ELM350 EFIS

Specification and Installation Instructions

Rev1.2

September 2024

Models

- EFIS **ELM350**

Note:

ELM350 EFIS is a non-TSO certified flight instrument.

Credits

This manual has been authored by Vladimir Miloslavine, the designer and developer of the ELM350 EFIS. All images and visual materials are the exclusive property of 360 Avionics. This document is provided free of charge for all customers and is available for download.

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Revision History

Below is the document's revision hi story.

Revision #	Revision Date	Comments
Rev 1.0	May 19, 2023	Initial Release of this document
Rev 1.1	September 26, 2024	Corrections and new features
Rev 1.2	January 11, 2025	New features

Contents

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1. Introduction

The **ELM350 Electronic Flight Instrument (EFIS)** is an advanced device engineered to provide critical flight information for pilots of experimental aircraft. Although not TSO-certified, the ELM350 EFIS delivers exceptional functionality and is designed to fit into standard aviation panel openings of **3 1/8"**.

This product manual outlines the **features**, **installation**, and **operation** of the ELM350 EFIS, providing essential guidance for its optimal use.

Please note: Throughout this document, the terms **"xPlane Mini," "ELM350," "device," "unit,"** and **"instrument"** are used interchangeably to refer to the ELM350 EFIS.

2. General Description

The **ELM350 EFIS** is an advanced electronic flight instrument consisting of a **microcontroller**, **LCD display**, durable **housing**, and various integrated sensors. These sensors include a **gyroscope**, **accelerometer**, **static and dynamic pressure sensors**, and a **GPS receiver**. Additionally, two external sensors— a **GPS antenna** and an **Outside Air Temperature (OAT) sensor**— complement the system. The built-in LCD display provides a clear interface for presenting all flight-related data.

The **ELM350 EFIS** is composed of two distinct modules:

1. **Graphics Processing Unit (GPU)**: Responsible for controlling the LCD display and managing all output data.
2. **Sensors Processing Unit**, also known as the **Attitude and Heading Reference System (AHRS)**: Handles data from all integrated sensors, including the gyroscope, accelerometer, and pressure sensors.

Each processing unit operates with its own independent firmware, ensuring seamless and efficient functionality. These units communicate through high-speed, dedicated protocols to synchronize data processing and display.

For user control, the front panel is equipped with **two rotating knobs** and **two push buttons**, enabling intuitive operation. The device also features a **MicroSD card slot**, located on the side, for map storage and other essential data.

3. Technical Specifications

Description	ELM350
Input voltage	+10 to +28 Volts
Power consumption	2.0W
Current	1.1A at 12V
Unit size	95mm x 95mm x 100mm (with knobs)
Weight	150 g
Operation humidity	25% to 90%
GPU processor	ARM Multicore
Sensors processor	ARM
System startup time	26 sec
Display	3.5” ultra-bright 640x480px
SD Card slot	Standard MicroSD 128Gb max FAT32
Panel opening	3.125” (79mm)
External communication	CAN bus (proprietary protocol) and RS232
Pitch/Roll range	360 degrees
Altitude range	-1000ft to 32000ft
Vertical speed range	10000ft/min up/down
Receiver	GPS receiver high sensitive Ublox
Antenna	Mag mount GPS with male SMA connector
Pitot/Static lines	¼” Quick connect
Manufacturer	360 Avionics Company

4. AHRS (sensors processing unit)

The **Attitude and Heading Reference System (AHRS)** utilizes data from multiple sensors, including an **accelerometer**, **gyroscope**, **dynamic pressure sensor**, and **GPS**. These sensors enable accurate calculations of attitude and heading, including **roll**, **pitch**, **yaw**, and **heading** information. In some versions of the unit, additional sensors such as an **Outside Air Temperature (OAT) sensor** or **magnetometer** may be integrated to further enhance AHRS calculations.

The AHRS continuously processes data from these sensors using advanced mathematical algorithms and digital filtering to estimate the current **Roll**, **Pitch**, and **Yaw (RPY)**. These parameters are then visually displayed via the artificial horizon. While the AHRS performs highly accurate calculations, it is important to note that, depending on sensor inputs and various external factors, some **RPY errors** may occur. To minimize such errors, **GPS data** and **True Airspeed (TAS) or Calibrated Airspeed (CAS)** are required, particularly during banked turns. It is highly recommended to keep the **GPS antenna** connected at all times, as **GPS course** and other critical parameters significantly improve the accuracy of attitude estimations.

Reminder for Pilots: Maintaining **coordinated flight** is crucial for accurate RPY estimation. While short periods of uncoordinated flight may not cause significant errors, extended uncoordinated flight will lead to considerable inaccuracies in RPY calculations.

In the event of uncoordinated flight, RPY parameters may display incorrect values, meaning the artificial horizon may not reflect the actual flight attitude. Once coordinated flight is resumed, it typically takes **20-35 seconds** for the system to recalibrate and return to accurate RPY indications.

Steep banking turns (greater than 50-55^{o}) may also introduce errors in RPY output, as certain parameters may exceed the operational thresholds of the sensors. Following the return to coordinated flight, the system will require **20-35 seconds** to realign the artificial horizon and provide accurate RPY data.

During **aerobatic maneuvers**, the system may experience substantial errors in attitude and horizon indications due to the physical limitations of the sensors. After normal flight is reestablished, it may take **more than 1 minute** for the AHRS to stabilize and present accurate attitude information on the display.

5. Pitot and Static systems

The **ELM350** is equipped with highly accurate **dynamic** and **static pressure sensors**, featuring dedicated **Pitot** and **Static ports** located on the back of the unit. The **Pitot sensor** serves as the primary source for airspeed data, ensuring precise airspeed readings during flight. In situations where the Pitot sensor's airspeed information is deemed unreliable—due to internal error thresholds defined by the manufacturer—the system automatically switches to **ground speed** derived from the **GPS sensor**. An appropriate alert will be displayed when this occurs to notify the pilot of the sensor switch.

For models equipped with an **Outside Air Temperature (OAT) probe**, **True Airspeed (TAS)** functionality is available. The OAT sensor enables advanced calculations and additional enhanced features in this version of the unit, providing a more comprehensive suite of flight data.

The **Pitot** and **Static ports** are designed with **¼" quick-connect fittings** to facilitate easy and secure installation.

Important Note: After connecting the Pitot and Static lines to the unit, it is crucial to perform a **Pitot/Static leak test** on the aircraft. This ensures that all connections are properly sealed and plumbed, minimizing the risk of inaccurate readings.

Both the **airspeed** and **altitude sensors** are factory-calibrated, requiring no further calibration after installation.

6. LCD Display

The **ELM350** is equipped with a **3.5" TFT LCD display** featuring a resolution of **640 x 480 pixels**, ensuring excellent **color accuracy** and **contrast**. The display is designed with **high-brightness technology** to remain fully readable in **direct sunlight**, making it ideal for cockpit environments exposed to varying light conditions.

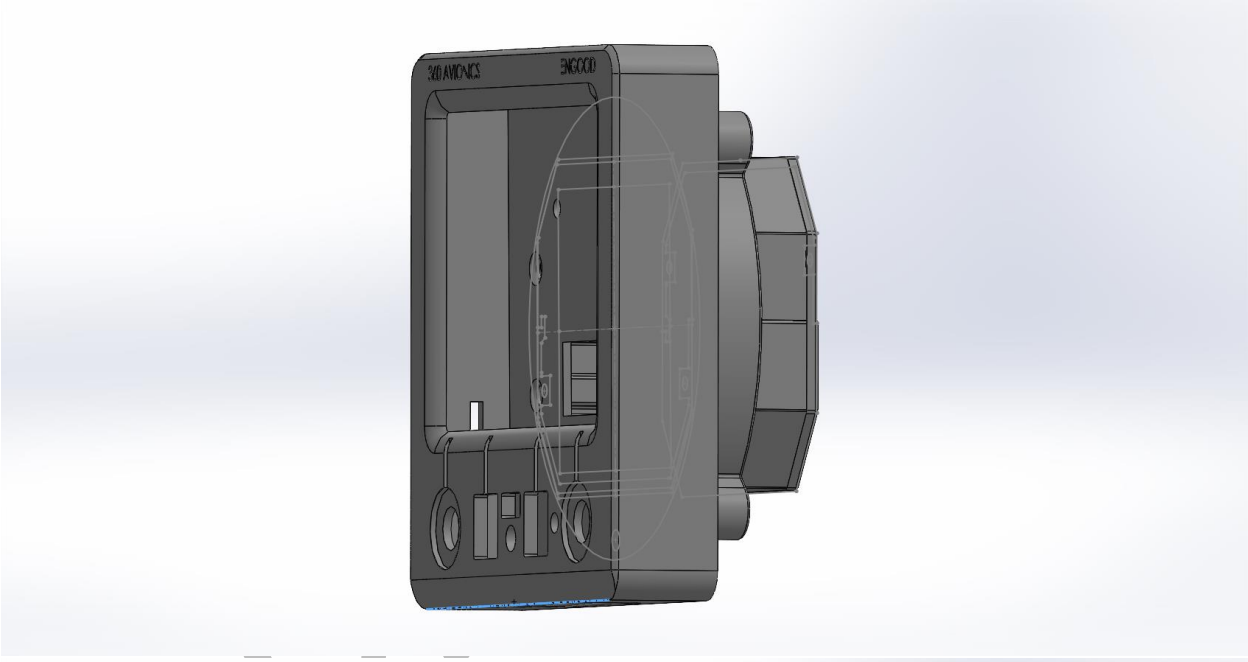
Additionally, the **ELM350** incorporates built-in **ambient light sensors** on the front panel. These sensors enable the **auto-brightness** functionality, which can be controlled through the **Settings Menu** under **General Config > Display Brightness (Disp Brg)**. When the auto-brightness feature is activated, the display will automatically adjust its brightness in response to ambient light conditions—**increasing brightness** in sunlight and **dimming** in low-light or night environments.

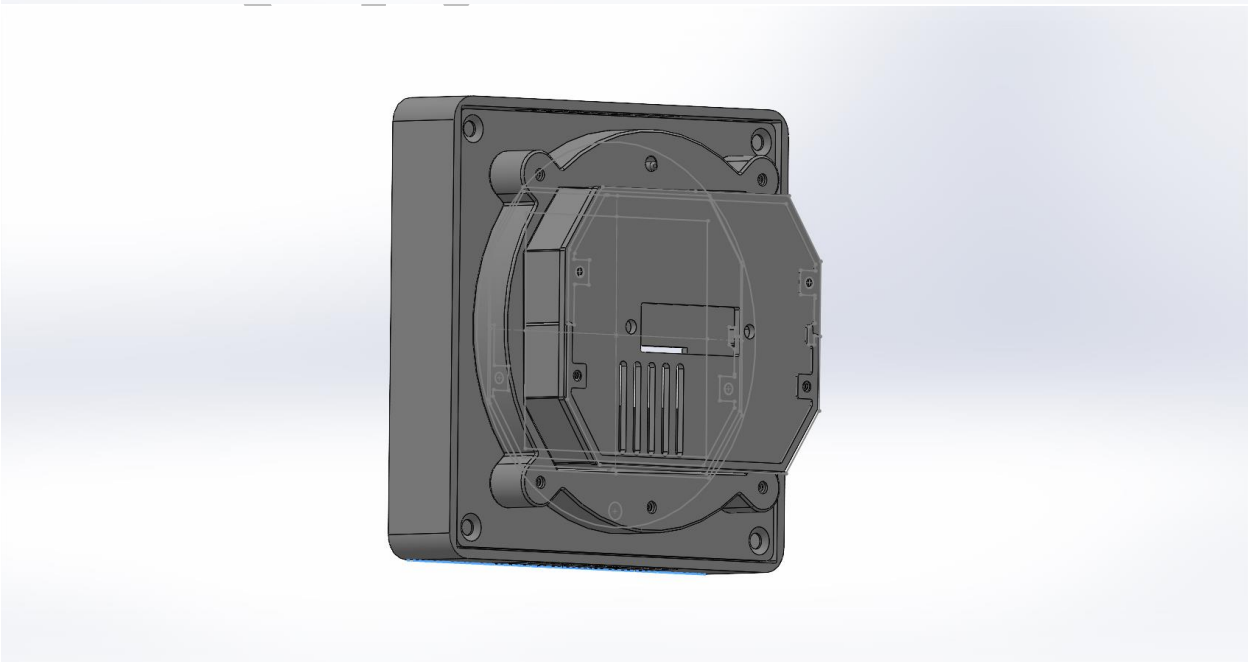
⚠ Display is non-touch. Avoid pushing on the display with finger or other objects and avoid cleaning the displays with abrasive chemicals not designed for cleaning of LCD displays.

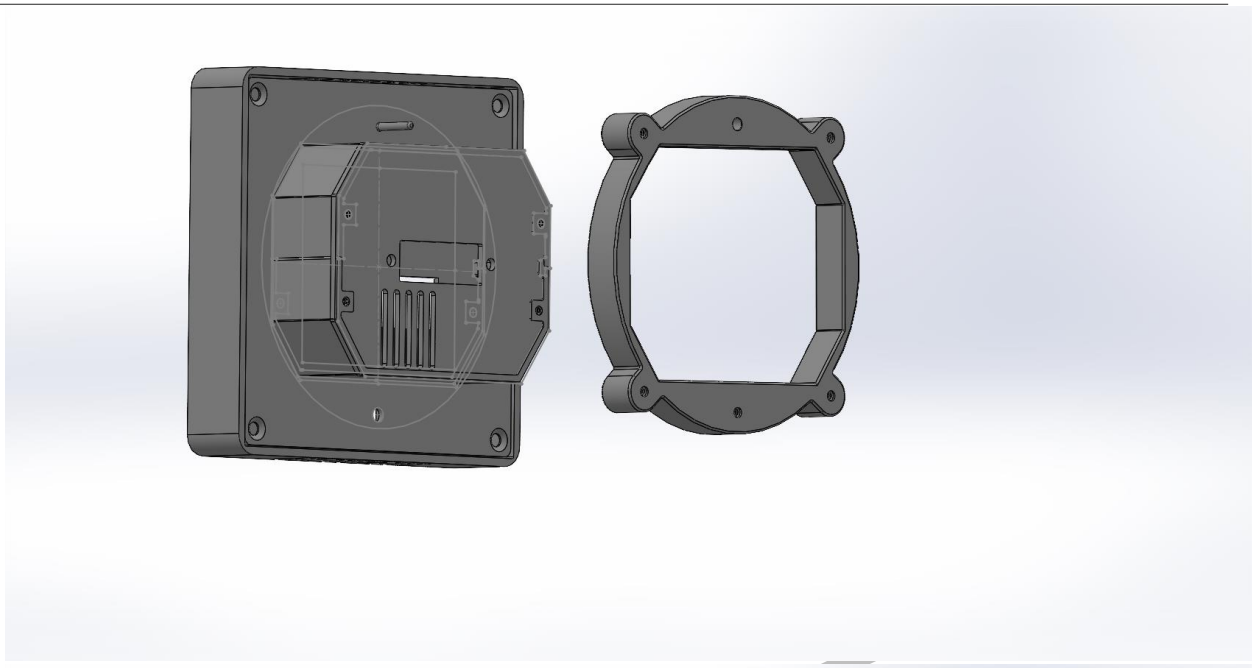
7. Product installation

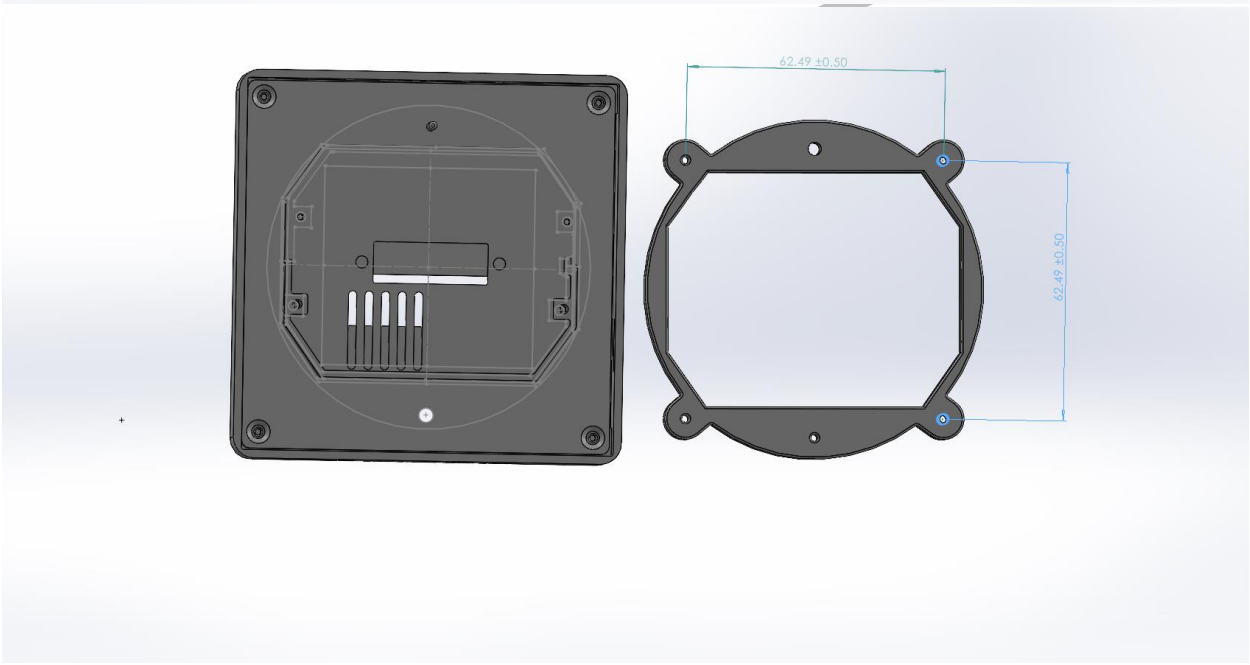
7.1 Space requirements

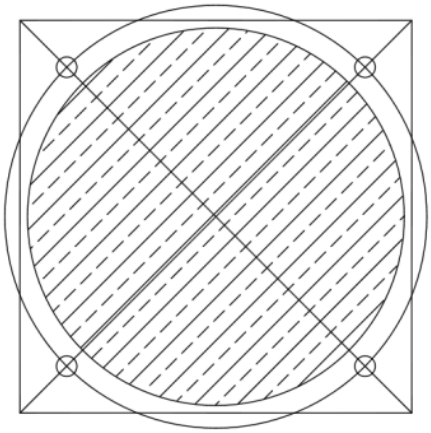
The **ELM350** is designed to fit seamlessly into a **3.125-inch opening** in the aircraft instrument panel. The mounting bracket features **four threaded #6-32 holes** for secure attachment. While using **three mounting points** is generally sufficient to firmly hold the instrument in place, it is recommended to utilize **all four** mounting points whenever possible for optimal stability and security.





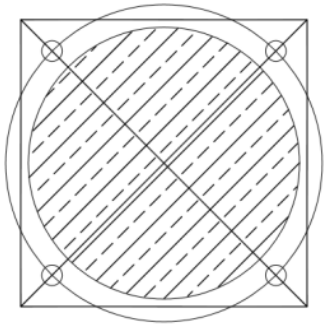






3 1/8 (80mm) Instrument Hole

1. Draw a 3.25" X 3.25" Square
2. Scribe 2 diagonal line corner to corner
3. Using the center of the lines, scribe a 3.5" diameter circle.
4. At the intersection of the diagonals and the 3.5" dia circle drill 4 holes to clear #8 screw (.170" dia.)
5. Using the center of the diagonal lines cut a hole with a hole saw 3.125" dia.



2 1/4 (57mm) Instrument Hole

1. Draw a 2.375" X 2.375" Square
2. Scribe 2 diagonal line corner to corner
3. Using the center of the lines, scribe a 2.625" diameter circle.
4. At the intersection of the diagonals and the 2.625 dia circle drill 4 holes to clear #8 screw (.170" dia.)
5. Using the center of the diagonal lines cut a hole with a hole saw 2.250" dia.

The installation depth of the unit will require approximately 105mm (not including depth of the plumbing for Pitot and Static lines and connector).

Use 7/64” hex drive to attach instrument to mounting bracket.

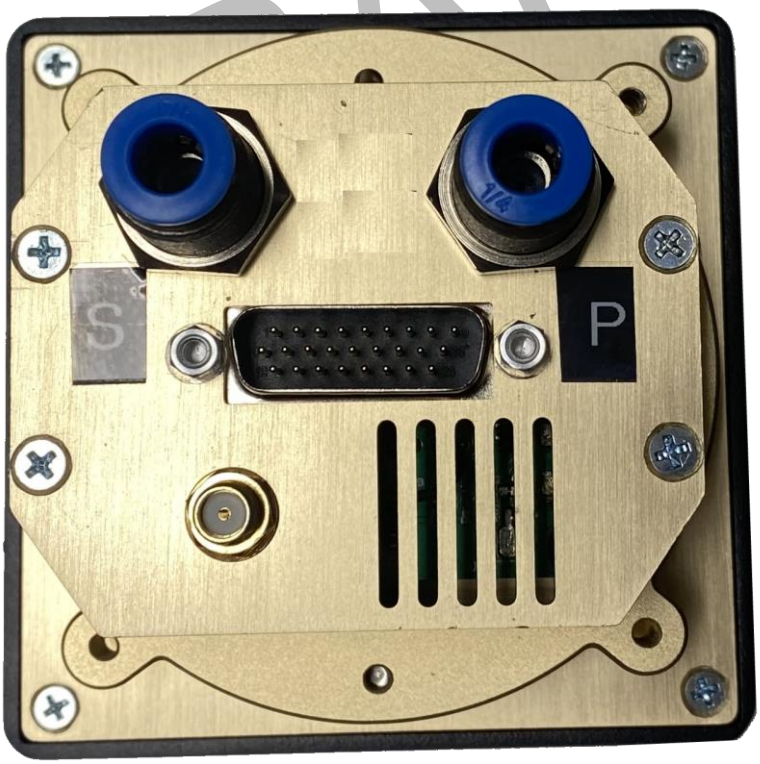
7.2 Proper alignment of the instrument

For optimal performance of the **ELM350**, it is essential that the instrument panel is aligned **perpendicular** to the aircraft's flight path. To ensure accurate functionality of the AHRS sensors (accelerometer and gyroscope), the **X-axis** of the device must be oriented in the direction of the flight path, the **Y-axis** perpendicular to the flight path, and the **Z-axis** perpendicular to the ground.

If the instrument panel is **not perpendicular** to the flight path, the AHRS sensor axes will be misaligned, leading to incorrect operation. In such cases, the device will require calibration or leveling. For detailed instructions on the AHRS sensor leveling procedure, please refer to the relevant section of this manual.

7.3 Connections

The **ELM350** features various connectors located on the backside of the unit, including plumbing connectors (¼"), a GPS antenna port, and the main power/interface connection. For all electrical connections, the device employs a **26-pin D-SUB male connector** positioned centrally. A **female D-SUB connector** is included in the kit for all necessary wiring. For optimal performance and reliability, it is recommended to use wire gauges between **22 AWG** and **24 AWG**.



Quick connect ¼" Pitot line is marked as **'P'** and Static line is marked as **'S'** on the back of the unit (or on the connector's body). It is recommended that the installer labels the tubing connected to the two ports. This will ensure that correct connections will be made, should unit be removed / reinstalled.

GPS Antenna:

The GPS port uses SMA type female connector. Any type of GPS antenna with SMA male connector and 3.3V-5V voltage level can be used. Magnetic mount GPS antenna is included with the kit. The best location for the GPS antenna would be on top of the instrument panel under the windshield window where best and unobscured sky visibility is achieved. GPS antenna should never be mounted underneath the panel or behind the panel.

In case when antenna is installed outside of the airplane on the roof, it must be secured to the surface using a very strong adhesive, to ensure that the antenna will withstand strong winds. If planning to install the GPS antenna on the roof of the airplane, please seek advice from an experienced aviation maintenance specialist.

When tightening the GPS connector, hand-tightening is sufficient. Do not overtighten.

26-pin Main connector pinout:

1 – A/C Power **+V** (positive)	14 – RS-232 Tx2
2 - A/C Power **+V** (positive)	15 – RS-232 Rx2
3 – CAN bus Low	17,24 – GND (OAT-, Audio-, UART)
4 – CAN bus High	19 – OAT sensor signal input
7 – RS-232 Tx1	25 – A/C Power **GND** (negative)
8 – RS-232 Rx1	26 – A/C Power **GND** (negative)
11 – OAT sensor power+	
13 – Audio OUT+ (not in use)	

For optimal performance, it is recommended to use **22 AWG** wire for all power connections (pins **1, 2, 25, and 26**). For all other connections, **24 AWG** wire is acceptable. It is advisable to use military specification (milspec) wires for all connections to ensure high quality and robustness of the wiring.

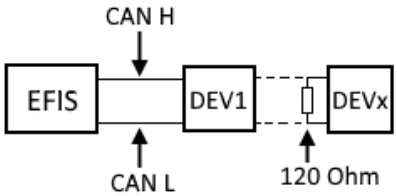
The kit includes a **female D-SUB 26-pin connector header** with options for soldering or crimping the pins. A plastic enclosure for the connector header is also provided. If soldering wires, please ensure that they are securely attached without any cold solder joints.

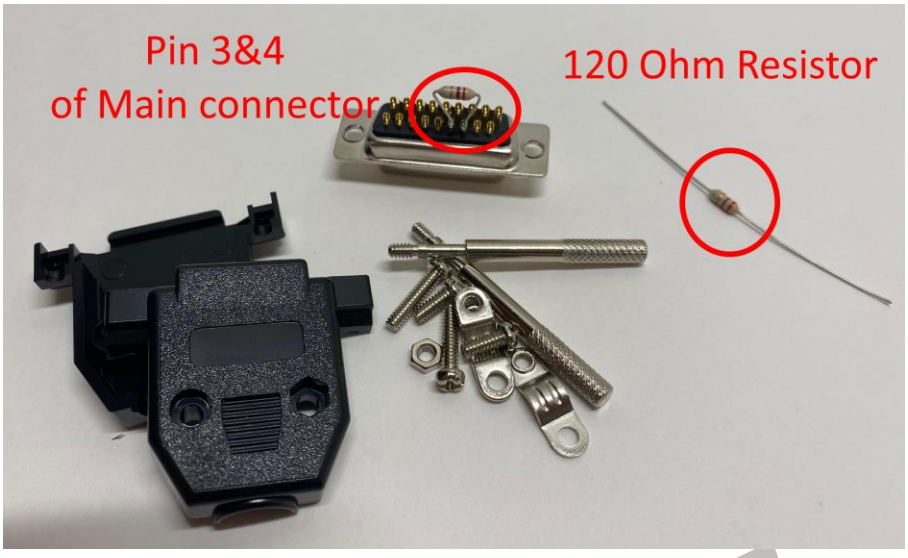
CAN Bus termination:

The **ELM350** can be installed in the aircraft in conjunction with compatible **360 Avionics** external magnetometers and/or engine monitors, connecting them to a single **CAN** line.

When the **ELM350** is installed independently (without an external magnetometer, **VICS** voice module, or engine monitor module), it is necessary to install a **120 Ohm termination resistor** (included with the kit) between **pin 3** and **pin 4** of the CAN line. This resistor must be securely installed on the connector and left within the enclosure.

When an external module (DEV) such as the **EnGood engine monitor**, **VICS voice information system**, or external magnetometer is connected, a CAN bus termination resistor must be installed to properly terminate the CAN bus at the end of the line. Please refer to the diagram below for proper configuration.





Power bus:

Use AWG22 or less gauge of wires to connect power to the unit (pins 1,2,25,26). It is required to have 3A circuit breaker on power line for the ELM350. This circuit breaker should be accessible from pilot's seat. Ground wire can be connected to chassis ground or directly to the battery negative terminal.

Power line with circuit breaker is usually connected via Avionics master switch or via Main master switch depending on the airplane configuration.

OAT Sensor (probe):

The **Outside Air Temperature (OAT)** sensor is an optional component that can be connected to the **ELM350**. When the OAT sensor is installed, additional data such as **True Air Speed (TAS)** and OAT will be displayed.

The OAT sensor consists of a digital probe housed in a threaded aluminum casing. The standard cable length is **59 inches (150 cm)**, which is typically sufficient for installation on the same side as the **ELM350** unit. While the OAT cable can be extended to your desired length, it should not exceed **14.76 feet (4.5 meters)**.

If an extension is necessary, ensure that all wire connections are properly extended and insulated to avoid electrical short circuits and potential damage to the unit.

<u>OAT sensor is connected to main 26pin connector pins:</u>

11 – OAT sensor power
17 – GND
19 – OAT sensor input signal

OAT sensor should be installed in a way that exposes its sensing surface to the outside air. It is important to avoid installation of the sensor in close proximity to engine heat, exhaust pipes and exhaust heat.

OAT pinout:

Note: Wire colors of the sensors may vary depending on the model.

Version 1	Version 2	Function
Orange strip	Red	OAT sensor power (+3V3)
White	Black	GND
Blue strip	Yellow	OAT sensor output signal

*Please note that if OAT sensor is installed in a position where it cannot measure real outside temperature (installation inside of the cabin, near heat source, etc) the OAT, TAS, Density Altitude and certain other information will be inaccurately calculated and displayed by **ELM350**. It is possible to Disable OAT sensor from "Settings" menu > "External devices > Use OAT" submenu.*

OAT Sensor (probe) installation:

Carefully assess the optimal location for the **OAT sensor**, taking into account the aforementioned limitations, such as the maximum cable length and proximity to heat sources. Additionally, ensure the airplane's structural integrity when selecting a safe location for the probe; avoid drilling through critical structural components like spars.

Once the location is determined, proceed to drill a hole through the aircraft's skin.

For Probes with a Threaded Bottom:

1. Install the probe into the drilled hole and secure it by tightening the nut.
2. Apply **Loctite (Blue)** to the threads to prevent the probe from loosening due to chassis vibrations.

For Probes without a Threaded Bottom:

1. Use a small rubber grommet (approximately **0.187 inches in diameter** or similar) installed in the skin surface.
2. Insert the temperature probe into the grommet and secure it using a silicone gasket maker to lock the sensor in place.

Next, route the wire from the sensor to the back of the **ELM350** and connect the wires to the appropriate pins in the **26-pin connector**. Details regarding the sensor pinout and the 26-pin main connector are provided above.

RS-232 Ports:

Pins used for the ports

7 – RS-232 Tx1
17 – GND (UART, OAT- and Audio-)
8 – RS-232 Rx1
14 – RS-232 Tx2
15 – RS-232 Rx2

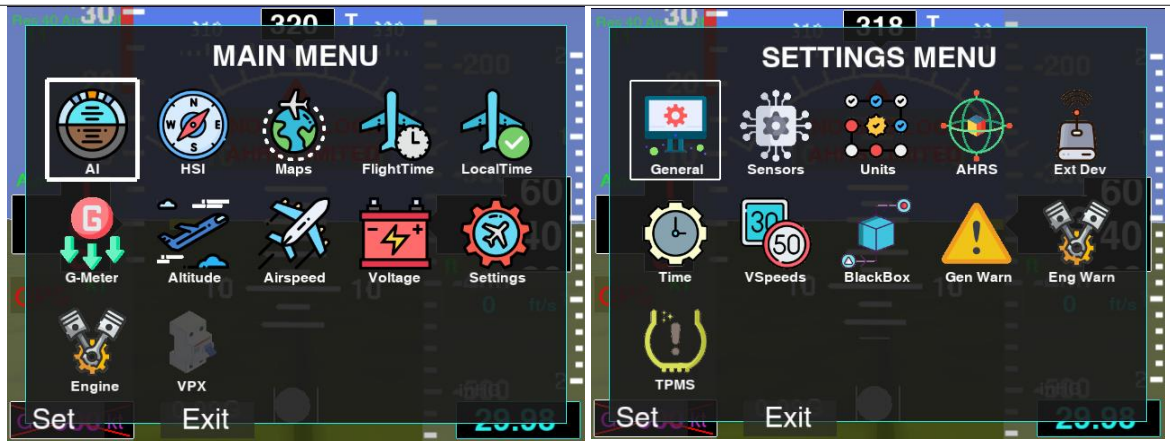
8. AHRS sensors leveling procedure and Pitch Adjust

8.1 AHRS sensors leveling procedure

In most airplanes, the instrument panel is perpendicular to both the flight path and the ground when the aircraft is leveled, such as during normal cruise flight. During production, each **ELM350** is calibrated for this installation, and the appropriate offset values are recorded in the device's memory. Each time the device is powered on, these offset values are automatically applied for calibration. However, there may be instances when re-calibration of the sensors is necessary.

If re-calibration is required, please follow the steps below:

1. **Level the Airplane:** Ensure that the aircraft's position is aligned with straight and level flight (cruise attitude). The airplane must be leveled in both the pitch and roll axes. Consult with your aircraft maintenance engineer if needed, and use jacks to level the airplane when applicable.
2. **Power On the ELM350:** Turn on the **ELM350** and wait for it to boot up until the **AHRS** is ready.
3. **Access the Main Menu:** Once the device has booted, if the artificial horizon indicator is not displayed on the screen, open the Main Menu by pushing the left knob and then selecting "**Settings Menu**"



1. Rotate the left knob and select "AHRS config" submenu, then select ***'Accl Cal Ovrd'.*** *If this option is not visible, continue rotating the knob until you find it.*

2. To select menu option (***'Accl Cal Ovrd')*** push the knob. The selector background will change from blue to orange.

3. Rotate the left knob to select ***'Re-Cal'***

4. Push the left knob to start recalibration process. The note will change to "Disabled". This means that re-calibration process has started.

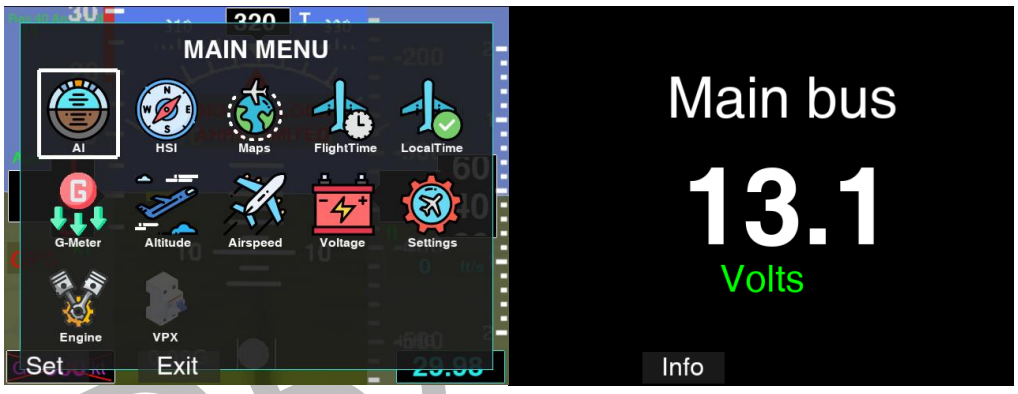
5. After 3-4 seconds the following message ***'Updating Please Wait'*** will show up on the display.

6. Once the calibration is completed, you will return to the “AHRS Config” submenu and the setting option will automatically change back to “Enabled”.

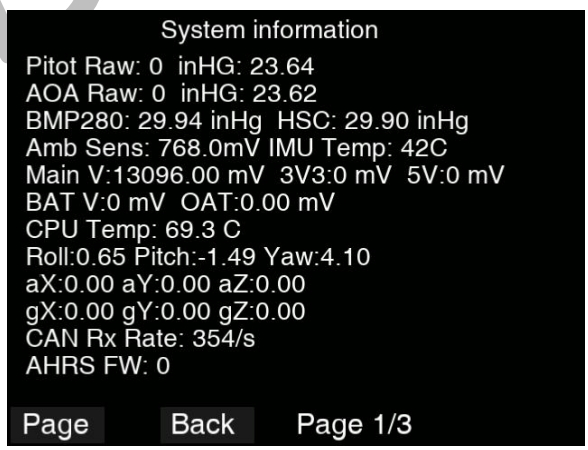
7. Push the left button to return back to the “Artificial Horizon” mode.

8. Calibration of AHRS is completed at this time. Make sure that you have horizon calibrated properly.

9. To verify that calibration was completed successfully, open ‘Info Page’. To do so, switch to Voltmeter mode by first pushing the left knob and then selecting Voltage from menu, then press left button (label “Info” should be shown)



10. Ensure that Roll and Pitch are at “zero”. Yaw does not need to be at “zero”.



11. Calibration is completed and verified.

12. Exit the “Info Page” by pressing ‘Back” (left button).

8.2 Pitch Adjust

In some cases, you may only need to adjust the pitch for a single flight. In this case, you may want to use “Pitch Adjust” option instead of “AHRS sensors leveling procedure”.

1. In the “Settings Menu” select “General Config”, then “Pitch Adjust”
2. Chose the correct number of “degrees” to compensate for the pitch. If on the ‘artificial horizon indicator” the nose is pointing downward, select a number below “0”; if on the artificial horizon indicator, the nose is pointing “upward”, select a number above “0”.

Pitch adjust will reset to “0” when the device is powered “OFF”.

9. Maintenance and Repair

AHRS leveling procedure should be performed annually (every 12 months). Pitot/static systems leak test should be performed every 24 months to ensure proper operation of the device.

There are no field repairable parts inside of the ELM350 EFIS. In case of any malfunction, the unit should be returned to the manufacturer for test and repair.

10. Firmware Update Procedure

The **GPU** and **AHRS** modules within the **ELM350** operate using two distinct firmware components. Each unit is preloaded with the latest available firmware at the time of production. However, future firmware updates can be performed via the USB port located on the front panel of the **EFIS**.

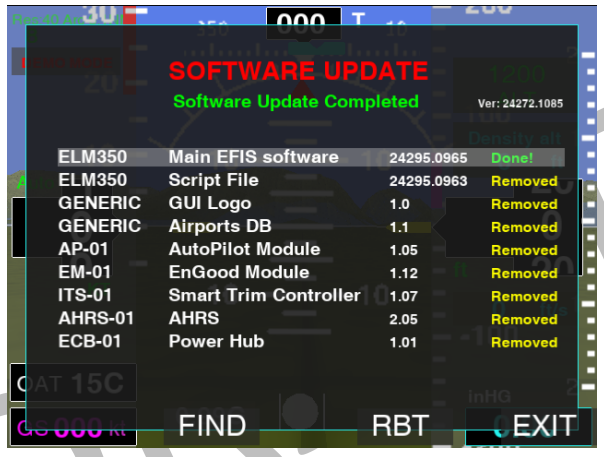
⚠ Note: It is strongly recommended to have airplane battery connected to external trickle charger for the duration of the firmware update. This is needed to avoid unexpected power outage and unsuccessful firmware update.

To perform a firmware update for your unit, please follow these simple steps:

1. **Download the Firmware:** Obtain the firmware from www.360avionics.com or receive it via email from a 360 Avionics technical support agent.
2. **Prepare the USB Drive:** Copy the firmware update file to a USB flash drive formatted as FAT32. The drive should be under 16GB in size. Place the firmware in the x:/Updates folder at the root of the USB flash drive. Use the adapter cable included with the EFIS to connect the USB flash drive to the miniUSB port located on the EFIS.
3. **Check the Updates Folder:** Ensure that nothing else is saved in the Updates folder except for the firmware files. The update typically consists of a single file with a .360 extension, and the file name usually includes the model of the device being updated.
4. **Power On the ELM350:** Start the ELM350. Ensure that your battery has sufficient power to keep the ELM350 running for at least 30 minutes. It is recommended to use a trickle charger connected to your airplane's battery.
5. **Access the Update Menu:** Navigate to "Main Menu" → "Settings" → "Black Box" and select "Software Update."
6. **Insert the USB Drive:** Insert the USB flash drive containing the firmware update into the USB port on the front panel of the EFIS using the adapter cable. Wait at least 20 seconds before proceeding to the next step.
7. **Search for Updates:** Press the "FIND" button to search for the update on the USB drive. The ELM350 will search for available updates and display them on the screen.

8. **Select the Update:** Rotate the left knob to choose the desired update. Press the left knob to confirm your selection. A green checkmark will appear in the small square next to the selected update. To initiate the firmware update, press the “UPDT” button once. The update process may take anywhere from a few seconds to 15 minutes, depending on the updates selected.

9. **Complete the Update:** Once the firmware update is complete, a “Software Update Completed” message will be displayed. At this point, reboot the unit by pressing the “RBT” button.



11. Operations

11.1 Configuring your device

⚠ For proper operation of the device, the device must be configured with the airplane's V speeds: Vr, Vx, Vy, Va, Vs0, Vs1, Vfe, Vno, Vne. Refer to your plane's Pilot Operating Handbook ("POH") for the specific speeds that apply to your airplane.

⚠ Please note that ALL of the V Speeds set in this sub section should be entered in Knots regardless of 'Speed units' setting.

The speeds can be configured in the "Settings" menu > "V speeds" submenu.

Starting with Vr, set all of the speeds for your airplane. Navigate to the speed that you would like to change in "V speeds Menu", and *follow the following steps:*

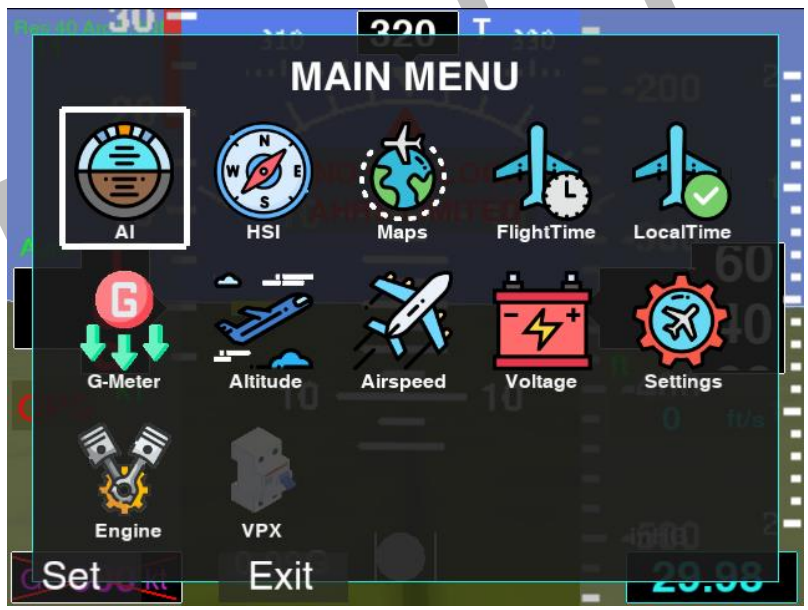
1. *Access the "Settings Menu" by pressing the left knob*
2. *Open Submenu V-Speeds by rotating the left knob and then pushing on it*
3. *Navigate to "Speed Vr" menu option and select it by pushing the knob once*
4. *The selector will turn blue*
5. *Rotate the knob clockwise or counter clock-wise to select the speed value that matches Speed Vr for your airplane*
6. *Push the knob once*
7. *The selector will turn orange*

Performs steps 3 to 7 for all of the other Speed Types. Once all of the speeds have been set for your airplane exit the menu by pressing left button 'Exit'

11.2 EFIS Operation Modes

ELM350 has the following modes of operation:

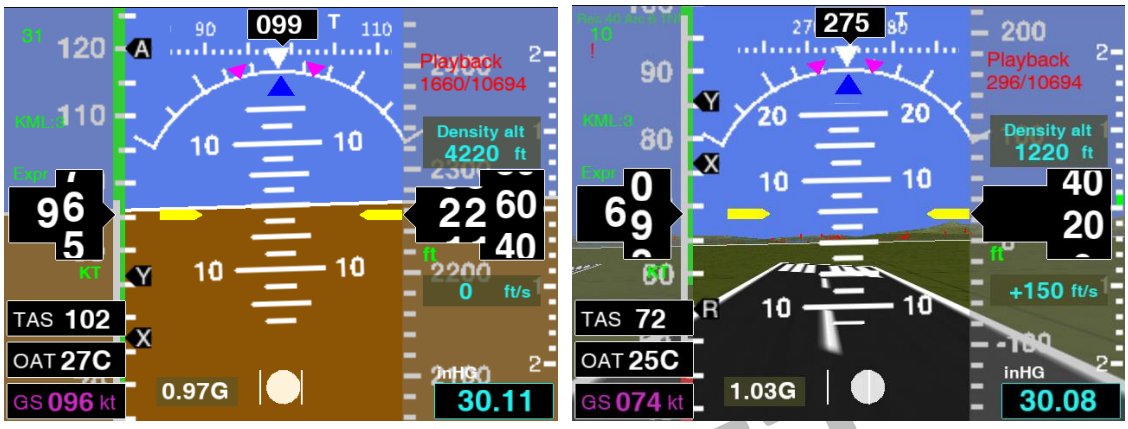
- Artificial horizon indicator
- Compass/HIS
- Map (Sectional/Global)
- Flight Time
- Local Time
- G-meter
- Altimeter
- AirSpeed
- Voltmeter
- Oil life
- EnGood Engine Monitoring (*limited to monitoring functionality)
- VPX Integrated Circuit breakers support



By default, whenever the unit is powered up it starts with the Artificial horizon indicator, however this can be changed via the "**Settings Menu**" > "**General Config**" > "**Start mode**" if desired.

Artificial horizon indicator

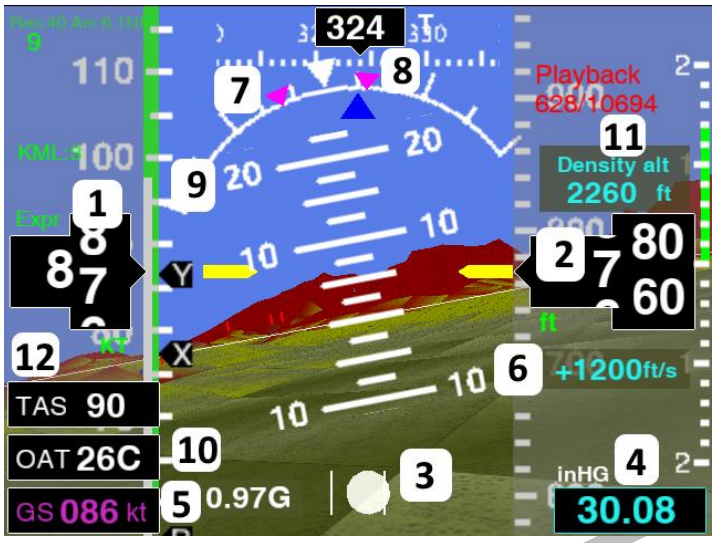
Artificial horizon in ELM350 has two modes of operations: Normal and Experimental 3D with synthetic view. Please note that Synthetic view mode is currently experimental only.



Artificial horizon mode of operation can be selected via 'Settings' menu under 'General Config' -> 'Horizon Mode'

All placement of the labels is identical for both modes. Please note that terrain awareness is only available when 3D artificial horizon mode is in use.

Terrain and obstacles databases are required for your region to properly operate artificial horizon in 3D Synthetic vision mode. These databases can be updated using "***Software Update***" menu using a procedure similar to a firmware update. Refer to section *10* for Firmware Update Procedure.



The artificial horizon indicator in both Normal and 3D Synthetic view modes displays the following flight parameters:

1. **Current Speed:** The speed shown can be either Ground Speed (in red) or Air Speed (in white), depending on the source of airspeed used by the ELM350. The units for current speed are displayed below the speed indicator in green.
2. **Current Altitude Indicator:** The current altitude value appears on the right side of the display, with units shown below the altitude indicator in green. **Density Altitude** is displayed above the current altitude indicator when the OAT sensor is connected and enabled in the main menu.
3. **Slip/Skid Ball Indicator:** Located at the bottom of the screen, the slip/skid ball indicator shows if the airplane is coordinated, indicated by the ball being inside the gate.
4. **Ground Pressure Indicator:** Found at the bottom right of the screen, the ground pressure indicator displays units above it. To adjust the ground pressure based on ATIS, rotate the knob clockwise or counterclockwise.
5. **Ground Speed Indicator:** Shown at the bottom left of the screen, it indicates current ground speed. If the GPS signal is unavailable, “NO GPS” will be displayed. When the signal is available, the current ground speed appears, with “GS” indicating ground speed.
6. **Vertical Speed Indicator:** Located on the right side, beneath the altitude indicator, it shows altitude change per minute in the same units as altitude. Vertical speed is shown in white for steady or descending flight, with a “-” sign indicating descent. In green, it indicates climb, with a “+” sign.
7. **Turn Bank Arc:** Positioned at the top center of the display, this arc represents the current bank angle. During flight, two small blue triangles are displayed beside the center white triangle, indicating a standard turn bank (2 min/turn).

8. **Current Track Indicator:** Located at the top of the display, it defaults to (M) Magnetic track but can switch to (T) True track in the “Settings Menu” > “External devices” > “Mag Decl Corr.” The current mode (M or T) is indicated to the right.
9. **Vertical Speed Color Strip:** On the left side of the screen, this strip shows V speed markers (Vfe, Vy, Vx, Vr, etc.), moving according to the airplane’s current speed.
10. **Outdoor Air Temperature (OAT):** Located at the bottom left above the ground speed indicator, OAT information includes units next to the value.
11. **Density Altitude:** Automatically calculated when the OAT sensor is connected and enabled in the “Settings menu” > “External devices” > “Use OAT.”
12. **True Air Speed (TAS):** Calculated whenever the OAT sensor is connected and enabled in the “Settings menu” > “External devices” > “Use OAT.” This function requires the Pitot airspeed-enabled version of the unit.

Compass mode

The **Directional Indicator / Compass Mode** is available in both Ring and Arc modes. The functionality and information provided are similar in each mode. Switching between modes can be easily done by pressing the left button.

In compass mode ELM350 displays the following information:

1. **Current Track**: The display shows the (M) Magnetic track by default. Users can switch to (T) True north in the “Settings Menu” > “External Devices” > “Mag Decl Corr.” The current mode (M or T) is indicated to the right of the track indicator.
2. **Current Heading Bug Setting**: Located at the bottom right of the display, the current heading bug setting is represented by a triangle ‘Heading Bug Indicator.’ To adjust the heading bug, rotate the knob clockwise or counterclockwise.
3. **Heading Bug Indicator**: This indicator is positioned on the compass dial.
4. **Ground Speed Indicator**: The ground speed is displayed at the bottom left of the screen.

By default, compass information is derived from the GPS Course Over Ground (COG), providing a precise value when the airplane is in motion and a GPS signal is available. The COG is presented as True direction. If enabled in the “Settings Menu” > “External Devices” > “Mag Decl Corr,” the COG will convert from True to Magnetic direction and be displayed accordingly.

Enhanced Flight Time mode

Extended Flight Time mode provides current:

1. UTC time
2. Local time
3. Flight time
4. Timer

Local time and UTC time are set via the “Settings Menu” > ‘Time submenu”. Flight time counter is automatically started as soon as airplane is airborne and stopped upon landing. Timer can be used for fuel tanks switch or other purposes and can be manually started/stopped and reset by pressing the left button. Timer can be reset by pressing and holding the right button.

Note that the timer will continue counting the time, even if the screen is switched to a different mode (Compass, Artificial Horizon, etc).

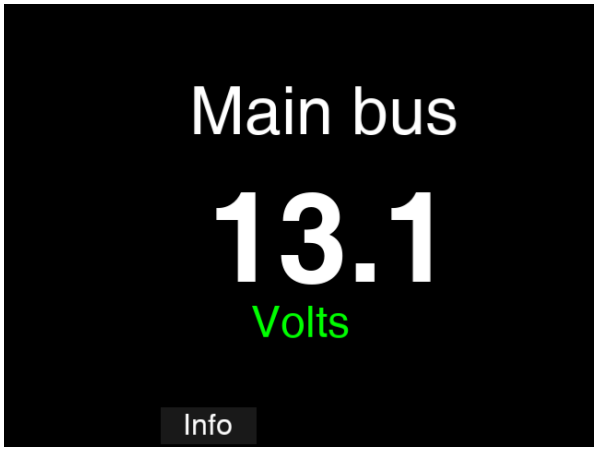
Time/Flight Time mode

Time/Flight Time mode is similar to Enhanced Flight time mode with two main differences:

- Only *Current Local Time* and *Flight Time* are indicated on the display
- Flight time is shown in decimals (aviation standard)

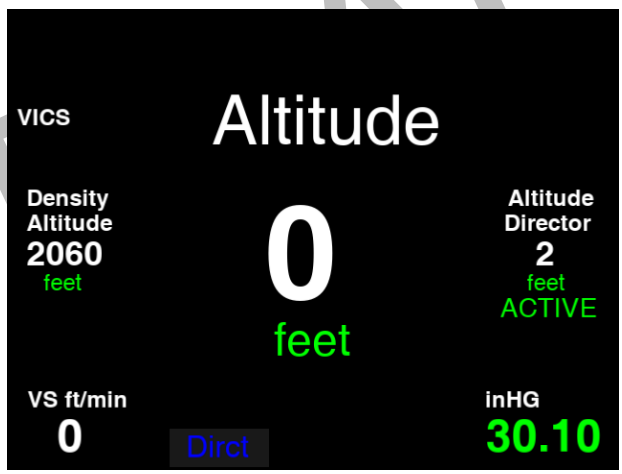
From this page it is possible to access ‘Oil Life’ page (described below).

Voltmeter mode



Voltmeter mode shows current voltage information as read on ELM350 power bus V+.
You can open an 'Info' page with additional technical details which can be used for calibration and other purposes by pressing left button while in Voltmeter mode.

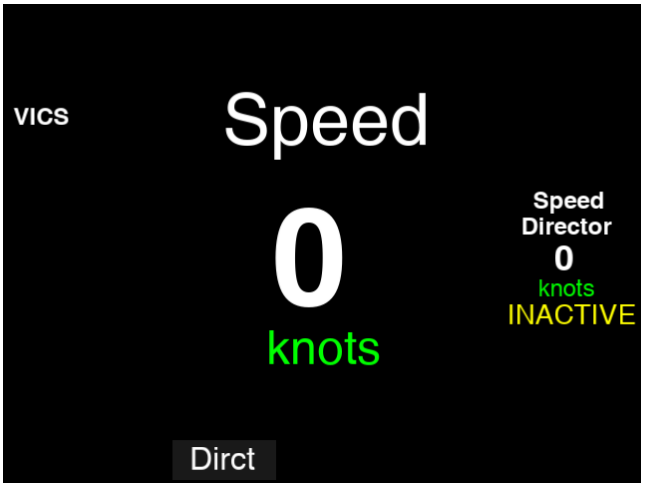
Altitude Mode



Altitude mode provides:

- current altitude information in the center of the display
- density altitude on the left of the current altitude (only if OAT is installed and enabled)
- vertical speed information on the bottom left of the display
- current ground pressure setting (with respective units shown above it) on the bottom right of the display. You can change the current ground pressure setting by turning the knob clockwise or counter clockwise.
- altitude director information on the right of the current altitude (if external VICS is connected)

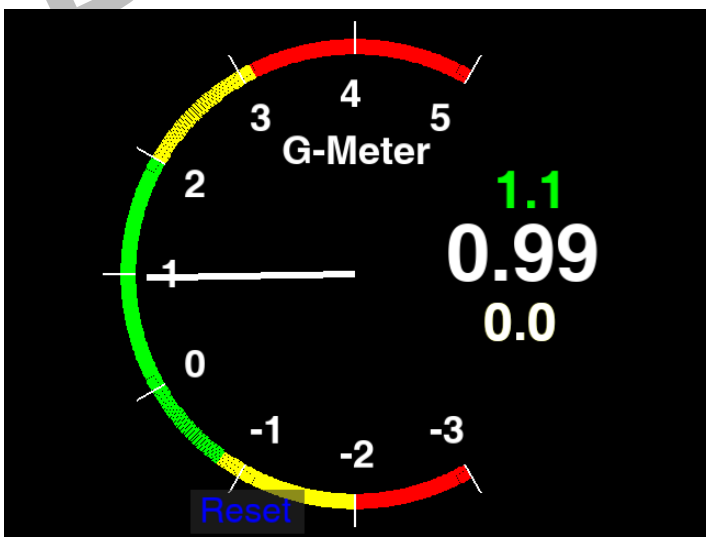
Speed Mode



Speed mode provides:

- current speed information in the center of the display
- speed director information on the left of the current speed (if external VICS is connected)
- speed units

G-Meter mode



G-Meter can display the following information:

1. current G force (needle)
2. highest registered G reached during current flight
3. lowest G reached during the same flight

To reset current values press and hold the left button.

Oil Life Timer mode

The Oil Life Timer displays the cumulative flight time since the last oil change in decimal hours and minutes. It is recommended to reset this timer during each oil change by pressing and holding the right button until the Oil Life Timer resets to '0.0'.

The timer operates as follows:

- **Activation**: The Oil Life Timer starts when the airplane becomes airborne (once Vr is reached).
- **Deactivation**: The timer stops upon landing (when speed is below Vs).

The Oil Life Timer enables pilots to conveniently track the total flight time since the last oil change, allowing for effective scheduling of maintenance.

Fuel Alarm

The Fuel Alarm feature can be enabled or disabled in the **Settings** > **Time** menu. This option allows the user to activate a repetitive alarm that reminds them to switch fuel tanks at a predefined interval (between 0 and 240 minutes).

- **Disabled**: When the alarm is set to '0', it is disabled.
- **Enabled**: When a value between 1 and 240 is set, the unit will display the on-screen reminder message "Switch Fuel Tanks" at the specified intervals.

To dismiss the warning and return to the previous screen, press the left button.

If external VICS module is connected the audio reminder 'Switch fuel tanks' will also annunciate. More details about how to set this function read below under Settings->Time menu description.

Use of external MAG-01 Digital 3-axis Magnetometer and Heading Sensor

MAG-01 Magnetometer Overview

The **MAG-01** is a small, lightweight, and cost-effective source of stabilized magnetic heading information. It accurately senses the Earth's magnetic field in three axes, providing essential data for Air Data and AHRS (Attitude and Heading Reference System) to determine the aircraft's heading. The MAG-01 easily integrates with the ELM1000 or ELM350 systems, though it is important to note that the MAG-01 is currently non-TSO certified and intended for installation in experimental (home-built) airplanes only.

Key Features

- **Microprocessor-Based:** The MAG-01 utilizes advanced microprocessor technology to sense the Earth's magnetic field alignment and relay this information to compatible AHRS systems (ELM1000, ELM350, ELM200/300) for referencing magnetic heading.
- **3-Axis Measurement:** The magnetometer provides full three-axis measurements, ensuring precise and stabilized digital indications of magnetic field strength and direction.
- **Gyroscopic Stabilization:** Built into the magnetometer is a gyroscopic sensor that provides stabilized information across all axes, accommodating the full range of pitch and roll limits.
- **Enhanced Flight Reference:** The ELM1000 and ELM350 AHRS utilize comparative inputs from GPS, the MAG-01 magnetometer, and air data computer information to achieve high integrity and precision in digital flight reference. This system combines the functionalities of a Vertical Gyro and a Directional Gyro to measure Roll, Pitch, and Heading angles.
- **Solid-State Technology:** Replacing traditional rotating mass instruments, the MAG-01 employs long-life solid-state sensing technology to provide electronically stabilized AHRS.

Installation Considerations

When installing the MAG-01, ensure it is positioned away from the AHRS and other electronic components to minimize external magnetic interference. Recommended installation locations include:

- Outboard of the wing at the wingtip
- Tail section
- Inside the vertical stabilizer

Connectivity

The MAG-01 features a DB15 connector on its front wall, requiring only four wires to interconnect with ELM1000 or ELM350 EFIS systems. Additionally, a separate circuit breaker (3A) must be installed and labeled as “Compass” or “MAG-01” in the panel.

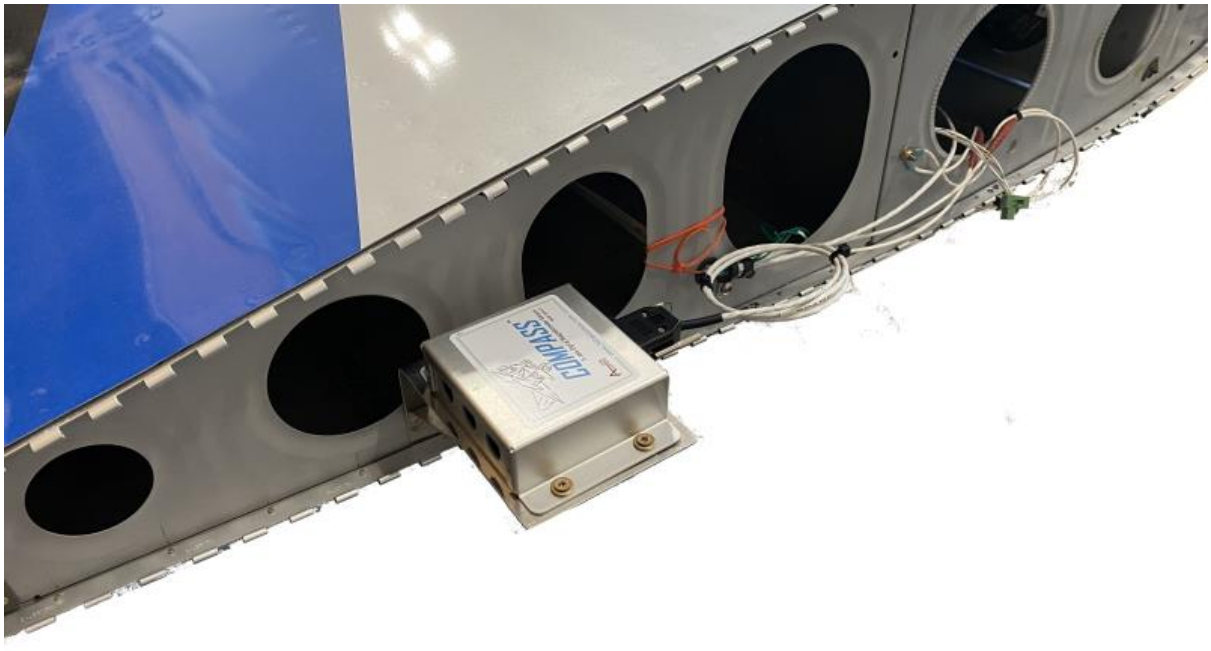
For detailed pin-out diagrams and connection methods, please refer to the “Hardware Installation” section.

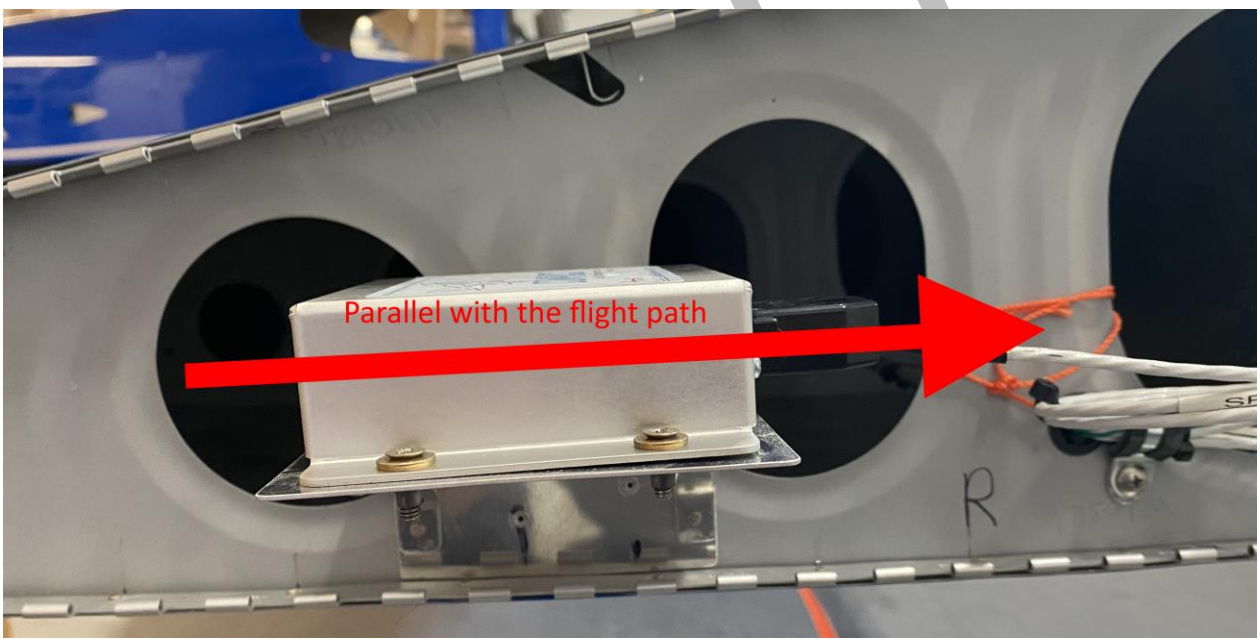
Magnetometer connector pinout:

Pin 1 – Power Input +
Pin 15 – Ground
Pin 10 – CAN Bus Low (should be connected to pin 3 of ELM350 Main Connector)
Pin 11 – CAN Bus High (should be connected to pin 4 of ELM350 Main Connector)

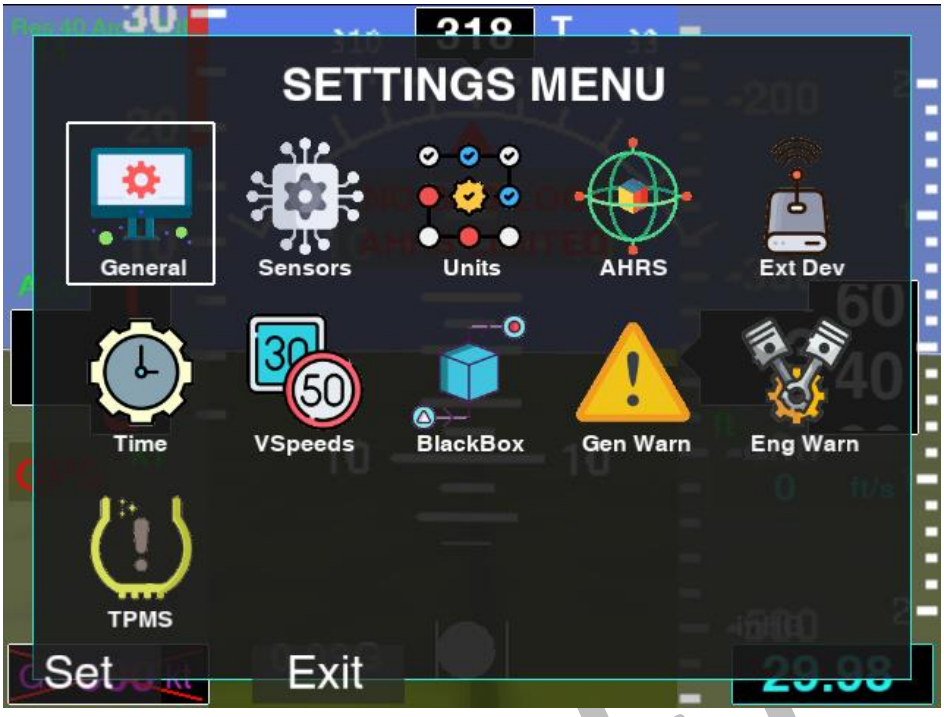
Physical Installation

Magnetometer should be installed with the connector forward and matching the airplane nose direction. Enclosure should be installed in the way so the magnetometer body will be in a parallel with the flight path.
Please see the images provided below for the reference:





12. Settings Menu



The ELM350 built-in **Settings menu** contains various parameters that can be adjusted and configured.

Accessing the Settings Menu:

1. Press the left knob to open the Main Menu.
2. Rotate the left knob to select the **Settings** menu, then press the left knob to enter.

Navigating the Settings Menu:

- Rotate the knob clockwise or counterclockwise to scroll through the menus and submenus.
- Press the left knob to select and open a desired menu or submenu.
- When the menu selector's background is blue, you can scroll through options.
- Upon selecting a desired option, the background color changes from blue to orange.

Adjusting Settings:

- With the selector's background color set to orange, you can change settings by turning the knob.
- Once the desired setting is found, press the knob to apply the selected setting. The menu selector’s background will return to blue.

Exiting the Menu:

- To exit a submenu, navigate to the '…' option (located at the top of any submenu) and press the knob to return to the root of the Settings menu.
- To exit the Settings menu at any time, press the left button labeled 'Exit'.

Note: Some changes may not apply instantaneously. When this occurs, a message "Updating. Please Wait" will be displayed. Once the changes are applied, the message will disappear, and the Settings menu will be shown again.

13. Black Box functionality

The **ELM350** is equipped with a built-in "**black box" recorder** that captures all flight parameters from various sensors at pre-set time intervals.

Recording Intervals:

- By default, the recording interval is set to 10**,000 ms (10 seconds)**.
- Users can select a different time interval in the **Settings menu** under **Black Box submenu** > **'FR Period'** and **'KML Period'**.

Data Recording Process:

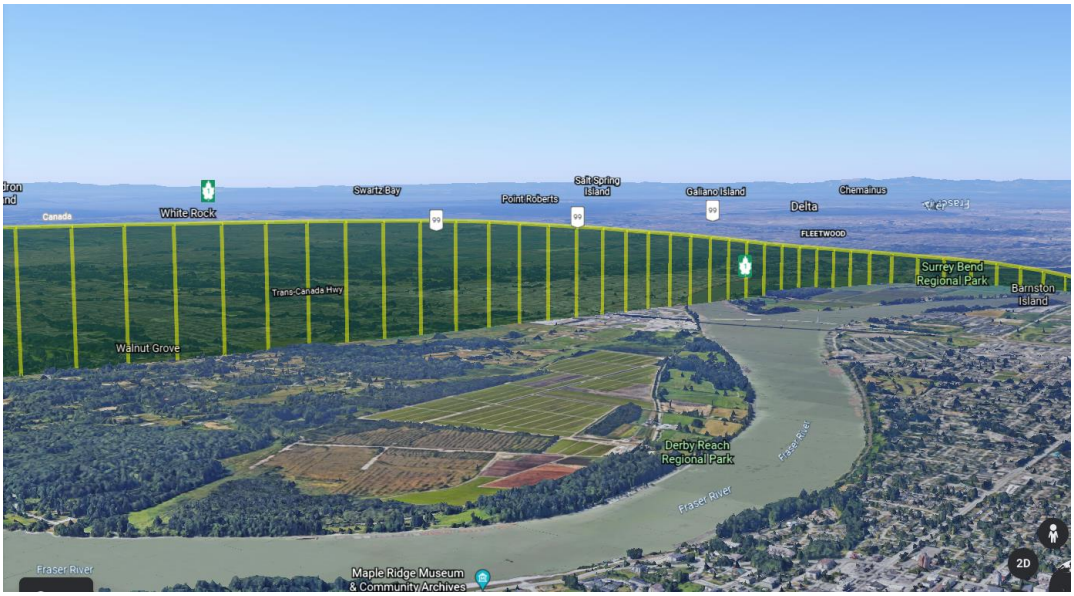
- The black box recorder begins data recording upon takeoff, once the speed reaches **Vr** (rotation speed).
- Recording ceases when the airplane lands, specifically when the speed falls below **Vs** (stalling speed).
- All recorded parameters are stored in the internal flash memory.

Data Exporting:

- Recorded data can be exported from the flash memory to a USB flash drive in two formats:
  - **Internal ELM350 format** (designed for future compatibility with specialized software).
  - **.KML format** for Google Earth.

Using KML Files:

- The exported **.KML file** can be opened using Google Earth software installed on a computer or accessed online via earth.google.com.
- This format allows users to visualize the flight path and altitude of the recorded flight, which can be valuable for flight analysis.



To export past flights from the black box memory on to SD card select from the “Settings menu” > “Black Box submenu” > ***BlackBox Func***.

1. Ensure that USB Flash drive via adapter cable is connected to miniUSB port.
2. Select **BlackBox Func** in the “Settings menu” > “Black Box submenu” by pushing the left knob
3. Choose ‘BB USB Export’ sub setting
4. Push the knob to start export. Display will indicate current export status.
   Once completed you will be prompted.

5. Remove USB flash from the unit and insert to PC. Copy exported files (KML) and open them with Google Earth.
6. Each flight will be exported in individual file with name of file matching the date and time of the flight.

14. Settings menu items and their respective settings:

Submenu: **General Config**

Int Compass – Enables or Disables the use of internal compass (not available yet as an option, planned for future). Must be 'Disabled' at all times.

Pitch Adjust – Allows to adjust pitch horizon position up or down by some degrees.

Ki Gain – Should be set to 50. Do no adjust unless advised by manufacturer

Kp Gain – Should be set to 2500. Do no adjust unless advised by manufacturer

Set Defaults – '*EFIS + AHRS*' will completely reset the settings to default values (factory specified settings), '*EFIS*' will set graphical processing unit to defaults and '*AHRS*' will set the AHRS processing unit to defaults.

Disp Brg – '*Auto*' setting will use auto brightness mode based on the ambient sensor light. Range of *1 to 84* will allow to manually set display brightness. To select 'Auto' choose '0' value for setting.

Unit config – This setting is normally set by manufacturer. For ELM350 model unless otherwise stated it should be set to Pitot+GPS by default.

Start Mode – By default, the unit powers on with the "artificial horizon" mode displayed. The mode upon power "ON" can be set to any other mode, such as: *AI* – artificial horizon, *Compass* – compass mode, *Time* – extended flight time mode, *GMeter* – g-meter display mode, *Altimeter* – altimeter display mode, *Time(L)* – time/flight time mode

Show wind data – Enables/Disables wind speed and direction on AI display. Currently this mode is not functional. Option should become available with external compass add-on.

Maps Source – Choose where maps and other terrain databases are stored. By default, it set to internal however in newer versions by default it will set to ***SD Card***. Do not change unless directed by manufacturer.

Horizon Mode – Artificial Horizon mode can either be selected as 'Classic 2D' mode with no synthetic vision and obstacles awareness or as 'Test 3D' mode with synthetic vision and terrain/obstacle awareness functionality.

Demo Mode – Must always be set to Disabled unless used by dealer for ground stand demonstrations.

Dev ctrl – This mode is used to switch AHRS, EnGood and other connected supported units to specific mode. Directed by technical support if required.

GPS Source – Sets where ELM350 takes its GPS data from. By default always set to Auto.

Charts Source – Should be set to Pure or MBTiles depends on the type of chart maps is in use. Normally set to MBTiles.

Charts Scheme – For Charts Source: Pure set to XYZ and for Charts Source MBTiles set to TMS.

Submenu: **Sensors**

Alt Sensor – Allows to select internal pressure sensor to be BMP280 or HSCMRN. By default, it always should be set to HSCMRN. In case if static system is blocked and unusable the BMP280 internal pressure sensor can be used as a backup.

IMU Type – Should always be set to MPU9250.

BMP280 Offset – Allows to offset (positive or negative) the static pressure coming from backup pressure sensor to calibrate it. Normally this offset is pre-set at production but can be changed if needed during 24-month pitot/static calibration.

HSCMRN Offset – Allows to offset (positive or negative) the static pressure coming from primary pressure sensor (only for GPS + Pitot version of the unit) and calibrate it. Normally this offset is pre-set at production but can be changed if needed during 24-month pitot/static calibration.

Pitot Offset – Allows to offset (positive or negative) the pressure value coming from pitot sensor to calibrate it. Normally this offset is pre-set at production but can be changed if needed during 24-month pitot/static calibration.

VICs Lidar – Whenever VICs module with LiDar altimeter is connected set it to Enabled.

LiDar Calibrate – Allows to offset the height of LiDar sensor installation

Submenu: **Units**

Speed Units – Display speed units for GPS, TAS and Airspeed in *Knots*, *MPH* or *KPH*

Alt Units – Display altitude units in '*Feet'* or '*Meters'*

Press Units – Display pressure units in '*inHg'* or '*Bar'*

Temp Units – Display temperature units in *'Celsius'* or *'Fahrenheit'*

Fuel Units – Display fuel units in Liters or Gallons

Eng Temp Units – Display engine temperature in *'Celsius'* or *'Fahrenheit'*

Submenu: **AHRS Config**

***Trace** ** - Trace related options are intended for engineering use only and not described nor recommended for use by customer.

AHRS Reset – Forces AHRS part to restart, similar to "power ON/OFF" for internal AHRS only.

Corr Force – Correction force for banking turns. Should be always set to 'Auto' or 'Legacy' modes. Normally always set 'Auto'.

Accl Cal Ovrd – When the device comes from factory, this option is set to "Enabled". On each power 'ON', calibration settings from memory will be used. '*Re-Cal*' setting will force re-calibration of the roll and pitch when in 'Enable' mode. When set to '*Disabled*', the device will recalibrate attitude (roll, pitch) on each power 'ON' for current unit position. Set to '*Enable*' will lock current calibration and write it to memory.

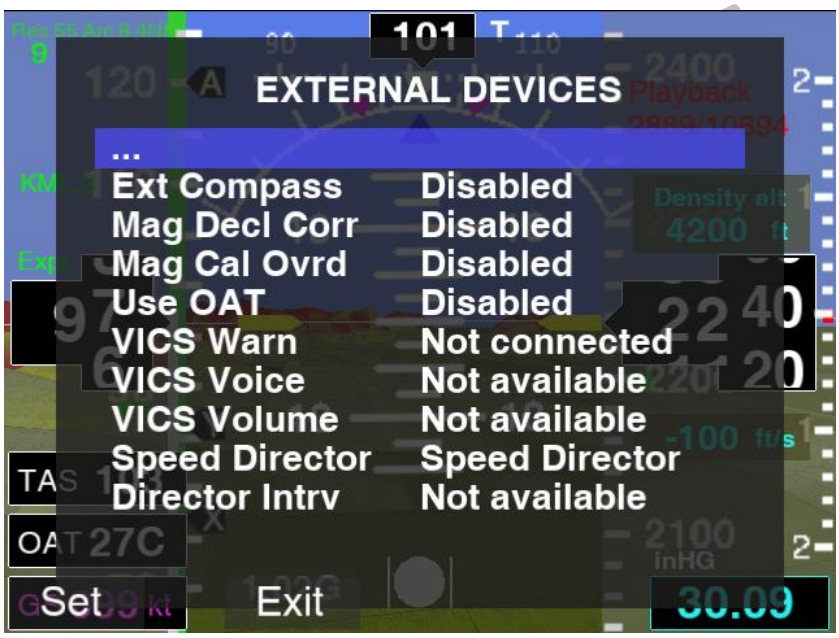
Accel Limit –This value represents the acceleration or deceleration threshold after which compensation for the attitude pitch indication is added to ensure proper attitude indication during rapid acceleration or deceleration (such as during take-off or landing). By default, acceleration limit is set to 1.2 kt/s. This value should be suitable for most airplanes, but for some airplanes, a different value can be chosen between 0.1 kt/s to 8 kt/s. Acceleration limit can also be disabled, if desired.

AHRS Mode – Source for AHRS data. Normally set to 'Primary' which refers to internal AHRS. Under certain circumstances may be set to 'Off/BackUp' mode which will use external AHRS source of attitude information.

ASI Calibrate – Airspeed sensor calibration mode. This normally done during production and does not require user to change the setting. However on some occasion (24-month pitot/static calibration) etc this function can be used. Function will recalibrate pitot sensor bias. It should be calibrated when avionics is ON but engine is off and no winds over 4-5 knots blowing to pitot tube sensor. Pitot tube sensor should be opened to ambient pressure at the time of calibration.

Mag Correct – Magnetometer correction of magnetic/true direction. Currently not in use.

Submenu: **External Devices**



Ext Compass – External Compass. ELM350 can work in conjunction with an external compass or compass built into external AHRS. Should an external compass be connected to ELM350, it can be activated in this menu option by selecting "Compass" or "Compass + AHRS". By default, external compass is "Disabled".

Mag Decl Corr – Declination correction – when GPS source for heading is in use, it is always 'True' direction. Enabling this option will automatically recalculate to 'Magnetic' direction based on magnetic declination in current location (based on GPS track and coordinates).

Mag Controls – External Magnetometer (compass) Controls
Mag Auto Cal – Default mode for compass
Mag Re-Cal/En – Magnetometer Recalibrate and Enable (for factory use only)
Acc Re-Cal/En – Magnetometer Accelerometer Recalibrate/En (for factory use only)
Mag Algo: 0 or 1. Default is 0.
Set N, NE, E, SE, S, SW, W, NW – Compass Rose Calibration for compass
Reset NESW Calibration – Resets the Compass Rose Calibration
Deviation Cal (OFF) – Default is OFF
Reset Deviation Cal – Resets the deviation calibration
Compass Defaults – Resets compass to defaults (for factory use only)
Set Bias X, Y, Z – factory settings only
Set Scale X, Y, Z – factory settings only
Mag Cal Idle – factory settings only

Use OAT – Enables/Disables OAT sensor readings. Please note that if OAT is disabled some other information such as TAS will become unavailable. Default set to Enabled.

VICS Warn* – Enables/Disables VICS external module warnings and allows to choose specific warnings only.

VICS Voice* – Allows to choose between Male and Female voices for external VICS module.

VICS Volume* – Sets the output volume for external VICS module.

Speed Director* – Enables/Disables Speed Director mode and allows to choose warning type

Director Intrv* – Sets the interval in seconds for Altitude and Speed Directors voice warnings

Altitude Director* – Enables/Disables Altitude Director mode and allows to choose warning type

COM1 Speed – Speed of the RS232 port1
COM1 Mode – Mode of operation for RS232 port1
COM2 Speed – Speed of the RS232 port1
COM2 Mode – Mode of operation for RS232 port1
Engine Monitor – Not used in this configuration

Alt Encoder Mode – Whenever ELM350 is used as an altitude encoder for various types of transponders, specific output protocol can be set here. Works in conjunction with appropriate COM Mode port settings (Altitude Encoder Out).

NMEA Out Message - Set the type of NMEA Out message for autopilot. By default always should be set to *'Internal'*.

uAvionix Mode – Sets the communication mode with uAvionix tailBeaconX. Default is HalfDuplex

**Details about VICS functionality and menu settings can be found in dedicated VICS Module Manual.*

Submenu: **Time**

Time and Date settings – Current time in 24h format and Date settings.

Time Zone – Setting for current time zone. UTC time is calculated based on this setting and current time.

Fuel Alarm – Sets repetitive alarm for fuel tanks switching. When set to 0 alarm is 'OFF'. Every pre-set period of time unit will show on-screen alarm message. If external VICS module is connected the audio reminder 'Switch fuel tanks' will also sound. To disable function set it to 0.

Total Oil Life, Hobbs and Air time – You can adjust Total Hobbs, Air time and Oil Life times from here.

Submenu: **V Speeds**

Speed V* – Sets *V speed* values for airplane in **Knots**. **WARNING! It is important to have these speeds set to match your airplane specific speeds.** Please refer to airplane's Pilot Operating Handbook ("POH"). A separate menu option is available for each speed type: Vr, Vx, Vy, Va, Vs0, Vs1, Vfe, Vno, Vne.

Submenu: **BlackBox**

KML Trace – Black Box KML Trace functionality option can be set to 'Enabled' for normal black box mode when all flight information is recorded for each flight (once the airplane is airborne and until it lands). Option can be set to '*Disabled*' - Black Box functionality will be turned off and no flight information will be recorded.

FR Period – Basic Flight Data trace period can set the time interval between black box readings. All flight parameters can be recorded into internal flash memory every 1,000ms to 10,000ms (1 sec to 10 sec). By default, the interval is set to 5,000ms (5 sec). It is recommended to keep this setting.

KML Period – KML Flight Data (Google Earth formatted) trace period can set the time interval between black box readings. Information can be recorded into internal flash memory every 1,000ms to 10,000ms (1 sec to 10 sec). By default, the interval is set to 6,000ms (6 sec). It is recommended to keep this setting.

BB, Eng USB Export – allows exporting previously stored FR or KML flight data logs for further use and review. USB flash drive should be connected via adapter cable.

Scrn USB Export – allows exporting screen shorts in .png format. USB flash drive should be connected via adapter cable.

Screenshot of the currently displayed information can be taken at any time by simultaneous press of both buttons for short time. This is useful feature for the case when you want to store your display information for further review.

Software Update – Activate software/DB update mode for ELM350

EnGood Period – How often EnGood monitor will record all current engine params to internal storage for further review. Default to 6sec.

Cal USB Import/Export – Calibration settings for EnGood import and export. These settings are unique to airplane and EM-01 Engine Monitor module

Submenu: **Info/Warnings**

Terrain Warning – Enables/Disables terrain awareness warning when in 3D artificial horizon mode only.

Obstacle Warning – Enables/Disables obstacle awareness warning when in 3D artificial horizon mode only.

Obstacle Min Dist – minimal distance to obstacle in NM to trigger warning. Works in conjunction with 'Obst Min Hdg'. By default set to 3NM.

Obstacle Min Hdg – minimal difference between current heading and track to obstacle (first hit point), in degrees, that will trigger warning. Works in conjunction with 'Obst Min Dist'. By default set to 3 degrees.

Terr Red Zone –Set how high the airplane should be over terrain to avoid triggering Red color (alarm) map. When airplane altitude is higher than the pre-set value over the terrain, the Red color (alarm) on the map will not be triggered. Default set to 300ft.

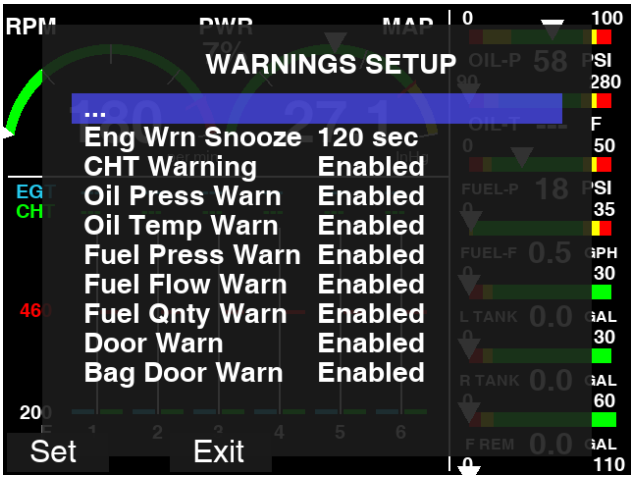
Terr Yellow Zone –Sset how high the airplane should be over terrain to avoid triggering Yellow color (warning) map. When airplane altitude is higher than pre-set value over the terrain, the Yellow color (warning) on the map will not be triggered. Default set to 700ft.

Traffic Warn – Enabled/Disables a traffic warning when external GDL90 ADSB source is connected

Traff Min Dist/Alt – Sets minimal distance to airplane when traffic becomes a threat and warning is indicated.

LiDar Altimeter – Sets a mode for LiDar altimeter connected to VICs system

Submenu: Warning Setup

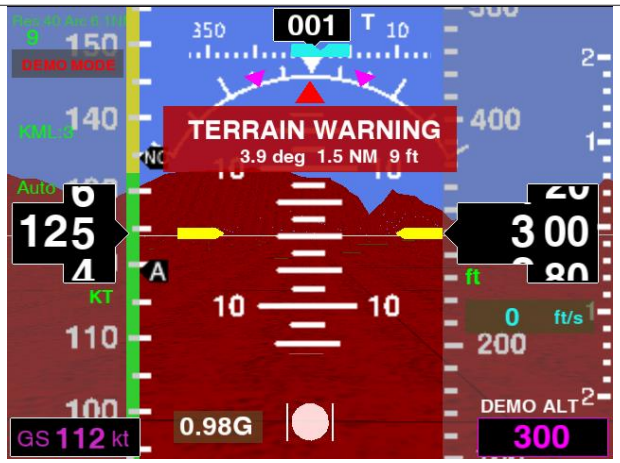


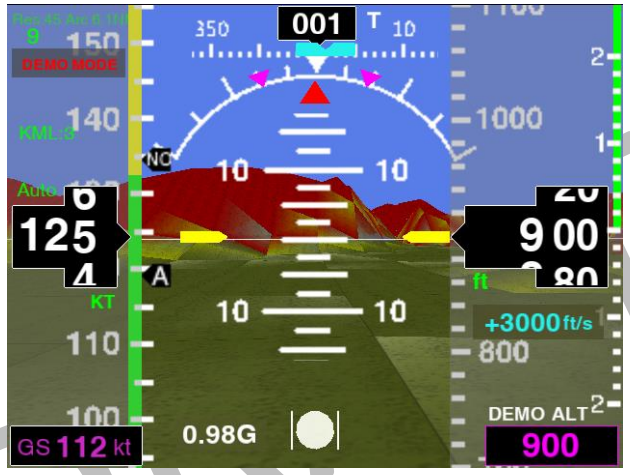
Engine Warning Snooze – When engine warning is raised and then snoozed how long to wait before repetitive warning is issued.
Various warnings – Enable/Disable various warnings depends on desired configuration
Fuel Alarm – Set the time to display a fuel alarm "Switch Tanks" message. Refer to section 7.2 for more information.

Submenu: TPMS SETUP

TPMS Mode – Enables/Disabled TPMS mode in EnGood Monitor EM-01 module
Sensor ABC – Sets 3-byte code of each individual TPMS Sensor.
Sensor 1 is nose wheel while 2 and 3 are the L and R mains.

<u>Terrain and Obstacle Awareness Functionality</u>





The **ELM350** features an advanced **Terrain Awareness and Warning System** designed to enhance flight safety by providing real-time alerts regarding terrain and obstacles ahead.

Color-Coded Terrain Alerts:

- **Red Zone Alert:**
  - When the terrain ahead is at or below a preset altitude (configured in the **Red zone setting**), it will be displayed in **red** on the screen.
  - A **Terrain Awareness Warning** will pop up, showing:
    - Track and distance to the first impact point.
    - Elevation of that impact point.

- **Yellow Zone Warning:**

- If the terrain ahead is displayed in **yellow**, this indicates that the altitude between the airplane and the terrain is above the **Red zone setting** but below the **Yellow zone setting** (warning zone).

Obstacle Alerts:

- The same awareness warning will be activated for obstacles. However, the terrain color will not change.

Voice Alerts:

- If the **VICs voice system** is connected, an audible alarm message will announce, "**TERRAIN AHEAD**" or "**OBSTACLE AHEAD**," providing an additional layer of alert for the pilot.

Print Screen Functionality

During the operation of the **ELM350**, users can capture a screenshot of the currently displayed image at any time. This feature is particularly useful for documenting parameters shown on the display or for troubleshooting with the manufacturer.

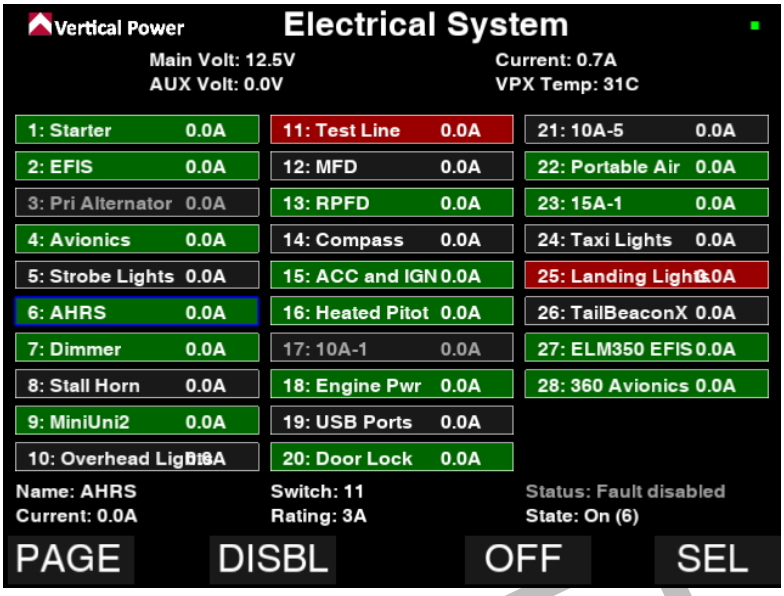
How to Capture a Screenshot:

- To take a snapshot, briefly press and release **both buttons** simultaneously.
- The screenshot will be saved in **.png format** with a filename that includes the current date and time, stored in the internal memory.

Exporting Screenshots:

- Screenshots can later be exported to a USB drive. To do this, navigate to the **'Black Box' submenu** and select the appropriate function for exporting screenshots.

VPX Solid State Circuit Breaker Module support



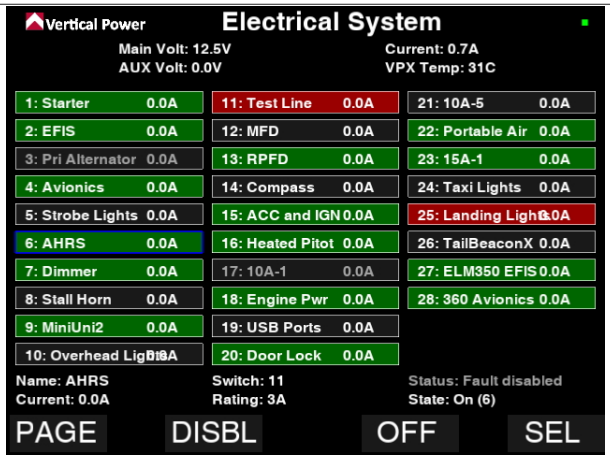
The **ELM350** features support for the **Vertical Power (VPX)** solid-state circuit breaker module, enabling the monitoring of live-time parameters, error clearing, and state switching for individual circuit breakers.

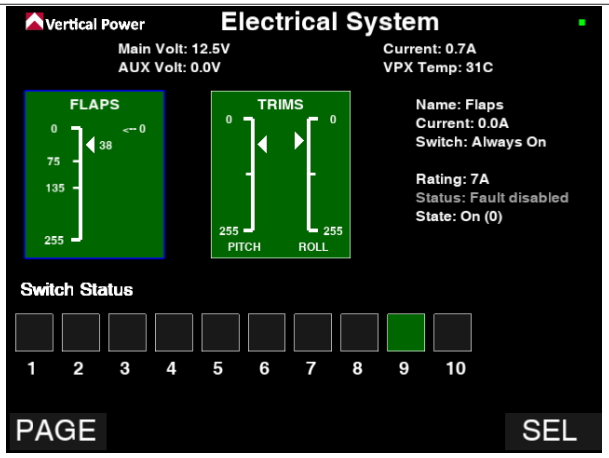
Communication:

- The ELM350 communicates with the VPX module via an **RS232 interface**.
- This communication can be selected through the **External Devices menu**.
- The default baud rate for this communication is set to **57600**.

Display Information:

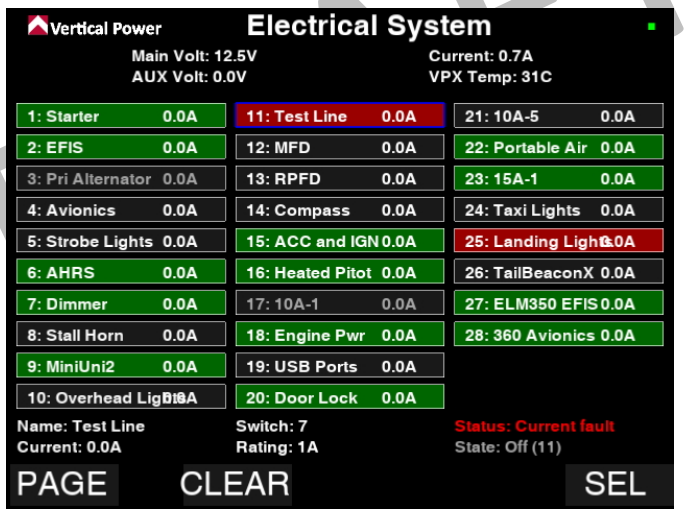
- When the VPX module is connected, its current state will be displayed on the main screen.
- The VPX menu consists of **two pages**:
  - **Page 1:** Displays circuit breaker information.
  - **Page 2:** Shows trims and switch information.
- By rotating the **right-side knob**, you can select the desired circuit breaker, which will be highlighted by a blue rectangle.





Circuit Breaker Control:

- When the circuit breaker is in a non-alarm mode:
  - The **left button** is used to **Enable/Disable** the breaker.
  - The **right button** is used to **turn it ON or OFF**.



When the selected circuit breaker is in **alarm mode**:

- The **left button** is used to **clear the alarm state**.

15. Operation Limitations

- Information from airplane's POH is always supersedes information provided in this manual
- This unit is non-TSO certified and cannot be installed on the certified airplane unless special permission is obtained from regulatory agency/airplane manufacturer.

16. Warranty coverage and limitations

360 Avionics company provides the warranty for this product against defects in materials and workmanship for the duration of 24-month (2 calendar years) from the date of retail purchase of this product by end user ('Warranty Period"). If a hardware defect arises and a valid claim is received within the Warranty Period, at its option and as the sole and exclusive remedy available to Purchaser, 360 Avionics company will either (1) repair the hardware defect at no charge, using new or refurbished replacement parts, or (2) exchange the product with a product that is new or which has been manufactured from new or serviceable used parts and is at least functionally equivalent to the original product, or, at its option, if (1) or (2) is not possible (as determined by 360 Avionics company in its sole discretion), (3) refund the purchase price of the product. Prior a refund is given, the product for which the refund should be provided must be returned to 360 Avionics and becomes 360 Avionics's property.

This Limited Warranty applies only to hardware products manufactured by 360 Avionics company that have the "360 Avionics" trademark, tradename, or logo attached to them at the time of manufacture by 360 Avionics company. The Limited Warranty does not apply to any non 360 Avionics hardware products or any software, even if packaged or sold with 360 Avionics hardware. Manufacturers, suppliers, or publishers, other than 360 Avionics company, may provide their own warranties to the Purchaser, but 360 Avionics and its distributors provide their products AS IS, without warranty of any kind. Software distributed by 360 Avionics company (with or without the 360 Avionics's brand name including, but not limited to system software) is not covered under this Limited Warranty. Refer to the licensing agreement accompanying such software for details of your rights with respect to its use. This warranty does not apply: (a) to damage caused by use with non 360 Avionics company products; (b) to damage caused by accident, abuse, misuse, flood, fire, earthquake or other external causes; (c) to damage caused by operating the product outside the permitted or intended uses described by 360 Avionics; (d) to damage caused by service (including upgrades and expansions) performed by anyone who is not a representative of 360 Avionics or an 360 Avionics Authorized Reseller; (e) to a product or part that has been modified to significantly alter functionality or capability without the written permission of 360 Avionics company; (f)to consumable parts, such as batteries, unless damage has occurred due to a defect in materials or workmanship; or (g) if any 360 Avionics serial number has been removed, altered or defaced.

To the extent permitted by applicable law, this warranty and remedies set forth above are exclusive and in lieu of all other warranties, remedies and conditions, whether oral or written, statutory, express or implied, including, without limitation, warranties of merchantability, fitness for a particular purpose, non-infringement, and any warranties against hidden or latent defects. If 360 Avionics cannot lawfully disclaim statutory or implied warranties then to the extent permitted by law, all such warranties shall be limited in duration to the duration of this express warranty and to repair or replacement service as determined by 360 Avionics in its sole discretion. 360 Avionics does not warrant that the operation of the product will be uninterrupted or error-free. 360 Avionics is not responsible for damage arising from failure to follow instructions relating to the product's use. No 360 Avionics reseller, agent, or employee is authorized to make any modification, extension, or addition to this warranty, and if any of the foregoing are made, they are void with respect to 360 Avionics company.

17. TSO approval and Liability limitations

This product does not yet have any TSO approvals as a flight instrument. 360 Avionics company as a manufacturer of this product will not help and responsibility for any sort of damage or destruction which can be caused by use of this product to any part of airplane caused by operation of this product.

To the extent permitted by applicable law, 360 Avionics company is not responsible for indirect, special, incidental or consequential damages resulting from any breach of warranty or condition, or under any other legal theory, including but not limited to loss of use; loss of revenue; loss of actual or anticipated profits (including loss of profits on contracts); loss of the use of money; loss of anticipated savings; loss of business; loss of opportunity; loss of goodwill; loss of reputation; loss of, damage to or corruption of data; or any other loss or damage howsoever caused including the replacement of equipment and property, any costs of recovering, programming, or reproducing any program or data stored or used with 360 Avionics company products and any failure to maintain the confidentiality of data stored on the product. Under no circumstances will 360 Avionics company be liable for the provision of substitute goods or services. 360 Avionics company disclaims any representation that it will be able to repair any product under this warranty or make a product exchange without risk to or loss of the programs or data. Some jurisdictions do not allow for the limitation of liability for personal injury, or of incidental or consequential damages, so this limitation may not apply to you.

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