

**BENDIX/KING®**

# KMD 550/850

Multi-Function Display

## Terrain Function (EGPWS) Pilot's Guide Addendum



For Software Version 01/13 or later

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Manual            KMD 550/850 Terrain Function (EGPWS) Pilot's  
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## **Summary**

Added Geodetic Sea Level (GSL)

Miscellaneous corrections

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## **Summary**

Added Auto Pop-Up feature

Miscellaneous corrections

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## **Summary**

This is the original release of this publication.

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# INTRODUCTION

The Terrain Function of the Bendix/King KMD 550/850 Multi Function Display allows for the display and control of several models of Honeywell Enhanced Ground Proximity Warning Systems (EGPWS). EGPWS provides terrain display, situational awareness, terrain alerting and warning, and obstacle alerting and warning to the pilot. It is intended to give advanced alerting and warning to the pilot to help reduce the possibility of Controlled Flight Into Terrain (CFIT).

This Pilot's Guide Addendum describes the operation of the KMD 550/850 display for controlling the EGPWS sensor. The detailed description of the general operation of the KMD 550/850 is contained in the other sections of the KMD 550/850 Pilot's Guide. For detailed information on the proper use and interpretation of the displayed EGPWS data please reference the pilot's guide that is provided with the EGPWS sensor.

The Bendix/King KMD 550/850 is shown below with the Terrain Page selected.



# NORMAL OPERATION



To display the terrain page press the TERR function select key.

The following illustration defines the data that appears on the Terrain Display Page:



- 1 **Display Range - RNG:###nm**
- 2 **Terrain Awareness State** - Displays **EGPWS TEST** when self-test is active, **TERR FAIL** when terrain is INOP due to a fault, **TERR N/A** when terrain is not available (no fault) and **TERR INHBT** when Terrain Awareness Warnings have been manually inhibited. The terrain picture will be blacked out if the state is **TERR FAIL** or **TERR N/A** (Some installations will also be blacked out for **TERR INHBT**).
- 3 **Aircraft Symbol** - Stylized airplane except in north-up mode when it is a plus symbol. Indicates present position.
- 4 **Outer Rotary Knob** (not present for all installations) - Allows selection of Normal (**NRM**), Test (**TST**) or Settings (**SET**) mode. Default is Normal.
- 5 **Range Rings** - Outer ring radius is selected range, inner ring radius is one half the selected range. Value of inner ring displayed at bottom of inner ring in 360° views and at the left edge of the inner ring in 120° views.
- 6 **EGPWS Peaks Elevation** (not present for all installations) - Maximum peaks elevation displayed over Minimum peaks elevation, #####
- 7 **GPS Flight Plan Overlay** - Current GPS flight plan.
- 8 **Display Orientation** - When in magnetic heading-up orientation, **Mag###° Hdg**; when in true heading-up orientation, **Tru###° Hdg**; when in magnetic track-up orientation, **Mag###° Trk**; when in true track-up orientation, **Tru###° Trk**; when in north-up orientation, **NORTH**
- 9 **EGPWS Geometric Altitude** (not present for all installations) - ##### **MSL** (Mean Sea Level) or ##### **GSL** (Geodetic Sea Level) depending on system configuration.
- 10 **Check Altitude Flag Window - CHECK ALT**
- 11 **Icon Bar** - Icons representing data available (black) and displayed (color).

# KMD 550/850 TERRAIN PAGE (EGPWS) OPERATIONAL CONTROLS



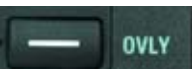
**MODE** - Toggles between Warnings Inhibited and Warnings Enabled. Not available in all installations.

**RNG▲/RNG▼** - Advances the indicator to the next range. The upper button increases range, the lower button decreases it. The EGPWS display ranges are: 1, 2.5, 5, 10, 20, 40, 80, 160, 320 nm. The selected range is displayed in the lower left corner of the display with the inner (half range) range ring distance displayed with the ring. The default range selected upon power-up is 10 nm.



**VIEW** - Toggles between 360° and 120° views.

*Note: When heading and track data are both invalid to EGPWS, the terrain is displayed in a north up view. The aircraft symbol changes to a plus symbol and the VIEW power key label is unlit.*



**OVLY** - Allows selection of flight plan, lightning or traffic data for overlay on the terrain data. The GPS flight plan data, lightning data and traffic data can be overlaid on the terrain map, if the desired data is available (Lightning and traffic data can be overlaid only if heading data is available).



**Outer Rotary Knob** - Allows selection of **TST** (self test), **NRM** (normal operation) or **SET** (settings) operation. **NRM** is the default. Not available in all installations.

*Note: On some terrain displays, an indication of Geometric Altitude will appear as GSL (Geodetic Sea Level). This altitude is the reference altitude for the display and the terrain awareness algorithm. This reference altitude is based on internally calculated Geometric Altitude and NOT corrected barometric altitude that must be used when navigating within the National Airspace System. Geometric Altitude is the height above Mean Sea Level (MSL) derived from the GPS receiver, filtered by the vertical figure of merits from the same GPS and complemented by short term variations in barometric altitude. It represents the aircraft's calculated true height above MSL and serves as the reference altitude for color-coding of the terrain display and the altitude input to the look-ahead algorithm. Because it is primarily comprised of GPS altitude, this reference altitude will often differ from cockpit displayed corrected barometric altitude. The Geometric Altitude is not to be used for navigation. It is presented to provide the crew with additional situational awareness of true height above sea level upon which terrain alerting and display is based. GPS altitude is an altitude above Mean Sea Level and it is the geodetic height above the WGS-84 ellipsoid corrected by the geoid height in the*

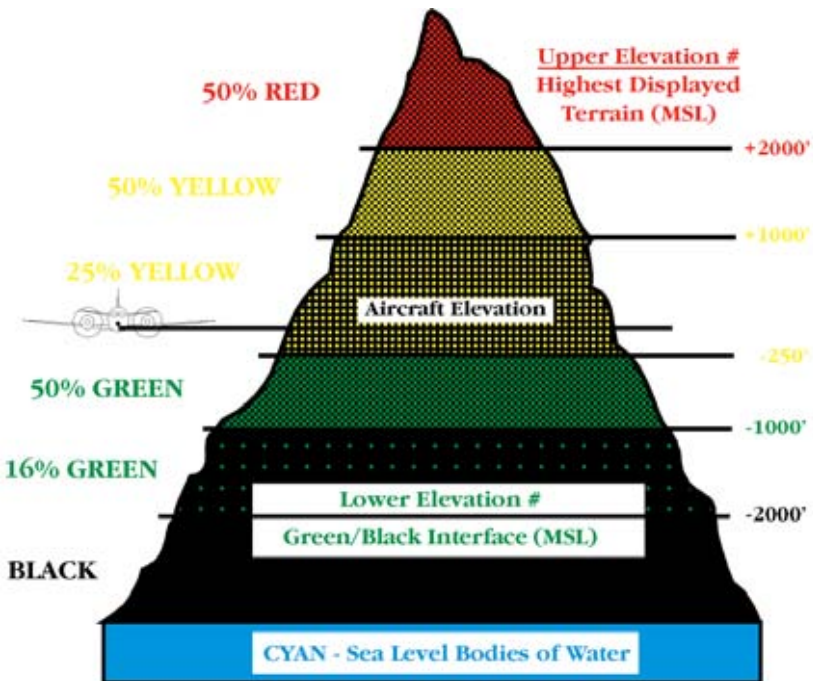
GPS receiver itself. With Selective Availability turned off as currently, the accuracy is usually better than 75 feet and with Selective Availability turned on, short term accuracy is on the order of 400 feet, but the geometric altitude should be within 100 feet.

## EGPWS OVERVIEW

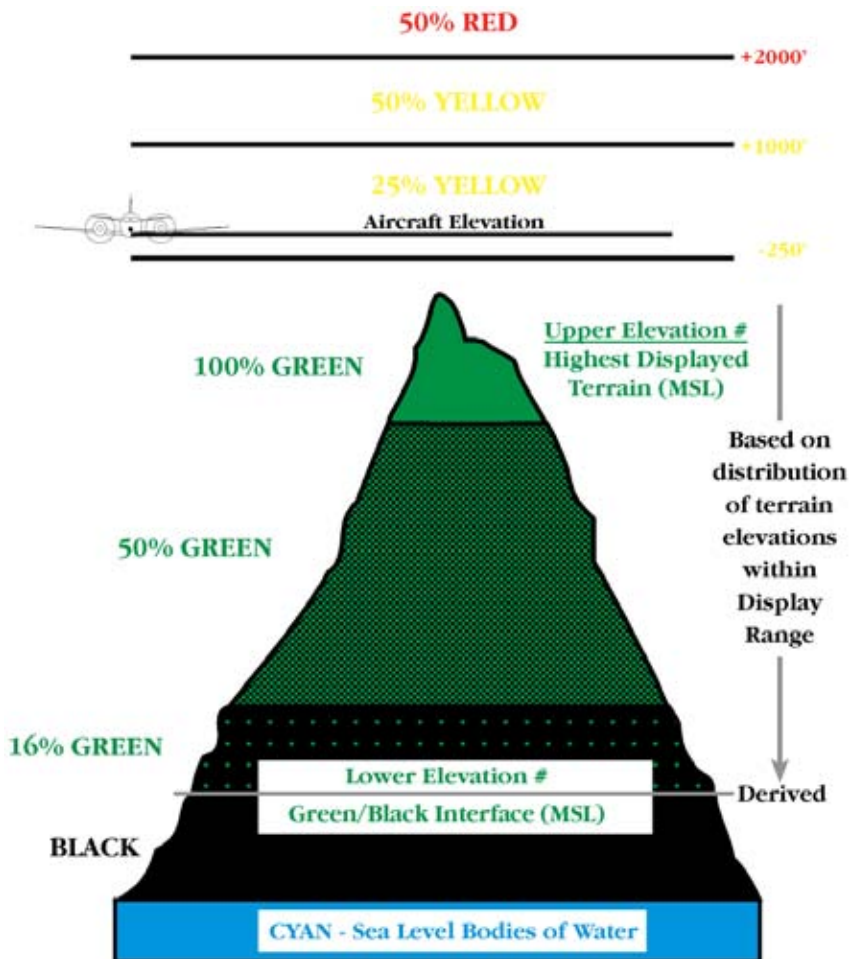
### TERRAIN AWARENESS DISPLAY

Graphical display of EGPWS terrain and obstacle data is the most important enhancement to Situational Awareness. This is especially true for lower performance aircraft. In addition to showing terrain ahead of the aircraft, (depending on configuration settings and display types) the system shows MSL altitude, Magnetic Track, Range in NM, and the elevations of the highest and lowest terrain features shown on the display. The color and intensity of the terrain displayed instantly alerts the pilot to areas of dangerous terrain and conversely to areas of less precipitous terrain. Range of the Terrain Display is selectable by the pilot from 1 nm to 320 nm.

The following figure shows the Terrain Display color patterns when the aircraft is at lower altitudes, with terrain near or above the aircraft altitude for the display range selected by the pilot.



The following figure shows the Terrain Display color patterns when the aircraft is at higher altitudes, where terrain is a least 250 feet below the aircraft altitude for the display range selected by the pilot.



The system will adjust colors on the Terrain Display automatically as the aircraft altitude changes. The Terrain Display also transitions between the lower altitude “relative” display and the higher altitude “peaks” display automatically, so no pilot action is required for system operation.

The most important function of the system is to provide the pilot with easily interpreted information about terrain/obstacles relative to the aircraft, and thus increase the pilot's Situational Awareness. In brief, when using the Terrain Display during flight, the normal presentation of green, yellow and red colors indicate:

<b>GREEN</b> colors	Terrain/Obstacles are below the aircraft altitude. Safe terrain/obstacle clearance is indicated.
<b>YELLOW</b> colors	Terrain is very near or above the aircraft altitude. THE AIRCRAFT DOES NOT HAVE SAFE TERRAIN CLEARANCE.
<b>RED</b> color	Terrain is well above the aircraft altitude (at least 2000 feet higher!). THE AIRCRAFT DOES NOT HAVE SAFE TERRAIN CLEARANCE. THE AIRCRAFT MAY NOT BE ABLE TO ESCAPE THIS TERRAIN.

*NOTE: Green colors indicating terrain/obstacles below the aircraft are NOT shown when the aircraft is on the ground, to reduce display clutter and to show only terrain that is significantly higher than the aircraft in the departure area. Green colors will appear when the aircraft has climbed approximately 500 to 800 feet above the elevation of the runway.*

The following picture shows an example of the Terrain Display with the flight plan data overlaid on the terrain data.



*NOTE: This guide is not intended to provide all the details of proper usage and interpretation of EGPWS information. Please reference the Pilot's Guide that was provided with the EGPWS sensor for more information.*

## EXAMPLE FLIGHT

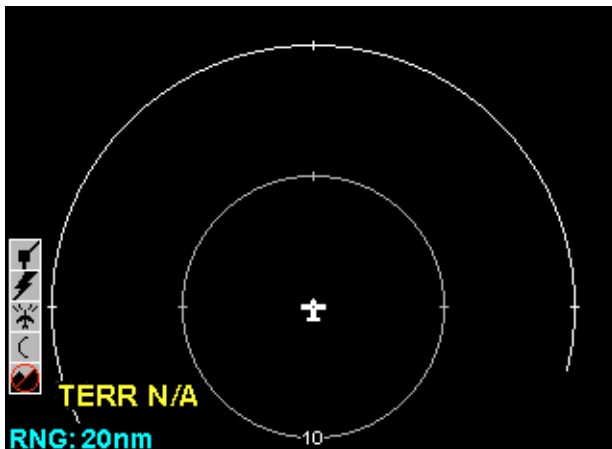
To demonstrate the use of the terrain page we will look at a sample flight from McElroy Airport (20V) to KGNB in Colorado. This flight goes down a mountain pass with high terrain on both sides.

Prior to take off the EGPWS can be tested by putting it into self test which is can be done by a remote mounted TEST switch for the EGPWS, or by putting the Outer Rotary Knob into the TST position (if available). The TEST CONT. softkey can be used to initiate deeper levels of self-test as available.

During EGPWS self test the following Test Pattern should be displayed on the KMD 550/850 Terrain Page.

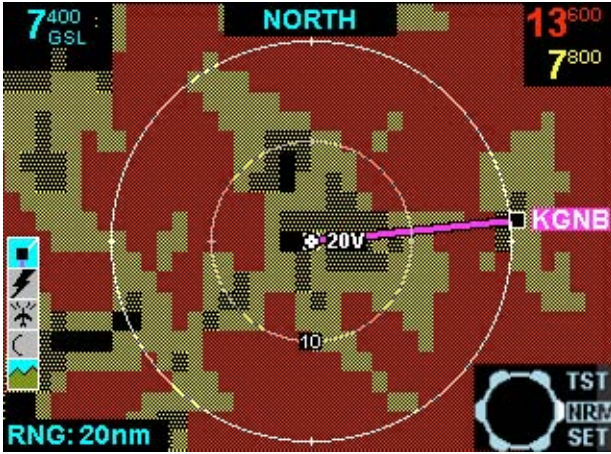


Once self test is completed the EGPWS will be acquiring a GPS position. This may take several minutes and during this time the display will show a display similar to the following:



*NOTE: Some EGPWS units get their position from an onboard navigator, such as an FMS, which must be on and outputting position.*

Once the EGPWS has acquired its position and while we are still sitting on the ramp at 20V we will not have enough ground speed for the EGPWS to determine the aircraft's track so the terrain display will be oriented in a north up view as shown.



Once we take off, the display will automatically switch to a 360 degree track up view. We are flying enroute at 10,200 Ft MSL as shown in the top left corner of the display.







If we want to see more details of terrain in front of us we can switch to the 120 degree view by pushing the VIEW Power Key. Pushing the VIEW key again will return us to the 360 degree view.



If our aircraft has a stormscope installed and connected to the KMD 550/850 we can check to see if there are thunderstorms ahead. The Terrain Page allows for overlays of flightplan information, traffic avoidance information and/or stormscope lightning strikes (if available). Pressing the OVLY Power Key will show what overlays are available and allow them to be toggled on and off. The Flightplan, Stormscope and Traffic Function Legend Icons will be in color when they are being overlaid as seen in the following figure:

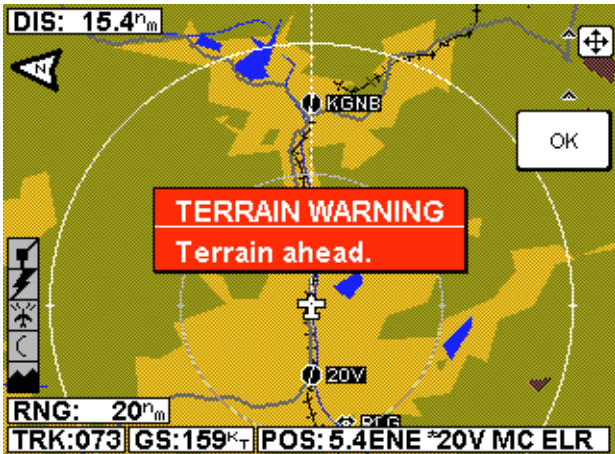


If we reduced our altitude to 8,400 Ft MSL then we would generate a Terrain Warning. The following figure shows an example of how a terrain warning looks on the Terrain Display page.



Depending on how your EGPWS is configured it may automatically reduce the range scale in the event of a warning to show more detail on the nearby terrain.

Other display pages of the KMD 550/850 can be selected with confidence since the EGPWS will always be running in the background as indicated by the gray terrain icon. If the EGPWS issues a warning or caution, a pop up message will appear on the active display page similar to that shown in the following figure. In some installations, the KMD 550/850 will be configured to automatically pop-up the Terrain Page in this situation.



The KMD 550/850 will display the following possible EGPWS pop up messages:

<u>Title</u>	<u>Text</u>	<u>Color</u>
TERRAIN ALERT	Caution obstacle.	Black text, yellow background
TERRAIN ALERT	Caution terrain.	Black text, yellow background
TERRAIN WARNING	Obstacle ahead.	White text, red background
TERRAIN WARNING	Terrain ahead.	White text, red background

If a pop up message is shown, then pushing the TERR function select key will reselect the Terrain Page.

## TERRAIN INHIBIT SWITCH

EGPWS requires the installation of a "Terrain Inhibit" switch as part of the system installation, or enabling of the MODE power key for selecting inhibit mode. When engaged by the pilot, this will inhibit all visual and aural alerts and warnings associated with the EGPWS. Also, an external annunciator lamp is illuminated and a message will be displayed indicating "Warnings Inhibited". For most systems the terrain display remains operational and will look similar to the following:



The purpose of Terrain Inhibit is to allow aircraft to operate without nuisance or unwanted warnings at airports that are not in the system database. Examples might be private airports or those with runways shorter than 2000 feet. Additionally, there may be some "VFR-only" airports where unique terrain features are in close proximity to the runway, and Terrain Inhibit may be used when operating in good VFR conditions. Terrain Inhibit should be NOT engaged for normal operations.

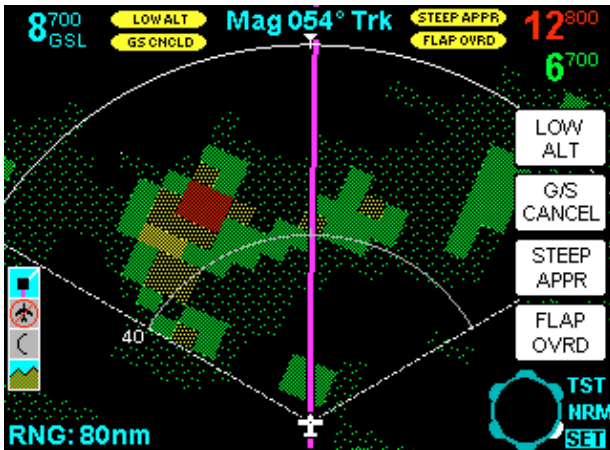
Note that the Terrain Icon shows a yellow exclamation point and the TAWS status shows TERR INHBT to indicate that warnings are inhibited.

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## SET FUNCTION

*Note: This feature is not available for all installations.*

The SET function allows setting of four EGPWS discrettes. The softkeys that are available are dependent on the particular aircraft installation. There is an annunciator indicating when each of the four discrettes is set. The following figure shows an example of all four discrettes configured and set.



## ERROR MESSAGES

### ***ALTITUDE MONITORING***

Some EGPWS sensors monitor the various altitude and temperature (if used) inputs that it receives during flight for the computation of Geometric Altitude. If there is an abnormal difference detected among these altitude values, the system can provide visual and voice alerts to the pilot.

Normal differences that are the result of non-ISA temperature conditions or are due to high or low-pressure systems will not normally activate the altitude monitor. Large errors due to faulty equipment or malfunctioning pitot-static systems will normally be detected by the monitor.

When an abnormal altitude discrepancy is detected by the system, there will be the text message “Check Alt” shown on the display as long as the condition that triggered the alert persists.

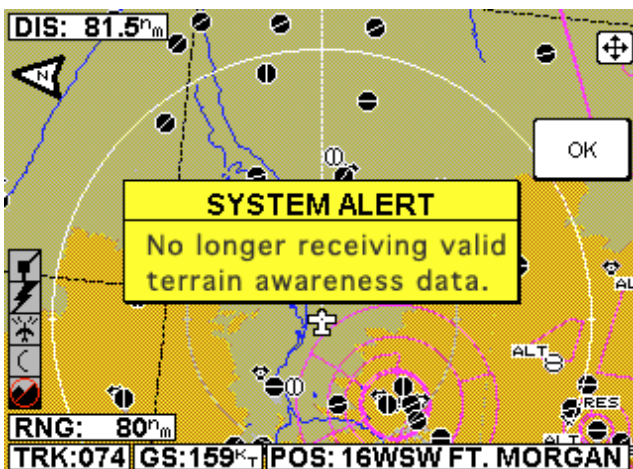
The pilot should check all aircraft altimeters to ensure that the correct altimeter setting is set, that altimeter systems cross-check and that the pilot’s altimeter is not stuck and indicating an erroneous altitude.



### **LOSS OF VALID EGPWS DATA**

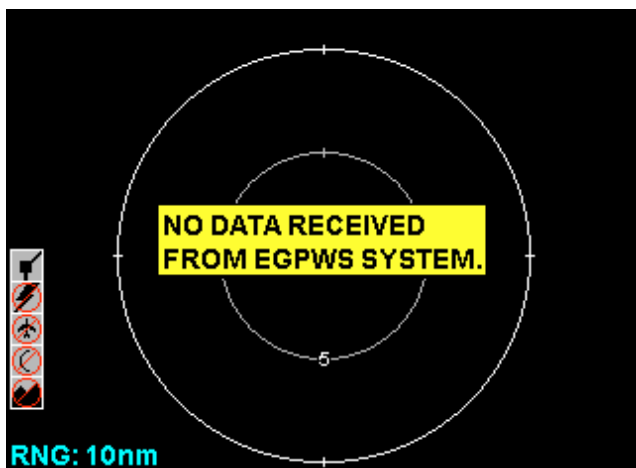
If another page of the KMD 550/850 is being viewed and the EGPWS data becomes invalid the following message will be displayed.

This may indicate that the EGPWS no longer has a valid GPS position. It could also indicate a problem with the EGPWS unit or the installation wiring. Note that the Terrain Icon is displayed with a red circle and slash through it to indicate that the EGPWS is no longer functioning properly.



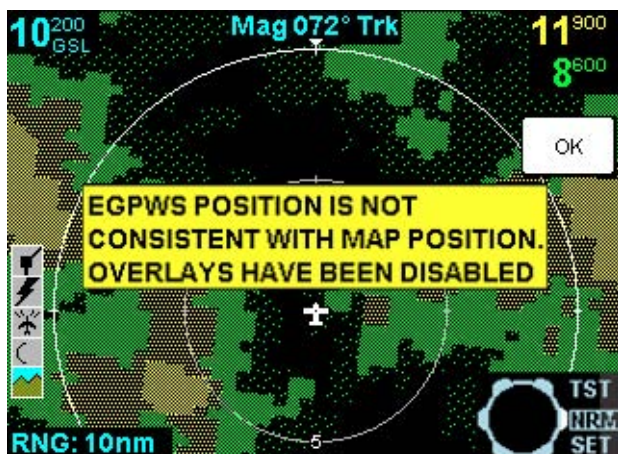
### **NO DATA RECEIVED**

If the KMD 550/850 is not receiving any data from the EGPWS sensor then the following screen will be displayed. This could indicate that power is not being provided to the EGPWS (e.g. a pulled breaker), a bad wiring connection between the display and the EGPWS sensor, or a failed EGPWS unit.



### ***INCONSISTENT POSITIONS***

The EGPWS sensor may use a different position source than the GPS sensor that is used by the KMD 550/850 for its map display. In the unlikely event that these two positions are significantly different, the following message will be displayed:



Since the two positions are different, all overlays on the Terrain page will be disabled. You should cross check your position since this may indicate a problem with either your GPS receiver or your EGPWS unit. Once the positions are back within tolerance of each other then overlays will be re-enabled.

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