01773
Telephone: (781) 402-7400 Fax: (781) 402-7599
Web Site: www.avidyne.com

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FlightMax™

Flight Situation Display

Introduction and Release Notes

Part Number 600-0054 Revision 00

Revision History

Date	Revision	Description
Sep. 7, 2000	00	Production Release

Avidyne Corporation
55 Old Bedford Road
Lincoln, Massachusetts 01773
Web Site: www.avidyne.com

Introduction
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Introduction and Release Notes

Introduction

The Avidyne FlightMax Flight Situation Display (referred to as the FSD) is the most advanced display and navigation system available for general aviation today. This part of the FlightMax FSD Pilot's Guide is an introduction to the system and the Pilot's Guide. Topics include:

- *Overview* - presents general information about the FlightMax FSD and the Pilot's Guide
- *Installation* - provides important information concerning the installation of the FlightMax FSD.
- *Release Notes* - explains what changes have occurred since the last release.
- *Temporary Documentation Changes* - explains how document changes are handled.
- *Notational Conventions* - explains the writing conventions used and what they mean.
- *Software License* - legal information about licensing and Avidyne software.

Overview

The FlightMax system consists of the following main components:

- FlightMax Control and Display Unit, incorporating a high brightness 5” diagonal active matrix color display
- Optional CD-ROM drive
- Registration and Warranty documentation package

An Approved Flight Manual Supplement (AMFS) will be provided by your installer. The AFMS contains information specific to your installation. It contains any operating limitations that may apply. Note that limitations listed in the AFMS are legally binding under the Federal Aviation Regulations.

Pilot’s Guide Structure

The Pilot’s Guide is divided into chapters and reflects the configuration of your system. The first three chapters are standard:

- Introduction and Release Notes
- General Operating Procedures
- FlightMax Map

The following chapters are optional, depending on which model and options are installed:

- FlightMax Lightning
- FlightMax Radar
- FlightMax Traffic
- FlightMax Charts
- FlightMax GroundProx

Also, there are various versions of Parts 5 and 6 (Radar and Traffic), in order to reflect the specific sensor being used. For example: if the traffic sensor is a Ryan TCAD, the user documentation will refer to that particular sensor.

Installation

Equipment Installation

The FlightMax FSD must be installed by your authorized dealer. Your dealer will connect the unit to your GPS and all other appropriate sensors, and will verify the proper configuration and operation of your equipment. He will supply you with the documentation you will need to use the equipment safely and effectively.

If your GPS installation is a new one, you must make sure that it is approved for your intended use. Any limitations on the flight conditions or operational circumstances under which your GPS may be used automatically apply to the use of its data by FlightMax options. For example, if your GPS installation is limited to VFR use only, this limitation applies to its use by the FSD as well.

Option Installation

All FlightMax functions are factory installed.

Proper installation of each FlightMax function is verified by the presence of its icon and text label in the system main menu. If the icon and label of any option you have purchased are not present in the system main menu, contact your dealer for assistance.

The icons and labels for some of the currently available options are shown in Figure 1.

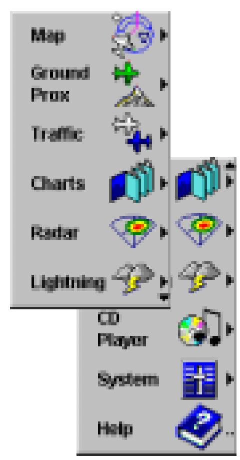

Figure 1: Function Icons

Release Notes

What's New

This release of the FSD introduces two new functions: FlightMax Map and FlightMax GroundProx, as well as a new model, the FlightMax 850.

FlightMax Map is a flexible moving map display, with the following features:

- External navigation from a GPS or FMS
- Three types of map displays: none, political and terrain
- Detail display of navaids, airports and airways.
- Flight plan display
- Overlay of radar, lightning, and/or traffic information.

GroundProx interfaces with an Enhanced Ground Proximity Warning System (EGPWS), with the following features:

- Color coded terrain display, indicating varying relative altitudes.
- Visual and aural warning of terrain/obstacle threats.

The new model FlightMax 850 supports the following features:

- Interface with Collins radars WXR 250/270/270A/900
- Interface with Bendix King radars 1100/1200/1300
- Optional interface with EGPWS

Temporary Documentation Changes

Documentation changes that reflect deviations from the intended behavior of the system or errors in the documentation issued with your system are referred to as *temporary changes*. Avidyne has adopted the standard industry practice of publishing these changes on an as-needed basis on yellow paper, for insertion into this manual at appropriate points.

When changes are necessary, Avidyne publishes a log of all temporary changes and a cumulative set of change pages. the log and change pages indicate what and where in the manual is being corrected. Please insert the change pages where indicated. Corrections are added to the next revision of the manual.

Notational Conventions

The Pilot's Guide uses several notational conventions for easier comprehension of the material. The following list contains some of the more common ones:

Table 1: Notational Conventions

Convention	Meaning
Italics	Italics are used for emphasis. This includes terms that are being introduced for the first time and terms that are being defined.
Bold	Bold is used to indicate fixed function controls and displays such as **Power**, **Enter**, **Escape** and **Menu**
Small Caps	Small Caps are used to indicate screen text exactly as it appears on the screen. This includes menu names (HELP, TRAFFIC, etc.), line select key labels (CONFIRM, SAVE, EDIT), flags (EXPIRED, HOLD), and others.
Menu Path	To make it easier to locate a specific function within the menu structure, Avidyne uses the same format to indicate the path: LIGHTNING→SETTINGS→CONTOURS STRIKE The higher level menu is always to the left.

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FlightMax™

Flight Situation Display

General Operating Procedures

Part Number 600-0055 Revision 00

Revision History

Date	Revision	Description
Sep. 7, 2000	00	Production Release

Avidyne Corporation
55 Old Bedford Road
Lincoln, Massachusetts 01773
Web Site: www.avidyne.com

General Operating Procedures Contents

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General Operating Procedures

Introduction

This part of the Pilot's Guide will explain general operating procedures for the FlightMax FSD. Topics include:

- *Overview* - provides a brief overview of the main operating features.
- *Controls and Display* - describes all the front panel controls and the display screen. There is also an explanation of the system startup sequence
- *Menus* - describes the various menu types and hierarchical structure of the menus.
- *Pages* - describes the various page types and their functions.
- *Messages* - explains the message bar, the message center, and messages issued by the system.
- *The System Menu* - explains how the system menu is used to configure the system.
- *CD-ROM Drive* - explains the CD -ROM and how to use it.
- *FSD Failsafe Features* - describes the methods used to prevent the display of false or misleading information.

All FlightMax functions are factory installed. Proper installation of each function is verified by the presence of its icon and text legend in the Main menu. If the icon and legend for any function is not present in the Main menu, contact Avidyne for assistance.

Overview

Figure 1: FSD Control Panel

Operating the Avidyne FlightMax FSD requires a basic understanding of the various controls and displays. This part of the User manual will explain the conventions used for general operation. The remaining parts of the User manual explain in detail the operation and use of the specific functions available with the FlightMax FSD.

The front panel of the FlightMax unit (Figure 1) contains several knobs and keys used for controlling the various functions. The Off/Brightness knob is used to turn the unit on and off as well as adjust the screen brightness. There are six line keys, three set function keys and a dual concentric knob used for controlling various screen functions.

Menus are used to navigate through various functions and they follow a consistent style. Each menu contains written text with an icon (if configured for display) to guide the user through the various pages. The Main menu is the starting point for all user operations. All functions are accessed from the Main menu.There is also a System menu for configuring the system.

The various screens for the different functions are referred to as pages. Menus are used to navigate through the different pages. The main page for each function is called the Data page. The number of pages for each function varies depending upon the amount and type of information the function needs to convey.

The system uses a color coded message bar to convey information to the pilot. This includes everything from general to critical information. Error message information is stored in the Message Center, providing the pilot with a history of messages.

Controls and Display

The Avidyne FlightMax controls consist of an Off/Brt knob, three set function keys, a variable function dual concentric knob and six line select keys (refer to Figure 2).

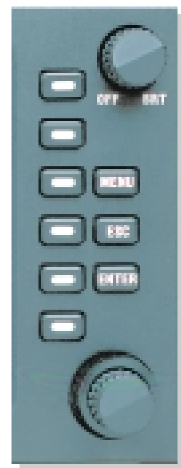


Figure 2: FSD Controls

Off/Brt Knob

This knob is located in the upper right hand corner of the FlightMax unit and serves two purposes. It turns the FlightMax FSD on or off and controls the brightness of the display screen. Turning the knob clockwise turns on the unit and increases the brightness of the display. In typical daylight conditions it is advisable to run at the full brightness (fully clockwise) setting. Screen brightness is controlled only by this knob.

If your aircraft is equipped with an avionics master switch or an avionics circuit breaker, the FSD can be turned on or off via the aircraft's power switching system. Avidyne recommends that the FSD be powered off during engine start and shutdown and whenever the alternator is brought on or off line.

Menu Key

When this key is depressed it will bring up any menu that is currently not displayed. It is also used to remove menus from the display. This key is also used to display menu items that don't fit within the screen. Using this key with the menus is explained in Menus.

Enter Key

The **Enter** key is similar to the enter key on a computer keyboard. When entering data into the system the Enter key is generally used to execute the change. Specific instances of when to use the **Enter** key are indicated throughout the manual.

Escape Key

The Escape key (labeled **Esc**, for lack of space, but referred to in the documentation as **Escape**, for clarity) is primarily used to navigate to higher level menus.

Line Select Keys

The Line Select keys are used to select menu items. The keys line up with the various menu functions and pressing a key will normally activate that function.

Control Knobs

The Control Knobs are a set of variable-function dual concentric knobs. These knobs are used for setting parameters and controlling the display. The function currently in use determines what tasks, if any, the knobs perform.

System Startup

System startup is automatic once power is applied. The system performs a brief hardware self-test, then systematically initializes its functions.

When the basic operating software has been loaded (less than a minute after power-on), the Avidyne logo appears on the system page (Figure 1*)*. The system then checks the CD-ROM drive for the presence of a data update CD. If one is found, a data load can be initiated.

The system then initializes the functions. Each function checks its own data and external equipment to make sure it can operate properly, then signals the system that it is fully initialized. The system then starts the next function. When all of the functions have been loaded, the system requests that the user press **Enter**. After pressing Enter FlightMax Map is displayed.

System Startup Sequence

1. Supply power to the FSD.
2. Using the **Off/Brt** knob, turn on the FSD. Make sure the display screen is at full brightness.
3. The system will display several pages showing self test and startup information. This information is unimportant in normal use (however it may be useful if

there is a problem with your unit).

4. The Avidyne logo appears on the system page. The screen displays “Press **Enter** To Continue” (see Figure 1).

5. After pressing **Enter** the Map display will come up. The system is now ready for use. Press **Escape** or **Menu**, to display the Main menu (see Figure 3).

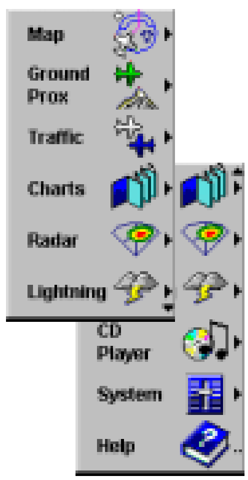


Figure 3: Main Menu

Menus

Figure 4: Main menu and line select keys

The FSD user interface is based on a hierarchical menu system. The top level is the Main menu (Figure 3). Each of the major functions in the system is represented by a menu that branches out from the Main menu.

In each menu, functions are assigned to the line select keys to the right of the display screen (Figure 4). Each function in the current menu is displayed on the screen so as to align with the line select key that activates it. If there is no legend adjacent to a particular line select key in a particular menu, that key has no function in that menu.

Figure 5: Disabled menu function

Under certain circumstances, the function normally associated with a line select key may be temporarily unavailable. This is represented in the menus by reducing the displayed intensity of the function's menu legend and removing its color ("graying out" the function). An example is shown in Figure 5.

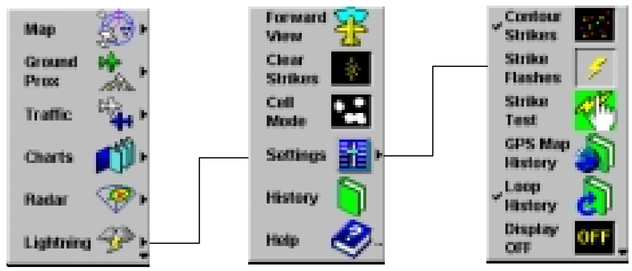
The menu path is indicated by the small menu legends located in the top center of the screen. These legends are presented in stair-step fashion to the left of the menu itself. An example of a menu path is shown in Figure 6. The current menu being used is the bottom legend.

Figure 6: Menu Path

In addition to the functions listed on the menu, each menu contains a help function. The help function gives a short explanation of the functions listed in the menu.

Menu Organization

The menus are organized in a hierarchical structure that provides easy access to the most important functions.



MAIN → LIGHTNING MAIN MENU → SETTINGS MENU

Figure 7: Menu Structure

The Main menu is the first menu to appear at startup and contains a list of all functions available on your system as well as accesses to the MAIN menu and the message center (a status page).

The top-most menu for a given function is referred to as the function's main menu. Figure 7 shows the Main menu to the left and the function main menu (in this case LIGHTNING) to the right of it. Settings is a sub-menu of the Lightning Main menu. When an action has been completed within one of the sub-menus the system returns to the functions main menu.

Every menu contains a HELP feature. The HELP page contains a brief explanation of each item in that menu.

Navigating through the Menus

The following table explains how to navigate through the menus:

Table 1: Menu Navigation

TO:	DO This :
move down (to lower levels)	press the line select key associated with the menu item
move up (towards Main menu)	press the fixed-function **Escape** key. Pressing the **Escape** key while in the Main menu, will remove the Main menu from display.
recall a menu	press the set function **Menu** key
remove a menu from the display	press the set function **Menu** key or wait a few seconds for it to automatically disappear*.
shift menu to the next menu page	press the set function **Menu** key to reveal additional menu items that don't fit within the display screen. A downward facing arrowhead symbol at the bottom of the menu or an upward facing arrowhead at the top, indicates the presence of additional menu items (Figure 3).

***NOTE:** Menus are set to disappear after a specified time interval to free up space on the screen (unless configured otherwise. See "The System Settings Page" on page 21.) When no menus are visible on the screen, pressing the **Menu** key will redisplay whichever menu was last active.

Menu Functions

There are several different types of functions that can be activated within a menu. Refer to Figure 8, the Lightning Menu, for examples of the different functions.

Lower level menus (sub-menus) are identified by a small triangle to the right of the menu item. Selecting the item will bring up the sub-menu. In the Lightning menu, selecting SETTINGS will bring up the SETTINGS sub-menu.

Actions are functions that are immediately executed as a result of selecting that menu item. In the LIGHTNING menu, selecting CLEAR STRIKES will immediately clear the display of all lightning strikes.

Toggles are functions that perform as on/off switches. They are used to select and deselect different viewing options. A toggle function is indicated by a check mark to the left of the menu item when it is enabled. The check is absent when the function is deselected. To toggle a function, select it by pushing the **Menu** button, then press the adjacent line-select button to toggle it.

Figure 8: Menu Functions

In the LIGHTNING menu, selecting FORWARD VIEW displays lightning strikes in front of the aircraft. Deselecting it presents a 360° view.

Selections are similar to toggles, but consist of a group of related toggle items on one menu. Only one item in the group may be selected at any time. Selecting a new menu item will deselect the previously selected item.

A *Double Dot* to the right of a menu item means selecting that item will bring up a status or configuration page.

Examples of Menu Functions

Depending on your system configuration, the following are examples of the different menu functions.

Actions

LIGHTNING→CLEAR STRIKES

Toggles

LIGHTNING→FORWARD VIEW
LIGHTNING→SETTINGS→STRIKE TEST

Selections

CHARTS→TYPE

Pages

All of the information presented by the FlightMax is organized into *pages*. Each page is organized and formatted to make it easy to understand the information it presents. Every page covers the entire display screen. Information from two (or more) pages cannot be displayed simultaneously, nor will the system do so. The menu system controls movement through pages. Map pages are selected by the knobs.

The following sections explain the various pages used on the FlightMax FSD.

Data Pages

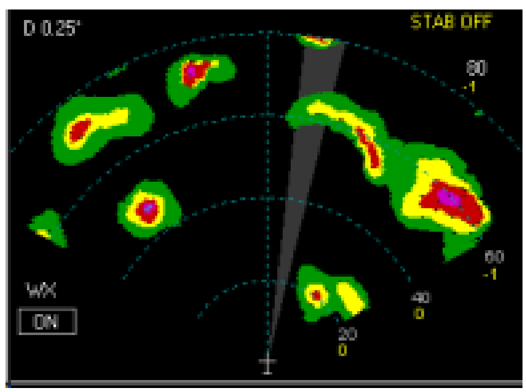


Figure 9: Radar Data Page

Data pages are used by the function to display the main data of that function. It is the first page to appear when the function is selected. Figure 9 shows the Flightmax Radar data page. This page displays weather data and your aircraft's relationship to it.

Data pages vary greatly in format due to the varying types of information presented by the functions.

Status Pages

Status pages provide information about the operational state of various system components. For example, the GPS status page (Figure 10) indicates how many satellites are currently in view and what signal strength the receiver is reporting for each.

The status page contains several common features in addition to the status information for that function.

Title Bar indicates what functions status is being viewed.

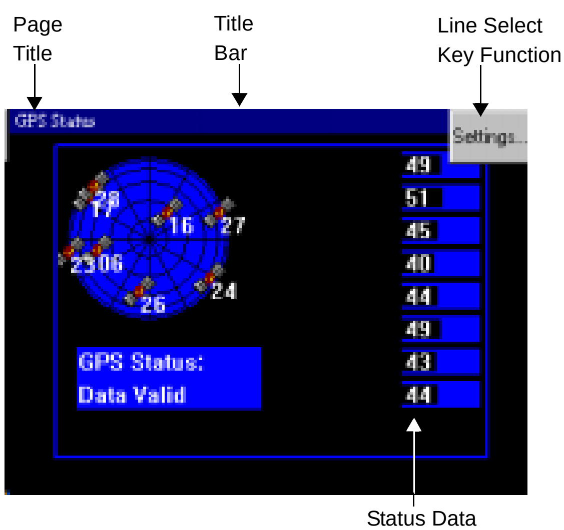


Figure 10: GPS Status Page

Enter and **Escape** keys are used to exit the page. Press the set function **Enter** or **Escape** keys to exit the page. Either one will work.

The **Line Select Key** function is normally used to enter an additional status page for that function or to enter a Configuration page. Press the line select key next to the screen button to initiate.

Confirmation Pages

Confirmation pages are used to confirm any changes that were requested from within that function.

Confirmation pages may also display error information and possible solutions when parameter values are incorrect.

Normally to accept any changes made within the function press the **Enter** key. To decline the changes press the **Escape** key. The changes will revert to the previous values.

Configuration Pages

> **NOTE:** Do not change any settings within any Setup Configuration Page without first consulting your installer.

Configuration pages are used to set system configuration parameters or operation parameters. For example, the *NavMap Settings page* (Figure 11) is used to set navaid displays for FlightMax Map during operation.

Setup configuration pages are used to set system parameters. Normally, after the FlightMax FSD has been installed and set up, these configuration pages should not be accessed.

Use the **Enter** key to accept changes to the parameter and the **Escape** key to leave that page.

Figure 11: NavMap, a Configuration Page

How to Change Page Parameters

The following table lists the different methods used by the FSD to change page parameters.

The knob controls are used for parameter selection and modification in most pages. Normally, the outer knob is used for parameter selection and the inner knob for parameter change.

Table 2: Changing Parameters

Parameter Type	How to Change
Check Box 	To place or remove a check in a check box, turn the inner knob. The outer knob will move from the check box to another parameter.
Numeric or Text Boxes 	These boxes are similar to lists but only one item (text or numeric) is displayed at time. Use the inner knob to change the value. The outer knob is used to move to another parameter.
Lists 	There are several different types of lists but changing the selections in a list are similar. The list is selected when the top line of the list is highlighted by a blue line. Use the inner knob to scroll up and down the list. For drop down lists, initially turning the inner knob will call up the entire list. Changes to the list do not become effective until **Enter** is pressed. If the list is to long to display, a scroll bar on the hand side indicates that there are more items on that list. Use the outer knob to move to another parameter.

NOTE: Individual parameters do not become effective immediately; they become effective only when **Enter** is selected.

Messages

The Message Bar

The message bar is an annunciation system that is used to keep the pilot informed about critical as well as routine information from the FSD.

When information needs to be conveyed the message bar appears at the bottom of the screen. It contains the following information (Figure 12):

- The message itself.
- A symbol representing the system component that issued the message.
- A symbol representing the priority of the message.
- The elapsed time since the message was issued.
- The total number of messages awaiting confirmation.

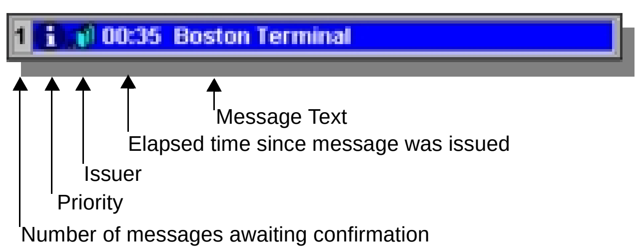


Figure 12: The Message Bar

Each issuer is identified by its icon, a smaller version of the ones used in the main main.

The message bar can display only one message at a time. If more than one message is available, the message bar will display the messages with the most criticality first (refer to Table 3 and Table 4 for message type and meanings). Warning, Global messages will be displayed over other types of messages.

Informational messages (and *only* informational messages) may be configured for automatic confirmation after a specified time. This can be done at the MAIN MENU→SYSTEM→SETTINGS menu.

Message Type

There are two types of messages, global and local.

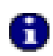
Table 3: Message Type

Type	Meaning
Local	Local messages are displayed only when the issuer's data is being displayed (such as the name of the current chart being displayed while in charts).
Global	Global messages are displayed no matter which screen is currently being viewed. Usually global messages are of a critical nature (such as the loss of a GPS receiver).

Message Priority

Each message is assigned one of the following three priority levels:

Table 4: Message Symbols

Symbol	Meaning
	**Informational** messages provide low priority information that is useful to know and require no response.
	**Cautionary** messages provide medium priority information, indicating that a non-critical change has taken place that may require the pilot's knowledge or some response on a non-emergency basis.
	**Warning** messages are high priority messages that require definite action by the pilot or that indicate a loss of essential functionality.

Background Color

Table 5: Message Background Color

Color	Meaning
Blue	The message can be confirmed immediately. Press **ENTER** to confirm (the message bar will disappear).
Gray	The message can be confirmed at a later time. Normally a gray background indicates the user is in a status, confirmation or configuration page and the message can be acknowledged only after leaving the page. Press **ESCAPE** to ignore the message.
Yellow	The message can be confirmed immediately, which causes the display to switch to the issuing function. Press **ENTER** to confirm. For example: while viewing Charts, a yellow message for Traffic appears. Confirming the message will switch the display to Traffic.
Red	The message should be confirmed immediately, which causes the display to switch to the issuing function. Press **ENTER** to confirm. For example: while viewing Charts, a red message for GroundProx appears. Confirming the message will switch the display to GroundProx.

The Message Center

The Message Center maintains a history of some messages. Messages that indicate the state of the system (i.e. communication loss of the GPS receiver, or failure to start an application) are maintained in the message center.

The message center occupies the lower portion of the System menus page. This page (Figure 13) appears by selecting System from the System Main menu .

When a system component issues a message, it is sent both to the message bar and to the message center.

Use the inner knob to scroll up and down and the outer knob to scroll side to side.

Figure 13: The Message Center

Messages Issued by the System

System messages are messages not associated with a specific function (i.e. Charts, Traffic etc.). Messages issued by the system are listed in Table 6. Those issued by the GPS interface are listed in Table 7.

> **NOTE:** Communication with the GPS receiver may be lost and than restored. If the message indicating that communication was lost is not confirmed and communication is subsequently restored, the message will be be removed from the message bar.
>
> Occasional GPS signal dropouts are normal and may be ignored. Persistent messages at close intervals should be investigated. Contact your avionics installer or Avidyne for advice.

Table 6: System Messages

Message	Meaning
Failure Starting <function> Failure to Start <function>	Abnormal system condition has caused startup of the named function to fail. You may wish to power you FSD down, then up, to see whether the function can be restored. If the condition persists record the exact wording of the message and contact Avidyne.
Already starting <function>, please wait	Abnormal system condition has caused attempted restart of the named function. Ignore the message and allow the system to complete its startup sequence. If all functions are available when startup is complete, they can be used with confidence. If the condition persists on restart, record the exact wording of the message and contact Avidyne.

Table 7: GPS Interface Messages

Message	Meaning
Nav Source Position Data is Valid	Normal condition – useful Nav Source data is being received.
Nav Source Position Data is NOT Valid	Your GPS is sending valid data, but not a valid position. Generally means that the GPS has lost satellite lock. If the condition persists, it may help to restart the GPS. If this condition is corrected and you have not confirmed the message, it will simply be removed.
Heading Data is Valid	Normal condition – useful heading data is being received.

Table 7: GPS Interface Messages

Message	Meaning
Heading Data is NOT Valid	Your GPS or FMS is sending valid data, but not a valid heading, even though it is capable of doing so. May indicate a problem with the remote compass system If this condition is corrected and you have not confirmed the message, it will simply be removed.
Nav Source NOT Connected	No data whatsoever is coming from your GPS. It may be turned off, the connection may be broken, or there may be a configuration error (if it has *never* worked or you have made configuration parameter changes). Check the GPS and try restarting it. You probably shouldn't attempt configuration parameter changes without advice from your installer.
Nav Source Data Format Error	Invalid data is coming from your GPS. If persistent, generally indicates a configuration error. Contact your installer.
GPS Settings Invalid (Can't Connect) GPS Settings Invalid (Failed to Connect)	The GPS interface cannot open the assigned port. Generally indicates a configuration error. Contact your installer.

The System Menu

The MAIN MENU→SYSTEM menu (Figure 14) is used to configure the system. It is primarily used by the installer to integrate the FSD with the other avionic systems and to set up the FSD to the pilots personnel preferences.

Figure 14: System Menu

The System Settings Page

The SYSTEM→SETTINGS page (Figure 15) provides options for menu display and message management. The setting options include the following:

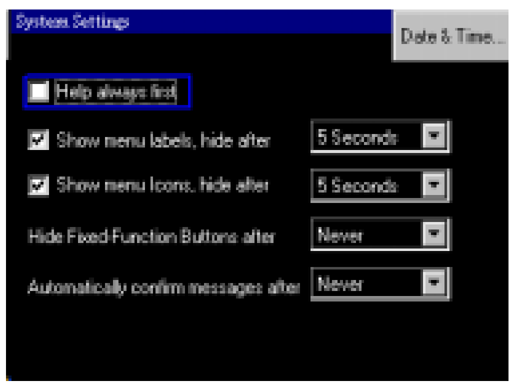


Figure 15: System Settings

Help always first: Whether THE HELP item in each menu is displayed first (the default) or last on all menus.

Show menu labels: Whether menu labels are displayed at all and, if so, whether they are automatically removed from the screen after a period of time.

Show menu icons: Whether menu icons are displayed at all and, if so, whether they are automatically removed from the screen after a period of time.

Hide Fixed-Function Buttons after: Define when the Fixed Function buttons in FlightMax Map are removed from the display, if ever.

Automatically confirm message after: Define when low priority messages are automatically confirmed after a period of time. Automatic message confirmation is only for low priority messages. Critical messages (see page page 16) must be confirmed by the pilot.

> **NOTE:** Removing icons and labels provides more display space so less of the currently viewed function is covered by menus and button labels.

Date & Time: Select this button to access the Date & Time page, Figure 16.

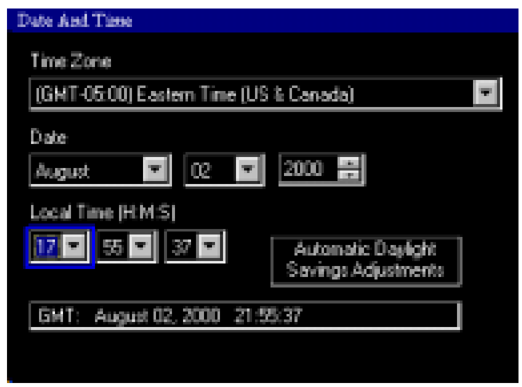


Figure 16: Date & Time Page

Time Zone: Select your primary time zone, based on Greenwich Mean Time (also referred to as "Zulu" time).

Date: Select today's date

Local Time: Select your present local time, based on a 24 hour clock.

Devices

The SYSTEM→DEVICES menu contains functions that allow the installer to set up the interfaces between the FSD and other aircraft systems. The number of functions on the Devices menu is dependent on the number of functions installed on your system.

Detailed information and procedures for using this menu and it's submenus appear in the FSD Installation manual.

In addition to aircraft systems interfaces, the DEVICES menu also provides access to a CD-ROM status page.

Shutdown

Previous versions of the FlightMax FSD required a Shutdown procedure prior to shutting off the FSD. The current version of the FlightMax FSD does not require special shut down procedures. Simply turn off the unit.

Help

The HELP menus provide brief descriptions of the functions on each menu. Each menu on the FSD has a help item. Help for the Charts main menu is shown in Figure 17. They are not designed as a substitute for this manual. Help does not provide access to an on-line manual.

Figure 17: Help Page

CD-ROM Drive

A separate CD-ROM drive is available as an FSD option. The CD-ROM drive is used to load new charts and to load Map database updates. Data update CD-ROMs are available from Avidyne on a subscription basis or individually. Call 1-800-AVIDYNE for more information.

The CD-ROM drive obtains its power from the FSD. It is always on when the FSD is on. There is no power indicator on the CD-ROM drive enclosure, but there is an orange indicator light that shows when the CD-ROM is in active use.

CAUTION

You must plug in or unplug the CD-ROM drive only when the FSD is powered down. If it is plugged in “hot”, the drive will not be recognized, and may be damaged.

CD-ROM Drive Operation

To load a CD-ROM into the drive, open the loading tray by pressing the CD-ROM eject button in the center of the unit. Place the CD, label side up, into the tray, popping its center hole onto the spindle, then push the tray in to shut it.

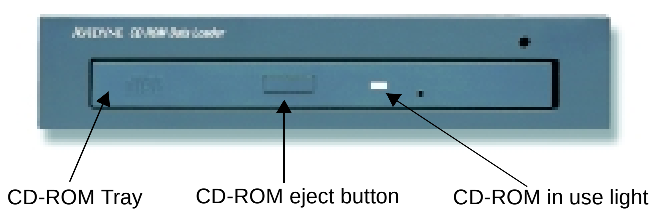


Figure 18: CD-ROM drive

To unload a CD press the CD-ROM eject button. The tray will move out and you can remove the disk, popping it off of the spindle.

Do not attempt to remove a CD while the orange light on the drive is on, indicating that the disk is in active use. Do not turn off the FSD in the middle of a data update operation; wait for it to complete or abort it, then turn off the unit. Failure to follow this precaution could damage the system and necessitate factory service.

Avidyne Fast Data Loader Function

The FlightMax FSD provides a capability for highly efficient updates to Charts and Map data that may be present on the FSD. It has minimal operator interface and is executed automatically at system power up.

At system power up, the FSD checks whether the optional Avidyne CD-ROM disk drive is present and whether a valid data update CD is loaded. The update CD must be installed immediately after power is applied to the FSD (within approximately 30 seconds). If one is present the system displays a confirmation page allowing the user to initiate the update or skip it.

If a confirmation page does not appear, the CD was not inserted in time. Shut down the system and restart again. The CD can be left in the loader. If the CD is read, the Fast Data Loader function is initiated.

The Fast Data Loader function determines which Charts and Map files need to be replaced by newer versions from the update CD and performs the replacement. Steps are taken to ensure that file replacement is accomplished without error, and that, whenever errors do occur, the system is left in a usable state.

During a data load the Data Loader page is displayed. The progress bar indicates how much data has been put on the hard drive. The Fast Data Loader function informs the pilot of any exceptional conditions that arose during its operation.

When the data loader completes, the system resumes its normal startup sequence. When the functions become available upon its completion, the new data will be available for use.

To abort any load, press the **Escape** key. The file being processed and files that have not been loaded will not be updated.

> **NOTE:** The Data Loader progress bar is inaccurate when loading a large amount of VFR Charts. The progress bar reaches 100% while the system has more charts to load. All other loading displays are accurate.
>
> If you are loading a large amount of VFR charts, ignore the progress bar. When the charts are finished loading, the system will continue with the normal start up sequence.

FSD Failsafe Features

Because of the potential safety issues that arise in any avionics system, the FSD has been designed with a number of failsafe features. These features are designed to eliminate any possibility that the FSD will display information that might be misleading and lead to an unsafe condition.

The following are some of the more important failsafe features:

1. The FSD checks all incoming GPS data for errors. If errors are detected, the GPS data is rejected. If this occurs, there will be a message in the message bar and each function that uses GPS data will invalidate displayed values based on GPS data.
2. Charts and Map depend on loadable data for their functionality. They check the data for validity before using it. If the data is found to be invalid, they will operate, but at reduced capability. Charts may be unable to display data in certain geographical areas. Reloading the data may correct the situation. If not, factory service will be required.
3. Each function is checked for proper operation as it runs. A function that exhibits signs of failure is automatically terminated. If this occurs, a Termination message is displayed in the message bar and the functions icon is grayed (Figure 19). The function can not be restarted except by restarting the FSD. If it occurs repeatedly, service may be required.

Figure 19: Failsafe Message - function Terminated

FlightMax™

Flight Situation Display

FlightMax Map

Part Number 600-0057 Revision 01

Revision History

Date	Revision	Description
Sep. 7, 2000	00	Pre-production Release
Sep. 12, 2000	01	Production Release

Avidyne Corporation
55 Old Bedford Road
Lincoln, Massachusetts 01773
Web Site: www.avidyne.com

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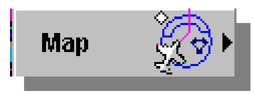


Figure 1: Map Icon

This part of the Pilots Guide explains Flightmax Map.

Flightmax Map is an overlay display that combines most of Avidyne's applications into one unified display. In addition to the overlay feature, Map also displays navigation information. Topics in this section include:

- *FlightMax Map Overview* - presents an overview of the Map function and its various modes of operation.
- *FlightMax Map Displays and Menus* - explains every page and menu used in FlightMax Map.
- *Navigational Symbols and Data* - explains all the symbols and data displays used by Map.
- *How to Use FlightMax Map* - explains how to use the overlay features of Map as well as other Map functions.
- *Failure Indications* - explains what is displayed when position data, heading/track data or sensor data is lost or invalid.
- *Menu Organization* - graphically shows the path to any menu in FlightMax Map.

Map is verified by the presence of its icon and text label in the Main menu. If Map's icon and legend shown in Figure 1 are not present in the system, contact your installer for assistance.

Database Updates

FlightMax Map includes a complete database of airports, navaids, airways, and navigational fixes. This database is used with the moving map to provide navigational information, and situational awareness.

The database should be kept current. Updates are available on CD-ROM. Consult the FAA-approved Flight Manual Supplement for details of any limitations imposed on the use of FlightMax Map when the database has expired. Contact Avidyne (1-800-AVIDYNE) for database update services.

The navigation data for the Avidyne FSD system includes copyrighted data compilations owned by Jeppesen Sanderson, Inc., for which Avidyne has been granted a limited, non-exclusive license to use. The copyrighted subject matter may be used only in connection with the ordinary and intended use of the Avidyne FSD, as described in this manual. Use for any other purpose, or reproduction or copying of any portion of said copyrighted subject matter, is strictly prohibited.

WARNING

FlightMax Map is an electronic aid to navigation, designed to be used in conjunction with approved navigational charts, not to replace them. Only charts and Notices to Airmen contain all of the information needed for safe flight and the pilot is responsible for their prudent use. It is a violation of the Federal Aviation Regulations to conduct flight operations without all available information concerning the flight. It is the pilot's responsibility to obtain, understand and obey current FAA guidance on the use of GPS-based navigational equipment and database currency requirements.

Limitations and Other Restrictions

FlightMax Map uses data supplied by a position source (GPS, FMS, etc.). Both the FlightMax FSD and the position source must be separately approved for use in your aircraft. Limitations that apply to the position source also apply to the FSD. If your GPS receiver is limited to

VFR use, this limitation applies to any use of its data by the FSD. Limitations may be imposed as part of the certification of FSD installation in your aircraft.

WARNING

The use of FlightMax Map may be subject to limitations that are specific to your installation. Limitations are listed in your Approved Flight Manual Supplement, not in this manual, and are binding under the Federal Aviation Regulations.

Map and Position Source Interface

FlightMax Map has been designed to interface with the most common positional sources available for general aviation, including the GPS and FMS. Any position source is capable of monitoring and reporting its operating status, which allows it to perform some of the following:

- detect loss of satellite reception
- detect excessive error in position estimation based on poor satellite geometry
- detection of reception or calculation errors by comparing the results obtained with different sets of satellite
- other conditions that could result in inaccurate position reports.

The type of certification the position source received determines the degree of self monitoring and annunciation.

The GPS/FMS is responsible for verifying the integrity with the FSD, and reporting any failures it detects to your FSD. The pilot is also responsible for cross-checking the position source for messages that indicate current or impending failure.

FlightMax Map Overview

FlightMax Map is a flexible moving map display. It can display a terrain or political map which can be overlaid with navigational information as well as other FlightMax functions including: Radar, Lightning and Traffic displays. The amount of detail and layers is controlled by the pilot.

FlightMax Map's moving map is generated from a database of information on airports, navigation aids, and airways. The aircraft's position, ground track, and heading are obtained from the external GPS receiver or Flight Management System (FMS). Other features, such as airports, navigation aids, and airways, are shown on the map in the proper position, with appropriate graphics. Detailed information about any airport or navigation aid in the navigation database is also available, when viewing the Nearest Page.

All flight plans are from the external navigational data source (GPS/FMS). When a flight plan is active, it is depicted on the map. The appropriate navigational information is also displayed.

FlightMax Map's display can be customized (within limits) to reflect the pilot's information requirements.In addition to the map display, there are two configurable data blocks available for navigation information. The overlay feature allows pilots to display radar, lightning and traffic information over the map. The amount and type of data displayed is controlled by the declutter function. This function defines which information is displayed at various map scales.

The pilot may adjust the map's scale and orientation at any time.

FlightMax Map Displays and Menus

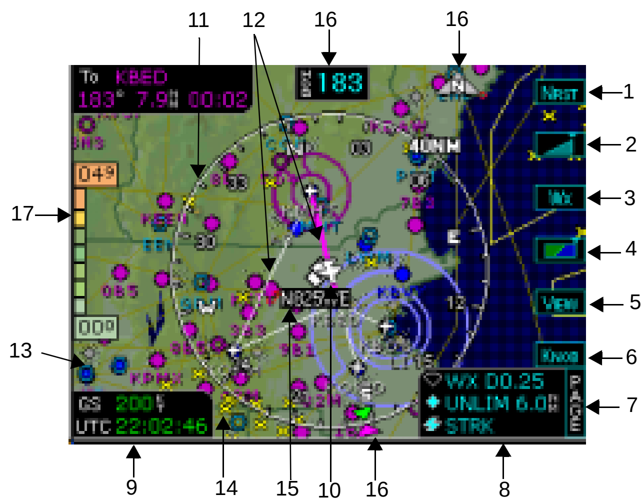


Figure 2: Map Data Page

1. **NRST** - Provides access to database information about the nearest airports, VOR's, or NDB's within a 60nm radius of the aircraft's present position.
2. **Declutter** - The declutter function provides a choice of four predefined levels of database nav map detail.
3. **Wx** - The Wx function selects the available weather sensors for display, radar and or lightning.
4. **MAP** - The MAP function will cycle through three types of map displays, none, base and terrain (+base).
5. **View** - The View function orients the map for Center view (shown), Forward view, Track/Heading, or North up.
6. **Knob function Select** - Selects the function of the outer knob. The functions are; trip page, bearing line control , and radar tilt .
7. **Knob Status** - Indicates the current function of the outer knob.
8. **Sensor Status** - Displays the status of the three external sensor functions, Radar, Traffic and Lightning.

9. **Data** (**Status) Blocks** - Contain course and navigation data. They are user defined and can be removed from the display.
10. **Airplane Symbol** - Shows the position of your aircraft in relation to the moving map and the selected view.
11. **Compass Rose** - Displays a 360° or 120° compass circle or arc. Also indicates the current range setting.
12. **Course Indications** - a magenta line represent the current leg of the trip, white lines represent all other legs.
13. **Nav Symbols** - The various nav symbols are described in Table 6 through Table 10. The amount of symbols is controlled by the Declutter button.
14. **Weather Indications** - Weather indications from the Radar and Lightning sensors are displayed when the weather overlays are active. The same symbology is used (lightning strikes are shown in Figure 2).
15. **Traffic Symbols** - Traffic indications from the Traffic sensor are displayed when the Traffic overlay is active. The same symbology is used.
16. **Track/ Heading Indications** - Three triangles around the compass rose provide actual track, desired track and heading indications. H/T Block provides the numerical heading info. The map orientation is indicated in the triangle to the right of the H/T Block. Indications are; N (North up), HDG (Heading up), TRK (Track up).
17. **Terrain Elevation Indicator (shown only when terrain is displayed)** - Indicates the color range currently being used. The numeric value is also indicated.

FlightMax Map Main Menu

The FlightMax Map main menu (Figure 3) provides access to various operating functions used to control the Map display.

Figure 3: Map Main Menu

Traffic

Selecting Traffic allows the pilot to turn on/off the traffic overlay. This is a toggle function, a check mark indicates that the Traffic overlay is active. The traffic display is dependent upon the type of traffic sensor being used and how the display is configured.

> **NOTE:** If your FlightMax does not interface with a traffic sensor, this menu item will not be displayed.

Compass Rose

Selecting the compass rose turns on/off the compass rose display. Depending upon the view selected, a full 360° ring is displayed or a 120° arc is displayed over the moving map. The cardinal points are labeled on the ring as well as tick marks in 10° increments. The ring is oriented in a track up or north up (magnetic) direction, depending on the view selected. Switching between views also changes the location of the aircraft symbol.

The current range scale (from 1nm to 500nm) is also shown next to the Compass Rose. However, when the Compass Rose is turned off, a basic range ring is still displayed.

Clear Strikes

Clears the current lightning strike data being displayed.

Settings

Selecting the Settings function provides access to the Settings submenu (Figure 4).

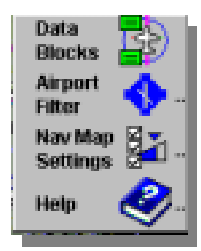


Figure 4: Settings Menu

Data Blocks

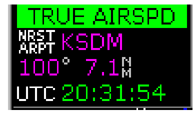


Figure 5: Data Block

Selecting this function will allow modification of the data blocks. The navigation item being modified is highlighted in green (Figure 5) . Up to four line items within each data block can be modified.The inner and outer knobs are used to select and modify the data block (See “Modify the Data Blocks” on page 36.). The changes are complete when Data Blocks is deselected from the sub menu or when the Fixed Function keys are displayed and the knobs key is pressed.

Airport Filter

Selecting Airport Filter will bring up the Airports Displayed page. This page is used for defining the airport type and symbols to be displayed. The Min. Runway Length box can be used to filter out airports by runway length (from 2000ft. - 7000ft. or show all lengths).

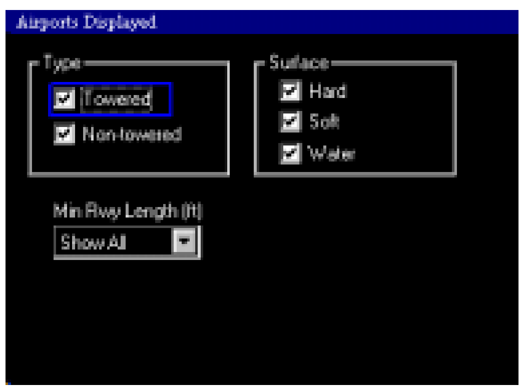


Figure 6: Airports Displayed Page

Nav Map Settings

Selecting this function will bring up the NavMap Settings page (see Figure 7). This page is used to define the navigation symbols for the Declutter button. Individual items can be selected for display or a specific group of items can be selected by choosing the VFR or IFR Default buttons.

Defining the NavMap settings will provide the pilot with some choices as to what items are available for display. The display of NavMap symbols is determined by this page, range, and predefined settings of the DeClutter button.

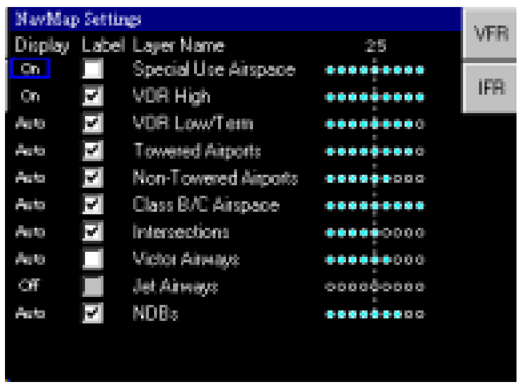


Figure 7: NavMap Settings Page

Each navaid has three possible Display settings:

On - Certain types of NavMap symbols will be displayed all the time regardless of range.

Auto - The navaid is displayed automatically. At lower map scales the navaid is displayed and as the scale is increased (zoomed out), at some “predefined point” the navaid is no longer displayed. The point at which the navaid is no longer displayed is based on the number and density of the symbols or display elements.

Off - Certain types of NavMap symbols are never displayed, regardless of range.

A check in the label box indicates the navaid name is displayed along with the symbol. If the box is grayed out, there is no choice in label display.

The nine circles to the right of the navaid represent the nine available map scales (1, 2, 5, 10, 25, 50, 100, 250, 500nm). A cyan color in the circle indicates that the navaid is displayed at that range. If the circle is open than its not available at that particular range. The vertical dash line indicates the current scale that is displayed on the moving map. See “Change the NavMap Settings” on page 35. for procedures on how to change the settings.

> **NOTE:** With a radar interface, some of the map scales will be the scales from the radar range. For example: if you have an RDR 1300 radar, one of the scales will be 40 instead of 50nm. Map will still cover a 1-500nm range no matter the limits of the radar.

Fixed Function Display

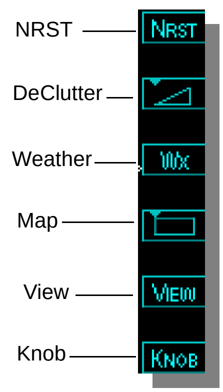


Figure 8: Fixed Function Display keys

The Fixed Function Display keys (see Figure 8) are accessed by pressing any one of the line select keys only when the menus are not displayed.

NRST

The NEAREST page (Figure 9) provides information about navigational fixes, including airports within 60 nm of your present position. The small window is used to select the waypoint type: airport, VOR, or NDB. The large window displays the list of the selected type. The list includes the ID of the waypoint, the bearing and distance from your present location, and it’s radio frequency.

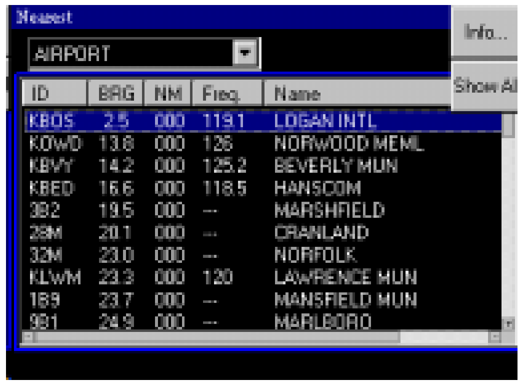


Figure 9: The Nearest Page

Use the outer knob to switch between the waypoint type and list. Use the inner knob to scroll and select the waypoint from the list. Selecting the Info key (see Figure 10) will display more information about the runway and radio frequencies of the selected airport (if available). The Show All/Filter key is used to show all airports or to apply the filter as defined in the Airport Display page (see Figure 6).

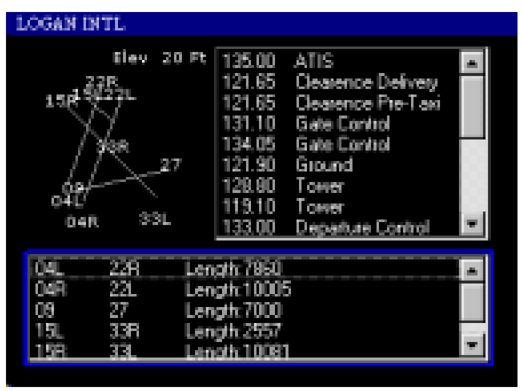


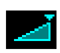
Figure 10: Airport Information

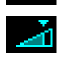
Declutter

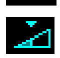
The Declutter button is used to reduce the number of displayed navigation symbols on the map. There are four selectable levels of declutter. The highest level of map content displays all available nav symbols. Each subsequent level reduces the number of symbols displayed until the lowest level is reached, where only the flight plan is displayed (no NavMap symbols are displayed). Decluttering is based on the density of symbols being displayed. Moving through areas of high and low density will cause symbols to appear and disappear from the screen. Which symbols get removed at each level is determined automatically by the software. The pilot does have some choices as to what NavMap symbols are displayed, based on the settings in the NavMap Settings page and the range selected.

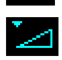
> **NOTE:** Changing ranges will also declutter the map. Certain symbols are not displayed at the higher map scales. See “Nav Map Settings” on page 9.

The declutter symbol represents a sliding scale with the following meanings:

 Maximum map content

 Medium map content

 Minimum map content

 Nav Map is not displayed

Wx

The Wx button turns on/off the weather overlays on the moving map display. Radar and Lightning are the two weather overlays available (if a radar and lightning source are connected to your system). The weather overlays can be displayed together or separately. The status of each weather overlay is shown in the status box located in the lower right corner of the display. A solid color symbol indicates that the overlay is in use. An open outlined symbol indicates the layer is not displayed. A yellow fill in the symbol indicates the function is on but is not available for display at Map. This could indicate that radar or lightning is not turned on at its function display, there is a communication problem between Map and the function, or the function is not configured properly for Map.

NOTE: Whatever settings were being used in the function are applied to the function when its being used as an overlay, i.e. if Lightning was in the cell mode then when its brought up as an overlay, it is also in the cell mode.

The weather overlay sequence is as follows:

	RADAR	LIGHTNING
1	OFF	OFF
2	OFF	ON
3	ON	ON
4	ON	OFF

Map Level

The map button is used to select the type of map display used under the NavMap display. There are three types of map displays available. They are:

None

No map features are displayed. The background color is solid black.

Base Map

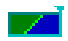
Only political boundaries and water are displayed against a black and blue background.

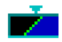
Terrain (+Base) Map

Political boundaries, water and terrain features (based on USGS terrain maps) are displayed. Terrain maps are available for North America, Europe, and Australia.

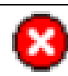
Map data is not displayed when your own ship's latitude is greater than 75 degrees (North or South)

The Map level button represents a sliding scale that represents the following map level:

 Terrain and Base Map

 Base Map Only

 No Maps

 **WARNING**

Not for terrain avoidance. Terrain maps are derived from the USGS EDC. They use DTED (digital terrain enhanced data) as a basis for their maps. The maps have a vertical accuracy of ±30 meters linear error at 90 percent confidence level.
Under NO circumstances should the color representations be used as a basis for terrain avoidance.

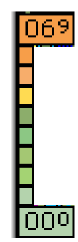


Figure 11: Terrain Legend

The colors used by FlightMax Map for terrain representation should in no way be used to determine relative altitude to your aircraft. The color scale ranges from a light green, representing low elevations to a dark brown, representing higher elevations with white representing altitudes above 15,000 feet. The Terrain Display Legend, visible when the terrain map is viewed, shows the color range from the lowest to the highest elevation for the current display. The numerical representations are in hundreds of feet.

Table 1 gives the altitudes for the color ranges used on the terrain maps.

Table 1: Elevation colors

Range	Colors
0 to 2500 ft.	Light green, to dark green
>2500 to 3000 ft.	Yellow
>3000 to 15,000 ft.	Light brown to dark brown
>15,000 ft.	White

View

The view button is used to orient the airplane symbol to the map. The View button cycles through the following view orientations:

- Forward View - Heading/Track UP
- Center View - Heading/Track UP
- Center View - North UP

There are three possible views:

Forward View

Places the aircraft symbol at the bottom center of the display. In forward view most activity is depicted as occurring in front of your aircraft. The compass rose is displayed as a 120° arc ahead of your aircraft. Lightning strikes and radar sweeps are displayed within the 120° arc.

In forward view the airplane symbol remains stationary with the nose pointing to the top of the screen. The map moves under the airplane symbol, to indicate ground track.

Center View

Places the aircraft symbol in the center of the display screen. Activity is depicted a full 360° around the airplane. The compass rose is displayed as a 360° ring. Lightning strikes are displayed a full 360° around the airplane. Radar is displayed within the limits of your radar arc parameters.

In center view the airplane symbol remains stationary with the nose pointing to the top of the screen. The map moves under the airplane symbol, to indicate course track.

NOTE: GPS receivers determine ground track, not heading. When the aircraft is stationary, ground track is indefinite, which means the display may not be properly oriented to the aircraft's heading. Also at very low ground speeds the ground track may appear erratic. Some GPS receivers do not report ground track when the aircraft is stationary or at very low ground speeds. FlightMax Map reports whatever data it receives from the GPS receiver.

North Up

In North up the map is oriented with true north toward the top of the screen. The airplane symbol rotates to reflect your ground track angle or heading. In NORTH UP mode, the map does not rotate; only the airplane symbol rotates in response to turns.

The compass rose is displayed as a full 360° compass. The airplane symbol remains centered within the compass, but changes its orientation depending on course track and heading.

Knob

Selecting the knob button determines the function for the *Outer* knobs. There are three possible choices:

Page

Turning the outer knob brings up the Trip page. The trip page provides relevant information for the current flight plan (Figure 12). Planned route data is displayed in the largest portion of the page. It lists next waypoints and route information from the current point to a destination. The planned distance and course (for To Waypoint) are given. The current route leg is the first line in the list of waypoints (the line with a “to” in front of it). The final destination is the last line of the list (the one with a “Dest” in front of it). It also lists ETA (estimated time of arrival) and cumulative ETE (estimated time en route) to each waypoint. The ETA and ETE calculations are based on the current rate of closure to the current waypoint, then travel along the planned route of flight at the current ground speed thereafter. ETA is reported in local time.

Figure 12: Trip Page

The top portion of the page displays your ground speed and track. Local and UTC time are also displayed.

A Course Deviation Indicator (CDI) showing lateral distance from the desired course is also shown. This is a graphical indication of the value given numerically for the To Wpt. There is ±5nm maximum deflection, regardless of system units setting. Arrow points toward current waypoint – up if fix is ahead, down if fix is behind. CDI is always correct sensing.

FlightMax Map's CDI does not act like a conventional OBS-style CDI, it reacts more like an HSI.

FlightMax Map uses your ground track angle and its knowledge of the location of the current waypoint to determine whether the waypoint is generally forward or aft of you. The direction indicator on the CDI is set accordingly.

The sensitivity for FlightMax's CDI does not change with distance to a fix, unlike a VOR. With FlightMax Map, the sensitivity and accuracy of the deviation bar is fixed at 5 nm maximum deflection.

The trip page is continuously maintained during flight. The distance and time values are updated with each new position fix from the GPS. The route legs advance with each waypoint passage.

If the flight plan doesn't fit on the entire screen, an ellipsis (three dots to indicate an omission) is shown in the next to last line of the screen. The last line is still displayed.

> **NOTE:** All flight plans are from the GPS/FMS.

Brg

Selecting bearing brings up a bearing line display. The bearing line is a white line drawn from the from the airplane symbol position to the outer range ring. The bearing line provides the pilot with an approximate bearing to any point within the range ring, i.e. a region of weather. The bearing number, in degrees, is displayed within the line and changes to reflect the corresponding movement of the bearing line.

The outer knob is used to move the bearing line right or left. The bearing line remains on screen until it is deselected or there is no knob movement for 15 seconds. Then the outer knob function reverts back to “Tilt” control. For systems without radar the display reverts back to “Page”.

Tilt

Selecting tilt provides for manual adjustment of the radar antenna using the outer knob. A screen annunciation indicates the angle and direction of the radar antenna: U for up, D for down and the amount of antenna tilt in quarter degrees, using decimal notation.

> **NOTE:** Tilt is not displayed if there is no radar connected to the FSD.

Overlay Sensor Status

Figure 13: Overlay Status

The Overlay Sensor Status box displays the current operating status of the three overlay sensors: Radar, Traffic and Lightning. The type of status information includes the sensor operating state, range options, selectable modes, etc. For example, Radar may be in Hold, Traffic is set for Unlimited range and Lightning is operating in Cell mode. This type of information will be displayed as a single line of text next to the sensor icon. When a sensor fails, the status line for that sensor will display "FAIL" in yellow.

To the left of each sensor status line is a symbol representing the sensor. The color of the symbol indicates the sensor status. The color-coding of the symbols indicates the following:

Table 2: Color Code for Overlay Status

Symbol	Status
Radar	If the symbol is filled with cyan, the graphical data from that sensor is available for display in the FlightMax Map function.
Traffic	If the symbol is filled with yellow, the system is unable to display data from that particular sensor. This may be due to a communication error, the function is not On, or there is a configuration problem.
Lightning	If the symbol is empty (outline only), that function (radar, traffic, or Lightning) is not active in the FlightMax Map function. Radar and Lightning are turned ON/OFF by the Wx button and Traffic is turned ON/OFF at the FlightMax Map main menu.

Overlay Sensor Parameters

Complete control of the configuration parameters and operating modes for the overlay sensors are controlled at that particular function. Some parameters and modes are not available in the FlightMax Map function.

For example: To change from strike mode to cell mode for the Lightning display you need to access the Lightning function and make the change. Contour cells is a way to display lightning strikes within the Lightning function but that mode is not available for display within the FlightMax Map function.

To understand how the layers of Map information are displayed refer to Table 3. The layers are listed in descending order, i.e. top level displays are listed at the top of the table and bottom level displays are listed at the bottom of the table.

Table 3: Map Layers

1	Status Block Data, Knob Label, Up Indicator, Own-Ship Symbol (OSS) and the Terrain legend Note: these items do not occupy common areas so the order among them is irrelevant.
2	Bearing Line
3	Traffic (when configured)
4	Range Ring3
5	Flight Plan
6	Lightning (when configured)
7	Navigational Data (when configured)
8	Radar Data (when configured)
9	Base Map (political boundaries and water) (when configured)
10	Terrain Data (when configured)
11	Black background

Radar

The purpose of the radar display in FlightMax Map is to present radar echoes on the display. Depending on the display options selected by the pilot, the echoes may appear over terrain, political boundaries and or bodies of water, or they may appear against a black background as in a normal radar display. The FlightMax Map radar function is a full screen color depiction of mapped radar echoes in a 120° Forward View format or a 360° Center View format. The radar echoes are scaled and rotated to their correct position relative to the nose of the aircraft. The pilot has control of the radar range and sensor tilt function. The Weather Alert Mode (WxA and CYC) are also available in FlightMax Map.

Not all Radar features and messages are available while viewing radar in FlightMax Map. The following will cause a loss of the radar display in FlightMax Map:

- Radar is in Vertical Profile mode.
- Radar is off.
- Radar is in standby.
- If there is a communication error between Radar and Map

Traffic

The purpose of the Traffic display in FlightMax Map is to present airborne intruders on the display. There are several possible traffic sensors available for use with FlightMax Map including SkyWatch, TCAD, and TCAS. Intruders are displayed as they are received from and identified by the sensor. The threat level assigned to an intruder is the threat level specified by the sensor when it transmits the intruder data. Threat data, range, bearing, altitude, ID and closing direction is defined by the sensor and the type of sensor used in your system. See the Traffic section.

Table 4: Traffic Threat Symbols

Symbol	Description
Traffic Advisory	Solid yellow circle with black border.
Proximate Traffic	Solid white diamond with black border.
Other Traffic	Open white diamond with white border.

Lightning

FlightMax Map displays thunderstorm lightning strike data with the Lightning overlay display. Lightning data comes from a passive thunderstorm detection system, such as a BF Goodrich Stormscope WX-500. The Thunderstorm Detector system maps thunderstorm activity by monitoring electrical discharge activity within a 200-mile radius of the aircraft. Thunderstorm information consists of current cell data (including range and azimuth) or strike data (including range and azimuth). Lightning strikes less than 25nm distant are not displayed if the display range is set too less than 25nm. If the display range is set to greater than 25nm, all lightning strikes will be displayed.

Table 5: Lightning Symbols

Symbol	Description
Strike Mode	Diagonal yellow cross (x), black border
Cell Mode	Orthogonal yellow cross (+), black border

FlightMax Map removes strikes when they are older than three minutes. To clear strikes, use the CLEAR STRIKES function from Map's main menu.

Track and Heading

FlightMax Map operates in a track-referenced or heading-referenced configuration. The possible sources for Track and Heading are: GPS, FMS, Stormscope (WX-500), and SkyWatch. Your installer will configure your system based on the equipment in your plane.

There are two screen views: Centered View and Forward View. These views are referenced to the aircraft symbol.

Centered View - The aircraft symbol is placed at the center of the screen.

Forward View - The aircraft symbol is placed at the bottom, center of the screen.

The display is capable of the following map orientations:

North Up - The map is oriented with true north toward the top of the screen. The airplane symbol rotates to reflect your ground track with a track source or heading with a heading source.

Heading Up - The map is drawn with the aircraft heading toward the top of the screen. The airplane symbol will always remain vertical and the map will rotate.

Track Up - The map is drawn with the ground track toward the top of the display screen. The airplane symbol will always remain vertical and the map will rotate.

> **NOTE:** The combination of Forward View with North Up orientation is not available. Heading Up and Track-Up are mutually exclusive. If a heading source is available then Heading-Up and North-Up are the available map orientations. If no heading source is available then Track-Up and North-Up are the available map orientations.

The map orientation is annunciated on the display as described in the next section.

Track and Heading Indicators

There are several indicators on the FlightMax Map display that provide Track and Heading information.

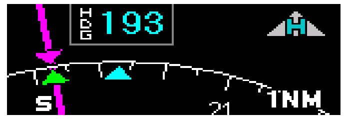


Figure 14: Track and Heading Indicators

Track - A magenta triangle is displayed on the outside of the range ring at the angle of desired track. This triangle is only displayed if the GPS source is providing the desired track.

A green triangle is displayed on the interior of the range ring at the actual track-angle. The green triangle is displayed only if, the GPS source is providing actual track information.

If a heading source is providing valid heading, a cyan triangle is displayed on the interior of the range ring pointing to the actual heading.

Heading/Track Block - If the current heading/track angle is valid, it is displayed numerically at the top of the screen, in the Heading/Track box. The numbers are cyan color if the source is heading, and green for track.

Abbreviated text is placed to the left of the number: HDG for heading, and TRK for track.

Up Indicator - The triangle symbol to the right of the Heading/Track Block indicates the view orientation. The symbol is only present if the current heading/track is valid. The letter within the triangle indicates which view orientation is up:

N = North Up

H = Heading Up

T = Track Up

See page 38 " Loss of Heading/Track" for what happens when heading or track is lost or invalid.

Navigational Symbols and Data

Symbols

FlightMax Map's moving map uses symbols contained in its navigational database, based on your navigational mode and flight situation.

FlightMax Map can display the following database items:

- Airports
- Navaids (VORs, NDBs and Waypoints)
- Airways (Victor and jet)
- Intersections, waypoints and other named fixes
- Class B and Class C controlled airspace
- Certain classes of special use airspace (Prohibited, Restricted, Warning, Alert and Military Operating Areas)

Navigational symbols used by FlightMax Map are shown in Table 6 through Table 10.

Table 6: Map Symbols-Navigational Fixes

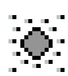
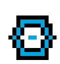
Symbol	Item	Description
	NDB	All NDB's
	VOR	All VOR's
	Waypoint	Terminal, Jet and Victor airway waypoints (intersections)

Table 7: Map Symbols-Airports (Fuel Available)

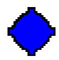
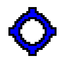
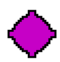
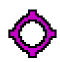
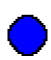
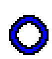
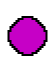
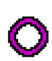
Fuel			Airport Type
Hard	**Soft**	**Water**	
			Towered
			Towered
			Non - Towered
			Non - Towered

Table 8: Map Symbols-Airports (NO Fuel Available)

NO Fuel			Airport Type
Hard	**Soft**	**Water**	
			Towered
			Towered
			Non - Towered
			Non - Towered

NOTE: The larger airport symbols are displayed as the map scales are reduced to the smaller ranges.

Lines

FlightMax Map uses several different line styles to convey airspaces and airways. Figure 15 and Table 9 describe the different line styles.

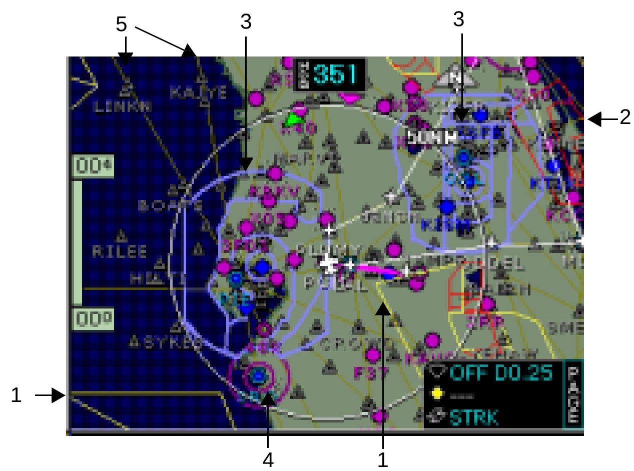
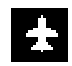
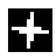


Figure 15: Line Styles

Table 9: Line Styles for Airspaces and Airways

#	Item	Color	Label
1	Military Operations Area	Yellow	ID label
	Alert Airspace	Yellow	ID label
	Warning Airspace	Yellow	ID label
2	Restricted Airspace	Red	ID label
	Prohibited Airspace	Red	ID label
3	Class B	Blue	Elevation
4	Class C	Magenta	Elevation
5	Victor Airways	Dark Yellow	ID label
	Jet Airways	Dark Yellow	ID label

Table 10: Map Symbols-Other

Symbol	Item	Symbol	Item
	Flight plan (inactive leg)*		Map Orientation
	Flight plan (active leg)		Airplane symbol
	Flight Plan, Course Waypoints		

* If all legs are shown in white, the GPS is not reporting the active leg of the flight plan.

Data Blocks

Navigational information on the moving map is presented in the Navigational Data Blocks. Each data block can display up to 4 items of navigational information, depending on the type and size of the information.

There are two possible data block locations, one in the upper left and one in the lower left corner of the display screen. If the data block is configured with no data, it will not be displayed. The content of each data block is determined by selecting navigational items from a database of 12 items. The navigational items are described in Table 11. The size of the data block is determined by the size and amount of text within the data block. The data block will automatically adjust to take up the least amount of real estate on the display screen.

A series of dashes (- - -) represents data that is invalid or unavailable at this time from the GPS.

Distances and speeds reported in the data blocks generally follow the system units settings.

.

Table 11: Data Block Information

Name	Description	Range
TO WPT	Name of, bearing and distance to the “to” waypoint in the active flight plan. Note that the bearing is from your *present position* directly to the fix. If you are off course, it will differ from your planned course. Distance is measured direct.	5 characters (Name) 1 to 360 degrees 0.0 to unlimited nm
TO WPT+ETE	Name of, bearing and distance to the “to” waypoint in the active flight plan. Note that the bearing is from your *present position* directly to the fix. If you are off course, it will differ from your planned course. Also displays ETE (Estimated Time En route)	5 characters (Name) 1 to 360 degrees 0.0 to unlimited nm HH:MM
NEXT WPT	Name of, and distance to the “next” waypoint in the active flight plan. Also displays ETE (Estimated Time En route)	5 characters (Name) 0.0 to unlimited nm HH:MM
DEST WPT	Name of and distance to final destination waypoint in system distance units. Distance is measured along planned route.	5 characters 0.0 to unlimited nm
NRST ARPT	Identifier of, bearing and distance to the nearest airport	5 characters (name)

Table 11: Data Block Information

Name	Description	Range
LAT/LON	Current latitude and longitude in degrees and decimal minutes	N/S 0 to 90° 0’ E/W 0 to 180° 0’
BARO ALT	Barometric Altitude	Based on data from FMS or GPS (see Note)
GND SPD	Current ground speed in system speed units.	0.0 to 999.9 knots
TRUE AIRSPD	Actual airspeed	From FMS
UTC TIME	UTC (or “Zulu”) time.	0 to 23h 59m 59s
LOCAL TIME	Local date and time. Derived from UTC time with time zone setting applied.	0 to 23h 59m 59s
blank	Blank space	

NOTE: The Baro Altitude is received from the FMS or GPS (via 429). The FMS calculates the altitude based on the barometric pressure entered into the FMS by the pilot.

This display is used to verify what has been put into the FMS/GPS. Do not rely on this display for terrain separation.

How to Use FlightMax Map

FlightMax Map Startup

FlightMax Map starts automatically as part of the normal initialization sequence of the FSD. To use MAP do the following:

1. Turn Power on to the FSD. The FSD will go through its normal startup routine. The FlightMax Map product Identification page will appear.

   Read all of the information on the product identification page and observe any operating limitations it reflects.

   NOTE: FlightMax Map's product identification page provides important information on database currency. Map displays the expiration date for the navigation data being used or the word "Expired" if past that date.

2. When prompted to do so, press **Enter** to start the FlightMax Map application.

   The FlightMax Map data page will appear.

3. The settings for FlightMax Map will be as follows:

   View - Forward view, Heading/Track or last configuration prior to shutdown.

   Declutter - last configuration.

   Data blocks - last configuration.

   Nav Map Symbols Setting - last configuration

   Airport Filters - last configuration prior to shutdown

   Traffic, Radar, and Lightning Overlays - are set to whatever configurations are available from the individual applications.

   NOTE: The message bar will display several messages indicating the status of the system and the other applications. Note any problems that may have occurred with the other applications. Press Enter to clear all messages from the message bar.

CAUTION

Operation with expired data may be hazardous and may be a violation of Federal Aviation Regulations. Avidyne recommends that Map is used with current data.

Display the Traffic Overlay

NOTE: Traffic can only be displayed if your system is configured with a traffic sensor.

1. Press the Menu key to display FlightMax Map's main menu
2. Select Traffic by pressing the line select key next to it.
3. To verify that the Traffic overlay is functional, check the traffic symbol (the middle one) in the status box located in the lower right hand corner of the display. The diamond should be a solid cyan color.

Changing the FlightMax Map's Scale

The map can be displayed in a wide range of scales, ranging from one nautical mile up to 500nm.

FlightMax Map scale, or zoom level, is controlled by the inner knob. When viewing a map page the inner knob will always control the map scale.

1. Rotate the inner knob clockwise to increase (zoom out) the map scale. Rotate counter clockwise to decrease (zoom in) the scale.

Changing the Map's Orientation

To change the maps orientation press the fixed function **View** line select key. There are three possible views:

Forward View - is verified by the airplane symbol located at the bottom center of the display and the compass rose display is a 120° arc.

Center View - is verified by the airplane symbol located in the center of the display and the compass rose display is a 360° ring.

North Up - is verified by the airplane symbol located in the center of the display, the compass rose display is a 360° ring and the orientation symbol displays an “N”.

To Select a Weather Overlay

To add the weather overlays (if available with your system) press the fixed function weather (Wx) line select key. Starting from a display with no weather overlays, there are three possible combinations:

1. Press the line select key once. This adds the Radar overlay. To verify that the Radar overlay is functional, check the Radar symbol (the top one) in the status box located in the lower right hand corner of the display. The symbol should be a solid cyan color.
2. Pressing the key again adds Lightning with the Radar overlay. To verify that Lightning has been added, check the Lightning symbol (the bottom one) in the status box located in the lower right hand corner of the display. The cross should be a solid cyan color
3. Press the key a third time and Radar is removed with only Lightning displayed
4. Pressing the key again removes all weather overlays.

   Selecting weather overlays is cyclic, you can continuously cycle through all the weather overlays.

Changing the Map Type

To change the map display, press the fixed function Map line select key. Pressing the key will cycle through three possible map displays:

None - No map features are displayed. The background color is solid black.

Base Map - Only political boundaries are displayed against a black background.

Terrain (+Base) Map - Political boundaries, water and terrain features (based on USGS terrain maps) are displayed.

Compass Rose Display

To display or remove the compass rose, do the following:

1. Bring up the Map main menu (Press Menu or Escape).
2. Select/deselect Compass Rose.
   A check mark indicates it is active.

Find the Nearest Waypoint/Airport

1. Bring up the fixed function keys by pressing any line select key (if they're not visible).
2. Press the line select key next to the NRST button to bring up the Nearest page.
3. The top small window should be highlighted. Use the inner knob to activate the drop down menu and select the list of waypoints to view: Airports, VOR's or NDB's.
4. Use the outer knob to select the larger bottom window and the inner knob to scroll down the displayed list.
5. If airports were selected the Info and Show All key will be active, they are grayed out if VOR's and NDB's are selected. Use the inner knob to select (highlight) an airport.
6. Press Info to see more detailed information about the highlighted airport (provided there is information available), including runway information and com frequencies.
7. Press Show all/Filter to see all airport types or only the airport types as defined on the Airport filter page.

Display Runway Depiction

To display runway depictions (if available), while flying near an airport, use the inner knob and adjust the range.

1. Under 10nm, white lines are used to depict the runway layout. Runway data is also displayed.
2. Between 10 and 25nm, a larger version of the airport symbol, with the runway layout is displayed.
3. Over 25nm just the airport symbol is displayed.

Change the Airport Display Settings

1. Select MAP→SETTINGS→AIRPORT FILTER
2. The Airports Displayed page (Figure 6) appears.
3. Use the outer knob to highlight the type and surface of airport. Use the Min. runway Length (ft.) to filter airports by runway length.

   Use the inner knob to place a check in any box.
4. Press Enter to accept the changes.

Change the NavMap Settings

1. Bring up the Map main menu and select Settings.
2. From the Settings submenu select Nav Map Settings, this brings up the Nav Map Settings page.
3. Use the outer knob to select the Display and Label boxes. Use the inner knob to change the setting.

   The Display setting choices are ON, OFF or AUTO

   The Label is displayed if the box is checked.
4. Use the VFR or IFR keys to select a predefined grouping of navaids.
5. Press Enter to accept the changes.

Declutter the Map

1. Bring up the fixed function keys by pressing any line select key.
2. Press the line select key next to the Declutter button (the right angle triangle symbol) to change the declutter display.

   A sliding arrow along the hypotenuse of the declutter symbol indicates what level of declutter is being displayed.

Change the Knob function

1. Bring up the fixed function keys by pressing any line select key.
2. Press the line select key next to the knob button to change the knob function.
3. There are three possible functions:

   Page - Turn the outer knob to bring up the trip page.

   BRG - Bring up the bearing line. Turn the outer knob to orient the bearing line.

   Tilt - Allows manual control of the radar tilt. Turn the outer knob to move the antenna.

   The default setting is Page.

Modify the Data Blocks

1. Bring up the Map main menu and select Settings.
2. From the Settings submenu select Modify Data Blocks.

   If the Data blocks are currently displayed the first line of the top left data block will be highlighted. The text will reflect the current data item in that position.

   If no Data blocks are displayed, the two data blocks will appear and the top line in the top left block will be highlighted. The text will say “blank”.
3. Use the inner knob to select a data item for that line. When a new item is selected the change is reflected immediately.
4. Use the outer knob to move to the next line. Use the inner knob to make any changes to this line.
5. If no item is to go into a line, select blank.
6. There are two sizes of data items that can be used in the data blocks, double line and single line items.

   Each data block is limited to four lines. Any combination of single and double line items, totaling up to four lines can be used.
7. When all changes to the data blocks are complete, press the menu button to bring up the Settings sub menu again.

   Deselect Modify Data Blocks. The green highlight line will disappear. Or press the fixed function knob key.

NOTE: Any changes will remain in effect, until the data blocks are modified again. This includes powering down the FSD, the last modification remains in effect.

A series of dashes (---) represents data that is unavailable at this time from the GPS.

Failure Indications

Loss of Position

If the position source becomes unavailable or invalid, the following conditions will occur:

- all sensor data (radar, traffic, and lightning) is removed from the display.
- the aircraft symbol is removed from the display.
- the range ring labels (N,E W, and S) are removed from the display.
- the map and flight plan data will continue to be displayed but the display is based on the last known good position
- the map orientation annunciation is removed form the display

When position data is restored, FlightMax Map will resume normal operations.

Loss of Heading/Track

If the heading/track source becomes unavailable or invalid, the following conditions will occur:

- all sensor data (radar, traffic, and lightning) is removed from the display.
- the aircraft symbol is replaced by a direction less symbol (a white + symbol).
- the range ring labels (N,E W, and S) are removed from the display.
- the map and flight plan data will continue to be displayed but the display is based on the last known good heading/track reading.
- the map orientation annunciation is removed form the display
- the heading/track indicator will display a series of dashes ("---")

When heading/track is restored, FlightMax Map will resume normal operations.

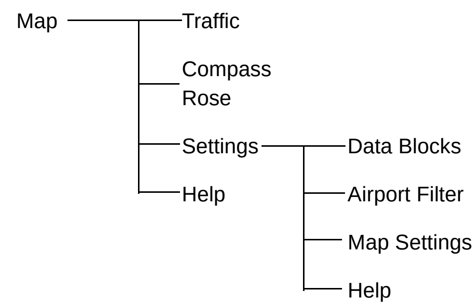
Unhealthy Sensor

FlightMax Map monitors the "health" of the sensor applications (radar, traffic and lightning) by means of a signal pulse. Map looks for a signal every three seconds from each sensor. If it doesn’t see this signal it assumes the sensor application has failed in some way. When this happens, the following occurs on the display:

- application data is removed from the overlay display.
- the word "FAIL" is displayed in the sensor's status line in yellow.
- the sensor symbol changes from cyan to yellow (if the sensor was on).

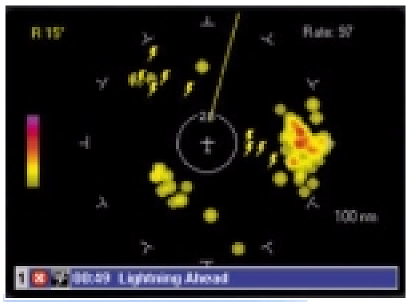
Menu Organization

The following Menu Tree graphically depicts the paths to all FlightMax Map menu functions.



FlightMax™

Flight Situation Display



FlightMax Lightning

Part Number 600-0058 Revision 00

Revision History

Date	Revision	Description
Sep. 7, 2000	00	Production Release

Avidyne Corporation
55 Old Bedford Road
Lincoln, Massachusetts 01773
Web Site: www.avidyne.com

FlightMax Lightning
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FlightMax Lightning

Introduction

Figure 1: Lighting Icon

This part of the Pilot's Guide explains FlightMax Lightning and its use with the BF Goodrich Avionics Systems WX-500 Weather Mapping System. Topics include:

- *Lightning Overview* - presents an overview of the Lightning function and the Stormscope WX-500 Weather Mapping System.
- *Lightning Pages and Menus* - explains every page and menu used in Lightning.
- *How to Use Lightning* - explains how to perform specific tasks using Lightning.
- *Messages and Error Indications* - provides the meanings of Lightning messages and error indications.
- *Menu Organization* - shows the path to any menu in Lightning.

FlightMax Lightning is verified by the presence of its icon and text label in the Main menu. If Lightning's icon and legend, shown in Figure 1, are not present in the Main menu, contact your installer for assistance.

Before reading this section, you should read and understand your Stormscope WX-500 User's Guide. It contains information essential to the proper use and interpretation of the displays presented by FlightMax Lightning.

Lightning Overview

WARNING

This section is not a guide to weather flying. It should be used in conjunction with your airborne thunderstorm sensor manual, to understand and interpret FlightMax Lightning displays. It is not intended as a guide to the safe use of this data in making route selection decisions in flight.

FlightMax Lightning displays weather avoidance data gathered by an airborne thunderstorm sensor, the BF Goodrich Avionics Systems Stormscope™ WX-500 Weather Mapping System. Proper use of FlightMax Lightning and the WX-500 can improve your ability to maintain a safe distance from thunderstorms by alerting you to their presence under instrument flight conditions and at distances that would preclude avoidance by visual means.

Briefly, airborne thunderstorm sensors detect the electrical discharge associated with lightning. By means of their specialized antennas and electronics and sophisticated processing software, they are able to determine the approximate range and relative bearing of each lightning strike. This information is then sent to the FSD for display.

Since lightning and thunderstorms are always associated with hazardous weather conditions, including extreme turbulence, heavy precipitation and damaging hail, avoidance of areas where lightning is present will increase the likelihood of avoiding these other hazards.

FlightMax Lightning provides access to all of the functions of the WX-500 sensor.

FlightMax Lightning is also available to the FlightMax Map function. The Map function is a terrain and navigation display with overlays of radar, traffic and lightning data. The FlightMax Lightning function provides Lightning data to the Map function for possible overlay display.

Lightning Pages and Menus

Data Page Layout

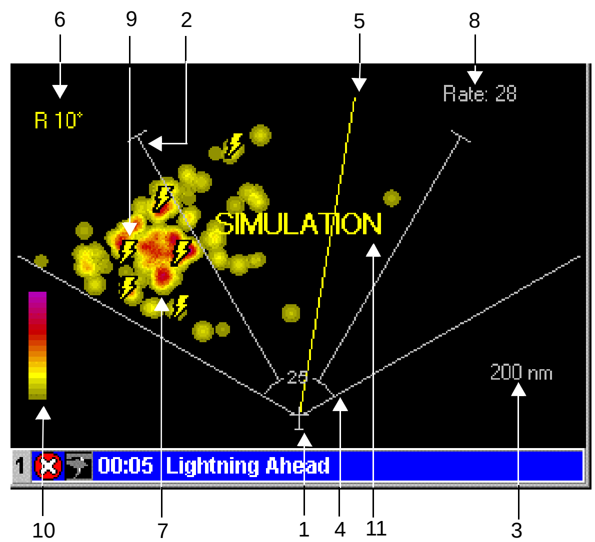

Figure 2: Data Page Layout

NOTE: The storms depicted in the screen graphics do not represent normal storm displays. They were created from actual sensor data, however they were not collected in flight. They are used to illustrate Lightning operation.

1. **Aircraft Symbol** - Shows the position of your aircraft in relation to the thunderstorms depicted on the page.
2. **Azimuth Marks** - Denote relative bearings from your aircraft's heading at 30× intervals.
3. **Display Range** - Shows the total sensing range (from the aircraft symbol to the outer ends of the azimuth marks). The small, inner knob controls the current display range.
4. **25nm ring** - Separates nearby activity from more distant activity.
5. **Bearing Line** - The large, outer knob controls the

angular location of the bearing line. The bearing line and bearing indicator are removed from the screen after 15 seconds of non-use.

6. **Bearing Indicator** - Provides precise bearing information to storm activity. The bearing indicator shows the actual relative bearing (in direction and degrees) at which the bearing line is positioned.
7. **Strikes** - Each strike is shown according to its position and azimuth relative to your aircraft as reported by the lightning sensor. Strikes can be displayed as clusters or as individual strikes.
8. **Strike Rate Indicator** - Displays the number of strikes per minute occurring within the displayed area, based on recent activity.
9. **Strike Flashes** - Depict areas of greatest activity.
10. **Strike Contouring Scale** - The color at the top of the scale indicates the color of the most severe activity.
11. **Mode Annunciator** - Indicates circumstances warranting special interpretation of the displayed data.

Lightning Main Menu

The Lightning main menu provides several options for changing and controlling the Lightning display.

Figure 3: Lightning Main Menu

Forward View

FORWARD VIEW is a toggle function, provides a choice between two views:

FORWARD VIEW is illustrated in Figure 2. Forward view presents storm data in front of your aircraft and is most useful during cruise.

CENTERED VIEW is illustrated in Figure 4. Centered view presents storm data 360°around your aircraft and is most useful during times when high maneuvering is anticipated, such as the terminal area.

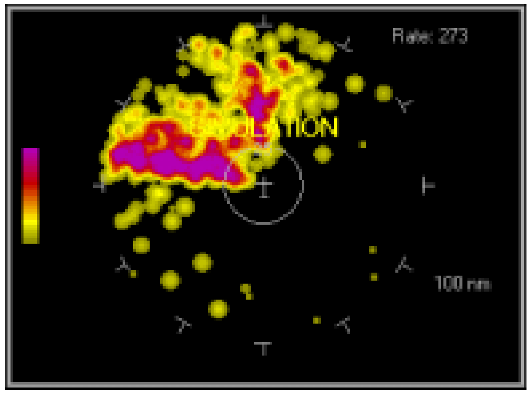

Figure 4: Centered View

Clear Strikes

CLEAR STRIKES, clears the page of lightning strikes and from the WX-500 memory. The most active storms will start to reappear on the screen after a clear strikes.

The WX-500 supports an optional external pushbutton by which strikes may be cleared as well. Use of this pushbutton has the same effect as the menu function.

> **NOTE:** the Lightning Ahead indication is cleared whenever strikes are cleared.

Cell Mode

Cell mode and Strike mode offer two different sensing and display modes for observing storm activity. CELL MODE is a toggle function accessed from the Lightning main menu. A check mark indicates CELL MODE is being used, no check mark indicates strike mode is in use. Both modes may be used with any of the SETTINGS displays, either normal or contoured strike display, with or without strike flashes.

STRIKE MODE is slightly more sensitive and tends to detect storms earlier but it exhibits certain sensing artifacts (“radial spread”) in conditions of high activity. In this mode lightning strikes are depicted as angled crosses (x).

CELL MODE suppresses the sensing artifacts, clumping strikes together to represent thunderstorm cells more closely. Cell mode offers a more accurate, easier to interpret display in conditions of high activity. However, some capacity for early detection of developing or distant storms is lost. In this mode lightning strikes are depicted as angled crosses (x).

Settings

Figure 5: Settings Menu

The LIGHTNING→SETTINGS submenu collects several functions that enable and disable specialized display modes. These functions are described in the following sections. The two history functions: GPS MAP HISTORY and LOOP HISTORY are grouped with the HISTORY function from the Lightning Main Menu for clarity

Contour Strikes

Contour strikes determines how storm activity is depicted visually on the FSD screen. Contour strikes is a toggle function. It depicts strikes in a contour or normal mode.

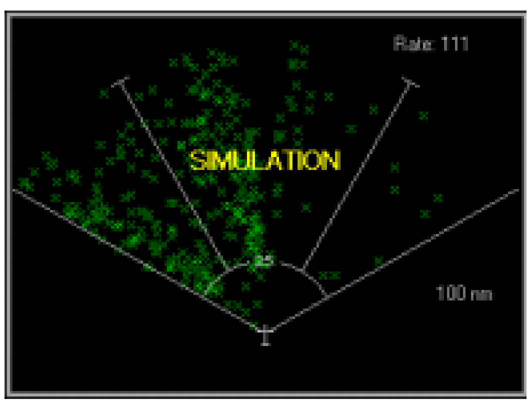

Figure 6: Normal Display Mode

In normal display mode, (Figure 6), strikes are depicted as crosses. Each cross appears on the page when the strike is reported to the FSD by the sensor and is removed three minutes later (or whenever CLEAR STRIKES is selected).

While the strike is displayed its appearance doesn’t change but its position may (if track stabilization is enabled). A single cross may indicate the presence of a thunderstorm. A cluster of crosses almost certainly does, and a region of crosses increasing in density should be assumed to indicate a building storm.

CONTOUR MODE (as shown in Figure 2), uses color spots to indicate storm activity.

In contour mode, each isolated strike is initially displayed as a spot, bright yellow in the center and darker yellow at its edges. The size of the spot varies according to the selected display range. As an isolated strike ages, it decreases in intensity and size until, at the end of three minutes, it disappears from the page.

Color is used to indicate a building storm or greater activity. Shades of orange, red and magenta are used to indicate increasing levels of activity. (A color scale representing the full range of color codes is presented on the page, see Figure 2). As the cluster of strikes ages, it is remapped down through the colors and reduced in extent until it fades completely from the page.

WARNING

NEVER fly near or through any thunderstorm, even if it appears to be decreasing in intensity.

Strike Flashes

STRIKE FLASHES causes a lightning stroke symbol to appear for five seconds at the position of each newly painted strike (Figure 2). These figures depict the areas of greatest activity in the immediate past, especially when they cluster.

Strike Test

STRIKE TEST is a test mode of the WX-500. In strike test mode, the WX-500 generates test strikes in a known location every two seconds. Lightning displays a target box on the page and displays all test strikes received, as shown in Figure 7, clearing each strike one second after reception. On a properly working system, the test strikes should appear and disappear within the test box at regular intervals.

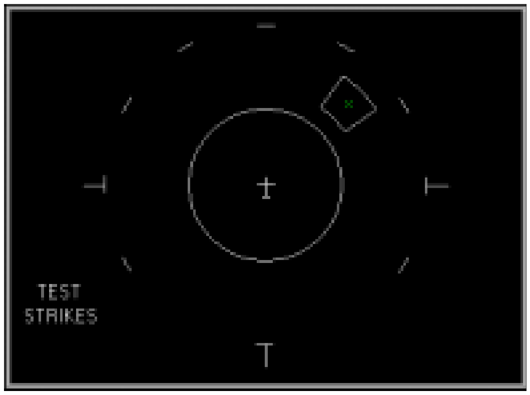

Figure 7: Strike Test

STRIKE TEST can be used as a preflight check or during flight if there is a question about the system's operational integrity.

Display Off

Display Off is a toggle function that enables or disables the display and other operating functions of Lightning. When Display Off is enabled, lightning sensor information is not displayed, error messages are not displayed and lighting information is not available to the "Map" function.

A large screen annunciation saying the lightning display is "Off" appears in the center of the screen. If Display Off is enabled on system power down it will be Off on power up.

History

The HISTORY function is available from the Lightning main menu. It (Figure 8) provides a recent history of storm activity. As you fly, Lightning records all strikes received by the sensor on the hard disk. It can save up to 30 minutes of strikes at the maximum rate they can be delivered from the sensor. This data can then be displayed and reviewed from the history page. When history is selected a large yellow annunciation that says "HISTORY" is displayed in the center of the screen to indicate that this is not a live display.

NOTE: Selecting History will deactivate the Lightning function in "Map".

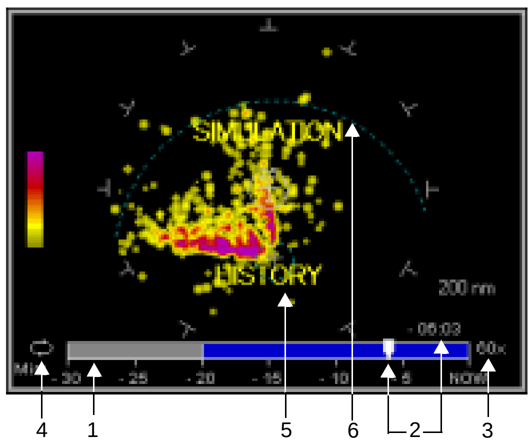

Figure 8: History Display

The history page includes the following features:

1. **Time Scale** - Located at the bottom of the history page shows how much data is available and which portion is selected for display. Gray represents available data and blue represents the portion currently selected for playback. If some of the available recording space has not yet been used, it is represented by a black section.

   The outer cursor knob controls the start point of the history playback (the blue portion of the scale).

   The inner cursor knob controls the playback rate.

2. **Playback Time Indicators** - are indicated graphically by the "slider" on the bar and numerically above the bar. The numerical value is the number of minutes and seconds *in the past* that the currently displayed strikes were recorded.

3. **Playback Rate** - a numeric indicator to the right of the

bar indicates how fast the playback is running. Playback rates range between 10x and 120x, with 10x being the slowest and 120x being the fastest. A playback rate of 120x for the full 30 minute capacity of the recording will go by in 15 seconds.

4. **Loop Indicator** - located to the left of the Time Scale. If it is displayed it indicates that the loop history mode for continuous playback is active.
5. **History Mode** - A large yellow history annunciation in the center of the screen is displayed during history mode.
6. **Sensor Range Circle** - The sensor range circle is a blue circle that marks the bounds of recorded data during replay.

GPS Map History

GPS Map History is selectable from the Lightning Settings menu. GPS Map History will re-reference strikes on playback to your current aircraft position. It creates the appearance that the lightning sensor system had been stationary at the point of playback instead of moving through the air during the period in which the recording was made. A dashed blue sensor range circle marks the bounds of the recorded data during replay. This boundary indicates old strikes outside the sensors range at the time old strikes were recorded. The GPS MAP HISTORY mode can be stopped by deselecting it from the menu.

Loop History

GPS Map History is selectable from the Lightning Settings menu. During normal history once the playback is finished the display returns to the main data page and a live lightning display. To view history data continuously use the LIGHTNING→SETTINGS→LOOP HISTORY function.

Loop History starts at the same time offset in the past and continues suppling data up to the current time. The time scale will keep retuning to the same number of minutes in the past and show lightning data from that point forward, until manually stopped. To stop continuous playback, deselect the function from the menu.

How to Use Lightning

Lightning Startup

FlightMax Lightning starts automatically as part of the normal initialization sequence of the FSD. To use LIGHTNING do the following:

1. Select Lightning from Main Menu.

   Lightning's product identification page will appear.

   Read all of the information on the product identification page and observe any operating limitations it reflects.

2. Press **Enter** to start the Lightning application.

   At startup, Lightning restores all mode selections that were active when it was last used

3. Lightning then displays its data page and main menu (Figure 9).

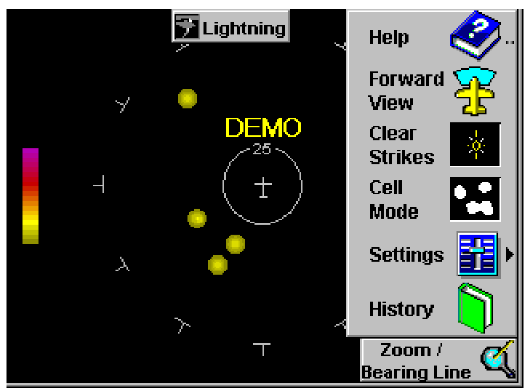

Figure 9: Demo Mode

Lightning Operations

Changing Between Forward and 360° View

Bring up Lightning's main menu, then select FORWARD VIEW. This is a toggle function. A check mark indicates the lightning display is in forward view, no check mark indicates 360° view.

Changing Between Normal and Color Contour Display

Bring up Lightning's main menu and select SETTINGS, this brings up the SETTINGS sub menu. Select CONTOUR STRIKES. This is a toggle function. A check mark indicates the display is in contour strike mode, no check mark indicates normal mode.

Turning Strike Flashes On or Off

In Lightning's main menu, select settings, this brings up the SETTINGS sub menu. Select STRIKE FLASHES. A check mark indicates Strike Flashes is on.

Changing between Cell Mode and Strike Mode

From Lightning's main menu, select CELL MODE. A check mark indicates cell mode is being used.

Clearing Lightning Strikes from the Screen

From Lightning's main menu, select CLEAR STRIKES.

Performing a Strike Test

Strike tests can be performed while on the ground or in flight to check system operation.

1. In Lightning's main menu, select SETTINGS→STRIKE TEST.

   Strikes should appear within the box at regular intervals (2-3 seconds). Occasional strikes outside the box does not constitute a failure.

2. Repeat to return to normal operation.

Cursor Control Functions

Outer Knob - Bearing

The outer knob is used to activate and orient the bearing line. The bearing line and bearing indicator are removed from the screen after 15 seconds of non-use.

Inner Knob - Range

The inner knob is used to select the display range (scale). There are three available range scales, 25, 100, and 200.

Demo Mode

Avidyne provides a demo mode to learn about and simulate Lightning operations while on the ground.

To enable demo operation, use the following procedure:

1. Locate and enter the MAIN→SYSTEM→DEVICES menu.
2. Activate the LIGHTNING configuration page (Figure 10).

   NOTE: while in the configuration page DO NOT change any other settings. Any changes (other than Demo mode) may result in a degradation or loss of lightning sensor data.

3. Select DEMO from the Operation Mode field.
4. Select **Enter** to confirm the changes.
5. To return to normal operation follow the preceding steps, however, select WEATHER for Operation Mode.

   While the WX-500's demo mode is enabled, operation of Lightning will display simulated data along with a DEMO annunciation on Lightning's data page (Figure 9).

   NOTE: Normal operation of Lightning must be restored before flight operations are conducted. You can confirm that the system has returned to normal operation by the removal of the DEMO annunciation from the screen.

How to Run History

To display and run the strike history do the following:

1. Select the desired display range for the history page.

   While on the history page, the cursor control knobs are used to control playback and cannot be used to control display range.

2. Select LIGHTNING→HISTORY or LOOP HISTORY if you wish to run History continuously.
3. The history page is displayed. A color coded time scale runs along the bottom of the display.

   Gray - represents available playback data

   Blue - represents the portion being played back

   Black - represents the recording space not used.

4. Use the large outer knob to set the start point for playback (the blue portion of the scale).

5. Use the small inner knob to set the playback rate.

6. The rate range is from 10x to 120x. 10x will play back a 30 minute recording in 3 minutes and 120x will do it in 15 seconds.

   The playback starts automatically and ends automatically and returns to the main data page with a live display.

Maintenance Functions

Maintenance functions should be performed by qualified service technicians, however there may be situations where access to the maintenance pages is required.

WARNING

Never change any settings in the Lightning configuration pages without consulting with your installer. Some changes may result in a loss of sensor data.

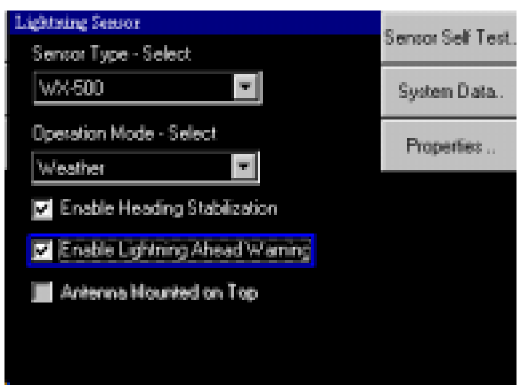

Figure 10: Lightning Configuration Page

Lightning Configuration Page

The LIGHTNING SENSOR configuration page (Figure 10) contains the following features:

Sensor Type

Used to select between the lightning sensor and a simulation program used in conjunction with the Demo mode.

Operation Mode

Normal operating mode is weather. Demo is used to learn Lightning operations. Noise Monitor is used during installation and configuration.

> **NOTE:** Occasionally the Noise Monitor mode will not initialize after selection. If this happens, select Demo mode first and then select Noise Monitor

Heading Stabilization

Enables heading stabilization when checked and disables it when not checked. The heading stabilization source is selected in the PROPERTIES page, described in the Properties Page section.

Lightning Ahead Warning

Enables display of the Lightning Ahead warning message in the message bar when checked and disables it when not checked.

Antenna Mounted on Top

Indicates that the sensor antenna is mounted on top of your aircraft when checked and that it is mounted on the bottom of your aircraft when not checked. This parameter is normally unavailable for change.

Properties Page

The PROPERTIES page provides access to two system configuration parameters. Normally these parameters, would be set by your dealer.

Comm Port - selects which communication port your sensor is connected to. Normally this is port 2.

Heading stabilization Input - defines what type of stabilization is being used if Heading stabilization has been checked on the Lightning configuration page.

The choices are:

None: no stabilization.

Synchro: uses a remote compass system with a synchro motor.

Stepper: uses a remote compass system with a stepper motor.

GPS Ground Track: generates a track stabilized display.

Self Test

Use SELF TEST to manually initiate the self test functions of the WX-500. The responses of the WX-500 are displayed as they are received.

Automatic self tests are performed at power up. Errors discovered during automatic self test are reported to the FSD and are available on the SYSTEM DATA pages.

System Data

Select SYSTEM DATA to gain access to four pages of system data reflecting details of the WX-500's status. These pages provide system information to the dealer. That information may be necessary if the system is experiencing problems.

Heading and Track Stabilization

Heading and track stabilization is available on the FSD if the aircraft is appropriately equipped and configured. Lightning sensors detect the relative bearing and distance of storms. Stabilization is a feature of some sensors which is used to move the storm display when your aircraft changes its heading.

Heading stabilization - uses a remote compass to calculate heading. On an unstabilized display, once a strike is recorded and displayed, it does not move on the display. This will cause storms to be displayed with inaccurate dimensions. Storms may appear elongated or compressed in azimuth, depending on the pattern of strikes recorded during a turn. With an unstabilized display, the screen must be cleared frequently to avoid presentation of confusing data. Because of this confusion a wider berth must be given to all storms. Aircraft properly equipped should use heading stabilization at all times.

CAUTION

Loss of remote compass function accompanied by a flag will cause loss of the heading stabilization function. If the remote compass function is lost or questionable and no flag is present, or if heading stabilization performance appears erratic, you should manually disable heading stabilization.

Track stabilization - has many similarities to heading stabilization, but is based on the ground track measured by the GPS rather than the heading measured by a remote compass. As your ground track angle changes, the change is used to correct the relative bearing of previously recorded strikes. As with heading stabilization, this allows them to be redisplayed at the corrected angle and allows new strikes to be recorded in correct relation to the previously recorded strikes.

Track stabilization is less effective in eliminating turn-related display artifacts in extreme winds, due to the significant changes in crab angle that may result. Strikes are always displayed in correct initial relation to the aircraft, but corrections through turns may not be as precise when winds are strong or gusty.

CAUTION

Track stabilization performance may be erratic when the aircraft is at rest or barely moving due to the inability of the GPS to calculate a reliable ground track angle. Mapping of storms at rest on the ground (after engine start or on the runup pad) may be unreliable and should be disregarded if track stabilization is enabled. Mapping of storms on helicopters in hovering or near-hovering flight may exhibit unpredictable characteristics.

Heading and track stabilization should be set by your installer.

Messages and Error Indications

FlightMax Lightning annunciates the following modes and failures by means of a yellow annunciation message :

Table 1: Mode and Error Annunciations

Message	Meaning
DEMO	Displayed during WX-500 demo mode.
END – STARTING WX	Displayed at end of history playback, prior to returning to normal real-time strike display.
HISTORY	Displayed during history playback.
LOSS OF SENSOR DATA	Communication of strike data from the sensor system to the FSD has been lost.
SENSOR ERROR	The sensor system has reported an error that may mean current data is incomplete or erroneous. The error may clear. One possible error represented by this message is a stuck mike. If this message appears, check your comm transmitters for indication of a stuck mike.
SENSOR FAILURE	The sensor system has reported an error that may mean current data is incomplete or erroneous. The error will not clear until power is removed from and reapplied to the sensor system. You should not generally attempt to fix such an error in flight.
SIMULATION	Reserved for use in non-production configurations.
Verify Antenna Location (run Setup)	There may be an inconsistency between the antenna location jumper setting and the software configuration. This message should only appear during installation. If it appears at a later date, contact your dealer before using Lightning further.

Lightning Ahead Indication

When viewing functions other than Lightning there is a Lightning Ahead alert indication available. The alert is displayed in the message bar. This indication will be given whenever new lightning appears within Lightning's alert area. The alert area extends 75 nm forward of the aircraft and 22° left and right of the nose regardless of display mode and range.

Figure 11 shows a typical display with a Lightning Ahead message in the message bar (note that the red lightning ahead alert area lines are not displayed during normal flight).

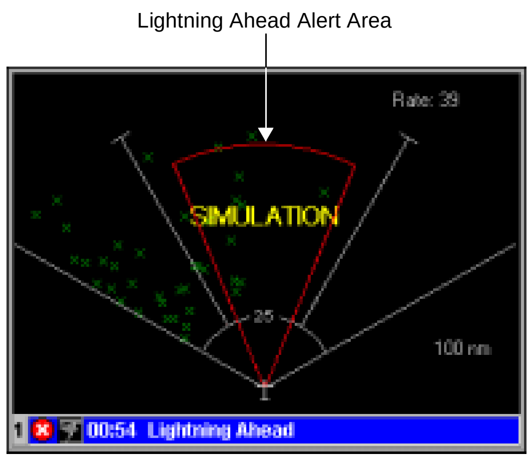

Figure 11: Lightning Ahead

The Lightning Ahead message displays the following characteristics:

- Confirming the Lightning Ahead message, will remove the message bar but the message will remain in the message center as long as lightning remains ahead.
- If lightning persists in the alert area for more than one minute after you confirm the message, the message will be redisplayed.
- When lightning is no longer detected in the alert area, the message is deleted from both the message bar and the message center.
- The Lightning Ahead feature continues to operate based

on current strike data even when you are using the strike history display.

The Lightning Ahead message feature is enabled or disabled from the Lightning configuration page, described in Lightning Configuration Page.

Menu Organization

The following Menu Tree graphically depicts the paths to all Lightning menu functions.

- Lightning
  - Forward
  - View
  - Clear Strikes
  - Cell Mode
  - Settings
    - Contour Strikes
    - Strike Flashes
    - Strike Test
    - GPS Map History
    - Loop History
    - Display Off
    - Help
  - History
  - Help

FlightMax™

Flight Situation Display

FlightMax Charts

Part Number 600-0056 Revision 00

Revision History

Date	Revision	Description
Sep. 7, 2000	00	Production Release

Avidyne Corporation
55 Old Bedford Road
Lincoln, Massachusetts 01773
Web Site: www.avidyne.com

FlightMax Charts
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FlightMax Charts

Introduction

Figure 1: Charts Icon

This part of the Pilot's Guide explains FlightMax Charts. Topics include:

- *Charts Overview* - presents an overview of the Charts function.
- *Charts Pages and Menus* - explains every page and menu used in Charts
- *How to Use Charts* - explains how to perform specific tasks using Charts.
- *Messages and Error Indications* - provides the meanings of Chart messages and error indications.
- *Menu Tree* - graphically shows the path to any menu in Charts.

FlightMax Charts is verified by the presence of its icon and text label in the Main Menu. If Charts' icon and label, shown in Figure 1, are not present in the Main Menu, contact your installer for assistance.

Charts Overview

FlightMax Charts is a digitized atlas of VFR and IFR enroute charts. In the United States, VFR charts include Sectionals (1:500,000), WACs (1:1,000,000), and Terminal Area charts (TACs, 1:250,000). U.S. IFR charts include NOAA IFR low altitude and high altitude enroute charts. In other parts of the world, the available charts and scales may differ.

Avidyne employs advanced image processing techniques to convert current versions of paper charts into digital data files for use on the FSD screen. The charts are distributed on CD-ROMs. Chart data from the CD-ROM is placed on the system’s hard drive using the system’s data loader.

FlightMax Charts is designed to supplement whatever mode of navigation is being used, helping to increase situational awareness. It does this by keeping constant track of your aircraft in relationship to the charts. Using charts, the pilot can easily determine his location with respect to the ground features, obstructions, navaids and airports depicted on the VFR charts. Charts is not a navigation tool. It should be used as a supplement to the navigating tool(s).

WARNING

NOT FOR NAVIGATION - FlightMax Charts is an aid to situational awareness designed to facilitate the use of approved navigational charts, not to replace them. Only charts and Notices to Airmen contain all of the information needed for safe flight and the pilot is responsible for their prudent use. It is a violation of the Federal Aviation Regulations to conduct flight operations without all available information concerning the flight

Charts Pages and Menus

Charts’ Data Page: the Moving Map

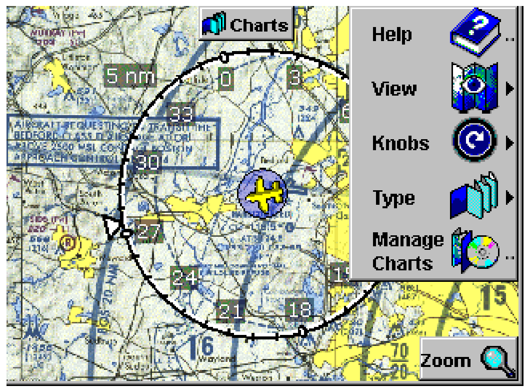


Figure 2: Charts Data Page and Main Menu

Charts’ data page (Figure 2) consists of a moving map with an airplane symbol superimposed to indicate your position in relation to the features depicted on the chart.

The default mode places the airplane symbol in the center of the screen with the chart moving beneath the airplane during flight.

Any time position data from the GPS receiver becomes unavailable, Charts removes the airplane symbol from the map, indicating that it has no information by which it can determine your location. The airplane symbol is restored when data is available again. Similarly, any time ground track data is lost, the airplane symbol is changed to a blue circle (the airplane is removed), indicating that position is known but orientation is not.

View Menu

The view menu provides several options for changing and controlling the charts display. The view menu is accessed from Charts main menu.

Figure 3: View Menu

Tracking

The VIEW→TRACKING menu contains two functions, CENTER and UNTETHERED, that determine the location of the airplane symbol on the display screen.

Center

In this mode, Charts anchors the airplane symbol at the center of the screen. This is the default mode when the system is started and is the most common enroute mode.

Figure 4: Tracking Menu

Untethered

In this mode, Charts anchors the map and the airplane symbol is in motion on the screen. When the airplane symbol reaches the edge of the display screen, it can continue off it. When used with the SCROLL function the pilot can move the map manually to see an area remotely located from his current position (see Knobs Menu).

Chart Orientation

The VIEW→ORIENTATION menu, provides two orientations for displaying charts.

Figure 5: Orientation Menu

North Up

Charts can be displayed with north at the top of the screen, similar to looking at a paper chart. The airplane symbol will still point in the direction of its heading.

Track Up

Charts can also be displayed according to your ground track.

If Track Up is selected and track data is not sent by the GPS, the chart will remain in the last previously established orientation. The airplane symbol will be removed to indicate the loss of track information, but the blue circle will remain and the chart will move, indicating receipt of a valid position.

Range Ring

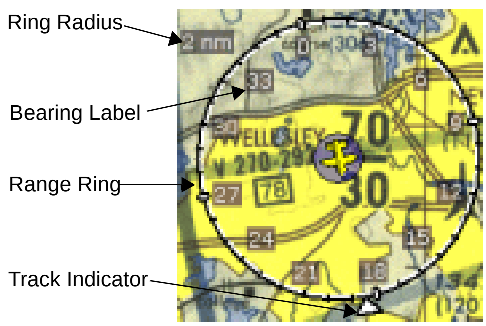


Figure 6: Range Ring

The VIEW—RANGE RING selection enables the display of a range ring on the Charts data page (Figure 6). The range ring is automatically displayed centered on the airplane symbol and uses a range scale based on the current map scale.

The radius of the ring is in nautical miles. Normally the scale of the ring is displayed alongside the upper left edge of the ring. The ring can be used to estimate distances to map features.

The range ring also provides information about the current ground track. The ring has tick marks at ten degree intervals and bearing labels every thirty degrees. It is oriented to magnetic north. A triangular indicator outside of the ring shows your current track.

If the GPS stops reporting position or ground track for any reason, the range ring is removed from the screen.

Flight Plan Overlay

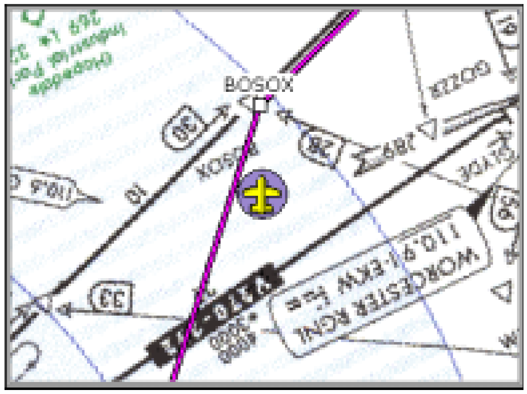


Figure 7: Flight Plan Overlay

The VIEW—FLIGHT PLAN selection enables a flight plan delivered by the GPS to be overlayed on the map (Figure 7). The GPS delivered flight plan consists of magenta lines connecting the individual waypoints, each of which is represented by a small box symbol and the waypoint's name. Waypoints are not differentiated as to type, since that information is not normally supplied by the GPS and is evident from the chart itself. The waypoints are located according to latitude and longitude information passed from the GPS. Some degree of misalignment between overlaid points and airway legs and the underlying chart data is normal, originating mainly from slight errors in the charts themselves.

If the GPS stops sending flight plan information, the flight plan overlay is removed from the screen. No other annunciation is given, and this is not considered an error condition. Flight Plan can be enabled at all times and from run to run of the FSD.

Knobs Menu

The KNOBS menu contains two functions, ZOOM and SCROLL, that determine how the dual concentric knobs can control map presentation.

Figure 8: Knobs Menu

Zoom

The zoom function controls the map scale. The large outer knob is used to zoom in large increments. The small inner knob is used to zoom in small increments. Turning either knob clockwise, zooms out. Turning the knobs counter clockwise, zooms in.

Scroll

The SCROLL function modifies the map's position on the display screen. SCROLL is only available when the map is untethered. The function is disabled (grayed out) otherwise.

Scrolling is useful for viewing a portion of the map that is distant from your current location. The large, outer knob scrolls the map left and right, while the small, inner knob scrolls the map up and down.

When the FSD is shutdown and restarted, Charts remembers and restores the last used map scale.

Chart Type Menu

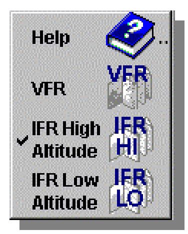


Figure 9: Chart Type Menu

The TYPE menu is used to select between three different types of charts: VFR charts, IFR low altitude charts or IFR high altitude charts. Selecting the type of chart from the menu will bring up that chart, provided it was loaded from the CD. If the type chart was not loaded, an error message is displayed indicating that chart is not loaded. When the FSD is shutdown and restarted, Charts remembers and restores the last used map type.
Some VFR charts are two-sided (Sectionals, for example). Each side is scanned separately and treated as though they were separate charts.

At present, Avidyne does not assemble the charts into a single "seamless" viewing area. When the aircraft symbol approaches the edge of a chart, the edge will be visible. Sometimes this edge will contain a white, scanned border. Sometimes it will be black. When the aircraft symbol reaches the edge of the chart, Charts will automatically switch to the adjacent chart if it is loaded.

Whenever Charts switches from one chart to another, whether because of a type change, scale change, or because the aircraft symbol has flown from one chart over another chart, it annunciates the name of the new chart in the message bar. This is a local message, so it will not appear if another function is displayed and will automatically be dismissed if you’ve enabled that feature in SYSTEM→SETUP→SETTINGS.

Manage Charts Configuration Page

Selecting Manage Charts from the Charts main menu will bring up the Manage Charts Configuration Page. This page is used to provide information about the charts loaded on the system and to do customized chart loads.

The MANAGE CHARTS configuration page displays a list of all known charts of the type purchased. The complete list always appears regardless of your particular chart subscription.

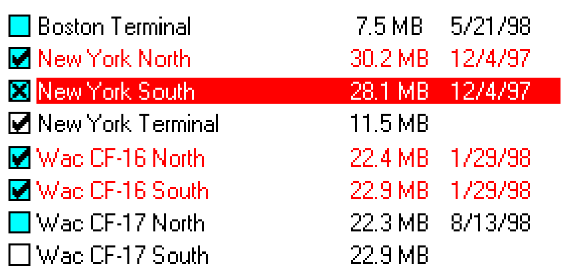


Figure 10: Chart Status and Update Selections

For each chart in the set, the system provides status information (Figure 10). Each chart has a single line in the list that contains the following information, from left to right:

- A check box that shows whether or not the chart is currently loaded.
- The name of the chart.
- An estimate of the disk space required to store the chart (to help you optimize your use of your system’s overall

disk capacity).

- If the chart is loaded on the system, its expiration date, if any.

The list also contains a special entry, LOAD ALL AVAILABLE CHARTS, that provides a convenient means of loading or updating everything in your subscription, subject to disk space limitations.

Each chart that is currently loaded on the system is indicated by blue shading in the check box and, for charts that expire, the presence of an expiration date in the fourth column of the list.

Red text and a red highlight indicate a chart that has already passed its expiration date.

How to Use Charts

Startup

FlightMax Charts starts automatically as part of the normal initialization sequence of the FSD. To start CHARTS do the following:

1. Select charts from the Main Menu.
   Charts Product Identification page will appear.
2. Press Enter to start the charts application.
   At startup, Charts re-establishes the chart type, map scale, and other display options that were set during the last usage.
3. Charts, then displays its data page and main menu (Figure 2).

Changing the Displayed Chart Type

1. In Charts' main menu, select TYPE.
2. Select VFR, IFR LOW or IFR HIGH, according to your preference.
3. A message in the center of the screen will appear while the new chart is being loaded. The name of the new chart will remain in the message bar.

Changing the Chart's Scale

1. If you have been scrolling the map, select KNOBS→ZOOM in Charts' main menu.
2. Use the outer knob for large scale changes.
3. Use the inner knob for small scale changes.
4. Changing the map scale may cause a new chart to be displayed. If so, its name will be shown in the message bar.

Scrolling the Chart

1. The chart must be untethered (disconnected from the aircraft's position) before it can be scrolled. Select VIEW→ TRACKING→UNTETHERED.

2. Select KNOBS→SCROLL.

3. Use the knobs to scroll the chart.

4. Changing the tracking mode back to CENTER cancels the scrolling function.

Changing the Tracking Mode

1. In Chart's main menu, select VIEW→TRACKING.

2. Select CENTER for the airplane symbol to remain centered with the chart moving beneath it.

3. Select UNTETHERED for the chart to remain stationary with the aircraft symbol moving upon it.

Updating Chart Data

Chart Updates

Aviation charts expire on different schedules depending on their type. If a particular chart is expired, an EXPIRED flag is automatically posted in the upper left-hand corner of the display screen. The pilot can also manually review the status of any chart by using MANAGE CHARTS.

New chart data files are prepared each time new charts are released. Chart data is provided on a separate CD-ROM and should be kept current. Updates are available either singly or by subscription directly from Avidyne. Please contact Avidyne (1-800-AVIDYNE) for details on these services.

Loading Charts

To load the latest chart data, an update CD-ROM must be inserted into a data loader at system startup. Avidyne's chart CD's contain a fast loader program that quickly loads charts data onto the system. If a particular Chart data file is already loaded on your system and the data loader finds that file on its update CD-ROM, it will automatically update the file on the FlightMax hard drive.
The data loader will not add files that are not already loaded.Adding a new charts data set can only be done

through MANAGE CHARTS.

To update charts do the following:

1. Insert the update CD-ROM into the data loader immediately after applying power to the system (you have approximately 30 seconds).
2. A confirmation page will appear asking you if you wish to continue with the update. Select "yes" .
3. The FlightMax will detect the CD and automatically load the data. Because the load occurs before all of the software options are started, it is much faster than using MANAGE CHARTS.

Using MANAGE CHARTS

CAUTION

The MANAGE CHARTS function should never be used as the "normal way" of loading update charts. Avidyne has incorporated several fail-safe features within MANAGE CHARTS to prevent accidental erasure of charts. However, the risk of accidentally deleting a chart increases while working within MANAGE CHARTS.

The primary purpose of the MANAGE CHARTS function is to add a new chart set to the system and to replace charts that may have been accidently deleted.

MANAGE CHARTS can perform three different tasks: load charts, remove charts and update expired charts. The type of charts (VFR, IFR high altitude or IFR low altitude) must be selected by means of the TYPE menu prior to entering MANAGE CHARTS.

Load All Available Charts

Checking the load all Available Charts, check box will load the entire CD. This is the fastest way to load all charts.

All checks and X's that are manually entered are obeyed.When loading several CD's some CD's may be skipped and the system will not keep track of disk space.

Individual Chart-by-chart Update

To update individual charts use the dual concentric knobs to indicate what operation needs to be performed on that chart.

Leaving the check box empty indicates no change to that chart.

Placing a check in the check box indicates that chart is to be updated.

> **NOTE:** Manage charts assumes all expired charts will be updated. If you do not want to update a specific expired chart, remove the check from that box.

Placing an X in the check box indicates that the chart is to be deleted.

Manage Charts keeps track of the number of expired charts and the number that need to be loaded. This is displayed at the bottom of the Manage Charts page.

Selecting Enter

Selecting Enter will execute all operations that have been requested. After enter is pressed the system executes a three step process:

1. All the CD's needed to accomplish the requests are loaded. The system will verify that the CD's are compatible with the requests.
2. All requested deletions are accomplished
3. All loads and updates are preformed and verified.

   During the loading process, the system provides a status by displaying a progress bar. As loading progresses, the bar fills from left to right, indicating in rough terms what portion of the data has been loaded.

Figure 11: Chart Loading Progress Bar

   The progress bar also permits you to cancel the operation by selecting Escape. If you do so, previously executed deletes and loads will remain in effect and the chart currently being loaded will be deleted.

CAUTION

All chart loading operations, especially LOAD ALL AVAILABLE CHARTS are lengthy. If necessary, abort the operation by means of the Escape key. Never turn off the FlightMax during a chart loading operation.

Updating a Chart Set

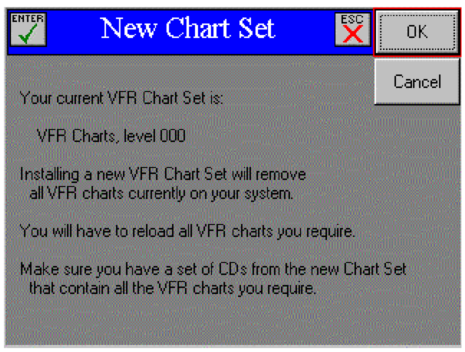


Figure 12: New Chart Set Confirmation Page

Charts maintains common information that describes the charts of a given type in a file called a chart set. To accommodate changes in the chart distribution system (for example, creation of new terminal area charts), new chart sets can be installed when they become available.

If this becomes necessary, you will receive a notice with your chart data update indicating that you must install the new chart set before you can use the data. Then, and only then, you should load the CD-ROM with the new data into the drive and select NEW CHART SET.

After confirming your intentions (Figure 12), the system will install the new file, changing the definitions of all charts of that type.

CAUTION

Adding a new chart set causes all charts of the active type to be deleted. If you do not have new CD-ROMs for the minimum set of charts of the active type that you need on the system, do not proceed with the operation. You will be unable to use any new charts of this type until you can load all that you need. You will be unable to load and use previously distributed chart data with the newly installed chart set.

Messages and Error Indications

FlightMax Charts requires that the on-board GPS be operational. The GPS must always send current location and ground track data.

The following is a list of messages and possible error indications while in charts:

Table 1: Mode and Error Indications

Error Indication	Meaning
Loss of airplane symbol and the range ring from the display screen.	GPS location is lost. The loss of the GPS will be displayed in the message bar and message center.
Loss of airplane symbol and the range ring from the display screen but the blue circle remains.	Ground track is lost. The map remains at the last valid orientation.
The flight plan overlay is removed.	The GPS has stopped sending flight plan data.
Delay while loading Charts.	This is normal. Sometimes it takes a significant amount of time when Charts must load new data to display a new chart or change the map scale.
Blank screen and message indicating not chart.	You’ve flown into an area for which there is no chart.

NOTE: never make any assumptions about your location from a map displayed without the airplane symbol, even if the map appears to move as you fly.

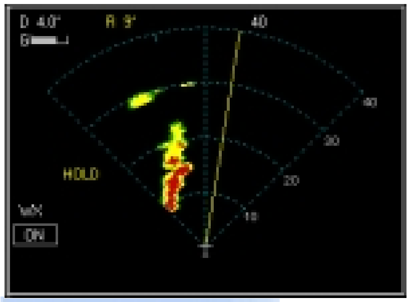
Menu Tree

The following Menu Tree graphically depicts the paths to all the Chart menus.

- Charts
  - View
    - Tracking
      - Center
      - Untethered
      - Help
    - Orientation
      - North Up
      - Track Up
      - Help
    - Range Ring
    - Flight Plan
  - Knobs
    - Zoom
    - Scroll
    - Help
  - Type
    - VFR
    - IFR High Altitude
    - IFR Low Altitude
    - Help
  - Manage Charts
  - Help

FlightMax™

Flight Situation Display



FlightMax Radar

(RDR-130/150/160)

Part Number 600-0059 Revision 00

Revision History

Date	Revision	Description
Sep. 7, 2000	00	Production Release

FlightMax Radar
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FlightMax Radar

Introduction

Figure 1: Radar Icon

This part of the Pilot's Guide, explains FlightMax Radar.

FlightMax Radar is an interface, control and display function for airborne weather radar systems. It duplicates the weather display functions of the original equipment indicators supplied with the following Bendix/King radar's: RDR-130/150/160. Topics include:

- *Radar Safety* - general radar safety information.
- *Radar Overview* - presents an overview of the Radar function.
- *Radar Pages and Menus* - explains all pages and menus used in Radar.
- *How to Use Radar* - explains how to perform specific tasks using Radar.
- *Messages and Error Indications* - provides the meanings of Radar messages and error indications.
- *Menu Tree* - shows the path to any menu in Radar.

FlightMax Radar is verified by the presence of its icon and text label in the Main Menu. If Radar's icon and label, shown in Figure 1, are not present in the Main Menu, contact your installer for assistance.

Radar Safety

Aircraft weather radar is specifically designed to emit a concentrated beam of microwave energy at potentially hazardous power levels. These hazards include the possibility of injury to ground personnel, ignition of flammable materials, including fuel, and damage to sensitive electronic devices. As the pilot in command, you are responsible for management of the radar system so as to eliminate these hazards.

The FAA has published an Advisory Circular, AC 20-68B, *Recommended Radiation Safety Precautions for Airborne Weather Radar*, that gives good basic guidelines for safe radar operation. The Advisory Circular has been included in Appendix 1 at the end of this section. Please read it thoroughly and observe its recommendations.

Maximum Permissible Exposure Level

U.S. Government standards for human exposure to microwave radiation permit a maximum level of 10 mW per square centimeter. When the radar is operating, this level may be exceeded within the area indicated in Figure 2. According to information published by the manufacturer of your antenna/receiver/transmitter (ART), strict observance of this boundary whenever your radar is operating should provide adequate protection.

WARNING

Exposure of ground personnel or other aircraft occupants to microwave energy emitted at positions within the MPEL boundary depicted in Figure 2 may be hazardous. Beware that the MPEL boundary is determined with respect to the antenna, not the radome or any other aircraft structure. The MPEL boundary shown in Figure 2 applies only to units specifically approved for use with FlightMax Radar. The MPEL boundary shown in Figure 2 does not guarantee protection against ignition of flammable materials or damage to sensitive electronic equipment exposed to microwave energy from your radar.

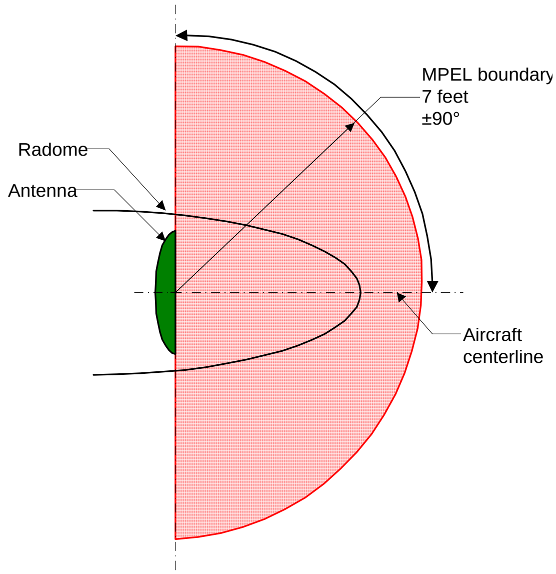

Figure 2: Maximum Permissible Exposure Level

Safe Radar Operation

CAUTION

In the event of a system malfunction, the radar could be on and emitting microwave radiation any time the FSD is on. If a malfunction of any sort is suspected, turn off the FSD and disable the radar by turning off the circuit breaker.

Based on the recommendations made by the FAA and by the manufacturer of your radar unit, Avidyne recommends the following safety procedures:

- At system startup, if the radar is not being used in flight, leave it off.
- At startup, if the radar is being used during the flight, switch to standby as soon as possible.

- Set the radar to TEST whenever it is convenient to do so in pre-takeoff checks. No microwave radiation is emitted in TEST operation. Never turn the radar ON without first checking its operation with TEST.
- Never turn the radar ON while on the ramp under any circumstances.
- To complete the pre-takeoff check or to check weather before takeoff, turn the radar ON while taxiing well clear of ground personnel, ground apparatus and other aircraft. Leave it ON for the minimum time necessary to verify proper operation of the radar or view the weather. If necessary, repeat on the runup pad with caution. Return to STANDBY when the checkout is finished.
- If radar is to be used during takeoff, do not switch it to ON until you are number one at the hold short line.
- Return the radar to STANDBY or OFF immediately after clearing the runway on landing. Do *not* continue to operate the radar while taxiing.

Radar Overview

Radar systems measure and map rainfall intensity within a scanned area. While rainfall itself is not generally hazardous to flight, intense rainfall may include severe turbulence which can be hazardous. A radar system can only display what it scans. If the antenna is not properly aligned, significant precipitation may be missed. Avoiding severe weather requires the pilot to have a complete understanding of the capabilities and limitations of his radar system, an understanding of thunderstorm dynamics, and up-to-date forecasts so as to avoid likely areas of severe weather.

FlightMax Radar provides access to all of the weather avoidance functions available with the original antenna/ receiver/transmitter (ART) unit. As the radar scans, it collects and maps rainfall intensity over a specific area to the left and right of your aircraft's heading. The intensity of rainfall at any given location is indicated by the color displayed at that point.

FlightMax Radar is also available to the Map function of the FlightMax FSD. The Map function is a terrain and navigation display with overlays of radar, traffic and lightning data. The Avidyne Radar function provides radar data to the Map function for possible overlay display.

Radar Pages and Menus

Radar's Data Page

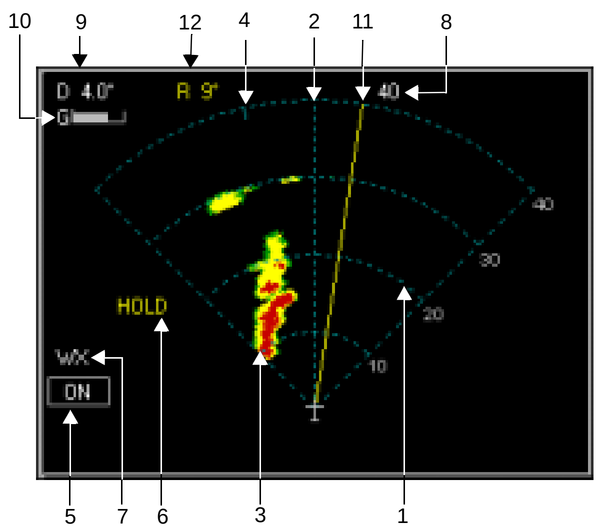

Figure 3: Radar Data Page

1. **Range Rings** - Scan limits and range rings are shown as dotted light blue lines. Range labels indicate the distance to each of the range rings.
2. **Heading Reference Line** - Marks the center of the scan area.
3. **Rainfall Echos** - Rainfall data returned from the ART, are displayed as color coded echos. See Table 1 for color meanings.
4. **Scan Indicator (Beam View™)** - The current position of the scan is shown by BeamView, a highlighted arc (as shown in Figure 3). Scan width of the arc is set at the Settings menu by your installer based on your antenna size. BeamView can be turned of and a small tic mark will indicate the position of the scan. Precipitation data is constantly updated as the radar scans.
5. **Function** - The function annunciation (ON, TEST, SBY, OFF) indicates the function status.

6. **Hold Flag** - The Hold flag indicates that the system is displaying a frozen representation of previously scanned data.

7. **Mode** - Mode (WX, WXA, GND) defines how the radar is being used. Wx and WxA orient the radar to weather phenomenon. Ground Mapping (GND) orients the radar to ground features.

8. **Range** - The Range number , indicates range intervals within the scale. The top most number indicates the the current selected range scale.

   Beam Altitude (TiltView™) (not shown)- The Beam Altitude numbers represent (in thousands of feet) the relative altitude of the center of the radar beam in relation to the aircraft's altitude at the distance shown above each number.

9. **Tilt** - Tilt indicates the angle and direction of the radar antenna: U for up, D for down and the amount of antenna tilt in quarter degrees, using decimal notation.

10. **Gain** - Receiver gain is shown on a bar whose length indicates fraction of full gain. It is shown only in ground mapping mode, since gain is not controllable in weather and weather alert modes.

11. **Bearing Line** - The bearing line provides the relative bearing to any feature displayed on the screen. The bearing line is controlled by the outer knob. It disappears from the screen after 15 seconds of non-use.

12. **Bearing** - The relative bearing of the Bearing line is given at the top of the screen – L for left, R for right and the number of degrees relative to the aircraft heading when it is selected.

Color Coding

FlightMax Radar indicates the rainfall rate by color. All standard radar indicators use a similar color coding system. Color usage is explained in Table 1.

Table 1: Rainfall Rate Color Coding

Rate (mm/ hour)	Color	Interpretation
<1	Black	Generally safe when away from other returns
1-4	Green	Use caution and observe for changes
4-12	Yellow	Caution-avoid whenever possible
12-50	Red	Danger- avoid at all times

CAUTION

FlightMax Radar is intended as a severe weather avoidance tool only. Penetrating cells or lines of cells is extremely dangerous with or without radar and must not be attempted. Give thunderstorms a wide berth. The flight precautions given in Table 1 are intended for highly proficient instrument pilots.

Radar Main Menu

The Radar main menu (Figure 4) provides access to all the operating functions used to control the radar system and options for changing the radar display.

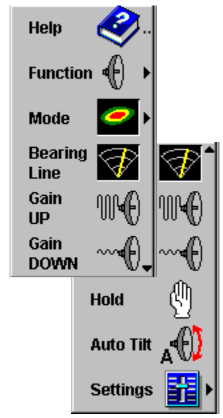

Figure 4: Radar Main Menu

Function

The radar Function menu (Figure 5) controls four functions: RADAR ON, TEST, STANDBY, and RADAR OFF. They are described below.

On

Selecting FUNCTION→ON places the radar in normal operation. The antenna scans and the Receiver/ Transmitter (R/T) transmits microwaves so as to detect precipitation. Confirmation that the radar is on is indicated by the presence of the moving scan indicator, radar echos, and the ON screen annunciation.

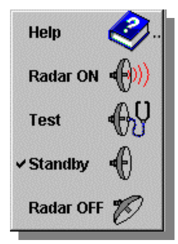

Figure 5: Function Menu

Test

Selecting FUNCTION→TEST initiates a radar self-test function that is monitored by the FlightMax FSD. The test function is confirmed by the presence of the TEST annunciation and the test display (Figure 6).

During self test, all of the circuitry and functions of the ART are exercised with the exception of the magnetron tube. No microwave energy is emitted in the test function. The test pattern display should follow the pattern shown in Figure 6 (green, yellow, red, yellow, green). If it does not, it indicates possible problems with the system that should be corrected before use.

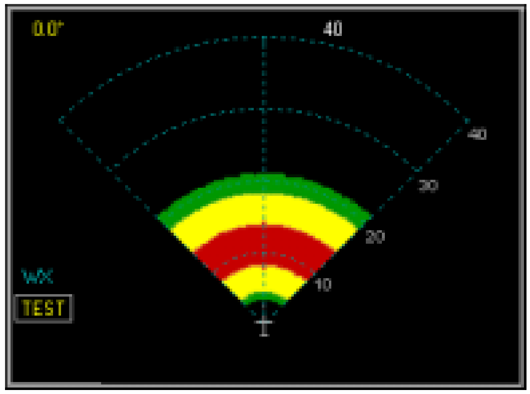

Figure 6: Radar Test Pattern

Standby

Selecting FUNCTION→STANDBY places the radar circuitry in an energized but inactive state. STANDBY Should be selected as soon as practical after starting the FSD. While in STANDBY, the magnetron tube in the ART is kept warm so the radar can be used immediately upon switching it on.

Confirmation that the radar is in standby is indicated by the absence of the moving scan indicator, no radar echo returns, and the SBY screen annunciation.

Standby mode also places the antenna Tilt in a 'Park' position as set by the installer. The park position places the antenna in one of the following positions: last position (at last shutdown), full up, centered (0°), or full down.

Off

Selecting FUNCTION→RADAR OFF removes power from the ART, disabling the radar. The antenna does not scan and no microwave energy is emitted.

Confirmation that the radar is off is indicated by the OFF annunciation on the data screen, along with the absence of radar returns and the moving scan indicator on the data screen. The radar system is off any time the FSD is off and will never be turned on except by direct action.

CAUTION

In the event of a system malfunction, the radar could be on and emitting microwave radiation any time the FSD is on. If you have any reason to suspect the radar is on, turn off the FSD or disable the radar by means of its circuit breaker before approaching ground personnel, equipment or other aircraft. Do not turn it on again except for diagnostic purposes at a safe distance from personnel and equipment.

Mode

The RADAR→MODE submenu provides for three operating options. There are three operating modes: Wx, WxA or Gnd Map. Only one mode may be used for operation.

Figure 7: Mode Menu

Wx

The Weather mode is the normal mode using during flight. Rainfall echos are displayed as color contours.

WxA

The weather alert mode operates the same as Wx mode but contains an additional feature. The red areas (the most severe conditions) flash between red and black as a further visual cue of the most hazardous conditions.

GndMap

Ground mapping mode orients the radar to ground features (Figure 8). By tilting the antenna down and varying the gain as necessary to get an intelligible image, coastlines, promontories, forested areas etc., can be displayed.

While in ground mapping mode the radar's receiver gain may be needed to bring in a display. The GAIN UP and GAIN DOWN functions are only enabled during the ground map mode. At startup the gain is set for maximum, the grey bar extends all the way across the scale.

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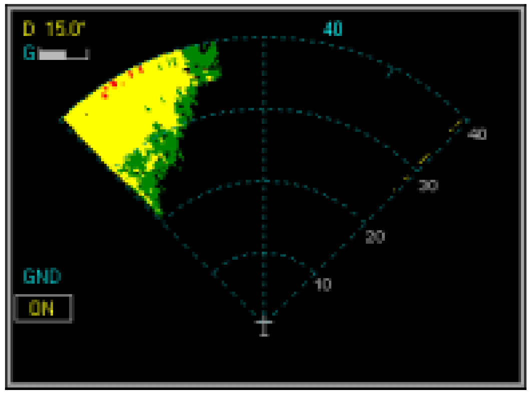


Figure 8: Ground Mapping Display

Bearing Line

A bearing line display is available within Radar. The bearing line is a yellow line drawn from the depicted aircraft position to the outer edge of the range field. The bearing line provides the pilot with an approximate bearing to a region of weather, or lack thereof.

The outer knob is used to move the bearing line right or left. The bearing line remains on screen until it is deselected or there is no knob movement for 15 seconds. Then the outer knob function reverts back to “Tilt” control.

Gain Up and Gain Down

The gain control changes the attenuation of the received signal (to the receiver portion) of the radar when in the ground mapping mode. Changing the gain is sometimes used to better examine the structure of heavy echo areas. Gain should normally remain at maximum (“full”).

The gain up and gain down functions are only available while in the GNDMAP mode. They are grayed out (inactive) when in other modes. The screen annunciation is a gray bar in the upper left corner of the screen. Maximum gain is indicated by a fully extended bar across the scale.

Hold

Hold is used to freeze the current radar echo display. The radar continues to scan, but the returns are not displayed. While HOLD is active, a screen annunciation to the left of the scanned area tells the pilot the display is no longer being updated. This allows the pilot to pause screen updates for a time, then examine changes when Hold is deactivated. Upon deactivation of HOLD, Radar resumes the normal display update from newly scanned data.

Auto-Tilt

Auto-Tilt automatically adjusts the radar antenna to maintain a constant, approximate antenna position from the point of activation. There is also compensation due to aircraft maneuvering in non stabilized radar installations. The amount of tilt is based on the altitude input and range selection. As the Range and altitude settings are changed, the Auto-Tilt will reposition the center of the radar beam at the edge of the displayed range, to the same altitude above ground, (± 10%).

To operate AutoTilt, the pilot levels off at the desired altitude and Auto-Tilt will activate. Any further changes in altitude and range adjustment is compensated for in Tilt. During operation, Auto-Tilt, lowers the tilt when Range is decreased in order to see approximately the same amount of ground returns at the edge of coverage, and raises tilt when Range is increased. Also, tilt is adjusted inversely with altitude changes to keep the radar beam at an approximate constant height above ground.

On system startup, Auto-Tilt is deactivated and the antenna position is left in its park position. Selecting Auto-Tilt from the radar main menu, sends a command to the radar sensor, which places it in the Auto-Tilt operating mode. A checkmark appears beside the Auto-Tilt menu item.

> **NOTE:** Manual tilt control is not available when Auto Tilt is active.

Settings

The Settings menu provides access to certain radar "settings". They include the following:

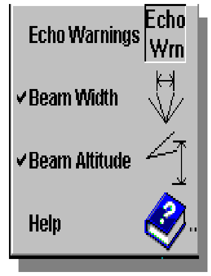


Figure 9: Settings Menu

Echo Warnings

Selecting this function allows for enabling or disabling of the Echo warnings function, which is used to display echo ahead warning messages in the message bar. See the Messages and Error Indications section for more information Echo Ahead messages. Once this parameter has been set it will be maintained from use to use.

Beam Width (BeamView) display

Selecting this function enables or disables the BeamView display. BeamView depicts a moving wedge across the radar screen that follows the sweep of the radar antenna. This wedge is sized to represent the actual beam width and is drawn in the black area of the normal sweep, underneath any echo information. The actual beam width is determined in the Radar Setup page and is based on the actual beam width of your specific R/T. Setup of the beam width should be done by your installer.

Beam Altitude (TiltView) display

Selecting this function turns On/Off the TiltView display. The TiltView numbers are depicted next to each range ring distance on the radar data page, in yellow. The numbers represent (in thousands of feet) the relative altitude of the center of the radar beam in relation to the aircraft's altitude. The beam altitude numbers take into account the Tilt and Range settings.

> **NOTE:** In non stabilized radars the number value is only correct in straight and level flight.

How to Use Radar

Radar Startup

FlightMax Radar starts automatically as part of the normal initialization sequence of the FSD. To use RADAR do the following:

1. Turn the FSD on. The unit will go through its normal startup sequence.
2. Press **Enter** when prompted. This will bring up the Map display.
3. Press **Escape** to bring up the Main Menu.
4. Select Radar from Main Menu.
5. Radar then displays its data page and main menu.

   Radar restores all mode selections that were active when it was last used.

Pre-takeoff Check

While at a safe distance from ground personnel, equipment and other aircraft, briefly turn the radar on and tilt the antenna below zero degrees.

WARNING

Do not turn your radar on except in accordance with the safety recommendations given in the Radar Safety section.

- Watch for the appearance of ground reflections, verifying that the ART is operating properly and that the antenna tilt is working correctly.
- Tilt the antenna through its full range, verifying appropriately changing images of objects on the ground below zero degrees, fading as you move through the horizon, to be replaced by images of any weather that may be present as you tilt the antenna up.

Turn the radar off as soon as possible after this test.

Test

Use the FUNCTION→TEST mode before every flight where radar is going to be used. Make it a part of the pre-takeoff checklist. The radar should be off and the FSD on, prior to performing a self test.

1. From the FUNCTION menu select stdby.

   Placing the radar in standby allows the magnetron tube to warm up. It should take approximately 2 minutes.

2. After the tube is warm, select test from the FUNCTION menu.

   While in test also check for:

   - proper operation of the range control (the pattern should change appropriately with selected range)
   - for proper operation of weather alert (WxA) mode (the red band should flash).

Turning the Radar On/Off

WARNING

Do not turn your radar on except in accordance with the safety recommendations given in the Radar Safety section.

To turn the radar on, go to Radar's main menu and select FUNCTION→ON.

To turn the radar off, go to Radar's main menu and select FUNCTION→OFF

Displaying Weather

1. In Radar's main menu, select MODE→WX for normal weather display or MODE→WXA for "weather alert" mode (i.e., red echos flash).
2. Tilt the antenna as necessary to visualize weather at, above or below your altitude.

Displaying Ground Map Data

1. In radar's main menu, select MODE→GND MAP.
2. Tilt the antenna and vary the gain as necessary to get a useful image.
3. Gain is controlled only in ground map mode.

   From Radar's main menu, select gain up or gain down to increase or decrease the R/T's gain.

Changing the Antenna's Tilt

1. Ensure that the bearing line is not active. If it is active, deselect the function.
2. Rotate the outer cursor control knob to manually adjust the antenna's tilt.

   The annunciation is in the upper left corner of the display screen. Tilt values are in degrees and range from D15.00° (DOWN) to U15.00° (UP). The outer knob only adjusts 'Tilt' when the 'Bearing Line' is not selected.
3. The tilt can also function automatically.

   From Radar's main menu select Auto Tilt to activate automatic tilt control.

Displaying the Bearing Line

1. In Radar's main menu, select BEARING LINE.

   A yellow line will appear on the center line azimuth and a yellow annunciation indicating the direction (right or left) and the value (in one degree increments) is displayed above the range field.
2. Rotate the outer cursor control knob to position the bearing line.
3. The bearing line will automatically disappear after 15 seconds of disuse.

Enable Echo Warnings

1. From radar's main menu, select SETTINGS→ECHO WARNINGS.
2. An area forming a 22° wedge from the nose of the aircraft is checked for total echos (indicating rainfall).
3. If there are storm indications ahead, the message bar will display RADAR ECHOS AHEAD or HEAVY RADAR ECHOS AHEAD depending upon the intensity of the storms.

Range Control

1. The inner, knob always controls the range scale except during system calibration (which is done by your installer).
2. Turn the knob clockwise to increase the scale and counter clockwise to decrease the scale.

Outer Knob Functions

The large, outer knob controls either antenna tilt, bearing line position, or Roll Trim (RDR-1100) depending on your selection.

The Outer Knob's function is annunciated by an icon and text in the lower right of the screen that is visible when the menu is visible.

Changing Beam Altitude

Beam Altitude is adjusted in conjunction with the range and antenna tilt. There is no independent control of Beam Altitude.

Adjusting the antenna tilt with the outer knob or adjusting the range with the inner knob will also change the beam altitude.

Messages and Error Indications

Table 2: Messages Issued by Radar

Message	Meaning
RADAR ECHOS AHEAD	Indicates presence of significant green and/or yellow echos within the currently selected range and ±22º of the aircraft heading. Generated only when an option other than Radar is being displayed.
HEAVY RADAR ECHOS AHEAD	Indicates presence of significant red echos within the currently selected range and ±22º of the aircraft heading. Generated only when an option other than Radar is being displayed.
SPEED BELOW 20 KTS – TURN RADAR OFF	Radar is ON (scanning) and GPS-reported ground speed is below 20 kts, suggesting that you have landed. Displayed only when an option other than Radar is being displayed.
BAD GROUND SPEED INPUT; NOTE RADAR IS ON	Radar is turned on and GPS-is not reporting valid ground speed. Displayed only when an option other than Radar is being displayed.
Groundspeed Input Operational	Ground speed data has been restored.
LOSS OF RADAR DATA	Communication with the radar sensor has been lost – no data is available.
RADAR SENSOR DATA RESTORED	Communication with the radar sensor has been restored.
RADAR ERROR	An error has occurred in the radar sensor system.This message will appear in four different cases and R/T Fault (general).

Table 2: Messages Issued by Radar

Message	Meaning
RADAR ERROR CLEARED	The previously reported error in the radar sensor system has been corrected
RADAR FAILURE	The radar system has failed. This error will *not* be cleared until the system is shut down and restarted.

Echo Ahead

The Echo Ahead warning monitors a predetermined area for significant radar returns while viewing other FSD functions. The alert is displayed in the message bar.

The monitored area (Figure 10) is a wedge 22º to either side of the aircraft nose to the range limit currently in use. Within this area, Radar checks the total indicated rainfall. Above a predetermined level of green/yellow content, Radar displays the message, “RADAR ECHOS AHEAD”. Above a predetermined level of red content, Radar instead displays the message, “HEAVY RADAR ECHOS AHEAD”.

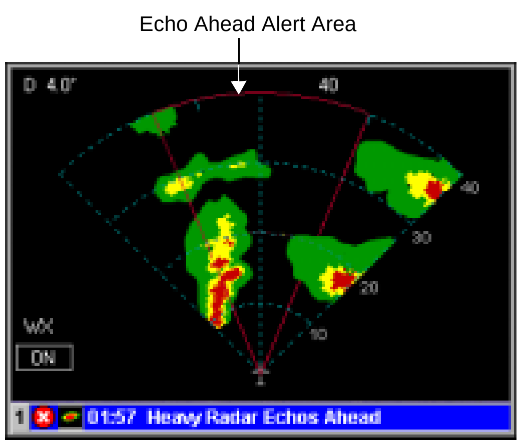


Figure 10: Echo Ahead

Low Ground Speed Warning

The Low Ground Speed Warning is a reminder to turn off the radar upon landing. FlightMax Radar monitors the ground speed reported by the GPS and, when your ground speed falls below 20 knots, the FSD displays a message in the Message Bar indicating “SPEED BELOW 20 KTS. – TURN RADAR OFF”.

If Radar is unable to obtain a valid ground speed from the system’s GPS interface while the radar is on, it displays the message “BAD GNDSPD INPUT; NOTE RADAR IS ON” in the Message Bar.

CAUTION

It is the pilot in command’s responsibility to insure that the radar is turned off after landing. Do not rely on the low ground speed message to prompt you to do so. We recommend that you make it a checklist item to turn off the radar after exiting the runway.

Menu Tree

The following Menu Tree graphically depicts the paths to all the Radar menu functions.

- Radar
  - Function
    - On
    - Test
    - Standby
    - Off
    - Help
  - Mode
    - Wx
    - WxA
    - Gnd Map
    - Help
  - Bearing Line
  - Gain Up
  - Gain Down
  - Hold
  - AutoTilt
  - Settings
    - Echo Warnings
    - Adjust Roll Trim
    - Stabilization
    - Beam Width
    - Beam Altitude
    - Help
  - Help

Appendix 1 - AC 20-68B

RECOMMENDED RADIATION SAFETY PRECAUTIONS FOR GROUND OPERATION OF AIRBORNE WEATHER RADAR

Department of Transportation

Federal Aviation Administration

8/8/80

Initiated by: AFO-512

1. **PURPOSE**. This circular sets forth recommended radiation safety precautions to be taken by personnel when operating airborne weather radar on the ground.

2. **CANCELLATION.** AC 20-68A, dated April 11, 1975, is canceled.

3. **RELATED READING MATERIAL.**
   a. Barnes and Taylor, Radiation Hazards and Protection (London: George Newnes Limited, 1963), p. 211.
   b. U.S. Department of Health, Education and Welfare, Public Health Service, Consumer Protection and Environmental Health Service, "Environmental health microwaves, ultraviolet radiation and radiation from lasers and television receivers - An Annotated Bibliography," FS 2.300: RH-35, Washington, U.S. Government Printing Office, pp. 56 - 57.
   c. Mumford, W. W., "Some technical aspects of microwave radiation hazards," Proceedings of the IRE, Washington, U.S. Government Printing Office, February 1961, pp. 427 - 447.

4. **BACKGROUND**. Dangers from ground operation of airborne weather radar include the possibility of human body damage and ignition of combustible materials by radiated energy. Low tolerance parts of the body include the eyes and testes.

5. **PRECAUTIONS.** Management and supervisory personnel should establish procedures for advising personnel of dangers from operating airborne weather radars on the ground. Precautionary signs should be displayed in affected areas to alert personnel of ground testing.
   a. General.
      (1) Airborne weather radar should be operated on the ground only by qualified personnel.

(2) Installed airborne radar should not be operated while the aircraft is in a hangar or other enclosure unless the radar transmitter is not operating, or the energy is directed toward an absorption shield which dissipates the radio frequency energy. Otherwise, radiation within the enclosure can be reflected throughout the area.

b. Body Damage. To prevent possible human body damage, the following precautions should be taken:

(1) Personnel should never stand nearby and in front of a radar antenna which is transmitting. When the antenna is not scanning, the danger increases.

(2) A recommended safe distance from operating airborne weather radars should be established. A safe distance can be determined by using the equations in Appendix 1 [omitted] or the graphs of figures 1 and 2 [omitted]. This criterion is now accepted by many industrial organizations and is based on limiting exposure of humans to an average power density not greater than 10 milliwatts per square centimeter.

(3) Personnel should be advised to avoid the end of an open waveguide unless the radar is turned off.

(4) Personnel should be advised to avoid looking into a waveguide, or into the open end of a coaxial connector or line connector to a radar transmitter output, as severe eye damage may result.

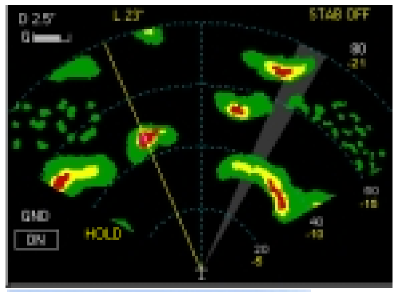
(5) Personnel should be advised that when high power radar transmitters are operated out of their protective cases, X-rays may be emitted. Stray X-rays may emanate from the glass envelope type pulser, oscillator, clipper, or rectifier tubes, as well as magnetrons.

c. Combustible Materials. To prevent possible fuel ignition, an installed airborne weather radar should not be operated while an aircraft is being refueled or defueled.

/s/

M. C. BEARD Director of Airworthiness

FlightMax™
Flight Situation Display



FlightMax Radar
(RDR-1100/1200/1300)

Part Number 600-0066   Revision 00

Revision History

Date	Revision	Description
Sep. 7, 2000	00	Production Release

Avidyne Corporation
55 Old Bedford Road
Lincoln, Massachusetts 01773
Web Site: www.avidyne.com

FlightMax Radar
Contents

Figures

Tables

FlightMax Radar

Introduction

This part of the Pilot's Guide, explains FlightMax Radar.

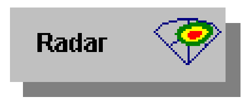


Figure 1: Radar Icon

FlightMax Radar is an interface, control and display function for airborne weather radar systems. It duplicates the weather display functions of the original equipment indicators supplied with the following Bendix/King radar's: RDR-1100/1200/1300. Topics include:

- *Radar Safety* - general radar safety information.
- *Radar Overview* - presents an overview of Radar.
- *Radar Pages and Menus* - explains all pages and menus used in Radar.
- *How to Use Radar* - explains how to perform specific tasks using Radar.
- *Messages and Error Indications* - provides the meanings of Radar messages and error indications.
- *Menu Tree* - shows the path to any menu in Radar.

FlightMax Radar is verified by the presence of its icon and text label in the Main Menu. If Radar's icon and label, shown in Figure 1, are not present in the Main Menu, contact your installer for assistance.

Radar Safety

Aircraft weather radar is specifically designed to emit a concentrated beam of microwave energy at potentially hazardous power levels. These hazards include the possibility of injury to ground personnel, ignition of flammable materials, including fuel, and damage to sensitive electronic devices. As the pilot in command, you are responsible for management of the radar system so as to eliminate these hazards.

The FAA has published an Advisory Circular, AC 20-68B, *Recommended Radiation Safety Precautions for Airborne Weather Radar*, that gives good basic guidelines for safe radar operation. The Advisory Circular has been included in Appendix 1 at the end of this section. Please read it thoroughly and observe its recommendations.

Maximum Permissible Exposure Level

U.S. Government standards for human exposure to microwave radiation permit a maximum level of 10 mW per square centimeter. When the radar is operating, this level may be exceeded within the area indicated in Figure 2. According to information published by the manufacturer of your antenna/receiver/transmitter (ART), strict observance of this boundary whenever your radar is operating should provide adequate protection.

WARNING

Exposure of ground personnel or other aircraft occupants to microwave energy emitted at positions within the MPEL boundary depicted in Figure 2 may be hazardous. Beware that the MPEL boundary is determined with respect to the antenna, not the radome or any other aircraft structure. The MPEL boundary shown in Figure 2 applies only to units specifically approved for use with FlightMax Radar. The MPEL boundary shown in Figure 2 does not guarantee protection against ignition of flammable materials or damage to sensitive electronic equipment exposed to microwave energy from your radar.

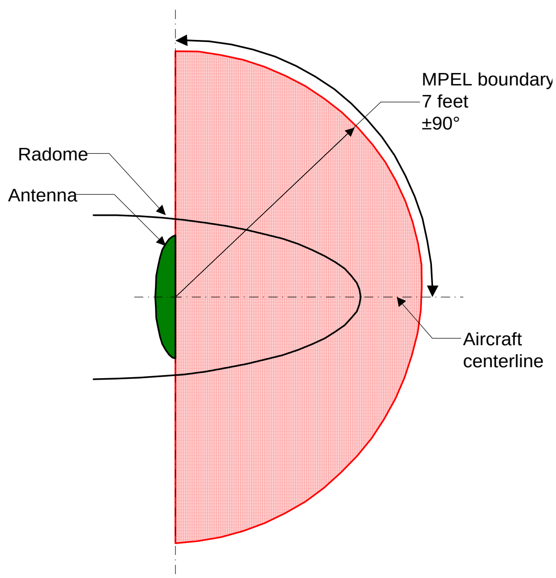


Figure 2: Maximum Permissible Exposure Level

Safe Radar Operation

CAUTION

In the event of a system malfunction, the radar could be on and emitting microwave radiation any time the FSD is on. If a malfunction of any sort is suspected, turn off the FSD and disable the radar by turning off the circuit breaker.

Based on the recommendations made by the FAA and by the manufacturer of your radar unit, Avidyne recommends the following safety procedures:

- At system startup, if the radar is not being used in flight, leave it off.
- At startup, if the radar is being used during the flight, switch to standby as soon as possible.

- Set the radar to TEST whenever it is convenient to do so in pre-takeoff checks. No microwave radiation is emitted in TEST operation. Never turn the radar ON without first checking its operation with TEST.
- Never turn the radar ON while on the ramp under any circumstances.
- To complete the pre-takeoff check or to check weather before takeoff, turn the radar ON while taxiing well clear of ground personnel, ground apparatus and other aircraft. Leave it ON for the minimum time necessary to verify proper operation of the radar or view the weather. If necessary, repeat on the runup pad with caution. Return to STANDBY when the checkout is finished.
- If radar is to be used during takeoff, do not switch it to ON until you are number one at the hold short line.
- Return the radar to STANDBY or OFF immediately after clearing the runway on landing. Do *not* continue to operate the radar while taxiing.

Radar Overview

Radar systems measure and map rainfall intensity within a scanned area. While rainfall itself is not generally hazardous to flight, intense rainfall may include severe turbulence which can be hazardous. A radar system can only display what it scans. If the antenna is not properly aligned, significant precipitation may be missed. Avoiding severe weather requires the pilot to have a complete understanding of the capabilities and limitations of his radar system, an understanding of thunderstorm dynamics, and up-to-date forecasts so as to avoid likely areas of severe weather.

FlightMax Radar provides access to all of the weather avoidance functions available with the original antenna/receiver/transmitter (ART) unit. As the radar scans, it collects and maps rainfall intensity over a specific area to the left and right of your aircraft's heading. The intensity of rainfall at any given location is indicated by the color displayed at that point.

The main data page where the pilot views Radar operation is a full screen color depiction of mapped radar echoes. A 'Sector Scan' mode is available that reduces the forward scan to 60° in sensors that support this mode. Normally the Scan is 120°. Echoes from a minimum of 2 miles to the maximum of the sensor being used are displayed. The echoes appear in real time in correlation with the scanning of the radar antenna.

FlightMax Radar is also available to the Map function of the FlightMax FSD. The Map function is a terrain and navigation display with overlays of radar, traffic and lightning data. The Avidyne Radar function provides radar data to the Map function for possible overlay display.

Radar Pages and Menus

Radar's Data Page

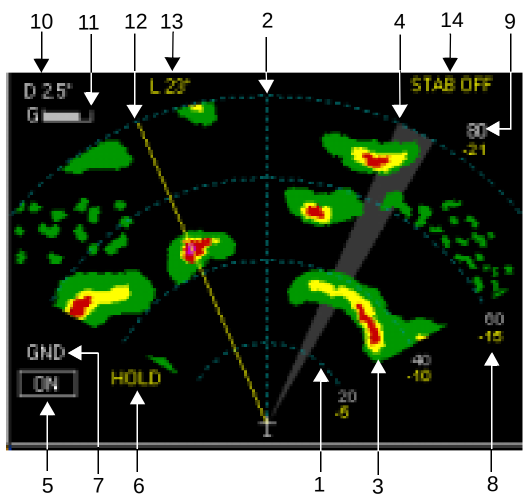


Figure 3: Radar Data Page

NOTE: Figure 3 displays as many features as possible. Your particular radar may not support all these features.

1. **Range Rings** - Scan limits and range rings are shown as dotted light blue lines. Range labels indicate the distance to each of the range rings.
2. **Heading Reference Line** - Marks the center of the scan area.
3. **Rainfall Echos** - Rainfall data returned from the ART, are displayed as color coded echos. See Table 1 for color meanings.
4. **Scan Indicator (Beam View™)** - The current position of the scan is shown by BeamView, a highlighted arc (as shown in Figure 3). Scan width of the arc is set at the Settings menu by your installer based on your antenna size. BeamView can be turned of and a small tic mark will indicate the position of the scan.

Precipitation data is constantly updated as the radar scans.

5. **Function** - The function annunciation (ON, TEST, SBY, OFF) indicates the function status.
6. **Hold Flag** - The Hold flag indicates that the system is displaying a frozen representation of previously scanned data.
7. **Mode** - Mode (WX, WXA, GNDMAP/SRCH) defines how the radar is being used. Wx and WxA orient the radar to weather phenomenon. GroundMap (GNDMAP) or Search (SRCH) orients the radar to ground features. Search is used on the RDR-1300.
8. **Beam Altitude (TiltView™)** - The Beam Altitude numbers represent (in thousands of feet) the relative altitude of the center of the radar beam in relation to the aircraft's altitude at the distance shown above each number.
9. **Range** - The Range number indicates range intervals within the scale. The top most number indicates the the current selected range scale.
10. **Tilt** - Tilt indicates the angle and direction of the radar antenna: U for up, D for down and the amount of antenna tilt in quarter degrees, using decimal notation.
11. **Gain** - Receiver gain is shown on a bar whose length indicates fraction of full gain. It is shown only in Search or GroundMap mode, since gain is not controllable in weather and weather alert modes.
12. **Bearing Line** - The bearing line provides the relative bearing to any feature displayed on the screen. The bearing line is controlled by the outer knob. It disappears from the screen after 15 seconds of non-use.
13. **Bearing** - The relative bearing of the Bearing line is given at the top of the screen – L for left, R for right and the number of degrees relative to the aircraft heading when it is selected.
14. **Stabilization Status** -Indicates the status of the radar's gyro-stabilization. The on screen annunciation, STAB OFF will disappear when stabilization is turned on.

Color Coding

FlightMax Radar indicates the rainfall rate by color. All standard radar indicators use a similar color coding system. Color usage is explained in Table 1.

Table 1: Rainfall Rate Color Coding

Rate (mm/ hour)	Color	Interpretation
<1	Black	Generally safe when away from other returns
1-4	Green	Use caution and observe for changes
4-12	Yellow	Caution-avoid whenever possible
>12	Red	Danger- avoid at all times

NOTE: On some radars during startup the screen may have a blue tint. This is normal while the R/T is warming up.

CAUTION

FlightMax Radar is intended as a severe weather avoidance tool only. Penetrating cells or lines of cells is extremely dangerous with or without radar and must not be attempted. Give thunderstorms a wide berth. The flight precautions given in Table 1 are intended for highly proficient instrument pilots.

Radar Main Menu

Figure 4: Radar Main Menu

The Radar main menu (Figure 4) provides access to all the operating functions used to control the radar system and options for changing the radar display.

Function

The radar Function menu (Figure 5) controls four functions: RADAR ON, TEST, STANDBY, and RADAR OFF. They are described below.

On

Selecting FUNCTION→ON places the radar in normal operation. The antenna scans and the Receiver/Transmitter (R/T) transmits microwaves so as to detect weather. Confirmation that the radar is on is indicated by the presence of the moving scan indicator, radar echos, and the ON screen annunciation.

Test

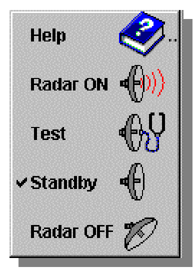


Figure 5: Function Menu

Selecting FUNCTION→TEST initiates a radar self-test function that is monitored by the FlightMax FSD. The test function is confirmed by the presence of the TEST annunciation and the test display (Figure 6).

During self test, all of the circuitry and functions of the ART are exercised with the exception of the magnetron tube. No microwave energy is emitted in the test function. The test pattern display should look similar to the pattern shown in Figure 6 (green, yellow, and red). If it does not, it indicates possible problems with the system that should be corrected before use.

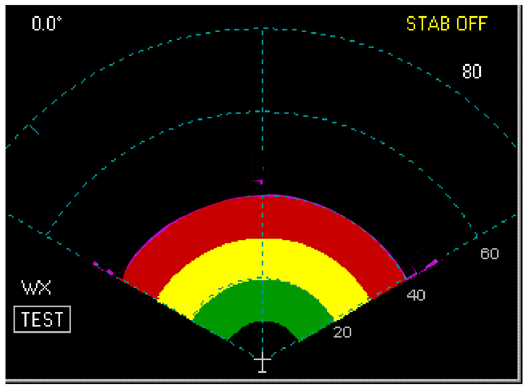


Figure 6: Radar Test Pattern

Standby

Selecting FUNCTION→STANDBY places the radar circuitry in an energized but inactive state. STANDBY Should be selected as soon as practical after starting the FSD. While in STANDBY, the magnetron tube in the ART is kept warm so the radar can be used immediately upon switching it on.

Confirmation that the radar is in standby is indicated by the absence of the moving scan indicator, no radar echo returns, and the SBY screen annunciation.

Standby mode also places the antenna Tilt in a 'Park' position as set by the installer. The park position places the antenna in one of the following positions: last position (at last shutdown), full up, centered (0°), or full down.

Off

Selecting FUNCTION→RADAR OFF removes power from the ART, disabling the radar. The antenna does not scan and no microwave energy is emitted.

Confirmation that the radar is off is indicated by the OFF annunciation on the data screen, along with the absence of radar returns and the moving scan indicator on the data screen. The radar system is off any time the FSD is off and will never be turned on except by direct action.

CAUTION

In the event of a system malfunction, the radar could be on and emitting microwave radiation any time the FSD is on. If you have any reason to suspect the radar is on, turn off the FSD or disable the radar by means of its circuit breaker before approaching ground personnel, equipment or other aircraft. Do not turn it on again except for diagnostic purposes at a safe distance from personnel and equipment.

Mode

The RADAR→MODE submenu provides several operating options for radar. There are three operating modes: Wx, WxA or SRCH/GnDMap. They are described below.

Figure 7: Mode Menu

Wx

The Wx mode is the normal weather mode using during flight. On system startup the Wx mode is preselected. The Wx mode is available in all supported radar sensors.

WxA

The weather alert mode operates the same as the Wx mode but contains an additional feature. The magenta areas (the most severe conditions) flash between magenta and black as a further visual cue of the most hazardous conditions.

SRCH/GnDMap

Search/GndMap mode orients the radar to ground features (Figure 8). By tilting the antenna down and varying the gain as necessary to get an intelligible image, coastlines, promontories, forested areas etc., can be displayed.

While in Search/GndMap mode the radar's receiver gain is needed to bring in a display. The GAIN UP and GAIN DOWN functions are only enabled during the Search/GndMap mode. At startup the gain is set for maximum, the grey bar extends all the way across the scale.

.

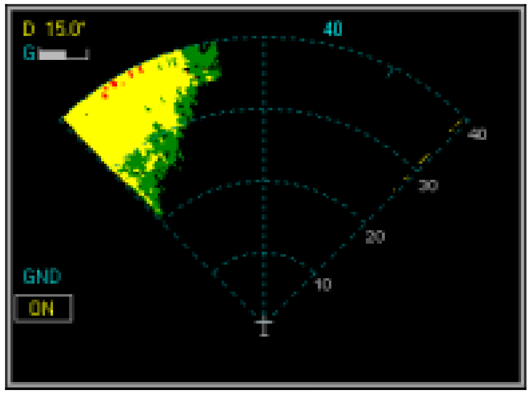


Figure 8: Search/GndMap Display

Bearing Line

A bearing line display is available within Radar. The bearing line is a yellow line drawn from the from the depicted aircraft position to the outer edge of the range field. The bearing line provides the pilot with an approximate bearing to a region of weather, or lack thereof.

> **NOTE:** the bearing line cannot be selected when “Roll Trim” is active.

The outer knob is used to move the bearing line right or left. The bearing line remains on screen until it is deselected or there is no knob movement for 15 seconds. Then the outer knob function reverts back to “Tilt” control.

Gain Up and Gain Down

The gain control changes the attenuation of the received signal (to the receiver portion) of the radar when in the Search/GndMap mode. Changing the gain is sometimes used to better examine the structure of heavy echo areas. Gain should normally remain at maximum (“full”).

The gain up and gain down functions are only available while in the SRCH/GNDMAP mode. They are grayed out (inactive) when in other modes. The screen annunciation is a gray bar in the upper left corner of the screen.

Maximum gain is indicated by a fully extended bar across the scale.

Hold

Hold is used to freeze the current radar echo display. The radar continues to scan, but the returns are not displayed. While HOLD is active, a screen annunciation to the left of the scanned area tells the pilot the display is no longer being updated. This allows the pilot to pause screen updates for a time, then examine changes when Hold is deactivated. Upon deactivation of HOLD, Radar resumes the normal display update from newly scanned data.

Auto-Tilt

Auto-Tilt automatically adjusts the radar antenna to maintain a constant, approximate antenna position from the point of activation. There is also compensation due to aircraft maneuvering in non stabilized radar installations. The amount of tilt is based on the altitude input and range selection. As the Range and altitude settings are changed, the Auto-Tilt will reposition the center of the radar beam at the edge of the displayed range, to the same altitude above ground, (± 10%).

To operate AutoTilt, the pilot levels off at the desired altitude and Auto-Tilt will activate. Any further changes in altitude and range adjustment is compensated for in Tilt. During operation, Auto-Tilt, lowers the tilt when Range is decreased in order to see approximately the same amount of ground returns at the edge of coverage, and raises tilt when Range is increased. Also, tilt is adjusted inversely with altitude changes to keep the radar beam at an approximate constant height above ground.

On system startup, Auto-Tilt is deactivated and the antenna position is left in its park position. Selecting Auto-Tilt from the radar main menu, sends a command to the radar sensor, which places it in the Auto-Tilt operating mode. A checkmark appears beside the Auto-Tilt menu item.

> **NOTE:** Manual tilt control is not available when Auto Tilt is active.

Sector Scan

Sector Scan is a reduced scan function that allows pilots to view a forward 60° arc of the normal scanning area. A 60° scan arc replaces the normally displayed scan arc (90°, 100° or 120°) and the radar sweep is confined to that 60° arc. This produces quicker echo updates.

Settings

The Settings menu provides access to certain radar "settings". They include the following:

Figure 9: Settings Menu

Echo Warnings

Selecting this function allows for enabling or disabling of the Echo warnings function, which includes displaying echo ahead warning messages in the message bar. See the Messages and Error Indications section for more information on Echo Ahead messages. Once this parameter has been set it will be maintained from use to use.

Adjust Roll Trim

Selecting this function enables the Roll Trim adjustment. Upon selection, the Outer Knob controls the Roll Trim adjust (refer to the appropriate Bendix/King Users manual on how to adjust for proper trim), and a Roll Trim Adjust annunciation appears on the screen. Once this parameter has been set it will be maintained from use to use.

When Roll Trim is selected the Bearing Line function is deactivated.

> **NOTE:** Normally this adjustment should be done as part of the system setup and calibration.

Stabilization

The Stabilization function allows for enabling and disabling of gyro stabilization of gyro-stabilized radar sensors. An on-screen display, informing the pilot that stabilization is off, is displayed in the upper right had corner.

Beam Width (BeamView) display

Selecting this function enables or disables the BeamView display. BeamView depicts a moving wedge across the radar screen that follows the sweep of the radar antenna. This wedge is sized to represent the actual beam width and is drawn in the black area of the normal sweep, underneath any echo information. The actual beam width is determined in the Radar Setup page and is based on the actual beam width of your specific R/T. Setup of the beam width should be done by your installer.

Beam Altitude (TiltView) display

Selecting this function turns On/Off the TiltView display. The TiltView numbers are depicted next to each range ring distance on the radar data page, in yellow. The numbers represent (in thousands of feet) the relative altitude of the center of the radar beam in relation to the aircraft's altitude. The beam altitude numbers take into account the Tilt and Range settings.

> **NOTE:** In non stabilized radars the number value is only correct in straight and level flight.

Azimuth Lines (RT-1301A/B Only)

This is a toggle function that turns On/Off additional azimuth lines at ±15° and ±30° on the Radar data page.

How to Use Radar

Radar Startup

FlightMax Radar starts automatically as part of the normal initialization sequence of the FSD. To use RADAR do the following:

1. Turn the FSD on. The unit will go through its normal startup sequence.
2. Press **Enter** when prompted. This will bring up the Map display.
3. Press **Escape** to bring up the Main Menu.
4. Select Radar from Main Menu.
5. Radar then displays its data page and main menu.
   Radar restores all mode selections that were active when it was last used.

Pre-takeoff Check

While at a safe distance from ground personnel, equipment and other aircraft, briefly turn the radar on and tilt the antenna below zero degrees.

WARNING

Do not turn your radar on except in accordance with the safety recommendations given in Radar Safety.

- Watch for the appearance of ground reflections, verifying that the ART is operating properly and that the antenna tilt is working correctly.
- Tilt the antenna through its full range, verifying appropriately changing images of objects on the ground below zero degrees, fading as you move through the horizon, to be replaced by images of any weather that may be present as you tilt the antenna up.

Turn the radar off as soon as possible after this test.

Test

Use the FUNCTION→TEST mode before every flight where radar is going to be used. Make it a part of the pre-takeoff checklist. The radar should be off and the FSD on, prior to performing a self test.

1. From the FUNCTION menu select STDBY.

   Placing the radar in standby allows the magnetron tube to warm up. It should take approximately 2 minutes.

2. After the tube is warm, select test from the FUNCTION menu.

   While in test also check for:

   - proper operation of the range control (the pattern should change appropriately with selected range)
   - for proper operation of weather alert (WxA) mode (the magenta band should flash).

Turning the Radar On/Off

WARNING

Do not turn your radar on except in accordance with the safety recommendations given in the Radar Safety section.

To turn the radar on, go to Radar's main menu and select FUNCTION→ON.

To turn the radar off, go to Radar's main menu and select FUNCTION→OFF.

Displaying Weather

1. In Radar's main menu, select MODE→WX for normal weather display or MODE→WXA for "weather alert" mode (i.e., red echos flash).
2. Tilt the antenna as necessary to visualize weather at, above or below your altitude.

Displaying Search/GndMap Data

1. In radar's main menu, select MODE→GND MAP/SRCH.
2. Tilt the antenna and vary the gain as necessary to get a useful image.
3. Gain is controlled only in the Search/GndMap mode.

   From Radar's main menu, select gain up or gain down to increase or decrease the R/T's gain.

Changing the Antenna's Tilt

1. Ensure that the bearing line or Roll Trim Adjust are not active. If either one is active, deselect the function.
2. Rotate the outer cursor control knob to manually adjust the antenna's tilt.

   The annunciation is in the upper left corner of the display screen. Tilt values are in degrees and range from D15.00° (DOWN) to U15.00° (UP). The outer knob only adjusts 'Tilt' when 'Bearing Line' and 'Roll Trim Adjust' are not selected.
3. The tilt can also function automatically.

   From Radar's main menu select Auto Tilt to activate automatic tilt control.

Displaying the Bearing Line

1. In Radar's main menu, select BEARING LINE.

   A yellow line will appear on the center line azimuth and a yellow annunciation indicating the direction (right or left) and the value (in one degree increments) is displayed above the range field.
2. Rotate the outer cursor control knob to position the bearing line.
3. The bearing line will automatically disappear after 15 seconds of disuse or may be dismissed by pressing BEARING LINE again.

NOTE: Tilt will not operate while the Bearing Line is displayed.

Enable Echo Warnings

1. From radar's main menu, select SETTINGS→ECHO WARNINGS.
2. An area forming a 22° wedge from the nose of the aircraft is checked for total echos (indicating rainfall).
3. If there are storm indications ahead, the message bar will display RADAR ECHOS AHEAD or HEAVY RADAR ECHOS AHEAD depending upon the intensity of the storms.

Range Control

1. The inner, knob always controls the range scale except during system calibration (which is done by your installer).
2. Turn the knob clockwise to increase the scale and counter clockwise to decrease the scale.

Outer Knob Functions

The large, outer knob controls either antenna tilt, bearing line position, or Roll Trim depending on your selection.

The Outer Knob's function is annunciated by an icon and text in the lower right of the screen that is visible when the menu is visible.

Changing Beam Altitude

Beam Altitude is adjusted in conjunction with the range and antenna tilt. There is no independent control of Beam Altitude.

Adjusting the antenna tilt with the outer knob or adjusting the range with the inner knob will also change the beam altitude.

Messages and Error Indications

Table 2: Messages Issued by Radar

Message	Meaning
RADAR ECHOS AHEAD	Indicates presence of significant green and/or yellow echos within the currently selected range and ±22º of the aircraft heading. Generated only when an option other than Radar is being displayed.
HEAVY RADAR ECHOS AHEAD	Indicates presence of significant red and/ or magenta echos within the currently selected range and ±22º of the aircraft heading. Generated only when an option other than Radar is being displayed.
SPEED BELOW 20 KTS – TURN RADAR OFF	Radar is ON (scanning) and GPS-reported ground speed is below 20 kts, suggesting that you have landed. Displayed only when an option other than Radar is being displayed.
BAD GROUND SPEED INPUT; NOTE RADAR IS ON	Radar is turned on and GPS-is not reporting valid ground speed. Displayed only when an option other than Radar is being displayed.
GROUNDSPEED INPUT OPERATIONAL	Ground speed data has been restored.
LOSS OF RADAR DATA	Communication with the radar sensor has been lost – no data is available.
RADAR SENSOR DATA RESTORED	Communication with the radar sensor has been restored.
RADAR ERROR	An error has occurred in the radar sensor system.This message will appear in four different cases: Driver-Reported Error (driver overrun) and four R/T Fault conditions: Antenna Fault, Transmit Fault and R/T Fault (general).

Table 2: Messages Issued by Radar

Message	Meaning
RADAR ERROR CLEARED	The previously reported error in the radar sensor system has been corrected
RADAR FAILURE	The radar system has failed. This error will *not* be cleared until the system is shut down and restarted.

Echo Ahead

The Echo Ahead warning monitors a predetermined area for significant radar returns while viewing other FSD functions. The alert is displayed in the message bar.

The monitored area (Figure 10) is a wedge 22º to either side of the aircraft nose to the range limit currently in use. Within this area, Radar checks the total indicated rainfall. Above a predetermined level of green/yellow content, Radar displays the message, “RADAR ECHOS AHEAD”. Above a predetermined level of red/magenta content, Radar instead displays the message, “HEAVY RADAR ECHOS AHEAD”.

.

Echo Ahead Alert Area

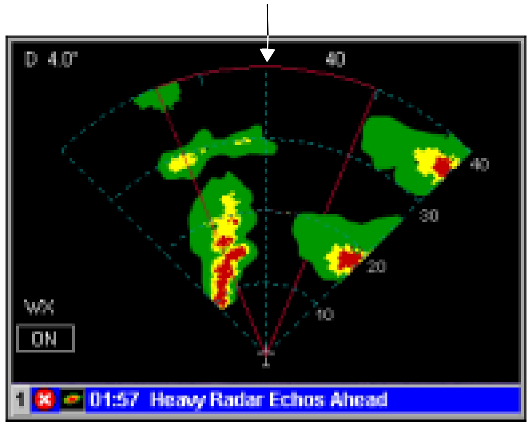


Figure 10: Echo Ahead

NOTE: The red lines depicted in Figure 10 are not visible on the FSD display.

Low Ground Speed Warning

The Low Ground Speed Warning is a reminder to turn off the radar upon landing. FlightMax Radar monitors the ground speed reported by the GPS and, when your ground speed falls below 20 knots, the FSD displays a message in the Message Bar indicating “SPEED BELOW 20 KTS. – TURN RADAR OFF”.

If Radar is unable to obtain a valid ground speed from the system’s GPS interface while the radar is on, it displays the message “BAD GNDSPD INPUT; NOTE RADAR IS ON” in the Message Bar.

CAUTION

It is the pilot in command’s responsibility to insure that the radar is turned off after landing. Do not rely on the low ground speed message to prompt you to do so. We recommend that you make it a checklist item to turn off the radar after exiting the runway.

Menu Tree

The following Menu Tree graphically depicts the paths to all the Radar menus.

- Radar
  - Function
    - On
    - Test
    - Standby
    - Off
    - Help
  - Mode
    - Wx
    - WxA
    - SRCH/GndMap
    - Help
  - Bearing Line
  - Gain Up
  - Gain Down
  - Hold
  - AutoTilt
  - Sector Scan
  - Settings
    - Echo Warnings
    - Adjust Roll Trim
    - Stabilization
    - Beam Width
    - Beam Altitude
    - Azimuth Lines (1300 only)
    - Help
  - Help

Appendix 1 - AC 20-68B

RECOMMENDED RADIATION SAFETY PRECAUTIONS FOR GROUND OPERATION OF AIRBORNE WEATHER RADAR

Department of Transportation

Federal Aviation Administration

8/8/80

Initiated by: AFO-512

1. **PURPOSE**. This circular sets forth recommended radiation safety precautions to be taken by personnel when operating airborne weather radar on the ground.

2. **CANCELLATION.** AC 20-68A, dated April 11, 1975, is canceled.

3. **RELATED READING MATERIAL.**
   a. Barnes and Taylor, Radiation Hazards and Protection (London: George Newnes Limited, 1963), p. 211.
   b. U.S. Department of Health, Education and Welfare, Public Health Service, Consumer Protection and Environmental Health Service, "Environmental health microwaves, ultraviolet radiation and radiation from lasers and television receivers - An Annotated Bibliography," FS 2.300: RH-35, Washington, U.S. Government Printing Office, pp. 56 - 57.
   c. Mumford, W. W., "Some technical aspects of microwave radiation hazards," Proceedings of the IRE, Washington, U.S. Government Printing Office, February 1961, pp. 427 - 447.

4. **BACKGROUND**. Dangers from ground operation of airborne weather radar include the possibility of human body damage and ignition of combustible materials by radiated energy. Low tolerance parts of the body include the eyes and testes.

5. **PRECAUTIONS.** Management and supervisory personnel should establish procedures for advising personnel of dangers from operating airborne weather radars on the ground. Precautionary signs should be displayed in affected areas to alert personnel of ground testing.
   a. General.
      (1) Airborne weather radar should be operated on the ground only by qualified personnel.

(2) Installed airborne radar should not be operated while the aircraft is in a hangar or other enclosure unless the radar transmitter is not operating, or the energy is directed toward an absorption shield which dissipates the radio frequency energy. Otherwise, radiation within the enclosure can be reflected throughout the area.

b. Body Damage. To prevent possible human body damage, the following precautions should be taken:

(1) Personnel should never stand nearby and in front of a radar antenna which is transmitting. When the antenna is not scanning, the danger increases.

(2) A recommended safe distance from operating airborne weather radars should be established. A safe distance can be determined by using the equations in Appendix 1 [omitted] or the graphs of figures 1 and 2 [omitted]. This criterion is now accepted by many industrial organizations and is based on limiting exposure of humans to an average power density not greater than 10 milliwatts per square centimeter.

(3) Personnel should be advised to avoid the end of an open waveguide unless the radar is turned off.

(4) Personnel should be advised to avoid looking into a waveguide, or into the open end of a coaxial connector or line connector to a radar transmitter output, as severe eye damage may result.

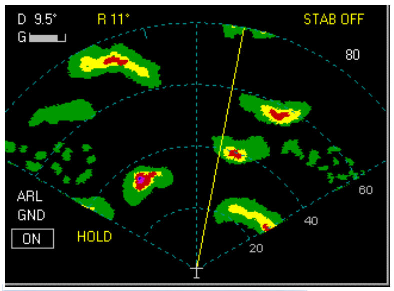
(5) Personnel should be advised that when high power radar transmitters are operated out of their protective cases, X-rays may be emitted. Stray X-rays may emanate from the glass envelope type pulser, oscillator, clipper, or rectifier tubes, as well as magnetrons.

c. Combustible Materials. To prevent possible fuel ignition, an installed airborne weather radar should not be operated while an aircraft is being refueled or defueled.

/s/

M. C. BEARD Director of Airworthiness

FlightMax™
Flight Situation Display



FlightMax Radar

(RDS-8X Series and RDR-2X00 Series)

Part Number 600-0060 Revision 00

Revision History

Date	Revision	Description
Sep. 7, 2000	00	Production Release

Avidyne Corporation
55 Old Bedford Road
Lincoln, Massachusetts 01773
Web Site: www.avidyne.com

FlightMax Radar
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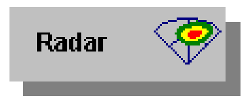

Figure 1: Radar Icon

This part of the Pilot's Guide, explains FlightMax Radar.

FlightMax Radar is an interface, control and display function for airborne weather radar systems. It duplicates the weather display functions of the original equipment indicators supplied with Bendix/King, or Allied Signal . Refer to the Features Matrix starting on page 28 for a complete listing of the R/T's and features supported by FlightMax Radar. Topics include:

- *Radar Safety* - general radar safety information.
- *Radar Overview* - presents an overview of Radar.
- *Radar Pages and Menus* - explains all pages and menus used in Radar.
- *How to Use Radar* - explains how to perform specific tasks using Radar.
- *Messages and Error Indications* - provides the meanings of Radar messages and error indications.
- *Menu Tree* - shows the path to any menu in Radar.
- *Features Matrix* - Lists in table format the various digital radars that interface with FlightMax Radar.

FlightMax Radar is verified by the presence of its icon and text label in the Main Menu. If Radar's icon and label, shown in Figure 1, are not present in the Main Menu, contact your installer for assistance.

Radar Safety

Aircraft weather radar is specifically designed to emit a concentrated beam of microwave energy at potentially hazardous power levels. These hazards include the possibility of injury to ground personnel, ignition of flammable materials, including fuel, and damage to sensitive electronic devices. As the pilot in command, you are responsible for management of the radar system so as to eliminate these hazards.

The FAA has published an Advisory Circular, AC 20-68B, *Recommended Radiation Safety Precautions for Airborne Weather Radar*, that gives good basic guidelines for safe radar operation. The Advisory Circular has been included in Appendix 1 at the end of this section. Please read it thoroughly and observe its recommendations.

Maximum Permissible Exposure Level

U.S. Government standards for human exposure to microwave radiation permit a maximum level of 10 mW per square centimeter. When the radar is operating, this level may be exceeded within the area indicated in Figure 2. According to information published by the manufacturer of your antenna/receiver/transmitter (ART), strict observance of this boundary whenever your radar is operating should provide adequate protection.

WARNING

Exposure of ground personnel or other aircraft occupants to microwave energy emitted at positions within the MPEL boundary depicted in Figure 2 may be hazardous. Beware that the MPEL boundary is determined with respect to the antenna, not the radome or any other aircraft structure. The MPEL boundary shown in Figure 2 applies only to units specifically approved for use with FlightMax Radar. The MPEL boundary shown in Figure 2 does not guarantee protection against ignition of flammable materials or damage to sensitive electronic equipment exposed to microwave energy from your radar.

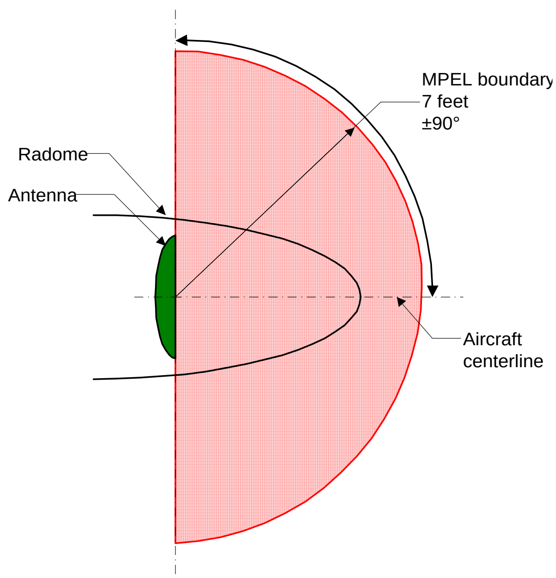

Figure 2: Maximum Permissible Exposure Level

Safe Radar Operation

CAUTION

In the event of a system malfunction, the radar could be on and emitting microwave radiation any time the FSD is on. If a malfunction of any sort is suspected, turn off the FSD and disable the radar by turning off the circuit breaker.

Based on the recommendations made by the FAA and by the manufacturer of your radar unit, Avidyne recommends the following safety procedures:

- At system startup, if the radar is not being used in flight, leave it off.
- At startup, if the radar is being used during the flight, switch to standby as soon as possible.

- Set the radar to TEST whenever it is convenient to do so in pre-takeoff checks. No microwave radiation is emitted in TEST operation. Never turn the radar ON without first checking its operation with TEST.
- Never turn the radar ON while on the ramp under any circumstances.
- To complete the pre-takeoff check or to check weather before takeoff, turn the radar ON while taxiing well clear of ground personnel, ground apparatus and other aircraft. Leave it ON for the minimum time necessary to verify proper operation of the radar or view the weather. If necessary, repeat on the runup pad with caution. Return to STANDBY when the checkout is finished.
- If radar is to be used during takeoff, do not switch it to ON until you are number one at the hold short line.
- Return the radar to STANDBY or OFF immediately after clearing the runway on landing. Do *not* continue to operate the radar while taxiing.

Radar Overview

Radar systems measure and map rainfall intensity within a scanned area. While rainfall itself is not generally hazardous to flight, intense rainfall may include severe turbulence which can be hazardous. A radar system can only display what it scans. If the antenna is not properly aligned, significant precipitation may be missed. Avoiding severe weather requires the pilot to have a complete understanding of the capabilities and limitations of his radar system, an understanding of thunderstorm dynamics, and up-to-date forecasts so as to avoid likely areas of severe weather.

FlightMax Radar provides access to all of the weather avoidance functions available with the original antenna/ receiver/transmitter (ART) unit. As the radar scans, it collects and maps rainfall intensity over a specific area to the left and right of your aircraft's heading. The intensity of rainfall at any given location is indicated by the color displayed at that point.

The main data page where the pilot views Radar operation is a full screen color depiction of mapped radar echoes in one of two possible Screen Formats: a 90°, 100° or 120° Forward View screen format or a 40°, 50° or 60° Vertical Profile View screen format (on radar sensors that support Vertical Profile). A sector scan option with a 60° screen format is also available with the RDR-2100. Echoes from a minimum of 2 miles to the maximum of the sensor being used are displayed. The echoes appear in real time in correlation with the scanning of the radar antenna.

FlightMax Radar is also available to the Map function of the FlightMax FSD. The Map function is a terrain and navigation display with overlays of radar, traffic and lightning data. The Avidyne Radar function provides radar data to the Map function for possible overlay display.

Radar's Data Page

FlightMax Radar's data page (Figure 3) is shown in a typical radar configuration in the horizontal plane. Radar sensors equipped with a Vertical Profile option can display a slice of approaching weather in vertical profile, see Figure 9. The same data appears in both displays.

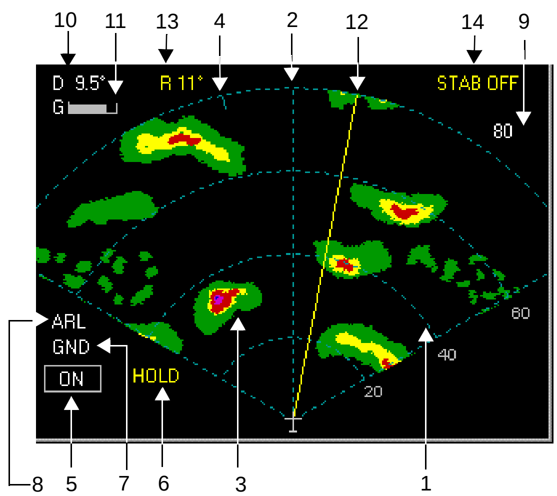

Figure 3: Radar Data Page

NOTE: Figure 3 displays as many features as possible. Your particular radar may not support all these features. See the Features Matrix (see Table 3, "Feature Matrix," on page 28) for a complete listing of the features available on your radar.

1. **Range Rings** - Scan limits and range rings are shown as dotted light blue lines. Range labels indicate the distance to each of the range rings.
2. **Heading Reference Line** - Marks the center of the scan area.
3. **Rainfall Echos** - Rainfall data returned from the ART, are displayed as color coded echos. See Table 1 for color meanings.

4. **Scan Indicator (Beam View™)** - The current position of the scan is shown by BeamView, a highlighted arc (as shown in Figure 3). Scan width of the arc is set at the Settings menu by your installer based on your antenna size. BeamView can be turned of and a small tic mark will indicate the position of the scan. Precipitation data is constantly updated as the radar scans.
5. **Function** - The function annunciation (ON, TEST, SBY, OFF) indicates the function status.
6. **Hold Flag** - The Hold flag indicates that the system is displaying a frozen representation of previously scanned data.
7. **Mode** - Mode (WX, WXA, GNDMAP, VP) defines how the radar is being used. Wx and WxA orient the radar to weather phenomenon. Ground Mapping (GND) orients the radar to ground features. VP orients the radar display to a vertical display. (Note: VP may not be available on your radar)
8. **Automatic Range Limit** - ARL depicts the limits of your radar range. (Note: ARL may not be available on your radar).
9. **Range** - The Range number indicates range intervals within the scale. The top most number indicates the the current selected range scale.

   Beam Altitude (TiltView™) (Not Shown) - The Beam Altitude numbers represent (in thousands of feet) the relative altitude of the center of the radar beam in relation to the aircraft's altitude at the distance shown above each number.
10. **Tilt** - Tilt indicates the angle and direction of the radar antenna: U for up, D for down and the amount of antenna tilt in quarter degrees, using decimal notation.
11. **Gain** - Receiver gain is shown on a bar whose length indicates fraction of full gain. It is shown only in ground mapping mode, since gain is not controllable in weather and weather alert modes.
12. **Bearing Line** - The bearing line provides the relative bearing to any feature displayed on the screen. The bearing line is controlled by the outer knob. It disappears from the screen after 15 seconds of non-use.

13. **Bearing** - The relative bearing of the Bearing line is given at the top of the screen – L for left, R for right and the number of degrees relative to the aircraft heading when it is selected.

14. **Stabilization Status** - Indicates the status of some gyro-stabilized radar sensors. The on screen annunciation, STAB OFF will disappear when stabilization is turned on.

Color Coding

FlightMax Radar indicates the rainfall rate by color. All standard radar indicators use a similar color coding system. Color usage is explained in Table 1.

Table 1: Rainfall Rate Color Coding

Rate (mm/ hour)	Color	Interpretation
<1	Black	Generally safe when away from other returns
1-4	Green	Use caution and look for changes
4-12	Yellow	Caution-avoid whenever possible
12-50	Red	Danger- avoid at all times
>50	Magenta	Severe- avoid at all times

NOTE: On some radars during startup the screen may have a blue tint. This is normal while the R/T is warming up.

CAUTION

FlightMax Radar is intended as a severe weather avoidance tool only. Penetrating cells or lines of cells is extremely dangerous with or without radar and must not be attempted. Give thunderstorms a wide berth. The flight precautions given in Table 1 are intended for highly proficient instrument pilots.

Radar Main Menu

The Radar main menu (Figure 4) provides access to all the operating functions used to control the radar system and options for changing the radar display.

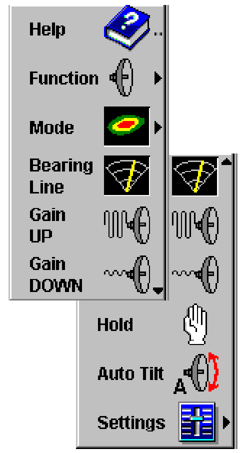

Figure 4: Radar Main Menu

Function

The radar Function menu (Figure 5) controls four functions: RADAR ON, TEST, STANDBY, and RADAR OFF. They are described below.

On

Selecting FUNCTION→ON places the radar in normal operation. The antenna scans and the Receiver/ Transmitter (R/T) transmits microwaves so as to detect weather. Confirmation that the radar is on is indicated by the presence of the moving scan indicator, radar echos, and the ON screen annunciation.

Test

Selecting FUNCTION→TEST initiates a radar self-test function that is monitored by the FlightMax FSD. The test function is confirmed by the presence of the TEST annunciation and the test display (Figure 6).

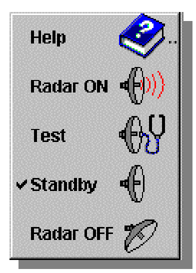

Figure 5: Function Menu

During self test, all of the circuitry and functions of the ART are exercised with the exception of the magnetron tube. No microwave energy is emitted in the test function. The test pattern display should look similar to the pattern shown in Figure 6 (green, yellow, red and magenta). If it does not, it indicates possible problems with the system that should be corrected before use.

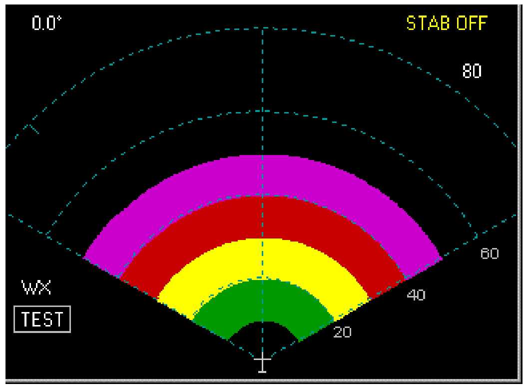

Figure 6: Radar Test Pattern

Standby

Selecting FUNCTION→STANDBY places the radar circuitry in an energized but inactive state. STANDBY Should be selected as soon as practical after starting the FSD. While in STANDBY, the magnetron tube in the ART is kept warm so the radar can be used immediately upon switching it on.

Confirmation that the radar is in standby is indicated by the absence of the moving scan indicator, no radar echo returns, and the SBY screen annunciation.

Standby mode also places the antenna Tilt in a 'Park' position as set by the installer. The park position places the antenna in one of the following positions: last position (at last shutdown), full up, centered (0°), or full down.

Off

Selecting FUNCTION→RADAR OFF removes power from the ART, disabling the radar. The antenna does not scan and no microwave energy is emitted.

Confirmation that the radar is off is indicated by the OFF annunciation on the data screen, along with the absence of radar returns and the moving scan indicator on the data screen. The radar system is off any time the FSD is off and will never be turned on except by direct action.

CAUTION

In the event of a system malfunction, the radar could be on and emitting microwave radiation any time the FSD is on. If you have any reason to suspect the radar is on, turn off the FSD or disable the radar by means of its circuit breaker before approaching ground personnel, equipment or other aircraft. Do not turn it on again except for diagnostic purposes at a safe distance from personnel and equipment.

Mode

The RADAR→MODE submenu provides several operating options for radar. There are three main operating modes: Wx, WxA or Gnd Map and two possible secondary modes: VP and ARL. The secondary modes are only available on aircraft so equipped. Only one main mode may be used for operation. The secondary modes can be used in conjunction with any of the main modes.

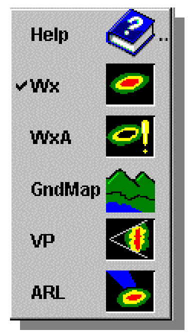

Figure 7: Mode Menu

Wx

The Wx mode is the normal weather mode using during flight. On system startup the Wx mode is preselected. The Wx mode is available in all supported radar sensors.

WxA

The weather alert mode operates the same as the Wx mode but contains an additional feature. The magenta areas (the most severe conditions) flash between magenta and black as a further visual cue of the most hazardous conditions.

GndMap

Ground mapping mode orients the radar to ground features (Figure 8). By tilting the antenna down and varying the gain as necessary to get an intelligible image, coastlines, promontories, forested areas etc., can be displayed.

While in ground mapping mode the radar's receiver gain is needed to bring in a display. The GAIN UP and GAIN DOWN functions are only enabled during the ground map mode. At startup the gain is set for maximum, the grey bar extends all the way across the scale.

.

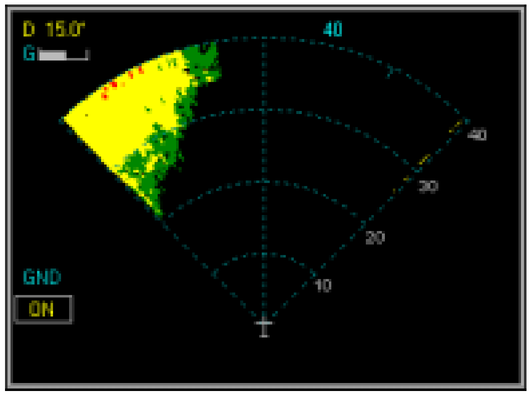

Figure 8: Ground Mapping Display

VP

The vertical profile mode allows the pilot to view approaching weather as a slice of the vertical plane instead of the more conventional horizontal, forward view (Figure 9). This feature is available on some radar sensors. See the Features Matrix to determine if your radar contains this feature. Other modes and functions are not affected by changing to vertical profile mode.

The vertical profile display contains the same annunciations (functions and modes) shown on the horizontal display, however, the annunciations may be in a another location due to the different configuration. A vertical profile annunciation (PROFILE) has been added. This provides information about the current azimuth displayed on the screen, left (L), right (R) or centered, and in degrees.

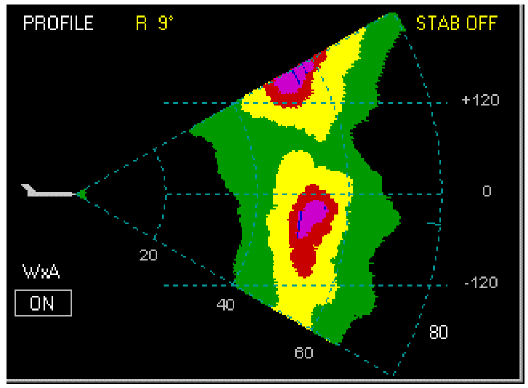

Figure 9: Vertical Profile view

ARL

Automatic range limit (ARL) is a software calculation that attenuates the radar signal. ARL calculates the attenuation of the microwave signal based on an integration of the returned echos along the radial path. It then determines when enough attenuation has occurred to not be able to detect any further echos (anything past that point is in the radar 'shadow'). The R/T then draws BLUE from that calculated point to the edge of the covered range as a symbol representing that shadow and a warning to avoid that area. Only certain sensors support the ARL function. When ARL is selected, an on screen annunciation is displayed to indicate that it's active.

Bearing Line

A bearing line display is available within Radar. The bearing line is a yellow line drawn from the from the depicted aircraft position to the outer edge of the range field. The bearing line provides the pilot with an approximate bearing to a region of weather, or lack thereof.

> **NOTE:** the bearing line cannot be selected when "Roll Trim" is active.

The outer knob is used to move the bearing line right or left. The bearing line remains on screen until it is deselected or there is no knob movement for 15 seconds.

Then the outer knob function reverts back to "Tilt" control.

Gain Up and Gain Down

The gain control changes the attenuation of the received signal (to the receiver portion) of the radar. Changing the gain is sometimes used to better examine the structure of heavy echo areas. Gain should normally remain at maximum ("full").

The gain up and gain down functions are only available while in the GNDMAP mode. They are grayed out (inactive) when in other modes. The screen annunciation is a gray bar in the upper left corner of the screen. Maximum gain is indicated by a fully extended bar across the scale.

Hold

Hold is used to freeze the current radar echo display. The radar continues to scan, but the returns are not displayed. While HOLD is active, a screen annunciation to the left of the scanned area tells the pilot the display is no longer being updated. This allows the pilot to pause screen updates for a time, then examine changes when Hold is deactivated. Upon deactivation of HOLD, Radar resumes the normal display update from newly scanned data.

Auto Tilt

The Auto-Tilt feature is available to all supported radars. Auto-Tilt automatically adjusts the radar antenna to maintain a constant, approximate antenna position from the point of activation. There is also compensation due to aircraft maneuvering in non stabilized radar installations. The amount of tilt is based on the altitude input and range selection. As the Range and altitude settings are changed, the Auto-Tilt will reposition the center of the radar beam at the edge of the displayed range, to the same altitude above ground, (± 10%).

To operate AutoTilt, the pilot levels off at the desired altitude and Auto-Tilt will activate. Any further changes in altitude and range adjustment is compensated for in Tilt. During operation, Auto-Tilt, lowers the tilt when Range is decreased in order to see approximately the same amount of ground returns at the edge of coverage, and raises tilt when Range is increased. Also, tilt is adjusted inversely with altitude changes to keep the radar beam at an approximate constant height above ground.

On system startup, Auto-Tilt is deactivated and the antenna position is left in its last position. Selecting Auto-Tilt from the radar main menu, sends a command to the radar sensor, which places it in the Auto-Tilt operating mode. A checkmark appears beside the Auto-Tilt menu item.

For systems with their own internal Auto-Tilt capability, see the “Feature Matrix” on page 28 and refer to the Users manual that came with your R/T.

Settings

The Settings menu provides access to certain radar “settings”. They include the following:

Figure 10: Settings Menu

Echo Warnings

Selecting this function allows for enabling or disabling of the Echo Warnings function. This includes turning on the Target Alert (provided by some radar sensors, see the Features Matrix), as well as displaying echo ahead warning messages in the message bar. See the Messages and Error Indications section for more information on Target Alert and Echo Ahead messages. Once this parameter has been set it will be maintained from use to use.

Adjust Roll Trim

Selecting this function enables the Roll Trim adjustment. The Roll Trim value is sent to radar sensors that support this function (see Features Matrix). The Roll Trim value is adjustable from –4.00° to +3.875° with a resolution of 0.125°. Upon selection, the Outer Knob controls the Roll Trim value, and a Roll Trim annunciation appears on the screen. Once this parameter has been set it will be maintained from use to use.

When Roll Trim is selected the Bearing Line function is deactivated.

> **NOTE:** Normally this adjustment should be done as part of the system setup and calibration.

Stabilization

The Stabilization function allows for enabling and disabling of gyro stabilization of some gyro-stabilized radar sensors (see the Features Matrix, to determine if this feature is supported on your R/T). An on-screen display informing the pilot that stabilization is off is displayed in the upper right had corner.

Beam Width (BeamView) display

Selecting this function enables or disables the BeamView display. BeamView depicts a moving wedge across the radar screen that follows the sweep of the radar antenna. This wedge is sized to represent the actual beam width and is drawn in the black area of the normal sweep, underneath any echo information. The actual beam width is determined in the Radar Setup page and is based on the actual beam width of your specific R/T. Setup of the beam width should be done by your installer.

Beam Altitude (TiltView) display

Selecting this function turns On/Off the TiltView display. The TiltView numbers are depicted next to each range ring distance on the radar data page, in yellow. The numbers represent (in thousands of feet) the relative altitude of the center of the radar beam in relation to the aircraft's altitude. The beam altitude numbers take into account the Tilt and Range settings.

> **NOTE:** In non stabilized radars the number value is only correct in straight and level flight.

Sector Scan (RDR - 2100 only)

Sector Scan is a reduced scan function that allows pilots to view a forward 60° arc of the normal scanning area. A 60° scan arc replaces the normally displayed scan arc (90°, 100° or 120°) and the radar sweep is confined to that 60° arc. This produces quicker echo updates. The Sector Scan arc can be displayed anywhere within the normal scanning area. The azimuth position of the reduced sector within the full scan is adjustable with the Bearing Line adjustment (outer knob) before Sector Scan is selected, or with the outer knob after being selected.

This means that if you activate the Bearing Line and adjust it before Sector Scan is activated, then Sector Scan will follow the Bearing Line azimuth. If Sector Scan is already selected, just turn the outer knob.

How to Use Radar

Radar Startup

FlightMax Radar starts automatically as part of the normal initialization sequence of the FSD. To use RADAR do the following:

1. Turn the FSD on. The unit will go through its normal startup sequence.
2. Press **Enter** when prompted. This will bring up the Map display.
3. Press **Escape** to bring up the Main Menu.
4. Select Radar from Main Menu.
5. Radar then displays its data page and main menu.
   Radar restores all mode selections that were active when it was last used.

Pre-takeoff Check

While at a safe distance from ground personnel, equipment and other aircraft, briefly turn the radar on and tilt the antenna below zero degrees.

WARNING

Do not turn your radar on except in accordance with the safety recommendations given in Radar Safety.

- Watch for the appearance of ground reflections, verifying that the ART is operating properly and that the antenna tilt is working correctly.
- Tilt the antenna through its full range, verifying appropriately changing images of objects on the ground below zero degrees, fading as you move through the horizon, to be replaced by images of any weather that may be present as you tilt the antenna up.

Turn the radar off as soon as possible after this test.

Test

Use the FUNCTION→TEST mode before every flight where radar is going to be used. Make it a part of the pre-takeoff checklist. The radar should be off and the FSD on, prior to performing a self test.

1. From the FUNCTION menu select STDBY.

   Placing the radar in standby allows the magnetron tube to warm up. It should take approximately 2 minutes.

2. After the tube is warm, select test from the FUNCTION menu.

   While in test also check for:

   - proper operation of the range control (the pattern should change appropriately with selected range)
   - for proper operation of weather alert (WxA) mode (the magenta band should flash).

Turning the Radar On/Off

WARNING

Do not turn your radar on except in accordance with the safety recommendations given in the Radar Safety section.

To turn the radar on, go to Radar's main menu and select FUNCTION→ON.

To turn the radar off, go to Radar's main menu and select FUNCTION→OFF

Displaying Weather

1. In Radar's main menu, select MODE→WX for normal weather display or MODE→WXA for "weather alert" mode (i.e., magenta echos flash).
2. Tilt the antenna as necessary to visualize weather at, above or below your altitude.

Displaying Ground Map Data

1. In radar's main menu, select MODE→GND MAP.
2. Tilt the antenna and vary the gain as necessary to get a useful image.
3. Gain is controlled only in ground map mode.

   From Radar's main menu, select gain up or gain down to increase or decrease the R/T's gain.

Changing the Antenna's Tilt

1. Ensure that the bearing line or Roll Trim Adjust are not active. If either one is active, deselect the function.
2. Rotate the outer cursor control knob to manually adjust the antenna's tilt.

   The annunciation is in the upper left corner of the display screen. Tilt values are in degrees and range from –15.00° (DOWN) to +15.00° (UP). The outer knob only adjusts 'Tilt' when 'Bearing Line' and 'Roll Trim Adjust' are not selected.
3. The tilt can also function automatically.

   From Radar's main menu select Auto Tilt to activate automatic tilt control.

Displaying the Bearing Line

1. From Radar's main menu, select BEARING LINE.

   A yellow line will appear on the center line azimuth and a yellow annunciation indicating the direction (right or left) and the value (in one degree increments) is displayed above the range field.
2. Rotate the outer cursor control knob to position the bearing line.
3. The bearing line will automatically disappear after 15 seconds of disuse.

Enable Echo Warnings

1. From radar's main menu, select SETTINGS→ECHO WARNINGS.
2. An area forming a 22° wedge from the nose of the aircraft is checked for total echos (indicating rainfall).
3. If there are storm indications ahead, the message bar will display RADAR ECHOS AHEAD or HEAVY RADAR ECHOS AHEAD depending upon the intensity of the storms.

Range Control

1. The inner, knob always controls the range scale except during system calibration (which is done by your installer).
2. Turn the knob clockwise to increase the scale and counter clockwise to decrease the scale.

Outer Knob Functions

The large, outer knob controls either antenna tilt, bearing line position, Roll Trim, or Vertical Profile azimuth depending on your selection.

The Outer Knob's function is annunciated by an icon and text in the lower right of the screen that is visible when the menu is visible.

Changing Beam Altitude

Beam Altitude is adjusted in conjunction with the range and antenna tilt. There is no independent control of Beam Altitude.

Adjusting the antenna tilt with the outer knob or adjusting the range with the inner knob will also change the beam altitude.

Multiple Indicator Support

Some aircraft may be equipped with multiple radar indicators. The indicators may be the original radar display units or Avidyne units in combination. Depending upon the radar sensor , up to two indicators may provide control commands to the sensor.

Updating the indicator screen is achieved with the datastream output from the sensor being sent to all the indicators. Different values for Function, Range, Tilt, Gain and VP Azimuth Position may be requested from each indicator, with the sensor returning radar data to each indicator in an alternating sequence. Each indicator, including the Avidyne unit(s), displays and updates its screen depending upon its status as either the primary or secondary indicator. The status is set during installation.

Messages and Error Indications

Table 2: Messages Issued by Radar

Message	Meaning
RADAR ECHOS AHEAD	Indicates presence of significant green and/or yellow echos within the currently selected range and ±22º of the aircraft heading. Generated only when an option other than Radar is being displayed.
HEAVY ECHOS AHEAD BEYOND 80NM	Indicates presence of significant green and/or yellow echos within the currently selected range, ±22º of the aircraft heading, and Target Alert is turned on. Generated only when an option other than Radar is being displayed.
HEAVY RADAR ECHOS AHEAD	Indicates presence of significant red and/or magenta echos within the currently selected range and ±22º of the aircraft heading. Generated only when an option other than Radar is being displayed.
SPEED BELOW 20 KTS – TURN RADAR OFF	Radar is ON (scanning) and GPS-reported ground speed is below 20 kts, suggesting that you have landed. Displayed only when an option other than Radar is being displayed.
BAD GROUND SPEED INPUT; NOTE RADAR IS ON	Radar is turned on and GPS-is not reporting valid ground speed. Displayed only when an option other than Radar is being displayed.
Groundspeed Input Operational	Ground speed data has been restored.
LOSS OF RADAR DATA	Communication with the radar sensor has been lost – no data is available.
RADAR SENSOR DATA RESTORED	Communication with the radar sensor has been restored.

Table 2: Messages Issued by Radar

Message	Meaning
RADAR ERROR	An error has occurred in the radar sensor system.This message will appear in five different cases in the Digital Radar version: Driver-Reported Error (driver overrun) and four R/T Fault conditions: 429 Fault, Antenna Fault, Transmit Fault and R/T Fault (general).
RADAR ERROR CLEARED	The previously reported error in the radar sensor system has been corrected
RADAR FAILURE	The radar system has failed. This error will *not* be cleared until the system is shut down and restarted.

Echo Ahead

The Echo Ahead warning monitors a predetermined area for significant radar returns while viewing other FSD functions. The alert is displayed in the message bar.

The monitored area (Figure 11) is a wedge 22º to either side of the aircraft nose to the range limit currently in use. Within this area, Radar checks the total indicated rainfall. Above a predetermined level of green/yellow content, Radar displays the message, “RADAR ECHOS AHEAD”. Above a predetermined level of red/magenta content, Radar instead displays the message, “HEAVY RADAR ECHOS AHEAD”.

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Echo Ahead Alert Area

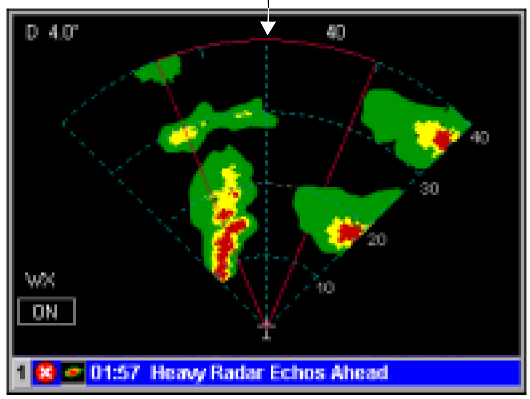


Figure 11: Echo Ahead

NOTE: The red lines depicted in Figure 11 are not visible on the FSD display.

Target Alert

FlightMax Radar software supports the 'Target Alert' warning used by some radar sensors. The alert appears when the R/T detects heavy echos beyond 80nm within ±10° and the selected Range is 80nm or less.

NOTE: Target Alert differs from the Echo Ahead detection, in that Echo Ahead uses a range selected by the user. Target Alert has a predefined range.

The alert is displayed in two forms. When radar is displayed on the FSD, it is shown as two red arcs separated by a black arc at the top of the screen (Figure 12). The second indication is a Message Bar warning. The Message Bar text is, "Heavy Radar Echos Beyond 80nm".

The Message Bar warning is cancelled upon pilot acknowledgement (selecting Enter), or upon elimination of the warning condition from the radar sensor.

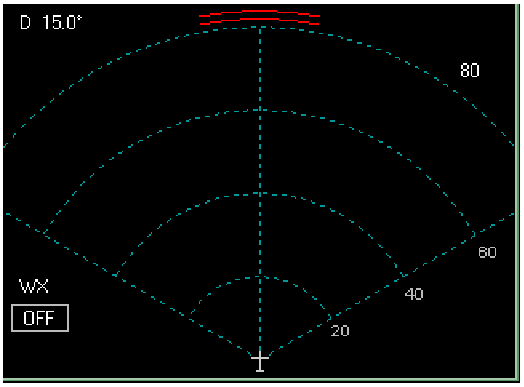


Figure 12: Target Alert

Low Ground Speed Warning

The Low Ground Speed Warning is a reminder to turn off the radar upon landing. FlightMax Radar monitors the ground speed reported by the GPS and, when your ground speed falls below 20 knots, the FSD displays a message in the Message Bar indicating "SPEED BELOW 20 KTS. – TURN RADAR OFF".

If Radar is unable to obtain a valid ground speed from the system's GPS interface while the radar is on, it displays the message "BAD GNDSPD INPUT; NOTE RADAR IS ON" in the Message Bar.

CAUTION

It is the pilot in command's responsibility to insure that the radar is turned off after landing. Do not rely on the low ground speed message to prompt you to do so. We recommend that you make it a checklist item to turn off the radar after exiting the runway.

Menu Tree

The following Menu Tree graphically depicts the paths to all the Radar menus.

- Radar
  - Function
    - On
    - Test
    - Standby
    - Off
    - Help
  - Mode
    - Wx
    - WxA
    - Gnd Map
    - VP
    - ARL
    - Help
  - Bearing Line
  - Gain Up
  - Gain Down
  - Hold
  - Sector Scan
  - AutoTilt
  - Settings
    - Echo Warnings
    - Adjust Roll Trim
    - Stabilization
    - Beam Width
    - Beam Altitude
    - Help
  - Help

Features Matrix

FlightMax Radar provides support for all standard features of the sensors listed in the following tables. The tables contain most of the features provided by each radar sensor.

Table 3: Feature Matrix

	RS-811A	RS-181A	RS-181A-VP	RS-841A	RS-841A-VP	RS-861A
Vertical Profile (VP)			•		•	
Automatic Range Limit (ARL)						•
Roll Trim	•	•	•	•	•	•
Target Alert						
Maintenance/Calib Text Page	•	•	•	•	•	•
Auto-Tilt	•*	•*	•*	•*	•*	•
Stab on/off	•	•	•			
Sector Scan						
Multiple Indicators	♦(2)	♦(2)	♦(2)	♦(2)	♦(2)	♦(2)
# of colors	4	4	4	4	4	5
Range Values	10, 20, 40, 80, 160, 240	10, 20, 40, 80, 160, 240	10, 20, 40, 80, 160, 240	5, 10, 20, 40, 80, 160, 240, 320	5, 10, 20, 40, 80, 160, 240, 320	5, 10, 20, 40, 80, 160, 240, 320
Scan Arcs supported	90°	90°	90°	120°	120°	120°

* Software provided Auto-Tilt

Table 4: Feature Matrix, continued

	RS-861A-VP	ART-2000	ART-2100
Vertical Profile (VP)	●	●	●
Automatic Range Limit (ARL)	●		●
Roll Trim	●	●	●
Target Alert		●	●
Maintenance/Calib Text Page	●	●	●
Auto-Tilt	●	●*	●
Stab on/off		●	●
Sector Scan			●
Multiple Indicators	♦(2)	♦(3)	♦(3)
# of colors	5	4	5
Range Values	5, 10, 20, 40, 80, 160, 240, 320	10, 20, 40, 80, 160, 240	5, 10, 20, 40, 80, 160, 240, 320
Scan Arcs supported	120°	90° 100°	90° 100° 120°

* Software provided Auto-Tilt

Appendix 1 - AC 20-68B

RECOMMENDED RADIATION SAFETY PRECAUTIONS FOR GROUND OPERATION OF AIRBORNE WEATHER RADAR

Department of Transportation

Federal Aviation Administration

8/8/80

Initiated by: AFO-512

1. **PURPOSE**. This circular sets forth recommended radiation safety precautions to be taken by personnel when operating airborne weather radar on the ground.

2. **CANCELLATION.** AC 20-68A, dated April 11, 1975, is canceled.

3. **RELATED READING MATERIAL.**
   - a. Barnes and Taylor, Radiation Hazards and Protection (London: George Newnes Limited, 1963), p. 211.
   - b. U.S. Department of Health, Education and Welfare, Public Health Service, Consumer Protection and Environmental Health Service, "Environmental health microwaves, ultraviolet radiation and radiation from lasers and television receivers - An Annotated Bibliography," FS 2.300: RH-35, Washington, U.S. Government Printing Office, pp. 56 - 57.
   - c. Mumford, W. W., "Some technical aspects of microwave radiation hazards," Proceedings of the IRE, Washington, U.S. Government Printing Office, February 1961, pp. 427 - 447.

4. **BACKGROUND**. Dangers from ground operation of airborne weather radar include the possibility of human body damage and ignition of combustible materials by radiated energy. Low tolerance parts of the body include the eyes and testes.

5. **PRECAUTIONS.** Management and supervisory personnel should establish procedures for advising personnel of dangers from operating airborne weather radars on the ground. Precautionary signs should be displayed in affected areas to alert personnel of ground testing.
   - a. General.
     - (1) Airborne weather radar should be operated on the ground only by qualified personnel.

(2) Installed airborne radar should not be operated while the aircraft is in a hangar or other enclosure unless the radar transmitter is not operating, or the energy is directed toward an absorption shield which dissipates the radio frequency energy. Otherwise, radiation within the enclosure can be reflected throughout the area.

b. Body Damage. To prevent possible human body damage, the following precautions should be taken:

(1) Personnel should never stand nearby and in front of a radar antenna which is transmitting. When the antenna is not scanning, the danger increases.

(2) A recommended safe distance from operating airborne weather radars should be established. A safe distance can be determined by using the equations in Appendix 1 [omitted] or the graphs of figures 1 and 2 [omitted]. This criterion is now accepted by many industrial organizations and is based on limiting exposure of humans to an average power density not greater than 10 milliwatts per square centimeter.

(3) Personnel should be advised to avoid the end of an open waveguide unless the radar is turned off.

(4) Personnel should be advised to avoid looking into a waveguide, or into the open end of a coaxial connector or line connector to a radar transmitter output, as severe eye damage may result.

(5) Personnel should be advised that when high power radar transmitters are operated out of their protective cases, X-rays may be emitted. Stray X-rays may emanate from the glass envelope type pulser, oscillator, clipper, or rectifier tubes, as well as magnetrons.

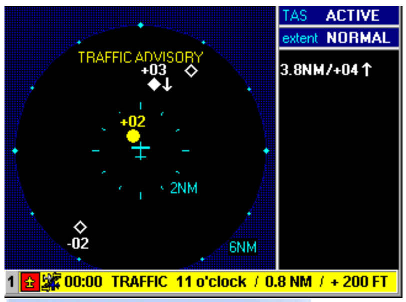
c. Combustible Materials. To prevent possible fuel ignition, an installed airborne weather radar should not be operated while an aircraft is being refueled or defueled.

/s/

M. C. BEARD Director of Airworthiness

FlightMax™

Flight Situation Display



FlightMax Traffic

(TAS)

Part Number 600-0061 Revision 00

Revision History

Date	Revision	Description
Sep. 7, 2000	00	Production Release

Avidyne Corporation
55 Old Bedford Road
Lincoln, Massachusetts 01773
Web Site: www.avidyne.com

FlightMax Traffic
Contents

Figures

Tables

FlightMax Traffic

Introduction

Figure 1: Traffic Icon

This part of the Pilot's Guide explains FlightMax Traffic and its use with the BF Goodrich SKYWATCH SKY497 Traffic Advisory System (TAS). Topics include:

- *Traffic Description* - provides a description of the Traffic function and the SkyWatch sensor.
- *Traffic Pages and Menus* - explains every page and menu used in FlightMax Traffic.
- *How to Use Traffic* - explains how to perform specific tasks using Traffic.
- *Messages and Error Indications* - provides the meanings of Traffic messages and error indications as well as the criteria used to generate information.
- *Menu Path* - graphically depicts the path to any menu in Traffic.

FlightMax Traffic is verified by the presence of its icon in the Main menu, Figure 1. If Traffic's icon is not present, contact your installer for assistance.

Before reading this section, you should read and understand the SkyWatch (TAS) Sky497 User's Guide. It contains information essential to the proper use and interpretation of the displays presented by FlightMax Traffic.

Traffic Description

FlightMax Traffic displays Traffic avoidance data gathered by the SkyWatch Traffic Alert System. Proper use of Traffic with the SkyWatch TAS can improve situational awareness of potential threat aircraft.

The purpose of the traffic display is to aid the pilot in visual acquisition of threat aircraft. This is accomplished by displaying the intruder aircraft's horizontal and, if altitude information is available, vertical position relative to the host aircraft. The traffic display system will provide traffic information on Mode A (no altitude data available), Mode C, and Mode S transponder equipped aircraft.

Traffic awareness systems alert pilots to other aircraft within their immediate airspace. They all consist of three major units: a sensor unit containing a processor with support electronics, a display unit, and antenna (Figure 2). The FSD replaces or supplements the display unit. It provides more information and easier recognition of potential threat aircraft.

For a complete understanding of the capabilities and performance characteristics of your system it is important that you read and understand the manual supplied with your traffic awareness system.

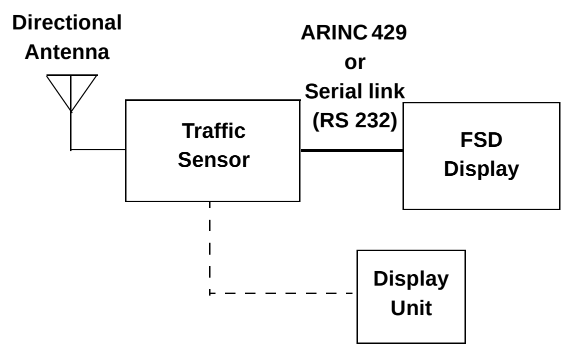


Figure 2: Traffic System Block Diagram

SkyWatch Description

SKYWATCH consists of three major assemblies:

- The Traffic Sensor (BF Goodrich calls this unit the TRC: Transmitter Receiver Computer) - SKY497
- The Display Unit - WX1000
- The Directional Antenna

The FSD replaces the SKYWATCH Display unit although the user has the option of continuing to use the SKYWATCH display. Both the Traffic Sensor and the Directional Antenna are still required. The FSD receives all its data from the Traffic Sensor. All displays on the FSD are generated using data from the Traffic Sensor.

The StormScope Option

BF Goodrich also makes the STORMSCOPE weather detection system. It can be configured to work with their SKYWATCH unit. If the STORMSCOPE option is attached to the SKYWATCH, the FSD operates as a slave to the SKYWATCH Traffic Sensor. The reason for this is to avoid conflict with the STORMSCOPE functions. In this configuration the pilot has access to weather information via the STORMSCOPE and traffic awareness via the FSD traffic option. As a slave, the FSD has no control over the traffic sensor, however, the following functions can be accessed:

- Altitude Display Mode - selects and displays the current altitude mode: Above, Below, Normal, and Unlimited.
- Display Range Mode- selects and displays the current range mode in nautical miles: 2nm and 6 nm.
- Help

If the STORMSCOPE option is not attached, the FSD can exercise greater control over the Traffic Sensor.

Traffic Pages and Menus

Data Page Layout

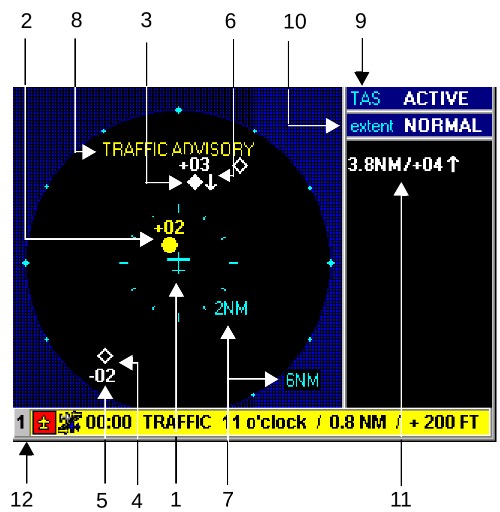


Figure 3: Data Page

1. **Aircraft Symbol** - This symbol represents your aircraft.
2. **Traffic Advisory Threat** - This symbol (a closed amber circle) represents an immediate traffic advisory threat and indicates the relative bearing and range of the intruder.In general a TA is displayed when an intruder aircraft is within 30 seconds of a possible collision or within 0.5nmi horizontal radius and a ± relative altitude range of your aircraft.
3. **Proximate Traffic** - This symbol (a white closed diamond) represents proximate traffic detected within a selected display range and altitude that is closer to your aircraft than the open diamond symbol, but does not generate a TA.
4. **Traffic** - This symbol (a white open diamond) represents traffic detected within a selected display range and altitude that does not generate a TA.

5. **Altitude** - The altitude number represents in hundreds of feet the relative altitude of an intruder aircraft. A positive tag indicates the intruder is above you, a negative tag indicates the intruder is below you. If the intruder is at the same altitude, 00 will be displayed. For example: +10 indicates the intruder is 1000 feet above you.

6. **Vertical Direction** - The arrow symbol represents the vertical direction of an intruder aircraft relative to your aircraft, moving at a relative rate of ascent or descent faster than 500fpm. An up arrow indicates an ascending intruder, a down arrow indicates the intruder is descending. No arrow indicates an intruder flying: level flight, moving vertically slower than 500fpm, or a non-altitude reporting intruder.

7. **Range** - The display is selectable for ranges of 2 or 6 nautical miles. The blue field around the 6nm ring represents the limits of sensor.

8. **System Status** - The System Status annunciation provides textual information across the primary view pane. The displays are in amber and include the following:

   SENSOR OFF, SENSOR STANDBY, SENSOR SELF-TEST, SENSOR FAILED, SENSOR DATA FAIL, TRAFFIC ADVISORY, TRAFFIC ADVISORY OFF-SCALE

9. **TAS Status** - The TAS indicator displays the current status of the sensor. The possible displays are: Off, Active, Error, and Standby.

10. **Extent Status** - The extent indicator displays the vertical mode the display is in. This includes: Normal, Above, Below, and Unlimited.

11. **Traffic Text** - Threats and other intruders which can’t be depicted in the view pane due to lack of bearing or range data are presented as a row of text. The text contains the threat level (TA if applicable) the distance or bearing from the host aircraft, the relative altitude (when available) and the vertical speed indicator. The text is the color of the associated threat level.

12. **Message Ba**r - If a function other than Traffic is active on the Avidyne FSD when a traffic advisory occurs, the FSD does not automatically switch to the Traffic display. Instead, a bright yellow message bar is

displayed along the bottom of the screen, alerting the pilot to a TA. The message bar includes the TA's bearing, distance, and relative altitude (if available). The message bar can display other traffic information as well. The pilot can access the Traffic display by pressing Enter.

Traffic Main Menu

The FSD supports two configurations of the SKYWATCH sensor. In one configuration there is no STORMSCOPE option on the SKYWATCH sensor. Without STORMSCOPE the WX-1000 SKYWATCH Display Unit is not integrated into the FlightMax FSD.

The other possible configuration has the STORMSCOPE option present with the WX-1000 SKYWATCH Display Unit attached to the sensor.

Main Menu Without StormScope

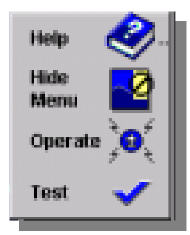


Figure 4: Menu w/o StormScope

Hide Menu

The menus can be hidden from view by selecting the Hide Menu command. The menus can be displayed at any time by pressing the Enter key.

Operate/Standby

Operate is a toggle function. Operate will place the SkyWatch sensor in a normal operating mode. The sensor will provide traffic data to the display.

Standby stops traffic data from being displayed on the FSD screen. The sensor is on, but no data is displayed. If the aircraft has a squat switch and is in the air, the SkyWatch unit will not enter Standby mode. Attempting to enter standby from the Traffic main menu while in flight, will fail, and Traffic will display a message informing the operator of its inability to place the SkyWatch unit in standby .

Test

Selecting Test will initiate the standard SkyWatch self-test. Refer to the SkyWatch Pilots Guide for information on Test mode.

Main Menu with StormScope

Figure 5: Menu with StormScope

Hide Menu
This is the only available function when Traffic is configured with the WX-1000 Display Unit and StormScope. All operator functions are performed at the WX-1000 display.

The menus can be hidden from view by selecting the Hide Menu command. The menus can be displayed at any time by pressing the Enter key.

Data Pane Displays

Figure 6: Data Pane

The data pane contains two constant displays: TAS and Extent.

The TAS display indicates the Skywatch mode of operation.

TAS Displays

Off
Displayed if the switch on the SKYWATCH Display Unit is turned off or there is no power to the Traffic Sensor unit, the FSD will display sensor OFF.

Active
Indicates the unit is functioning normally.

Fail
Indicates a failure has occurred

Stdby
Indicates the unit is in the standby mode

Test
Indicates the unit is undergoing a self test

Extent Displays

Extent displays the selected altitude range of the system. Figure 7 depicts the various altitude display modes

Normal
Displays traffic 2700 ft. above and below your aircraft

Above
Displays traffic 2700 feet below you and extends the ceiling up to 9000 feet above your aircraft.

Below
Displays traffic 2700 feet above you and extends the floor down to 9000 feet below your aircraft.

Unlimited (Unltd)
In this mode the FSD provides maximum altitude coverage above and below your aircraft. The maximum coverage is ± 9900.

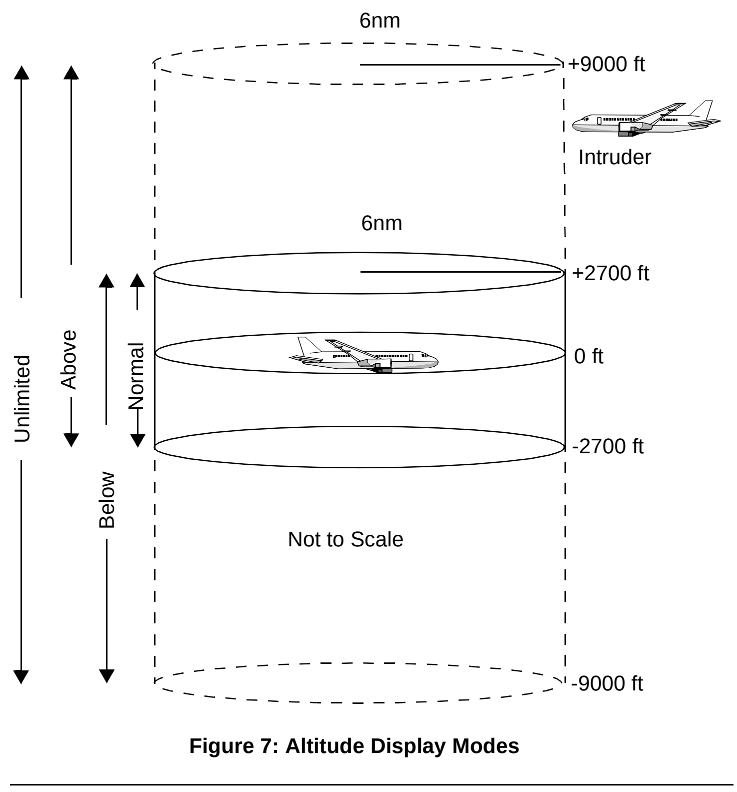


Figure 7: Altitude Display Modes

How to Use Traffic

Traffic Startup

FlightMax Traffic starts automatically as part of the normal initialization sequence of the FSD. To start TRAFFIC do the following:

1. Select Traffic from the Main Menu
2. Press **Enter** to start the Traffic application.
3. Traffic then displays its data page and main menu.

NOTE: When the Traffic product identification page first comes up, a brief error message in the message bar saying that the “traffic sensor has failed”, may appear while communication is being established. This message should go away in a few seconds and the startup sequence will continue.

Operation

Without StormScope

For systems without a STORMSCOPE attached, FlightMax Traffic allows the operator to transition between operate, standby and test mode. Switching to Test mode can only be done when the aircraft is on the **ground**. To transition between operate, standby and test do the following:

1. From Traffic’s main menu, select STANDBY to enter standby mode.
2. From Traffic’s main menu, select OPERATE to enter operate mode. The ability to switch out of STANDBY on the ground in conjunction with the ABOVE display mode is useful for scanning the airspace above the airport before takeoff.
3. From Traffic’s main menu, select TEST, the system will perform the normal SkyWatch startup self test.

NOTE: Test mode can only be entered into while the aircraft is on the ground.

With StormScope

For systems with a STORMSCOPE attached, the system goes through the following sequence:

1. Upon power up, the BFGoodrich SkyWatch unit performs a self-test.
2. If the SkyWatch unit passes the self-test, and the aircraft is on the ground, FlightMax Traffic enters standby mode.
3. If the SkyWatch unit passes self-test, and the aircraft has a squat switch and is in the air, FlightMax Traffic enters normal operating mode, with a display range of 6nm and an altitude display mode of NORMAL.
4. If the aircraft has a squat switch and FlightMax Traffic is in standby mode, Traffic will automatically enter normal operating mode 8 to 10 seconds after takeoff.
5. Upon landing, FlightMax traffic will automatically enter standby mode 24 seconds after landing.

NOTE: All behavior of FlightMax Traffic described in the preceding is determined by ARINC commands FlightMax Traffic receives from the SkyWatch unit.

Control Knob Functions

Outer Knob - Altitude

The outer knob is used to select between the different altitude modes.

Rotating the knob counter clockwise will display the modes in this sequence:

BELOW→NORMAL→ABOVE→UNLIMITED

Rotating the knob clockwise will produce the opposite sequence.

Inner Knob - Range

The inner knob is used to select the range (scale) for the Data page display. There is a choice of two range scales, 2nm, and 6nm. The default range is 6nm. Turning the knob counter clockwise will select the ranges in this sequence: 2nm→6nm.
Once the display range is at 6nm, further counter clockwise turns will have no effect.

Turning the knob clockwise will produce the opposite sequence: 6nm→2nm.
Once the display range is at 2nm, further clockwise turns will have no effect.

NOTE: In the 6nm scale a dark blue field surrounds the 6nm radius. This indicates that aircraft are not displayed beyond the 6nm range.

Audio

The Audio function of SKYWATCH is still active when the FSD is being used. Aural Traffic awareness warnings are generated from the SKYWATCH Traffic Sensor and connected directly to the aircraft audio system.

NOTE: There is no direct control of the audio from the FSD.

Messages and Error Indications

The system status annunciation describes the operating state of the system. The status is displayed in amber letters across the main Data page.

Table 1: Messages Issued by Traffic

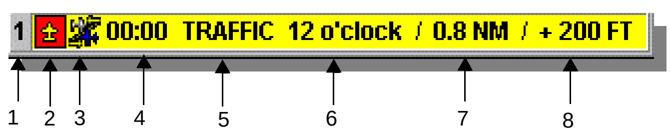
Message	Meaning
SENSOR STANDBY	Indicates the sensor is in standby mode. Standby is the normal status while the plane is on the ground. You must switch out of STANDBY to display traffic information.
SENSOR OFF	Indicates that the SKYWATCH sensor is powered down or incorrectly attached to the FSD (i.e. connected to the wrong ARINC port).
SENSOR FAIL or SENSOR DATA FAIL	Indicates that the SKYWATCH sensor or FSD has a fault.
SENSOR SELFTEST	Indicates the SKYWATCH is performing a self testing diagnostic. The self test can only be run from the Standby mode. Upon successful completion of the self test an audio message will be heard “Traffic Advisory System Test Passed” and the FSD screen will display STANDBY. If SENSOR FAILED is displayed, try repeating the test a few times. If it continues to fail refer to the SKYWATCH Users Guide.
TRAFFIC ADVISORY	Indicates the sensor has detected and issued a traffic advisory. This display supplements the visual symbol and/or textual information for threat aircraft. This display is the largest visual indicator that a TA exist.

Table 1: Messages Issued by Traffic

Message	Meaning
OFF-SCALE	If a threat at the level of the advisory is outside the display range, this message is displayed below the advisory message.

Message Bar

The Traffic Advisory message will appear whenever a TA is issued. When you are on another page or on the Traffic Data page, the message bar will appear in yellow across the bottom of the screen. The yellow background indicates that confirming this message (by pressing enter) will take you to the issuer's data page (in this case Traffic).



1. Number of messages awaiting Confirmation
2. Priority
3. Issuer
4. Elapsed time since message was issued
5. Type of Message
6. Bearing to intruder
7. Range in nautical miles
8. Vertical Separation

Traffic Advisory Criteria

The FSD traffic function receives it's data from the Sky497 sensor. The FSD is a slave to the criteria that the Sky497 sensor uses to issue a traffic advisory.

Sensitivity Levels

The Sky497 sensor uses two sensitivity levels for detecting intruders and generating a traffic advisory.

- *Sensitivity level A* is used during take-offs and landings.

Its purpose is to reduce the number of nuisance TA's encountered during those phases of your flight.

- *Sensitivity level B* is used to maximize the detection of intruders during the cruise phase of you flight.

The sensitivity levels are explained below.

Table 2: Sensitivity Level Parameters

Sensitivity Level	TA Parameters
A	Intruder is detected within 0.2nm horizontal radius and a ±600 ft relative altitude
	Intruder is detected within 15 -20 seconds of CPA*
B	Intruder is detected within 0.55nm horizontal radius and a ±800 ft relative altitude
	Intruder is detected within 20 -30 seconds of CPA*

* CPA means Closest Point of Approach

Sensitivity Level Criteria

There are three criteria that the Sky497 uses to determine which sensitivity level the sensor will operate in:

- Does your aircraft have a radio altimeter?[1]
- The current altitude of your aircraft
- The type and status of your aircraft's landing gear

The Sensitivity Level Criteria table on the next page provides a matrix of all possible configurations based on the three criteria that the Sky497 sensor uses to issue a traffic advisory and at which sensitivity level

1.Having a radio altimeter means having a compatible Arinc 429 radio altimeter wired to the Sky497 and providing valid altitude information.

.

Table 3: Sensitivity Level Criteria

Sensitivity Level	Radio Altimeter	Your Aircraft's Altitude	Your Landing Gear
A	Yes	Below 2000 ft AGL	N/A
B	Yes	Above 2000 ft AGL	N/A
A	No	N/A	Down
B	No	N/A	Up
B	No	N/A	Fixed

Traffic Configuration

CAUTION

Do not attempt to change any Traffic Configuration settings. Configuration of the Traffic function should only be done by authorized dealers.

To check the configuration of your system go to the System page and use the Main Menu to access the SKYWATCH Settings page.

SYSTEM→DEVICES→TRAFFIC SENSOR→ARINC SETTINGS

Figure 8: System Menu

1. When the Traffic Sensor page comes up TAS should be the only selection available. Selecting Enter will bring up the ARINC Settings page.
2. The SKYWATCH TRC is normally connected to ARINC port 3. If port 3 is not displayed, check with the dealer who installed your FlightMax

3. There is also a check box for selecting the STORMSCOPE option. This box should be checked if your aircraft has a WX-1000 Display Unit with the STORMSCOPE option attached.

   Do *not* check this box if there is no WX-1000 Display Unit attached, or there is a Display Unit but without the STORMSCOPE option.

Menu Path

The following Menu Tree graphically depicts the paths to all the Traffic menu functions.

Without StormScope

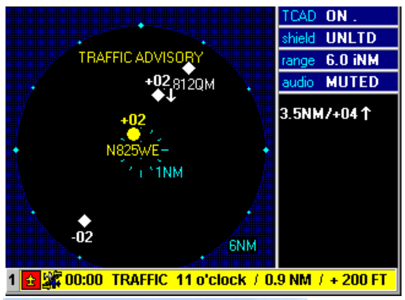
- Traffic
  - Hide Menu
  - Operate/Standby
  - Test
  - Help

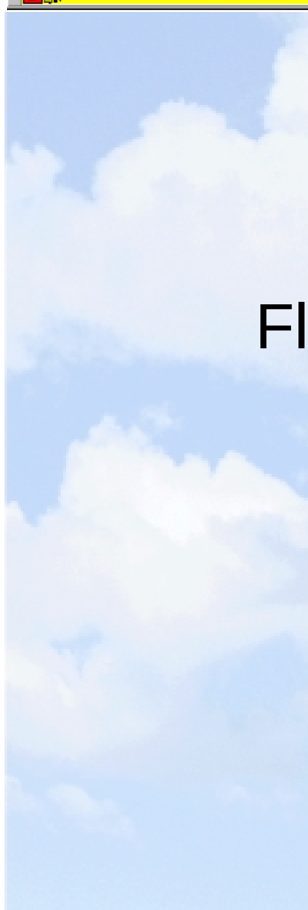
With StormScope

- Traffic
  - Hide Menu
  - Help

FlightMax™

Flight Situation Display





FlightMax Traffic

(TCAD)

Part Number 600-0062 Revision 00

Revision History

Date	Revision	Description
Sep. 7, 2000	00	Production Release

Avidyne Corporation
55 Old Bedford Road
Lincoln, Massachusetts 01773
Web Site: www.avidyne.com

FlightMax Traffic Contents

Figures

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FlightMax Traffic

Introduction

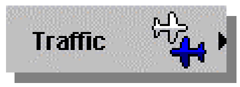


Figure 1: Traffic Icon

This part of the Pilot's Guide explains FlightMax Traffic and its use in conjunction with the Ryan Traffic and Conflict Alert Device (TCAD) 9900 series. Topics include:

- *Traffic Overview* - presents an overview of the Traffic function and the TCAD sensor.
- *Traffic Pages and Menus* - explains every page and menu used in FlightMax Traffic.
- *How to Use Traffic* - explains how to perform specific tasks using Traffic.
- *Messages and Error Indications* - provides the meanings of Traffic messages and error indications.
- *Menu Tree* - shows the path to any menu in Traffic.

FlightMax Traffic is verified by the presence of its icon and text label in the Main menu. If Traffic's icon and legend, shown in Figure 1, are not present in the Main menu, contact your installer for assistance.

Before reading this section, you should read and understand the Ryan TCAD 9900 series User's Guide. It contains information essential to the proper use and interpretation of the displays presented by Traffic.

Traffic Overview

FlightMax Traffic displays Traffic avoidance data gathered by the Ryan TCAD. Proper use of FlightMax Traffic with the Ryan TCAD can improve situational awareness of potential threat aircraft.

The purpose of the traffic display is to aid the pilot in visual acquisition of threat aircraft. This is accomplished by displaying the intruder aircraft's horizontal and, if altitude information is available, vertical position relative to the host aircraft. The traffic display system will provide traffic information on Mode A (no altitude data available), Mode C, and Mode S transponder equipped aircraft.

Traffic awareness systems alert pilots to other aircraft within their immediate airspace. They all consist of three major units: a sensor unit containing a processor with support electronics, a display unit, and antenna (Figure 2). The FSD replaces or supplements the display unit. It provides more information and easier recognition of potential threat aircraft.

For a complete understanding of the capabilities and performance characteristics of your system it is important that you read and understand the manual supplied with your traffic awareness system.

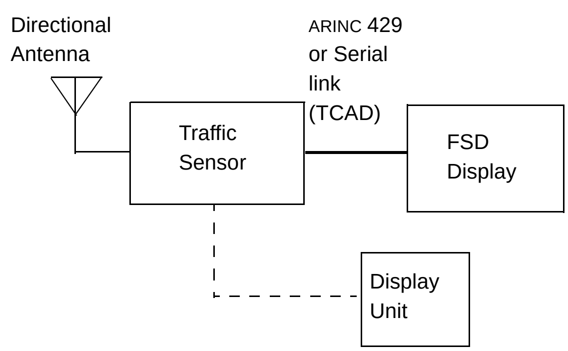


Figure 2: Traffic System Block Diagram

TCAD Description

TCAD consists of three major assemblies as well as aerodynamically designed blade antennas:

- The Traffic Sensor (Ryan refers to this unit as the Remote Processor)
- The Display
- The Transponder Coupler

The FSD replaces the Display unit, although the user has the option of continuing to use the TCAD display. The Traffic Sensor, the Antenna and the Transponder Coupler are still required. The FSD receives all its data from the Traffic Sensor. All displays on the FSD are generated using data from the Traffic Sensor. The Ryan TCAD receives and processes transponder signals from nearby aircraft to provide traffic alert information. Threat range is determined from the received amplitude of the transponder. Amplitude changes with range, and is used to calculate range and trend data. The increase or decrease of range data shows the trend in range. This trend information, particularly in closure situations, is important for effective collision alert, and is essentially independent of power variations among transponders.

The TCAD displays threats detected within a predetermined volume of airspace (the Air Traffic Shield). The size of the shield can be selected by the pilot, based on anticipated traffic conditions, using the various modes available within TCAD.

Traffic Pages and Menus

Data Page Layout

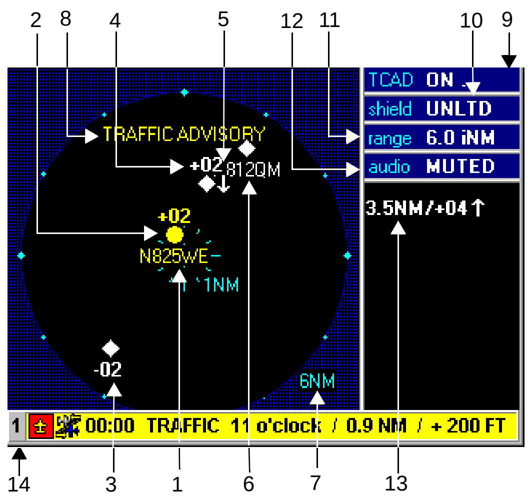


Figure 3: Data Page

1. **Aircraft Symbol** - This symbol represents your aircraft.
2. **Traffic Advisory Threat** - This symbol (a closed amber circle) represents an immediate traffic advisory threat and indicates the relative bearing and range of the intruder.

   In general a TA is displayed when an intruder aircraft is within ±500 vertical feet and 1.0nm of your aircraft.
3. **Proximate Traffic** - This symbol (a white closed diamond) represents proximate traffic detected within a selected display range and altitude that is close to your aircraft but does not generate a TA.
4. **Altitude** - The altitude number represents in hundreds of feet the relative altitude of an intruder aircraft. A positive tag indicates the intruder is above you, a negative tag indicates the intruder is below you. If the intruder is at the same altitude, 00 will be displayed. For example: +10 indicates the intruder is 1000 feet

above you.

5. Vertical Direction - This symbol represents the vertical direction of an intruder aircraft. An up arrow indicates an ascending intruder, a down arrow indicates the intruder is descending relative to your aircraft. No arrow indicates an intruder flying: level flight, or a non-altitude reporting intruder.
6. **Aircraft Identifier** - When available, an intruder identifier is displayed below the other intruder data, in the same color as the symbol. The identifier is the N-number or the Squawk code.
7. **Range** - This indicator shows the range rings and range indicators. The display is selectable for ranges of 1, 3 and 6 nautical miles. The blue field around the 6nm ring represents the limits of sensor.
8. **System Status Annunciation** - The System Status annunciation provides textual information across the primary view pane. The displays are in amber and include the following: TRAFFIC ADVISORY, TRAFFIC ADVISORY OFFSCALE
9. **TCAD Status** - The TCAD indicator displays the current status of the sensor. The possible displays are: Off, On and Fail. When the sensor is On there is a moving period within the display. The moving period confirms that the sensor is On and not locked up.
10. **Shield Status** - The shield indicator displays the current shield being used. The Air Traffic Shield is the optimum volume of airspace monitored by the TCAD. There are five shields selectable by the pilot: Ground, Terminal, Standard, Enroute, and Unlimited. Approach and Departure modes are automatic modes and are not pilot selectable.
11. **Sensing Range** - The range indicator displays the range being used by the current shield. The shields are set to a specific value in indicated nautical miles (iNM).
12. **Audio Status** - The audio indicator displays the status of the audio function within TCAD. When the system is muted, audible warnings are silenced for a specified duration. Mute does not disable Altitude Alert tones.
13. **Traffic Text** - Threats and other intruders which can’t be depicted in the view pane due to lack of bearing or

range data are presented as a row of text. The text contains the threat level (TA if applicable) the distance or bearing from the host aircraft, the relative altitude (when available) and the vertical speed indicator. The text is the color of the associated threat level.

14. **Message Bar** - If a function other than Traffic is active on the Avidyne FSD when a traffic advisory occurs, the FSD does not automatically switch to the Traffic display. Instead, a bright yellow message bar is displayed along the bottom of the screen, alerting the pilot to a TA. The message bar includes the TA's bearing, distance, and relative altitude (if available). The message bar can display other traffic information as well. The pilot can access the Traffic display by pressing Enter.

Traffic Main Menu

The Traffic main menu provides control of the following functions.

Figure 4: Main Menu

Hide Menu

The menu can be hidden from view by selecting the Hide Menu command. The menu can be displayed at any time by pressing the Enter key.

Mute

Mute is a toggle function, that silences or restores the TCAD audio alerts. Muting is temporary and the time of the mute is configured at the TCAD setting page.

Settings

Selecting the Settings function brings up the Settings submenu. From this menu the operator can enable or disable Approach mode. Enabling approach mode requires a destination field elevation to be entered.

Data Pane Displays

Figure 5: Data Pane

Status of the system is displayed in the right hand column of the Traffic Data page. There are four constant displays: TCAD status, shield status, sensing range and audio status.

TCAD status

The TCAD display indicates the status of the system.

Off

Is displayed if the TCAD is offline.

On

Indicates that the unit is functioning. In addition to the verbiage, there is a horizontally moving period at the end of the word ON. The continuously moving period indicates that the system is on and not locked up.

Fail

Indicates that the system is not functioning properly. The pilot should note any unusual displays, including any numbers or letters to assist maintenance.

> **NOTE:** When a data failure occurs with the TCAD sensor, the TCAD status displays OFF. This is inconsistent with the other message displays. It should display FAIL. The other error messages on the Traffic data page are correct. The main data pane will display a sensor error and the message bar will indicate sensor failure. This piece of the display is inconsistent with the actual state of the system. The sensor is not OFF.

Shield status

Displays what air traffic shield is presently being used. The Air Traffic Shield describes an adjustable volume of airspace, controlled by the pilot, to display potential threats, yet prevent extraneous traffic from being displayed.

The Air Traffic Shield has a specified radius and height above and below the aircraft. A detected threat will normally generate an alert (Figure 6).

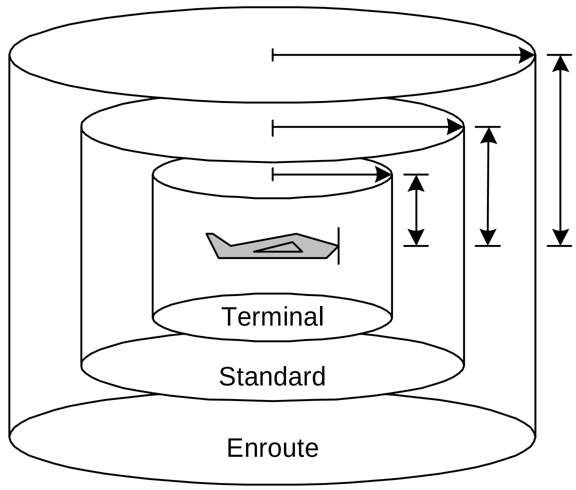


Figure 6: Shields

The following shields are available:

Enroute (ENRT)
Is used when the aircraft is at cruise. A large volume of airspace should be monitored because traffic is usually light, and threats could approach at high speeds and high rates of climb or descent.

Standard (STD)
Is used when transitioning from enroute flight. Traffic usually becomes more dense and the speed of potential threats is usually lower. Therefore a smaller shield size would be appropriate.

Terminal (TRML)
Is used when in the terminal area, because a smaller volume of airspace is generally best, in order to display threats and prevent display of extraneous traffic.

Ground (GND)
Is activated automatically upon startup or after landing by selecting it. Ground has a 200 foot ceiling for sensing intruders. TCAD will automatically transition from Ground Mode to Enroute mode after takeoff.

CAUTION

Do not operate TCAD in the Ground Mode when in flight.

Unrestricted Mode (UNLTD)
Can be used in place of enroute mode, if you need to expand the monitored airspace beyond the enroute shield.

Approach/Departure
Are transition modes that are non selectable by the pilot during flight. These modes automatically eliminate tones caused by aircraft on the ground as you approach or depart the runway. The approach mode can be enabled or disabled at the TCAD settings page. If approach is enabled, the pilot has to enter a destination field elevation.

Range

This display reflects the sensing range corresponding to the current shield being used.
The supported Ryan TCAD models are capable of operating in two different modes for sensing range: active or passive. In active mode the TCAD utilizes an interrogator to request transponder replies from nearby aircraft. In passive mode the TCAD listens to transponder replies triggered by external interrogators. Active mode provides greater range detection (10nm versus 6nm).

> **NOTE:** The model 9900B is only capable of operating in passive mode.

The operator can set the (horizontal) display range to the following:

Passive: 1, 3 or 6 miles.

Active: 1, 3, 6 or 10 miles

The maximum selectable display range is the smallest display range that is greater than or equal to the current shield radius.

For example: if the Standard shield is selected and its radius is 2 miles, the 6 mile range is not selectable.

Audio

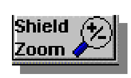
This display indicates the status of the Audio alerts, whether they're active or muted. The Audio function of TCAD is still active when the FSD is being used. Aural Traffic awareness warnings are generated from the TCAD Traffic Sensor and connected directly to the aircraft audio system. The pilot still has the capability to enable or disable voice alerts. The pilot is able to activate/deactivate the Mute function and change its duration (10-240 seconds).

Traffic Text

Intruder aircraft whose bearing cannot be determined by the sensor are called non-bearing aircraft. These aircraft are listed in the text column as shown in Figure 3. In

Information about the intruder is displayed as text under the audio field. The range in nautical miles and the altitude relative to your aircraft (above or below) is displayed if available.

Control Knob Indicator



A Shield/Zoom display in the lower right hand corner, indicates the functions of the inner and outer knobs.

How to Use Traffic

Traffic Startup

FlightMax Traffic starts automatically as part of the normal initialization sequence of the FSD. To use TRAFFIC do the following:

1. Select Traffic from the Main Menu.

   Traffic's product identification page will appear.

   Read all of the information on the product identification page and observe any operating limitations it reflects.

2. Press **Enter** to start the Traffic application.

3. Traffic then displays its data page and main menu.

   NOTE: When the Traffic product identification page first comes up, a brief error message in the message bar saying that the "traffic sensor has failed", may appear while communication is being established. This message should go away in a few seconds and the startup sequence will continue.

Control Knob Functions

Outer Knob - Altitude

The outer knob is used to select between the different altitude modes (shields). The available shields are: Enroute, Standard, Terminal, and Ground.

Inner Knob - Range

The inner knob is used to select the display range (scale). There are three range scales, 1nm, 3nm, and 6nm.

Turning the knob clockwise will select the ranges in this sequence (zoom in): 6nm→3nm→1nm.

Turning the knob counter clockwise will produce the opposite sequence (zoom out): 1nm→3nm→6nm.

In the 6nm scale a dark blue field surrounds the outside of the 6nm radius. This indicates that aircraft are not detected beyond the 6nm range.

Traffic Configuration

CAUTION

Do not attempt to change any Traffic Configuration settings without first checking with your authorized dealer.

Audio Configuration

This section explains how to configure the audio function for a FlightMax FSD using TCAD.

To change the audio settings use the following procedure and Figure 7:

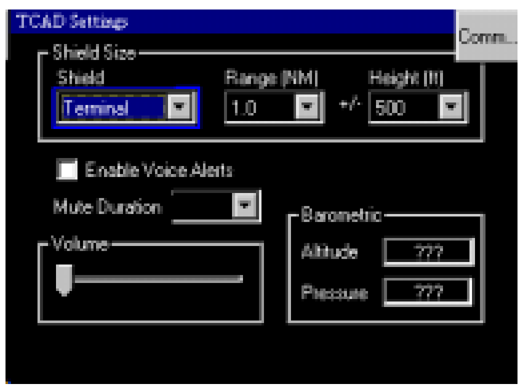


Figure 7: TCAD Settings

1. Go to the TCAD Settings page. This is reached from the Main Menu NOT the Traffic main menu (there is a Settings option on that menu as well:

   Main Menu→System→Devices→Traffic→TCAD Settings

2. To select any window on this page use the outer knob.

3. Select the Enable Voice Alerts box if you want to have audio alerts. Use the inner knob to place a check in the box.

   The system will generate a repetitive alert tone when a threat aircraft is within ±500 and 1.0iNM. The repetition rate increases when the threat aircraft is within ±300 feet and 0.7iNM. Enabling the Voice Alert means the last tone is replaced by the word “traffic”.

4. The mute function silences audible warnings for a specified duration. Select the Mute Duration pull down list to define the duration of the mute (10 to 240 seconds in 10 second intervals). Use the outer knob to select the window and the inner knob to select the duration.
5. The volume setting is also adjustable. The range is adjustable by using the inner knob. Clockwise raises the volume. Counter clockwise reduces it.

Setting the Shield size

When a shield is selected the maximum selectable range is applied.

To change the parameters of a shield use the following procedure and Figure 7:

1. Go to the TCAD Settings page. This is reached from the Main Menu NOT the Traffic main menu (there is a Settings option on that menu as well:

   Main Menu→Setup→Devices→Traffic→TCAD Settings
2. At the TCAD Settings page use the outer knob to select the Shield window. Use the inner knob to select the Shield from the drop down menu. There are 3 shields that can be modified: Terminal, Standard, and Enroute.
3. Use the outer knob to select the Range or Height windows. Use the inner knob to select the desired values from the respective drop down lists. The drop down lists contain the appropriate parameters for each shield. Table 1 gives the minimum and maximum values for the range and height of each shield.

Table 1: Shield Parameters

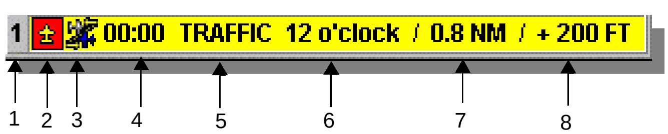
	Radius (iNM: 0.1)		Height (feet:100)	
	min	**max**	**min**	**max**
Terminal	0.5	1.5	200	1000
Standard	1.0	3.0	500	1500
Enroute	2.0	6.0	1000	2000

Messages and Error Indications

The system status annunciation describes the operating state of the system. The status is displayed in amber letters across the main Data page.

Message Bar

The Traffic Advisory message will appear whenever a TA is issued. When you are on another page or on the Traffic Data page, the message bar will appear in yellow across the bottom of the screen. The yellow background indicates that confirming this message (by pressing enter) will take you to the issuer's data page (in this case Traffic).



1. Number of messages awaiting Confirmation
2. Priority
3. Issuer
4. Elapsed time since message was issued
5. Type of Message
6. Bearing to intruder
7. Range in nautical miles
8. Vertical Separation

Traffic Advisory Criteria

The FSD traffic function receives its data from the TCAD sensor. The FSD is a slave to the TCAD sensor. The criteria that TCAD uses to acquire and display intruder threats determines what will be displayed on the FSD.

Traffic within ±500 feet altitude and 1.0iNM range of your aircraft will cause the TCAD sensor to generate a traffic advisory.

The TCAD processor uses several criteria to determine the existence of potential threat aircraft.

TCAD can monitor more than 50 aircraft at one time, the FSD can display up to nine aircraft on its screen. Generally, the shield size should be reduced when three threats are detected within the monitored area.

The following criteria are necessary to locate intruders:

Bearing

The TCAD Model 9900 series uses a patented Split Array antenna system and four receivers to provide bearing to the traffic. The direction of the traffic is determined using the top and bottom antennas. The top antenna, consisting of tow L-band elements, provides the front/aft resolution. The bottom antenna provides for left/right determination. The signals are combined and bearing to the traffic is presented to the FSD.

Range

TCAD uses signal strength to determine the range of traffic. Variations in output power from the opposing traffic will affect the iNM correlation to actual distance and is most pronounced at ranges beyond three iNM. Closure information should be the primary determinant of a threat beyond three iNM.

Non Altitude threats

The TCAD can detect aircraft without altitude-reporting capability. In this situation, TCAD provides iNM and horizontal closure information. When your aircraft is above 12,000 feet pressure altitude, non-Mode C traffic is not displayed.

Update Rate

TCAD is updated by transponder replies from threat aircraft. The rate of update is directly related to the density of the Secondary Surveillance radar environment and the interrogation from TCAS-equipped aircraft.

Mode A

The Ryan TCAD processing function decodes and pairs Mode A and C replies from threat aircraft, and sends the data on to be prioritized and displayed. A few ATC assigned Mode A codes are identical to Mode C codes, making it difficult for the processor to determine which of the A/C pair is the Mode A and which is the Mode C. In this case, both combinations are prioritized and displayed. If the threat aircraft or Mode A image is within the shield, it will be displayed. In the unlikely event that both the Mode A image and the threat are detected inside the monitored area, the combination is treated as a multiple threat.

The optimum volume of airspace to be monitored by Traffic changes with traffic density. When traffic is light, and aircraft are at cruising speeds, a large volume of airspace should be monitored. In higher density airspace, when the pilot is more alert for traffic and speeds are limited, a smaller surveillance volume is generally appropriate.

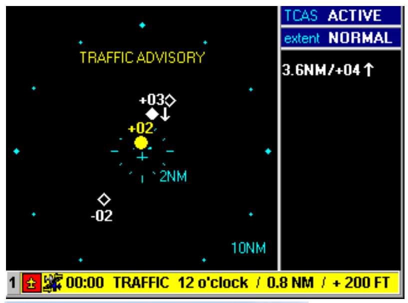
Menu Tree

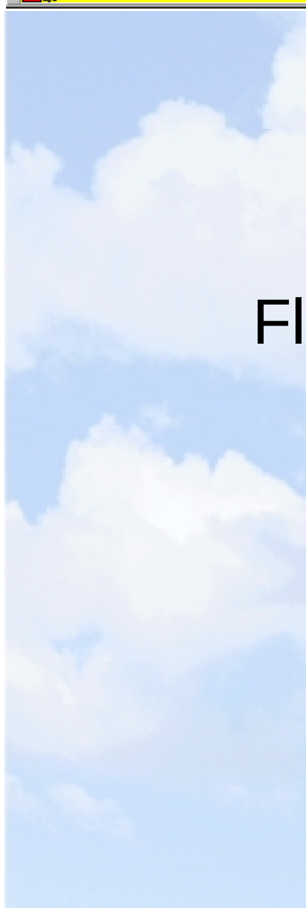
The following Menu Tree graphically depicts the paths to all the Traffic menu functions.

- Traffic
  - Hide Menu
  - Mute
  - Settings
  - Help

FlightMax™

Flight Situation Display





FlightMax Traffic

(TCAS)

Part Number 600-0063 Revision 01

Revision History

Date	Revision	Description
Sep. 7, 2000	00	Production Release
Sep. 14, 2000	01	Production Release

Avidyne Corporation
55 Old Bedford Road
Lincoln, Massachusetts 01773
Web Site: www.avidyne.com

FlightMax Traffic
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Introduction

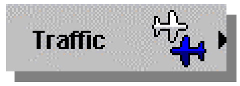


Figure 1: Traffic Icon

This part of the Pilot's Guide explains FlightMax Traffic and its use with a TCAS (ARINC 735-2) traffic awareness system. Topics include:

- *Traffic Overview* - presents an overview of the Traffic function.
- *Traffic Pages and Menus* - explains every page and menu used in Traffic.
- *How to Use Traffic* - explains how to perform specific tasks using Traffic.
- *Messages and Error Indications* - provides the meanings of Traffic messages and error indications.

FlightMax Traffic is verified by the presence of its icon and text label in the Main menu. If Traffic's icon and legend, shown in Figure 1, are not present in the Main menu, contact your installer for assistance.

For a complete understanding of the capabilities and performance characteristics of your system it is important that you read and understand the manual supplied with your traffic awareness system.

Traffic Overview

FlightMax Traffic displays Traffic avoidance data gathered by a TCAS System. FlightMax Traffic interfaces with TCAS I (Honeywell CAS 66A, BFG 791) systems. Proper use of Traffic with the TCAS system can improve situational awareness of potential threat aircraft.

The goal of any traffic awareness system is to identify potential threat aircraft. TCAS is an interrogation system that monitors the surrounding airspace searching for threat aircraft. Transponder signals from nearby aircraft are received by these systems. Information from the transponder signal is used to determine the range, bearing, relative altitude and closure rate of the threat aircraft. In some cases the aircraft ID can also be determined.

The purpose of the traffic display is to aid the pilot in visual acquisition of threat aircraft. The traffic display system will provide traffic information on Mode A (no altitude data available), Mode C, and Mode S transponder equipped aircraft.

Traffic awareness systems consist of three major units: a sensor unit containing a processor with support electronics, a display unit, and antenna (Figure 2). The FSD replaces or supplements the display unit. It provides more information and easier recognition of potential threat aircraft.

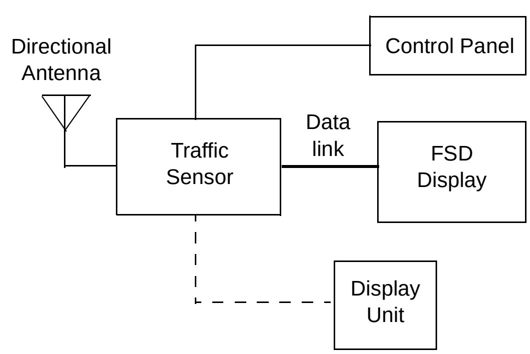


Figure 2: Traffic System Block Diagram

Traffic Pages and Menus

Data Page Layout

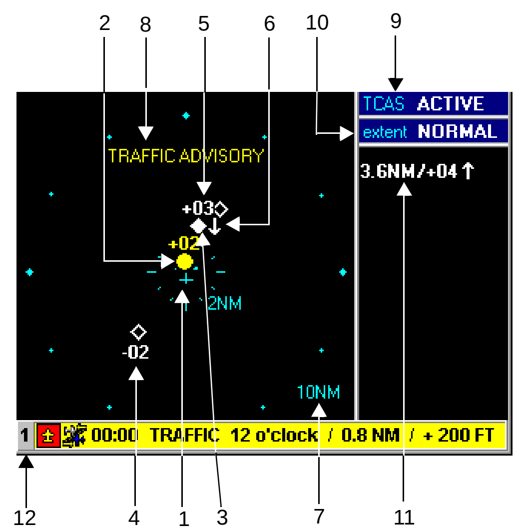


Figure 3: Data Page

The FAA has worked closely with the ATA, NASA, and both the SAE 5-7 and G-10 Committees in an effort to standardize TCAS symbology and features. A consensus has been reached for TCAS symbols and they are provided in AC 20-131A. Avidyne Traffic is in compliance with the display standards.

1. **Aircraft Symbol** - This symbol represents your aircraft.
2. **Traffic Advisory Threat** - This symbol (a closed amber circle) represents an immediate traffic advisory threat and indicates the relative bearing and range of the intruder.

   In general a TA is displayed when an intruder aircraft is within 30 seconds of a possible collision or within 0.5nmi horizontal radius and a ± relative altitude range of your aircraft.

3. **Proximate Traffic** - This symbol (a white closed diamond) represents proximate traffic detected within a selected display range and altitude that is closer to your aircraft than the open diamond symbol, but does not generate a TA.
4. **Traffic** - This symbol (a white open diamond) represents traffic detected within a selected display range and altitude that does not generate a TA.
5. **Altitude** - The altitude number represents in hundreds of feet the relative altitude of an intruder aircraft. A positive tag indicates the intruder is above you, a negative tag indicates the intruder is below you. If the intruder is at the same altitude, 00 will be displayed. For example: +10 indicates the intruder is 1000 feet above you.
6. **Vertical Direction** - The arrow symbol represents the vertical direction of an intruder aircraft relative to your aircraft, moving at a relative rate of ascent or descent faster than 500fpm. An up arrow indicates an ascending intruder, a down arrow indicates the intruder is descending. No arrow indicates an intruder flying: level flight, moving vertically slower than 500fpm, or a non-altitude reporting intruder.
7. **Range** - The range display is defined by the TCAS sensor. The TCAS sensor defines the sensing limit and sends that data to the FSD. The FSD displays pre- defined range rings up to and including the TCAS's sensing limit. The FSD also places a blue field around the outer most range ring to clearly annunciate the limit of the sensor. The FSD is capable of displaying ranges up to 40nm. Using the FSD display, the pilot can zoom in and out to the sensing limit of their TCAS sensor.
8. **System Status Annunciation** - The System Status annunciation provides textual information across the primary view pane. The displays are in amber and include the following:

   SENSOR OFF, SENSOR SELF-TEST, SENSOR FAILED, SENSOR DATA FAIL, TRAFFIC ADVISORY, TRAFFIC ADVISORY OFF-SCALE
9. **TCAS Status** - The TCAS indicator displays the current status of the sensor. The possible displays are: Off, Active and Error.

10. **Extent Status** - The extent indicator displays the vertical mode the sensor is in. This includes: Normal, Above, Below, and Unlimited.

11. **Traffic Text** - Threats and other intruders which can't be depicted in the view pane due to lack of bearing or range data are presented as a row of text. The text contains the threat level (TA if applicable) the distance or bearing from the host aircraft, the relative altitude (when available) and the vertical speed indicator. The text is the color of the associated threat level.

12. **Message Bar** - If a function other than FlightMax Traffic is active on the Avidyne FSD when a traffic advisory occurs, the FSD does not automatically switch to the Traffic display. Instead, a bright yellow message bar is displayed along the bottom of the screen, alerting the pilot to a TA. The message bar includes the TA's bearing, distance, and relative altitude (if available). The message bar can display other traffic information as well. The pilot can access the Traffic display by pressing Enter.

Traffic Menu

When TCAS is used as the traffic awareness sensor, there is minimal operator control. The only menu functions available are the HELP and HIDE MENU functions.

Figure 4: Main Menu

Data Pane Displays

Status of the system is displayed in the right hand column of the Traffic Data page. There are only two constant displays, TCAS and extent.

Figure 5: Data Pane

TCAS

The TCAS display indicates what mode of operation the sensor is in.

Off

If the TCAS Display Unit is turned off or there is no power to the Traffic Sensor unit, the FSD will display sensor OFF. If the display Unit is not present, the system will automatically come up when the Traffic Data page is selected from the FSD main menu.

Active
indicates the unit is functioning under normal operating conditions.

Fail
Indicates a failure has occurred.

Extent

Displays the altitude range of the system. The values for the different altitude ranges are defined by your TCAS sensor (on the CAS66, the control panel controls the altitude range). The following ranges are available:

Normal
displays traffic 2700 feet above and below your aircraft

Above
The Above mode displays traffic 2700 feet below you and extends the ceiling up to 8700 feet above your aircraft.

Below
The Below mode displays traffic 2700 feet above you and extends the floor down to 8700 feet below your aircraft.

Figure 6 shows typical values for these ranges.

> **NOTE:** The values in the previous explanations are typical, but may be different, depending upon the TCAS sensor used on your aircraft.

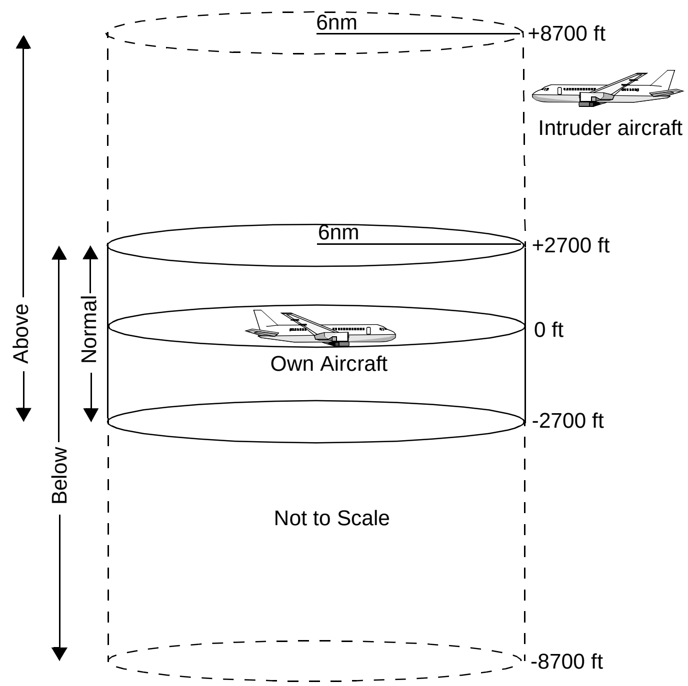


Figure 6: Altitude Display Modes

How to Use Traffic

Traffic Startup

FlightMax Traffic starts automatically as part of the normal initialization sequence of the FSD. To use TRAFFIC do the following:

1. Select Traffic from the Main Menu.

   Traffic's product identification page will appear.

   Read all of the information on the product identification page and observe any operating limitations it reflects.

2. Press **Enter** to start the Traffic application.

3. Traffic then displays its data page and main menu.

   NOTE: When the Traffic product identification page first comes up, a brief error message in the message bar saying that the "traffic sensor has failed", may appear while communication is being established. This message should go away in a few seconds and the startup sequence will continue.

Control Knob Functions

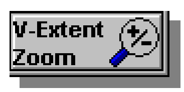


Figure 7: Knob Functions

Altitude

The outer knob is used to select between the different altitude modes.

Rotating the knob counter clockwise will display the modes in this sequence:

BELOW→NORMAL→ABOVE

Rotating the knob clockwise will produce the opposite sequence.

Range

The inner knob is used to select the range (scale) for the Data page display. The range scale is determined by the TCAS sensor . Turning the knob counter clockwise will increase the viewing range (up to 40nm).
Once the display range is at maximum, further counter clockwise turns will have no effect.

Turning the knob clockwise will reduce the viewing scale. Once the display range is at the lowest scale, further clockwise turns will have no effect.

In the 40nm scale a dark blue field surrounds the 40nm radius. This indicates that aircraft are not displayed beyond the 40nm range.

Messages and Error Indications

The system status annunciation describes the operating state of the system. The status is displayed in amber letters across the main Data page (see Figure 3).

Table 1: Messages Issued by Traffic

Message	Meaning
SENSOR OFF	Indicates that the TCAS sensor is powered down or incorrectly attached to the FSD.
SENSOR FAIL or SENSOR DATA FAIL	Indicates that the TCAS sensor or FSD has a fault.
SENSOR SELFTEST	Indicates the TCAS is performing a self testing diagnostic. Upon successful completion of the self test an audio message will be heard “Traffic Advisory System Test Passed”. If SENSOR FAILED is displayed, try repeating the test a few times. If it continues to fail refer to the TCAS users Guide.
TRAFFIC ADVISORY	Indicates the sensor has detected and issued a traffic advisory. This display supplements the visual symbol and/or textual information for threat aircraft. This display is the largest visual indicator that a TA exist.
OFF-SCALE	If a threat at the level of the advisory is outside the display range, this message is displayed below the advisory message.

Message Bar

The Traffic Advisory message is shown in Figure 8. This message will appear whenever a TA is issued. When you are on another page or on the Traffic Data page the message bar will appear in yellow across the bottom of the screen with information about the range, bearing and vertical separation of the intruder. The yellow background indicates that confirming this message (by pressing ENTER) will take you to the issuer's data page (in this case Traffic).

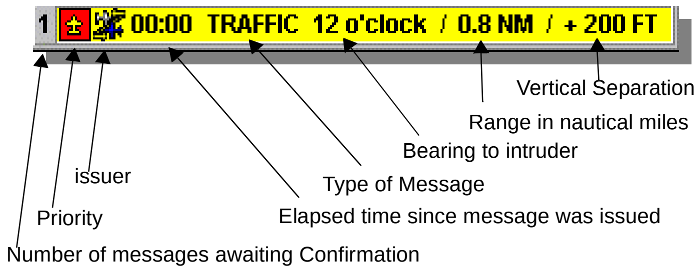


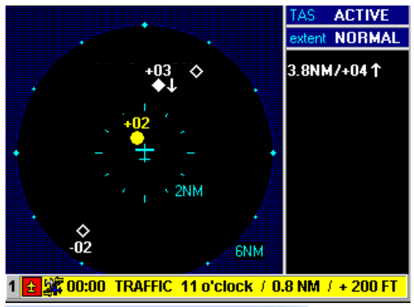
Figure 8: Traffic Advisory Message Bar

Traffic Advisory Criteria

The FSD traffic function receives its data from the TCAS sensor. The FSD is a slave to whatever criteria the sensor uses to issue a traffic advisory.

FlightMax™

Flight Situation Display



FlightMax Traffic

(TAS)

Part Number 600-0061 Revision 02

Revision History

Date	Revision	Description
Sep. 7, 2000	00	Production Release
May 18, 2001	01	Production Release per ECO 01-052
Jan 21, 2002	02	Production Release per ECO 02- 027

Avidyne Corporation
55 Old Bedford Road
Lincoln, Massachusetts 01773
Web Site: www.avidyne.com

FlightMax Traffic
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FlightMax Traffic

Introduction

Figure 1: Traffic Icon

This part of the Pilot's Guide explains FlightMax Traffic and its use with the Goodrich Skywatch™ Traffic Advisory System (TAS), the Bendix King KTA-870 TAS, and the KMH-880 TAS/EGPWS. Topics include:

- *Traffic Description* - provides a description of the Traffic function and the Skywatch sensor.
- *Traffic Pages and Menus* - explains every page and menu used in FlightMax Traffic.
- *How to Use Traffic* - explains how to perform specific tasks using Traffic.
- *Messages and Error Indications* - provides the meanings of Traffic messages and error indications as well as the criteria used to generate information.
- *Menu Path* - graphically depicts the path to any menu in Traffic.

FlightMax Traffic is verified by the presence of its icon in the Main menu, Figure 1. If Traffic's icon is not present, contact your installer for assistance.

Before reading this section, you should read and understand the TAS Pilot's Guide. It contains information essential to the proper use and interpretation of the displays presented by FlightMax Traffic.

Traffic Description

FlightMax Traffic displays Traffic avoidance data gathered by a Traffic Alert System (TAS). Proper use of Traffic with the TAS can improve situational awareness of potential threat aircraft.

The purpose of the traffic display is to aid the pilot in visual acquisition of threat aircraft. This is accomplished by displaying the intruder aircraft's horizontal and, if altitude information is available, vertical position relative to the host aircraft. The traffic display system will provide traffic information on Mode A (no altitude data available), Mode C, and Mode S transponder equipped aircraft.

Traffic awareness systems alert pilots to other aircraft within their immediate airspace. They all consist of three major units: a sensor unit containing a processor with support electronics, a display unit, and antenna (Figure 2). The FSD provides more information and easier recognition of potential threat aircraft.

For a complete understanding of the capabilities and performance characteristics of your system it is important that you read and understand the manual supplied with your traffic awareness system.

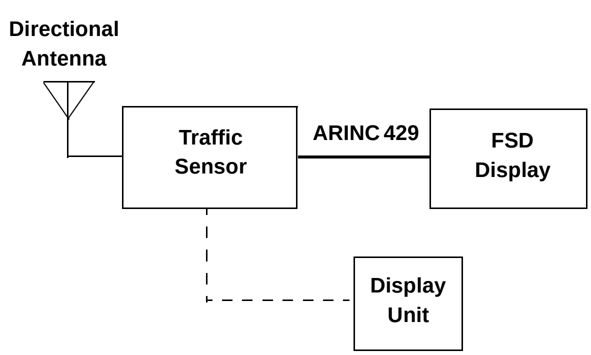


Figure 2: Traffic System Block Diagram

Skywatch TAS Description

Skywatch consists of three major assemblies:

- The Traffic Sensor (Goodrich calls this unit the TRC: Transmitter Receiver Computer)
- The Display Unit
- The Directional Antenna

The FSD replaces the Skywatch Display unit although the user has the option of continuing to use the Skywatch display. Both the Traffic Sensor and the Directional Antenna are still required. The FSD receives all its data from the Traffic Sensor. All displays on the FSD are generated using data from the Traffic Sensor.

The Stormscope Option

Goodrich also makes the Stormscope weather detection system. It can be configured to work with their Skywatch unit. If the STORMSCOPE option is attached to the Skywatch, the FSD operates as a slave to the Skywatch Traffic Sensor. The reason for this is to avoid conflict with the STORMSCOPE functions. In this configuration the pilot has access to weather information via the STORMSCOPE and traffic awareness via the FSD traffic option. As a slave, the FSD has no control over the traffic sensor, however, the following functions can be accessed:

- Altitude Display Mode - selects and displays the current altitude mode: Above, Below, Normal, and Unlimited.
- Display Range Mode - selects and displays the current range mode in nautical miles.
- Help

If the STORMSCOPE option is not attached, the FSD can exercise greater control over the Traffic Sensor.

Bendix/King TAS Description

The Bendix/King KMH 880 and the KTA 870 are the Traffic components of an Integrated Hazard Avoidance System (IHAS).

The KMH 880 is an integrated traffic advisory system and Enhanced Ground Proximity Warning System (EGPWS).

The KTA870 is a dedicated traffic advisory system. Both products use an active Mode C interrogation technique. They use dual directional antennas that present position and altitude for up to 30 intruder aircraft. The system will display traffic equipped with a Mode S and/or Mode A/C transponder.

Traffic Pages and Menus

Data Page Layout

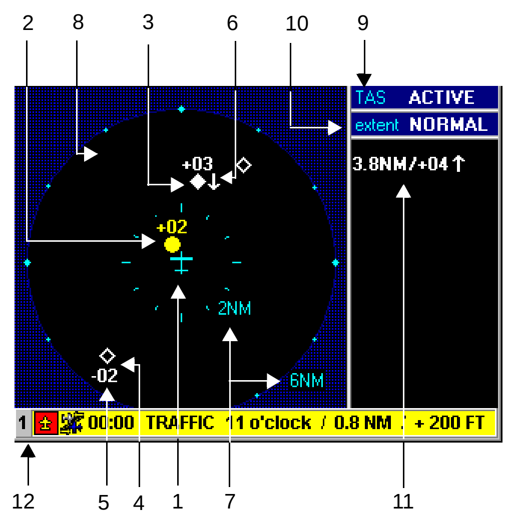


Figure 3: Data Page

1. **Aircraft Symbol** - This symbol represents your aircraft.
2. **Traffic Advisory Threat** - This symbol (a closed amber circle) represents an immediate traffic advisory threat and indicates the relative bearing and range of the intruder.
3. **Proximate Traffic** - This symbol (a white closed diamond) represents proximate traffic detected within a selected display range and altitude that is closer to your aircraft than the open diamond symbol, but does not generate a TA.
4. **Other Traffic** - This symbol (a white open diamond) represents traffic detected within a selected display range and altitude that does not generate a TA.
5. **Altitude** - The altitude number represents in hundreds of feet the relative altitude of an intruder aircraft. A positive tag indicates the intruder is above you, a negative tag indicates the intruder is below you. If the

intruder is at the same altitude, 00 will be displayed. For example: +10 indicates the intruder is 1000 feet above you.

6. **Vertical Trend**- The arrow symbol represents the vertical trend of an intruder aircraft relative to your aircraft, moving at a relative rate of ascent or descent faster than 500fpm. An up arrow indicates an ascending intruder, a down arrow indicates the intruder is descending. No arrow indicates an intruder in level flight, moving vertically slower than 500fpm, or a non-altitude reporting intruder.

7. **Range** - The possible ranges for Skywatch sensors are, 2nm, 6nm, and 11nm. The Skywatch HP model has an additional range of 35nm.

   The possible ranges for the Bendix/King sensors are 2nm, 6nm, 10nm, 20nm, and 40m.

   The blue field around the outer most ring represents the limits of sensor.

8. **System Status (not Shown)** - The System Status annunciation provides textual information across the primary view pane. The displays are in amber or cyan and include the following:

   SENSOR OFF, SENSOR STANDBY, SENSOR SELF-TEST, SENSOR FAIL, SENSOR DATA FAIL, OFF-SCALE

9. **TAS Status** - The TAS indicator displays the current status of the sensor. The possible displays are: Off, Active, Error, and Standby.

10. **Extent Status** - The extent indicator displays the vertical mode the display is in. This includes: Normal, Above, Below, and Unlimited.

11. **Traffic Text** - Threats and other intruders which can't be depicted in the view pane due to lack of bearing or range data are presented as a row of text. The text contains the threat level (TA if applicable) the distance or bearing from the host aircraft, the relative altitude (when available) and the vertical speed indicator. The text is the color of the associated threat level.

12. **Message Ba**r - If a function other than Traffic is active on the Avidyne FSD when a traffic advisory occurs, the FSD will display a bright yellow message bar along the bottom of the screen. This alerts the pilot to a TA. The

message bar includes the TA's bearing, distance, and relative altitude (if available). The pilot can access the Traffic display by pressing Enter.

Traffic Main Menu (Skywatch)

The FSD supports two configurations of the Goodrich Skywatch sensor. In one configuration there is no STORMSCOPE option on the Skywatch sensor. Only the FSD will display Traffic.

The other possible configuration has the STORMSCOPE option present with the WX-1000 Skywatch Display Unit attached to the sensor. Both the WX-1000 and the FSD can display traffic.

Main Menu Without Stormscope

Figure 4: Menu w/o Stormscope

Operate/Standby

Operate is a toggle function. Operate will place the Skywatch sensor in a normal operating mode. The sensor will provide traffic data to the display.

Standby stops traffic data from being displayed on the FSD screen. The sensor is on, but no data is displayed. If the aircraft has a squat switch and is in the air, the Skywatch unit will not enter Standby mode. Attempting to enter standby from the Traffic main menu while in flight will fail, and Traffic will display a message informing the operator of its inability to place the Skywatch unit in standby.

Test

Selecting Test will initiate the standard TAS self-test. Refer to the TAS Pilot's Guide for information on Test mode. Test will only be displayed on the menu when in Standby.

Main Menu with Stormscope

Help Menu

Help is the only available function when Traffic is configured with the WX-1000 Skywatch Display Unit and Stormscope. All operator functions are performed at the

WX-1000 display.

Traffic Main Menu (Bendix/King TAS)

When a Bendix/King TAS is used as the traffic awareness sensor, there are no menus. To leave the Traffic display press the ESC button. This will return you to the last function you were at prior to viewing Traffic.

Data Pane Displays

Figure 5: Data Pane

The data pane contains two constant displays: TAS and Extent.

The TAS display indicates the mode of operation.

TAS Displays

Off
Displayed if there is no power to the Traffic Sensor unit. The FSD will display sensor OFF.

Active
Indicates the unit is functioning normally.

Fail
Indicates a failure has occurred.

Stdby
Indicates the unit is in the standby mode.

Test
Indicates the unit is undergoing a self test.

Extent Displays

Extent displays the selected altitude range of the system. Figure 6 depicts the various altitude display modes.

Normal
Displays traffic 2700 ft. above and below your aircraft.

Above
Displays traffic 2700 feet below you and extends the

ceiling up to 9000 feet above your aircraft.

Below
Displays traffic 2700 feet above you and extends the floor down to 9000 feet below your aircraft.

Unlimited (Unltd)
In this mode the FSD provides maximum altitude coverage above and below your aircraft. The maximum coverage is ± 9900.

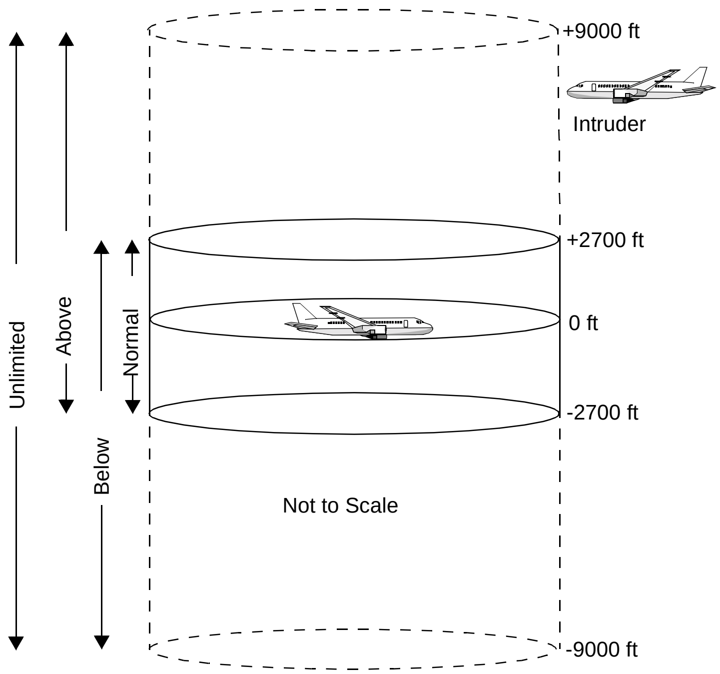


Figure 6: Altitude Display Modes

How to Use Traffic

Accessing Traffic

FlightMax Traffic starts automatically as part of the normal initialization sequence of the FSD. To use Traffic press **Escape** to bring up the Main Menu then select TRAFFIC. Traffic then displays its data page and main menu.

Operation

Skywatch Without Stormscope

For systems without a Stormscope attached, FlightMax Traffic allows the operator to transition between operate, standby and test mode. Switching to Test mode can only be done when the aircraft is on the **ground**. To transition between operate, standby and test do the following:

1. From Traffic's main menu, select STANDBY to enter standby mode.
2. From Traffic's main menu, select OPERATE to enter operate mode. The ability to switch out of STANDBY on the ground in conjunction with the ABOVE display mode is useful for scanning the airspace above the airport before takeoff.
3. From Traffic's main menu, select TEST, the system will perform the normal Skywatch startup self test.

   NOTE: Test mode can only be entered into while the aircraft is on the ground.

Skywatch With Stormscope

For systems with a Stormscope attached, the system goes through the following sequence:

1. Upon power up, the Goodrich Skywatch unit performs a self-test.
2. If the Skywatch unit passes the self-test, and the aircraft is on the ground, FlightMax Traffic enters standby mode.

3. If the Skywatch unit passes self-test, and the aircraft has a squat switch and is in the air, FlightMax Traffic enters normal operating mode, with the maximum display range and an altitude display mode of NORMAL.
4. If the aircraft has a squat switch and FlightMax Traffic is in standby mode, Traffic will automatically enter normal operating mode 8 to 10 seconds after takeoff.
5. Upon landing, FlightMax traffic will automatically enter standby mode 24 seconds after landing.

NOTE: All behavior of FlightMax Traffic described in the preceding is determined by ARINC commands FlightMax Traffic receives from the TAS sensor

Bendix/King TAS Operation

Bendix/King TAS operation is done by external control. See your TAS pilot's guide and installer for information on how your unit is controlled.

Control Knob Functions

Outer Knob - Extent

The outer knob is used to select between the different altitude modes.

Rotating the knob counter clockwise will display the modes in this sequence:

BELOW→NORMAL→ABOVE→UNLIMITED

Rotating the knob clockwise will produce the opposite sequence.

Inner Knob - Range

The inner knob is used to select the range (scale). The possible ranges for Skywatch are: 2nm, 6nm and 11nm. The Skywatch HP adds an additional range of 35nm. The Bendix/King sensors use 2nm, 6nm, 10nm, 20nm and 40nm. Turning the knob counter clockwise will decrease the range scale.
Once the display range is at the lowest range, further counter clockwise turns will have no effect.

Turning the knob clockwise will increase the range scale.

Once the display range is at maximum range, further clockwise turns will have no effect.

> **NOTE:** At the maximum scale a dark blue field surrounds the outer radius. This indicates that aircraft are not indicated beyond that range.

Audio

The Audio function of TAS is still active when the FSD is being used. Aural Traffic awareness warnings are generated from the TAS Sensor and connected directly to the aircraft audio system.

> **NOTE:** There is no direct control of the audio from the FSD.

Messages and Error Indications

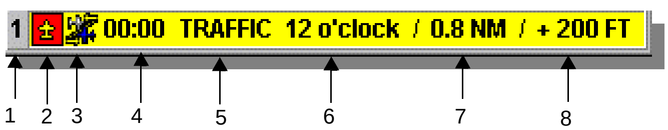
The system status annunciation describes the operating state of the system. The status is displayed in amber or cyan letters across the main Data page.

Table 1: Messages Issued by Traffic

Message	Meaning
MESSAGE COLOR = CYAN	
SENSOR STANDBY	Indicates the sensor is in standby mode. Standby is the normal status while the plane is on the ground. You must switch out of STANDBY to display traffic information.
SENSOR OFF	Indicates that the TAS sensor is powered down or incorrectly attached to the FSD (i.e. connected to the wrong ARINC port).
SENSOR FAIL or SENSOR DATA FAIL	Indicates that the TAS sensor or FSD has a fault.
SENSOR SELFTEST	Indicates the TAS is performing a self testing diagnostic. The self test can only be run from the Standby mode. Upon successful completion of the self test an audio message will be heard “Traffic Advisory System Test Passed” and the FSD screen will display STANDBY. If SENSOR FAILED is displayed, try repeating the test a few times. If it continues to fail refer to the TAS Pilot’s Guide.
MESSAGE COLOR = AMBER	
SENSOR FAIL or SENSOR DATA FAIL	Indicates that the TAS sensor or FSD has a fault.
OFF-SCALE	If a threat at the level of the advisory is outside the display range, this message is displayed below the advisory message.

Message Bar

The Traffic Advisory message will appear whenever a TA is issued. When you are on another page or on the Traffic Data page, the message bar will appear in yellow across the bottom of the screen. The yellow background indicates that confirming this message (by pressing enter) will take you to the issuer's data page (in this case Traffic).



1. Number of messages awaiting Confirmation
2. Priority
3. Issuer
4. Elapsed time since message was issued/updated (in the case of a TA, the time remains at 0)
5. Type of Message
6. Bearing to intruder
7. Range in nautical miles
8. Vertical Separation

Traffic Advisory Criteria

The FSD traffic function receives its data from the TAS sensor. The FSD is a slave to the criteria that the sensor uses to issue a traffic advisory.

Sensitivity Levels

The Skywatch sensor uses two sensitivity levels for detecting intruders and generating a traffic advisory.

- *Sensitivity level A* is used during take-offs and landings. Its purpose is to reduce the number of nuisance TA's encountered during those phases of your flight.
- *Sensitivity level B* is used to maximize the detection of intruders during the cruise phase of your flight.

The sensitivity levels are explained below.

Table 2: Sensitivity Level Parameters

Sensitivity Level	TA Parameters
A	Intruder is detected within 0.2nm horizontal radius and a ±600 ft relative altitude
	Intruder is detected within 15 -20 seconds of CPA*
B	Intruder is detected within 0.55nm horizontal radius and a ±800 ft relative altitude
	Intruder is detected within 20 -30 seconds of CPA*

* CPA means Closest Point of Approach

Sensitivity Level Criteria

There are three criteria that the Skywatch uses to determine which sensitivity level the sensor will operate in:

- Does your aircraft have a radio altimeter?[1]
- The current altitude of your aircraft
- The type and status of your aircraft's landing gear

The Sensitivity Level Criteria table on the next page provides a matrix of all possible configurations based on the three criteria that the Skywatch sensor uses to issue a traffic advisory and at which sensitivity level

1.Having a radio altimeter means having a compatible Arinc 429 radio altimeter wired to the Skywatch and providing valid altitude information.

.

Table 3: Sensitivity Level Criteria (Skywatch)

Sensitivity Level	Radio Altimeter	Your Aircraft's Altitude	Your Landing Gear
A	Yes	Below 2000 ft AGL	N/A
B	Yes	Above 2000 ft AGL	N/A
A	No	N/A	Down
B	No	N/A	Up
B	No	N/A	Fixed

Menu Path

The following Menu Tree graphically depicts the paths to all the Traffic menu functions.

Without Stormscope

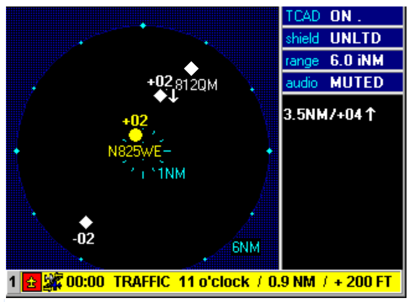
- Traffic
  - Hide Menu
  - Operate/Standby
  - Test
  - Help

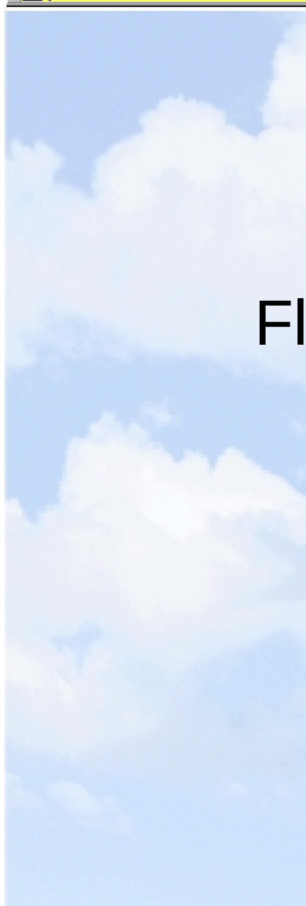
With Stormscope

- Traffic
  - Hide Menu
  - Help

FlightMax™

Flight Situation Display





FlightMax Traffic

(TCAD)

Part Number 600-0062 Revision 02

Revision History

Date	Revision	Description
Sep. 7, 2000	00	Production Release
May 18, 2001	01	Production Release per ECO 01-052
Feb. 6, 2002	02	Production Release per ECO 02-038

Avidyne Corporation
55 Old Bedford Road
Lincoln, Massachusetts 01773
Web Site: www.avidyne.com

FlightMax Traffic
Contents

Figures

FlightMax Traffic

Introduction

Figure 1: Traffic Icon

This part of the Pilot's Guide explains FlightMax Traffic and its use in conjunction with the Ryan Traffic and Collision Alert Device (TCAD) 9900B and 9900BX. Topics include:

- *Traffic Overview* - presents an overview of the Traffic function and the TCAD sensor.
- *Traffic Pages and Menus* - explains every page and menu used in FlightMax Traffic.
- *How to Use Traffic* - explains how to perform specific tasks using Traffic.
- *Messages and Error Indications* - provides the meanings of Traffic messages and error indications.
- *Menu Tree* - shows the path to any menu in Traffic.

FlightMax Traffic is verified by the presence of its icon and text label in the Main menu. If Traffic's icon and legend, shown in Figure 1, are not present in the Main menu, contact your installer for assistance.

Before reading this section, you should read and understand the Ryan TCAD 9900 series User's Guide. It contains information essential to the proper use and interpretation of the displays presented by Traffic.

Traffic Overview

FlightMax Traffic displays Traffic avoidance data gathered by the Ryan TCAD. Proper use of FlightMax Traffic with the Ryan TCAD can improve situational awareness of potential threat aircraft.

The purpose of the traffic display is to aid the pilot in visual acquisition of threat aircraft. This is accomplished by displaying the intruder aircraft's horizontal and, if altitude information is available, vertical position relative to the host aircraft. The traffic display system will provide traffic information on Mode A (no altitude data available), Mode C, and Mode S transponder equipped aircraft.

Traffic awareness systems alert pilots to other aircraft within their immediate airspace. They all consist of three major units: a sensor unit containing a processor with support electronics, a display unit, and antennas (Figure 2). The FSD replaces or supplements the display unit. It provides additional information and simplified recognition of potential threat aircraft.

For a complete understanding of the capabilities and performance characteristics of your system it is important that you read and understand the manual supplied with your traffic awareness system.

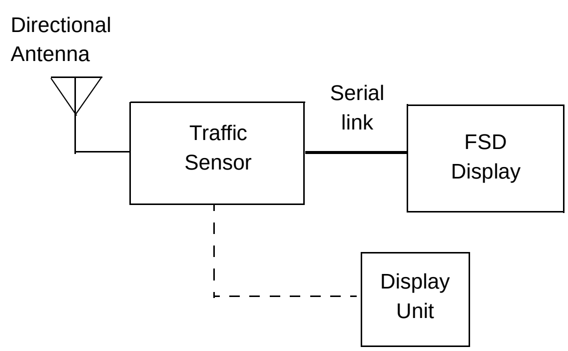


Figure 2: Traffic System Block Diagram

TCAD Description

TCAD consists of three major assemblies as well as two aerodynamically designed blade antennas:

- The Traffic Sensor (Ryan refers to this unit as the Remote Processor)
- The Display
- The Transponder Coupler

The FSD replaces the Display unit, although the user has the option of continuing to use the TCAD display. The Traffic Sensor, the Antenna and the Transponder Coupler are still required. The FSD receives all its data from the Traffic Sensor. All displays on the FSD are generated using data from the Traffic Sensor.

The 9900B receives and processes transponder signals from nearby aircraft to provide traffic alert information. Threat range is determined from the received amplitude of the transponder. Amplitude changes with range, and is used to calculate range and trend data. The increase or decrease of range data shows the trend in range. This trend information, particularly in closure situations, is important for effective collision alert, and is essentially independent of power variations among transponders.

The 9900BX also interrogates transponders from nearby aircraft. The vertical separation of host and intruder is determined by comparing decoded altitude replies to the host's altitude. The range is determined using radar time to arrival technique. Bearing is determined using the dual directional antennas mounted on the top and bottom of the aircraft. Altitude date from the intruder is referenced to pressure altitude (29.92 inches or 1013mb), as is the onboard encoder providing separation information.

The TCAD displays threats detected within a predetermined volume of airspace (the Air Traffic Shield). The size of the shield can be selected by the pilot, based on anticipated traffic conditions, using the various modes available within TCAD.

Traffic Pages and Menus

Data Page Layout

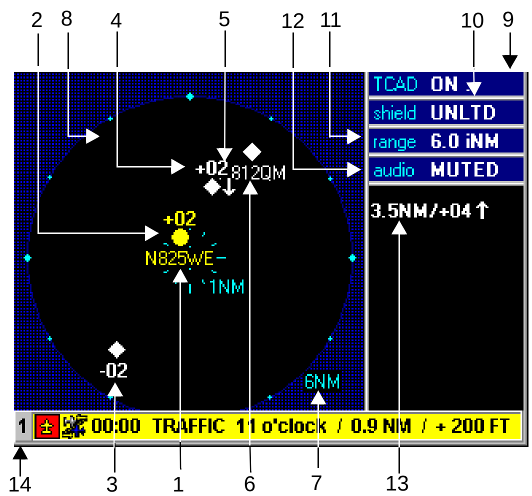


Figure 3: Data Page

1. **Aircraft Symbol** - This symbol represents your aircraft.
2. **Traffic Advisory Threat** - This symbol (a closed amber circle) represents an immediate traffic advisory threat and indicates the relative bearing and range of the intruder.
3. **Proximate Traffic** - This symbol (a white closed diamond) represents proximate traffic detected within a selected display range and altitude that is close to your aircraft but does not generate a TA.
4. **Altitude** - The altitude number represents in hundreds of feet the relative altitude of an intruder aircraft. A positive tag indicates the intruder is above you, a negative tag indicates the intruder is below you. If the intruder is at the same altitude, 00 will be displayed. For example: +10 indicates the intruder is 1000 feet above you.
5. **Vertical Trend** - This symbol represents the vertical

trend of an intruder aircraft. An up arrow indicates an ascending intruder, a down arrow indicates the intruder is descending relative to your aircraft. No arrow indicates an intruder flying: level flight, or a non-altitude reporting intruder.

6. **Aircraft Identifier** - When available, an intruder identifier is displayed below the other intruder data, in the same color as the symbol. The identifier is the N-number or the Squawk code.

7. **Range** - This indicator shows the range rings and range indicators. The available ranges are dependent on the sensor used. The blue field around the outermost ring represents the limits of the sensor.

8. **System Status Annunciation (not shown)** - The System Status annunciation provides textual information across the primary view pane. The displays are in amber and include the following: SENSOR OFF, SENSOR DATA FAIL, OFFSCALE

9. **TCAD Status** - The TCAD indicator displays the current status of the sensor. The possible displays are: Off, On and Fail. When the sensor is On there is a moving period within the display. The moving period confirms that the sensor is On and not locked up.

10. **Shield Status** - The shield indicator displays the current shield being used. The Air Traffic Shield is the optimum volume of airspace monitored by the TCAD. There are five shields selectable by the pilot: Ground, Terminal, Standard, Enroute, and Unlimited. Approach and Departure modes are automatic modes and are not pilot selectable.

11. **Sensing Range** - The range indicator displays the range being used by the current shield. The shields are set to a specific value in indicated nautical miles (iNM).

12. **Audio Status** - The audio indicator displays the status of the audio function within TCAD. When the system is muted, audible warnings are silenced for a specified duration. Mute does not disable Altitude Alert tones.

13. **Traffic Text** - Threats and other intruders which can’t be depicted in the view pane due to lack of bearing or range data are presented as a row of text. The text contains the threat level (TA if applicable) the distance

or bearing from the host aircraft, the relative altitude (when available) and the vertical speed indicator. The text is the color of the associated threat level.

14. **Message Bar** - If a function other than Traffic is active on the Avidyne FSD when a traffic advisory occurs, the FSD will display a bright yellow message bar along the bottom of the screen. This alerts the pilot to a TA. The message bar includes the TA's bearing, distance, and relative altitude (if available). The pilot can access the Traffic display by pressing Enter.

Traffic Main Menu

The Traffic main menu provides control of the following functions.

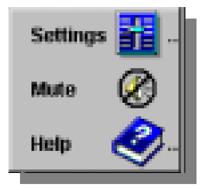


Figure 4: Main Menu

Settings

Selecting Settings will bring up the Settings Page 1. Approach mode is enabled or disabled at this page. From this page you can access the Settings Page 2. Shield size, mute duration and audio volume are configured on this page.

Mute

Mute is a toggle function that silences or restores the TCAD audio alerts. Muting is temporary and the time of the mute is configured at the TCAD Setting Page 2.

Data Pane Displays

Status of the system is displayed in the right hand column of the Traffic Data page. There are four constant displays: TCAD status, shield status, sensing range and audio status.

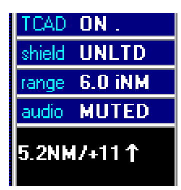


Figure 5: Data Pane

TCAD status

The TCAD display indicates the status of the system.

Off

Is displayed if the TCAD is offline.

On

Indicates that the unit is functioning. In addition to the verbiage, there is a horizontally moving period at the end of the word ON. The continuously moving period indicates that the system is on and not locked up.

Fail

Indicates that the system is not functioning properly. The pilot should note any unusual displays, including any numbers or letters to assist maintenance.

Shield status

Displays what air traffic shield is presently being used. The Air Traffic Shield describes an adjustable volume of airspace, controlled by the pilot, to display potential threats, yet prevent extraneous traffic from being displayed.

The Air Traffic Shield has a specified radius and height above and below the aircraft.

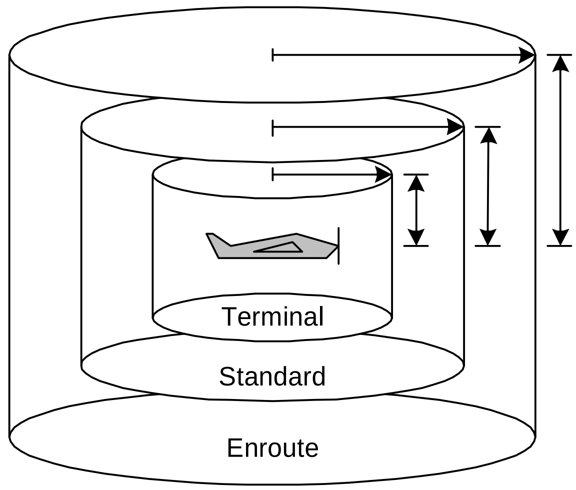


Figure 6: Shields

The following shields are available:

Enroute (ENRT)
Is used when the aircraft is at cruise. A large volume of airspace should be monitored because traffic is usually light, and threats could approach at high speeds and high rates of climb or descent.

Standard (STD)
Is used when transitioning from enroute flight. Traffic usually becomes more dense and the speed of potential threats is usually lower. Therefore a smaller shield size would be appropriate.

Terminal (TRML)
Is used when in the terminal area, because a smaller volume of airspace is generally best, in order to display threats and prevent display of extraneous traffic.

Ground (GND)
Is activated automatically upon startup or after landing by selecting it. Ground has a 200 foot ceiling for sensing intruders. TCAD will automatically transition from Ground Mode to Enroute mode after takeoff.

CAUTION

Do not operate TCAD in the Ground Mode when in flight.

Unrestricted Mode (UNLTD)
Can be used in place of enroute mode, if you need to expand the monitored airspace beyond the enroute shield.

Approach/Departure
Are transition modes that are non selectable by the pilot during flight. These modes automatically eliminate tones caused by aircraft on the ground as you approach or depart the runway. The approach mode can be enabled or disabled at the TCAD settings page. If approach is enabled, the pilot has to enter a destination field elevation.

Range

This display reflects the sensing range corresponding to the current shield being used. The supported Ryan TCAD models are capable of operating in two different modes for sensing range: active or passive. In active mode the TCAD utilizes an interrogator to request transponder replies from nearby aircraft. In passive mode the TCAD listens to transponder replies triggered by external interrogators. Active mode provides greater range detection.

> **NOTE:** The model 9900B is only capable of operating in passive mode.

The operator can set the (horizontal) display range to the following:

9900B: 1, 3 or 6 miles.

9900BX: 1, 3, 6, 10 or 20 miles.

The maximum selectable display range is the smallest display range that is greater than or equal to the current shield radius.

For example: if the Standard shield is selected and its radius is 2 miles, the 6 mile range is not selectable.

Audio

This display indicates the status of the Audio alerts, whether they're active or muted. The Audio function of TCAD is still active when the FSD is being used. Aural Traffic awareness warnings are generated from the TCAD Traffic Sensor and connected directly to the aircraft audio system. The pilot still has the capability to enable or disable voice alerts. The pilot is able to activate/deactivate the Mute function and change its duration (10-240 seconds).

Traffic Text

Intruder aircraft whose bearing cannot be determined by the sensor are called non-bearing aircraft. These aircraft are listed in the text column as shown in Figure 3. The range in nautical miles and the altitude relative to your aircraft (above or below) is displayed if available.

Control Knob Indicator

A Shield/Zoom display in the lower right hand corner, indicates the functions of the inner and outer knobs.

How to Use Traffic

Accessing Traffic

FlightMax Traffic starts automatically as part of the normal initialization sequence of the FSD. To use Traffic press **Esc** to bring up the Main Menu then select TRAFFIC. Traffic then displays its data page and main menu.

Control Knob Functions

Outer Knob - Altitude

The outer knob is used to select between the different altitude modes (shields). The available shields are: Enroute, Standard, Terminal, Ground, and Unlimited.

Inner Knob - Range

The inner knob is used to select the display range (scale).

Turning the knob counter clockwise will decrease the range scale. Once the display range is at the lowest range, further counter clockwise turns will have no effect.

Turning the knob clockwise will increase the range scale. Once the display range is at maximum range, further clockwise turns will have no effect.

In the outer most scale a dark blue field surrounds the outside of the maximum radius. This indicates that aircraft are not detected beyond that range.

Configuration Settings

Approach Mode

To enable the Approach Mode do the following:

1. Bring up the Traffic Main menu and select Settings. The Settings Page is displayed (Figure 7).
2. Use the inner knob to place a check mark in the Enable field.
3. Use the outer knob to select Field Elevation.

4. Use the inner knob to set the Field Elevation

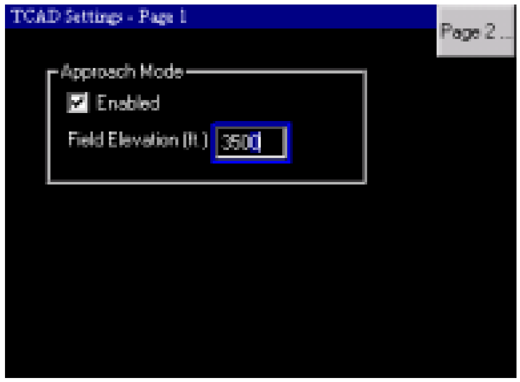


Figure 7: Settings Page 1

Audio Configuration

To change the audio settings use the following procedure :

1. Bring up the Traffic Main menu and select Settings, then select Page 2..
2. Use the outer knob to select the Enable Voice Alerts box if you want to have audio alerts. Use the inner knob to place a check in the box.

   The system will generate a repetitive alert tone when a threat aircraft is within ±500 and 1.0iNM. The repetition rate increases when the threat aircraft is within ±300 feet and 0.7iNM. Enabling the Voice Alert means the last tone is replaced by the word “traffic”.
3. The mute function silences audible warnings for a specified duration. Select the Mute Duration pull down list to define the duration of the mute (10 to 240 seconds in 10 second intervals). Use the outer knob to select the window and the inner knob to select the duration.
4. The volume setting is also adjustable. The range is adjustable by using the inner knob. Clockwise raises the volume. Counter clockwise reduces it.

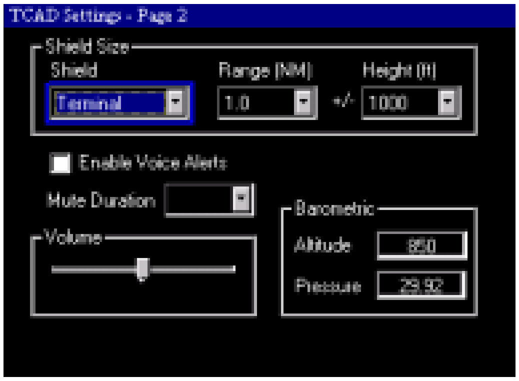


Figure 8: Settings Page 2

Setting the Shield size

When a shield is selected the maximum selectable range is applied. To change the parameters of a shield do the following:

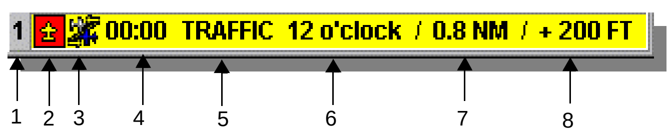
1. Bring up the Traffic Main menu and select Settings, then select Page 2.
2. Use the outer knob to select the Shield window. Use the inner knob to select the Shield from the drop down menu. There are 3 shields that can be modified: Terminal, Standard, and Enroute.
3. Use the outer knob to select the Range or Height windows. Use the inner knob to select the desired values from the respective drop down lists. The drop down lists contain the appropriate parameters for each shield.

Messages and Error Indications

The system status annunciation describes the operating state of the system. The status is displayed in Cyan letters across the main Data page.

Message Bar

The Traffic Advisory message will appear whenever a TA is issued. When you are on another page or on the Traffic Data page, the message bar will appear in yellow across the bottom of the screen. The yellow background indicates that confirming this message (by pressing enter) will take you to the issuer's data page (in this case Traffic).



1. Number of messages awaiting Confirmation
2. Priority
3. Issuer
4. Elapsed time since message was issued
5. Type of Message
6. Bearing to intruder
7. Range in nautical miles
8. Vertical Separation

Traffic Intruder Display Criteria

The FSD traffic function receives its data from the TCAD sensor. The FSD is a slave to the TCAD sensor. The criteria that TCAD uses to acquire and display intruder threats determines what will be displayed on the FSD.

The TCAD processor uses several criteria to determine the existence of potential threat aircraft.

TCAD can monitor more than 50 aircraft at one time, the

FSD can display up to nine aircraft on its screen. Generally, the shield size should be reduced when three threats are detected within the monitored area.

The following criteria are necessary to locate intruders:

Bearing

The TCAD Model 9900B and 9900BX series use a patented Split Array antenna system and receivers to provide bearing to the traffic. The direction of the traffic is determined using the top and bottom antennas. The top antenna, consisting of two L-band elements, provides the front/aft resolution. The bottom antenna provides for left/right determination. The signals are combined and bearing to the traffic is presented to the FSD.

Range

The 9900B uses signal strength to determine the range of traffic. The 9900BX has an active interrogation system to determine range.

Non Altitude threats

The TCAD can detect aircraft without altitude-reporting capability. In this situation, TCAD provides iNM and horizontal closure information. When your aircraft is above 12,000 feet pressure altitude, non-Mode C traffic is not displayed.

Update Rate

TCAD is updated by transponder replies from threat aircraft.

Mode A

The Ryan TCAD processing function decodes and pairs Mode A and C replies from threat aircraft, and sends the data on to be prioritized and displayed. A few ATC assigned Mode A codes are identical to Mode C codes, making it difficult for the processor to determine which of the A/C pair is the Mode A and which is the Mode C. In this case, both combinations are prioritized and displayed. If the threat aircraft or Mode A image is within the shield, it will be displayed. In the unlikely event that both the Mode A image and the threat are detected inside the monitored area, the combination is treated as a multiple threat.

The optimum volume of airspace to be monitored by Traffic changes with traffic density. When traffic is light, and aircraft are at cruising speeds, a large volume of airspace should be monitored. In higher density airspace, when the pilot is more alert for traffic and speeds are limited, a smaller surveillance volume is generally appropriate.

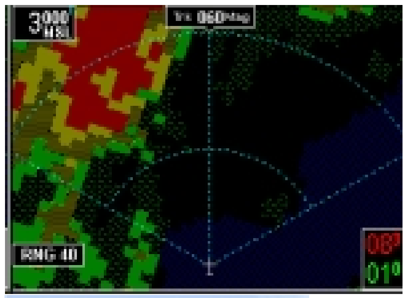
Menu Tree

The following Menu Tree graphically depicts the paths to all the Traffic menu functions.

- Traffic
  - Hide Menu
  - Mute
  - Settings
  - Help

FlightMax™

Flight Situation Display



FlightMax GroundProx

Part Number 600-0064 Revision 00

Revision History

Date	Revision	Description
Sep. 7, 2000	00	Production Release

Avidyne Corporation
55 Old Bedford Road
Lincoln, Massachusetts 01773
Web Site: www.avidyne.com

FlightMax GroundProx
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FlightMax GroundProx

Introduction

Figure 1: GroundProx Icon

This part of the Pilot's Guide explains Flightmax GroundProx. Flightmax GroundProx is a control and display interface for airborne Terrain Awareness and Warning System (TAWS) equipment. Topics include:

- *GroundProx Overview* - presents an overview of the GroundProx function.
- *GroundProx Pages and Menus* - explains every page and menu used in GroundProx
- *How to Use GroundProx* - explains how to perform specific tasks using GroundProx.
- *Messages and Error Indications* - provides the meanings of GroundProx messages and error indications.
- *Menu Organization* - graphically shows the path to any menu in GroundProx.
- *Honeywell Software Levels* - explains the different software levels used on Honeywell EGPWS and how they interface with the FlightMax FSD.

Flightmax GroundProx is verified by the presence of its icon and text label in the Main Menu. If the GroundProx icon and label, shown in Figure 1, are not present in the Main Menu, contact your installer for assistance.

GroundProx Overview

FlightMax GroundProx displays data from an external, Enhanced Ground Proximity Warning System (EGPWS), to provide pilots with a color visual display of the terrain along and below the airplane’s flight path.

The terrain display is color-coded so as to indicate the varying relative altitudes and threat levels of the adjacent terrain. Visually, the GroundProx display is similar to a radar display. Terrain data is continuously updated by a radar like sweep across the screen. The data is overlaid with range rings, allowing pilots to estimate relative distance to terrain features. The display range is adjustable, as defined by the EGPWS. An adjustable bearing line can also be displayed.

The EGPWS is powered separately from the MFC, and is always “on”, whether or not the MFC or GroundProx Display is functioning. All non display functions, including aural alerts, operate independently from the GroundProx display.

Terrain Caution and Terrain Warning conditions are visually annunciated on the display. Urgent and immediate terrain situations are indicated in the message bar, even if another function is currently displayed. Exceptional conditions, such as loss of communication or other fault conditions as reported by the EGPWS are also annunciated on the display.

Peaks Mode

During normal operation, the EGPWS displays terrain topography that is above or within 2000 feet below the aircraft. The EGPWS can be configured to an optional mode of operation called “Peaks Mode”. This configuration requires a hardware change on the EGPWS.

When the Peaks Mode option is engaged additional features are displayed, including terrain display independent of the aircraft’s altitude, digital elevations for the highest and lowest displayed terrain, and a distinctive presentation of 0 MSL elevation water (sea level and corresponding shoreline).

GroundProx Pages and Menus

Data Page Layout

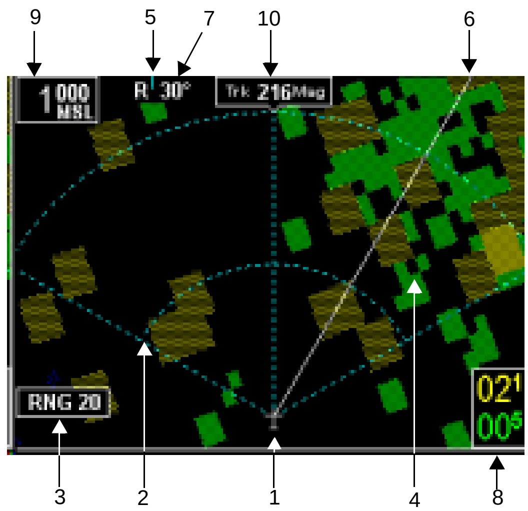


Figure 2: GroundProx Data Page

1. **Aircraft Symbol** - White symbol that is always in a “heading up” orientation.
2. **Range Rings** - Range rings are shown as dotted cyan lines. Radius to outer ring is shown in Range annunciation. Inner ring is one half the outer ring. Range rings can be displayed in the forward (arc) view or centered (ring) view. Figure 2 is shown in forward view.
3. **Range**- The range number indicates the currently selected range scale. The supported ranges are 2.5, 5,10, 20, 40, 80, 160, 240, and 320 nm, with 80nm as the default scale.
4. **Terrain Data** - Terrain data is depicted as color areas representing various altitude levels and potential hazard situations (see Table 1 for color definitions).
5. **Scan Marker** - The marker is a short vertical, cyan colored line that moves across the top of the display area. It indicates the current position of the scan.

6. **Bearing Line** - The bearing line is a white line that provides the relative bearing to any feature displayed on the screen. The bearing line is activated and controlled by the outer knob. It disappears from the screen after 15 seconds of non use. The bearing line can be used in forward or centered view.

7. **Bearing** - Presents the relative bearing, in degrees, of the bearing line, relative to the top of the screen. L for left, R for right .

8. **Peaks Mode Elevations** - This annunciation is displayed if the EGPWS is configured for peaks mode operation. The two numerical values correspond to the highest terrain/obstacle elevation displayed and the bottom elevation of the lowest color band displayed. Elevations are expressed in feet above sea level, with the hundreds digit displayed half size, i.e. 10^{8} is equal to 10,800 feet and 01^{0} is equal to 1000 feet. If there is no appreciable difference in elevation (flat terrain) only the highest value is displayed. The color of each elevation value is the same as the color of the terrain display containing that elevation (green, yellow or red).

9. **MSL Altitude**[1] - This annunciation indicates the mean sea level altitude of the aircraft. The current altitude is displayed with each scan, rounded down to the nearest 100ft. The altitude value is expressed in feet. If the EGPWS ceases to supply valid MSL altitude data, the annunciation will display 3 dashes.

10. **Heading**[1] - This display presents the type of heading reference being used by the EGPWS. There are five possible annunciations: Magnetic Heading, True Heading, Magnetic Track, True Track, and North. If valid data is not available, the annunciation is replaced by three dashes.

Color Coding

GroundProx displays terrain data using the following basic colors: black, green, yellow, red, and magenta. In addition, if the Peaks mode is enabled, blue will be used.

Table 1 lists all the colors generated by the EGPWS and their meaning. Some colors are listed as percentages.

1.These annunciations are not supported with earlier versions of Honeywell software. See “Honeywell Software Levels” on page 17.

These percentages indicate the amount of color dots alternating with black dots to produce a more subdued color. Generally speaking the more subdued the color, the farther away the terrain/obstacle is from the aircraft.

> **NOTE:** Yellow shading in the table indicates values that only apply to Peaks mode configuration.

Table 1: Color Definitions

Color	Meaning
Solid Red	Terrain/Obstacle threat area, a **WARNING** is generated.
Solid Yellow	Terrain/Obstacle threat area, a **CAUTION** is generated.
50% Red Dots	Terrain/Obstacle that is more than 2000 feet above aircraft.
50% Yellow Dots	Terrain/Obstacle that is between 1000 and 2000 feet above aircraft.
25% Yellow Dots	Terrain/Obstacle that is 500 (250 with gear down) feet below to 1000 feet above aircraft altitude.
Solid Green (Peaks only)	Shown only when no Red or Yellow terrain/ Obstacle areas are within range on the display. Highest terrain/Obstacle not within 500 (250 with gear down) feet of aircraft altitude.
50% Green Dots	Terrain/Obstacle that is 500 (250 with gear down) feet below to 1000 feet below aircraft altitude.
50% Green Dots (Peaks only)	Terrain/Obstacle that is the middle elevation band when there is no Red or Yellow terrain areas within range on the display.
16% Green Dots	Terrain/Obstacle that is 1000 to 2000 feet below aircraft altitude.
16% Green Dots (Peaks only)	Terrain/Obstacle that is the lower elevation band when there is no Red or Yellow terrain areas within range on the display.

Table 1: Color Definitions

Color	Meaning
Black	No significant terrain/obstacle
16% Blue (Peaks only)	Water at sea level elevation (0 feet MSL).
Magenta Dots	Unknown terrain. No terrain data in the data base for the magenta area shown.

GroundProx Main Menu[2]

The GroundProx main menu (Figure 3) provides access to all the operating functions used to control the GroundProx system and display.

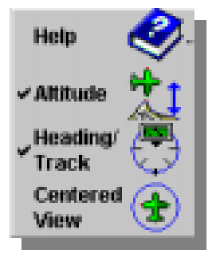


Figure 3: GroundProx Main Menu

Altitude

The Altitude menu item is a toggle function that activates the MSL Altitude Annunciation. The annunciation is located at the top left of the display area. When the MSL Altitude Annunciation is active a check mark is displayed to the left of this menu item.

The EGPWS provides altitude data to the GroundProx display. The altitude value is expressed in feet above sea level. The hundreds, tens, and units digits are displayed half the size of the higher order digits. The lower order digits are rounded down to the next to the next lower multiple of 100 feet for display.

If the MSL Altitude annunciation is active at system shutdown it will be active when GroundProx is started again.

Heading/Track

The Heading/Track menu item is a toggle function that activates the Heading/Track Annunciation. The

2.The Main Menu does not support Altitude, Heading/Track, and Centered View selections for earlier versions of Honeywell Software. See “Honeywell Software Levels” on page 17.

annunciation is located at the top center of the display area. When the Heading Annunciation is active a check mark is displayed to the left of this menu item.

There are five possible Display References: Magnetic Heading, True Heading, Magnetic Track, True Track, and North. If the EGPWS has reliable heading data, it will send that to the GroundProx display. If reliable heading data is not available, but reliable ground track data is, the EGPWS will supply terrain display data in a "Track Up" configuration, and the ground track angle will be presented in the Heading annunciation. If neither reliable heading or ground track data is available, the EGPWS supplies terrain display data in a "North Up" configuration. North Up is also used whenever heading is not available and ground speed drops below about 40 knots. The annunciation becomes "North".

> **NOTE:** The type of heading reference being used is not selectable. This data is provided by the EGPWS and is dependent on the model of EGPWS being used and it's level of software.

If the Heading annunciation is active at system shutdown it will be active when GroundProx is started again.

Centered View

The Centered View menu item is a toggle function that switches the display presentation between Forward View and Centered View. When Centered View is active a check mark is displayed to the left of this menu item. Forward View is always active when GroundProx starts up, so there's no check mark.

In centered view the airplane symbol is located in the center of the display area with terrain data displayed 360° around the aircraft (see Figure 5).

In Forward view the airplane symbol is located at the bottom center of the display area. Terrain data is displayed forward of the aircraft, similar to a radar display.

When switching between forward and centered views, there is be a slight delay between the request and the receipt of terrain data in the new format. During the transition period a small dashed rectangle appears above the range annunciation. This enclosed rectangle contains the letters FWD or CTR depending on whether the operator has requested a Forward or Centered view. When GroundProx begins receiving data in the new view format, this annunciation is removed from the screen. The rectangle is drawn dashed to indicate the transient nature of the annunciation.

Figure 4: View Change

The default view is always forward view. When the GroundProx is shutdown, the next time GroundProx is started, the view will be forward.

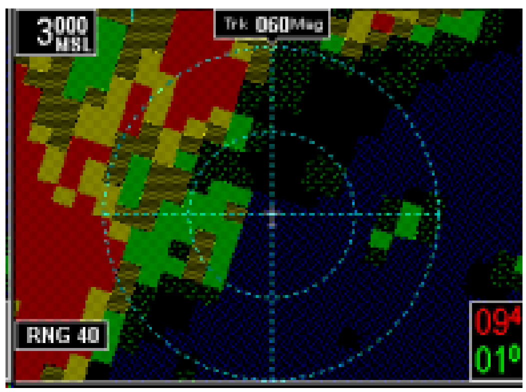


Figure 5: Centered View

How to Use GroundProx

GroundProx Startup

FlightMax GroundProx starts automatically as part of the normal initialization sequence of the FSD. To use GROUNDPROX do the following:

1. Select GROUNDPROX from the Main Menu.

   At startup, GroundProx restores the Heading and Altitude settings that were active when it was last used
2. When GroundProx first comes up it will display an annunciation “Display Initializing”. This screen will remain active while communications is established between the EGPWS and the FSD.
3. GroundProx then displays its data page and main menu.

AutoRange

“AutoRange” is an EGPWS installation option. If AutoRange is enabled in the EGPWS, whenever a terrain alert takes place the display range is automatically set to 10nm, overriding the operator’s current range selection. Upon receipt of an auto-range occurrence, FlightMax GroundProx updates the Range Rings and Range Annunciation to 10nm. Manual range control is not disabled by an Auto-Range event. The pilot may manually reset the range to any desired value, starting from the range value set by AutoRange.

Control Knob Functions

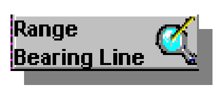


Figure 6: Knob Functions

Bearing

The outer knob is used to activate and orient the bearing line. Turning the outer knob in either direction will cause the bearing line to appear on the screen. Initially the line will appear at 0°, followed by movement in the direction indicated by the knob. Turning the outer knob counter clockwise will move the bearing line to the left. Turning the knob clockwise will move the line toward the right.

The bearing line functions in both center and forward view.

If the outer knob is not turned within 15 seconds after the bearing line is displayed or used, the bearing line will deactivate.

Range

The inner knob is used to select the range (scale) for the Data page display. The available ranges are 2.5, 5, 10, 20, 40, 80, 160, 240, and 320nm. At startup the Range is preset to 80nm. Ranges 240 and 320 are not available in Centered View.

Turning the knob counter clockwise will decreases the viewing range (down to 2.5nm).
Once the display range is at minimum, further counter-clockwise turns will have no effect.

Turning the knob clockwise will increase the viewing scale.
Once the display range is at the highest scale, further clockwise turns will have no effect.

If the EGPWS is sending terrain data when the range is changed the FSD clears the screen to a magenta color, then begins painting the new terrain display data on the screen. The range value annunciated on the screen is not changed until data at the new range is received.

When changing ranges there may be a slight delay between the request and the receipt of terrain data at the new range, particularly if the pilot piles up several requests by rapidly turning the knob. During the transition period a small dashed rectangle appears above the range annunciation. Except for the dashed line, this rectangle looks identical to the range annunciation. The range value it contains is the last range the pilot requested. When GroundProx begins receiving terrain display data at the new range, the dashed rectangle is removed from the screen.

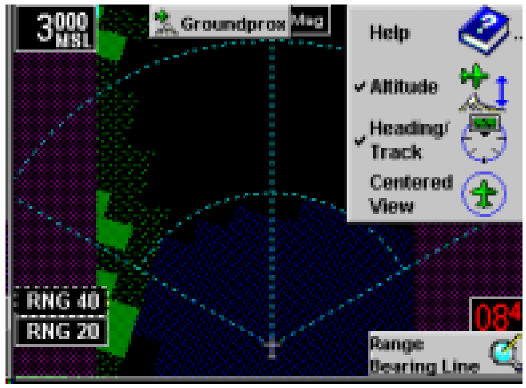


Figure 7: Changing Range

Changing the View Orientation[3]

To change the display orientation:

1. Bring up the GroundProx main menu.
2. Select Center View.

   A check mark indicates the display is in center view, no check mark indicates the display is forward view.

   The default is always forward view.

To Add/Remove Altitude Annunciation[3]

1. Bring up the GroundProx main menu.
2. Select Altitude from the menu.

   A check mark indicates the altitude annunciation is displayed.

To Add/Remove Heading Annunciation[3]

1. Bring up the GroundProx main menu.
2. Select Heading from the menu.

   A check mark indicates the heading annunciation is displayed.

3.This annunciation is not available with earlier versions of Honeywell software. See “Honeywell Software Levels” on page 17.

Messages and Error Indications

Status Annunciations

The system status annunciation describes the operating state of the system. The status is displayed in amber letters across the main Data page.

Table 2: GroundProx Status Messages

Message	Meaning
SENSOR OFF	Indicates that the EGPWS sensor is powered down or incorrectly attached to the FSD. The terrain display becomes a dark magenta.
DISPLAY INITIALIZING	During its startup phase, GroundProx detects the EGPWS equipment configuration and informs the EGPWS equipment of various parameters regarding the Avidyne GroundProx Display configuration. During this initialization phase the GroundProx displays the text DISPLAY INITIALIZING in yellow block letters.
SENSOR UNAVAILABLE	If the EGPWS declares its display capability inoperative at any time during its communication with the GroundProx it displays the text SENSOR UNAVAILABLE in yellow block letters. The EGPWS may still be able to issue aural alerts.
SENSOR FAILED	If the GroundProx detects errors in the data transmission from the EGPWS equipment, or if the EGPWS fails to transmit certain expected data to the FSD in a timely manner, this error message is displayed.
DISPLAY FAILED	If the GroundProx application determines through its own means of self-verification that it is not operating properly, it displays this message.

Table 2: GroundProx Status Messages

Message	Meaning
SENSOR SELF-TEST	When the EGPWS is performing a Self-Test it indicates this to GroundProx by transmitting a distinctive terrain test pattern for display. The words “Self-Test” are displayed over the test pattern. The text will remain until the self test is finished.
WARNINGS INHIBITED	The pilot may inhibit the functioning of the EGPWS equipment. (This capability is required by TSO-C151a.). The EGPWS will indicate to the Avidyne GroundProx Display that it is in the inhibited state.
IMPROPER CONFIGURATION	Under certain circumstances GroundProx may determine that the MFC is improperly configured with respect to the GroundProx function and there is no point in attempting to communicate with the EGPWS. Contact your installer or Avidyne for assistance.

Check Altitude[4]

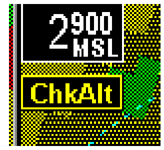


Figure 8: ChkAlt Message

If the EGPWS receives an anomalous altitude reading it will indicate this situation to the GroundProx. Avidyne GroundProx presents a Check Altitude Annunciation on the screen.

The Check Altitude Annunciation consists of the text "ChkAlt" enclosed in a rectangle. (see Figure 8).

GroundProx removes the Check Altitude Annunciation from the display when the EGPWS receive a correct altitude value.

Message Bar

The GroundProx Advisory message is shown in Figure 9. This message will appear whenever a Terrain/Obstacle caution or alert is issued by the EGPWS. A GroundProx message bar alert can appear while viewing another function or while in GroundProx. The message bar will appear in yellow or red across the bottom of the screen with information about the type of message (caution or warning) and whether there is terrain or an obstacle ahead. Pressing the **Enter** key will immediately take you to the GroundProx page (if you're not already there).

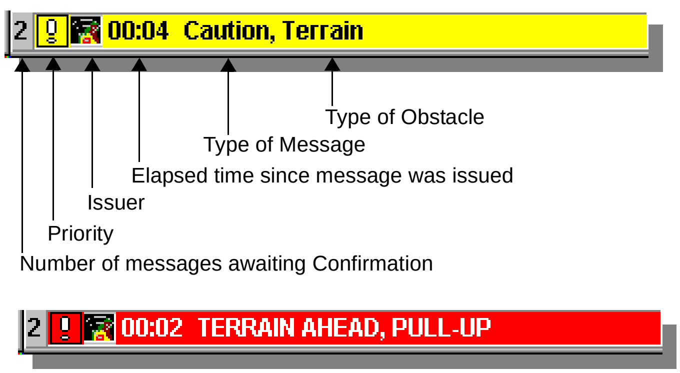


Figure 9: GroundProx Advisory Message Bar

4.Not available with earlier versions of Honeywell software. See "Honeywell Software Levels" on page 17.

Terrain and Obstacle Alerts

Terrain and obstacle alerts are the most critical situations displayed by the GroundProx. There are two types of alerts: caution and warning.

When a terrain or obstacle caution occurs, the display area that caused the alert is changed to a solid (100%) yellow. If auto-ranging is enabled, the display range is set to 10 nm.

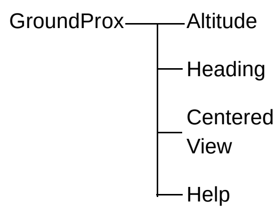
When a terrain or obstacle warning occurs, the display area that caused the alert is changed to a solid (100%) red. If auto-ranging is enabled, the display range is set to 10 nm.

There are four possible messages that are generated by the EGPWS during an alert: CAUTION, TERRAIN (for a Caution alert) or TERRAIN AHEAD, PULL-UP (for a Warning alert). If the alert is due to an obstacle, the message will be changed to CAUTION, OBSTACLE or OBSTACLE AHEAD, PULL-UP depending on whether it's a caution or a warning. The EGPWS is able to distinguish between objects and terrain data and will issue the appropriate message.

Because of the critical nature of alerts the caution or warning always appears in the message bar. When the message bar appears the pilot can view the GroundProx display (if viewing another function) by pressing the Enter key. In order not to obscure terrain display data, the menu is not displayed when the pilot transitions to the GroundProx display. As usual, the pilot may restore the menu to the display by pressing the Menu key.

Menu Organization

The following Menu Tree graphically depicts the paths to all GroundProx menu functions



Honeywell Software Levels

Honeywell supports different levels of software for their EGPWS models. Groundprox supports most recent levels of Honeywell software but earlier versions of the software will *not* contain the following features:

- the MSL altitude display.
- the Heading/Track display
- Center view display.

Table 3: Software Levels

MODEL	SOFTWARE LEVEL	
	Minimum Features	All Features
MK V	210	212
MK VI	001	003
MK VII	210	212
MK VIII	001	003
MK XXI	N/A	001
MK XXII	N/A	001
GA	N/A	001