GTN 650/750 SERIES SW V3.00 UPGRADE SUPPLEMENT

The Pilot's Guides have been revised for SW Version 3.00. This supplement provides information regarding new features of software version 3.00 for GTN 6XX/7XX Series units.

- GTN 625/635/650 Pilot's Guide
  (Garmin P/N 190-01004-03) Rev C
- GTN 725/750 Pilot's Guide
  (Garmin P/N 190-01007-03) Rev C

***NOTE**: The combination of the following documents is equivalent to the Pilot's Guide revisions listed above:*

- GTN 650/750 Series SW Version 3.00 Upgrade Supplement

and either

- GTN 625/635/650 Pilot's Guide
  (Garmin P/N 190-01004-03) Rev B

or

- GTN 725/750 Pilot's Guide
  (Garmin P/N 190-01007-03) Rev B

Current documents are available at www.garmin.com for free download. Printed copies may be purchased by contacting Garmin Customer Support.

Warnings and Messages

***WARNING**: Do not use data link weather information for maneuvering in, near, or around areas of hazardous weather. Information contained within data link weather products may not accurately depict current weather conditions.*

***WARNING**: Do not use the indicated data link weather product age to determine the age of the weather information shown by the data link weather product. Due to time delays inherent in gathering and processing weather data for data link transmission, the weather information shown by the data link weather product may be significantly older than the indicated weather product age.*

***CAUTION**: The United States government operates the Global Positioning System and is solely responsible for its accuracy and maintenance. The GPS system is subject to changes which could affect the accuracy and performance of all GPS equipment. Portions of the Garmin GTN 725/750 utilize GPS as a precision electronic NAVigation AID (NAVAID). Therefore, as with all NAVAIDs, information presented by the GTN 725/750 can be misused or misinterpreted and, therefore, become unsafe.*

***NOTE**: Limitation for SafeTaxi®*

Do not use SafeTaxi or Chartview functions as the basis for ground maneuvering. SafeTaxi and Chartview functions do not comply with the requirements of AC 20-159 and are not qualified to be used as an airport moving map display (AMMD). SafeTaxi and Chartview are to be used by the flight crew to orient themselves on the airport surface to improve pilot situational awareness during ground operations.

TABLE OF CONTENTS

1 TRANSPONDER CONTROL

1.1 Flight ID

1. While viewing the transponder page, touch the **Flight ID** key.

2. Touch the numeric keypad, or use the rotary knobs, to select the desired Flight ID number and then press **Enter**. The selected number will be shown in the Flight ID key.

1.2 GDL 88 ADS-B Reporting

One of the features of the optional GDL 88 is to send Automatic Dependent Surveillance – Broadcast (ADS-B) position reports for enhanced situational awareness. The GDL 88 is a remote-mount module that communicates with panel-mounted avionics for traffic and weather display, and for equipment control. The GDL 88 receives position information from the GTN GPS receiver. The display and control of the information sent depends on the equipment installation and configuration by the installer. Some installations allow control by the pilot of the information sent, while others do not.

The Anonymous Mode, when armed, will replace the Flight ID with a temporary randomized number for privacy while the position information will still be provided. The call sign will be sent as "VFR." To enable Anonymous Mode, the Squawk Code must be set to the VFR code (based on the GDL 88 configuration) and the **Anonymous** key must be selected.

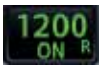
Viewing the ADS-B Control Panel Without Manual Controls

1. Touch the Transponder window to view the ADS-B control panel.

Figure 1-1 ADS-B Control Panel

2. Touch the Transponder window again to return to the previous display.

Viewing the ADS-B Control Panel With Manual Controls



1. Touch the Transponder window to view the ADS-B control panel.

Figure 1-2 ADS-B/Transponder Control Panel

2. Touch the **Anonymous Mode** key to toggle arming the Anonymous mode.

3. While viewing the transponder page, touch the **Flight ID** key.

4. Touch the numeric keypad, or use the rotary knobs, to select the desired Flight ID number and then press **Enter**.

***NOTE**: Changing the flight ID while in anonymous mode wouldn't actually change the flight ID because a randomized ID is being broadcast. If the ANONYMOUS key is armed, change the squawk code to the VFR code to activate Anonymous mode.*

1.3 Extended Squitter Transmission

When "Enable ES" is selected, the GTX 33/330 turns on Extended Squitter (ES) transmissions. Extended Squitter technology improves situational awareness and flight safety. With Extended Squitter capabilities, position, velocity, and heading information are automatically transmitted to other aircraft and ground stations. The current air traffic control system depends on a transponder request for pertinent aircraft information and does not include 3D position. Extended Squitter provides automatic transmission of aircraft information without a request. "Enable ES" should be active for normal operations.

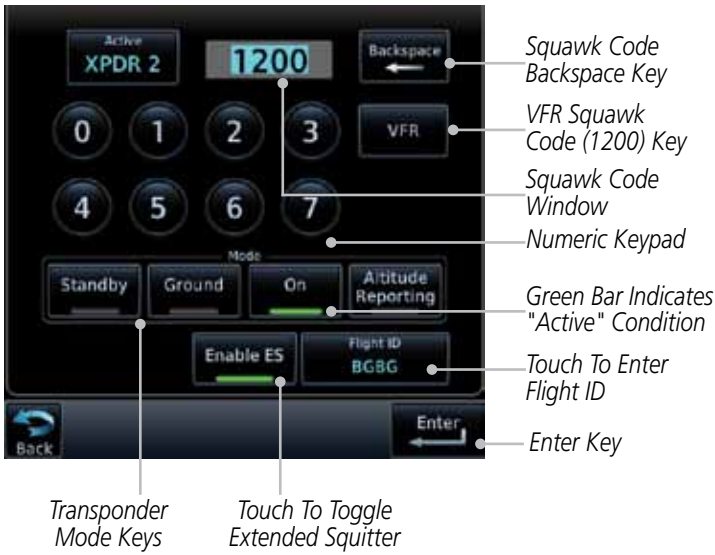


Figure 1-3 Transponder Control Panel With Extended Squitter Capability

1. While viewing the Transponder (XPDR) page, touch the **Enable ES** key to toggle Extended Squitter Off and On.

2. Touch the **Flight ID** key and use the keypad to select a Flight ID and then touch **Enter**.

3. After selecting a Flight ID, the selected value will be shown in the **Flight ID** key.

2 AUDIO CONTROL

2.1 3D Audio (GTN 7XX only)

Advanced processing adjusts audio in the headset to mimic how the human ear normally hears and registers sounds in space. This 3-D Audio feature makes it seem as though different audio sources are coming from different directions around you. Now it's much easier to focus on and understand one particular source from among many. For example, COM 1 will seem to be coming from the left while COM 2 may seem to be coming from the right. When 3D Audio is disabled, balance is restored.

***NOTE:** The stereo/mono headsets must be in the stereo position in order for 3D audio to function.*

Touch the **3D Audio** key to toggle the 3D Audio function on and off.

This is currently done such that audio sources will either be 30 degrees to your left (330 degrees), 30 degrees to your right, and directly in front (0 degrees). The following table details the left/right balance of the audio level depending on the selected Com:

Active Com	1	2	3
1,2,3	330	0	30
1,2	330	30	N/A
1,3	330	N/A	30
2,3	N/A	330	30
1	0	N/A	N/A
2	N/A	0	N/A
3	N/A	N/A	0

Table 2-1 3D Audio Left/Right Balance

2.2 Telligence™ Voice Command (GTN 7XX only)

Garmin's Telligence Voice Command voice recognition feature allows the pilot (and optionally copilot) to control the GTN 7XX connected to a GMA 35 using spoken commands. To activate Voice Recognition, push and hold the Push-to-Command (PTC) button while speaking a command. When the Push-to-Command button is released, the GTN 7XX will respond.

If a command is understood by the GTN 7XX, a positive acknowledgement chime will be played, and the relevant page will be displayed to reflect the change (if applicable). The pilot should verify that the correct response has occurred. If the desired change has not occurred, the pilot should repeat the command by using the Push-to-Command button, or by manually using the GTN 7XX touch screen.

If a command is not understood by the GTN 7XX, a negative acknowledgement tone will be played. The pilot should repeat the command by using the Push-to-Command button, or by manually using the GTN 7XX touch screen. In the event of any abnormal Voice Recognition operation, the front panel controls and touch screen may be used to override Voice Recognition and manually control the GTN 7XX.

NOTE: *If Telligence Voice Command malfunctions and needs to be disabled, remove power to the GMA 35 audio panel by pulling the audio panel circuit breaker. This will force the audio panel into the fail-safe mode. The pilot will be able to communicate using the COM 2 radio only.*

The following table lists the available Voice Recognition commands, the associated actions, and the voice response if applicable:

Control	Example Phrase	Action
COM	"COM one"	Toggles COM1 audio
	"MIC one"	Selects MIC1/COM1 audio
	"COM one MIC"	Selects MIC1/COM1 audio
	"COM two"	Toggles COM2 audio
	"MIC two"	Selects MIC2/COM2 audio
	"COM two MIC"	Selects MIC2/COM2 audio
	"COM three"	Toggles COM3 audio
	"MIC three"	Selects MIC3/COM3 audio
	"COM three MIC"	Selects MIC3/COM3 audio
	"Split COM" OR "Split Mode"	Toggles split COM mode
NAV	"NAV one"	Toggles NAV1 audio.
	"NAV two"	Toggles NAV2 audio.
MUSIC	"MUSIC one mute" OR "Mute MUSIC one"	Mutes Music 1 on radio reception.
	"Disable MUSIC one mute" "MUSIC one mute disable" "Disable mute MUSIC one" OR "Mute MUSIC one disable"	Disables Music 1 mute on radio reception.
	"MUSIC two mute" OR "Mute MUSIC two"	Mutes Music 2 on radio reception.
	"Disable MUSIC two mute" "MUSIC two mute disable" "Disable mute MUSIC two" OR "Mute MUSIC two disable"	Disables Music 2 mute on radio reception.
Speaker	"Speaker" OR "Cabin Speaker"	Toggles Cabin Speaker on/off.
COM Clearance Recorder	"Play" "Read back" OR "Say again"	Opens Audio Clearance Recorder and plays the last received radio transmission.
PA	"P - A" OR "Passenger Address"	Toggles PA on/off.

Control	Example Phrase	Action
Marker Beacon	"Marker" OR "Marker Beacon"	Same action as pressing Marker Audio.
Volume Adjustments	"(Desired selection*) volume up"	Increases volume of desired selection.
	"(Desired selection*) volume down"	Decreases volume of desired selection.
Volume Adjustments	"(Desired selection*) volume	Displays the current volume but does not change it.
* Desired selection: "Speaker", "pilot", "copilot", "passenger", "pass", "phone", "marker", "telephone", "music one", or "music two". **NOTE**: Finer volume adjustment may be made using the Volume knob on the GTN 7XX. The voice command "Up" or "Down" is equivalent to five clicks of the Volume knob.		
Distribution (Blue Mode)	"Distribute telephone to (desired position(s) **)" OR "Distribute phone to (desired position(s) **)"	Distributes Telephone to desired positions.
	"Distribute music one to (desired position(s) **)"	Distributes MUS1 to desired position(s).
	"Distribute music two to (desired position(s)**)"	Distributes MUS2 to desired position(s).
** Desired position(s): "All", "none", "pilot", "copilot", "passenger", "pass", or any combination of pilot, copilot, passenger, or pass. **NOTE**: The word "to" may be omitted from distribution phrases.		
3D Audio	"Three-D audio"	Enables 3D audio Voice Response: "Three-D audio left, three-D audio right".
	"Standard audio"	Enables standard audio (disables 3D audio) Voice Response: "Standard Audio".

Table 2-2 Voice Recognition Commands

3 MAP

3.1 Airspace

The Airspace viewing range options select whether the Airspaces are shown on the Map and at and below the selected map ranges. The Smart Airspaces selection filters airspaces to show the ones appropriate for your altitude.

Feature	Selection
Smart Airspace	**Off**, On
Show Airspaces	Off, 1000 ft, 1500 ft, 2500 ft, 0.5 NM, 0.75 NM, **1 NM**, 1.5 NM
Class B/TMA Range	Off, 1 NM, 1.5 NM, 2.5 NM, 4 NM, **5 NM**
Class C/TCA Range	Off, 0.75 NM, 1 NM, 1.5 NM, 2.5 NM, **4 NM**, 5 NM, 7.5 NM, 10 NM
Class D Range	Off, 0.75 NM, 1 NM, 1.5 NM, 2.5 NM, 4 NM, **5 NM**, 7.5 NM, 10 NM
Restricted Range	Off, **10 NM**, 15 NM, 25 NM, 40 NM, 50 NM, 75 NM, 100 NM
MOA (Military) Range	Off, 0.75 NM, 1 NM, 1.5 NM, 2.5 NM, 4 NM, **5 NM**, 7.5 NM, 10 NM, 15 NM, 25 NM, 40 NM, 50 NM, 75 NM, 100 NM
Other/ADIZ Range	None, Least, Less, **Normal**, More, Most
Restore Defaults	Returns values to original factory settings

Table 3-1 Map Setup Airspace Options

3.2 Smart Airspaces

Garmin's Smart Airspace™ feature aids visual clarity on-screen by de-emphasizing airspace that's well above or below the aircraft's current altitude. The vertical separation is 1000 feet at sea level and the vertical separation will gradually increase to 2000 feet until the aircraft reaches 10,000 feet. Anything above 10,000 feet keeps the 2000 feet vertical separation.

***NOTE:** Smart Airspace only changes the depiction of the airspace on the moving map display. It does not alter the Airspace Alerts that can be set on the System-Alerts portion of the system.*

Smart Airspaces - Off *Smart Airspaces - On*

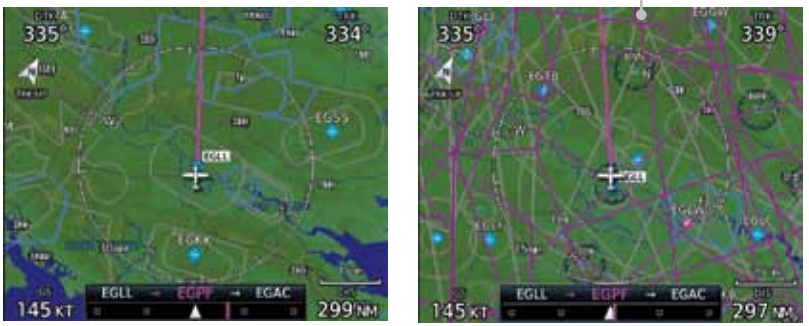
Figure 3-1 Display of Smart Airspaces (Airspace Borders Grayed)

To control the display of European airway airspaces:

1. While viewing the Map Setup Airspaces option, touch the **Other/ADIZ Range** key and select a value.

2. Select **Off** for the Other/ADIZ Range to turn off the display of airway airspaces.

Airway Airspaces - On



Airway Airspaces - Off *Airway Airspaces - On*

Figure 3-2 Selecting the Display of European Airway Airspaces

4 TRAFFIC

4.1 ADS-B Traffic

ADS-B technology is an important part of the FAA's Next Generation Air Transportation System (NextGen), allowing for enhanced safety, efficiency, and the ability of the system to handle greater numbers of aircraft. ADS-B In allows a properly-equipped aircraft to access FAA broadcast services such as TIS-B and FIS-B. With ADS-B Out, the avionics transmit an aircraft's precise location, as well as specific information about that aircraft, to ground stations and other aircraft equipped with 978 MHz ADS-B technology.

If more than one target is occupying the same area of the screen, the GTN will combine the two traffic targets into one traffic group. The group symbol maintains the iconology of the highest priority traffic target in the group and indicates a grouped symbol by the presence of an asterisks to the left of the grouped traffic target.

Traffic targets displayed on the dedicated traffic page may be selected in order to obtain additional information about a traffic target or to view all targets in a grouped target. When a grouped target is selected, the **Next** key on the dedicated traffic page will cycle through all targets located in close proximity to where the screen has been touched.

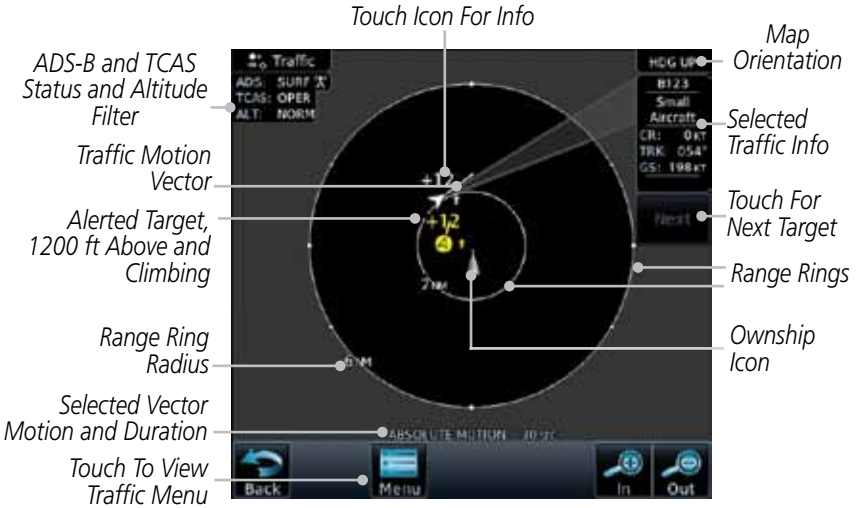


Figure 4-1 ADS-B Traffic Page

***NOTE**: The "Next" key on the dedicated traffic page will cycle through all targets located in close proximity to where the pilot has touched the screen.*

Symbol	Description
	Basic Non-Directional Traffic
	Basic Directional Traffic
	Basic Off-scale Selected Traffic
	Proximate Non-Directional Traffic
	Proximate Directional Traffic
	Proximate Off-scale Selected Traffic
	Non-Directional Alerted Traffic
	Off-Scale Non-Directional Alerted Traffic
	Directional Alerted Traffic
	Off-Scale Directional Alerted Traffic
	Non-Directional Surface Vehicle
	Directional Surface Vehicle

Table 4-1 ADS-B Traffic Symbols

***NOTE**: Color of basic and proximate traffic is dependent on configuration (cyan or white) and airborne/on-ground status of target (target is brown when on the ground, see the surface vehicles).*

4.2 ADS-B Traffic Menu

The Traffic Menu allows control of the traffic information display.

Figure 4-2 ADS-B Traffic Menu

4.2.1 ADS-B Status

ADS-B Status displays the current status of traffic application: Off, Surface, or Airborne.

Touch the **ADS-B Status** key to toggle the ADS-B Status.

4.2.2 TCAS Status

This shows the current status of the TCAS system. The modes reported by the traffic device are "Operate" while in the air and "Standby" while on the ground. This control allows the pilot to manually select the TCAS Status.

Touch the **TCAS Status** key to toggle the TCAS Status.

4.2.3 Motion Vector

When Absolute Motion Vectors are selected, the vectors extending from the traffic targets depict the target reported track and speed over the ground. When Relative Motion Vectors are selected, the vectors extending from the traffic targets display how the traffic target is moving relative to your aircraft. These vectors are calculated using the traffic targets track and ground speed and your aircraft's track and ground speed. These two values are combined to depict where the traffic target is moving purely with respect to your aircraft and give a forecast of where the traffic target will be, relative to your aircraft, in the near future.

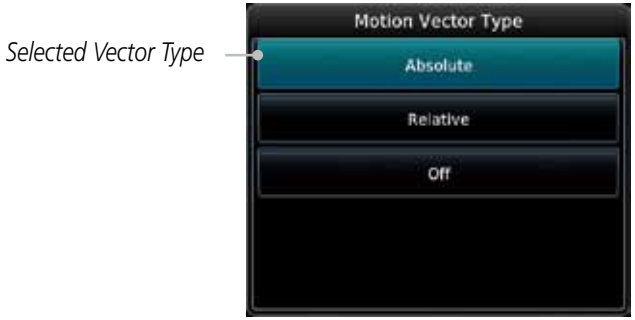


Figure 4-3 Traffic Motion Vector Type Selection

***NOTE**: Absolute motion vectors are colored either white or cyan. Relative motion vectors are always green. The annunciation on the bottom of the dedicated traffic page indicates which vector type is selected and their length.*

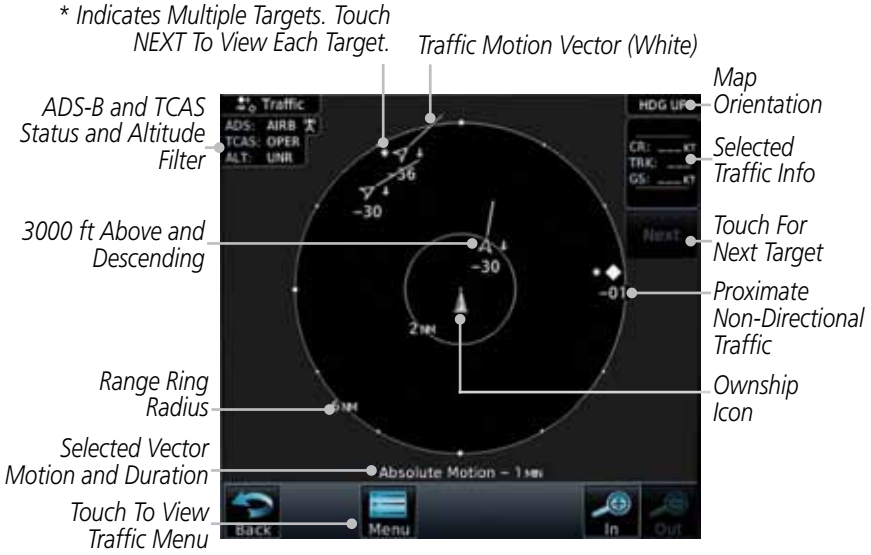


Figure 4-4 Absolute Motion (White Vectors)

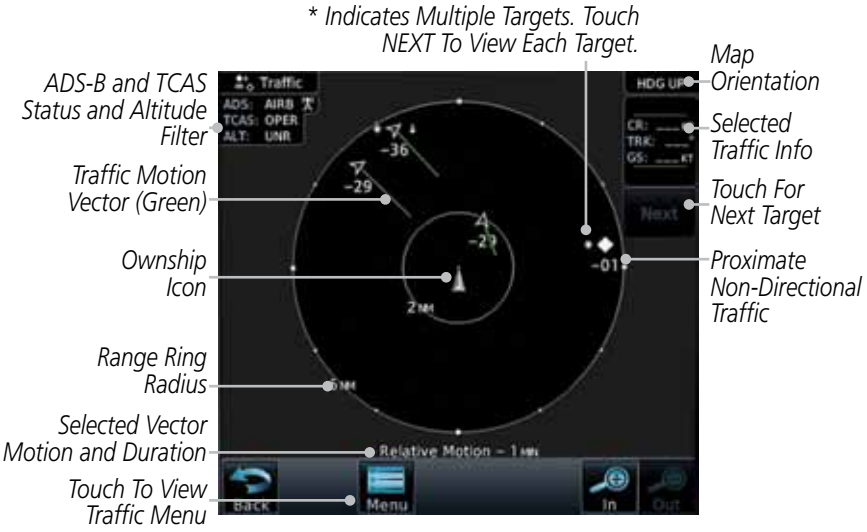


Figure 4-5 Relative Motion (Green Vectors)

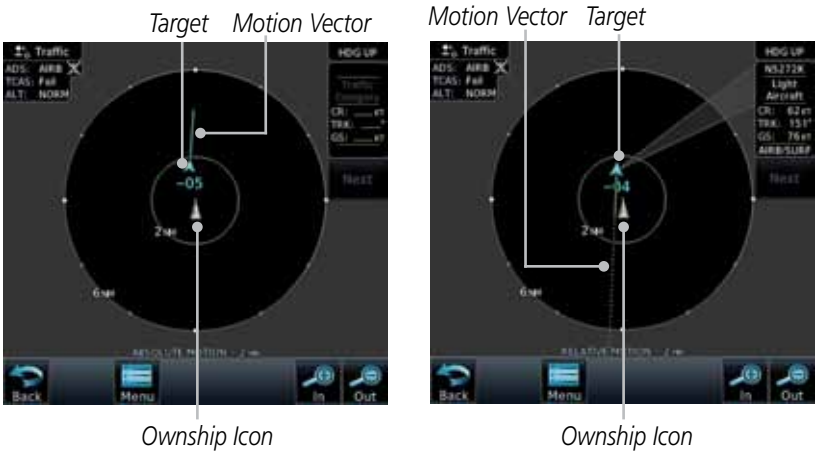


Figure 4-6 Comparison of Absolute and Relative Motion Vectors With a Single Target

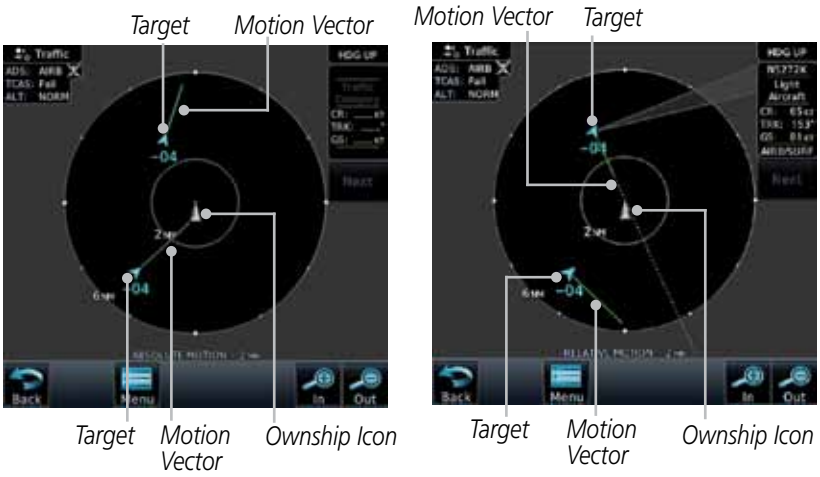


Figure 4-7 Comparison of Absolute and Relative Motion Vectors With a Two Targets

4.2.4 Vector Duration

The Vector Duration selection sets the time that the vector will show the calculated distance and direction of the traffic target. A longer duration will result in a longer vector.

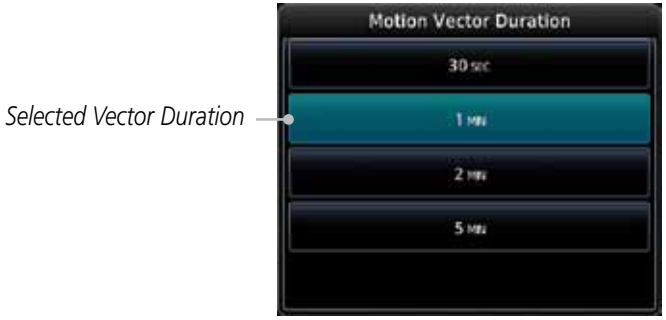


Figure 4-8 Traffic Motion Vector Duration Selection

4.2.5 Altitude Filter

1. Touch the **Altitude Filter** key to change the altitude volume.
2. Select the desired altitude volume by touching the **BELOW**, **NORMAL**, **ABOVE**, or **UNRESTRICTED** keys. The selection is displayed in the Altitude mode field.

Figure 4-9 Traffic Altitude Filter Selection

Altitude Mode	Displayed Traffic Range
Below	-9900 ft to 2700 ft
Normal	-2700 ft to 2700 ft
Above	-2700 ft to 9900 ft
Unrestricted	All Traffic Shown

Table 4-2 Displayed Traffic Range

4.3 RYAN TCAD 9900BX with the GDL 88

Ryan TCAD is a system that provides audio and visual alerts for traffic near your aircraft. The information from this system can be interfaced through the GTN series. Operating instructions and details on the modes of operation are described in the Ryan TCAD operator's handbooks.

- TCAS-like symbols are used in the 9900BX.
- Altitude modes are available (normal, look up, look down, unrestricted).
- Ranges are manually controlled for the current shield.
- Traffic display range selections:
  - Ryan 9900BX — 1 NM, 1 and 2 NM, 2 and 6 NM, 6 and 12 NM, and 12 and 24 NM.

4.3.1 Ryan TCAD Description

***NOTE:** Refer to the Ryan TCAD Pilot's Guide for a detailed description of the Ryan TCAD System.*

The Ryan TCAD (Traffic and Collision Alert Device) is an on-board air traffic display used to identify potential collision threats. TCAD computes relative altitude and range of threats from nearby Mode C and Mode S-equipped aircraft. TCAD will not detect aircraft without operating transponders or those that are beyond radar coverage. TCAD, within defined limits, creates a "shield" of airspace around the aircraft that detected traffic cannot penetrate without triggering an alert.

TA: Traffic Advisory. This is traffic with 500 feet, or less, of altitude separation that is converging or maintaining altitude separation.

PA: Proximity Advisory. This is traffic with 500 feet of altitude separation that is not a TA.

TRFC: Other traffic.

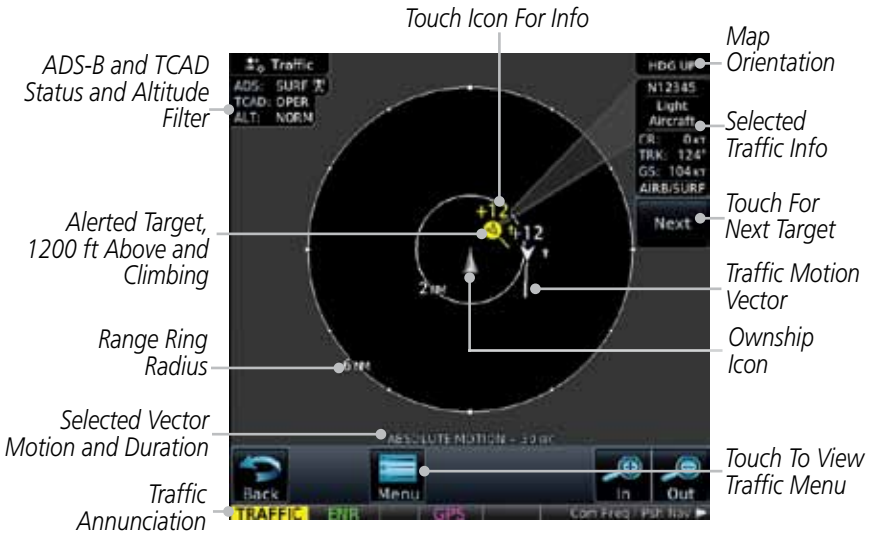


Figure 4-10 Traffic Page for Ryan TCAD with GDL 88

4.3.2 Altitude Mode

The GDL 88 has four altitude display modes: Normal (±2,700 feet, Above (-2,700 feet to +9,000 feet), Below (-9,000 feet to +2,700 feet), and Unrestricted (±9,900 feet). The GDL 88 continues to track up to 30 intruder aircraft within its maximum surveillance range, regardless of the altitude display mode selected.

The selected altitude display mode is displayed in the upper left-hand corner of the Traffic page.

While viewing the Traffic page, touch the **Altitude Filter** key to change the altitude volume. Select the desired altitude volume by touching the **BELOW**, **NORMAL**, **ABOVE**, or **UNRESTRICTED** keys. The selection is displayed in the Altitude mode field.

Figure 4-11 Traffic Altitude Filter Selection

Altitude Mode	Displayed Traffic Range
Below	-9900 ft to 2700 ft
Normal	-2700 ft to 2700 ft
Above	-2700 ft to 9900 ft
Unrestricted	All Traffic Shown

Table 4-3 Displayed Traffic Range

4.3.3 TCAD Control Menu

The TCAD Control Menu allows control over the settings for the TCAD Traffic display.

Figure 4-12 TCAD Traffic Menu

1. While viewing the Traffic menu, touch the **TCAD Control** key.

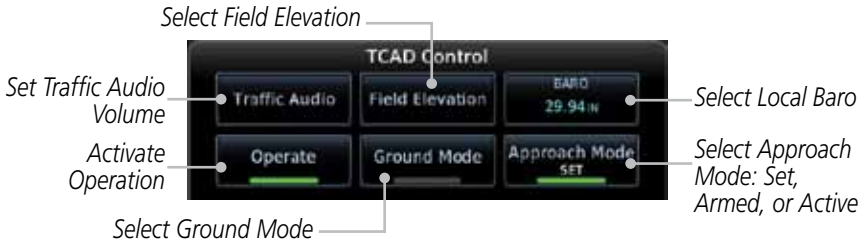


Figure 4-13 TCAD Control Menu

2. Touch the desired key from the menu to make any settings.

4.3.4 Traffic Audio

1. While viewing the TCAD Control menu, touch the **Traffic Audio** key.

Figure 4-14 TCAD Traffic

2. Touch the arrow keys to raise or lower the TCAD Traffic Audio level. The selected volume will be shown as a percentage value and graphically with a bar graph.

3. Touch the **Back** key to return to the TCAD Control menu.

4.3.5 Field Elevation

1. While viewing the TCAD Control menu, touch the **Field Elevation** key.

Figure 4-15 TCAD Traffic Field Elevation Selection

2. With the **Use DEST APT** key deactivated (no green bar), touch the **Field Elevation** key to manually select the Field Elevation for traffic reporting. Use the keypad to select the elevation value.

3. Touch the **Enter** key to accept the selected value. The selected value will be shown in the **Field Elevation** key.

4. Touch the **Use DEST APT** key to automatically use the field elevation of the destination airport of the active flight plan for traffic reporting.

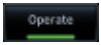
NOTE: *Activating the Use DEST APT feature automatically uses the elevation for the current destination airport for the TCAD. If no destination airport is present in the GTN system, the TCAD will not receive a field elevation and therefore not automatically enter approach mode.*

4.3.6 Baro

1. While viewing the TCAD Control menu, touch the **BARO** key to manually select the barometric pressure.
2. Use the keypad to select the barometric pressure value.

3. Touch the **Enter** key to accept the selected value. The selected value will be shown in the **BARO** key.

4.3.7 Operate



1. While viewing the TCAD Control menu, touch the **Operate** key to activate TCAD traffic.
2. Touching the **Operate** key toggles TCAD traffic operation on and off.

4.3.8 Ground Mode

1. While viewing the TCAD Control menu, touch the **Ground** key to activate Ground Mode TCAD traffic.
2. Touching the **Ground** key toggles Ground Mode on and off.

4.3.9 Approach Mode

1. While viewing the TCAD Control menu, touch the **Approach** key to activate Approach Mode TCAD traffic.
2. Touching the **Approach** key toggles Approach Mode on and off.

4.4 TCAD 9900B Operation

The TCAD 9900B provides a passive system that uses transponder replies from other aircraft to acquire traffic information.

Figure 4-16 Traffic Page for Ryan TCAD 9900B

Symbol		Description
Imminent Traffic (Traffic within ±500 feet AND 1.0 NM; OR no altitude AND within 1.0 NM)	Non-Imminent Traffic	
		Traffic Closing Vertically
		Traffic Diverging Vertically
		Traffic not Closing or Diverging Vertically

Table 4-4 9900B TCAD Symbols

4.4.1 Select Local Barometric Pressure

1. While viewing the TCAD display, touch the **Baro** key to select the local barometric pressure.

2. Use the keypad to select the values and touch **Enter** to save the values.

4.4.2 Select Active Shield

1. While viewing the TCAD display, touch the **Active Shield** key to select the Active Shield values (Departure, Enroute, or Ground).

2. Touch the desired setting to save the values.

4.4.3 TCAD 9900B Traffic Menu

The TCAD 9900B Menu allows control over the settings for the TCAD Traffic display.

1. While viewing the Traffic page, touch the **Menu** key.

Figure 4-17 TCAD 9900B Traffic Menu

2. Touch the desired key from the menu to make any settings.

4.4.3.1 Traffic Audio

1. While viewing the TCAD Control menu, touch the **Traffic Audio** key.

Figure 4-18 TCAD Traffic Audio

2. Touch the arrow keys to raise or lower the TCAD Traffic Audio level. The selected volume will be shown as a percentage value and graphically with a bar graph.

3. Touch the **Back** key to return to the TCAD Control menu.

4.4.3.2 Shield Setup

The Shield Setup function allows you to select the Shield Type (mode of operation) and the size of the shield volume that will provide alerts when entered by aircraft.

Approach Shield Type

1. While viewing the TCAD Control menu, touch the **Shield Type** key and touch the Approach Shield Type.

Figure 4-19 TCAD 9900B Shield Setup for Approach

2. Touch the **Field Elevation** key.

3. With the **Use DEST APT** key deactivated (no green bar), touch the **Field Elevation** key to manually select the Field Elevation for traffic reporting. Use the keypad to select the elevation value.

4. Touch the **Enter** key to accept the selected value. The selected value will be shown in the **Field Elevation** key.

5. Touch the **Use DEST APT** key to automatically use the field elevation of the destination airport of the active flight plan for traffic reporting.

NOTE: *Activating the Use DEST APT feature automatically uses the elevation for the current destination airport for the TCAD. If no destination airport is present in the GTN system, the TCAD will not receive a field elevation and therefore not automatically enter approach mode.*

En Route, Standard, or Terminal Shield Type

1. While viewing the TCAD Control menu, touch the **Shield Type** key and touch the desired Shield Type: Enroute, Standard, or Terminal.

Figure 4-20 TCAD 9900B Shield Setup for En Route, Standard, and Terminal

2. Touch the **Shield Height** key and use the keypad to select the Shield Height value. The selected value will be shown in the **Shield Range** key.

3. Touch the **Shield Range** key and use the keypad to select the Shield Range value. The selected value will be shown in the **Shield Range** key.

4.4.3.3 Approach Mode

1. While viewing the TCAD Control menu, touch the **Approach** key to activate Approach Mode TCAD traffic.
2. Touching the **Approach** key toggles Approach Mode between Set, Armed, or Active.

4.5 TCAD 9900BX Operation

The TCAD 9900BX provides an active system that interrogates other aircraft to acquire traffic information.

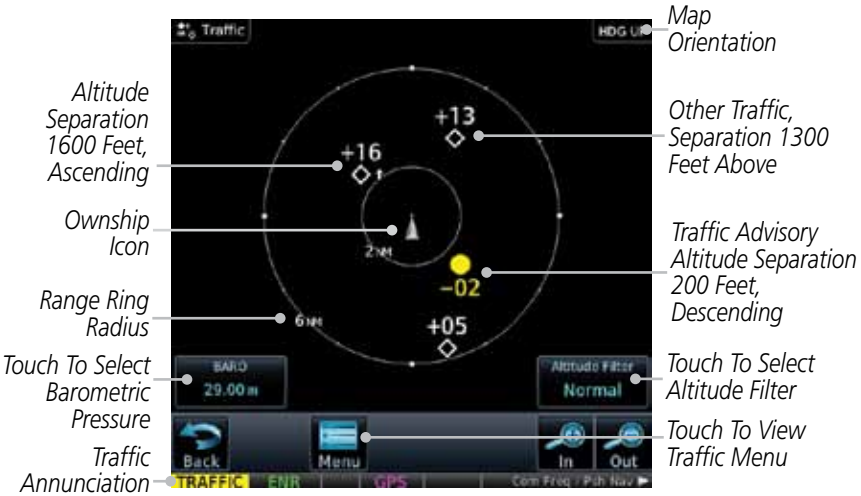


Figure 4-21 Traffic Page for Ryan TCAD 9900BX

Symbol	Description
	Traffic Advisory
	Proximity Advisory (color may be configured as cyan)
	Other Traffic (color may be configured as cyan)
	Out-of-Range Traffic Advisory

Table 4-5 9900BX (TCAS) Symbols

4.5.1 Select Local Barometric Pressure

1. While viewing the TCAD display, touch the **Baro** key to select the local barometric pressure.

2. Use the keypad to select the values and touch **Enter** to save the values.

4.5.2 Select Altitude Filter

While viewing the Traffic page, touch the **Altitude Filter** key to change the altitude volume. Select the desired altitude volume by touching the **Normal**, **Above**, **Below**, or **Unrestricted** keys. The selection is displayed in the Altitude Filter field.

Figure 4-22 Traffic Altitude Filter Selection

Altitude Mode	Displayed Traffic Range
Below	-9900 ft to 2700 ft
Normal	-2700 ft to 2700 ft
Above	-2700 ft to 9900 ft
Unrestricted	All Traffic Shown

Table 4-6 Displayed Traffic Range

4.5.3 TCAD 9900BX Traffic Menu

The TCAD 9900BX Menu allows control over the settings for the TCAD Traffic display.

1. While viewing the Traffic page, touch the **Menu** key.

Figure 4-23 TCAD 9900BX Traffic Menu

2. Touch the desired key from the menu to make any settings.

4.5.3.1 Traffic Audio

1. While viewing the TCAD Control menu, touch the **Traffic Audio** key.

Figure 4-24 TCAD Traffic Audio

2. Touch the arrow keys to raise or lower the TCAD Traffic Audio level. The selected volume will be shown as a percentage value and graphically with a bar graph.

3. Touch the **Back** key to return to the TCAD Control menu.

4.5.3.2 Shield Setup

The Shield Setup function allows you to select the Shield Type (mode of operation) and the size of the shield volume that will provide alerts when entered by aircraft.

Approach Shield Type

1. While viewing the TCAD Control menu, touch the **Shield Type** key and touch the Approach Shield Type.

Figure 4-25 TCAD 9900BX Shield Setup for Approach

2. Touch the **Field Elevation** key.

3. With the **Use DEST APT** key deactivated (no green bar), touch the **Field Elevation** key to manually select the Field Elevation for traffic reporting. Use the keypad to select the elevation value.

4. Touch the **Enter** key to accept the selected value. The selected value will be shown in the **Field Elevation** key.

5. Touch the **Use DEST APT** key to automatically use the field elevation of the destination airport of the active flight plan for traffic reporting.

NOTE: *Activating the Use DEST APT feature automatically uses the elevation for the current destination airport for the TCAD. If no destination airport is present in the GTN system, the TCAD will not receive a field elevation and therefore not automatically enter approach mode.*

En Route, Standard, or Terminal Shield Type

1. While viewing the TCAD Control menu, touch the **Shield Type** key and touch the desired Shield Type: Enroute, Standard, or Terminal.

Figure 4-26 TCAD 9900BX Shield Setup for En Route, Standard, and Terminal

2. Touch the **Shield Height** key and use the keypad to select the Shield Height value. The selected value will be shown in the **Shield Range** key.

3. Touch the **Shield Range** key and use the keypad to select the Shield Range value. The selected value will be shown in the **Shield Range** key.

4.5.3.3 Approach Mode

1. While viewing the Traffic menu, touch the **Approach** key to activate Approach Mode TCAD traffic.
2. Touching the **Approach** key toggles Approach Mode between Set, Armed, or Active.

4.5.3.4 Ground Mode

1. While viewing the Traffic menu, touch the **Ground** key to activate Ground Mode TCAD traffic.
2. Touching the **Ground** key toggles Ground Mode between On and Off.

5 WEATHER

The GTN 7XX and GTN 6XX can display Connext Weather from a Garmin GSR 56 and FIS-B weather from a GDL 88. The GTN 7XX can display weather radar from a Garmin GWX system or from selected 3rd party radars. Only one weather radar system may be interfaced to the system. For detailed information on the operation of 3rd party radars, refer to their specific documentation.

5.1 Garmin GWX Radar Description (GTN 7XX Only)

The Garmin GWX 68 and GWX 70 Airborne Color Weather Radars combine excellent range and adjustable scanning profiles with a high-definition target display.

To focus radar scanning on specific areas, Sector Scanning offers pilot-adjustable horizontal scan angles of 20º, 40º, 60º, or 90º (up to 120º with the GWX 70). A vertical scanning function helps to analyze storm tops, gradients, and cell buildup activity at various altitudes.

See the documentation of each radar for specific features.

5.1.1 Principles of Pulsed Airborne Weather Radar

The term RADAR is an acronym for RAdio Detecting and Ranging. Pulsed radar locates targets by transmitting a microwave pulse beam that, upon encountering a target, is then reflected back to the radar receiver as a return "echo." The microwave pulses are focused and radiated by the antenna, with the most intense energy in the center of the beam and decreasing intensity near the edge. The same antenna is used for both transmitting and receiving. The returned signal is then processed and displayed on the GTN 7XX.

Radar detection is a two-way process that requires 12.36 micro-seconds for the transmitted microwave pulses to travel out and back for each nautical mile of target range. It takes 123.6 micro-seconds for a transmitted pulse to make the round trip if a target is 10 NM away.

The GWX weather radar should be used to avoid severe weather, not for penetrating severe weather. The decision to fly into an area of radar targets depends on target intensity, spacing between the targets, aircraft capabilities and pilot experience. Pulse type weather radar detects only precipitation, not clouds or turbulence. The display may indicate clear areas between intense returns, but this does not necessarily mean it is safe to fly between them. Only Doppler radar can detect turbulence.

Airborne weather radar has other capabilities beyond weather detection. It also has the ability to detect and provide distance to objects on the ground, such as, cities, mountains, coastlines, rivers, lakes, and oceans.

5.1.2 Antenna Beam Illumination

It is important to understand the concept of the antenna beam illumination. The radar beam is much like the beam of a spotlight. The farther the beam travels, the wider it gets. The radar is only capable of "seeing" what is inside the boundaries of the beam.

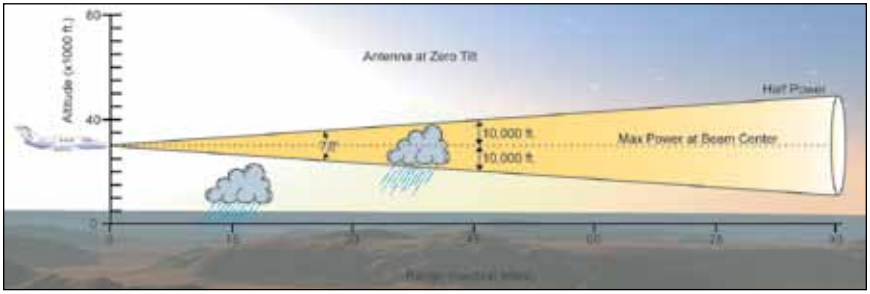


Figure 5-1 Radar Beam from 12 inch Antenna

The vertical dimensions of the radar beam are shown in the figure above and the same holds true for the horizontal dimensions. In other words, the beam will be as wide as it is tall. Note that it is possible not to see areas of precipitation on the radar display because of the antenna tilt setting. With the antenna tilt set to zero in this illustration, the beam overshoots the precipitation at 15 NM. The curvature of the earth can also be a factor, especially at range settings of 150 NM or more.

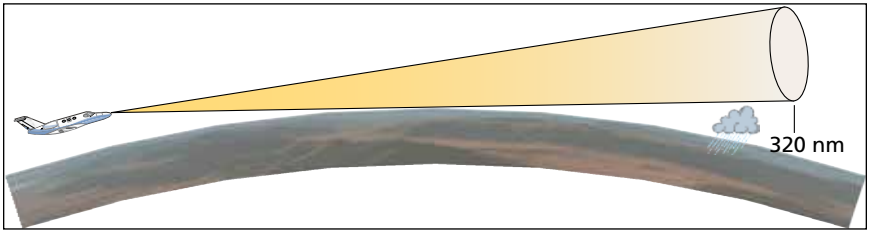


Figure 5-2 Radar Beam in Relation to the Curvature of the Earth

5.1.3 Radar Signal Attenuation

The phenomena of weather attenuation needs to be kept in mind whenever operating the weather radar. When the radar signal is transmitted, it is progressively absorbed and scattered, making the signal weaker. This weakening, or attenuation, is caused by two primary sources, distance and precipitation.

Attenuation because of distance is due to the fact that the amount of radar energy at a distance from the antenna is inversely proportional to the square of the distance. The reflected radar energy from a target 40 miles away that fills the radar beam will be one fourth the energy reflected from an equivalent target 20 miles away. This would appear to the operator that the storm is gaining intensity as the aircraft gets closer. Internal circuitry within the GWX system compensates for much of this distance attenuation.

Attenuation due to precipitation is not as predictable as distance attenuation. It is also more intense. As the radar signal passes through moisture, a portion of the radar energy is reflected back to the antenna. However, much of the energy is absorbed. If precipitation is very heavy, or covers a large area, the signal may not reach completely through the area of precipitation. The weather radar system cannot distinguish between an attenuated signal and area of no precipitation. If the signal has been fully attenuated, the radar will display a "radar shadow." This appears as an end to the precipitation when, in fact, the heavy rain may extend much further. A cell containing heavy precipitation may block another cell located behind the first, preventing it from being displayed on the radar. Never fly into these shadowed areas and never assume that all of the heavy precipitation is being displayed unless another cell or a ground target can be seen beyond the heavy cell. The WATCH™ feature of the GWX Weather Radar system can help in identifying these shadowed areas. Areas in question will appear as "shadowed" or gray area on the radar display. Proper use of the antenna tilt control can also help detect radar shadows.

Attenuation can also be due to poor maintenance or degradation of the radome. Even the smallest amount of wear and tear, pitting, and pinholes on the radome surface can cause damage and system inefficiency.

5.1.4 Radar Signal Reflectivity

5.1.4.1 Precipitation

Precipitation or objects more dense than water, such as earth or solid structures, will be detected by the weather radar. The weather radar will not detect clouds, thunderstorms or turbulence directly. It detects precipitation associated with clouds, thunderstorms, and turbulence. The best radar signal reflectors are raindrops, wet snow or wet hail. The larger the raindrop the better it reflects. The size of the precipitation droplet is the most important factor in radar reflectivity. Because large drops in a small concentrated area are characteristic of a severe thunderstorm, the radar displays the storm as a strong return. Ice, dry snow, and dry hail have low reflective levels and often will not be displayed by the radar. A cloud that contains only small raindrops, such as fog or drizzle, will not reflect enough radar energy to produce a measurable target return.

Figure 5-3 Precipitation Type and Reflectivity

5.1.4.2 Ground Returns

The intensity of ground target returns depends upon the angle at which the radar beam strikes the ground target (Angle of Incidence) and the reflective properties of that target. The gain can be adjusted so shorelines, rivers, lakes, and cities are well defined. Increasing gain too much causes the display to fill in between targets, thus obscuring some landmarks.

Cities normally provide a strong return signal. While large buildings and structures provide good returns, small buildings can be shadowed from the radar beam by the taller buildings. As the aircraft approaches, and shorter ranges are selected, details become more noticeable as the highly reflective regular lines and edges of the city become more defined.

Bodies of water such as lakes, rivers, and oceans are not good reflectors, and normally do not provide good returns. The energy is reflected in a forward scatter angle with inadequate energy being returned. They can appear as dark areas on the display. However, rough or choppy water is a better reflector and will provide stronger returns from the downwind sides of the waves.

Mountains also provide strong return signals to the antenna, but also block the areas behind. However, over mountainous terrain, the radar beam can be reflected back and forth in the mountain passes or off canyon walls using up all or most of the radar energy. **In this case, no return signal is received from this area causing the display to show a dark spot which could indicate a pass where no pass exists.**

5.1.4.3 Angle of Incidence

The angle at which the radar beam strikes the target is called the Angle of Incidence. Incident angle ("A") is illustrated below. This directly affects the detectable range, the area of illumination, and the intensity of the displayed target returns. A large incident angle gives the radar system a smaller detectable range and lower display intensity due to minimized reflection of the radar energy.

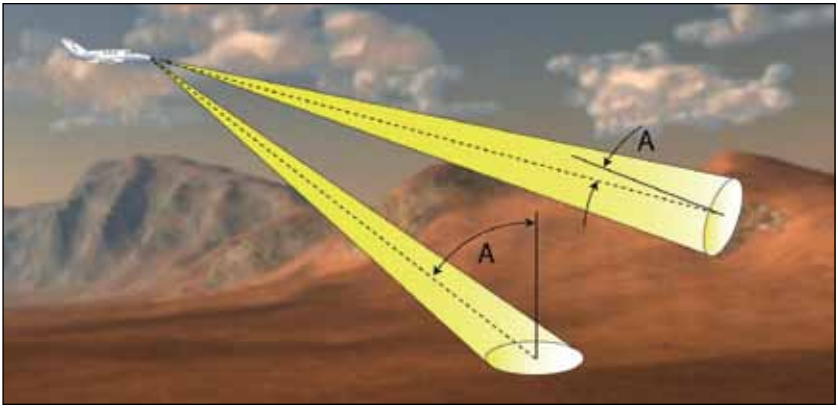


Figure 5-4 Angle of Incidence

A smaller incident angle gives the radar a larger detectable range of operation and the target display will show a higher intensity. Since more radar energy is reflected back to the antenna with a low incident angle, the resulting detectable range is increased for mountainous terrain.

5.2 Radar Operating Distance (GTN 7XX Only)

The following information establishes a minimum safe distance from the antenna for personnel near an operating airborne weather radar. The minimum safe distance is based upon the FCC's exposure limit at 9.3 to 9.5 GHz for general population/uncontrolled environments which is 1 mW/cm^2. See Advisory Circular 20-68B for more information on safe distance determination.

5.2.1 Maximum Permissible Exposure Level (MPEL) (GWX 68)

The zone in which the radiation level exceeds the US Government standard of 1 mW/cm^2, is the semicircular area of at least 11 feet from the 12 inch antenna as indicated in the illustration below. All personnel must remain outside of this zone. With a scanning or rotating beam, the averaged power density at the MPEL boundary is significantly reduced.

5.2.2 Maximum Permissible Exposure Level (MPEL) (Other Radars)

See the appropriate documentation for MPEL.

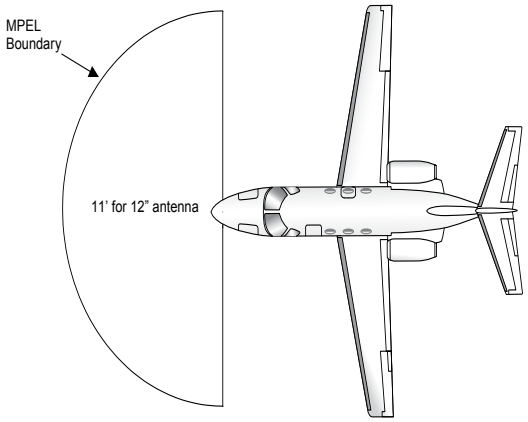


Figure 5-5 MPEL Boundary

5.3 Basic Radar Antenna Tilt Setup (GTN 7XX Only)

The following discussion is a simple method for setting up the weather radar antenna tilt for most situations. It is not to be considered an all encompassing setup that will work in all situations, but this method does provide good overall parameters for the monitoring of threats. Ultimately, it is desired to have the antenna tilted so that the bottom of the radar beam is four degrees below parallel with the ground. The following discussion explains one way of achieving this.

With the aircraft flying level, adjust the antenna tilt so ground returns are displayed at a distance that equals the aircraft's current altitude (AGL) divided by 1,000. For example, if the aircraft is at 14,000 feet, adjust the tilt so the front edge of ground returns are displayed at 14 NM. Note this antenna tilt angle setting. Now, raise the antenna tilt 6º above this setting. The bottom of the radar beam is now angled down 4º from parallel with the ground.

Practical Application Using the Basic Tilt Setup

At this point, when flying at altitudes between 2,000 and 30,000 feet AGL, any displayed target return should scrutinized. If the displayed target advances on the screen to 5 NM of the aircraft, avoid it. This may be either weather or ground returns that are 2,000 feet or less below the aircraft. Raising the antenna tilt 4º can help separate ground returns from weather returns in relatively flat terrain. This will place the bottom of the radar beam level with the ground. Return the antenna tilt to the previous setting after a few sweeps.

If the aircraft is above 29,000 feet, be cautious of any target return that gets to 30 NM or closer. This is likely a thunderstorm that has a top high enough that the aircraft cannot fly over it safely.

If the aircraft altitude is 15,000 feet or lower, set the displayed range to 60 NM. Closely monitor anything that enters the display.

Also, after setting up the antenna tilt angle as described previously, ground returns can be monitored for possible threats. The relationship between antenna tilt angle, altitude, and distance is one degree of tilt equals 100 feet of altitude for every one nautical mile.

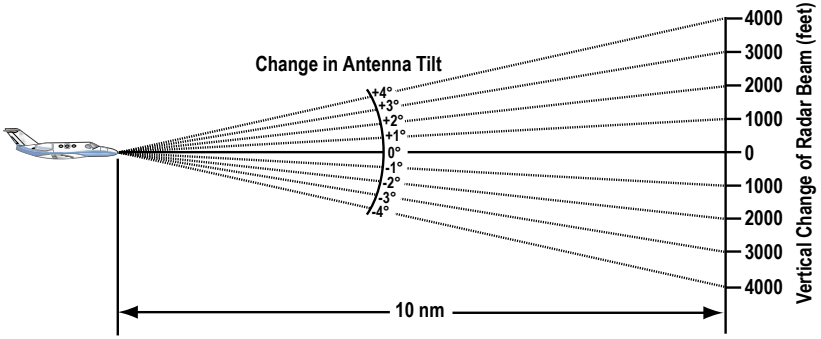


Figure 5-6 Vertical Change in Radar Beam per Nautical Mile

Therefore, with the antenna tilt set so that the bottom of the beam is four degrees below parallel with the ground, a target return at 10 NM is approximately 4,000 feet below the aircraft; at 20 NM, 8,000 feet; at 50 NM, 20,000 feet. In other words, at this tilt setting, a ground return (such as a mountain peak) being displayed at 10 NM would have a maximum distance below the aircraft of 4,000 feet. If that ground target return moves to 5 NM, maximum distance below the aircraft will be 2,000 feet.

This setup will provide a good starting point for practical use of the GWX radar. There are many other factors to consider in order to become proficient at using weather radar in all situations.

5.4 Radar Weather Mapping and Interpretation (GTN 7XX Only)

5.4.1 Weather display Interpretation

When evaluating various target returns on the weather radar display, the colors denote approximate rainfall intensity and rates as shown in the table below.

Weather Mode Color	GWX 68 Radars		GWX 70 Radars	3rd Party Radars
	Approximate Intensity	Approximate Rainfall Rate (in/hr)	Approximate Intensity	Radar Return Level (see radar documentation for details)
BLACK	< 23 dBZ	< .01	< 23 dBZ	0
GREEN	23 dBZ to < 33 dBZ	.01 - 0.1	23 dBZ to < 33 dBZ	1
YELLOW	33 dBZ to < 41 dBZ	0.1 - 0.5	33 dBZ to < 41 dBZ	2
RED	41 dBZ to < 50 dBZ	0.5 - 2	> 41 dBZ	3
MAGENTA	50 dBZ and greater	> 2		4

Table 5-1 Precipitation Intensity Levels

5.4.2 Thunderstorms

Updrafts and downdrafts in thunderstorms carry water through the cloud. The more severe the drafts, the greater the number and size of the precipitation droplets. With this in mind, the following interpretations can be made from what is displayed on the weather radar. Avoid these areas by an extra wide margin.

- In areas where the displayed target intensity is red or magenta (indicating large amounts of precipitation), the turbulence is considered severe.
- Areas that show steep color gradients (intense color changes) over thin bands or short distances suggest irregular rainfall rate and strong turbulence.
- Areas that show red or magenta are associated with hail or turbulence, as well as heavy precipitation. Vertical scanning and antenna tilt management may be necessary to identify areas of maximum intensity.

Along squall lines (multiple cells or clusters of cells in a line), individual cells may be in different stages of development. Areas between closely spaced, intense targets may contain developing clouds not having enough moisture to produce a return. However, these areas could have strong updrafts or downdrafts. Targets showing wide areas of green are generally precipitation without severe turbulence.

Irregularities in the target return may also indicate turbulence, appearing as “hooks,” “fingers,” or “scalloped” edges. These irregularities may be present in green areas with no yellow, red, or magenta areas and should be treated as highly dangerous areas. Avoid these areas as if they were red or magenta areas.

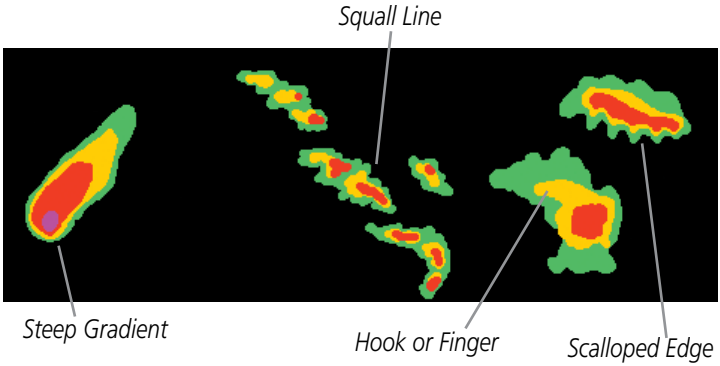


Figure 5-7 Cell Irregularities

Thunderstorm development is rapid. A course may become blocked within a short time. When displaying shorter ranges, periodically select a longer range to see if problems are developing further out. That can help prevent getting trapped in a "blind alley" or an area that is closed at one end by convective weather.

Figure 5-8 The "Blind Alley" Overhead View

In areas of multiple heavy cells, use the Vertical Scan feature along with antenna tilt management to examine the areas. Remember to avoid shadowed areas behind targets.

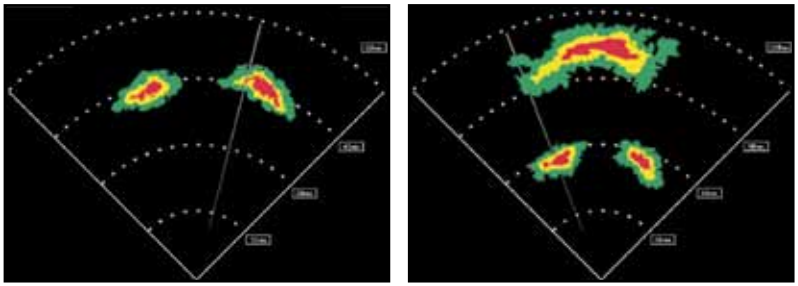


Figure 5-9 The "Blind Alley" Vertical Scan

5.4.3 Tornadoes

There is no conclusive radar target return characteristics which will identify a tornado, however, tornadoes may be present if the following characteristics are observed:

- A narrow, finger-like portion, as shown on the previous page, extends and, in a short time, curls into a hook and closes on itself.
- A "hook" which may be in the general shape of the numeral "6," especially if bright and projecting from the southwest quadrant (northeast quadrant in the southern hemisphere) of a major thunderstorm.
- V- shaped notches.
- Doughnut shapes.

These shapes do not always indicate tornadoes, nor are tornado returns limited to these characteristics. Confirmed radar observations of tornadoes most often have not shown shapes different from those of a normal thunderstorm display.

5.4.4 Hail

Hail results from updrafts carrying water high enough to freeze. Therefore, the higher the top of a thunderstorm, the greater the probability that it contains hail. Vertically scanning the target return can give the radar top of a thunderstorm that contains hail. Radar top is the top of a storm cell *as detected by radar*. It is not the actual top, or true top of the storm. The actual top of a storm cell is seen with the eyes in clear air and may be much higher than the radar top. The actual top does not indicate the top of the hazardous area.

Hail can fall below the minimum reflectivity threshold for radar detection. It can have a film of water on its surface, making its reflective characteristics similar to a very large water droplet. Because of this film of water, and because hail stones usually are larger than water droplets, thunderstorms with large amounts of wet hail return stronger signals than those with rain. Some hail shafts are extremely narrow (100 yards or less) and make poor radar targets. In the upper regions of a cell where ice particles are "dry" (no liquid coating), target returns are less intense.

Hail shafts are associated with the same radar target return characteristics as tornados. U-shaped cloud edges 3 to 7 miles across can also indicate hail. These target returns appear quite suddenly along any edge of the cell outline. They also change in intensity and shape in a matter of seconds, making vigilant monitoring essential.

5.5 GWX Radar Operation in Weather Mode (GTN 7XX Only)

***WARNING**: Begin transmitting only when it is safe to do so. When transmitting while the aircraft is on the ground, no personnel or objects should be within 11 feet of the antenna.*

***CAUTION**: In Standby mode, the antenna is parked at the center line. It is always a good idea to put the radar in Standby mode before taxiing the aircraft to prevent the antenna from bouncing on the bottom stop and possibly causing damage to the radar assembly.*

When the weather radar system is in the Weather or Ground Map mode, the system automatically switches to Standby mode on landing.

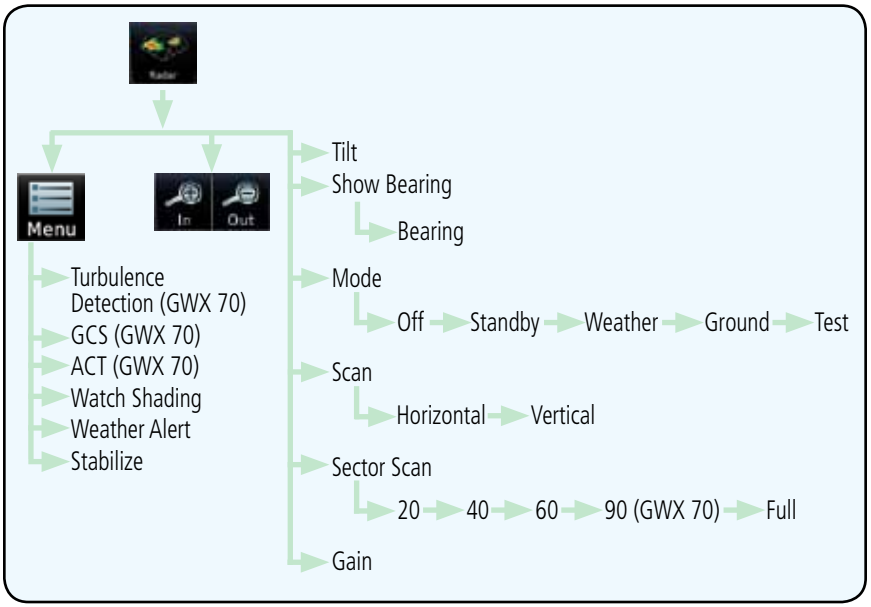


Figure 5-10 Weather Radar Functional Diagram

5.5.1 Viewing Weather on the Weather Radar Page


1. From the Home page, touch the **Weather** key on the Home page and then touch the **Radar** key (if necessary).

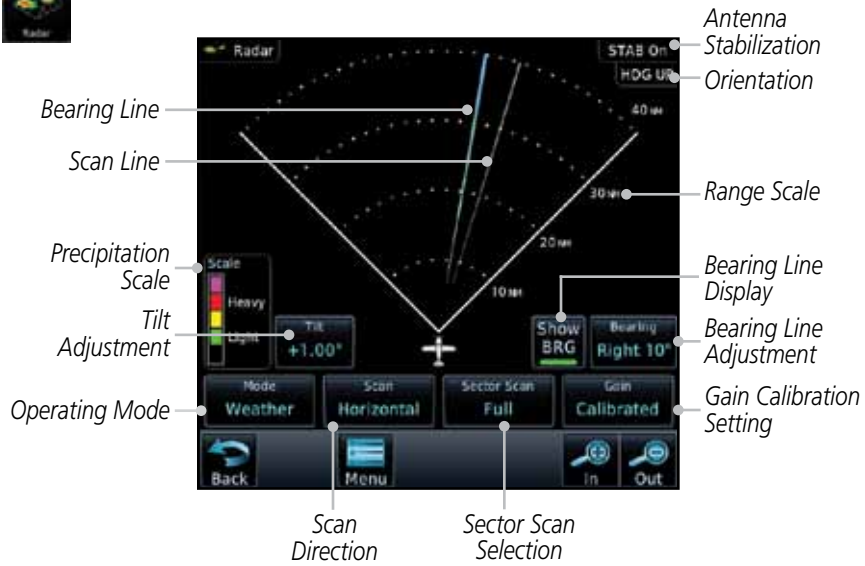
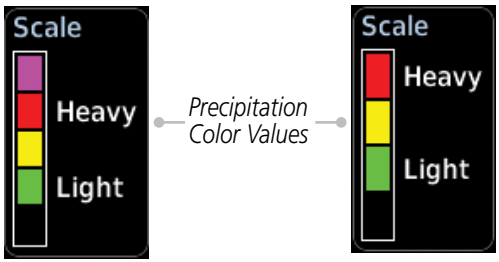


Figure 5-11 Weather Radar Page (Horizontal Scan)

2. Touch the **MODE** key and then touch the function desired.

3. The color-coded precipitation scale is shown on the left side of the display. A table describing the precipitation intensity levels is in section 12.3.5.1.



GWX 68 *GWX 70*

Figure 5-12 Weather Radar Precipitation Scale

4. Touch the **IN** and **OUT** keys to select the desired range. Touch the desired keys to set any required values as described below.

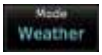
5.5.2 Configuring Weather Radar Page

To configure the WX Radar page, the Radar Mode must be in Ground, Weather, or Test mode. When one of these modes is selected, a warm-up period is initiated (countdown is displayed on the screen). After the warm-up is complete, the selected mode will be available.

1. While on the ground, touch **MODE**.

2. In the Weather Radar Mode window, touch **STANDBY**.

Figure 5-13 Weather Radar Mode Selection



3. Touch **MODE** and select Weather, Ground, or Test. A caution window is displayed.

Figure 5-14 Caution for Radar Activation Confirmation

4. Touch **OK** to acknowledge the selected mode will be activated.

If Weather or Ground is selected, a warm-up period is initiated (countdown is displayed on the screen). After the warm-up is complete, the radar begins transmitting.

5.5.3 Vertically Scanning a Storm Cell

When vertically scanning with stabilization ON, the actual physical area that the radar is sweeping may not match the vertical scan display. This occurs whenever the aircraft pitch is not at 0 degrees. To compensate for this, the vertical display will "erase" the portion of the vertical display that is no longer being scanned. It will appear that the vertical sweep "wraps around" when reaching the end of the GTN vertical display. The radar is simply "erasing" the portion of the vertical display that is not currently being scanned.

***NOTE:** Vertical scanning of a storm cell should be done with the aircraft wings level to avoid constant adjustment of the Bearing Line.*

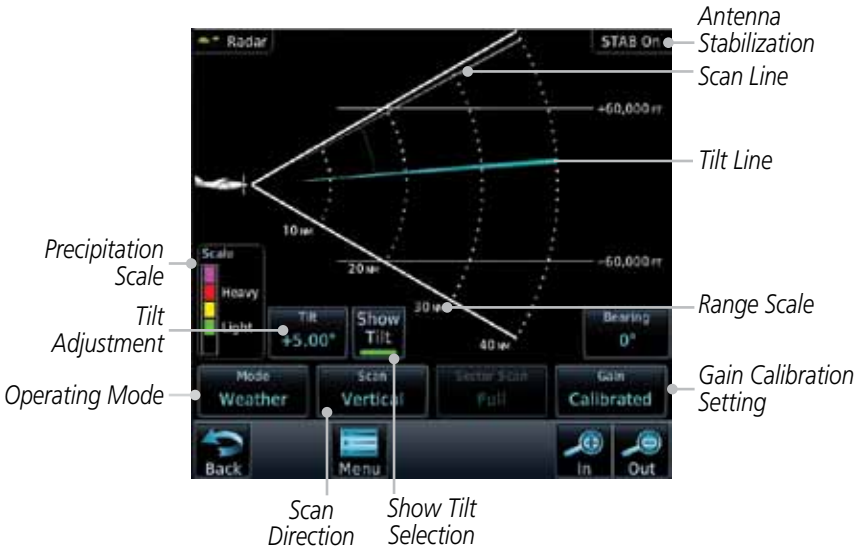


Figure 5-15 Weather Radar Page (Vertical Scan)

5.5.4 Adjusting the Antenna Tilt Angle

In order to make an accurate interpretation of a storm cell, the radar beam should be pointed at the wet part of the weather cell to record the proper rainfall intensity (color level). The ideal aiming point is just below the freezing level of the storm. The best way to find this point is to use the Vertical Scan feature. The antenna tilt angle can be centered on the strongest return area in the vertical scan to get a more accurate view of the coverage and intensity of the target in the horizontal scan.

1. While viewing the WX Radar page touch the **TILT** key. An adjustment window will be displayed.

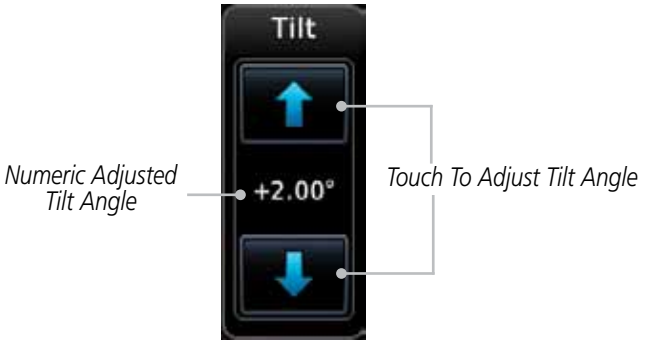


Figure 5-16 Adjusting Tilt

2. Touch the **Up and Down Arrow** keys to adjust the Tilt. The range is DN 15° to UP 15°.

3. Touch **Back** to save the values and return to the Radar display.

5.5.5 Adjusting the Bearing Line

1. Touch the **SHOW BRG** key. This displays the Bearing Line in Horizontal Scanning mode.
2. To adjust the Bearing Line, touch the **BEARING** key. An adjustment window will be displayed.

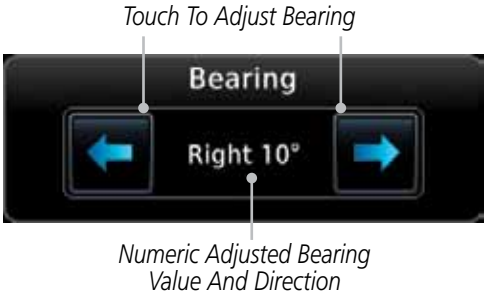


Figure 5-17 Bearing Line Adjustment

3. Touch the Gain Adjustment arrow keys to change the gain.

4. Touch **Back** to save the values and return to the Radar display.

5.5.6 Adjusting Gain

Gain is used to adjust the sensitivity of the radar receiver. It can be used to adjust the characteristics of the returns from the surface.

***WARNING**: Changing the gain in weather mode will cause precipitation intensity to be displayed as a color not representative of the true intensity. Remember to return the gain setting to : "Calibrated" for viewing the actual intensity of precipitation.*

1. While viewing the WX Radar page touch the **GAIN** key. The Gain Adjustment Bar will be displayed.

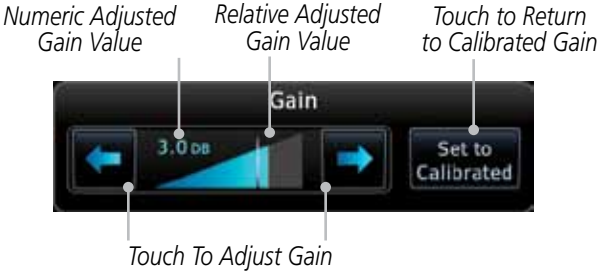


Figure 5-18 Gain Adjustment

2. Touch the Gain Adjustment arrow keys to change the gain.

3. Touch **Back** to save the values and return to the Radar display.

Restore Calibrated Gain

1. While viewing the WX Radar page touch **GAIN** to display the Gain adjustment window.

2. Touch the **SET TO CALIBRATED** key. This will restore the calibrated gain.

5.5.7 Sector Scan

Adjusting the Sector Scan reduces the scan angle from Full in increments of ±20°, ±40°, and ±60° in horizontal or vertical scanning.

1. While viewing the WX Radar page, touch **Sector Scan** to display the Sector Scan Mode window.

GWX 68 *GWX 70*

Figure 5-19 Sector Scan Mode

2. Touch the desired mode. After selection, you are returned to the Weather Radar Menu screen.

3. Touch **Back** again to return to the Weather Radar screen.

Figure 5-20 Selected Sector Scan Range

5.5.8 Weather Radar Menu

Touch **Menu** to view the Weather Radar Menu.

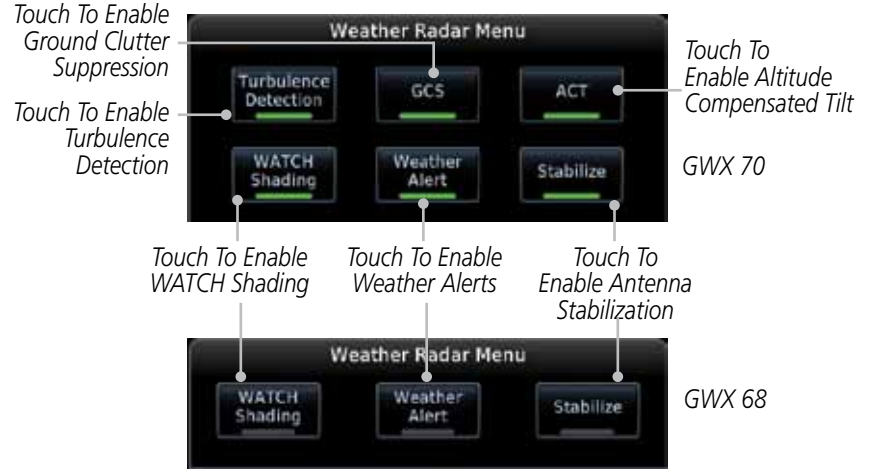


Figure 5-21 Weather Radar Menu Selections

***NOTE**: Ground Clutter Suppression (GCS) and Turbulence Detection is only supported for 12" or larger RADAR antennas. Turbulence Detection is only supported out to a range of 40 NM and is disabled at display ranges greater than 160 NM.*

5.5.8.1 Weather Attenuated Color Highlight (WATCH™)

While in horizontal scan mode, this feature can be used as a tool to determine areas of possible inaccuracies in displayed intensity due to weakening of the radar energy. This weakening is known as "attenuation." The radar energy weakens as it passes through areas of intense precipitation, large areas of lesser precipitation, and distance. Issues with the radome will also attenuate the radar energy. All these factors have an effect on the return intensity. The more energy that dissipates, the lesser the displayed intensity of the return. Accuracy of the displayed intensity of returns located in the shaded areas are suspect. Make maneuvering decisions with this information in mind. Proper antenna tilt management should still be employed to determine the extent of attenuation in a shaded area.

1. While viewing the Weather Radar Menu, touch **WATCH Shading** to toggle WATCH Shading.
2. To deactivate Watch Mode, repeat sequence.

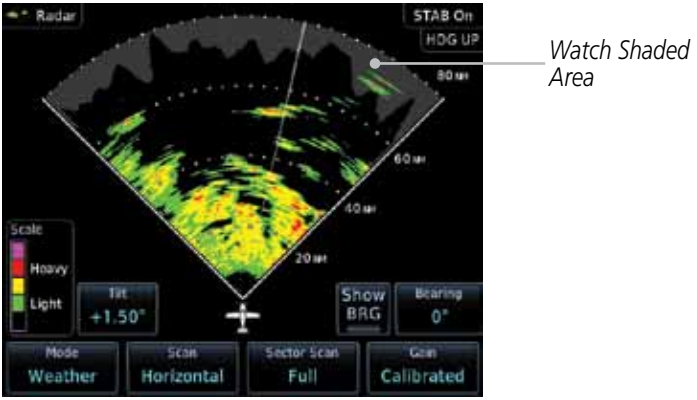


Figure 5-22 Horizontal Scan with WATCH

5.5.8.2 Weather Alert

The Weather Alert feature may be used to indicate the presence of heavy precipitation beyond the currently displayed range and 80 to 320 NM from the aircraft's present position. Weather Alert targets appear as red bands along the outer range ring at the approximate azimuth of the detected returns.

If a Weather Alert is detected within ±10° of the aircraft heading, a message will be displayed in the Messages page. Touch the **MSG** key to view messages.

Figure 5-23 Weather Alert Display

If the antenna tilt is adjusted too low, a weather alert can be generated by ground returns. To avoid this issue, set the display range to less than 80 NM in the terminal area. Weather alerts can also be deactivated in the terminal area.

1. While viewing the Weather Radar Menu, touch **Weather Alert** to toggle Weather Alerts.
2. To deactivate Weather Alerts, repeat sequence.

5.5.8.3 Antenna Stabilization

1. While viewing the Weather Radar Menu, touch **Stabilize** to toggle Antenna Stabilization.
2. To deactivate Antenna Stabilization, repeat sequence. The current stabilization condition is shown in the top right of the weather radar display.

5.5.8.4 Altitude Compensated Tilt (ACT) - GWX 70 only

Altitude Compensated Tilt (ACT) automatically adjusts the tilt to compensate for altitude changes as you climb or descend.

1. While viewing the Weather Radar Menu, touch **ACT** to toggle ACT.
2. To deactivate ACT, repeat sequence.

5.5.8.5 Turbulence Detection - GWX 70 only

Turbulence Detection activates a feature that detects and displays severe turbulence. Turbulence Detection is inactive at ranges greater that 160 NM. If Turbulence Detection is enabled and available, Turbulence Detection will be reported as Inactive in any of the following conditions:

- Scan orientation is not Horizontal
- Scan range is greater than 160 NM
- Radar mode is not Weather

1. While viewing the Weather Radar Menu, touch **Turbulence Detection** to toggle Turbulence Detection.
2. To deactivate Turbulence Detection, repeat sequence.

5.5.8.6 Ground Clutter Suppression (GCS) - GWX 70 only

Ground Clutter Suppression reduces the amount of returns as a result of highly reflective objects on the ground, such as buildings or cities, while maintaining the intensity and size of weather returns.

1. While viewing the Weather Radar Menu, touch **GCS** to toggle Ground Clutter Suppression.
2. To deactivate Ground Clutter Suppression, repeat sequence.

5.6 Connext Weather

Connext Weather is an optional feature available with the Iridium® satellite system that is interfaced through the optional Garmin GSR 56. Connext Weather may be viewed in the Weather and Map functions. The Weather pages may be oriented to either Track Up, Heading, or North Up. Both Connext and XM Weather may be installed and selected individually. Connext Weather coverage is available throughout most of Europe, Canada and the U.S. Additional radar coverage areas are being added continuously.

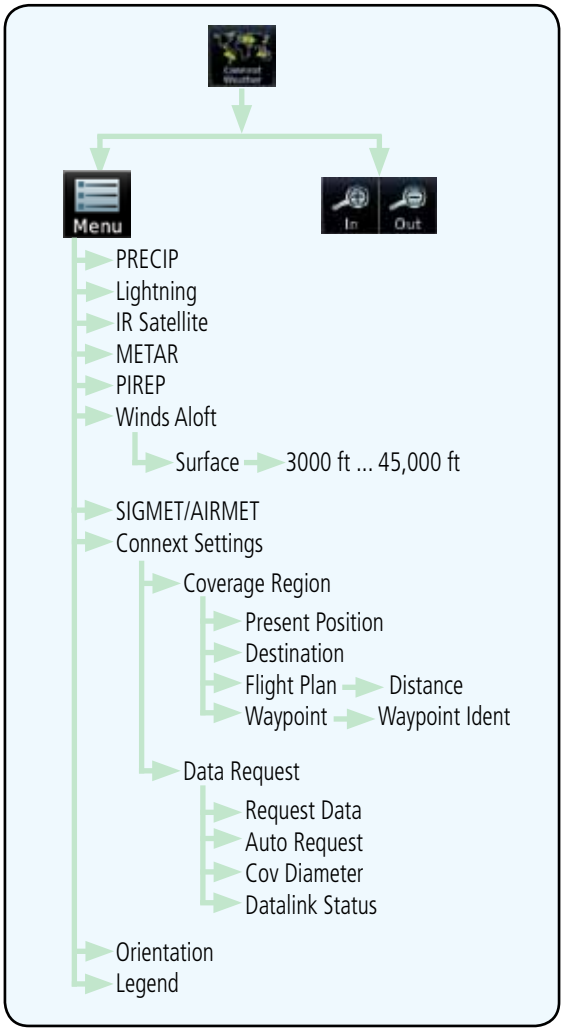


Figure 5-24 Connext Weather Functional Diagram

More detail on Connext weather products and coverage can be found at: http://fly.garmin.com/fly-garmin/gfds-weather/

***NOTE**: A system can be configured for multiple weather products, but only one may be selected for viewing in the Weather or map pages at a given time.*

1. While viewing the Connext Weather page, press the **MENU** key to display the Connext Weather Menu.

Figure 5-25 Select Connext Weather

2. Touch the desired key to access the settings. The settings will affect the display on both the Weather and Map pages.

5.6.1 Using Connext Satellite Weather Products

When a weather product is active on the Weather Data Link Page or the Navigation Map Page, the age of the data is displayed on the screen. The age of the product is based on the time difference between when the data was assembled on the ground and the current GPS time. Weather products are refreshed at selectable intervals.

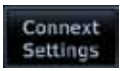
Weather products expire at intervals based on each product. When the data expires, it is removed from the display. This ensures that the displayed data is consistent with what is currently being broadcast by Connext Satellite Radio services. If more than half of the expiration time has elapsed from the time the data is received, the color of the product age displayed changes to yellow.

5.6.2 Connext Weather Menu

The Connext Weather page is customized by selecting options from the Connext Weather and the Connext Settings Menus. The Connext Weather Menu options include choices for Weather Setup and displaying selected weather products. The Connext Settings Menu makes settings for the Coverage Region and Data Request frequency.

1. While viewing the Connext Weather page, touch the **MENU** key to display the Connext Weather Menu. Touch the desired keys to toggle the weather product.

Figure 5-26 Connext Weather Menu



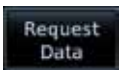
2. Touch the **Connext Settings** key to make detailed settings for the Connext Weather display.

5.6.3 Connext Settings

Figure 5-27 Connext Settings Menu

5.6.3.1 Connext Data Request

It is necessary to request the downloading of weather products. Requests can be sent manually or set to automatically update at a selected rate. The Connext weather data may be updated at any time regardless of the automatic update timing by selecting a Manual Request. When multiple requests are made, some products are merged with the old data (SIGMETs/AIRMETs, TAFs, TFRs, and METARs), but the old data of other products is discarded.



1. While viewing the Connext Settings Menu, touch the **Request Data** key to manually request data.

2. Touch the **Auto Request** key to set the Auto Request Period.

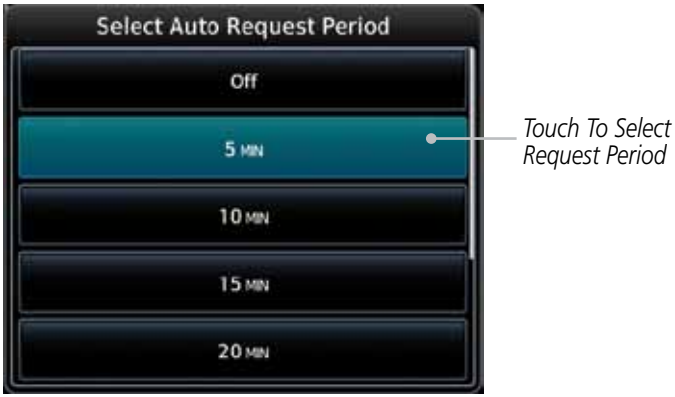
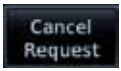


Figure 5-28 Select Auto Request Period



3. Touch the **Cancel Request** key to cancel a request in progress.

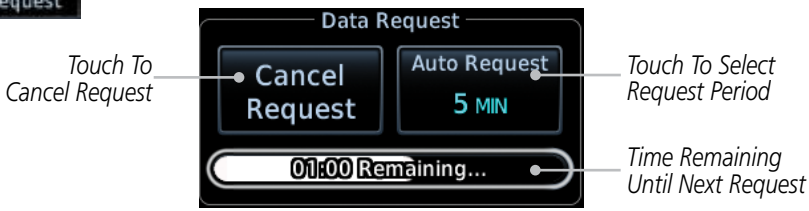


Figure 5-29 Cancelling A Request

5.6.3.2 Connext Data Request Coverage Region

Present Position Data Request

Touch the **Present Position** key to request that weather information will be shown around your present position.

Destination Connext Data Request

Touch the **Destination** key to request that weather information will be shown around the destination waypoint in the flight plan.

Flight Plan Data Request

Touch the **Flight Plan** key to request that weather information will be shown around the active flight plan.

Flight Plan Distance Data Request

Touch the **Distance** key to request that weather information will be shown for the selected distance along the active flight plan.

Waypoint Connext Data Request

1. Touch the **Waypoint** key to request that weather information will be shown around the selected waypoint.

2. Select the waypoint and then press **ENT.**

Diameter/Route Width Connext Data Request

After selecting a coverage option in the previous section, select the desired **Diameter** and then press **ENT.**

5.6.3.3 Connext Weather Map Orientation

1. While viewing the Connext Weather Menu, touch the **Orientation** key.
2. Touch the orientation choices of North Up, Track Up, and Heading Up and to accept the displayed value and return to the Connext Weather Menu.

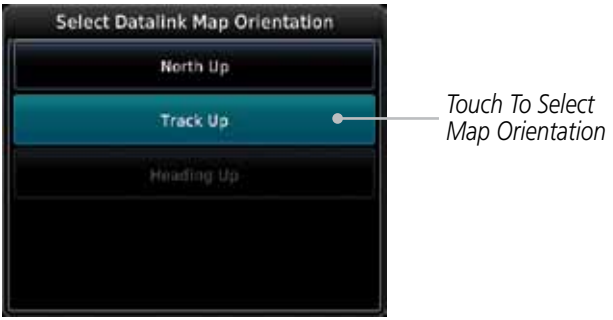


Figure 5-30 Connext Weather Map Orientation

5.6.4 Register With Connext

It is necessary to register the GTN with Connext to utilize the weather products.

1. Call Garmin Customer Service to create a Connext account. Provide the GTN System ID and airframe info (model, tail number, etc).
2. Customer Service will issue an access code to enter on the Connext Registration page.
3. While viewing Connext Settings Menu, touch the **Datalink Status** key.

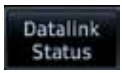


Figure 5-31 GSR 56 Status

4. Touch the **Connext Registration** key to display the Connext Registration display.

Figure 5-32 Connext Registration Page

5. Touch the Access Code key to enter the appropriate code and then touch the **Enter** key.

6. Touch the **Register** key to complete the process. The GTN will contact the Connext servers using the GSR 56 transceiver. If the access code and system ID are correct, it will download and display the airframe info.

Deactivate Unit Registration With Connext

Registration of the GTN unit with Connext can be deactivated so that the unit can no longer make requests to Connext. This does not cancel the subscription.

1. While viewing the Connext Registration display, touch the Access Code field and enter an invalid access code to deactivate the Connext registration.
2. Any weather requests will now fail and the system will no longer be linked to the Connext account.

5.6.5 Connext Weather Product Age

The weather product expiration time and the refresh rate are shown in the following table. The refresh rate represents the interval at which Connext Satellites broadcast new signals that may or may not contain new weather data. It does not represent the rate at which weather data is updated or new content is received by the Data Link Receiver. Weather data is refreshed at intervals that are defined and controlled by Connext and its data vendors.

Weather Product	Expiration Time (Minutes)
PRECIP	30
Lightning	30
IR Satellite	60
SIGMETs / AIRMETs	60
METARs	90
Winds Aloft	90
Pilot Weather Report (PIREP) (Blue - Regular, Yellow - Urgent)	90
Temporary Flight Restriction (TFR)	60

Table 5-2 Connext Weather Products and Aging Times

***WARNING**: Do not use the indicated data link weather product age to determine the age of the weather information shown by the data link weather product. Due to time delays inherent in gathering and processing weather data for data link transmission, the weather information shown by the data link weather product may be significantly older than the indicated weather product age.*

5.6.6 TFRs

Temporary Flight Restrictions (TFRs) provide detailed information for local short term restrictions.

Figure 5-33 Connext TFR Legend

1. Touch a TFR symbol on the Weather page to view details.

Figure 5-34 Connext TFR Detail

2. Touch the **Back** key to return to the Weather display.

5.6.7 Precipitation (PRECIP) Data

Graphical data is overlaid on the map indicating the rainfall detected by ground based radar for a specific area. The colors indicating increasing levels of rainfall progresses from light green for light rainfall to red for heavy rainfall. Review the Limitations section in the front of this guide for the limitations that apply to the Connext data. Rainfall data is color coded as follows:

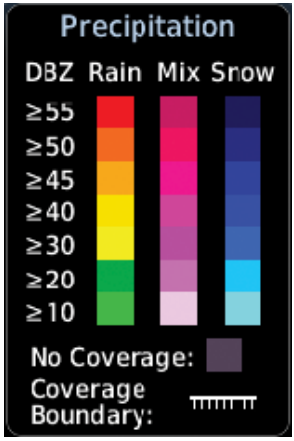


Figure 5-35 Connext PRECIP Weather Map Display and Legend

The "No Coverage" color indicates that no data is available for that area, and rainfall in that area is unknown.

When weather data is received, the airborne system will display that data for 20 minutes. If no new data has been received for a given area, the rainfall will be removed after 20 minutes and the area will revert back to the "No Coverage" color.

The Connext Weather Function is based on a ground-to-air data link and requires that the appropriate ground systems are broadcasting weather data and the aircraft is within reception range of the Ground Broadcast Transceiver (GBT).

5.6.8 Lightning

Lightning data shows the approximate location of cloud-to-ground lightning strikes. A strike icon represents a strike that has occurred within a two kilometer (1.08 NM) region. The exact location of the lightning strike is not displayed. Only cloud to ground strikes are reported in the US and extreme southern Canada (cloud to cloud strikes are not reported).

Figure 5-36 Connext Data Link Lightning and Legend

5.6.9 Infrared Satellite Data

Infrared Satellite data is available over North America and Europe and depicts cloud top temperatures from satellite imagery. Brighter cloud top colors indicate cooler temperatures occurring at higher altitudes. Information is updated every half hour.

Figure 5-37 Connext Infrared Satellite Data Map Display and Legend

5.6.10 METARs

***NOTE**: Atmospheric pressure reported for METARs is given in hectopascals (hPa), except in the United States, where it is reported in inches of mercury (in Hg). Temperatures are reported in Celsius.*

***NOTE**: METAR information is only displayed within the installed aviation database service area.*

METAR (METeorological Aerodrome Report), known as an Aviation Routine Weather Report, is the standard format for current weather observations. METARs are generally updated hourly, but some site are more frequent. Special updates are done as conditions warrant. METARs typically contain information about the temperature, dew point, wind, precipitation, cloud cover, cloud heights, visibility, and barometric pressure. They can also contain information on precipitation amounts, lightning, and other critical data. METARs are shown as colored flags at airports that provide them.

METAR Symbol	Description
	VFR (ceiling greater than 3000 ft. AGL and visibility greater than five miles)
	Marginal VFR (ceiling 1000–3000 ft. AGL and/or visibility three to five miles)
	IFR (ceiling 500 to below 1000 ft. AGL and/or visibility one mile to less than three miles)
	Low IFR (ceiling below 500 ft. AGL or visibility less than one mile)
	Unknown

Table 5-3 METAR Symbols

Figure 5-38 Connext Weather - Graphic METARs and Legend

5.6.11 PIREPs

Pilot Weather Reports (PIREPs) provide timely weather information for a particular route of flight. When significant weather conditions are reported or forecast, Air Traffic Control (ATC) facilities are required to solicit PIREPs. A PIREP may contain non-forecast adverse weather conditions, such as low in-flight visibility, icing conditions, wind shear, and turbulence. PIREPs are issued as either Routine (UA) or Urgent (UUA).

Figure 5-39 Connext Weather - PIREPs

Figure 5-40 Connext Weather - PIREPs Legend

5.6.12 Winds Aloft

Winds Aloft data shows the forecast wind speed and direction at the surface and at selected altitudes. Altitudes can be selected in 3000 foot increments from the surface up to 42,000 feet MSL. Pressing the **WX Aloft ALT +** or **–** soft keys steps down or up in 3,000 foot increments.

Figure 5-41 Connext Weather - Winds Aloft

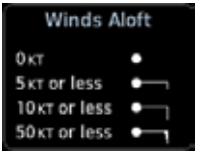


Figure 5-42 Connext Weather - Winds Aloft Legend

Winds Aloft Altitude

The Winds Aloft Altitude option allows you to select the altitude for the Winds Aloft weather product. Altitude can be selected in 3,000 foot increments from the surface up to 42,000 feet MSL.

Pressing the **WX Aloft ALT +** or **–** soft keys steps down or up in 3,000 foot increments. In the figure shown above, 6,000 feet is selected and Winds Aloft data is shown for winds reported at an altitude of 6,000 feet.

5.6.13 SIGMETs and AIRMETs

SIGMETs (SIGnificant METeorological Information) and AIRMETs (AIRmen's METeorological Information) are broadcast for potentially hazardous weather considered of importance to aircraft. A Convective SIGMET is issued for hazardous convective weather. A localized SIGMET is a significant weather condition occurring at a localized geographical position.

Figure 5-43 Connext Weather Page - AIRMETs/SIGMETs

When enabled, SIGMET/AIRMETs advise the pilot of potentially hazardous weather. SIGMETs are directed to all aircraft. AIRMETs are intended for light aircraft. SIGMET/AIRMET data covers icing, turbulence, dust, and volcanic ash as issued by the National Weather Service. The update rate is selected in the Connext Settings Menu.

Figure 5-44 Connext Weather - AIRMETs/SIGMETs Detail and Legend

When enabled, the following AIRMETs are available for display:

- Icing
- Turbulence
- IFR conditions
- Mountain obscuration
- Surface winds

5.7 FIS-B Weather

The Flight Information Services (FIS-B) function is capable of displaying text and graphic weather information with GDL 88 installations. No subscription for FIS-B services is required with the GDL 88.

The FIS-B Function is a graphic weather display capable of displaying graphical weather information on UAT equipped installations. Graphical data is overlaid on the map indicating the rainfall detected by ground based radar for a specific area. Colors are used to identify the different NEXRAD echo intensities (reflectivity) measured in dBZ (decibels of Z). "Reflectivity" (designated by the letter Z) is the amount of transmitted power returned to the radar receiver. The dBZ values increase as returned signal strength increases. Precipitation intensity is displayed using colors corresponding to the dBZ values. Review the Limitations section in the front of this guide for the limitations that apply to the FIS-B data. An example of how rainfall data is color coded follows:

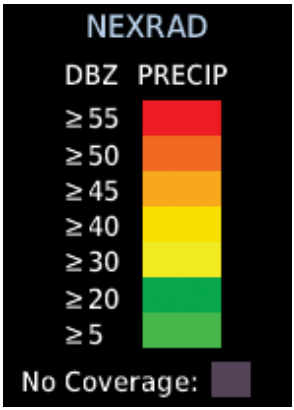


Figure 5-45 FIS-B Weather Precipitation Legend

The FIS-B Function is based on a ground-to-air data link and requires that the appropriate ground systems are broadcasting weather data and the aircraft is within reception range of the Ground Broadcast Transceiver (GBT).

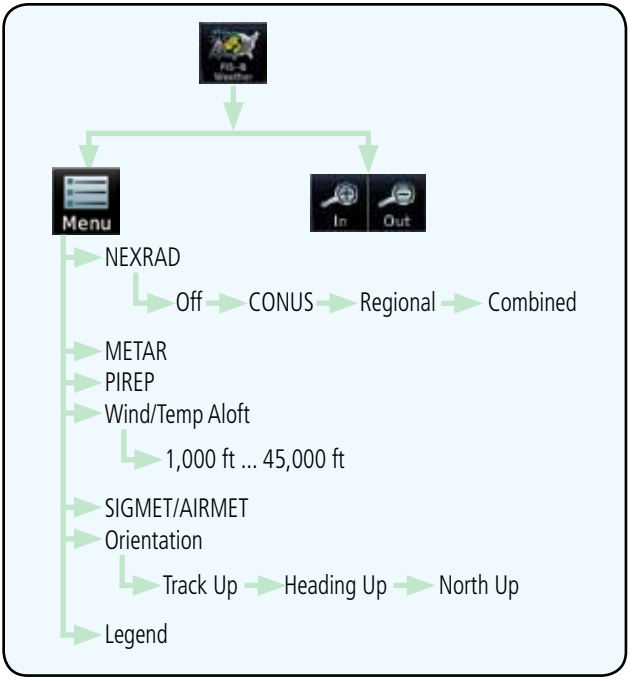


Figure 5-46 FIS-B Weather Functional Diagram

Weather Product	Expiration Time (Minutes)	Transmission Interval (Minutes)	Update Interval (Minutes)
CONUS NEXRAD	60	15	15
Regional NEXRAD	30	2.5	5
AIRMETs	60	5	As Available (Typically 20 minutes)
SIGMETs	60	5	As Available (Typically 20 minutes), then at 15 minute intervals for 1 hour
METARs	90	5	1 minute (where available), As Available otherwise (Typically ≤ 20 minutes)
Winds and Temperatures Aloft	90 or at the end of the valid period	10	12 hours
Pilot Weather Report (PIREP) (Blue - Regular, Yellow - Urgent)	90	10	As available (Typically 20 minutes)
TAFs	60	10	8 hours
TFRs	60	10	20
NOTAMs	60	10	As available (Typically 20 minutes)

Table 5-4 FIS-B Weather Products and Aging

***WARNING**: Do not use the indicated data link weather product age to determine the age of the weather information shown by the data link weather product. Due to time delays inherent in gathering and processing weather data for data link transmission, the weather information shown by the data link weather product may be significantly older than the indicated weather product age.*

5.7.1 FIS-B Operation

Weather data reception time is shown in the upper right corner of the screen. An indicated time shows if the aircraft is currently within reception coverage of a ground station with weather broadcast capabilities. The ground system determines the weather coverage area and extent of data that is transmitted by each ground station. The GDL 88 can display weather from multiple ground stations.

1. From the Home page, touch the **Weather** key on the Home page and then touch the **FIS-B Weather** key (if necessary).

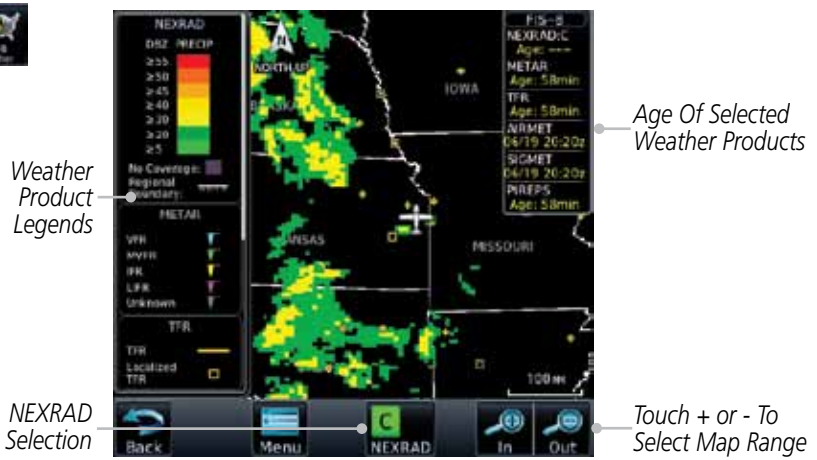


Figure 5-47 FIS-B Weather Page (NEXRAD Key Shown)

2. While viewing the FIS-B weather page, touch the **Menu** key to configure the Data Link Weather page.

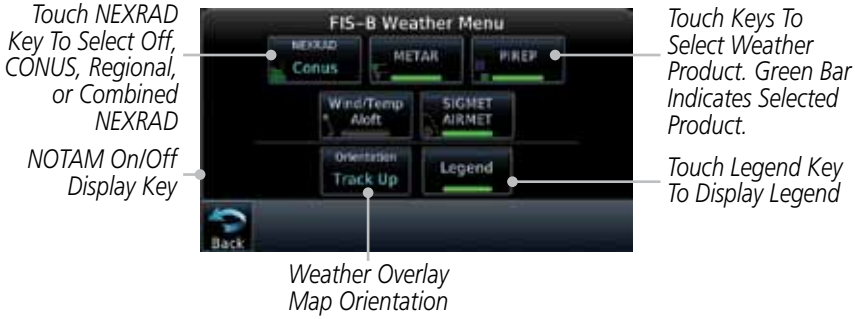


Figure 5-48 FIS-B Weather Data Link Menu

3. Once you selected what items you want to display, touch **BACK** to return to the FIS-B Weather page.

5.7.2 FIS-B NEXRAD

WSR-88D weather surveillance radar or NEXRAD (NEXt generation RADar) is a Doppler radar system that has greatly improved the detection of meteorological events such as thunderstorms, tornadoes, and hurricanes. An extensive network of NEXRAD stations provides almost complete radar coverage of the continental United States, Alaska, and Hawaii. The unobstructed range of each NEXRAD is 124 nautical miles.

5.7.2.1 NEXRAD Abnormalities

There are possible abnormalities regarding displayed NEXRAD images. Some, but not all, causes of abnormal displayed information include:

- Ground Clutter
- Strobes and spurious radar data
- Sun strobes, when the radar antenna points directly at the sun
- Military aircraft deploy metallic dust which can cause alterations in radar scans
- Interference from buildings or mountains, which may cause shadows
- Scheduled maintenance may put a radar off-line

5.7.2.2 NEXRAD Limitations

Certain limitations exist regarding the NEXRAD radar displays. Some, but not all, are listed for the user's awareness:

- NEXRAD base reflectivity does not provide sufficient information to determine cloud layers or precipitation characteristics (hail vs. rain, etc).
- NEXRAD base reflectivity is sampled at the minimum antenna elevation angle. An individual NEXRAD site cannot depict high altitude storms at close ranges, and has no information about storms directly over the site.
- The resolution of displayed Regional NEXRAD data is approximately two kilometers and the resolution of displayed CONUS NEXRAD data is approximately 10 kilometers. Therefore, when zoomed in on the display, each square block is two kilometers (1.08 NM) or 10 kilometers (5.4 NM) on a side. The intensity level reflected by the square will be the highest level sampled within the area covered by each block.

5.7.2.3 NEXRAD Intensity

Colors are used to identify the different NEXRAD echo intensities (reflectivity) measured in dBZ (decibels of Z). "Reflectivity" is the amount of transmitted power returned to the radar receiver. Reflectivity (designated by the letter Z) covers a wide range of signals (from very weak to very strong). So, a more convenient number for calculations and comparison, a decibel (or logarithmic) scale (dBZ), is used. The dBZ values increase as the strength of the signal returned to the radar increases.

5.7.2.4 NEXRAD

When enabled, NEXRAD weather information is shown. Composite data from all of the NEXRAD radar sites in the United States is shown. This data is composed of the maximum reflectivity from the individual radar sweeps. The display of the information is color-coded to indicate the weather level severity. Refer to the legend for a description of the color code.

The NEXRAD option has selections of Regional, CONUS, or Combined NEXRAD. CONUS NEXRAD includes a composite of available NEXRAD radar imagery across the 48 states. Regional NEXRAD is a composite of available NEXRAD radar imagery in a local area, showing a more detailed image than CONUS NEXRAD.

Continental US NEXRAD (CONUS)

The Display CONUS NEXRAD selection shows NEXRAD radar information for the entire continental United States. CONUS NEXRAD data is updated every 15 minutes.

Figure 5-49 Weather Page With CONUS Displayed

Regional NEXRAD

The Regional NEXRAD selection shows regional NEXRAD radar information within 500 miles of the aircraft location.

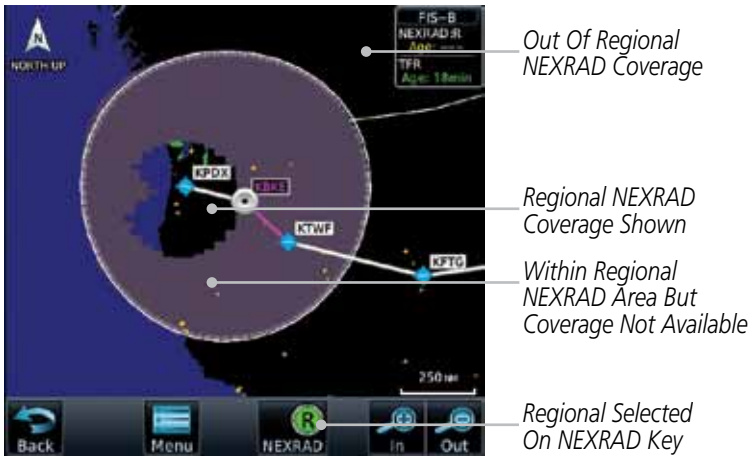


Figure 5-50 Weather Page With Regional NEXRAD Displayed

Combined NEXRAD

Regional NEXRAD data within 150 NM of the aircraft location and CONUS NEXRAD data everywhere else. The two types of NEXRAD are separated by a white stippled border. This boundary is updated whenever new Regional or CONUS NEXRAD data is received.

Figure 5-51 Weather Page With Combined NEXRAD Displayed

Selecting NEXRAD in the FIS-B Weather Menu

1. While viewing the FIS-B weather page, touch the **Menu** key to select the NEXRAD choice.
2. Touch the **NEXRAD** key to select Off, Regional, CONUS, or Combined NEXRAD.

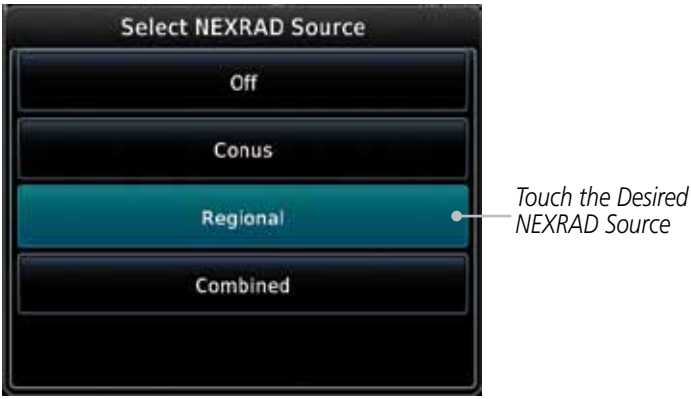


Figure 5-52 NEXRAD Source Selection

3. Touch the **Back** key to return to the FIS-B Weather Menu.

5.7.3 FIS-B TFRs

Temporary Flight Restrictions (TFRs) provide detailed information for local short term restrictions. The update rate is approximately every 20 minutes.

Figure 5-53 FIS-B TFR Legend

1. Touch a TFR symbol on the Weather page to view details.

Figure 5-54 FIS-B TFR Detail

2. Touch the **Back** key to return to the Weather display.

5.7.4 FIS-B METARs

When enabled, graphic METARs (METeorological Aviation Reports) are shown as colored flags at airports that provide METAR reports. Press the **METARs** key to enable or disable METARs. Refer to the Legend for a description of the color code. The update rate is every five minutes.

METAR Symbol	Description
	VFR (ceiling greater than 3000 ft. AGL and visibility greater than five miles)
	Marginal VFR (ceiling 1000–3000 ft. AGL and/or visibility three to five miles)
	IFR (ceiling 500 to below 1000 ft. AGL and/or visibility one mile to less than three miles)
	Low IFR (ceiling below 500 ft. AGL or visibility less than one mile)
	Unknown

Table 5-5 METAR Symbols

1. While viewing the FIS-B weather page, touch the **Menu** key to select the METAR choice. Touch an airport symbol for more METAR detail.

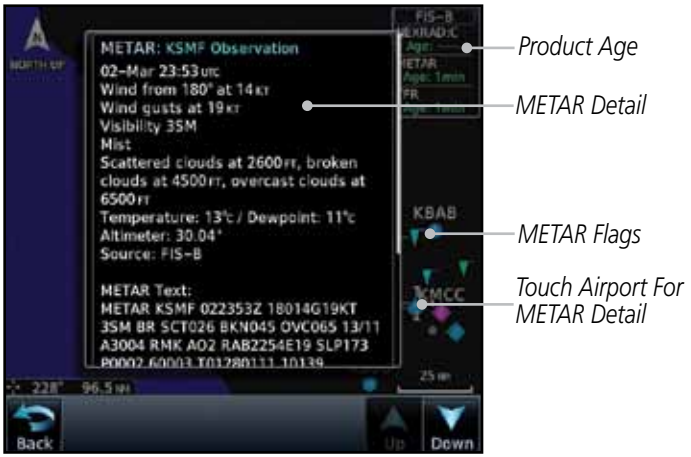


Figure 5-55 METARS

2. Touch the **METAR** key to toggle METARS on or off.

3. Touch the **Back** key to return to the FIS-B Weather page.

5.7.5 FIS-B PIREPs

Pilot Weather Reports (PIREPs) provide timely weather information. When significant weather conditions are reported or forecast, Air Traffic Control (ATC) facilities are required to solicit PIREPs. A PIREP may contain non-forecast adverse weather conditions, such as low in-flight visibility, icing conditions, wind shear, and turbulence. PIREPs are issued as either Routine (UA) or Urgent (UUA). The update rate is approximately every 20 minutes.

1. While viewing the FIS-B weather page, touch the **Menu** key to select the PIREP choice.

2. Touch the **PIREP** key to toggle PIREPs on or off.

Figure 5-56 Weather Display With PIREP Information Active

3. Touch a weather information symbol to view details for that item.

Figure 5-57 PIREP Information Detail

4. Touch the **Back** key to remove the detailed information.

5. Touch the **PIREP** key again to turn it off.

5.7.6 FIS-B Winds and Temperatures Aloft

Winds and Temperatures Aloft data shows the forecast wind speed, direction, and Temperature at selected altitudes. Altitudes can be selected in increments from the 1,000 feet up to 53,000 feet. The update rate is every 12 hours.

1. While viewing the Data Link Weather menu, touch the **Wind/ Temp Aloft** key.

Figure 5-58 Winds Aloft

2. Touch the **WX Aloft ALT** − or + keys to increase or decrease the reporting altitude of the winds aloft in increments. The selected altitude is shown in a window above the altitude keys.

3. Touch the **Wind/Temp Aloft** key again to turn it off.

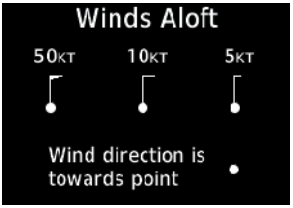


Figure 5-59 FIS-B Winds Aloft Legend

5.7.7 SIGMETs and AIRMETs

SIGMETs (SIGnificant METerological Information) and AIRMETs (AIRmen's METerological Information) are broadcast for potentially hazardous weather considered of importance to aircraft. The update rate is approximately every 20 minutes.

Figure 5-60 FIS-B SIGMET/AIRMET Legend

1. While viewing the FIS-B Weather menu, touch the **SIGMET/ AIRMET** key.

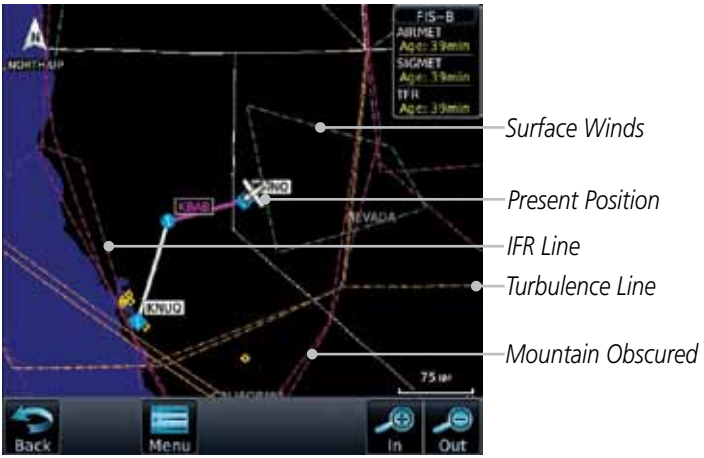


Figure 5-61 FIS-B SIGMETs and AIRMETs

2. Touch a SIGMET/AIRMET line to view details. Touch the **Back** key to return to the Weather display.

Figure 5-62 SIGMET and AIRMET Details

3. Touch the **SIGMET/AIRMET** key again to turn it off.

6 SYSTEM

6.1 GDL 88 Status

The GDL 88 Status page displays information about the status of the GDL 88.

Status	Description
On	Application is on/running. Required ownship input data is available and meets the performance criteria.
Available to Run	Application is configured. Required input data is available and meets the performance criteria. This state represents that the ASA Application is manually or automatically selected off.
Unavailable – Fault	Required Input data is not available due to a failure or the ASA Application process is failed.
Unavailable to Run	Required Input data is available but does not meet the performance criteria or is not available due to Non-Computed Data (NCD) conditions.

Table 6-1 Traffic Application Status

1. While viewing the External LRUs page, touch **More Info** for the GDL 88 LRU.

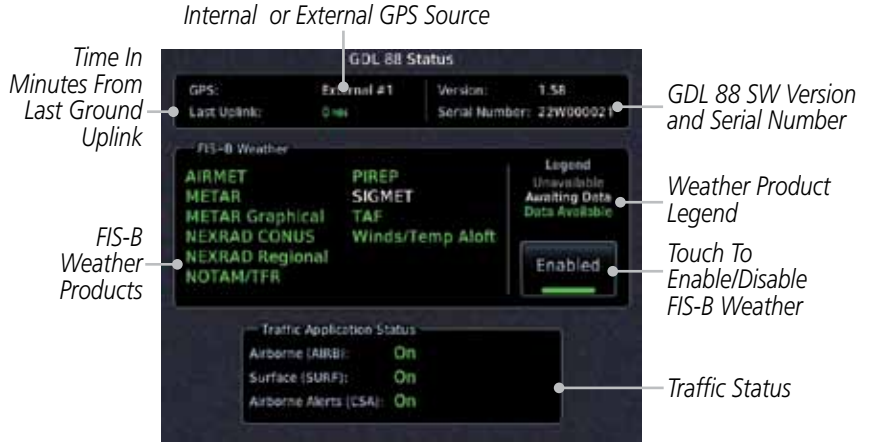
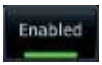


Figure 6-1 GDL 88 Status



2. Touch the **Enabled** key to toggle whether FIS-B Weather is enabled/disabled for use.

6.2 GSR 56 Status

The GSR 56 Status page displays information about the status of the GSR 56.

1. While viewing the External LRUs page, touch **More Info** for the GSR 56 LRU.

Figure 6-2 GSR 56 Status

2. Touch the **Connext Registration** key to display the Connext Registration display.

Figure 6-3 Connext Registration Page

7 IRIDIUM PHONE OPERATION (OPTIONAL)

Optional satellite telephone operation is available through the Iridium® satellite system that is interfaced through the Garmin GSR 56.

Figure 7-1 Services Phone Page

7.1 Status

The Status section shows the Call Time, Phone Status, and Call Suppression selected. The Call Time value shows the length of the call time for the current call using the Iridium phone. Phone Status shows the current operating status of the Iridium phone.

Status	Description
Idle	The Iridium phone is not using the GSR 56 for communicating at this time.
Initializing	The GSR 56 and its driver are currently initializing.
Connected	The GSR 56 is connected to the called number.
Connecting Call	The GSR 56 is in the process of connecting to the called number.
Changing Volume	The volume level on the GSR 56 is changing.
Busy	The phone is in use by another service and the call may not be made.
Dialing	The GSR 56 is dialing the called number.
Incoming Call	A call is being made to the GSR 56.
Hanging Up	The GSR 56 is disconnecting from the current call.
Unavailable	The GSR 56 is currently not usable by the Iridium phone system.

Table 7-1 Iridium Phone Status

7.2 Making a Phone Call

1. While viewing the Iridium Phone page, touch **Phone**, select a phone number, or select one from Contacts.

Figure 7-2 Making a Phone Call

2. Touch **Enter** to accept the selected number.

3. Touch the **Call** key.

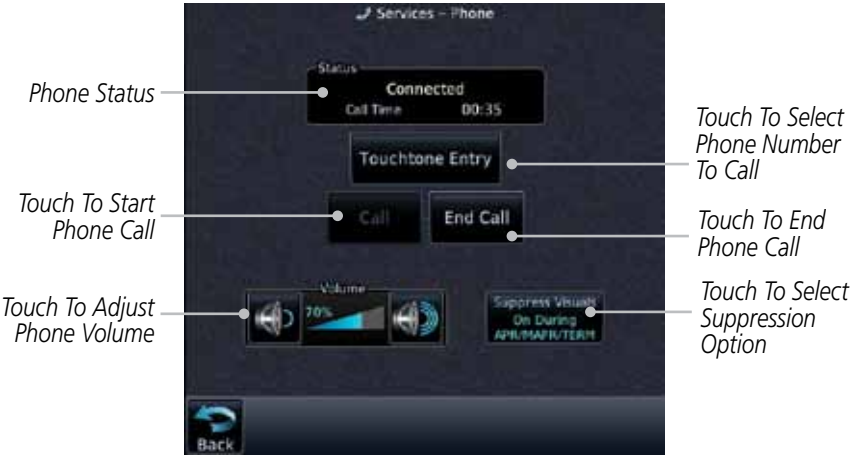


Figure 7-3 Phone Call In Progress

4. To make a direct call with a keypad, touch the **Touchtone Entry** key.

Figure 7-4 Touchtone Entry Pad

5. After completing the call, touch the **End Call** key.

7.3 Answering a Phone Call

An incoming phone call will generate a pop-up announcing the call. When a call is accepted, the pop-up will show that the call is connected and the cumulative call time will be shown.

1. When an incoming call is available, touch the **Enter** key or the **ANSWER** key to answer the call. Or, press the **Ignore** key to not answer the call and hang up.

Figure 7-5 Incoming Call Pop-Up

2. After a called is accepted and connected, the connection time will be shown on the pop-up. Touch the **ATT** soft key to attenuate the call volume; touching it again will return to normal volume. Touch the **HANG UP** soft key to end the call.

7.4 Suppress Visuals

Call Suppression controls calling when use of the Iridium phone system is allowed.

***NOTE**: The "Suppress Visuals" setting only affects the visual indication of an incoming call/text. It does not inhibit the phone ringer or incoming SMS chime. Garmin recommends that you inhibit the audio from the GSR 56 unless a phone call is active.*

Status	Description
Off	Call Suppression is turned off. Calls may be transmitted and received through the Iridium phone.
On	Call Suppression is turned on. The incoming call pop-up will not be shown. The call may still be answered on the phone page. Outgoing calls are not affected.
On During APR/ MAPR/TERM	Call Suppression is turned on during Approach, Missed Approach, and Terminal operations. The incoming call pop-up will not be shown. The call may still be answered on the phone page. Outgoing calls are not affected.

Table 7-2 Call Suppression

1. While viewing the Iridium Phone page, touch the **Suppression** key.
2. Touch the desired Call Suppression type.

Figure 7-6 Select Call/SMS Suppression

3. Or, press **Back** to return to the Phone page without making a selection.

7.5 Phone Volume

Use the Phone Volume controls to adjust the loudness of the phone calls you hear. Volume controls will only be available when the Idle, Connected, or Changing Volume states are displayed.

Adjusting the Phone Volume with the Soft Keys

1. While viewing the Iridium Phone page, touch the **VOL** keys to adjust the phone volume.

Figure 7-7 Select Soft Keys for Phone Volume Adjustment

2. The phone volume level is shown as a bar graph.

7.6 SMS Text Operation

Send and receive text messages through the GSR 56 phone connection.

1. While viewing the Services page, touch the **SMS Text** key.

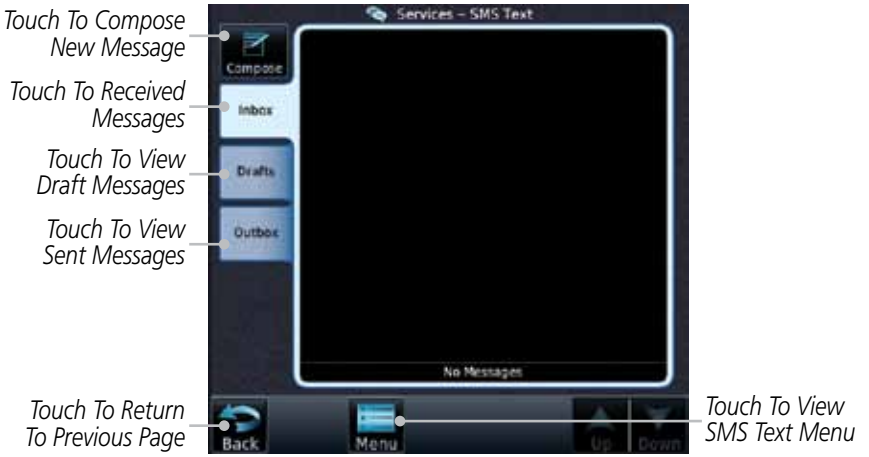


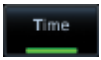
Figure 7-8 SMS Text Page

2. Select Compose, Inbox, Drafts, or Outbox.

7.6.1 SMS Text Messaging Menu

The SMS Text Messaging Menu allows you to sort, mark, or delete messages and select call suppression.

Figure 7-9 SMS Text Messaging Menu



1. Touch the **Time** key to sort messages by Time or the **Address** key to sort by Address.

2. Touch the **Suppression** key and then touch the call suppression choice. The current choice will be shown on the **Suppression** key.

3. While viewing the Inbox, Drafts, or Outbox, touch the **Mark All As Read** to tag the messages as having been read.

4. Touch the **Delete All Messages** to delete the messages in the viewed category.

7.6.2 Composing a SMS Text Message

1. While viewing the SMS Text page, touch the **Compose** key.

Figure 7-10 Compose a New SMS Text Message

2. Touch the **To** window to select the recipient. Select either a Phone Number or E-mail Address.

Figure 7-11 Select Destination for the SMS Text Message

3. Use either the keypad or select from the Contacts.
4. Touch the **Message** window to enter the text for the message. Use the keypad to create the message.

5. Touch **Send** to send the message. Touch **Save** to save the message as a draft. Touch **Delete** to delete this message.

7.6.3 A Failed SMS Text Message

1. While viewing the Services page, touch the **SMS Text key** and touch the Outbox tab. A failed message is noted with an "x."

Figure 7-12 SMS Text Message List Showing a Failed Message

2. Touch the failed message. Touch the **Send Again** key to resend the message. Touch the **Delete** key to delete the message.

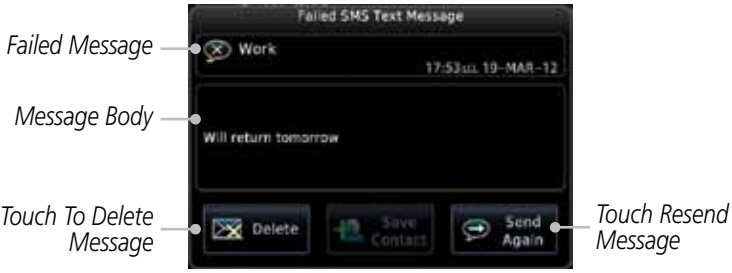


Figure 7-13 Resend a Failed SMS Text Message

7.7 Position Reporting

Position Reporting is a system which collects system variables and transmits them over the Iridium® satellite at a given interval through the GSR 56.

1. While viewing the Services page, touch the **Position Reports** key.

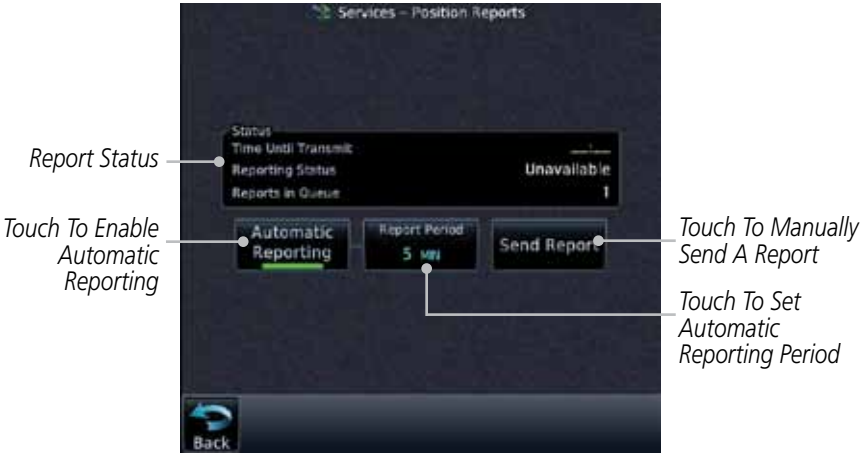


Figure 7-14 Services Position Reporting

2. Touch the **Automatic Reporting** key to enable Automatic Reporting.

3. After Automatic Reporting is enabled, touch the **Report Period** key to set the Reporting Period.

4. Select the Report Period with the keypad and press **Enter**.

5. When Automatic Reporting is disabled, touch the **Send Report** key to manually send a report.

7.7.1 Status

The Status window shows the time until the next data transmission and the status of the reporting system.

***NOTE**: The GSR 56 does not report its serial number until 90 seconds after power up of the GTN. As a result, for that period, the product info for the GSR 56 will show "Waiting."*

7.7.2 Position Reporting Status

The Time Until Transmit field is a countdown timer that shows the time until the next data transmission. This field is blank when the aircraft is on the ground. Position Reporting will be enabled when the aircraft is in the air.

Status	Description
Idle	The reporting system is not using the GSR 56 for reporting at this time.
Initializing	The GSR 56 and its driver are currently initializing.
Transferring	A position report is currently being transmitted.
Unavailable	The GSR 56 is currently not usable by the reporting system.

Table 7-3 Position Reporting Status

Figure 7-15 Position Reporting Status

7.8 Contacts

The Phone Book may hold up to 128 entries. A phone number may be entered and dialed without saving it to the Phone Book. Note that it is necessary to dial a "1," the area code, and then the number.

7.8.1 Creating a Contact

1. While viewing the Services page, touch the **Contacts** key.

Figure 7-16 Contact List

2. Touch the **Add** key to add a new contact.

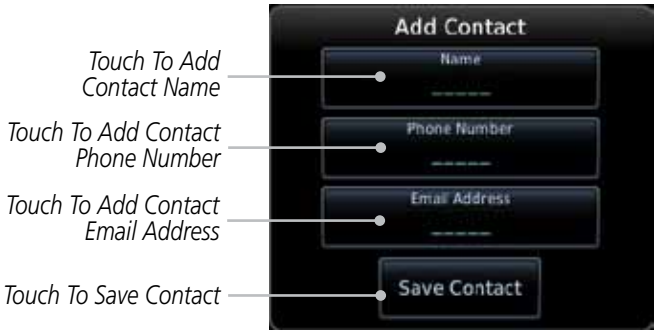


Figure 7-17 Add a New Contact

3. Use the keypad to enter the information for each item and then touch the **Save Contact** key.

7.8.2 Using a Contact

1. While viewing the Contacts page, touch an existing contact.

Figure 7-18 Using the Contact List

2. Touch the desired function for the selected Contact.

8 CROSSFILL

Dual units may be interfaced to crossfill information between the two units. This option will not be available unless dual units are configured.

When Crossfill is turned on with one GTN, it is automatically turned on in the other GTN. Some items are always crossfilled regardless of the crossfill setting; others are dependent on the crossfill setting.

The GTN can be can also be interfaced with the GNS 400W/500W units. The GTN can automatically send the Active Flight Plan and active Direct-To course to the GNS unit. The GTN User Waypoints can be manually sent to the GNS unit. The GNS unit can manually send its User Waypoints to the GTN unit.

Waypoint names longer than six characters, or duplicates, sent from the GTN unit to the GNS unit will replace some characters with a "+" sign, while leaving significant characters to aid in identification (such as, USR003 becomes US+003).

NOTE: *Upon crossfill being activated, the GTNs may take up to 10 seconds to crossfill the flight plans. The pilot must verify the flight plan in each unit prior to use. The GTN and GNS units must have databases with the same cycle.*

GTN-to-GTN Crossfilling:

This data is always crossfilled:

- User waypoints
- Flight plan catalog
- Alerts (traffic popup acknowledgement, missed approach waypoint popup acknowledgement, altitude leg popup acknowledgement)
- External sensors (transponder status and commands, synchro heading)
- System setup:
  - User-defined NAV frequencies to store favorites
  - Date/Time convention
  - Nearest airport criteria
  - Units (Nav angle, Distance/Speed, etc.)
  - User-defined COM frequencies to store favorites
  - Ownship icon
  - CDI Scale setting

- ILS CDI Capture setting

This data is crossfilled only if crossfill is turned on by the pilot:

- Active navigation (flight plan)

1. While viewing the System Setup page, touch the **Crossfill** key to toggle between Enabled and Disabled Crossfill.

or

2. When Crossfill is about to be enabled, you will be prompted to note that data will be overwritten in the other unit. Touch **OK** to enable Crossfill or touch **Cancel** to return to the System Setup page without enabling Crossfill.

Figure 8-1 Confirming Crossfill Selection

GTN-GNS Crossfilling:

- GTN to GNS – Active flight plans, active direct-to, User waypoints
- GNS to GTN – User waypoints

1. While viewing the System Setup page, touch the **GNS Crossfill Settings** key to reach the GNS Crossfill settings.

Figure 8-2 GTN-GNS Crossfill Selection

2. Touch **Auto GNS Crossfill** to enable Crossfill and send the Active Flight Plans and the active Direct-To course to the GNS unit.

3. Touch the Transfer User Waypoints key to transfer the User Waypoints from the GTN unit to the connected GNS unit.

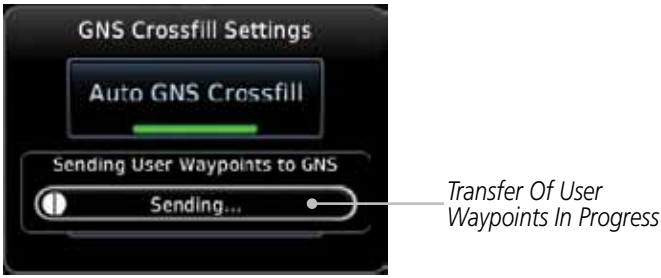


Figure 8-3 GTN-GNS Crossfill

9 MESSAGES

When a Message has been issued by the unit, the Message (**MSG**) key/annunciator in the lower left of the display will blink. Touch the **MSG** key to view the messages. After viewing the messages, touch the **Back** key to return to the previously viewed page. The Messages provide an aid to troubleshooting system operation.

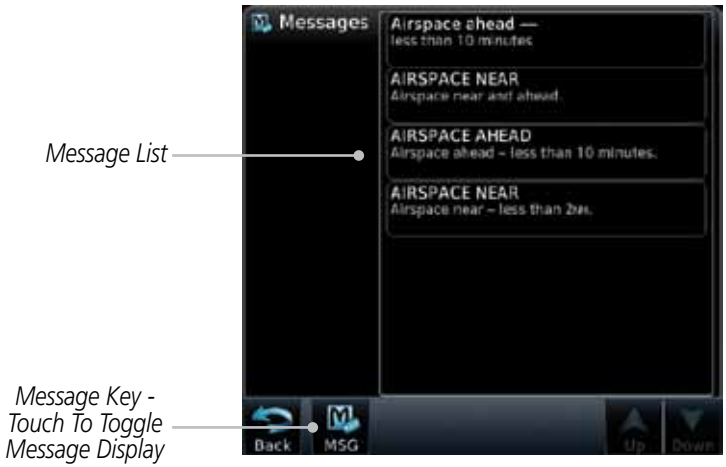


Figure 9-1 Message Display

Message	Description	Action
ABORT APPROACH - GPS approach no longer available.	This message is triggered outside the MAP if the GTN system can no longer provide approach level of service. Vertical guidance will be removed from the external CDI/HSI display.	Initiate a climb to the MSA or other published safe altitude, abort the approach, and execute a non-GPS based approach.
AIRSPACE ALERT - Inside airspace.	The aircraft inside an airspace type for which alerts are configured.	No action is necessary; message is informational only.

Message	Description	Action
AIRSPACE ALERT - Airspace within 2 nm and entry in less than 10 minutes.	The aircraft is within 2 nm and predicted to enter an airspace type, within 10 minutes, for which alerts are configured.	No action is necessary; message is informational only.
AIRSPACE ALERT - Airspace entry in less than 10 minutes.	The aircraft is predicted to enter an airspace type, within 10 minutes, for which alerts are configured.	No action is necessary; message is informational only.
AIRSPACE ALERT - Within 2 nm of airspace.	The aircraft is within 2nm of an airspace type for which alerts are configured.	No action is necessary; message is informational only.
APR GUIDANCE AVAILABLE - Press "Enable APR Output" before selecting APR on autopilot.	The GTN is configured for KAP140/KFC225 autopilot, and approach guidance is now available.	Press the "Enable APR Output" key on the GTN, this will cause the autopilot to go into ROL mode. Engage the autopilot into approach mode. See section 6.14 for additional information.
APPROACH DOWNGRADE - Approach downgraded. Use LNAV minima.	Approach has been downgraded from LPV or LNAV/VNAV, to an LNAV approach. Vertical guidance will be removed from the external CDI/HSI display.	Continue to fly the approach using published LNAV minimums.

Message	Description	Action
APPROACH NOT ACTIVE - Do not continue GPS approach.	GPS approach could not transition to active (e.g., the GTN is on an approach and did not have the required HPL/VPL to get into at least LNAV, so is still in TERM).	Abort the approach, and execute a non-GPS based approach.
AUDIO PANEL - Audio panel needs service.	The GMA 35 is reporting to the GTN that it needs service. The audio panel may continue to function.	Contact dealer for service.
AUDIO PANEL - Audio panel is inoperative or connection to GTN is lost.	The GTN is configured for Garmin audio panel control (GMA 35) and the GTN cannot communicate with the GMA 35. No control of the GMA 35 will be possible.	Remove power from the GMA 35 audio panel by pulling the circuit breaker labeled "Audio." The pilot will be able to communicate with the Com 2 radio. Contact dealer for service.
CDI SOURCE - Select appropriate CDI source for approach.	Aircraft is on a GPS approach but CDI is set to VLOC, or aircraft is on VLOC approach and CDI is set to GPS *and* aircraft is less than 2 nm from the FAF.	Select the appropriate CDI source for approach.
CDI/HSI FLAG - Main lateral/ vertical flag on CDI/HSI is inoperative.	The Main Lateral Superflag or Main Vertical Superflag output has been turned off due to an over-current condition.	Verify course guidance is valid and correct by crosschecking with the GTN on-screen CDI and other navigational equipment. Contact dealer for service.

Message	Description	Action
COM RADIO - Com radio needs service.	The com radio is reporting that it needs service. The com radio may continue to function.	Cycle the power to the COM radio. Contact dealer for service.
COM RADIO - Com radio may be inoperative.	The com radio is not communicating properly with the system.	Press and hold the volume knob or the external com remote transfer (COM RMT XFR) switch, if installed – this will force the com radio to 121.5 MHz. Contact dealer for service.
COM RADIO - Com overtemp or undervoltage. Reducing transmitter power.	Com radio is in overtemp or undervoltage mode and transmitting power has been reduced to prevent damage to the com radio. Radio range will be reduced.	Decrease length of com transmissions, decrease cabin temperature and increase cabin airflow (especially near the GTN). Check aircraft voltage and reduce electrical load as necessary. Contact dealer for service if this message persists.
COM RADIO - Com locked to 121.5 MHz. Hold remote com transfer key to exit.	Com radio is locked to 121.5 MHz.	The external com remote transfer (COM RMT XFR) switch has been held and the com radio is tuned to 121.5. To exit this mode, hold the com remote transfer (COM RMT XFR) switch for two seconds.
CONFIGURATION - Terrain/TAWS configuration is invalid. GTN needs service.	TAWS is inoperative due to a configuration problem with the GTN. This message will be accompanied by a TER FAIL annunciation.	Contact dealer for service.
CONFIGURATION MODULE - GTN configuration module needs service.	The GTN cannot communicate with its configuration module. The GTN may still have a valid configuration.	Contact dealer for service.

Message	Description	Action
COOLING - GTN overtemp. Reducing backlight brightness.	Backlight brightness has been reduced due to high display temperatures. The backlight level will remain high enough to be visible in daylight conditions.	Decrease cabin temperature and increase cabin airflow (especially near the GTN). Contact dealer for service if this message persists.
COOLING FAN - The cooling fan has failed.	The GTN cooling fan is powered, but it is not turning at the desired RPM.	Decrease cabin temperature and increase cabin airflow (especially near the GTN) to prevent damage to the unit. Contact dealer for service.
CROSSFILL ERROR - Crossfill is inoperative. See CRG for crossfilled items.	Crossfill is not working due to loss of communication with other GTN or due to one GTN needing service.	See section 16.4.1.4 for a list of crossfilled items that will no longer be crossfilled. Contact dealer for service.
CROSSFILL ERROR - GTN software mismatch. See CRG for crossfilled items.	Crossfill is configured "on" but is not working due to software mismatch.	See section 16.4.1.4 for a list of crossfilled items that will no longer be crossfilled. Contact dealer to have software versions updated.
CROSSFILL ERROR - Crossfill is inoperative. See CRG for crossfilled items.	An error was detected during unit-to-unit communication of data. This can be caused by problems with HSDB wiring or by either GTN needing service. See the Cockpit Reference Guide (CRG) for crossfilled items.	Start both GTNs in Configuration Mode and ensure that both GTNs are configured for crossfill. Contact dealer for service.

Message	Description	Action
CROSSFILL ERROR - GTN Navigation DB mismatch. See CRG for crossfilled items.	The navigation databases do not match between GTNs resulting in a loss of communication between two units.	Check the specified database version of both GTNs and ensure it is up-to-date. Update the specified database if needed.
CROSSFILL STATUS - Crossfill is turned off.	Crossfill is turned off.	No action.
DATABASE - Chart function unavailable.	The GTN is configured for ChartView or FliteCharts and chart verification has failed.	Contact dealer for service.
DATABASE - Chart database valid until [DATE].	The GTN is configured for ChartView or FliteCharts and the chart database has or is about to expire.	Verify chart database expiration date on the System – System Status page. Update chart database if necessary for operations.
DATABASE - A procedure has been modified in a cataloged flight plan.	A new database update caused a procedure to be truncated because the flight plan now has too many waypoints or removed a procedure because it no longer exists in the database.	Verify stored cataloged flight plans and procedures. Modify stored flight plans and procedures as necessary to include the current procedures by re-loading those procedures to the stored flight plan routes.
DATABASE - Verify user-modified procedures in stored flight plans are correct.	A stored flight plan contains procedures that have been manually updated, and a navigation database update has occurred.	Verify that the user-modified procedures in stored flight plans are correct.

Message	Description	Action
DATABASE - Verify airways in stored flight plans are correct.	A stored flight plan contains an airway that is no longer consistent with the current navigation database.	Verify that the airways in stored flight plans are correct. Modify stored flight plans as necessary to include the current airways by re-loading those airways to the stored flight plan routes.
DATABASE - Terrain or Obstacle database not available.	The terrain or obstacle database is missing or corrupt.	Re-load these databases on the external SD card.
DATABASE - Terrain display unavailable for current location.		
DATACARD ERROR - SD card is invalid or failed.	External SD card has an error and the unit is not able to read the databases.	ChartView, FlightCharts, and Terrain databases will not be accessible by the unit. Contact dealer for service.
DATACARD REMOVED - Reinsert SD card.	External SD card was removed.	Reinsert SD card.
DATALINK - GDL 69 is inoperative or connection to GTN is lost.	The GTN is configured for a Garmin datalink (GDL 69 or 69A) and the GTN cannot communicate with the datalink. Data from the datalink will not be available.	Contact dealer for service.

Message	Description	Action
DATALINK - GDL 88 is inoperative or connection to GTN is lost.	The GTN is configured for a Garmin datalink (GDL 88) and the GTN cannot communicate with the datalink. Data from the datalink will not be available.	Contact dealer for service.
DATALINK - GDL 88 ADS-B failure. Unable to transmit ADS-B messages.	GDL 88 is not able to transmit an ADS-B message due to a failure with the GDL 88 system or antenna(s).	Contact dealer for service.
DATALINK - GDL 88 ADS-B fault.	The GDL 88 has detected a fault with one of the GDL 88 UAT/1090 antennas.	Contact dealer for service.
DATALINK - ADS-B fault: UAT receiver.	The GDL 88 has detected a UAT receiver fault.	Contact dealer for service.
DATALINK - ADS-B fault: 1090 receiver.	The GDL 88 has detected a 1090 receiver fault.	Contact dealer for service.
DATALINK - GDL88 ADS-B is not transmitting position. Check GPS devices.	The GDL 88 has detected a position input fault.	Contact dealer for service.
DATALINK - GDL88 control input fault. Check transponder is in correct mode.	The GDL 88 has lost communication with the transponder.	Contact dealer for service.

Message	Description	Action
DATALINK - GDL88 ADS-B fault. Pressure altitude input is invalid.	The GDL 88 has lost communication with the pressure altitude source.	Contact dealer for service.
DATALINK - GDL88 ADS-B traffic has failed.	GDL 88 may have lost GPS position. The GDL 88 has detected an internal failure.	Contact dealer for service.
DATALINK - GDL88 CSA failure.	The GDL 88 is reporting to the GTN that the CSA application has failed. Traffic alerting on ADS-B traffic is unavailable.	Ensure the aircraft has a clear view of the sky. If the problem persists. Contact dealer for service.
DATALINK - GDL88 external traffic system inoperative or connection lost.	The GDL 88 has detected a TAS/TCAS input fault.	Contact dealer for service.
DATALINK - GDL88 external traffic system has a low battery.	The GDL 88 is reporting that the external traffic system has a low battery.	Contact dealer for service.
DATALINK - GDL88 configuration module needs service.	The GDL 88 has detected a configuration module fault.	Contact dealer for service.
DATALINK - GDL88 needs service.	GDL 88 has detected an internal fault.	Contact dealer for service.

Message	Description	Action
DATALINK - GSR56 is inoperative or connection to GTN is lost.	The GTN is configured for a Garmin GSR 56 and the GTN cannot communicate with the GSR 56. GSR Weather, Position Reporting, and Phone Services will be unavailable.	Close the GSR 56 circuit breaker and ensure the GSR 56 is receiving power. Contact dealer for service.
DATALINK - GSR56 data services inoperative; registration required.	The GSR 56 is not registered. GSR Weather, Position Reporting, and Phone Services will be unavailable.	Contact dealer for service.
DATA LOST - Pilot stored data was lost. Recheck settings.	User settings such as map detail level, nav range ring on/off, traffic overlay on/off, and alert settings have been lost.	Recheck settings.
DATA SOURCE - Pressure altitude source inoperative or connection to GTN lost.	The GTN is configured to receive pressure altitude but is not receiving it from any source.	If the GTN is being used to forward pressure altitude to a transponder, the transponder will not be receiving pressure altitude from the GTN while that message is present. Contact dealer for service.
DATA SOURCE - Heading source inoperative or connection to GTN lost.	The GTN is configured to receive heading information but is not receiving it from any source.	Heading up map displays will not be available. Contact dealer for service.
DEMO MODE - Demo mode is active. Do not use for navigation.	The GTN is in Demo Mode and must not be used for actual navigation.	Do not use for navigation. Power cycle the GTN to exit demo mode. Also ensure that the Direct-To key is not stuck.

Message	Description	Action
FPL WAYPOINT LOCKED - Stored flight plan waypoint is not in current navigation database.	A stored flight plan waypoint is no longer in the current navigation database.	Verify stored cataloged flight plans and procedures. Modify stored flight plans as necessary to include waypoints that are in the current navigation database.
FPL WPT MOVED - Stored flight plan waypoint has changed location.	A stored flight plan waypoint has moved by more than 0.33 arc minutes from where previously positioned.	Verify stored cataloged flight plans and procedures. Modify stored flight plans as necessary to include waypoints that are in the current navigation database.
GDL 59 FAIL - GDL 59 is inoperative.	GDL 59 is reporting a system fault.	Contact dealer for service.
GDL 59 - GDL 59 needs service. Return unit for repair.	The GDL 59 is reporting that it needs service. The com radio may continue to function.	Cycle the power to the GDL 59. Contact dealer for service.
GDL 59 ROUTER FAIL - GDL 59 router has failed.	GDL 59 router has failed.	Contact dealer for service.
GLIDESLOPE - Glideslope receiver needs service.	The glideslope board is indicating that it needs service. The glideslope board may continue to function.	Verify glideslope deviation indications with another source and crosscheck final approach fix crossing altitude. If another glideslope source is not available for verification, fly a GPS based approach. Contact dealer for service.
GLIDESLOPE - Glideslope receiver has failed.	The glideslope board is not communicating property with the system.	Fly an approach that does not use the glideslope receiver (VOR, LOC, GPS). Contact dealer for service.

Message	Description	Action
GNS CROSSFILL - GTN user waypoint(s) replaced with GNS user waypoints.	A user waypoint from the GNS replaced one or more existing waypoints on the GTN.	Ensure that the waypoints on the GNS have unique names before transferring to the GTN to avoid overwriting existing waypoints.
GNS CROSSFILL - Catalog full; not all GNS waypoint(s) transferred.	A user waypoint from the GNS could not be created because the user waypoint catalog is full.	Remove some of the waypoints from the catalog to make room for the waypoints from the GNS.
GNS CROSSFILL - Waypoint transfer failed.	Waypoint transfer failed/incomplete.	The data transfer should be reattempted.
GPS NAVIGATION LOST - Insufficient satellites. Use other navigation source.	GPS position has been lost due to lack of satellites.	Wait for GPS satellite geometry to improve. Ensure the aircraft has a clear view of the sky. Use a different GPS receiver or a non-GPS based source of navigation. Contact dealer for service.
GPS NAVIGATION LOST - Erroneous position. Use other navigation source.	GPS position has been lost due to erroneous position.	Use a different GPS receiver or a non-GPS based source of navigation. Contact dealer for service.
GPS RECEIVER - GPS receiver has failed. Check GPS coax for electrical short.	Internal communication to the SBAS board is inoperative.	Use a different GPS receiver or a non-GPS based source of navigation. Contact dealer for service.

Message	Description	Action
GPS RECEIVER - Low internal clock battery.	The GPS module indicates that its clock battery is low. Almanac data may have been lost. The unit will function normally, but may take a longer than normal period to acquire a GPS position.	Contact dealer for service.
GPS RECEIVER - GPS receiver needs service.	The GPS module is reporting that it needs service. The GPS module may continue to function.	Use a different GPS receiver or a non-GPS based source of navigation. Contact dealer for service.
GPS SEARCHING SKY - Ensure GPS antenna has an unobstructed view of the sky.	The GPS module is acquiring position and may take longer than normal. This message normally occurs after initial installation or if the unit has not been powered for several weeks.	No action is necessary; message is informational only.
GTN - GTN needs service.	The GTN has lost calibration data that was set by Garmin during manufacturing.	Contact dealer for service.
INTERFACE ADAPTER - GAD 42 configuration needs service.	GAD 42 indicates a configuration error.	Verify all input/output data from/ to the GAD 42 Interface Adapter. Contact dealer for service.
INTERFACE ADAPTER - GAD 42 needs service.	GAD 42 indicates it needs service. The GAD 42 may continue to function.	Verify all input/output data from/ to the GAD 42 Interface Adapter. Contact dealer for service.

Message	Description	Action
INTERNAL SD CARD ERROR - GTN needs service.	Internal SD card has an error. This card is not accessible by the user.	Contact dealer for service.
INTERNAL SD CARD REMOVED - GTN needs service.	Internal SD card was removed or failed. This card is not accessible by the user.	Contact dealer for service.
KEY STUCK - HOME key is stuck.	The HOME key has been in pressed position for at least 30 seconds. This key will now be ignored.	Verify the HOME key is not pressed. Press the Home key again to cycle its operation. Contact dealer for service if this message persists.
KEY STUCK - Direct-To key is stuck.	The Direct-To key has been in pressed position for at least 30 seconds. This key will now be ignored.	Verify the Direct-To key is not pressed. Contact dealer for service if this message persists.
KNOB STUCK - Volume knob is stuck in the pressed position.	The Volume knob has been in pressed position for at least 30 seconds. This knob press will now be ignored.	Verify the volume knob is not pressed. Contact dealer for service if this message persists.
KNOB STUCK - Dual concentric inner knob is stuck in the pressed position.	The dual concentric inner knob has been in pressed position for at least 30 seconds. This knob press will now be ignored.	Verify the dual concentric knob is not pressed. Contact dealer for service if this message persists.
LOCKED FLIGHT PLAN Cannot activate a flight plan containing a locked waypoint.	The user is trying to activate a flight plan that contains a locked waypoint.	Unlock the flight plan by modifying stored flight plans as necessary to include waypoints, procedures, and airways that are in the current navigation database.

Message	Description	Action
LOSS OF INTEGRITY (LOI)- Verify GPS position with other navigation equipment.	Antenna may be shaded from satellites. The GPS module has reported a loss of integrity.	Make sure the aircraft is clear of hangars, buildings, trees, etc. Use a different GPS receiver or a non-GPS based source of navigation. Contact dealer for service if this message persists.
MAGNETIC VARIATION - Aircraft in area with large mag var. Verify all course angles.	MagVar is flagged as unreliable in the MagVar database. This normally occurs when operating at high latitudes that do not support a Nav Angle of Magnetic.	Verify that the geographical region supports navigation based on magnetic variation.
NAV ANGLE - NAV Angles are referenced to True North (T).	Nav angle is set to True.	No action is necessary; message is informational only.
NAV ANGLE - NAV Angles are referenced to a User set value (U).	Nav angle is set to User.	No action is necessary; message is informational only.
NON-WGS84 WAYPOINT - See CRG. Location may be different than where surveyed for [WPT].	The active waypoint is not referenced to the WGS84 datum. See Note 1 at the end of the table.	No action is necessary; message is informational only.
OBS - OBS is not available due to dead reckoning or no active waypoint.	OBS requires an active waypoint and is not supported in dead reckoning mode.	No action is necessary; message is informational only.

Message	Description	Action
PARALLEL TRACK - Parallel track not supported past IAF.	Parallel track is not supported on approaches.	No action is necessary; message is informational only.
PARALLEL TRACK - Parallel track not supported for turns greater than 120 degrees.	Parallel track is not supported for turns greater than 120 degrees due to the acute angle.	No action is necessary; message is informational only.
PARALLEL TRACK - Parallel track not supported for leg type.	Parallel track is not supported on current leg type.	No action is necessary; message is informational only.
REMOTE KEY STUCK - Remote OBS key is stuck.	The remote OBS (OBS MODE SEL) key/switch has been in pressed position for at least 30 seconds. This input will now be ignored. This input is not available in all installations.	Verify the OBS MODE SEL key/switch is not stuck. Contact dealer for service if this message persists.
REMOTE KEY STUCK - Remote CDI key is stuck.	The remote CDI (CDI SRC SEL) key/switch has been in pressed position for at least 30 seconds. This input will now be ignored. This input is not available in all installations.	Verify the CDI SRC SEL key/switch is not stuck. Contact dealer for service if this message persists.
REMOTE KEY STUCK - Com push-to-talk key is stuck.	The Push To Talk key/switch has been in pressed position for at least 30 seconds. This input will now be ignored and the com radio will no longer transmit.	Verify the Push To Talk key/switch is not stuck. Contact dealer for service if this message persists.

Message	Description	Action
REMOTE KEY STUCK - Com remote transfer key is stuck.	The remote com transfer (COM RMT XFR) key/switch has been in pressed position for at least 30 seconds. This input will now be ignored. This input is not available in all installations.	Verify the COM RMT XFR key/ switch is not stuck. Contact dealer for service if this message persists.
REMOTE KEY STUCK - Com remote frequency increment key is stuck.	The remote com frequency increment (COM CHAN UP) key/ switch has been in pressed position for at least 30 seconds. This input will now be ignored. This input is not available in all installations.	Verify the COM CHAN UP key/ switch is not stuck. Contact dealer for service if this message persists.
REMOTE KEY STUCK - Com remote frequency decrement key is stuck.	The remote com frequency decrement (COM CHAN DN) key/ switch has been in pressed position for at least 30 seconds. This input will now be ignored. This input is not available in all installations.	Verify the COM CHAN DN key/ switch is not stuck. Contact dealer for service if this message persists.

Message	Description	Action
REMOTE KEY STUCK - Nav remote transfer key is stuck.	The remote nav transfer (NAV RMT XFR) key/ switch has been in pressed position for at least 30 seconds. This input will now be ignored. This input is not available in all installations.	Verify the NAV RMT XFR key/ switch is not stuck. Contact dealer for service if this message persists.
REMOTE KEY STUCK - Remote go around key is stuck.		
REMOTE KEY STUCK - TAWS inhibit key is stuck.	The TAWS INHIBIT discrete input has been in pressed position for at least 30 seconds. This input will now be ignored. This input is not available in all installations.	Verify the TAWS INHIBIT key/switch is not stuck. Contact dealer for service if this message persists.
SEARCHING SKY - Search-the-sky in progress.	The GTN is searching the sky for GPS satellites.	Wait 20 minutes for the unit to complete the cycle or until the current position is located.
SELECT FREQUENCY - Select appropriate NAV frequency for approach.	Correct NAV frequency is not set in the active NAV frequency for the approach procedure.	Insert the correct frequency into the active navigation frequency window.
SET COURSE - Set course on CDI/ HSI to [current DTK].	The selected course on the CDI/HSI does not match the current desired track.	Set the CDI/HIS selected course to the current desired track.

Message	Description	Action
STEEP TURN - Aircraft may overshoot course during turn.	Flight plan contains an acute course change ahead which will require a bank in excess of normal to follow the guidance. If coupled to the autopilot, the autopilot may not be able to execute the steep turn needed to follow the course guidance.	No action is necessary; message is informational only. If desired, slow the aircraft to shallow the turn.
STORMSCOPE - StormScope is inoperative or connection to GTN is lost.	The GTN is configured for a WX-500 StormScope but is not receiving data from it.	Close the Stormscope circuit breaker and ensure Stormscope is receiving power. Contact dealer for service.
STORMSCOPE - Invalid heading received from StormScope.	The WX-500 StormScope reports that it has an invalid heading source.	GTN StormScope data is correct and may be used. Contact dealer for service.
TAWS AUDIO INHIBITED - TAWS audio inhibit input is stuck.	The TAWS Audio Inhibit discrete input has been active for at least 30 seconds. This input is active in all installations. TAWS audio may be heard at the same time as other audio alerts.	Contact dealer for service.
TIMER - Timer has expired.	A user-configured timer has expired.	No action is necessary; message is informational only.

Message	Description	Action
TRAFFIC - Traffic device is inoperative or connection to GTN is lost.	The GTN is configured for a traffic device but is not receiving data from it. Traffic will not be displayed on the GTN.	Contact dealer for service.
TRAFFIC - Traffic device has been in standby for more than 60 seconds.	The GTN is airborne and the traffic device has been in standby for more than 60 seconds.	Set the traffic device to "operate" on the traffic page if traffic alerts are desired.
TRAFFIC - Traffic device battery low. Traffic device user config settings not saved.		Contact dealer for service.
TRANSPONDER - Transponder 1 and 2 Mode S addresses do not match.	The GTN is configured for two transponders and their Mode S addresses do not match. This message is intended to assist installers and will not occur in a properly configured system.	Contact dealer for service.
TRANSPONDER 1 OR 2 Transponder 1 or 2 needs service.	The transponder is reporting to the GTN that it needs service. The transponder may continue to function.	Verify squawk code and altitude with ATC. Contact dealer for service.
TRANSPONDER 1 OR 2 Transponder 1 or 2 is inoperative or connection to GTN is lost.	The GTN is configured for transponder 1 or 2 but is not able to communicate with the transponder.	Verify squawk code and altitude with ATC. Contact dealer for service.

Message	Description	Action
TRANSPONDER 1 OR 2 ADS-B is not transmitting position.	The transponder has insufficient data to support ADS-B.	Ensure the aircraft has a clear view of the sky. Contact dealer for service.
TRUE NORTH APPROACH - Verify NAV Angles are referenced to True North (T).	A procedure is loaded that is referenced to true north and the active leg has a published true north reference.	Verify the Nav Angle is set to True North.
VERTICAL CALCULATOR - Approaching target altitude. Start descent.	User has configured a vertical descent calculation, and the aircraft is within 60 seconds of the calculated top of descent.	No action is necessary; message is informational only.
VERTICAL CALCULATOR - Approaching target altitude.	User has configured a vertical descent calculation, and the aircraft is approaching the target altitude.	No action is necessary; message is informational only.
VERTICAL WAYPOINT - Can't reach current vertical waypoint.		
VLOC RECEIVER - Navigation receiver needs service.	The nav radio is reporting that it needs service. The nav radio may continue to function.	Use GPS based navigation. Contact dealer for service.
VLOC RECEIVER - Navigation receiver has failed.	The nav radio is not communicating property with the system.	Use GPS based navigation. Contact dealer for service.

Message	Description	Action
VNAV - Unavailable: Unsupported leg type in flight plan.		
VNAV - Unavailable: Excessive cross-track error.		
VNAV - Unavailable: Excessive track angle error.		
VNAV - Unavailable: Parallel course selected.		
WAYPOINT - Arriving at [wpt name].	User has configured the arrival alarm and is within the specified distance.	No action is necessary; message is informational only.
WX ALERT - Possible severe weather ahead.		
WX RADAR FAIL - Weather radar is inoperative.	Weather radar is reporting a system fault.	Contact dealer for service.
WX RADAR SERVICE - Weather radar needs service. Return unit for repair.	Weather radar is reporting a system failure.	Contact dealer for service.

Table 9-1 Messages

Note 1: There are several reference datums that waypoints can be surveyed against. TSO-C146 normally requires that all waypoints be referenced to the WGS84 datum, but allows for navigation to waypoints that are not referenced to the WGS84 datum so long as the pilot is notified. Certain waypoints in the navigation database are not referenced to the WGS84 datum, or their reference datum is unknown. If this is the case, this message is displayed. Garmin cannot determine exactly how close the non-WGS84 referenced waypoint will be to the WGS84 datum that the GTN uses. Typically, the distance is within two nautical miles. The majority of non-WGS84 waypoints are located outside of the United States.

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GARMIN International, Inc.
1200 East 151st Street, Olathe, Kansas 66062, U.S.A.
Tel. 913/397.8200 or 866/739.5687
Fax 913/397.8282

Garmin AT, Inc.
2345 Turner Rd., S.E., Salem, Oregon 97302, U.S.A.
Tel. 503/581.8101 or 800/525.6726
Fax. 503/364.2138

Garmin (Europe) Ltd.
Liberty House, Bulls Copse Road, Hounsdown Business Park,
Southhampton, SO40 9RB, U.K.
Tel. +44 (0) 870 850 1243
Fax +44 (0) 238 052 4004

GARMIN Corporation
No. 68, Jangshu 2nd Road, Shijr, Taipei County, Taiwan
Tel. 886/2.2642.9199
Fax 886/2.2642.9099

Garmin Singapore Pte. Ltd.
46 East Coast Road, #05-06 Eastgate
Singapore 428766
Tel. (65) 63480378 Fax (65) 63480278

www.garmin.com
https://fly.garmin.com/fly-garmin

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