ELM800/1000 EFIS

Specification and Installation Instructions

Rev1.9

May 2026

Model

- EFIS **ELM800**

Note:

ELM800 EFIS is non-TSO certified flight instrument.

Model

- EFIS **ELM1000**

Note:

ELM1000 EFIS is non-TSO certified flight instrument.

Credits

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Revision History

Below is the document's revision story.

Revision #	Revision Date	Comments
Rev 1.0	May 20, 2023	Initial Release of this document
Rev 1.0.1	August 07, 2023	Additional information added
Rev 1.1	September 26, 2024	Additional features and info
Rev 1.2	May 11, 2025	ELM800 and features added
Rev 1.3	February 06, 2026	Additional features added
Rev1.4	March 14, 2026	Rotax 9xx iS series support
Rev1.5	May 02, 2026	Additional features added
Rev1.6	June 21, 2026	Additional features added
Rev1.7	July 09, 2026	Mistakes fixed
Rev1.8	August 29, 2026	Additional features added
Rev1.9	September 05, 2026	New features introduction

Contents

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1. Introduction

The ELM800/1000 Electronic Flight Instrument System (EFIS) is an advanced electronic device designed to provide various flight information to pilots of experimental airplanes. The ELM800/1000 are a non-TSO-certified flight instruments, available in a form factor compatible with most standard aviation panels. This product manual outlines the EFIS functionality, installation, and operation. The functionality, installation and operation of ELM800 and ELM1000 are almost identical.

Please note: In this document, the terms "EFIS", “ELM800”, "ELM1000", "device", "unit", and "instrument" are used interchangeably when referring to the ELM800 / ELM1000 EFIS.

2. General Description

The ELM800 / ELM1000 Electronic Flight Instrument System (EFIS) is an electronic device comprised of a microcontroller, an LCD display, a touch panel, a housing case, and various built-in sensors, including a gyroscope, accelerometer, static and dynamic pressure sensors, and a GPS receiver. Additionally, there are two external sensors: a GPS antenna and an Outside Air Temperature (OAT) sensor. The integrated LCD display is used to present all flight information.

The ELM800 / ELM1000 EFIS consists of two distinct modules: the Graphics Processing Unit (GPU) and the Sensors Processing Unit, also known as the Attitude and Heading Reference System (AHRS). The GPU is directly connected to the display, controlling the LCD and all output data. The AHRS is responsible for reading and processing sensor data. Both units have their own firmware and function independently, communicating with each other at high speeds via dedicated protocols.

For user control, the ELM800 / ELM1000 features two rotating knobs and six push buttons on the front panel. A built-in USB port is also located on the front for easy access. Additionally, the ELM800 / ELM1000 is equipped with an internal SATA drive for map and database storage.

3. Technical Specifications

Description	ELM800/1000
Input voltage	+10 to +28 Volts
Power consumption	25W
Current	1.8A at 14V
Unit size ELM800	220mm x 150mm x 75mm (with knobs)
Unit size ELM1000	280mm x 205mm x 75m (with knobs)
Weight	750 g
Operation humidity	25% to 90%
GPU processor	NVIDIA
Sensors processor	ARM
System startup time	26 sec
Display ELM800	8.0” ultra-bright 1280x720px
Display ELM1000	10.2” ultra-bright 1280x800px
USB Port	Standard USB 2.0
External communication	Proprietary LAN, CAN bus (proprietary protocol) and RS232 (NMEA)
Pitch/Roll range	360 degrees
Altitude range	-1000ft to 32000ft
Vertical speed range	10000ft/min up/down
Receiver	u-Blox high-sensitivity GPS receiver with WAAS
Antenna	Mag mount GPS with male SMA connector
Pitot/Static/AOA lines	¼” Quick connect
Manufacturer	360Avionics

4. AHRS (sensors processing unit)

Please note that the ELM800 / ELM1000 EFIS may feature either an internal, built-in AHRS system or an external AHRS module.

The Attitude and Heading Reference System (AHRS) is based on a combination of accelerometers, gyroscopes, dynamic pressure sensors, and GPS data. These sensors are essential for accurately calculating attitude and heading, which include roll, pitch, yaw, and heading information. Depending on the version of the unit, additional sensors, such as an Outside Air Temperature (OAT) sensor or magnetometer, may also be used to enhance AHRS calculations.

The sensor data is processed in the AHRS module, where complex mathematical algorithms and digital filtering are applied to estimate the current Roll, Pitch, and Yaw (RPY) and display them on the screen via the artificial horizon. Depending on the sensor accuracy and environmental factors, some errors in the estimated RPY may occur. For best performance, GPS data and/or True Airspeed (TAS) or Calibrated Airspeed (CAS) are necessary to reduce errors, particularly during banked turns. It is highly recommended to keep the GPS antenna connected at all times, as GPS-based parameters help improve attitude estimation. Coordinated flight will further minimize errors in RPY calculations.

Reminder for Pilots: Maintaining coordinated flight is critical for accurate RPY estimation. Short periods of uncoordinated flight may not cause significant errors, but prolonged uncoordinated flight will lead to inaccuracies in RPY calculations.

In an uncoordinated flight, the RPY parameters displayed on the artificial horizon will likely show errors, meaning the horizon line on the display will not match the true horizon as perceived by the pilot. After resuming coordinated flight, it will take approximately 20–35 seconds for the RPY data to correct itself and return to accurate readings.

Steep banking turns, especially those exceeding 50–55 degrees, can also introduce errors in the RPY output, as sensor readings may reach their upper or lower thresholds. Once normal, coordinated flight resumes, the RPY data will typically correct itself within 20–35 seconds.

Aerobatic maneuvers will likely result in substantial errors in artificial horizon and attitude indications due to the limitations of the sensors. After returning to normal flight conditions, it may take over 1 minute for the RPY data to stabilize and show accurate attitude on the display.

5. Pitot and Static systems

Pitot/Static/AOA + GPS:
The ELM800 / ELM1000 EFIS is equipped with highly accurate built-in dynamic and static pressure sensors, with Pitot and Static ports located on the back of the unit or the external AHRS module (if applicable). The Pitot sensor is the primary source of airspeed data. However, in cases where the Pitot sensor's airspeed information is deemed unreliable (as determined by manufacturer-defined internal error thresholds), the system will automatically switch to displaying ground speed derived from the GPS sensor. When this occurs, an appropriate alert will be shown on the display.

True Airspeed (TAS) is available in this version of the EFIS when an Outside Air Temperature (OAT) probe is installed and connected. The installation of the OAT probe also enables additional enhanced functionality within the unit.

The Pitot, Static, and Angle of Attack (AOA) ports are designed for ¼" quick-connect fittings. **Note:** AOA is an optional feature and is not included in the standard configuration of the ELM800 / ELM1000.

When connecting the Pitot/Static/AOA lines to the EFIS, it is crucial to perform a pitot/static leak test on the aircraft to ensure that all connections are properly sealed and plumbed.

Airspeed and altitude sensors come factory-calibrated and do not require any additional calibration after installation.

6. LCD Display

The **ELM800** features a high-definition LCD display with a resolution of **1280 x 720 pixels**, offering excellent color reproduction and contrast. It utilizes **high-brightness, sunlight-readable technology** with a **8.0" diagonal**. This **TFT LCD** display, equipped with a bright backlight, is designed for use in environments with direct sunlight. A **capacitive touch panel** is mounted on top of the LCD, allowing for smooth and responsive touch interaction.

The **ELM1000** features a high-definition LCD display with a resolution of **1280 x 800 pixels**, offering excellent color reproduction and contrast. It utilizes **high-brightness, sunlight-readable technology** with a **10.2" diagonal**. This **TFT LCD** display, equipped with a bright backlight, is designed for use in environments with direct sunlight. A **special capacitive touch panel** is mounted on top of the LCD, allowing for smooth and responsive touch interaction.

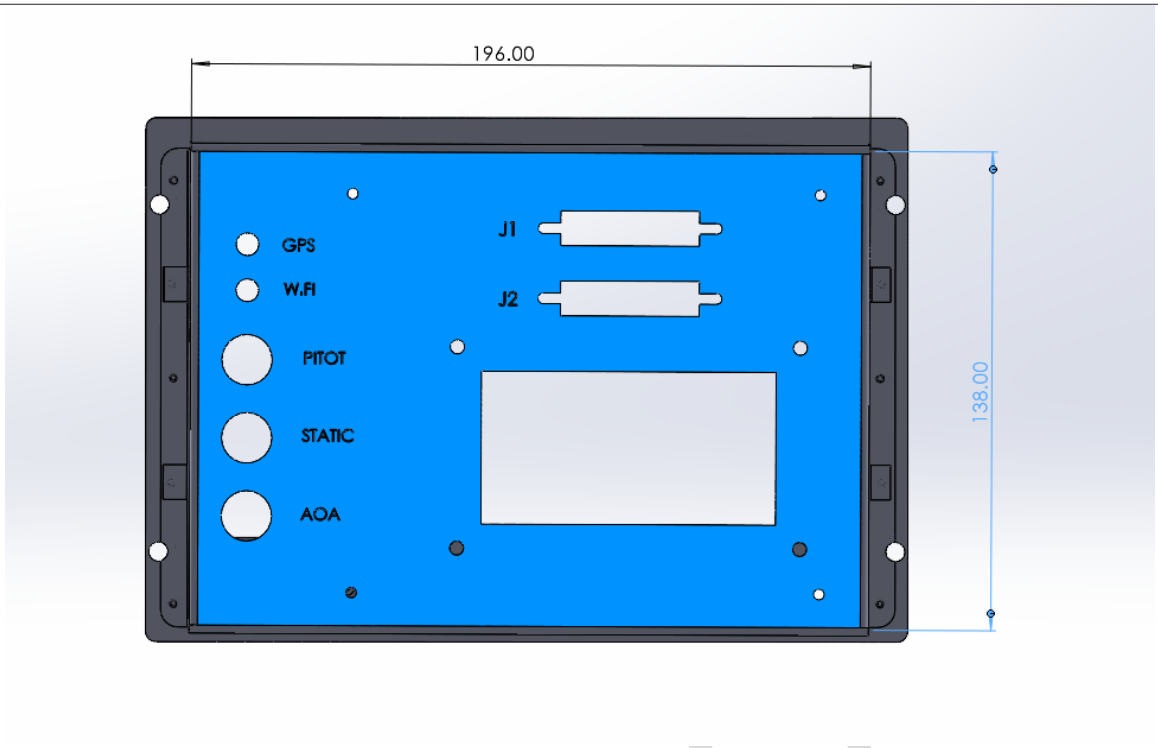
The ELM800 / ELM1000 also includes **built-in ambient light sensors** located on the front panel. The **auto-brightness** feature can be toggled in the **Settings menu** under **General Config > Disp Brg**.

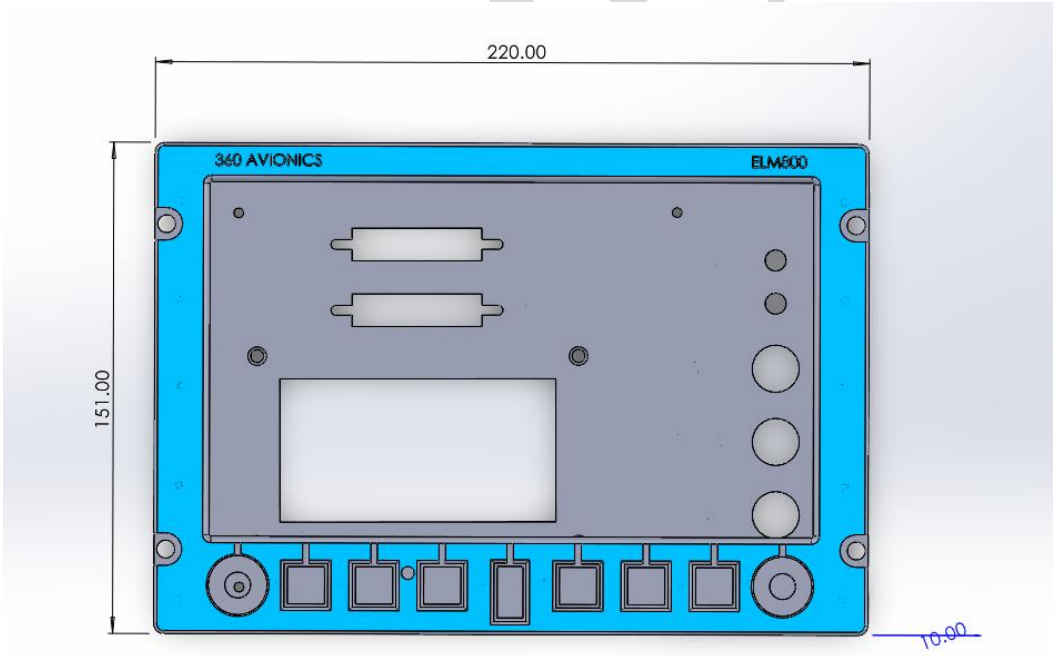
When the auto-brightness feature is enabled, the display brightness automatically adjusts to ambient light conditions, becoming brighter in direct sunlight and dimmer at night for optimal readability.

7. Product installation

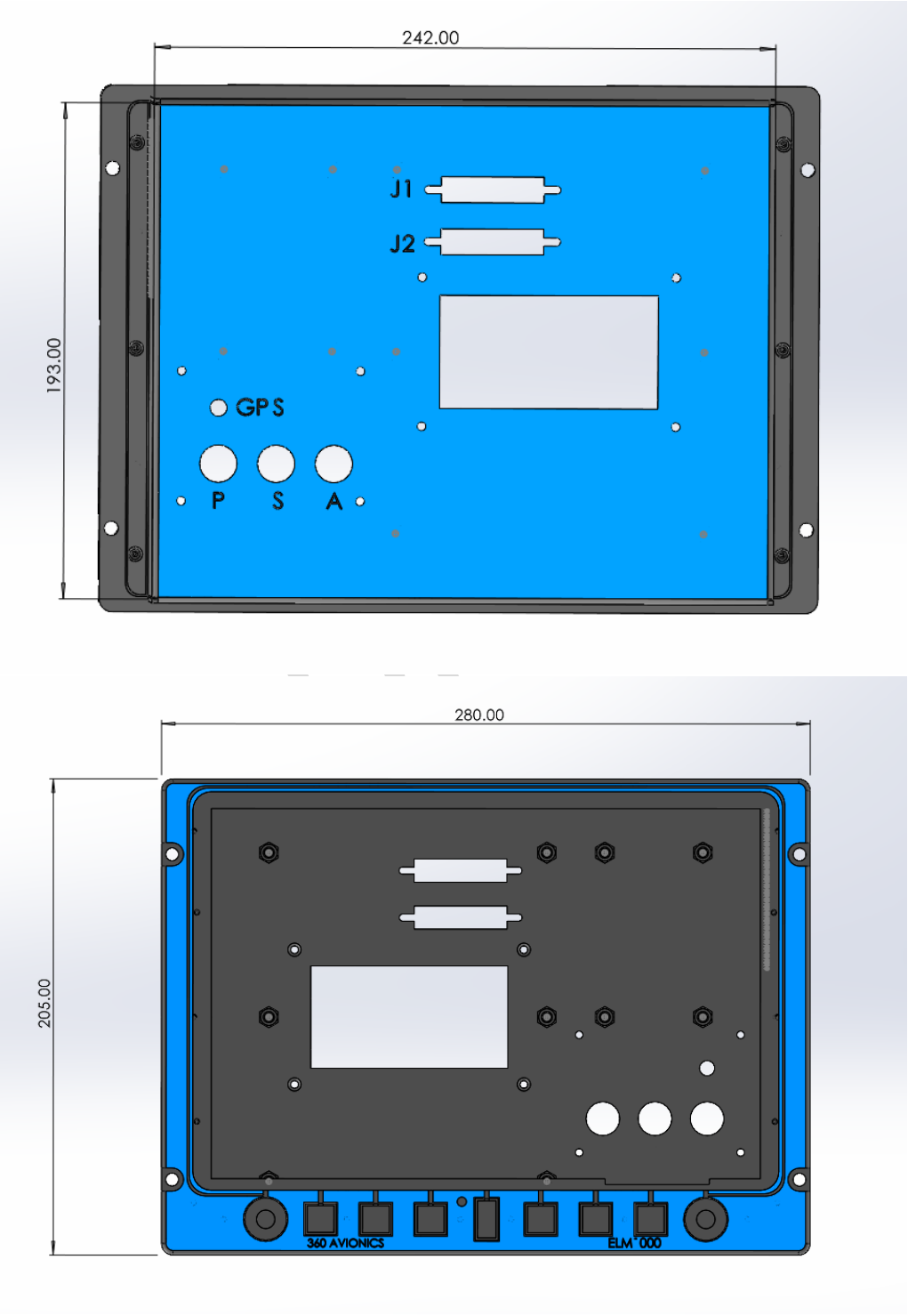
All dimensions are given in Millimeters (mm).

ELM800 EFIS requires rectangle cutout in airplane panel for installation.
The dimensions of the rectangle cutout are shown in the drawing below and they are respectively 196mm in width and 138mm in height.



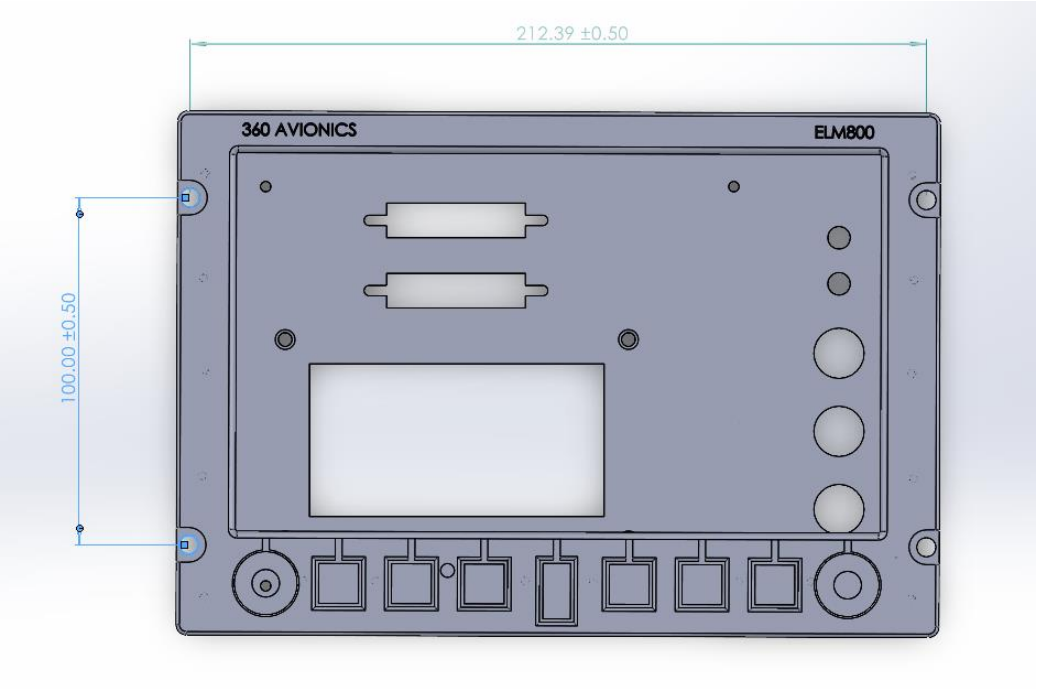


ELM1000 EFIS requires rectangle cutout in airplane panel for installation.
The dimensions of the rectangle cutout are shown in the drawing below and they are respectively 242mm in width and 193mm in height.

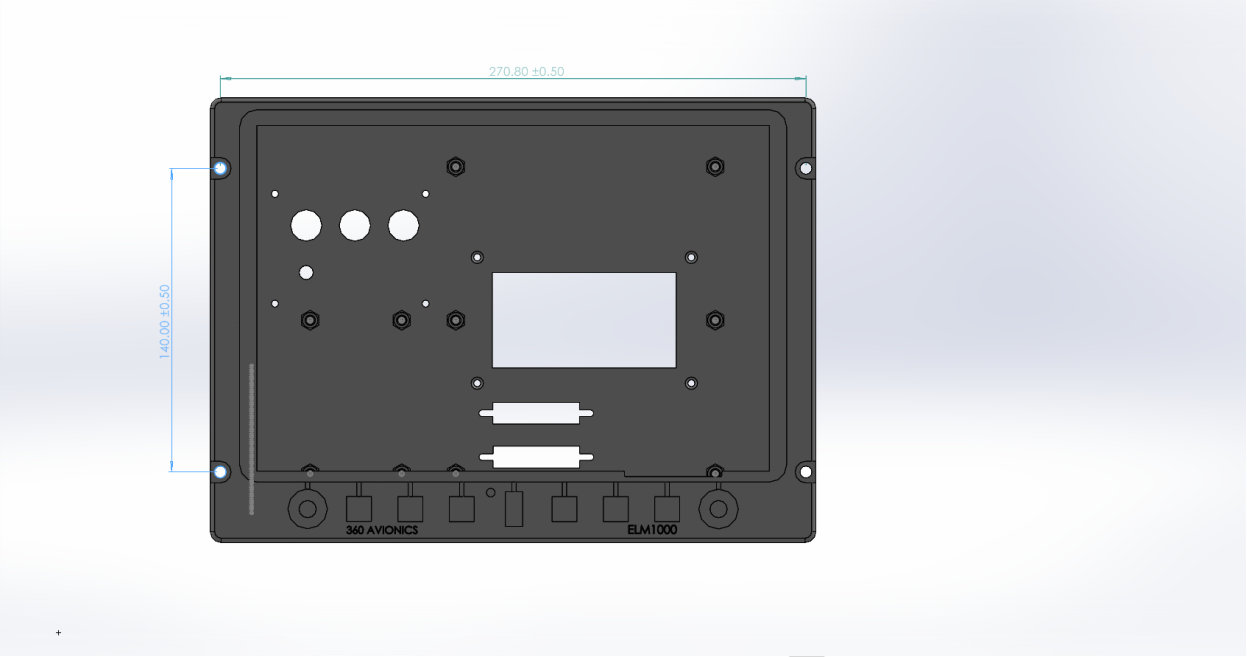


ELM800/1000 EFIS requires four (4) machine screws or bolts for panel installation. EFIS has four (4) holes in its front panel with a dimeter of 5.50mm each. It is recommended to use a mounting hardware of the size no less than #8-32

The vertical distance between holes (ELM800) is 100mm and the horizontal distance is 212mm as shown below.
It is recommended to use a nut plates for the panel to simplify EFIS installation/removal.



The vertical distance between holes (ELM1000) is 140mm and the horizontal distance is 270.8mm as shown below.
It is recommended to use a nut plates for the panel to simplify EFIS installation/removal.

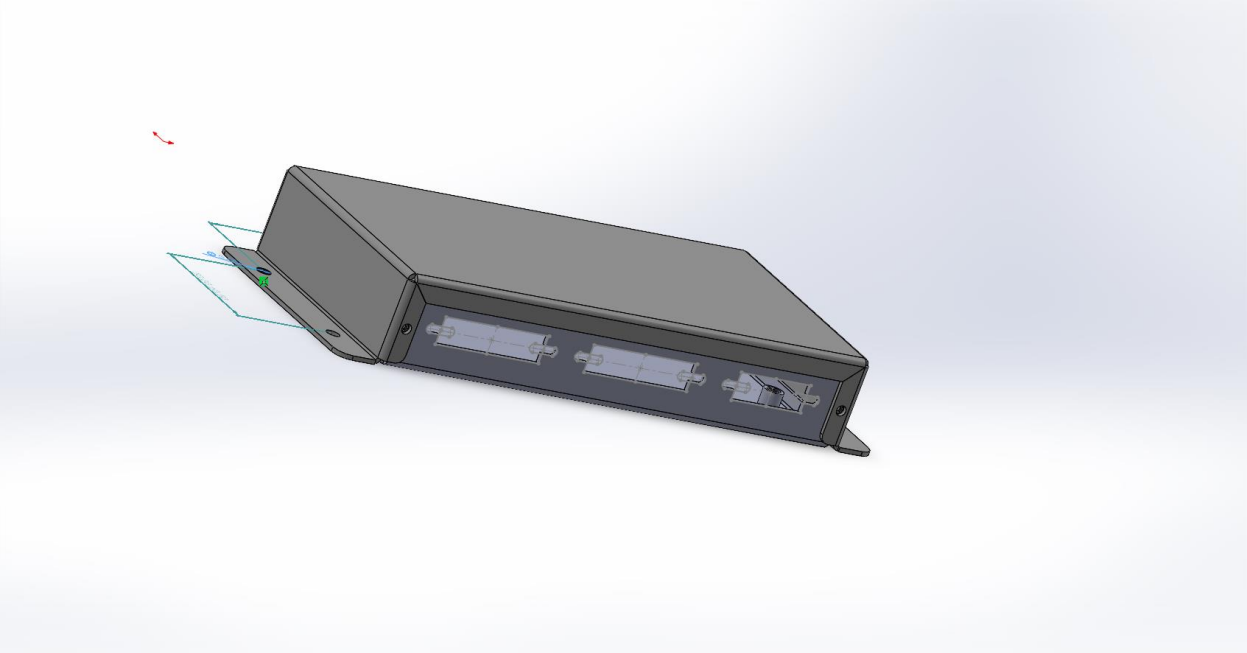


At the back side of the EFIS there are connectors so it is recommended to have a clearance with other parts of at least 120mm.

EnGood EM-01/02 sensor processing unit

It is recommended that EnGood EM-01/02 sensor processing unit is installed behind the instrument panel. There are 4 mounting holes. Each hole has a diameter of 5mm.
Horizontally, the distance between the mounting holes is 198mm; vertically, the distance between the vertical mounting holes is 50mm.

⚠ Important: Please allow at least 85mm of clearance between the front panel of Engood sensor processing unit and other parts for connectors and wires.



Recommended mounting hardware is #6-32 bolts. It is preferable to have a nut plates installed in the panel to simplify installation and removal of the EM-01/02 module.

7.1 Proper alignment of the instrument

It is assumed that the **instrument panel** is always perpendicular to the airplane's flight path. For proper operation of the **ELM800/1000**, the **AHRS sensors** (such as accelerometers and gyroscopes) must be correctly aligned. Specifically:

- The **X axis** of the sensors must point in the same direction as the flight path,
- The **Y axis** must be perpendicular to the flight path, and
- The **Z axis** must be perpendicular to the ground.

If the instrument panel is **not perpendicular** to the flight path, the **AHRS sensors' axes** will be misaligned, and the device will not function correctly. In such cases, the device will require calibration or leveling. For details on the **AHRS sensor leveling procedure**, please refer to the appropriate section of this manual.

7.2 Connections

On the backside of the **EFIS unit**, there are connectors for **pitot/static/AOA plumbing**, the **GPS antenna**, and two **main power connectors**. For all electrical connections, the **ELM800/1000** uses two **25-pin D-SUB male/female connectors** located at the top center of the unit. A male/female D-SUB connector is included in the kit for wiring purposes. The recommended wire gauge for connections is **22AWG–24AWG**.

The **quick-connect ¼" pitot line** is marked as **'P'**, and the **static line** is marked as **'S'** on the back of the unit. It is recommended that the installer labels the tubing connected to these ports to ensure correct reconnection if the unit needs to be removed and reinstalled. If applicable, the **AOA connector** is marked **'A'**.

GPS Antenna:

The **GPS port** uses an **SMA type female connector**. Any GPS antenna with an **SMA male connector** and a **3.3V–5V voltage level** can be used. A **magnetic-mount GPS antenna** is included with the kit. The ideal location for the GPS antenna is on top of the instrument panel under the windshield, where it has an unobstructed view of the sky. The GPS antenna should never be mounted underneath or behind the panel, as this may hinder signal reception.

If the antenna is installed outside the airplane, such as on the roof, it must be securely attached using a strong adhesive to ensure it withstands high wind speeds. For external installations, it is recommended to seek advice from an experienced aviation maintenance specialist to ensure proper placement and durability.

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

25-pin Main connector's pinout:

J1 Connector (Top)

1- **Power Ground Input**
2- **Power Ground Input**
3- GND
4- GND
5- GND
6- RS232 TX4
7- RS232 RX4
8- RS232 TX3
9- RS232 RX3
10- Reserved
11- Reserved
12- CAN bus Low
13- CAN bus High
14- **AUDIO OUT L**
15- RS232 TX1
16- RS232 RX1
17- RS232 TX2
18- RS232 RX2
19- **AUDIO OUT R**
20- Reserved
21- Reserved
22- Reserved
23- Reserved
24- **Power +V Positive Input**
25- **Power +V Positive Input**

J2 Connector (Bottom)

1- GND
2- GND
3- RS485-1 A
4- RS485-1 B
5- RS485-2 A (ELM1000 only)
6- RS485-2 B (ELM1000 only)
7- Unused
8- ARINC429 A Rx (ELM1000x only)
9- ARINC429 B Rx (ELM1000x only)
10- Reserved
11- Reserved
12- Reserved
13- Reserved
14- GND
15- ARINC429 A Tx(ELM1000x only)
16- ARINC429 B Tx(ELM1000x only)
17- Video1 Input (ELM1000x only)
18- Video2 Input (ELM1000x only)
19- GND
20- OAT Sensor Signal
21- OAT Sensor Power+ Out
22- Reserved
23- Reserved
24- +12V Cam (ELM1000x only)
25- Reserved

It is recommended to use **22 AWG** wire for all power connections (pins 1, 2, 24, and 25 of J1). For all other connections, **24 AWG** wire is acceptable. Use **milspec wires** for all connections to ensure high quality and robustness. The kit includes male and female **D-SUB 25-pin connector headers** for either soldering or crimping pins, along with a plastic enclosure for the connector header.

When soldering wires, ensure that they are securely attached to avoid cold solder joints.

EM-01 and EM-02 Engine Sensor Processing Units

Please note that models EM-01 and EM-02 have some pin differences!

Connector J1 (DB25) ***Match for both models***

1- CHT1+	11- CHT6+	21- EGT4-
2- CHT1-	12- CHT6-	22- EGT5+
3- CHT2+	13- GND	23- EGT5-
4- CHT2-	14- EGT1+	24- EGT6+
5- CHT3+	15- EGT1-	25- EGT6-
6- CHT3-	16- EGT2+	
7- CHT4+	17- EGT2-	
8- CHT4-	18- EGT3+	
9- CHT5+	19- EGT3-	
10- CHT5-	20- EGT4+	

Connector J2 (DB25) (EM-01)

1- Oil Temp+
2- Oil Temp-
3- Aux Temp+
4- Aux Temp-
5- RPM Sens Input
6- Fuel Flow Sens1 Input
7- Fuel Flow Sens2 Input
8- Oil Press Sens Input
9- Fuel Press Sens Input
10- MAP Sens Input
11- Current Sens Input
12- Flaps Pos Sens Input
13- Rudder Trim Sens Input
14- Left Door Sens In
15- Fuel Meter Right Sens Input
16- GND
17- GND
18- GND
19- Reserved
20- Fuel Meter Left Sens Input
21- Elevator Trim Sens
22- 5V for Sens
23- 5V for Sens
24- 5V for Sens
25- Right Door Sens In

Connector J2 (DB25) (EM-02)

1- Oil Temp+
2- Oil Temp-
3- Aux Temp+
4- Aux Temp-
5- RPM Sens Input
6- Fuel Flow Sens1 Input
7- Fuel Flow Sens2 Input
8- Oil Press Sens Input
9- Fuel Press Sens Input
10- MAP Sens Input
11- Current Sens Input
12- Flaps Pos Sens Input
13- Rudder Trim Sens Input
14- Left Door Sens In
15- Fuel Meter Right Sens Input
16- Analog Input 15
17- CO Sensor Input
18- Battery Voltage Input
19- AUX5 Input
20- Fuel Meter Left Sens Input
21- Elevator Trim Sens
22- 5V for Sens
23- 5V for Sens
24- 5V for Sens
25- Right Door Sens In

Connector J3 (DB15) (EM-01)

1- Power IN (12V)
2- Reserved
3- Reserved
4- Reserved
5- Unused Input
6- Roll Trim Sens Input
7- Reserved
8- GND
9- Warn Lamp Output2 (Master Warning)
10- CAN bus Low
11- CAN bus High
12- Warn Lamp Output1 (Low Oil pressure)
13- Reserved
14- Baggage Door Sens In
15- Power Ground Input

Connector J3 (DB15) (EM-02)

1- Power IN (12V)
2- Reserved
3- Reserved
4- Reserved
5- Engine CAN Low
6- Roll Trim Sens Input
7- Reserved
8- GND
9- Warn Lamp Output2
10- CAN bus Low
11- CAN bus High
12- Warn Lamp Output1
13- Engine CAN High
14- Baggage Door Sens In
15- Power Ground Input

6.4 Power bus:

EM-01/02 Sensor Processing Unit
Use AWG20 or less gauge of wires to connect power to the sensors unit (pins 1 and 15 of J3 connector). It is required to have 5A circuit breaker on power line for this module. 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.

6.5 Data communication bus:

EM-01/02 Sensor Processing Unit must be connected to *ELM800/1000 EFIS* using CAN bus for all data exchange between devices.

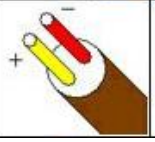
Use only twisted pair of milspec wire AWG22-24 for this connection.

Connect pins as follows:

Signal	***EM-01/02***	***ELM800/1000***
CAN Low	10 (J3)	12 (J1)
CAN High	11 (J3)	13 (J1)

6.6 Sensors

CHT, EGT, Oil Temperature, GearBox, Coolant and under Cowling Sensors:

Type	Material		Color Code	Range (°C)	
Thermocouple Grade	Positive Wire	Negative Wire		Minimum	Maximum
J	Iron	Constantan		0	750
K	Chromel	Alumel		-200	1250

Compatible Sensors

The **CHT** (Cylinder Head Temperature) and **EGT** (Exhaust Gas Temperature) sensors compatible with the **EM-01/02 Sensor Processing Unit** are **K-type thermocouple sensors**. It is also possible to use **J-type thermocouple sensors**; however, this must be specified during production (please inform us when placing your order).

By default, the kit includes **ungrounded K-type thermocouple** CHT and EGT sensors. Each sensor features two wires:

- **"+" positive** (yellow wire)
- **"-" negative** (red wire)

Temperature Sensor Connections

- For **Gearbox**, **Under Cowling**, and **Coolant Temperatures**, the **K-type thermocouple (ungrounded)** is used.
  - **Under Cowling Sensor**: This sensor cannot be used simultaneously with the gearbox temperature sensor. Connect either the gearbox or the cowling temperature sensor to the **AUX temperature input** of the EM-01/02 (Connector J2, pins **3 and 4**).
  - **Coolant Temperature Sensor**: This sensor should be connected instead of the CHT sensor 5 (Connector J1, pins **9 and 10**). Note that this setup makes it impossible to use both the CHT5 and the coolant sensor at the same time.

⚠ Important: Please note that the sensor wires cannot be extended or replaced using any wires made of material other than specified in the table above. If extension of K-type thermocouple wires is required you, must source specific K-type extension wires.

It is recommended to use **crimp-on terminals** for the sensor wires and to join them using **bolts and nuts** with washers. Ensure that such connections are well insulated after the connection is made to prevent any electrical issues.

Important Considerations:

- Pay attention to **heat sources** such as exhaust pipes. Avoid routing sensor wires close to these sources to prevent melting or shorting of the wires.

The supplied **DB25 pin connector** and pins will require the avionics installer to perform appropriate crimping of the wires into the connectors. A description of this procedure is outside the scope of this manual and should be performed based on the installer's experience.

EGT Sensor Installation

1. **Drilling the Hole**:
    - Drill a hole of **5 mm (1/5”)** in your exhaust pipe.
    - Position the hole **2” to 4”** from the cylinder exhaust port.
    - Ensure that the hole in each exhaust pipe is drilled at the same distance from the cylinder exhaust port to maintain equal temperature readings across the cylinders.
2. **Installing the Probe**:
    - Install a clamp over the pipe, then insert the probe and tighten the clamp.
    - Adjust the probe’s end depth inside the exhaust pipe to be approximately in the middle.
    - Tighten the probe’s nut on top.
3. **Final Checks**:
    - Ensure that after installation, the probe will not interfere with your cowling or other components of the engine.

CHT spring loaded sensor for Lycoming engines comes with special fitment adapter. Sensor is installed in the special port available in each cylinder head using the adapter. Sensor can be adjusted using the spring for correct depth.

Depends on engine model various CHT sensors can be used including ring type (under spark plug) sensors.

Pressure Sensors:

Pressure sensors for Oil and Fuel pressure used with EM-01/02 Sensor Processing Unit are 5Volt analog sensors.

Sensors threaded: ***1/8"-27 NPT / 1/8" NPT***
Each sensor has three (3) wires:

Red – Positive Power +5V
Black – Negative GND
Green – Signal Output

Pressure sensors connections:

GND (black) should be connected to any of pins: 16,17 or 18 of J2 (EM-01). For EM-02 connect to aircraft power ground.

Power (red) should be connected to any of pins 22,23 or 24 of J2 (EM-01)

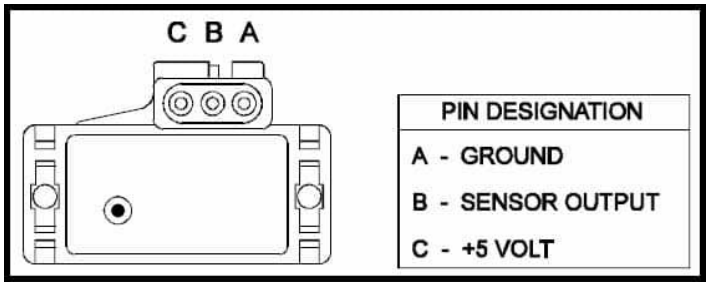
Signal output of the sensor (green) should be connected to appropriate pin of J2 depending on sensor function:

(J2)
8 – Oil pressure
9- Fuel pressure

Both Oil and Fuel pressure sensors should have correct pressure limit spec for planned pressure. We provide sensors of 100PSI but may also provide higher or lower limit sensors upon request.

MAP Sensor:

MAP sensor used with EM-01/02 Sensor Processing Unit is a 5V analog sensor.



Sensor connector may have the following colors:

(shown in the left picture)
Red – Power+5V should be connected to any of pins 22,23 or 24 of J2 (EM-01)
Black – Negative GND should be connected to any of pins: 16,17 or 18 of J2 (EM-01). For EM-02 connect to airplane ground.
Blue – Signal Output should be connected to pin 10 of J2

(shown in the right picture)
Red – Power+5V should be connected to any of pins 22,23 or 24 of J2 (EM-01)
Yellow – Negative GND should be connected to any of pins: 16,17 or 18 of J2 (EM-01). For EM-02 connect to airplane ground.
Blue – Signal Output should be connected to pin 10 of J2

Fuel Flow Sensor

Fuel flow sensor is not included with the kit but can be ordered separately. We recommend using a Floscan 201 but any other fuel flow sensor which uses PWM as an output can be used.

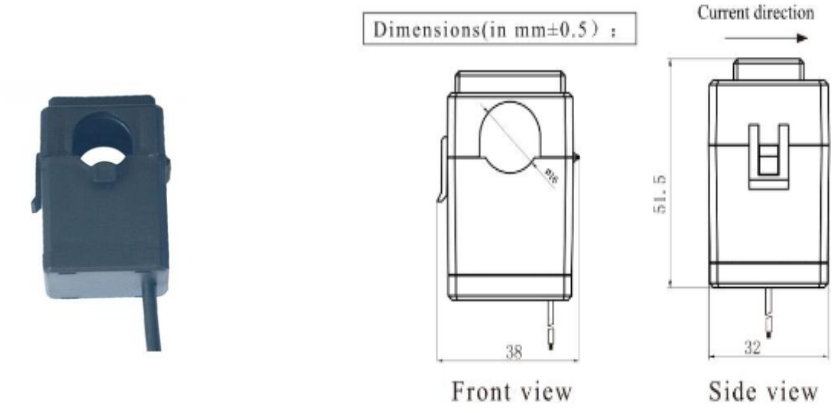
EM-01 Sensor Processing Unit can support single or dual fuel flow sensors configuration.

Floscan 201 has the following wire colors:

Red – Connect to +12V. It can be connected to pin1 of J3 (EM-01) or to separate 12V power source via 1A circuit breaker.
Black – *GND* (recommended to ground it near the sensor location)
White – *Signal output* connect to pin6 of J2 if this is a single Fuel flow sensor installation
*Connect White output of second Fuel Flow sensor to pin7 of J2 *(dual Fuel Flow install)*

Current Flow Sensor

EM-01 Sensor Processing Unit supports analog current flow Hall split core sensors connection. We successfully tested the following Hall split core sensor: **HSTS016L** 100Amp sensor



Sensor has the following wire colors:

Red – Power+5V should be connected to any of pins 22,23 or 24 of J2 (EM-01)
Black – Negative GND should be connected to any of pins: 16,17 or 18 of J2 (EM-01). For EM-02 connect to airplane ground.
Yellow – Signal output should be connected to pin11 of J2
White – (not connected)

Current sensor should be installed around the main battery positive wire and secured. The best location for the sensor can be determined by installer, depending on the location of the battery.

Flaps Position, Rudder Trim and Elevator Trim Sensors

Sensors for Flaps, Rudder, Roll and Elevator trim are simple analog sensors with voltage output of 0V to 5V. We have successfully tested the following types of sensors and servo/sensor combos:

- Ray Allen POS-12
- Ray Allen T2-10A
- Other Ray Allen servo/sensor combos

Most of Ray Allen sensors or servo/sensor combos will have three (3) wires for sensing purposes:

Orange – Usually connected to +5V, so unless this wire is already connected in your setup to servo you may safely connect it to any of pins 22,23 or 24 of J2 (EM-01/02 Sensor Processing Unit).
WARNING! Do not connect this wire to EM-01/02 module if it is already connected with your servo.

Green – Signal position output wire. Connect it to appropriate input of EM-01/02 (flaps, rudder, roll or elevator).

Blue - Usually connected to GND, so unless this wire already connected in your setup to servo you may safely connect it to any of pins: 16,17 or 18 of J2 (EM-01). For EM-02 connect to airplane ground.
WARNING! Do not connect this wire to EM-01/02 module if it is already connected with your servo.

Fuel Tank Level Sensors

EM-01 Sensor Processing Unit is capable of reading the data from standard resistor type fuel level sensors with range of resistance from 30 Ohm to 240 Ohm.

Simply connect the wire from fuel level sensor installed in your fuel tank to appropriate input in J2 connector of EM-01/02.

Use pins:
15 (J2) – Right fuel tank
20 (J2) – Left fuel tank

Main and Baggage Door Sensors

You can use any sort of a trigger sensor for your doors. It can be a simple push button type sensor which has two contacts and acts as a simple button.

Connect one contact of sensor to chassis GND of airplane. Connect second contact of the sensor to appropriate input of J2 and J3 connectors of EM-01/02 Sensor Processing Unit.

Use pins:
25 (J2) – Right door
14 (J2) – Left door
14 (J3) – Baggage door

Additional Temperature Sensors

When using the EM01 or EM02 with a 4 cylinder engine, the unused inputs for CHT 5, CHT 6, EGT 5, and EGT 6 can be used to connect additional sensors.

Standard K type ungrounded thermocouples can be connected as follows:

CHT 5 connect to **coolant temperature sensor**
CHT 6 connect to **intercooler inlet temperature sensor**
EGT 5 connect to **gearbox temperature sensor**
EGT 6 connect to **intercooler outlet temperature sensor**

After connecting the sensors, open Settings, then the EnGood menu, and enable and configure each sensor accordingly.

Warning Lamp Outputs

EM-01/02 Sensor Processing Unit has two warning lamp outputs. These can be used to drive small 12V lamps in panel.

Pins to connect are:
12 (J3) – Lamp1 Low Oil Pressure
9 (J3) – Lamp2 Master Warning

When triggered, warning lamp output will become internally grounded via transistor and allow up to 250mA of current to flow.

Connect one contact of lamp to +12V in airplane and connect another contact of lamp to warning lamp output on EM-01/02 Sensor Processing Unit.

Lamp1 should be labeled on panel as “Oil Pressure”. This lamp will turn on if oil pressure is below the pre-set limit. Also this lamp will turn on upon powering of the EnGood Engine Monitor System and will immediately turn off during engine start as soon as engine’s oil pressure reaches the minimum trigger limit.

Lamp2 is unused at this time.

Rotax 91x iS series engine connection:

Rotax 91x iS series engines feature a modern, fully electronic engine management system with a dual-lane ECU architecture and integrated CAN bus communication designed specifically for aircraft avionics integration. Each ECU lane operates independently and continuously transmits engine data to the pilot display over a dedicated CAN bus interface. The system provides a comprehensive set of real-time parameters derived from engine-mounted sensors, including engine speed, fuel flow, manifold air pressure, oil pressure, oil temperature, coolant temperature, exhaust gas temperature for all cylinders, manifold air temperature, ambient air temperature and pressure, throttle position, ECU supply voltage, and additional parameters such as boost pressure, airflow, and wastegate position for turbocharged variants . The ECU also transmits system status, sensor status, and device health information, allowing full monitoring of engine condition and redundancy status. It should be noted that cylinder head temperature sensors are not part of the standard Rotax iS CAN interface and must be implemented externally if required.

The CAN bus interface for Rotax 91x iS engines is available through the HIC (Hybrid Ignition Circuit) connectors located in the engine bay, with separate connectors assigned to Lane A and Lane B of the dual ECU system. Each lane provides its own independent CAN interface to ensure redundancy, and both lanes should be connected to the avionics system for full functionality and fault tolerance. The CAN lines (Engine CAN High and Engine CAN Low) are routed through these HIC connectors and are internally terminated within the ECU, while the connected display system must provide proper bus termination as required by CAN standards . The exact physical location of HIC A and HIC B connectors is on the engine assembly near the ECU modules in the engine compartment, typically mounted on or adjacent to the ignition system housing. Pin assignments for CAN communication are defined per connector, with dedicated pins for CAN High and CAN Low on each lane, and care must be taken to maintain proper separation between Lane A and Lane B wiring to preserve system redundancy.

Rotax Engine Side

HIC Connector A (12 pin)
19428-0015 or 19428-0031

Pin 5 – CAN BUS LOW 1A
Pin 6 – CAN BUS HIGH 1A

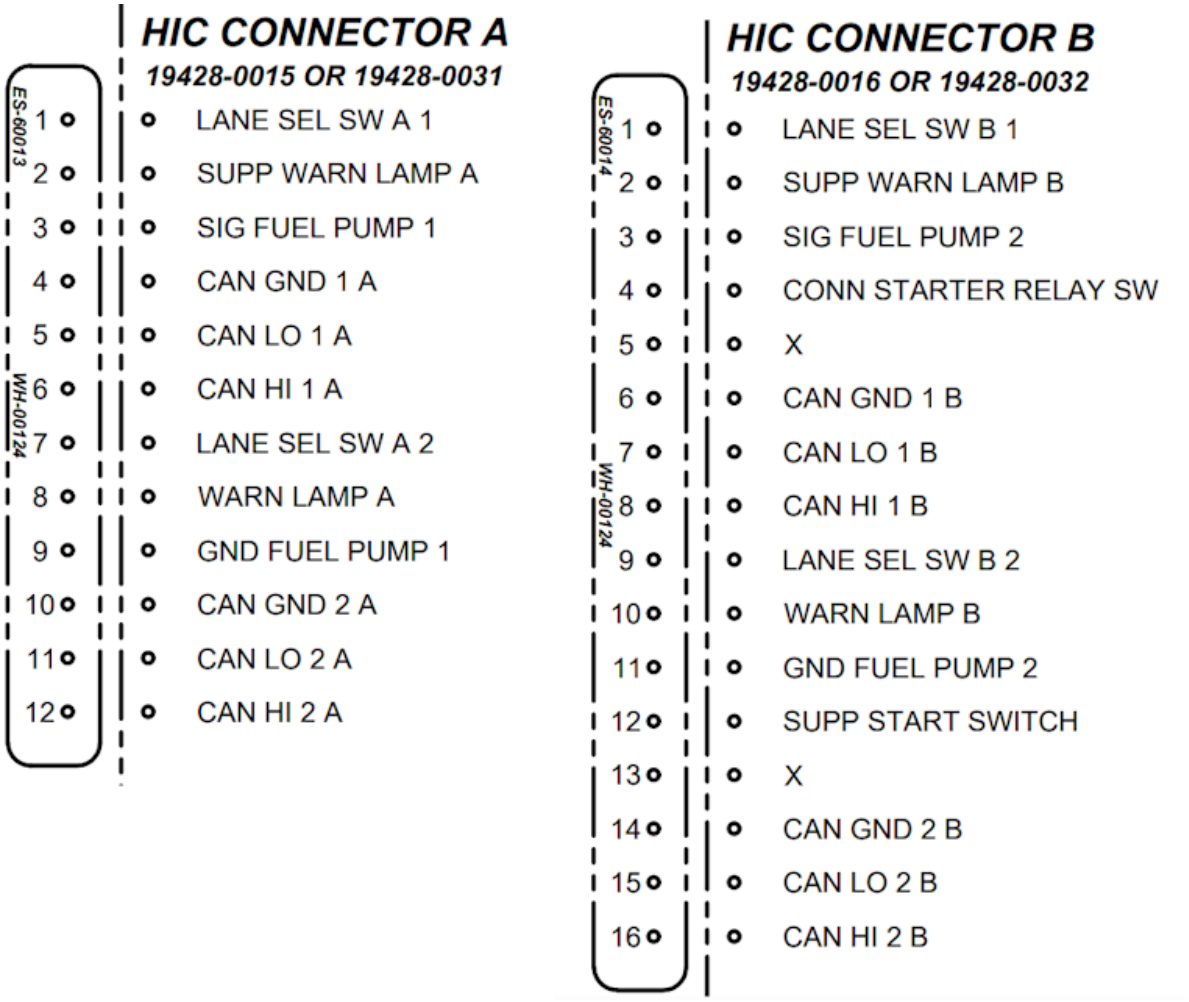
HIC Connector B (16 pin)
19428-0016 or 19428-0032

Pin 7 – CAN BUS LOW 1B
Pin 8 – CAN BUS HIGH 1B

CAN BUS LOW 1A *and* ***CAN BUS LOW 1B*** *are connected together and routed to EM-02 connector* ***J3 pin 5 (Engine CAN Low)****.*

CAN BUS HIGH 1A *and* ***CAN BUS HIGH 1B*** *are connected* ***together*** *and routed to EM-02 connector* ***J3 pin 13 (Engine CAN High)****.*

Rotax 91xiS series HIC connector's pinout



When a Rotax 91x iS series engine is interfaced with the EM-02 via CAN bus, optional CHT sensors may be installed and connected to the EM-02 inputs CHT1 through CHT4.

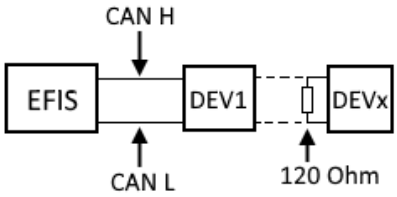
To configure the EFIS for Rotax communication, set Settings → EnGood → Engine Model to Rotax 91x iS.

CAN Bus termination:

The ELM800/1000 can be installed in the aircraft alongside compatible 360 Avionics external modules such as magnetometers, engine monitors (e.g., ENGOOD), or the VICS voice information system, all connected via a single CAN bus line.

When the ELM1000 is installed *without* any external CAN modules, a **120 Ohm termination resistor** (included in the kit) **must be installed between pin 12 and pin 13 of connector J1**. This resistor should be placed inside the connector and left within the enclosure to ensure proper CAN bus operation.

If one or more external CAN modules (e.g., ENGOOD engine monitor, VICS, or magnetometer) are used, the **termination resistor must be placed at the end of the CAN bus line**, as shown in the diagram below, to ensure correct signal termination and prevent communication errors.



Once the system is fully assembled and all CAN bus wires are connected to the devices, measure the resistance between the CAN H and CAN L wires at the device that is farthest from the EFIS. If the measured resistance is between 115 and 125 Ohms, install a 120 Ohm termination resistor at the farthest device to properly terminate the CAN bus. If the measured resistance is between 55 and 65 Ohms, no additional termination resistors are required.

Power bus:

Use **AWG 22** or a lower gauge wire to connect power to the unit (pins 1, 2, 24, and 25 of **J1**). A **5A circuit breaker** is required on the power line for the **ELM800/1000**. This circuit breaker should be easily accessible from the pilot's seat.

The ground wire can be connected either to the chassis ground or directly to the battery's negative terminal.

The power line with the circuit breaker is typically connected via the **Avionics Master Switch** or the **Main Master Switch**, depending on the airplane's configuration.

OAT Sensor (probe):

The **Outside Air Temperature (OAT)** sensor is optional and can be connected to the **ELM800/1000**. When the OAT sensor is installed, additional information such as **True Air Speed (TAS)** and OAT will be displayed. We strongly recommend having this sensor installed.

The OAT sensor is a digital probe enclosed in a threaded aluminum housing. The standard cable length is **59 inches (150 cm)**, which should be sufficient for installation on the same side as the EFIS unit. You may extend the OAT cable length to your desired length, but it should not exceed **14.76 feet (4.5 meters)**. If cable extension is necessary, ensure that wire connections are properly extended and isolated to avoid electrical shorts and potential damage to the unit.

<u>OAT sensor is connected to **J2** main connector pins:</u>

21 – OAT sensor power
19 – GND
20 – 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.

<u>OAT pinout:</u>

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 the OAT (Outside Air Temperature) sensor is installed in a location where it cannot accurately measure true outside air temperature (e.g., inside the cabin or near a heat source), the EFIS will display incorrect values for OAT, True Airspeed (TAS), Density Altitude, and other temperature-dependent data.

If accurate OAT readings are not possible due to installation constraints, the OAT sensor can be disabled by navigating to:
Settings > External Devices > Use OAT

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 **ELM800/1000** and connect the wires to the appropriate pins in the **J2 connector**. Details regarding the sensor pinout and the J2 main connector are provided above.

RS-232 Ports:

Pin numbers used for the ports

Port1 (Conn. J1)
TX - 15
RX - 16

Port2 (Conn. J1)
TX - 17
RX - 18

Port3 (Conn. J1)
TX - 8
RX - 9

Port4 (Conn. J1)
TX - 6
RX - 7

For each port the settings and functionality is configured via 'Settings" -> "External Devices" menu.

ARINC429 Port: *(available only in model ELM1000x)*

Pin numbers used for the port J2 (bottom)

Pin 8 - ARINC429 A Rx (ELM1000x only)

Pin 9 - ARINC429 B Rx (ELM1000x only)

Pin 15 - ARINC429 A Tx (ELM1000x only)

Pin 16 - ARINC429 B Tx (ELM1000x only)

Can be connected to ARINC429 Tx and Rx A and B lines of Garmin GPS175 or similar

Video Inputs: *(available only in model ELM1000x)*

Pin numbers used for the port J2 (bottom)

Pin 17 – Video Input1 (ELM1000x only)

Pin 18 – Video Input2 (ELM1000x only)

Pin 24 - +12V power for Camera (limited to 250mA)

Video input1 accepts composite video signal from NTSC standard analog camera or NTSC thermal camera.

Trig Avionics COMM and Transponder connection

ELM800/1000 series EFIS supports connection of single TRIG TY91/92 series COMM radio and TRIG TT21/22 transponder.
ELM1000 model has two dedicated RS485 channels while ELM800 has only single dedicated RS485 channel for this connection.

ELM1000 J2 connector

3 – RS485-1 A	5 - RS485-2 A
4 – RS485-1 B	6 - RS485-2 B

ELM800 J2 connector

3 – RS485-1 A
4 – RS485-1 B

ELM1000 Connections

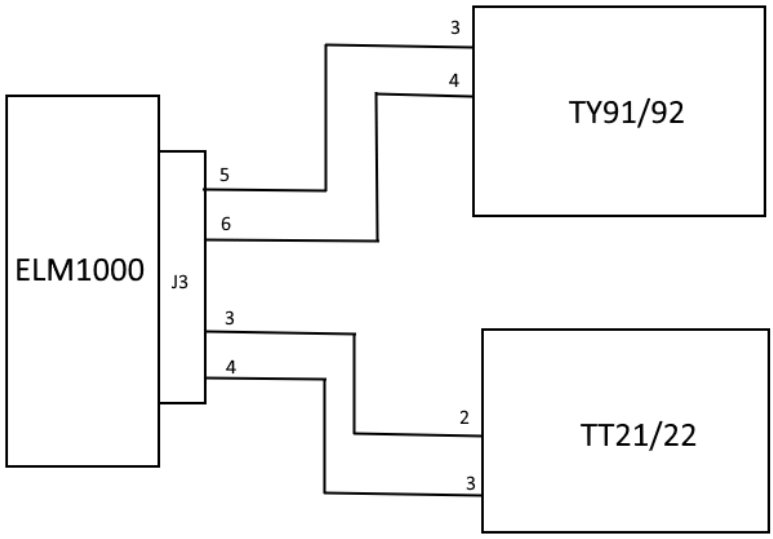
If connecting single TY91/92 or TT21/22 only, use J2 connector pins 5 and 6 (port2).

At the TY91/92 use its pins 3 - TMAP1A and 4 - TMAP-1B to connect with EFIS.
At the TT21/22 use its pins 2 – TMAP1A and 3 – TMAP1B to connect with EFIS

Set in Settings -> External Devices:
COM2 Mode: Trig COMM1 (for TY91/92) or Trig XPonder (for TT21/22)
COM2 Speed: 38400

If connecting both TY91/92 and TT21/22 use J2 connector pins 5 and 6 (port2) for TY91/92 and pins 3 and 4 (port1) for TT21/22 connection.
At the TY91/92 use its pins 3 - TMAP1A and 4 - TMAP-1B to connect with EFIS.
At the TT21/22 use its pins 2 – TMAP1A and 3 – TMAP1B to connect with EFIS

Set in Settings -> External Devices:
COM1 Mode: Trig XPonder (for TT21/22)
COM1 Speed: 38400
COM2 Mode: Trig COMM1 (for TY91/92)
COM2 Speed: 38400



ELM800 Connections

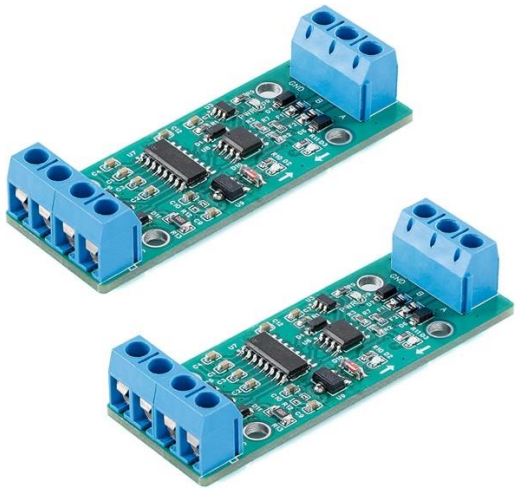
If connecting single TY91/92 or TT21/22 only, use J2 connector pins 3 and 4 (port1).
At the TY91/92, use its pins 3 - TMAP1A and 4 - TMAP-1B to connect with EFIS.
At the TT21/22, use its pins 2 – TMAP1A and 3 – TMAP1B to connect with EFIS

Set in Settings -> External Devices:
COM1 Mode: Trig COMM1 (for TY91/92) or Trig XPonder (for TT21/22)
COM1 Speed: 38400

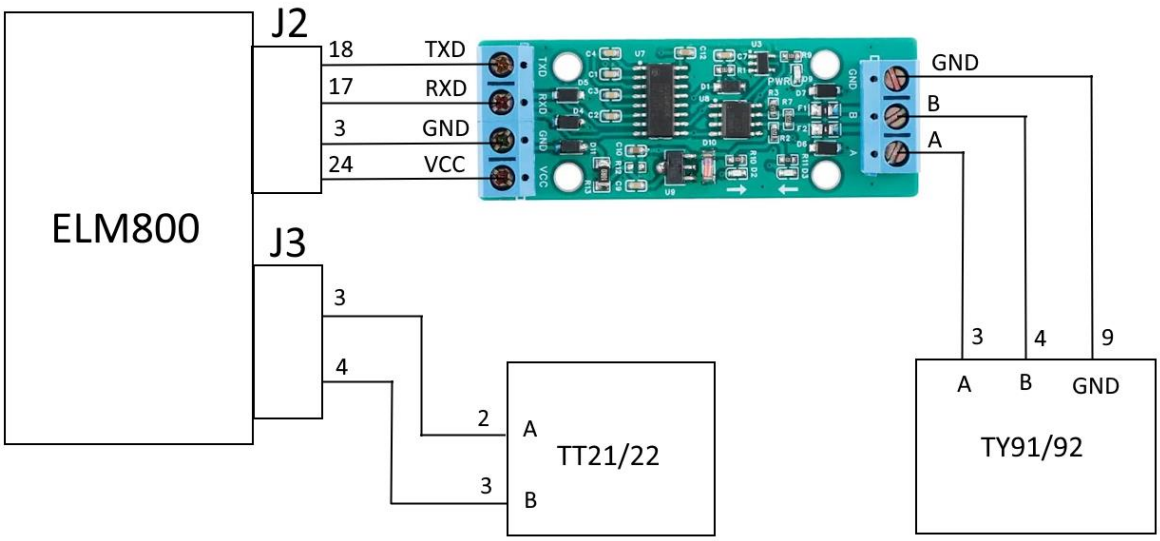
If connecting both TY91/92 and TT21/22 use J2 connector pins 3 and 4 (port1) for TT21/22 connection.
At the TT21/22, use its pins 2 – TMAP1A and 3 – TMAP1B to connect with EFIS

Set in Settings -> External Devices:
COM1 Mode: Trig XPonder (for TT21/22)
COM1 Speed: 38400
COM2 Mode: Trig COMM1 (for TY91/92)
COM2 Speed: 38400

For TY91/92 connection, use RS232 to RS485 Converter adapter:



Connect adapter to EFIS ELM800, TT21/22 and TY91/92 as follows:



For control head connection at Trig unit use second pair of TMAP A/B pins. Do not connect control head in parallel with EFIS on the same TMAP pins.

If you connect TT21/22 control head please set in EFIS menu:
Set in Settings -> External Devices:
Trig XPonder: Ctrl Head
When not control head is in use for TT21/22 set
Trig XPonder: Headless

LAN / Ethernet Connection and Multi-EFIS Synchronization

The ELM800/1000 supports automatic synchronization between multiple compatible 360 Avionics EFIS units through a standard Ethernet LAN connection. This feature is intended for aircraft installations using more than one EFIS, for example a Left PFD, MFD, and Right PFD. Each EFIS must be configured for its correct role using Settings → General Config → EFIS Mode. If only one EFIS is installed, EFIS Mode should be set to PFD Single.

Two EFIS units may be connected directly to each other using a standard Ethernet network cable. When three or more network devices are used, all units should normally be connected to a common Ethernet switch or network hub. The EFIS units may also be connected through an aircraft router or other Ethernet network. When DHCP is available, IP addresses may be assigned automatically. All synchronized EFIS units must be connected to the same local network/subnet.

No manual pairing is required. Compatible 360 Avionics devices automatically advertise their presence and discover other compatible devices on the network. In a multi-EFIS installation, the Left PFD normally operates as the primary synchronization master. The MFD operates as a synchronized display. A Right PFD normally operates as a synchronized display while the Left PFD is available and can provide backup master functionality if the Left PFD is no longer available.

LAN synchronization keeps navigation-related information consistent between the connected EFIS displays. This includes the active flight plan, active waypoint and leg, Direct-To operation, loaded procedures and approaches, procedure sequencing, missed-approach state, and other related navigation and map information. Changes made on the master EFIS are automatically distributed to the other synchronized displays. Depending on the function, compatible controls operated from an MFD or other synchronized EFIS may also be sent back to the master so that the aircraft navigation system continues to operate as one integrated system.

Important: During normal flight, LAN synchronization does not replace the independent AHRS or GPS source of each EFIS. Each EFIS continues to use its own local attitude, air-data and GPS information for the aircraft position and primary flight indications. The network is used to synchronize common navigation and system information. This provides redundancy and prevents the loss of one EFIS or one AHRS/GPS source from automatically becoming a loss of flight data on the remaining EFIS units.

In Demo Mode, additional simulated aircraft position and flight data may be synchronized between displays so that all EFIS units show the same simulated flight. This Demo Mode behavior does not apply to normal aircraft operation.

8. Settings Menu Lock / Unlock

To prevent accidental changes to critical configurations, the EFIS includes an extra layer of protection for the *Settings* menu. By default, the *Settings* menu is grayed out and inaccessible when the EFIS is powered on.

To unlock the *Settings* menu:

1. Rotate the **left knob** to highlight the *Settings* menu.
2. Press and **hold the left knob for 3 seconds**.

The *Settings* menu will then unlock and become accessible.

9. AHRS sensors leveling procedure and Pitch Adjust

9.1 AHRS sensors leveling procedure

In most airplanes, the instrument panel is perpendicular to the flight path and the ground when the airplane is leveled (such as in normal cruise flight). During production, each **ELM800/1000** is calibrated for this installation, and the corresponding offset values are recorded in the device's memory. Each time the device is turned **ON**, these offset values are automatically used for calibration. However, there may be instances when re-calibration of the sensors is required.

If re-calibration is required, the following procedure should be followed:

1. Level airplane, ensure its position is the same as in a straight and leveled flight (cruise attitude). Airplane should be leveled in both pitch and roll axis. Consult with your aircraft maintenance engineer if required. Use jacks to level airplane when applicable.

2. Turn on ELM800/1000 and wait until it boots up and AHRS is ready.

3. Once the device is booted, if artificial horizon indicator is not displayed on the screen, you will need to open Main Menu by pushing left Knob and then select “Settings Menu”

4. 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.*

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

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

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

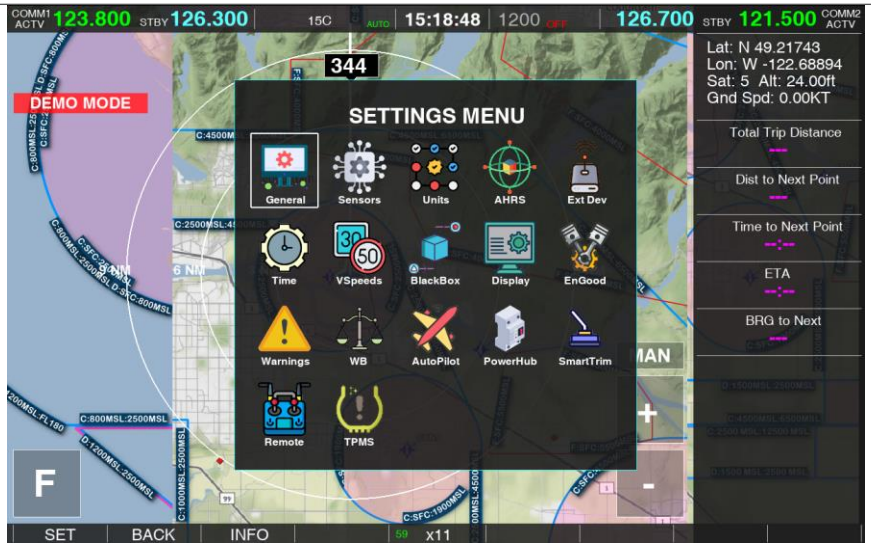
8. After 3-4 seconds the following message ***'Updating Please Wait'*** will show up on the display.

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

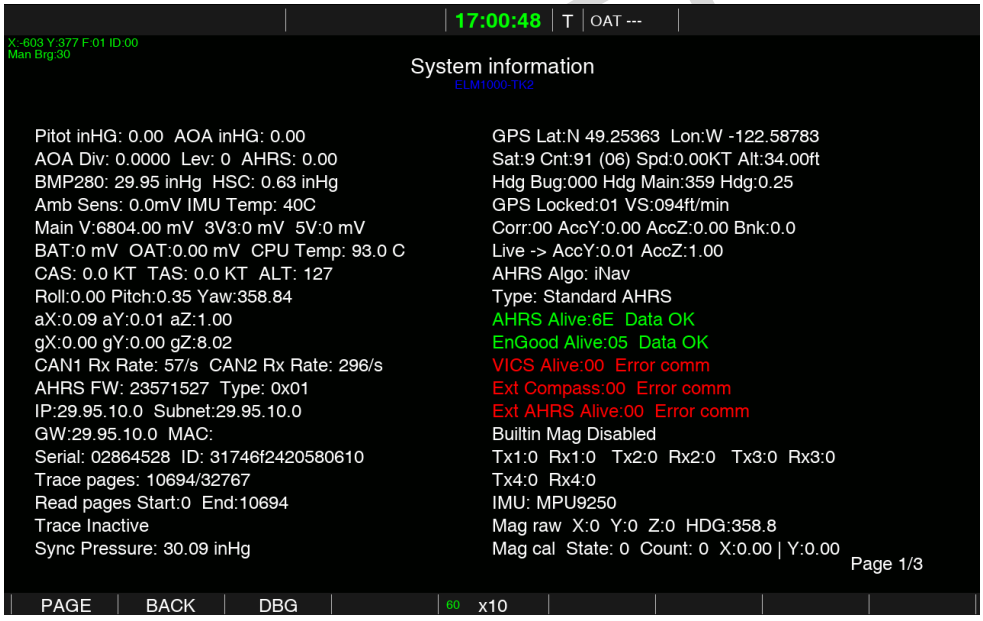
10. Push the left button to return back to the "Artificial Horizon" mode.

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

12. To verify that calibration was completed successfully, open 'Info Page'. To do so open Settings menu mode by first pushing the left knob and then selecting Settings from menu, then press second from the left button (label "Info" should be shown)



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



14. Calibration is completed and verified.

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

9.2 Pitch Adjust

In some cases, you may only need to adjust the pitch for a single flight. In this situation, you can use the **"Pitch Adjust"** option instead of performing the **"AHRS sensors leveling procedure."**

To adjust the pitch:

1. In the **Settings Menu**, select **General Config**, then **Pitch Adjust**.
2. Choose the appropriate number of **degrees** to compensate for the pitch. If the nose is pointing downward on the **artificial horizon indicator**, select a number below **0**. If the nose is pointing upward, select a number above **0**.

Note: The pitch adjust will reset to **0** when the device is powered **OFF**.

10. 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 ELM800/1000 EFIS. In case of any malfunction, the unit should be returned to manufacturer for test and repair.

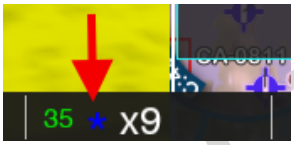
11. Firmware Update Procedure

11.1 Online Update

Requirements

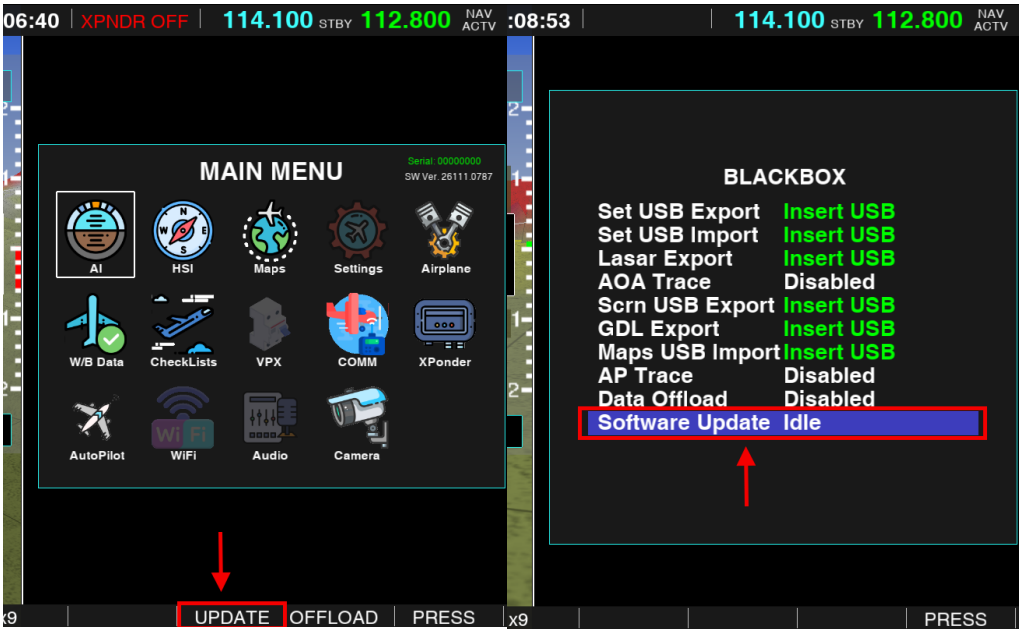
- EFIS must be connected to the Internet via:
  - WiFi dongle, or
  - LAN cable
- Internet connection must be stable and high speed

When a valid Internet connection is established, a small blue star icon appears at the bottom center of the display next to the zoom level indicator.



Procedure

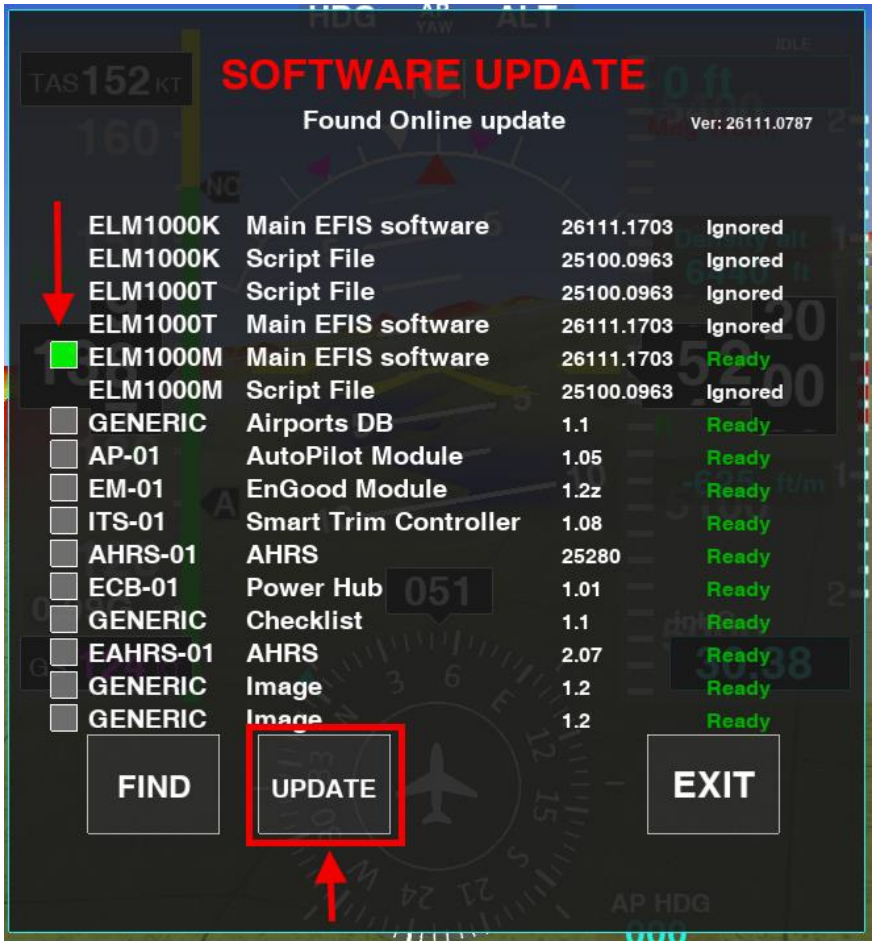
1. Press the **left knob** to open the **Main Menu**
2. Navigate to:
   Main Menu → Settings → BlackBox → Software Update
   or press **Button 5 (UPDATE)**



3. In the Software Update screen, press **FIND**
    - The system will check for available updates
    - This process may take up to one minute

4. If updates are available:
    - A list of updates will be displayed
    - Each update has a checkbox on the left

5. To select the main firmware update:
    - Locate **Main EFIS Software** in the list
    - Tap the checkbox until it turns green
6. If instructed, select additional updates in the same way



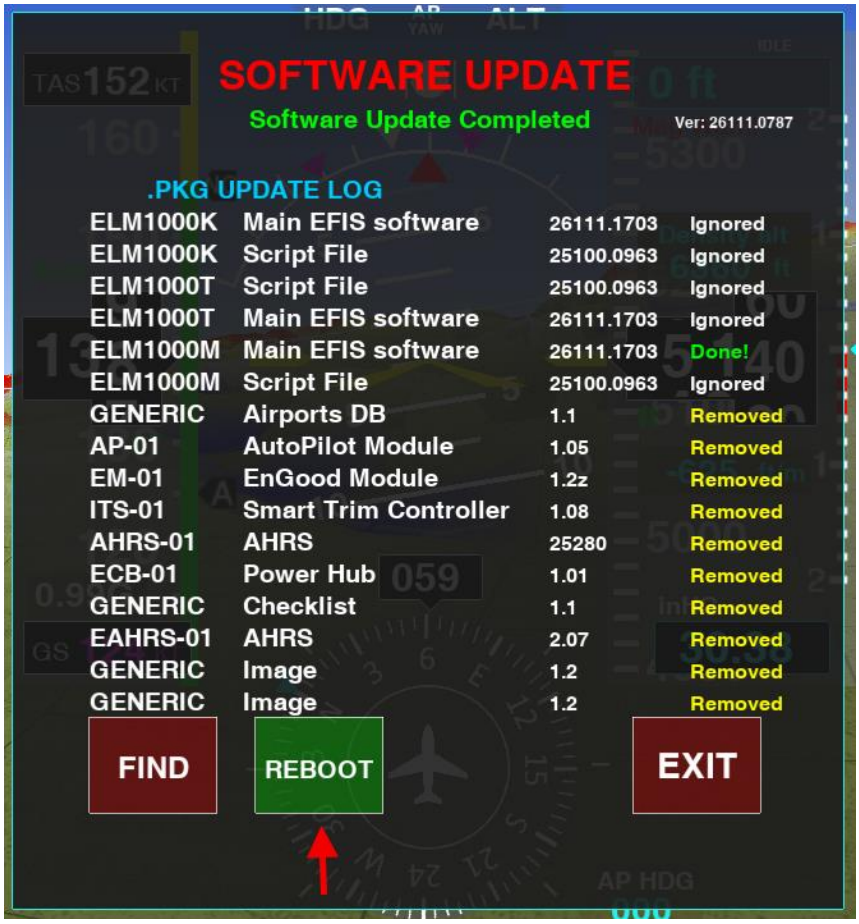
7. Press **UPDATE** to begin installation

Completion

- Wait until the update process is fully completed
- Press **REBOOT** on the display

Important:
Reboot is required to activate the new software

After reboot, the EFIS will run the updated firmware



11.2 USB Update

Preparation

1. Download the correct update file from the manufacturer website
   Example:
   ELM800 Main Firmware Update
2. Prepare a USB flash drive:
   - Capacity: 4 GB to 16 GB
   - Format: FAT32
3. Create folder on USB drive root:

   Updates

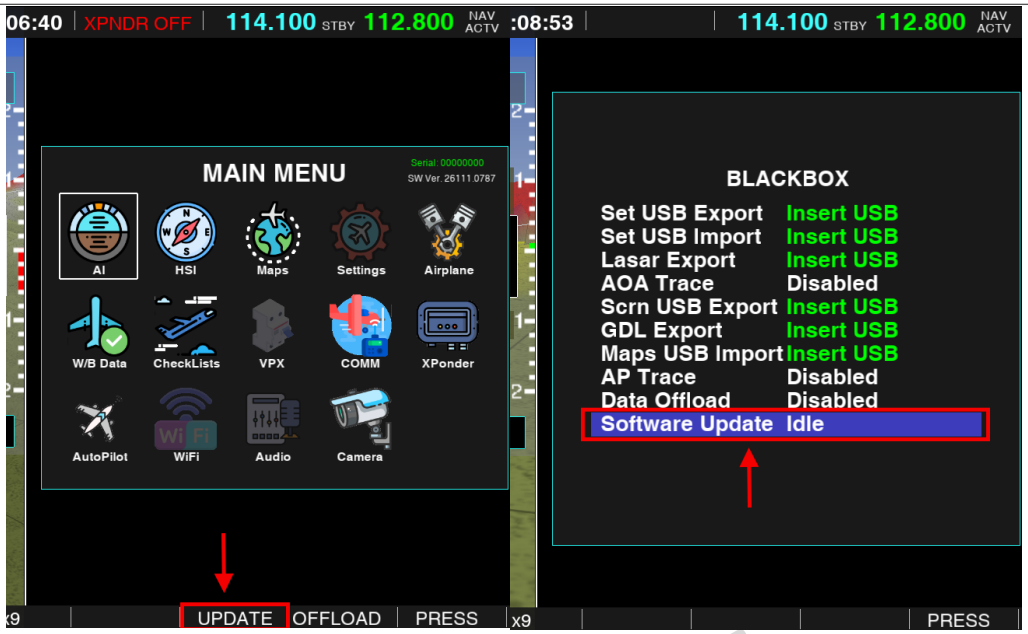
4. Copy update files into the folder ***Updates***

Important Restrictions

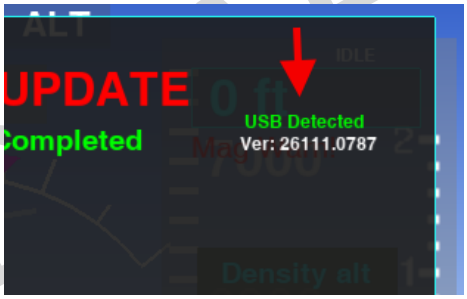
- Only **single firmware update file** is allowed in the folder
- No additional `.pkg` files must be present

Procedure

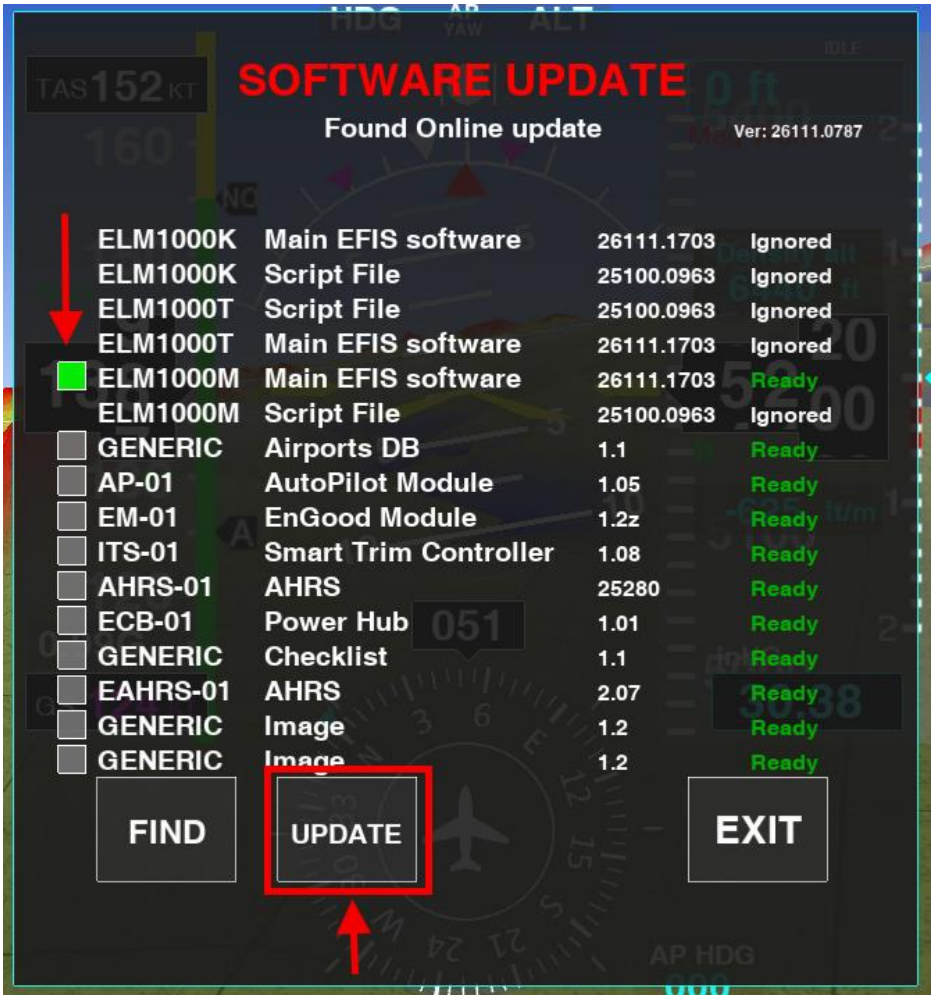
1. Insert the USB drive into the EFIS front USB port
2. Open the update menu:
   - Press **left knob → Main Menu**
   - Navigate to:
     Settings → BlackBox → Software Update
     or press **Button 5 (UPDATE)**



3. Confirm USB detection:
    - "USB Detected" appears in green in the top right corner



4. Press **FIND**
    - Wait for the system to scan for updates
5. When the update appears:
    - Select **Main EFIS Software**
    - Enable the checkbox (turns green)
6. Press **UPDATE**

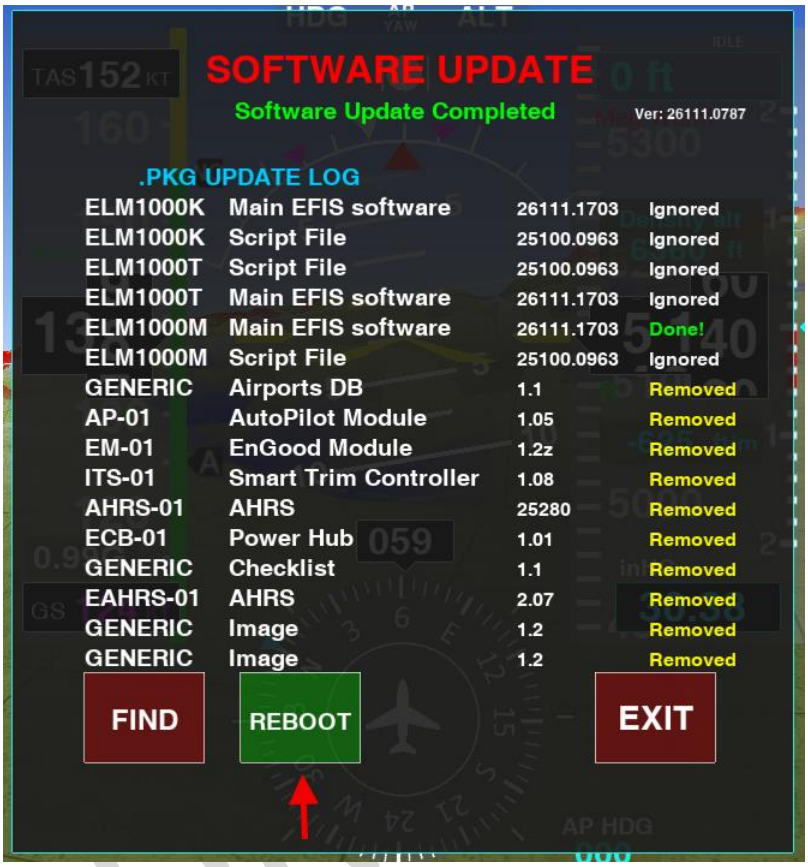


Completion

- Wait for installation to finish
- Press **REBOOT**

Important:
Do not power off the system during the update

After reboot, the EFIS will run the updated firmware



11.3. Navigation Database Update

11.3.1 USB Update

Preparation

1. Download required database updates from the manufacturer website
   Example:
   ELM800/1000 Obstacles Database Update
2. Prepare USB flash drive:
   - Capacity: 4 GB to 16 GB
   - Format: FAT32
3. Create folder on USB drive root:

   Updates

4. Copy update files into the folder ***Updates***

Important Notes

- Multiple database updates may be placed in the folder
  Example:
  - VFR charts
  - IFR charts
  - Obstacles database
- **Only one VFR charts and one IFR charts set can be installed in EFIS at same time**
- **Do NOT include any firmware update files** in the folder

Power Requirement

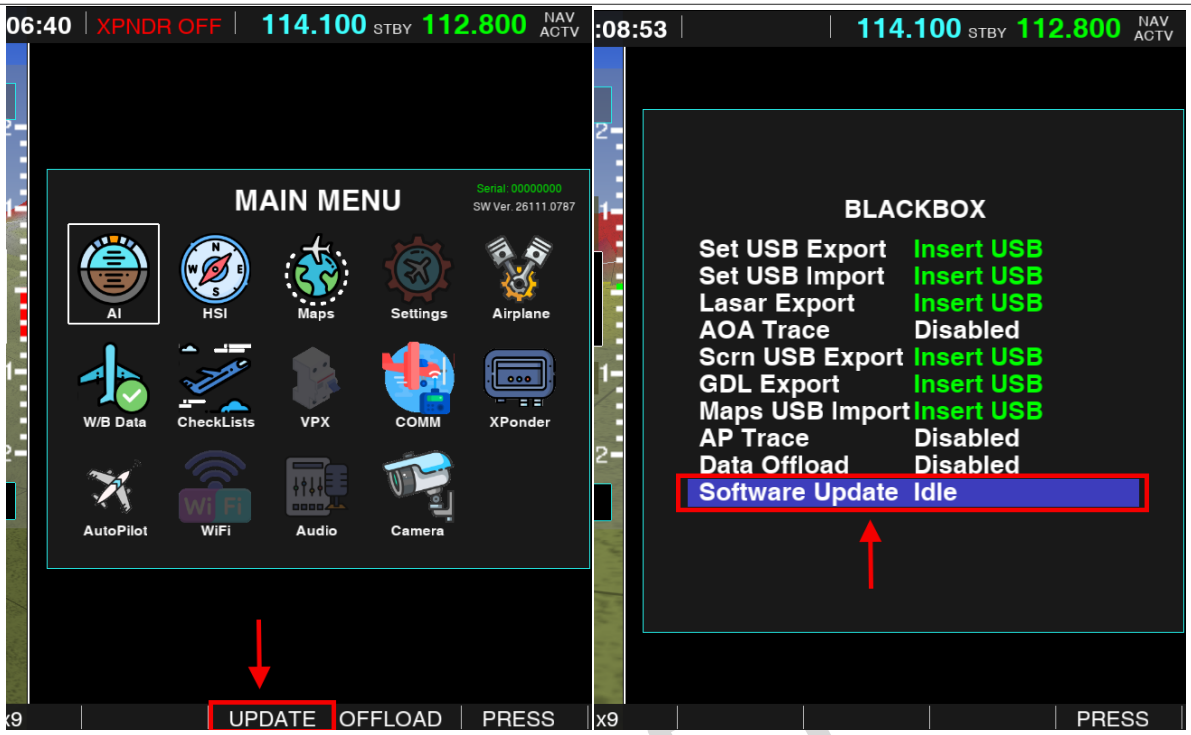
IMPORTANT:
Use external or ground power during database updates

Database updates may take up to **one hour or more** depending on data size

---

Procedure

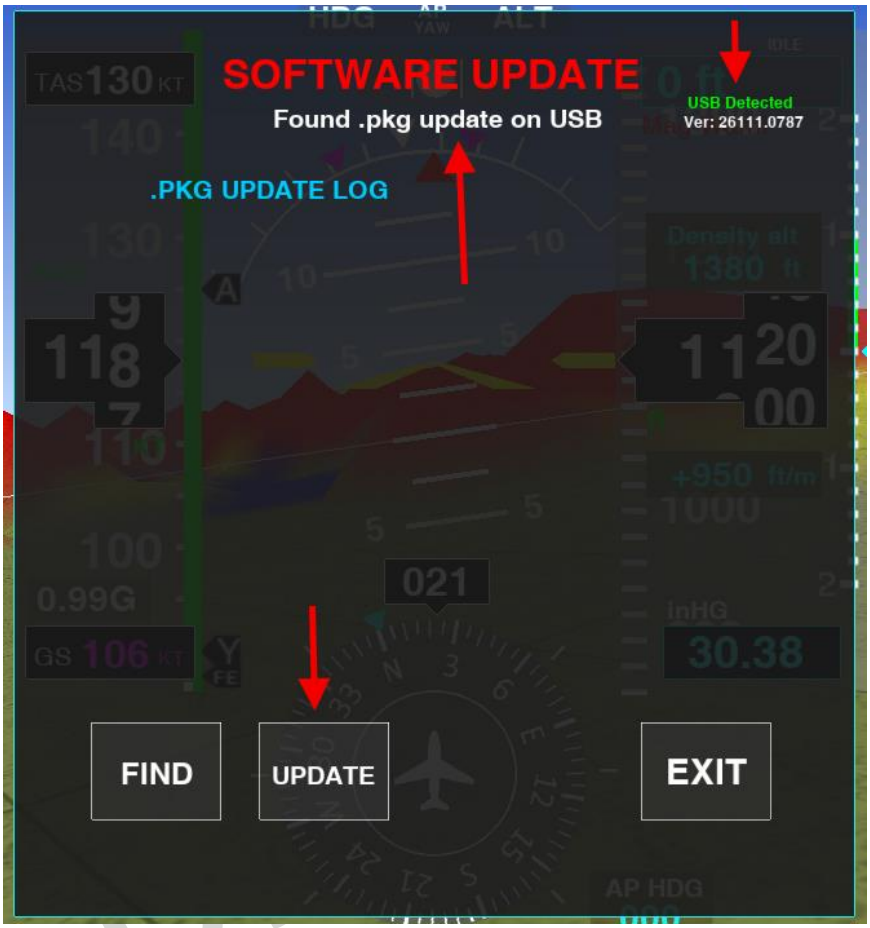
1. Insert USB drive into EFIS
2. Open update menu:
   - Press **left knob → Main Menu**
   - Navigate to:
     Settings → BlackBox → Software Update
     or (quick method) press **Button 5 (UPDATE)**
   - Please note that **Settings** menu locked by default for safety. To unlock press and hold left knob for 3 seconds while **Settings** menu selected.



3. Confirm USB detection:
   - "USB Detected" appears in green
4. Press **FIND**

5. When detected, the system will display:

```
Found .pkg update on USB
```



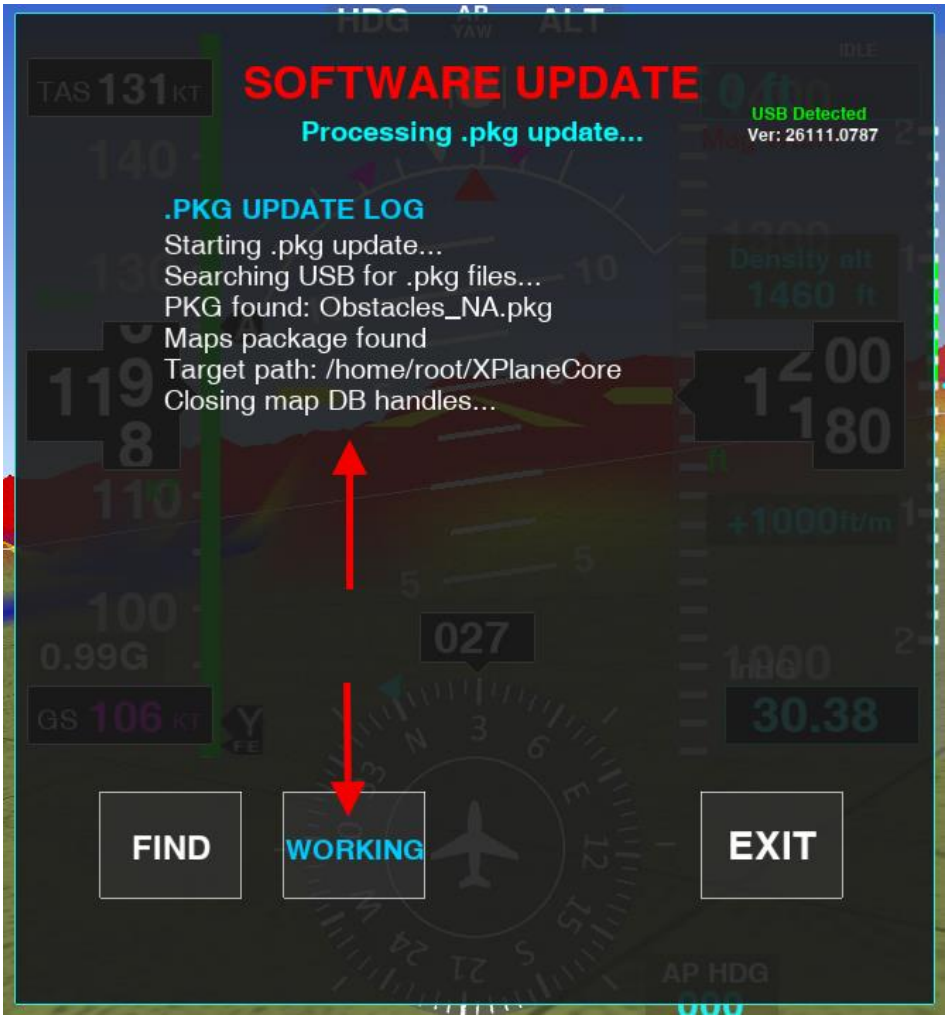
6. Press **UPDATE**

Completion

- The display will show update progress and logs
- Wait until the process completes

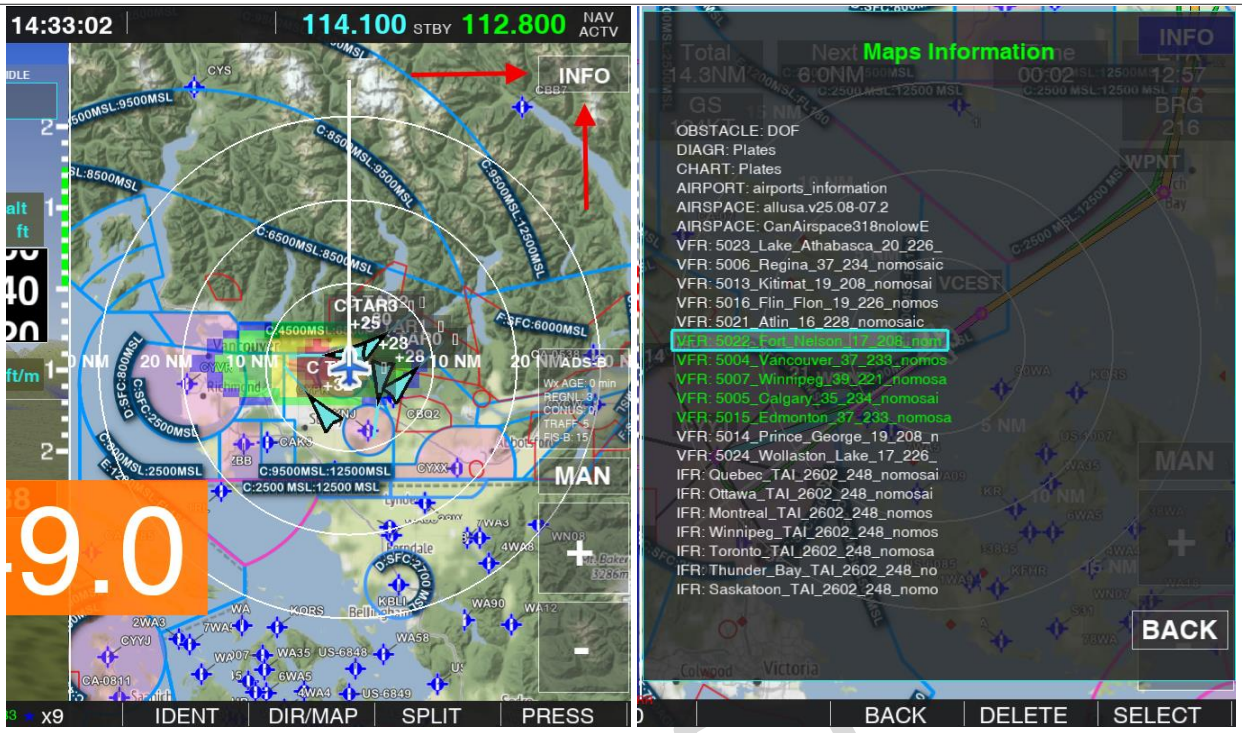
Important:
Do not turn off power during update

- Press **REBOOT** after completion



11.3.2. Verifying Installed Databases

1. Open the **Map** page (full screen or split screen)
2. Press the **INFO** button (top right corner)
3. The system will display:
    - Installed databases
    - Active databases
4. To exit:
    - Press and hold **BACK**



Any database that begins with VFR or IFR can be activated or deactivated. Active databases are shown in green and inactive databases are shown in white color.

To change the state of a VFR or IFR database, rotate the right knob to select the desired database, then press the knob. When the database turns green it is active, and when it appears white it is inactive.

After changing the database selection, the BACK button on the display will change to REBOOT. Press this button to reboot the EFIS so the new database selection is properly loaded.

11.4 LAN Update Sharing between EFIS units

When multiple compatible ELM-series EFIS units are connected through the aircraft LAN network, an update package obtained by one EFIS can be shared with the other compatible EFIS units. This avoids downloading the same update separately on every display or moving a USB flash drive from one EFIS to another.

First perform the normal update search on one EFIS using either an Internet connection or a USB flash drive. Press FIND and allow the EFIS to locate and prepare the available update exactly as described in the previous sections. If another compatible EFIS is detected on the LAN and the downloaded software package can be used by that EFIS model, a SHARE button will be available in the SOFTWARE UPDATE window.

Press SHARE to transfer the update package to the compatible EFIS units connected to the LAN. The package is transferred directly between the EFIS units and checked after reception to confirm that the complete file was received correctly. The receiving EFIS automatically opens its Software Update page and prepares the received package in the same manner as if FIND had been performed locally.

Important: Sharing an update does not automatically install the update on another EFIS. Each EFIS must be updated individually. After the transferred package has been received and verified, the pilot or installer must review the displayed update information and manually press UPDATE on that EFIS. This prevents one EFIS from remotely starting a software installation on another unit.

Software update packages are shared only with compatible EFIS models. An update intended for one EFIS software family will not be transferred to an incompatible EFIS model.

Navigation, chart, obstacle and other compatible data `.pkg` updates can also be distributed through the LAN. When a supported data update is found, the package may be transferred to other compatible EFIS units on the network. The receiving EFIS stores and verifies the package but does not install it automatically. UPDATE must still be pressed locally on each EFIS to begin installation.

Do not disconnect aircraft power or network connections while an update package is being transferred. For large navigation or chart databases, transfer and installation may require considerable time. As with normal USB database updates, external or ground power is recommended for large updates. Your existing manual already warns that database updates can take one hour or more and recommends external/ground power, so this wording stays consistent with the existing procedure.

I would also add one small note to the existing Online Update section on page 51 because it currently says the EFIS can connect to the Internet via “LAN cable.” Put this directly after that requirement:

Note: An Internet connection through a LAN cable and EFIS-to-EFIS LAN synchronization are separate functions. Internet access is required only for downloading an online update. Once an update package has been downloaded, compatible EFIS units on the local aircraft network can receive the package directly from another EFIS without requiring a separate Internet download.

Final Notes

- Always use correct update files for your EFIS model
- Please note that you can only install and have one VFR charts set in EFIS
- Do not interrupt power during any update process
- Always reboot after update completion

12. Operations

12.1 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 independent from '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'

12.2 EFIS Operation Modes

ELM800/1000 has the following modes of operation:

- Artificial horizon indicator
- Compass/HIS
- Map (Sectional/Global)
- Airplane Overview
- Weight and Balance
- Checklists
- Artificial horizon split with one of [map, HSI, Time, Engine monitor, VPX]
- Map split with engine monitor (MFD only)

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.

During operation of ELM800/1000 the top and bottom info lines are always contains important information such as time, radio frequencies, warnings and button/knob help/function.

Pay attention to labels on top of buttons for its basic functionality.

Artificial horizon indicator

Artificial horizon in ELM800/1000 has two modes of operations: Standard 2D or Full 3D with synthetic view. It also can be set in day or night mode of operation (automatically by surise/sunset)

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 view mode. These

databases can be updated via Software Update menu in the similar to firmware update manner.

Flight Parameters Displayed by the Artificial Horizon Indicator

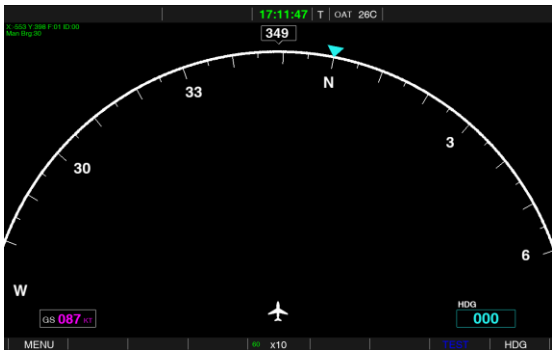
The artificial horizon indicator in both Normal and 3D Synthetic view shows the following flight parameters:

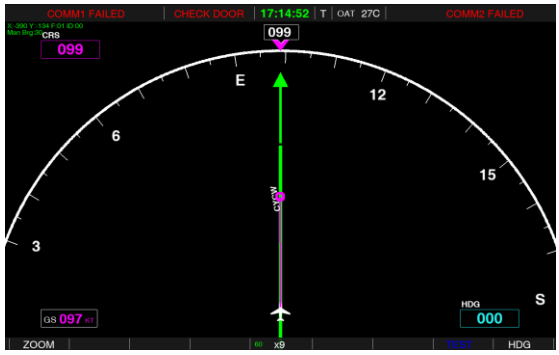
1. **Current Speed:** Displays either ground speed (in red) or airspeed (in white) depending on the source used by the ELM800/1000. The units for current speed are always displayed below the speed indicator in green.
2. **Current Altitude Indicator:** The current altitude value appears on the right side of the display, with the units shown below the altitude indicator in green. When the OAT sensor is connected and enabled, density altitude is shown above the current altitude indicator.
3. **Slip/Skid Ball Indicator:** Located at the bottom of the screen, the slip/skid ball indicates airplane coordination; the airplane is coordinated when the ball is inside the gate.
4. **Ground Pressure Indicator:** Found at the bottom right of the screen, this indicator shows the ground pressure with units displayed above it. To adjust the ground pressure based on ATIS, rotate the knob clockwise or counterclockwise.

5. **Ground Speed Indicator:** Positioned at the bottom left of the screen, it displays current ground speed when GPS signal is available. If GPS signal is lost, the message "NO GPS" will appear. Units are shown to the right of the ground speed value, with "GS" indicating ground speed.
6. **Vertical Speed Indicator:** Located on the right side of the screen beneath the altitude indicator, it shows altitude change per minute in the same units as altitude. A white vertical speed indicates the airplane is steady or descending (with a "-" sign for descending), while green indicates climbing (with a "+" sign).
7. **Turn Bank Arc:** This arc is displayed at the top center of the screen, indicating the current bank angle. During flight, two small blue triangles (▼) appear on either side of the center white triangle to represent a standard turn bank (2 minutes per turn).
8. **Current Track Indicator:** Located at the very top of the display, it defaults to (M) Magnetic track but can be switched to (T) True track in the "Settings Menu" > "External Devices" > "Mag Decl Corr." The current mode (M or T) is shown to the right of the indicator.
9. **Vertical Color Speed Strip:** Found on the left side of the screen, this strip displays V speed markers (Vfe, Vy, Vx, Vr, etc.), moving in accordance with the current speed of the airplane.
10. **Outdoor Air Temperature (OAT):** OAT information is displayed at the bottom left of the screen, above the ground speed indicator, with units shown 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 when the OAT sensor is connected and enabled in the "Settings Menu" > "External Devices" > "Use OAT." This requires a Pitot airspeed enabled version of the unit.
13. **Angle of Attack (AOA) Indicator:** Designed to indicate the current angle of attack; this option is not included with the standard ELM800/1000 and must be ordered separately. A special pitot sensor is required for operation.
14. **Engine Monitor CHT/EGT Temperatures:** When connected to the EM-01 EnGood sensor module, it provides current engine temperatures (CHT and EGT) for all cylinders.
15. **G-Force Sensor:** Registers the current G-force, as well as the top and bottom limits reached during flight.
16. **Wind Direction Indicator:** Shows current wind speed and direction, functioning only in conjunction with an external magnetometer.
17. **Engine Monitor Sensors and Other Information:** When connected to the EM-01 EnGood sensor module, it provides current engine sensor parameters, including RPMs and MAP.

Compass mode

Directional indicator / Compass mode is also available in Arc mode.





Compass Mode Display Information

In compass mode, the ELM800/1000 displays the following information:

1. **Current Track:** The display defaults to showing the (M) Magnetic track. This can be changed 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 icon. To adjust the heading bug setting, rotate the knob clockwise or counterclockwise.
3. **Heading Bug Indicator:** The heading bug indicator is located on the compass dial, allowing pilots to easily reference the desired heading.
4. **Ground Speed Indicator:** Found at the bottom left of the display, this indicator shows the current ground speed.

Directional Information Sources:

- When the MAG-01 is not installed, the compass information is derived from the GPS Course Over Ground (COG), which provides precise directional information while the airplane is in motion and GPS signal is available. The COG represents the True direction.
- If enabled in the "Settings Menu" > "External Devices" > "Mag Decl Corr," the COG will be converted from True to Magnetic direction for display on the compass.
- When the MAG-01 is installed and enabled in the settings menu, the ELM800/1000 utilizes directional information received from the MAG-01 instead of GPS COG. The MAG-01 provides accurate and stabilized directional information during flight.

Use of external MAG-01/02 Digital 3-axis Magnetometer and Heading Sensor

MAG-01/02 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-01/02 easily integrates with the ELM800/1000 EFISes, though it is important to note that the MAG-01/02 is currently non-TSO certified and intended for installation in experimental (home-built) airplanes only.

Key Features

- **Microprocessor-Based:** The MAG-01/02 utilizes advanced microprocessor technology to sense the Earth's magnetic field alignment and relay this information to compatible AHRS systems (ELM1000, ELM800, ELM310, 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 ELM800/1000 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-01/02 employs long-life solid-state sensing technology to provide electronically stabilized AHRS.

Installation Considerations

When installing the MAG-01/02, 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

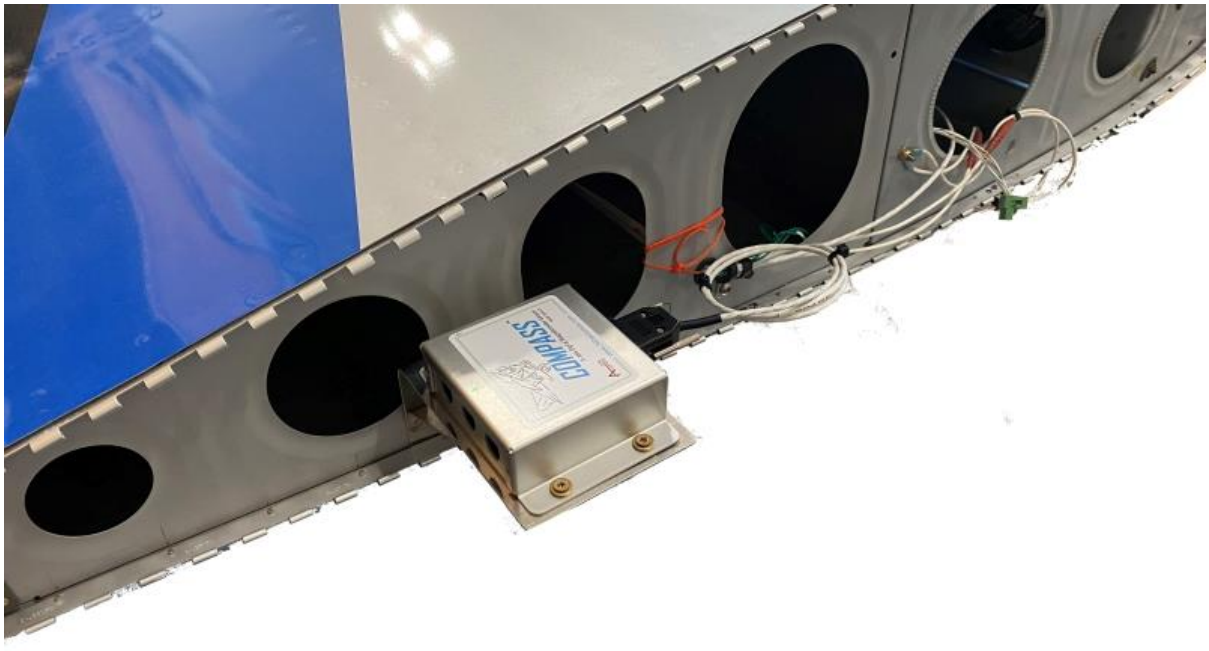
The MAG-01/02 features a DB15 connector on its front wall, requiring only four wires to interconnect with ELM1000 or ELM350 EFIS systems. Additionally, a separate circuit breaker (3A) must be installed and labeled as “Compass” or “MAG-01 or 02” depends on your model in the panel.

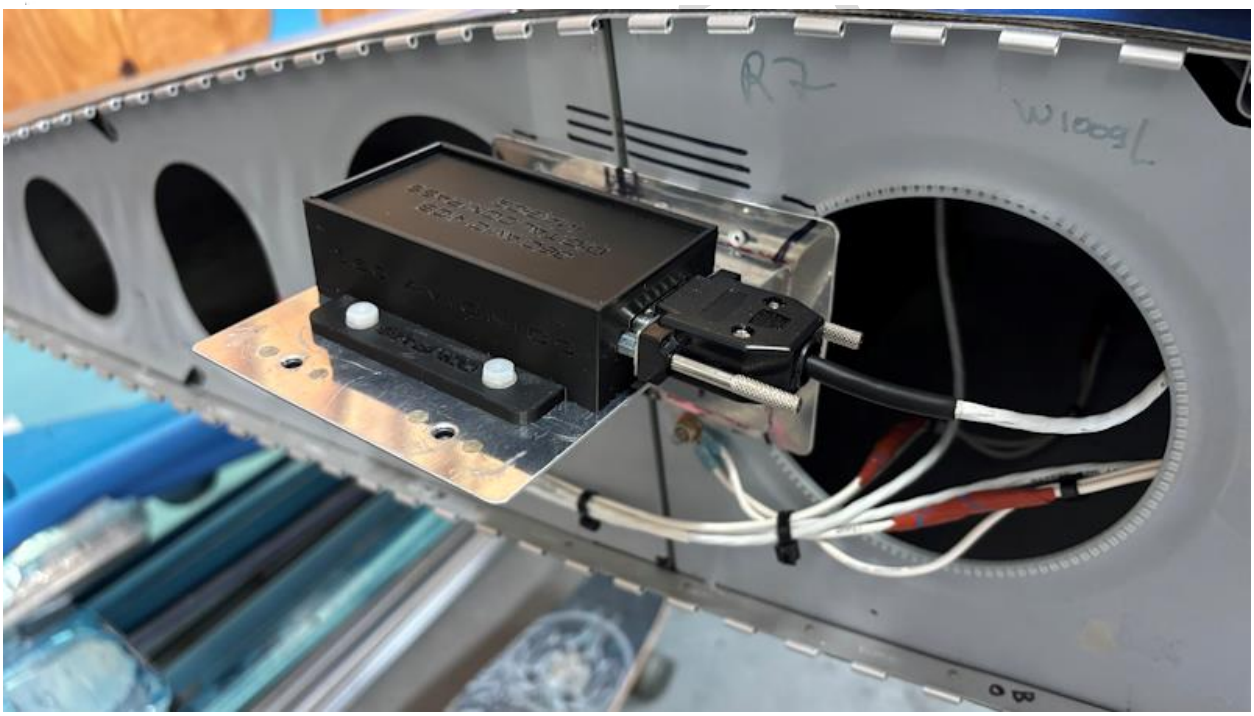
Magnetometer connector pinout:

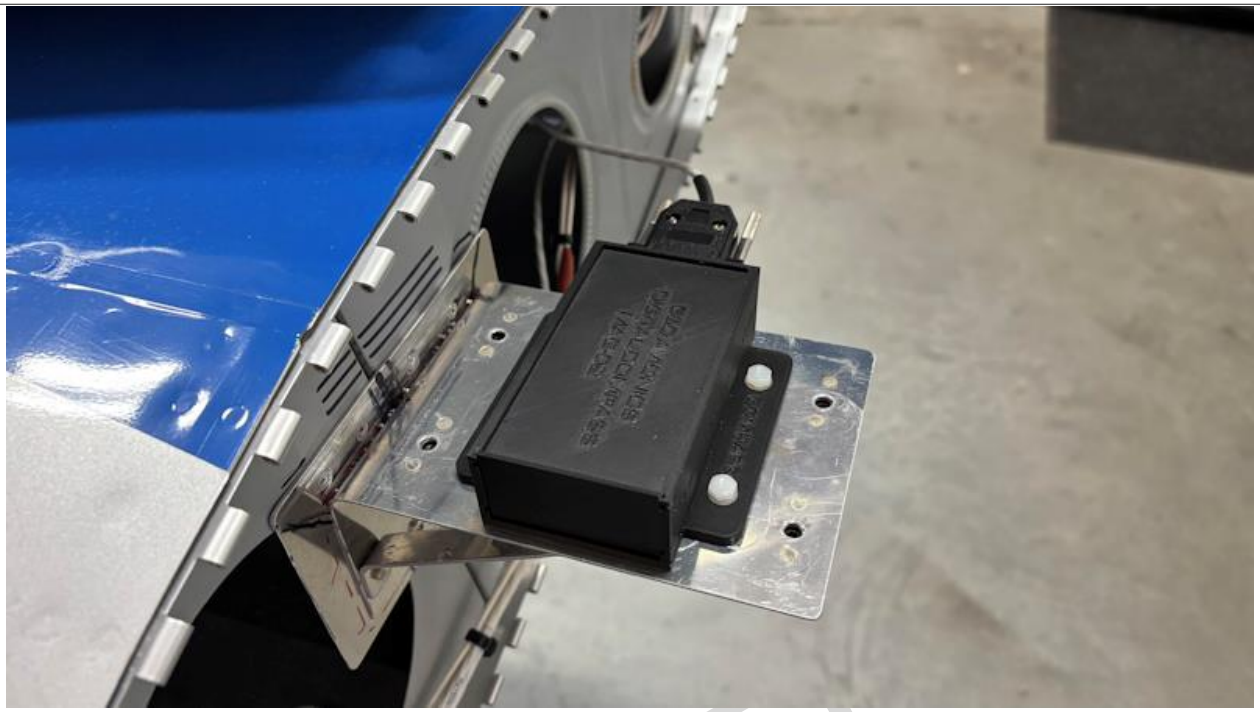
Pin 1 – Power Input +
Pin 15 – Ground
Pin 10 – CAN Bus Low (should be connected to pin 12 of ELM800/1000 Main Connector)
Pin 11 – CAN Bus High (should be connected to pin 13 of ELM800/1000 Main Connector)

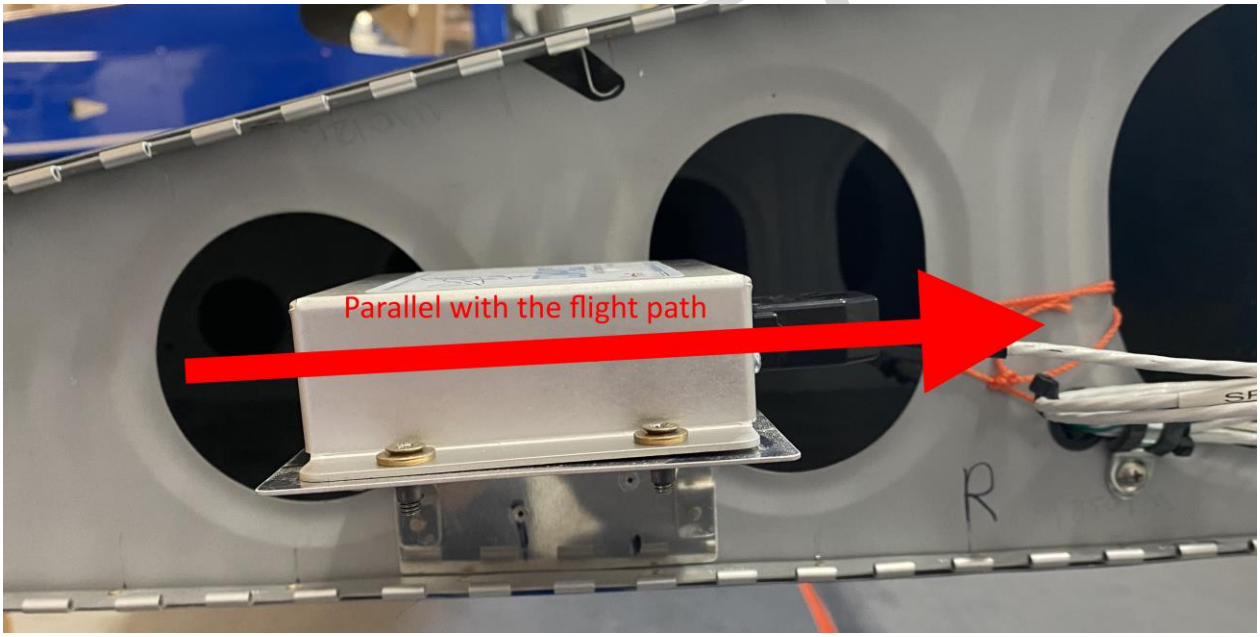
Physical Installation

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:

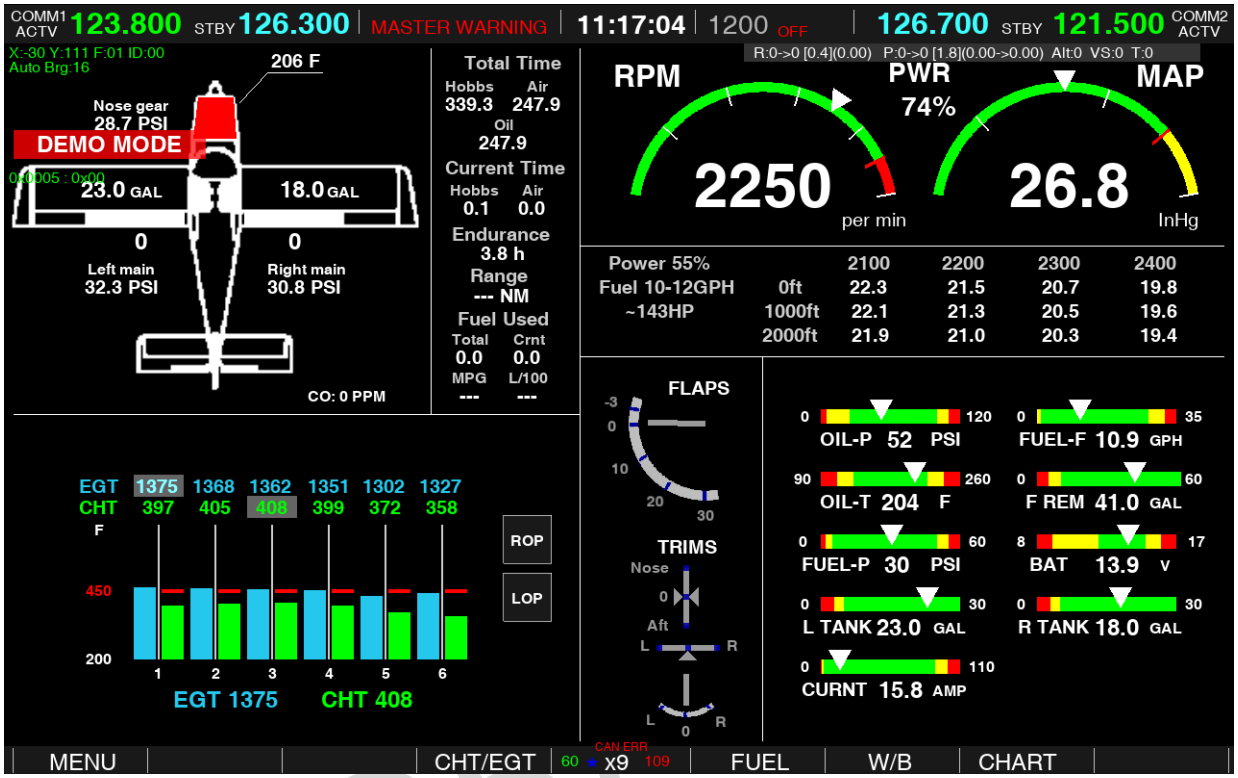








Enhanced Aircraft Flight Information Mode



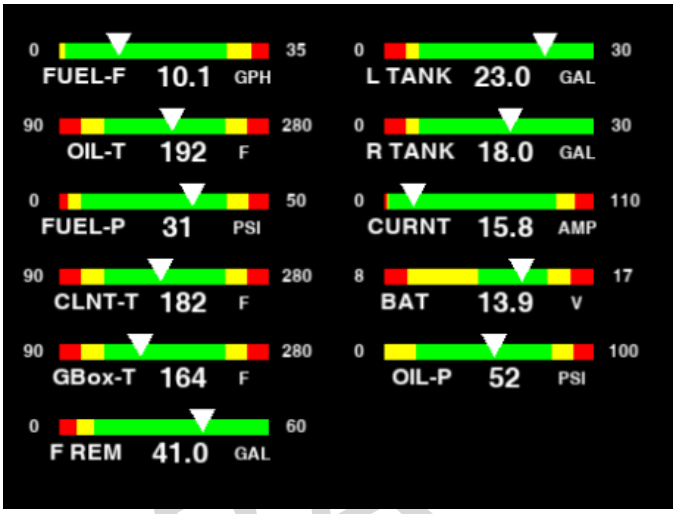
Enhanced Aircraft Flight Information Mode

The **Enhanced Aircraft Flight Information Mode** consolidates crucial aircraft data into a single display screen, providing pilots with real-time insights into their aircraft's status and performance. The following information is available:

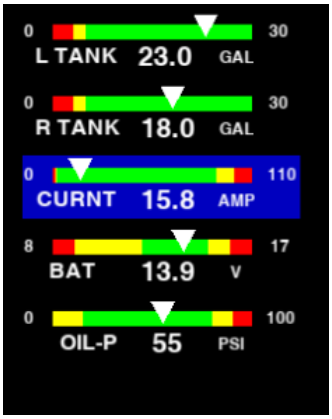
- **Airplane Doors and Flaps Status:** Current status and position of airplane doors and flaps.
- **Current Airplane Times:** Displays Hobbs, Air, and Oil times.
- **Endurance and Range:** Information on endurance, range, and fuel used.
- **Fuel Efficiency Metrics:** Displays MPG and L/100 km information for comparison with vehicle travel only.
- **Engine Power Charts:** Power charts specific to your engine, which can be uploaded for any engine model.
- **Flaps and Trims Position:** Current positions of flaps and trims.
- **Engine Monitoring Information:** Real-time data on EGT (Exhaust Gas Temperature), CHT (Cylinder Head Temperature), pressures, RPMs (Revolutions Per Minute), MAP (Manifold Absolute Pressure), and more.
- **CHT Live Graphs:** Live graphs of CHT data displaying the last 3 minutes of information.
- **ROP and LOP Assistant:** Assistance for Lean of Peak (LOP) and Rich of Peak (ROP) operations.
- **CO Level in cabin (if special CO sensor is installed)**

Engine Gauge Display and Custom Arrangement

The EFIS automatically displays all enabled engine and system gauges based on the sensors configured in the system settings. Under normal conditions, up to 10 active gauges are shown using the standard two-column layout. If more than 10 gauges are enabled, the EFIS automatically switches to a more compact display with reduced spacing and smaller text, allowing up to 12 gauges to be shown at the same time.



The position of the displayed gauges can be customized directly from the touchscreen. To move a gauge, touch and hold it until its background becomes blue. Then touch and hold another gauge to swap the positions of the two gauges. If a gauge is highlighted but you decide not to move it, touch and hold the same highlighted gauge again to cancel the selection.

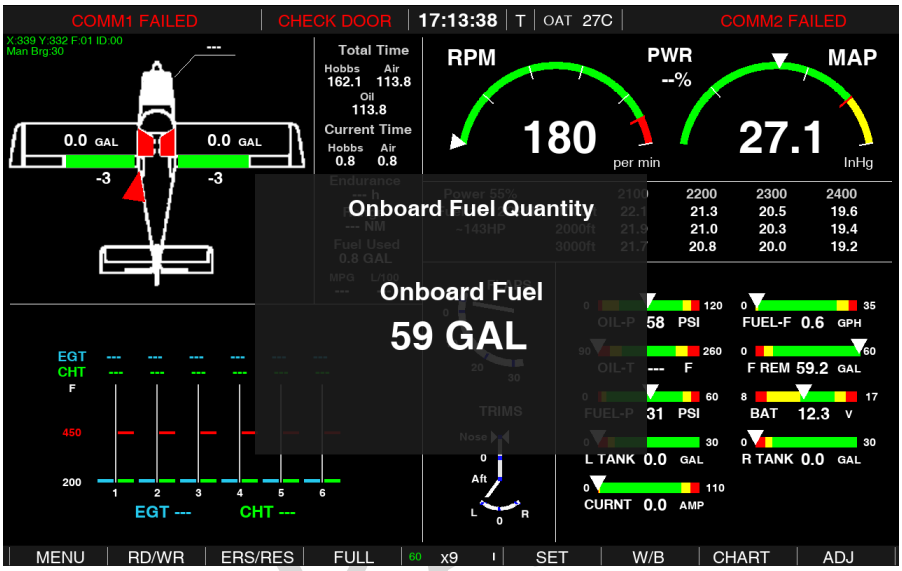


The customized gauge order is saved automatically and remains in effect after the EFIS is restarted. This allows each pilot to arrange the most important engine and system information in the preferred screen locations without changing which sensors are enabled.

Navigating Power Charts

To switch between engine power charts for different power levels, press button 6 labeled **"CHART."** The chart will display three altitudes, with the current altitude always positioned in the middle.

Total amount of fuel on board can be set from this mode. Press button 4 from the left "FUEL". New menu appear on the screen.



Rotate right knob to set fuel quantity on board then press button 4 "SET" again to store the fuel quantity.

Fuel Alarm Feature

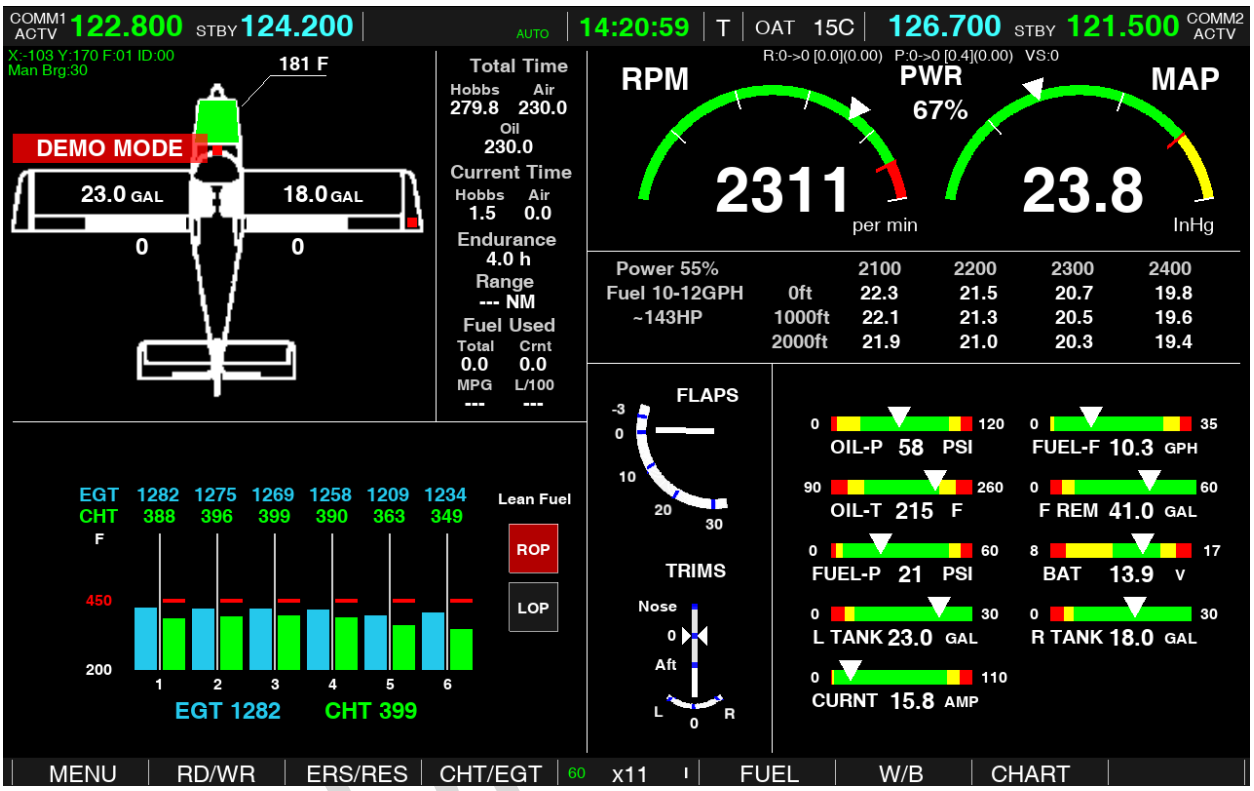
The **Fuel Alarm** can be easily enabled or disabled in the **Settings Menu** under **Time**. This feature allows the user to set a repetitive alarm that reminds them to switch the fuel tanks at predefined intervals, ranging from **0 to 240 minutes**.

- **Alarm Settings:**
  - Setting the alarm to **0** disables the feature.
  - When enabled (setting between **1 and 240 minutes**), the unit will display a reminder message on the screen: **"Switch Fuel Tanks"** at the specified intervals.
- **Acknowledging the Alarm:**
  - To dismiss the warning and return to the previous screen, simply press the **left button**.

If an external **VICS** module is connected, an **audio reminder** stating **"Switch Fuel Tanks"** will also be triggered.

For detailed instructions on setting this function, please refer to the **Settings Menu** under **Time**.

Lean of Peak / Reach of Peak Assistant

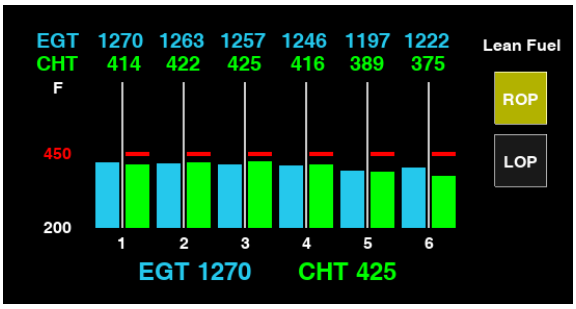


Leaning Assistant Feature

The **Leaning Assistant** is designed to simplify the leaning process for pilots. It offers two primary modes based on **Exhaust Gas Temperature (EGT)**: **ROP (Reach of Peak)** and **LOP (Lean of Peak)**.

Steps for Using the Leaning Assistant:

1. **Climb and Level Off:**
   - After takeoff, climb to your desired cruise altitude and level off.
   - Set your appropriate power settings (Throttle/MAP and Prop/RPM).
   - Allow the EGTs to stabilize for about **30 seconds to 1 minute**.
2. **Select Leaning Mode:**
   - Tap the **ROP** or **LOP** button on the screen, depending on your desired leaning method.
   - The selected button will turn **red**, indicating it is armed and ready for use.
3. **Begin Leaning:**
   - Gradually lean your fuel while closely monitoring the selected button's color and the information displayed.

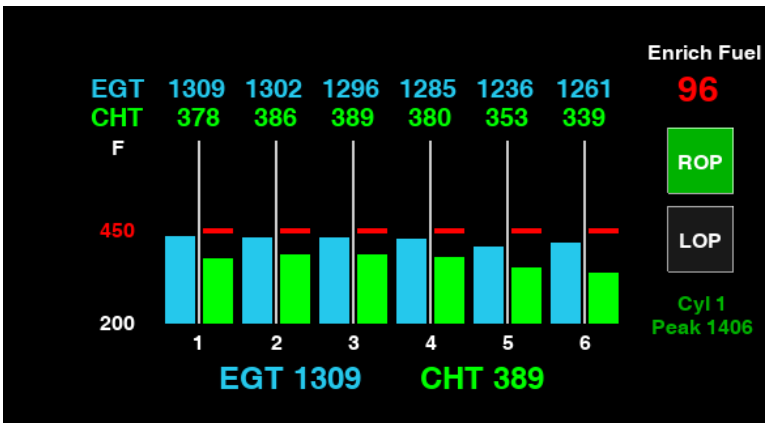


ROP (Reach of Peak) Mode:

- In **ROP Assistant mode**, the engine monitor waits for the first cylinder's EGT to reach its peak and flatten.
- As soon as the temperature of the first cylinder reaches its peak and stabilizes, the button will turn **green**, and the temperature difference between the peak EGT and the current EGT for that cylinder will be displayed.

LOP (Lean of Peak) Mode:

- In **LOP Assistant mode**, the engine monitor waits for all cylinders' EGTs to reach their peak and flatten.
- Once the temperature of the last cylinder (the last in sequence) reaches its peak and stabilizes, the button will turn **green**, and the temperature difference between the peak EGT and the current EGT for that cylinder will be shown.

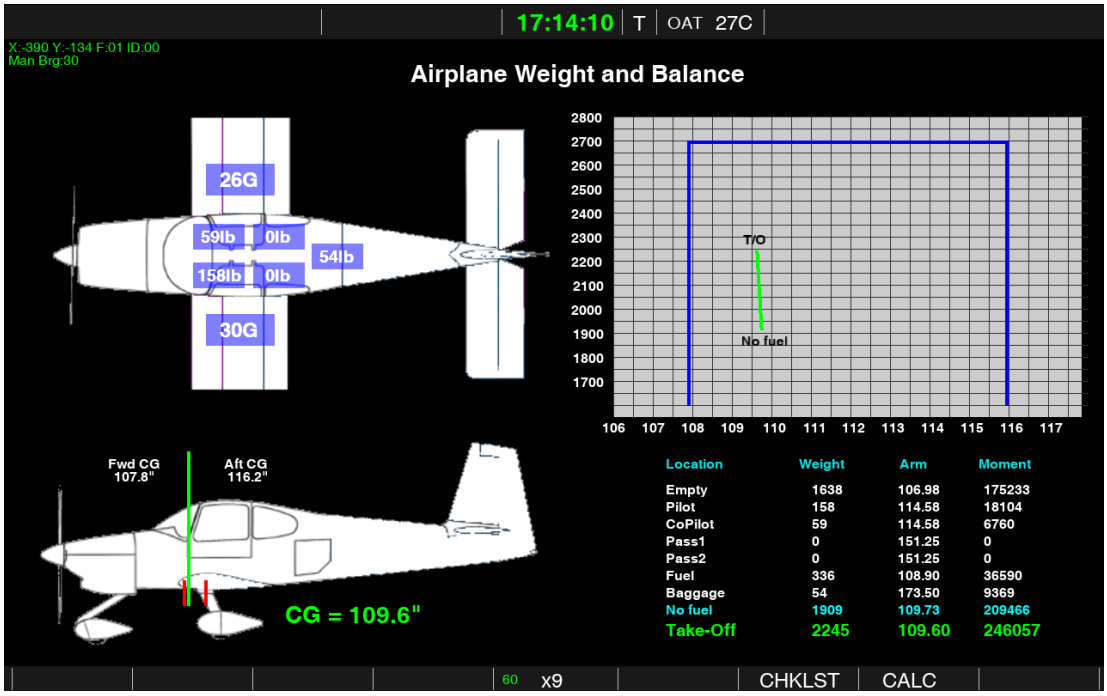


If you use **ROP** mode, after button became green start slowly enrichening fuel and monitor EGT temperature difference shown on top of the button. Stop enrichening as soon as you reach

your desired temperature difference (normal is 80-100F but can be different depends on your engine).

If you use **LOP** mode, after button became green continue slowly leaning fuel and monitor EGT temperature difference shown on top of the button. Stop leaning as soon as you reach your desired temperature difference (normal is 20-50F but can be different depends on your engine).

Weight and Balance Mode

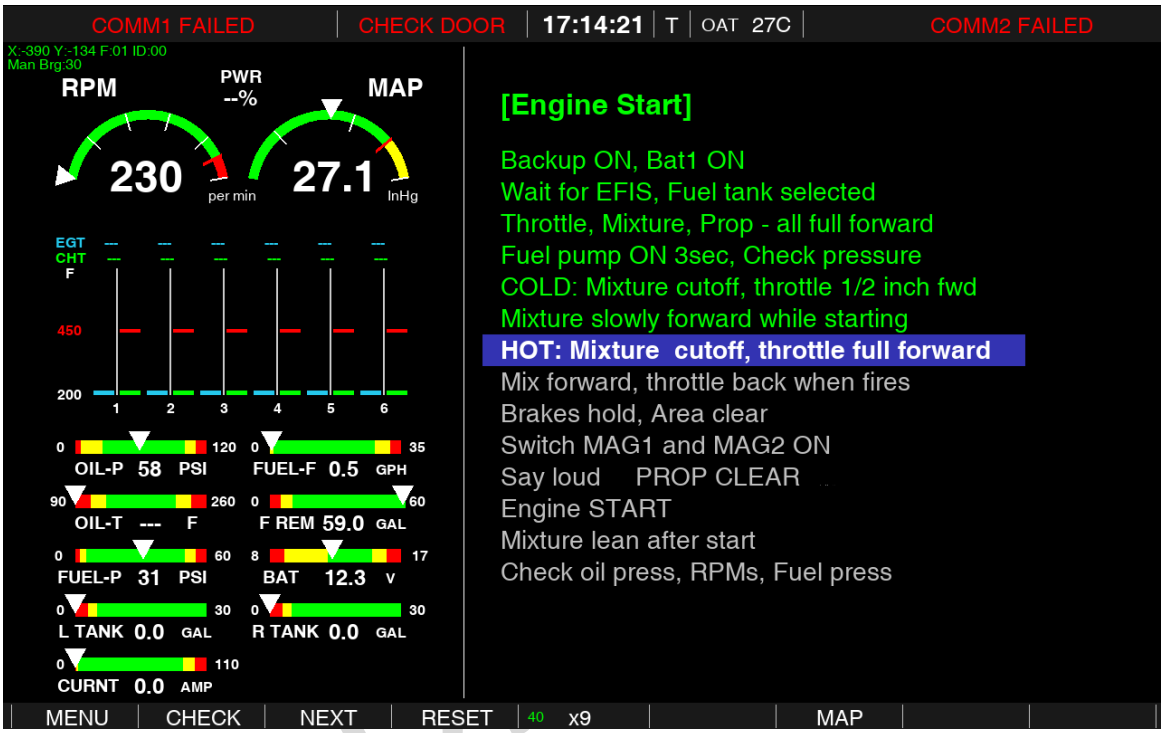


This mode allows to calculate current weight and balance based on pre-defined airplane parameters (can be updated/set for any airplane).

1. Simply touch blue rectangle on the airplane top view and set the weight for pilot/pax, as well as amount of fuel in gallons on board. When specific field is touched it becomes red. Rotate left knob to adjust the number. Once adjusted press button 1 “SET” to set the value.
2. Press button 6 “CALC” to calculate weight and balance for the airplane. Image is self intuitive and shows both graph and CG on the airplane side.

All settings including arms, default pax/pilot/baggage weights can be adjusted via appropriate settings menu: “Settings” -> “W/B Checks”

Checklists Mode



Checklists mode allows pilot to quickly and efficiently proceed with all required checklists before/during/after flight.

Checklists can be easily customized and uploaded to the EFIS.

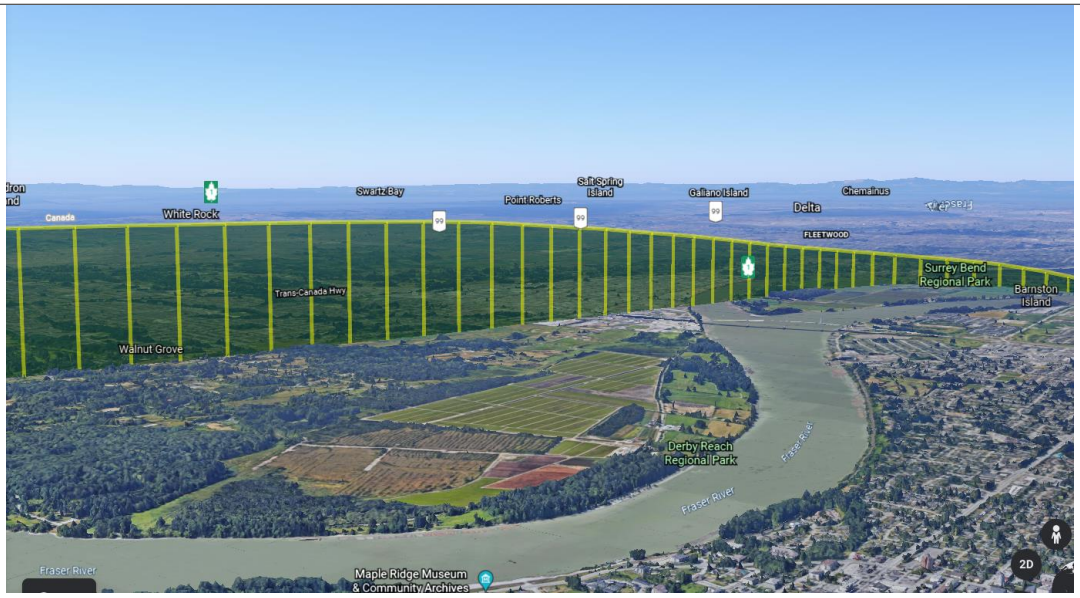
Press button 1 “CHECK” to check the item (mark it green) and press button 2 “NEXT” to move to next check list.
Button 3 “RESET” starts everything over by unchecking all checked items of all lists.

13. Black Box functionality

ELM800/1000 has built-in black box recorder functionality. Black box recorder takes all flight parameters from all sensors on every pre-set time interval. By default, the time interval is set to 5,000ms (5 seconds), but a different time interval can be selected in the “Settings menu” > “Black Box submenu” > **‘FR Period’** and **‘KML Period’**.

All parameters are recorded to the internal flash memory. Data record starts on takeoff when speed has reached Vr and stops when airplane has landed (when speed falls below Vs). Recorded data can be exported from flash memory to USB flash in two formats – internal ELM1000 format (for future expansion to read with special software) and also in .KML Google Earth format.

Exported .KML file can be opened using Google Earth software installed on computer or online via **earth.google.com** This format will allow one to see the flight path and altitude of the recorded flight that can be useful 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***.

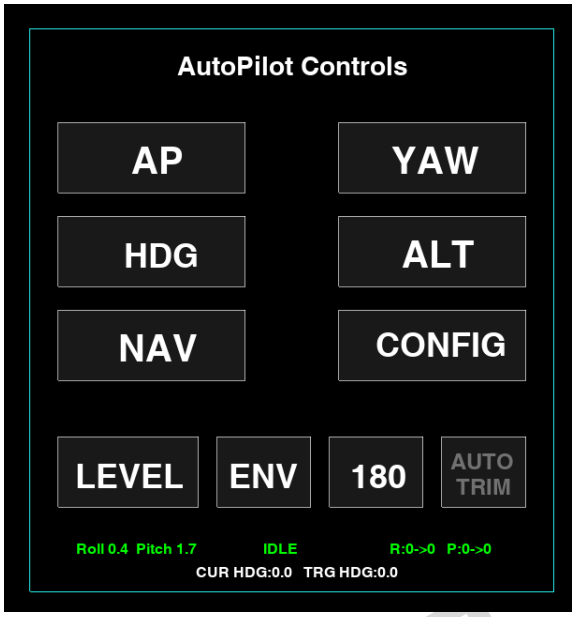
1. Ensure that USB Flash drive via adapter cable is connected to USB port.
2. Select **BlackBox Func** in the “Settings menu” > “Black Box submenu” by pushing the left knob
3. Choose ‘BB USB Export’ sub setting
4. Push the knob to start export. Display will indicate current export status.
   Once completed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

ELM800/1000 EFIS supports autopilot controls for compatible AP modules (AP-01, etc).
Refer to autopilot manual for all installation and configuration steps.

If Autopilot connected to ELM800/1000 network and activated in the Settings menu the ‘AP’ button will appear in the bottom left corner (artificial horizon mode). If Yaw damper also installed and connected its control button will show on top of the ‘AP’ button.

By touching ‘AP’ button Autopilot menu will appear on display. This menu let pilot to engage/disengage various autopilot modes.



'AP' button will engage/disengage autopilot in both altitude and lateral modes. When autopilot activates button's background becomes green.

'HDG' button will engage/disengage autopilot in heading (lateral) mode while altitude mode will not be engaged.

'NAV' button will engage/disengage autopilot in navigation mode if flight plan is loaded and activated. This mode can only be engaged when flight plan is active in EFIS. In case if 'NAV' mode is active and flight plan gets cancelled autopilot will automatically switch to HDG mode instead.

'YAW' button will engage/disengage yaw damper.

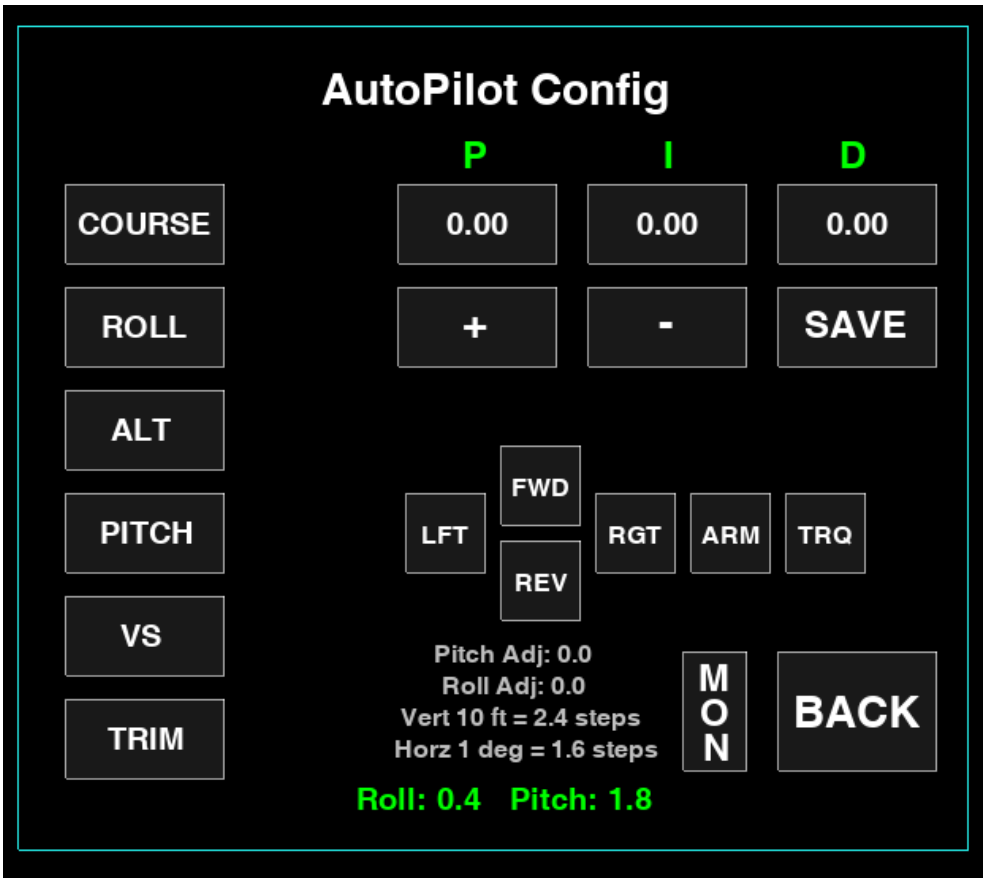
'ALT' button will engage/disengage altitude hold/vertical control mode.

'LEVEL' button will immediately bring airplane in 'straight and leveled' position and then will engage autopilot (if not engaged) in both HDG and ALT modes.

'ENV' button will activate/deactivate attitude-envelope protection mode. This mode will limit airplane in both pitch and roll angles depends on preset values.

'180' button will perform 180 degrees turn of the airplane and then will engage autopilot (if not engaged) in both HDG and ALT modes.

'CONFIG' button allows pilot to configure his autopilot's sensitivity and speed of reaction depends on airplane/airframe type.



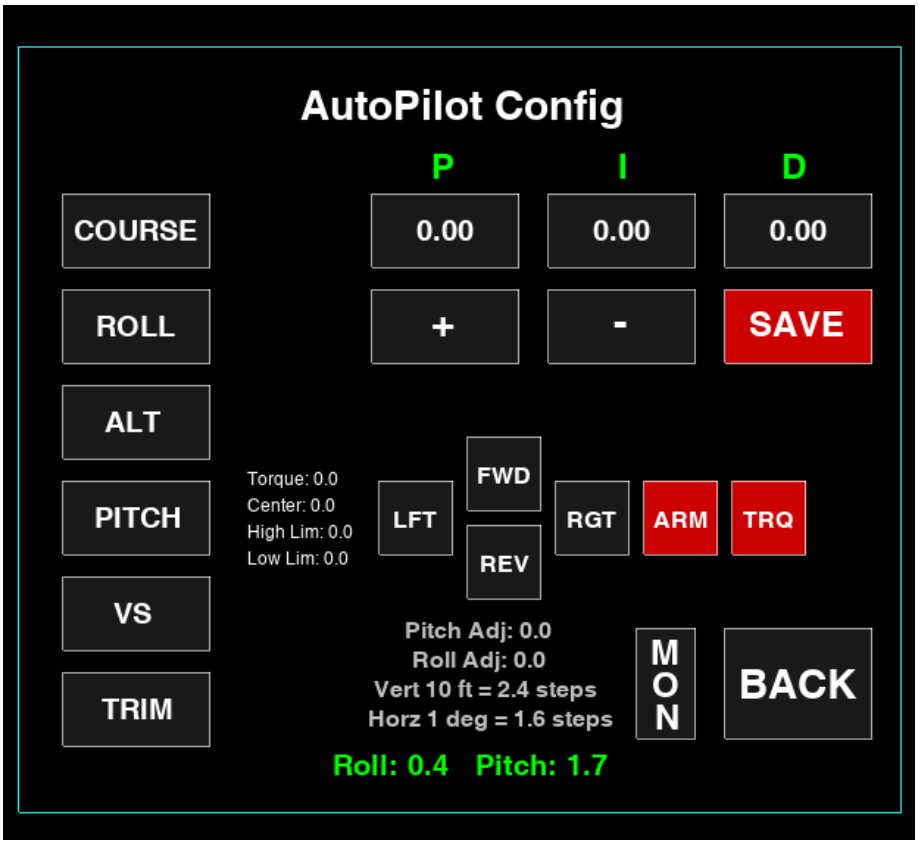
WARNING! 'CONFIG' mode should be used only while airplane is on the ground.

While in autopilot configuration mode:

'ARM' button allows to arm and test autopilot's direction of operation for both pitch and roll. Press on ARM button and once it becomes red your pitch and roll servos will both be engaged. Press on 'FWD' button should move stick (yoke) forward (nose down), button 'REV' should move stick (yoke) backwards (nose up), button 'LFT' should move stick (yoke) left (bank to the left) and button 'RGT' should move stick (yoke) right (bank to the right).

Set desired pitch servo torque level (0…255) via main ‘Settings -> Autopilot menu’. Now configure pitch up/down warning limit, which will show warning to pilot on display during normal operations.

This limit needed to warn pilot when pitch servo operates at its maximum torque level and airplane should be trimmed manually.

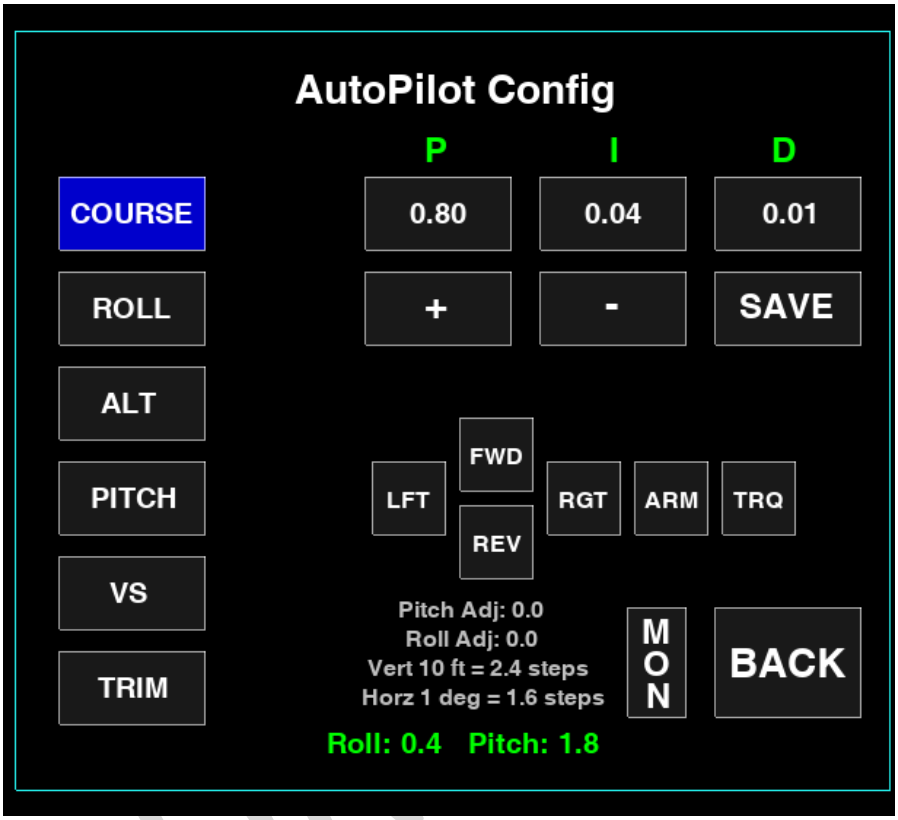


Make sure that ARM button is red, now press TRQ button so it also becomes red.

Slowly pull the stick (yoke) as if you climbing. Pull the stick/yoke until pitch servo slips. This will set the maximum pitch up force which servo can withhold.

Slowly push the stick (yoke) forward until pitch servo slips. This will set the maximum pitch down force which servo can withhold.

Press ‘SAVE’ button to save these new presets in to memory. Now your pitch servo’s torque alarm configured.



Special fine tune mode for the autopilot can be accessed via top left column of buttons.

Please refer to autopilot manual for information on how to adjust and tune autopilot's sensitivity in pitch and roll axis.

Flight Planning and Instrument Approach Operations

The ELM800/1000 provides flight-plan navigation, coded instrument procedures, NAV-radio ILS/LOC guidance, and autopilot coupling. GPS/RNAV guidance may be provided either by the EFIS internal GPS or by a compatible external ARINC navigator such as the Garmin GPS 175.

WARNING: The ELM800/1000 is experimental avionics. Always verify the selected airport, runway, procedure, transition, frequencies, courses, altitudes and minimums against a current approved chart before flight.

WARNING – INTERNAL GPS: RNAV approach guidance generated from the ELM800/1000 internal GPS is experimental and non-certified. It must not be considered an approved IFR GPS navigator or certified LPV/LNAV/VNAV source. Do not rely on internal GPS approach guidance as the sole means of navigation in IMC.

WARNING – AUTOPILOT: The pilot must continuously monitor the aircraft, navigation source and autopilot modes and must be prepared to disconnect the autopilot immediately.

Flight Plans

A normal flight plan can be created directly in the ELM800/1000 or received from compatible external equipment.

When **AP NAV** is selected, the autopilot follows the active ELM flight plan laterally. ALT HOLD is normally maintained unless another vertical mode or procedure guidance is active.

When a new external flight plan is received while another flight plan is already active, the existing plan remains in use until the new route has been completely received and validated. The pilot is then presented with the incoming flight-plan message and can **ACCEPT** or **DECLINE** it.

Declining the new plan leaves the existing flight plan unchanged. Repeated transmissions of the same plan are ignored.

When **External Navigator Control** is active, a flight plan received from the GPS 175 is mirrored on the ELM display automatically. In this mode the GPS 175 remains the navigation master; the mirrored ELM flight plan is primarily for display and situational awareness.

Opening the Procedure Menu

Select **PROC** to open the **LOAD PROCEDURE** page.

The airport can be selected using:

- **KEYBOARD** – enter the airport identifier.
- **NEAREST** – select from nearby airports.

The same procedure system can also be opened from the **PROC** tab on an Airport Information page. In this case the airport is already selected.

Select the required procedure type, runway, procedure and transition as applicable.

The current navigation-database identification and validity dates are displayed at the top of the procedure window.

If a coded procedure or required leg cannot be safely supported, the ELM displays a **PROCEDURE NOT SUPPORTED** or similar warning. Do not use the internal AP NAV path for an unsupported procedure.

Selecting the GPS Procedure Source

The LOAD PROCEDURE page provides two GPS source selections:

INT GPS selects the ELM800/1000 internal GPS and internal procedure sequencer.

ARINC selects the connected external navigator.

When ARINC is selected, the page indicates either:

ARINC GPS CONNECTED

or

ARINC DATA NOT AVAILABLE

When the GPS 175 will control navigation, select **EXTERNAL CONTROL**. While External Control remains active, pressing PROC returns directly to the **EXTERNAL NAVIGATOR** page.

Internal GPS RNAV Procedures

With **INT GPS** selected, the ELM800/1000 loads and sequences the coded procedure itself.

1. Select the airport, runway and approach.
2. Select the required transition.
3. Enter the published minimums.
4. Select **DA** or **MDA** as applicable.
5. Select **LOAD PROCEDURE**.
6. Verify the loaded legs and procedure against the current approach chart.
7. Engage both autopilot axes when appropriate.
8. Select **AP NAV** to follow the loaded route while maintaining altitude.
9. Select **ARM GPS APPR** when ready to arm final approach capture.

The display identifies internal guidance as **EFIS LNAV** or **EFIS LNAV+V** when an internally generated vertical path is available.

IMPORTANT: "LNAV+V" indicates an internally generated advisory/experimental vertical path. It does not mean the internal GPS has become a certified LPV or LNAV/VNAV navigator.

The autopilot continues following the loaded procedure and captures final lateral guidance when the required conditions are satisfied. Where internal vertical guidance is available, the glidepath may capture after lateral guidance has been established.

Active lateral GPS approach guidance is annunciated **GPS**. Captured vertical path guidance is annunciated **GP**.

ILS and LOC Approaches

ILS and LOC approaches use the connected NAV receiver. They do not use GPS 175 GPS guidance for the final localizer or glide slope.

After selecting the ILS or LOC procedure:

1. Verify the published frequency and final approach course.
2. Enter the applicable DA or MDA.
3. Select **SET VLOC + CRS**.
4. Confirm that the NAV receiver is tuned correctly and that the displayed course agrees with the chart.
5. Select **LOAD PROCEDURE** where coded entry/approach legs are available.
6. Use **AP NAV** as required to fly the loaded entry route.
7. Establish a suitable localizer intercept.
8. Engage both autopilot axes and select **ARM APPR**.

While APPR is armed, the current lateral and vertical modes continue until capture.

After localizer capture, **LOC** becomes the active lateral mode.

On an ILS, the glide slope can capture after the localizer is established and the aircraft reaches the glide slope from the proper side. After capture, **GS** becomes the active vertical mode.

A LOC-only approach does not provide GS capture.

External Navigator – Garmin GPS 175

When the GPS 175 is used through ARINC, the GPS 175 owns the flight plan, approach sequencing and GPS navigation solution. The ELM800/1000 receives the guidance and controls the aircraft through its autopilot.

Do not separately load the same RNAV approach into the ELM internal procedure system. Load and activate the required flight plan and approach in the GPS 175, then use **ARINC → EXTERNAL CONTROL** on the ELM.

The **EXTERNAL NAVIGATOR** page shows:

- Navigator connection status.
- Active waypoint.
- Lateral steering status.
- GPS approach type and operating mode.
- GPS approach integrity.
- Vertical-guidance availability.
- Pilot-entered minimums.
- AP NAV and GPS APPR controls.

GPS 175 Interface Configuration

GPS 175 ARINC Wiring

Connect the ELM1000 and GPS 175 ARINC 429 interfaces directly as follows:

- **ELM1000 ARINC RX A/B → GPS 175 ARINC TX A/B**, pins **5 and 6**.
- **ELM1000 ARINC TX A/B → GPS 175 ARINC RX A/B**, pins **27 and 28**.

Maintain the correct **A-to-A** and **B-to-B** polarity.

Consult with official Garmin's GPS175 connection schematics and pinout information.

The RS-232 Aviation Output connection is separate from the ARINC connection and is used for transfer of flight-plan information from the GPS 175 to the ELM1000.

In ELM1000 Settings for desired RS232 port set Aviation In mode and speed 9600.

GPS 175 Interface Configuration

The GPS 175 must be configured to provide ARINC navigation guidance to the ELM1000 and to transmit flight-plan information through its RS-232 Aviation output.

Enter the GPS 175 **Configuration Mode**, open the **Interfaces** setup page, and configure the ports connected to the ELM1000 as follows:

ARINC 429 Output to ELM1000

- **Format:** GAMA Format 3
- **Speed:** High

ARINC 429 Input from ELM1000

- **Format:** EFIS/ADC (Air Data)
- **Speed:** High

ARINC SDI

- **SDI:** Common

RS-232 Output to ELM1000

- **Format:** Aviation Output 1

The RS-232 port number may be Port 1, 2 or 3 depending on the aircraft wiring; the port physically connected to the ELM1000 must be configured as **Aviation Output 1**.

The GPS 175 installation documentation identifies **EFIS/ADC** as an available ARINC input format, **GAMA Format 3** as an available ARINC output format, **High** as 100 kbps ARINC operation, **Common** as the SDI setting that accepts all ARINC inputs and transmits with SDI 0, and **Aviation Output 1** as an available RS-232 output format.

After configuration and wiring are complete, power-cycle the equipment if required and verify on the ELM1000 that:

ARINC NAVIGATOR CONNECTED

is displayed before using external GPS navigation, GPS approach guidance or autopilot coupling.

Also verify that the flight plan entered or activated on the GPS 175 is received and displayed correctly on the ELM1000 before flight.

Flying a GPS 175 Flight Plan

Load and activate the desired flight plan in the GPS 175.

The GPS 175 Aviation Output transfers the route to the ELM1000 for map display. The GPS 175 remains responsible for waypoint sequencing.

On the ELM:

1. Select **ARINC** as the GPS procedure source.
2. Select **EXTERNAL CONTROL**.
3. Confirm **ARINC NAVIGATOR CONNECTED**.
4. Confirm that the active waypoint and flight plan agree with the GPS 175.
5. Confirm **AP LATERAL VALID**.
6. Engage the autopilot and select **AP NAV**.

When AP NAV is active, the GPS 175 supplies the lateral steering command and the ELM autopilot flies that command through its normal roll-control system. The ELM continues to enforce its autopilot bank limits and servo control.

Selecting AP NAV from the External Navigator page also establishes normal altitude hold unless another valid vertical mode is already controlling the aircraft.

Flying a GPS 175 RNAV Approach

Load and activate the complete approach and transition in the GPS 175.

Before arming the approach:

1. Verify the approach, runway and transition on the GPS 175 against the current chart.
2. Verify the mirrored flight plan and active waypoint on the ELM.
3. Enter the published minimums on the **EXTERNAL NAVIGATOR** page using **–10** and **+10**.
4. Confirm **AP LATERAL VALID**.
5. Confirm that GPS approach status and integrity are valid.
6. Engage both autopilot axes.
7. Select **AP NAV** if it is not already active.
8. Select **ARM GPS APPR**.

The button changes to **GPS APPR ARMED** while waiting for capture and **GPS APPR ACTIVE** after lateral approach capture.

The GPS course and deviation presentation is shown in magenta.

Vertical Guidance

The External Navigator page clearly indicates whether usable vertical guidance is being received.

VERTICAL GUIDANCE NOT AVAILABLE means the ELM is not receiving valid vertical approach guidance suitable for coupling.

For LPV or LNAV/VNAV operation, the GPS 175 must report a valid final-approach mode and integrity and must provide valid vertical deviation and scaling.

When this information becomes valid, vertical guidance is available for capture. After the autopilot captures the glidepath, **GP** becomes the active vertical mode.

LNAV and LP approaches remain lateral-only and do not provide GP capture.

The GPS 175 provides the vertical path information; the ELM autopilot calculates and commands the required descent through its normal vertical-speed and pitch-control system.

Minimums

Minimums are always pilot-entered and must be taken from the current approved chart.

For database-loaded internal, ILS or LOC procedures, select the correct **DA** or **MDA** type and enter the altitude in feet MSL.

The ELM announces **MINIMUMS** when descending through the entered altitude.

At a **DA**, the autopilot does not make the decision to land or go around. The pilot must continue visually when authorized or initiate the missed approach.

Where **MDA** is selected, the autopilot will not intentionally command descent below the entered MDA.

In External Navigator mode, the GPS 175 and the current approach chart remain authoritative for approach type and minimums. The pilot must not depend on the ELM to determine the correct minimum automatically.

Loss of External GPS Guidance

The ELM continuously monitors external navigation data and will not intentionally continue following stale GPS steering.

If usable external lateral guidance is lost, the autopilot stops using the stale GPS command and captures the aircraft's current heading.

If the GPS 175 still reports a valid approach, APPR may remain armed and can recapture when valid steering returns.

If navigator connection, GPS integrity or valid approach status is lost, the GPS approach is cancelled.

If captured vertical guidance is lost, the autopilot leaves GP and captures the current altitude.

WARNING: Any unexpected change from NAV/GPS to HDG, loss of GP, red guidance warning, integrity warning or disagreement between the ELM and GPS 175 requires immediate pilot attention.

Missed Approach / TO/GA

The ELM does not automatically decide to execute a missed approach. The pilot must command the go-around.

For an internally loaded coded approach, pressing **TO/GA** commands an immediate climb and, where supported, activates the coded missed-approach sequence and the first published missed-approach altitude. If the missed procedure contains unsupported legs or no usable missed altitude, the EFIS displays a warning and will not automatically execute it.

If TO/GA is selected before the MAP, the aircraft begins the climb immediately while continuing the final lateral path toward the MAP before entering the coded missed-approach legs.

For an externally controlled GPS 175 approach, the GPS 175 remains responsible for missed-approach lateral sequencing. Before pressing TO/GA, the pilot must select the published missed-approach altitude on the autopilot. The selected altitude must be safely above the current aircraft altitude.

When TO/GA is activated during an external approach, the ELM:

- Cancels GP/final approach capture.
- Commands a positive climb toward the selected altitude.
- Keeps external GPS NAV active.
- Allows the GPS 175 to sequence and provide lateral guidance through the missed approach.

WARNING: Always verify the missed-approach altitude and published missed procedure before reaching minimums. Never depend on automation to replace the pilot's responsibility to initiate and monitor the missed approach.

15. Settings Menu

ELM800/1000 has a built in ***Settings menu*** where various parameters can be adjusted and configured.

To enter '*Settings menu*' press the left knob or touch display on top of the knob position 'SET'. Main menu will open up. Select with left knob 'Settings' menu and push the left knob or touch desired menu with finger.

Settings menu has submenus under each menu option.

It is easy to navigate through the "Setting menu" by turning the left knob clockwise or counter clockwise and by pressing the left knob to select/open. Alternatively touch desired item to set.

- You can rotate the knob to move the selector up and down to scroll through the menus

- By pressing the knob, you can enter a desired menu or submenu

- When the menu selector's background is blue, you can rotate the knob to move the selector up and down to scroll through the menu or submenu options. Alternatively you can swipe finger up/down at the right side of the menu inside of the menu box.

- When a desired menu or submenu option is found, you can select it by pressing the knob or touching the selection. Selector's background color will change from blue to orange.

- When the selector's background color is orange, the option was selected and the settings for the selected option can now be changed. Turn the knob clockwise or counterclockwise to scroll through the settings.

- Once the desired setting is found, press the knob once to apply the selected setting for the given option. Menu selector's background will turn back to blue. Alternatively touch the selection with finger.

- To exit a submenu, mover selector to '…' option (always most upper in any submenu) and push the knob, this will return back to root of settings menu. You may also touch display on top of the button 1 in 'BACK' position.

- To exit a Settings menu at any time press left button labeled 'Exit'

Please note: when certain settings are selected, the changes are not applied instantaneously, instead a message 'Updating. Please Wait' will be displayed. Once the changes are applied, the message will disappear and the "Setting menu" will be displayed.

16. Settings menu items and their respective settings:

Submenu: **General Config**

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 of 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 32* will allow to manually set display brightness. Adj Min allows to set min bright ambient conditions, Adj Max allows to set max bright ambient conditions, Reset Adj will reset these to defaults.

Unit config – This setting is normally set by manufacturer. For ELM800/1000 model unless otherwise stated it should be set to Pitot+GPS by default.

Start Mode – By default, the unit powers on to the "artificial horizon" mode. The mode upon power "ON" can be set 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 addon.

Debug Target – This setting is only for debug use and does not need to be changed

EFIS Mode – If ELM800/1000 is the only EFIS installed in your airplane set it to PFD Single. Otherwise, if more than single ELM800/1000 is installed set appropriate mode for this EFIS (PFD, MFD, etc). This will influence functionality of the EFIS.

Sync Pressure – If more than single ELM800/1000 is in use then this setting allows to use pilots PFD to autoset ground pressure on all connected ELM800/1000 EFISes simultaneously

Maps Source – Choose where maps and other terrain databases are stored. By default it set to internal SATA drive however it may also be set to USB or internal FLASH. Do not change unless directed by manufacturer.

Dev Ctrl – *Special functionality. Not for use unless directed by tech support.*

Horizon Mode – Artificial Horizon mode can be selected either Classic 2D with no synthetic view and obstacles or Synthetic 3D mode with synthetic vision and terrain/obstacle awareness mode ON.

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

Heading Source - Must always be set to Auto

GPS Source – Set where ELM800/1000 will take its GPS data. Normally set to Auto

Debug Info – Normally set to disabled

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.

Internet Weather – In case if you have an active internet connection to your EFIS you may obtain METARs for surrounding airports in the Airport Information Menu

Software Update – Activate software update functionality

Touch Calibration – Allows touch screen calibration

Airplane visual – Change visual airplane appearance in some menus

Telemetry – Enable Telemetry data transfer in flight (see. Telemetry description below)

Telemetry Time – Rate of telemetry data send during the flight

WiFi AP Mode – For versions with built in WiFi for flight plan transfer only! (ForeFlight, etc)

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) to 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.

Oil and Fuel pressure sensors – Set here the maximum pressure value for respective sensor installed. We normally set it to 100PSI and use appropriate spec sensors.

Current Sensor – Set here current sensor max spec current

A Sensor Midpoint – Mid point for current sensor. Normally should be set to 2.5V

RPM Pulse Length – For all modern ignition systems which provide a RPM signal it should be set to Standard. For noisy old type ignition systems where RPM signal comes with additional noise it can be set to other specific value.

Analog and Main V dividers – Do not change these values. Factory predefined.

Flaps Calibration – Option to calibrate flaps voltage from sensor for various flaps positions. Set flaps with sensor connected to desired position then select the position from the calibration setting and press knob to save new voltage

Rudder Calibration – Designed to calibrate rudder trimmer voltage from sensor for various rudder trimmer positions (center, full left, full right). Set rudder trimmer with sensor connected to desired position then select the position from the calibration setting and press knob to save new voltage

Elevator Calibration – Designed to calibrate elevator trimmer voltage from sensor for various elevator trimmer positions (center, nose up, nose down). Set elevator trimmer with sensor connected to desired position then select the position from the calibration setting and press knob to save new voltage

L and R Tank Calibration – Designed to calibrate fuel tank levels for every 5 gallons. Calibrate first on empty tank, and then add by 5 gallons until full and calibrate every 5 gallon position via the calibration setting. You may calibrate each tank separate or just calibrate one and then copy values to another one (assume identical sensors and tanks are in use)

AOA Calibrate – Angle of Attack calibration. Currently not used.

Kalman Speed – Speed of filter reaction. Preset at manufacturer.

VICs LiDar – Laser altimeter functionality built in VICs module activation/deactivation

LiDar Calibrate – Allows to set airplane height while on the ground.

Roll Calibration – Designed to calibrate roll trimmer voltage from sensor for various rudder trimmer positions (center, full left, full right). Set roll trimmer with sensor connected to desired position then select the position from the calibration setting and press knob to save new voltage

Flaps, Pitch, Roll, Yaw Position Source – set where position information is taken from (EM01 [EnGood], PowerHub, Smart Trim)

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'*

Submenu: **AHRS Config**

***Trace** ** - Trace related options are intent 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 never requires to be changed.

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.

Slip/Skid Sensitivity – Should always be set to Normal

Submenu: **External Devices**

Ext Compass – External Compass. EFIS can work in conjunction with an external compass or External comas built in to external AHRS. Should an external compass be connected to EFIS, 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 Cal Ovrd – External Magnetometer (compass) Calibration Override – when external compass requires recalibration, it can be done using this setting.

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

COMx Speed – Speed of the RS232 port x

COMx Mode – Mode of operation for RS232 port x

COMM1/2 Mode – Type and protocol of COMM radio connected to EFIS

Lasar Logging – Should be always disabled

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

Alt Encoder Mode – Whenever xPlane Mini also used as a 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).

Ping ValCOMM – Support for older firmware versions of VAL Avionics COMM 2000

Sync COMM – If only single ELM800/1000 is installed set to Disabled. In case if more than one ELM1000 is installed set to Master on the unit which is connected to COMM radios and set to Slave on other units to sync display information from COMM radios.

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

Trig Xponder – When Trig device is set as COMM1/XPonder this sets either COMM1 only or XPonder mode (headless or with Control head)

**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. Ex. Los Angeles is GMT -8, New York is GMT -5

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 voice message 'Switch fuel tanks' will be given. 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.

Reset Oil, Hobbs, Air times – Times can be reset to 0.0 here

Sync Time - If only single ELM800/1000 is installed set to Disabled. In case if more than one ELM1000 is installed set to Master on the unit which is PFD and Slave on other ELM1000 units to sync the current time between.

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 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 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.

Cal USB Import and Export – All calibration information (sensors values, etc) can be exported to external USB flash and then reimported should you require to replace your Engine Monitor display for some reason.

Lasar Export – Not in use

AOA Trace – Not in use

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

Maps USB Import – Import and Update Maps from USB source

Data Offload – Allows offloading data via internet to secure server for future use. See “Data offload ” below.

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.

Submenu: **Display/Config**

***COMM/NAV Info* –** Set the position of COMM and NAV radio's information in top info line.

***G-Meter* –** Enables/Disables G-Meter in AI mode display

***Engine Monitor* –** Set position where engine monitor information is shown during split/screen operation

***AI Split Mode* –** Default right side mode for split screen on startup

***Show AOA* –** Enables/Disables AOA indication on display. In case if this is a second ELM800/1000 in the system set to slave so it will take AOA information from the PFD master ELM800/1000 unit

***AI Full Engine Monitor* –** Configures what engine monitor info is shown in AI mode of display

Map Rad Vec – Show distance radiuses and heading vector around airplane in the map mode

Synthetic Vision Sun – Enable synthetic vision to change colors depends on time of the date in your location (based on GMT setting and GPS coordinates)

HITS (Highway in the skies) – Activates virtual tunnel when flying to destination waypoint for easy navigation

Map Trail – Enables the green trail on the map which shows airplane path for past 90 minutes of flight

Water Bodies – For supported regions shows water bodies on 3D synthetic vision

Submenu: **EnGood**

Engine Type – Set either 4 or 6 cylinder engine here to properly format display and show specific to individual cylinders temperature information.

MAP Sensor – MAP sensor presence in the system

Fuel Quantity Sensors – Set to "Installed" if fuel level sensors are connected

Fuel on Board – Set total fuel on board in all tanks

FF1 and FF2 K-Factors – Fuel Flow K-Factor number for sensor 1 and optional sensor 2. Normally each fuel flow sensor has its K-factor written on it. For example Floscan 201 with standard K-Factor 29.50 is set as: 29500 in this setting
K-Factor is a fine adjustment value for any fuel flow sensor

RPM Factor – This parameter describes how many pulses from RPM sensor are actual 1 RPM of engine. For 6 cylinder it is normally 1.5 while for 4 cylinder engine it is 2. However it may differ for your particular RPM output type so adjust accordingly.

ECU Defaults – Forces EM-01 engine monitor module to its default settings

Fuel Flow1 and 2 – Set if Fuel Flow sensor(s) are in use and installed

MAP Offset – You can offset MAP pressure in case if readings from the MAP sensor for some reason are different from actual.

Fuel Units – Units used for fuel information indication: Liters or Gallons

Eng Temp Units – Units used for engine temperature indication

****Various Limits*** **-** allows setting all minimum and maximum limits for various engine parameters. Consult with your engine documentation to set correct values. By default values are set for Lycoming IO-360 and Lycoming IO-540 engines.

Door Sensors – Set if door sensors are connected

Baggage Door Sensor - Set if baggage door sensor is installed

Cowling Temperature Sensor – Set if AUX1 sensor is installed

Fuel Pressure Sensor – Set if Fuel pressure sensor is installed

Current Sensor – Set if current sensor is installed

CHT, EGT, Oil and Cowl Temp Type sensors – Should be set to Standard at all times

Engine Model – Set convenient Continental/Lycoming, or Rotax (CAN bus) or ULPower (CAN Bus) engine type installed

Submenu: **Info/Warnings**

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

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'. Default set to 3NM.

Obstacle Min Hdg – minimal heading difference (current vs track to obstacle) in deg to trigger warning. Works in conjunction with 'Obst Min Dist'. Default set to 3 degrees.

Terr Red Zone – This set how high airplane should be over terrain to avoid triggering Red color (alarm) map. When airplane altitude is more than pre-set value over the terrain it will not trigger the Red color (alarm) map. Default set to 300ft.

Terr Yellow Zone – This set how high airplane should be over terrain to avoid triggering Yellow color (warning) map. When airplane altitude is more than pre-set value over the terrain it will not trigger the Yellow color (warning) map. Default set to 700ft.

Fuel Lean Warning – This function requires MAP, RPM and fuel flow sensors as well as engine charts loaded to function properly. Function will monitor the fuel flow and pop-up warning in case if fuel flow exceeds current power settings pre-set fuel flow limits.

LiDar Altimeter – This function activates LiDar altimeter information on display during landing/final approach. Please refer to VICs module manual for all details about this feature.

Traffic Warning – This function enables ADS-B traffic warnings on the screen

Traf Min Distance and Altitude – This sets minimal ADS-B traffic vertical and horizontal distances when warning message get triggered.

Stall Audio Warning – This enables stall audio warnings via VICs module. Refer to VICs manual for details on this feature.

VPX Warning – This enabled the warnings from Vertical Power solid state circuit breaker system

TPMS Warning – This enables warnings from EM-01 module with TPMS system connected

Airspace Warning – This enables airspace warnings on display

Submenu: **WB/Checks**

Various Weight and Balance settings specific to airplane.

Submenu: **Autopilot**

AP Mode – This enables/disables autopilot feature.
Yaw Damper – This enables/disables yaw damper feature.
Pitch and Roll Torque – This set's maximum torque for both pitch and roll servos in range of 1…255. Higher the number, higher the torque. Default value is 200 for both pitch and roll.
Pitch and Roll Coef – Sets the sensitivity coefficient for pitch and roll. Number higher than 20 makes sensitivity higher and numbers below 20 makes sensitivity lower. Default values are 25 for roll and 22 for pitch. Refer to autopilot manual for details on this setting
Reverse Pitch and Roll – this setting will reverse pitch/roll servo direction. *Warning Set these two parameters once on the ground and never change them unless required.*
Roll and Pitch angle Limits – sets the limits for pitch/roll during autopilot normal operations.
Pitch Trim – sets the mode for the trim. Default is Manual.
Set Defaults – sets default parameters in autopilot module.
Yaw Center and Activity – this is to control TruTrak Yaw damper parameters only
Envelope Protection – this set envelope protection mode ON or OFF at startup by default. This mode can be also activated/deactivated via AutoPilot touch menu.
Envelope Protection Pitch and Roll limits – sets the limits for autopilot while envelope protection mode is active.
AutoTrim Speed – When autotrim is in use it sets the trim speed.

AutoTrim Direction – Sets autotrim direction (Normal or Reversed)
P Torque Limit H – Sets the high torque limit (do not change unless directed)
P Torque Limit L – Sets the low torque limit (do not change unless directed)

Submenu: **PowerHub**

This product is under development and this part will be updated in the future

Submenu: **SmartTrim**

Set defaults – Resets the auto trim module to defaults
Analog and Main V dividers – do not change
Pitch, Roll, Yaw and Flaps direction – Normal or reversed
Low and High ASI limits – set the speed limits between which the autotrim will adjust the speed. When set both to 0 the auto trim speed functionality is disabled.
Smart Trim – set if smart trim is installed

Submenu: **Remote**

Joystick – set type of joystick in use. Type1 is a BMW iDrive controller (2014-2018 models)
Button1 – 4 – sets function for buttons

Submenu: **TPMS**

This product is under development and this part will be updated in the future

Submenu: **ADSB**

Set Defaults – Reset ADSB-01 module to factory defaults
1090TL set – Normal 250mV (offset in mV for ADSB 1090 sensitivity)
Controls – Activates various functions (for field test use only)
Use CAN bus – Allows to transfer all data to EFIS via CAN bus instead of Wifi or RS232
AHRS Feed – Enabled full AHRS data feed via WiFi to compatible FB (ForeFlight, etc)
WiFi Mode – Normal set to Broadcast, unless required Unicast (ForeFlight)

Print Screen Functionality

During EFIS operation at any time screenshot of the currently displayed image can be taken and stored internally in **.png** format. This is useful feature when during normal operation is may become required to store some parameters shown on display or for some sort of troubleshooting with manufacturer at later or just sharing with others.
To take a snap shot of the display at any time shortly press and release two buttons around (closest to) USB port simultaneously (button 3 and 4). Screen shot with name of current time and date in **.png** format gets stored in to internal memory. It can be exported using online connection or USB drive then. Please refer to submenu '***BlackBox***' and appropriate function.

Data Offload functionality (USB or online)

When EFIS is connected to internet (WiFi/Cable) or USB flash drive is inserted it is possible to offload engine data, flight data, KML data, screenshots and make a backup of all configs to the secured server or USB drive (see Telemetry chapter). Also it is possible to restore your earlier stored configs from the remote server. Select Data offload from BlackBox menu and then select the item you want to offload by pressing the respective button on display. Status of the transfer will be shown in the bottom of the menu.

Terrain and Obstacle Awareness Functionality

Terrain Awareness Warning System

The **Terrain Awareness Warning System** enhances pilot safety by providing real-time alerts regarding potential terrain hazards ahead.

Warning Levels:

1. **Warning Level:**
    - When the terrain ahead is at or below the preset altitude (defined in the **Red Zone Setting**), the dangerous terrain will be highlighted in **red** on the display.
    - A **Terrain Awareness Warning** popup will appear, showing:
        - Track and distance to the first impact point.
        - Elevation of that point.
    - In this level, the warning message will have a **black background** and will not trigger additional warnings via the VICS (Voice Information and Control System).
2. **Alarm Level:**
    - If the warning escalates to an **alarm level**, the background of the warning message will change to **red**.
    - If the VICS is connected, an additional voice warning will be provided.

Mute Feature:

- By touching the warning message on the display, the alert will be muted for **180 seconds**.

Yellow Zone:

- If the terrain ahead is displayed in **yellow**, it indicates that the altitude between the airplane and the terrain is more than the Red Zone setting but less than the Yellow Zone setting (warning zone).

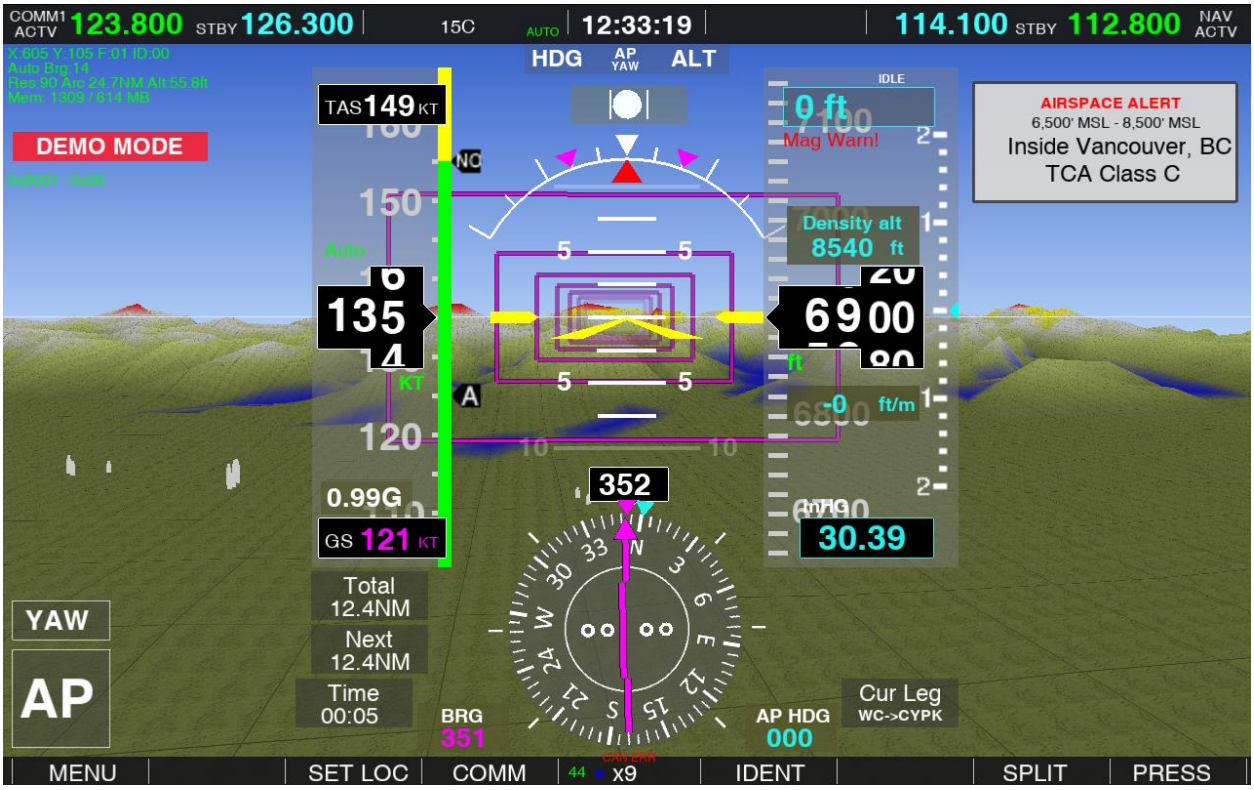
Obstacle Awareness:

- The same awareness warning will apply for obstacles, although the terrain color will not change.
- If the VICS voice system is connected, voice alarm messages such as "**TERRAIN AHEAD**" or "**OBSTACLE AHEAD**" will sound to alert the pilot.

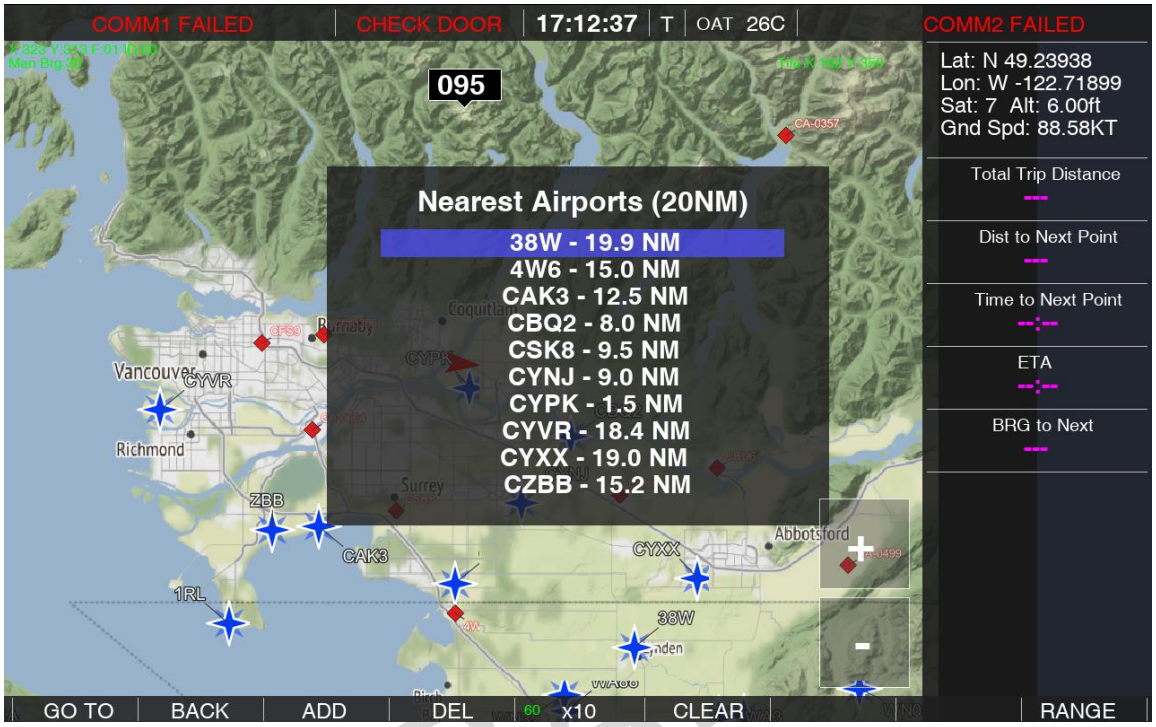
Airspace Alert Functionality

When the Airspace Warnings feature is enabled in Settings under Warnings / Airspace Warnings, the system continuously monitors the aircraft position relative to nearby controlled or restricted airspace. A popup message will be displayed whenever an airspace is detected ahead of the aircraft's current track, or when the aircraft is approaching the airspace vertically from above or below. For airspace located ahead, the alert is triggered approximately five minutes prior to the predicted entry based on current groundspeed and track. For vertical proximity, the alert will activate when the aircraft is within 500 feet above or below the airspace boundaries. This provides the pilot with timely awareness to take appropriate action before entering controlled or restricted airspace.

To dismiss the message, touch it on the screen.



Maps Mode and Flight Planing Functionality



Map Mode

In **Map Mode**, users can navigate and interact with the displayed map, which includes various functionalities for zooming and flight planning.

Map Zooming:

- **Knob Control:** Rotating the **left knob** will change the zoom level of the currently displayed map.
- **Button Control:** Zoom can also be adjusted by pressing the **"+"** or **"–"** buttons located at the bottom right corner of the map.
- **Gesture Control:** A **two-finger swipe** over the map allows for changing the zoom level intuitively.

Flight Planning Modes

There are two primary flight planning modes: **NEAR** and **GO TO**.

NEAR Mode:

- To activate **NEAR Mode**, press the button labeled **1 "NEAR"**. This mode displays the nearest airports surrounding the airplane's position.
- **Range Adjustment:** The **right knob** can be used to change the search range for nearest airports, with a default setting showing airports within **20 NM**.
- **Airport Selection:**
  - Use the **left knob** to select the desired airport for a direct route.
  - Press the **left knob** to activate **"Direct TO"** mode.

Additional Information Display:

- On the right side of the screen, you will see information about:
  - Current GPS position
  - Satellite reception
  - Ground speed
- When in **"Direct TO"** or **Flight Plan Mode**, the right side of the screen will also display:
  - **Total trip distance**
  - **Distance to next point**
  - **Estimated Arrival Time**
  - **Bearing to the next point**
- Flight plan route points will be indicated in the bottom right of the screen.

GO TO Mode:

GO TO Mode

When in **Map Mode**, pressing the **second button "GO TO"** opens a flight plan entry window, allowing users to create and manage flight plans efficiently.

Airport by Name Flight Planning:

1. **Entering Airport Code:**
    - Enter a three or four-letter airport code using **keyboard**
    - Press the **ENTER** to add airport to flight plan
    - Type next airport or waypoint name and press **ENTER** again to repeat
    - To **HIDE** keyboard press the HIDE button (left knob or on keyboard)
    - Current flight plan entries are shown at the top side of display
2. **Loading the Flight Plan:**
    - Once all desired airports or waypoints are entered, press **button 1 "LOAD"** to load and activate the flight plan.

Loading Flight Plans from Internal Drive or USB:

- Users can load flight plans created on external devices (such as ForeFlight, Garmin, etc.) in **.fpl format**.
- Example Workflow:
    1. Create a flight plan on an iPad using the **ForeFlight** app.
    2. Email the flight plan to yourself in **.fpl format**.
    3. Copy the flight plan file to a USB drive in the folder named **'FlightPlan'**.
    4. Insert the USB drive into the ELM1000.
    5. While in **"GO TO" mode**, press **button 5 'FPL'**.
        - If no USB drive is inserted, this button will allow access to the local flight plans database stored on the ELM1000.

Flight Plan Menu:

- A new menu will appear, displaying all flight plans stored either on the ELM1000 (Local) or in the **'FlightPlan'** folder on the USB drive (USB).

Select desired flight plan by rotating left knob and press on it to activate.

If you want to store flight plan to local database press ‘STORE’ button. This will create a copy of this flight plan on local ELM1000 EFIS.

Runway extension lines:

If available in local database for each airport in flight plan, runway extension lines will show with their respective numbering.

Moving the Map in Pan Mode

To view an area outside the current map view, touch the map and drag it in any direction. This activates Pan Mode.

When Pan Mode is active, the GPS button on the right side of the map will turn blue. You can then move the map freely with your finger to view any location.

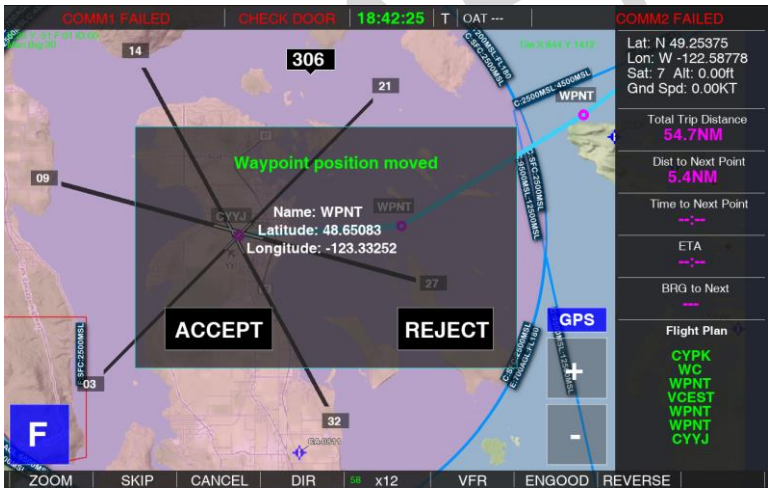
Pan Mode is useful when planning or editing a flight plan. To return to the normal GPS centered map view, touch the GPS button again.

Flight plan live editing:

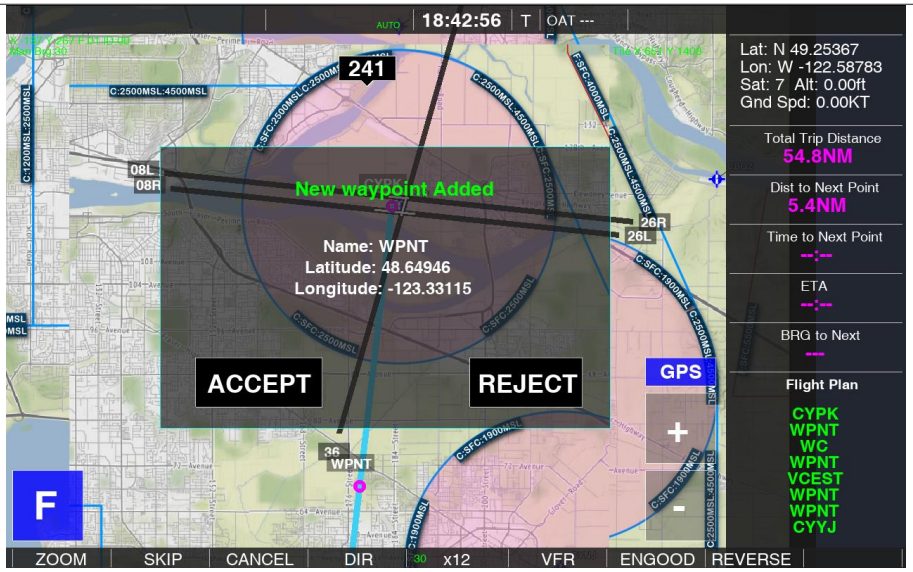
While flight plan is loaded and activated you may add or delete waypoints or move their position on the map. To do that push on 'F' (Function) button at the lower left corner of the map. Button will lit blue (active).

To delete waypoint – set zoom level of the map so you can see desired waypoint and its label on the screen. Touch with your finger waypoint and watch the waypoint label. As soon as background of waypoint label becomes red – release finger. Confirmation dialog will pop-up. Push on 'Delete' or 'Close' to either delete or keep waypoint.

To move waypoint – Touch with your finger waypoint and watch the waypoint label. As soon as background of waypoint label becomes blue – it is in live move mode. Keep finger over the waypoint and move it across the map to new desired location. Release the finger when set to desired location on the map. Confirmation dialog will pop up. Push on 'Accept' to keep new position of waypoint or 'Reject' to return waypoint to original position.



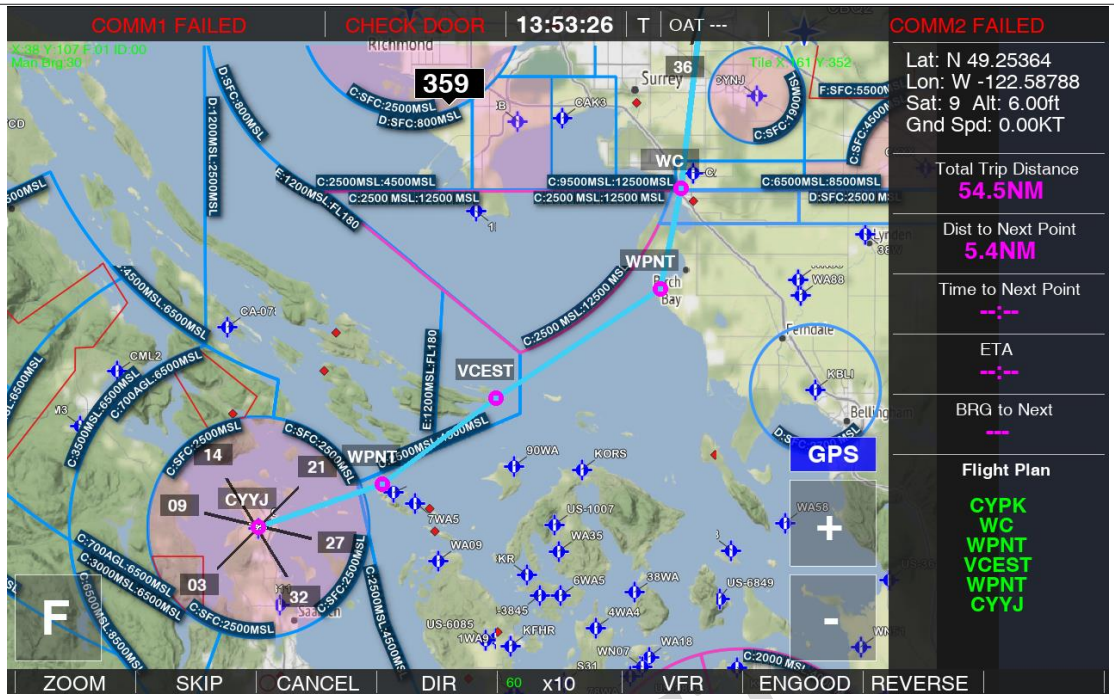
To add new waypoint – touch and hold with your finger on any flight plan leg at the location where you want to insert waypoint. In short moment new waypoint show up under your finger – keep holding your finger and now move it to the desired location on the map. Flight plan lines will move and follow your finger. Release when set to desired location on the map. Confirmation dialog will pop up. Push on 'Accept' to add waypoint or 'Reject' to delete newly created waypoint.



<u>To create new flight plan by selecting desired waypoints on the map</u>:

While in Map mode, press on second button “GO TO” will open a flight plan entry window. Now touch the ‘F’ (Function) button in the lower left corner of the map. It will lit blue when active.

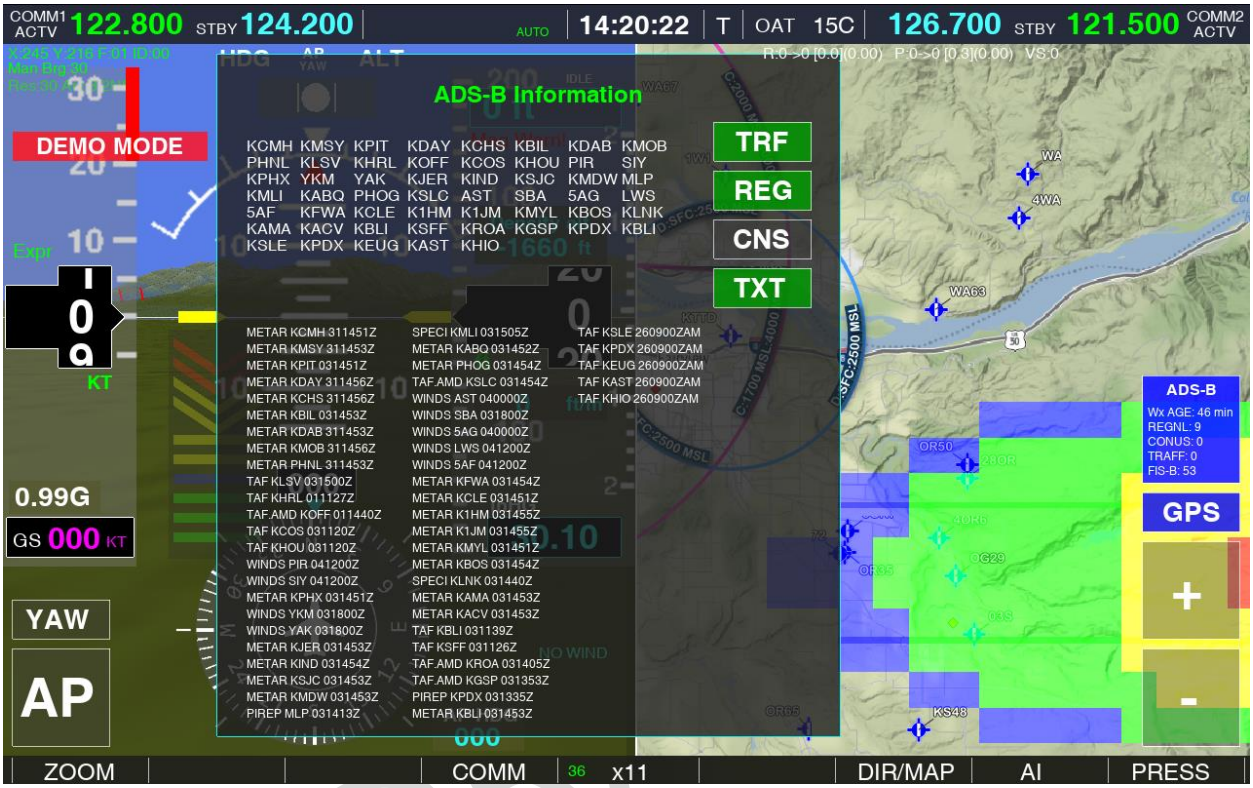
Touch desired waypoints on the map to create a flight plan. Each new waypoint will show on a map together with a flight leg line. To delete last waypoint press on button 3 ‘DEL’. To clear flight plan press on button 4 ‘CLEAR’.
To activate a flight plan press on button 1 ‘LOAD’.



When one of the RS232 ports of ELM800/1000 is set to 'NMEA Out' it will be used to send a flight plan to another device such as Garmin AERA 660 or Garmin GPS 296/396/296 and others which support NMEA sentences format as input. You may configure desired speed for the port depends on the settings in your host device.

'NMEA Out' mode can drive an autopilot for point-to-point navigation.

ADS-B Data Details:



If ADS-B receiver is connected with ELM1000 EFIS it is possible to monitor what data is received from the receiver. While in artificial horizon split map or full map modes the ADS-B label at the middle right of the display will show: the age of the latest NEXRAD weather update, counters for received regional and CONUS weather updates, ADS-B traffic messages and Flight Information data (FIS-B) received.

By touching the ADS-B label at the middle, right of the display the ADS-B Information window will open. This window will show airport codes (at the top) and type of reports (at the bottom) received.

Buttons at the top right allow to set what types of data is desired to receive:
TRF – Traffic information
REG – Regional NexRad weather
CNS – CONUS NexRad weather
TXT – Textual information (TAF, PIREP, METAR, WINDS, etc)

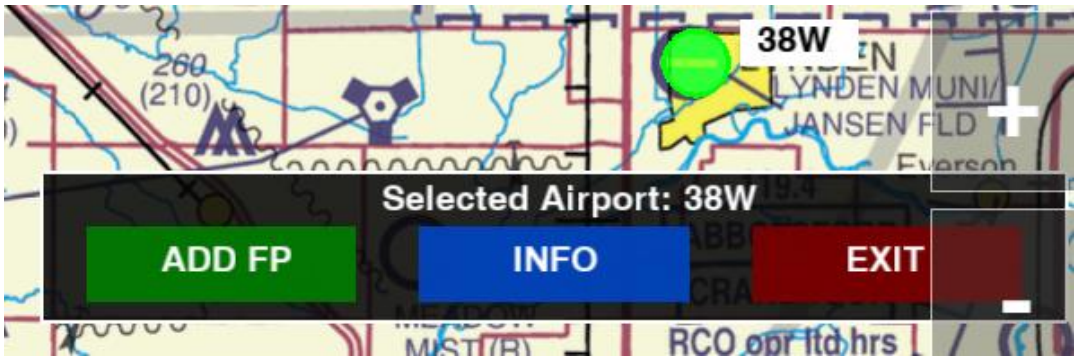
Airport Information and IFR approach plates:

There are two ways to access airport information:

Method 1

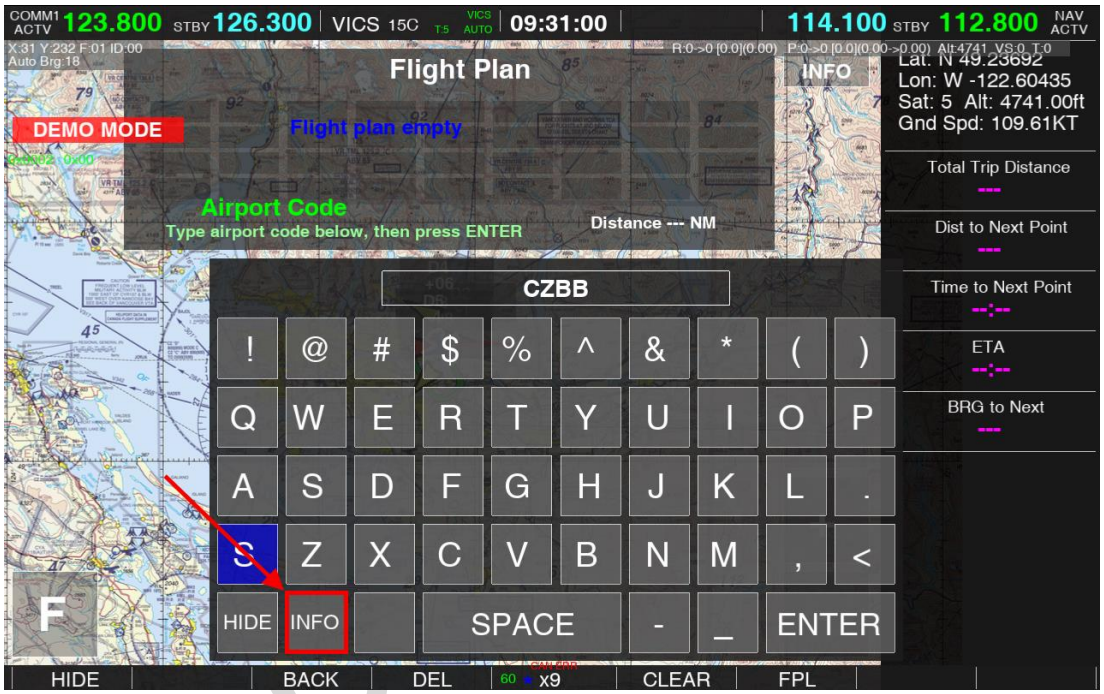
While using either Split Map Mode or Full Screen Map Mode, touch an airport on the map to open the Airport Menu.

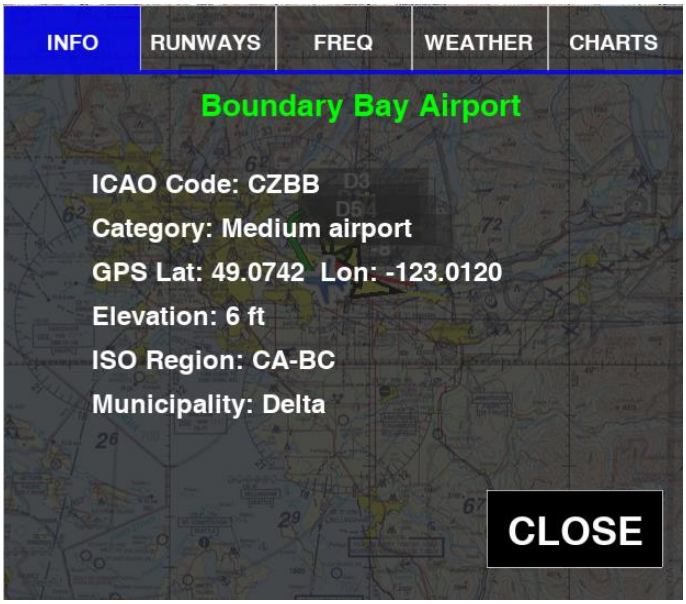
The selected airport will be highlighted with a green filled circle on the map. From the Airport Menu, you can add the airport to your Flight Plan or open the Airport Information page.



Method 2

Open the full-screen map, then press the "GO TO" button to enter flight-planning mode. Enter the airport code and press the "INFO" button on the keyboard. The Airport Information popup screen will then open.





The Airport Information page is divided into several tabs. You can open or switch between tabs by touching the desired tab on the screen.

The **Info** tab displays general airport information, including the ICAO identifier, GPS position, and airport elevation.

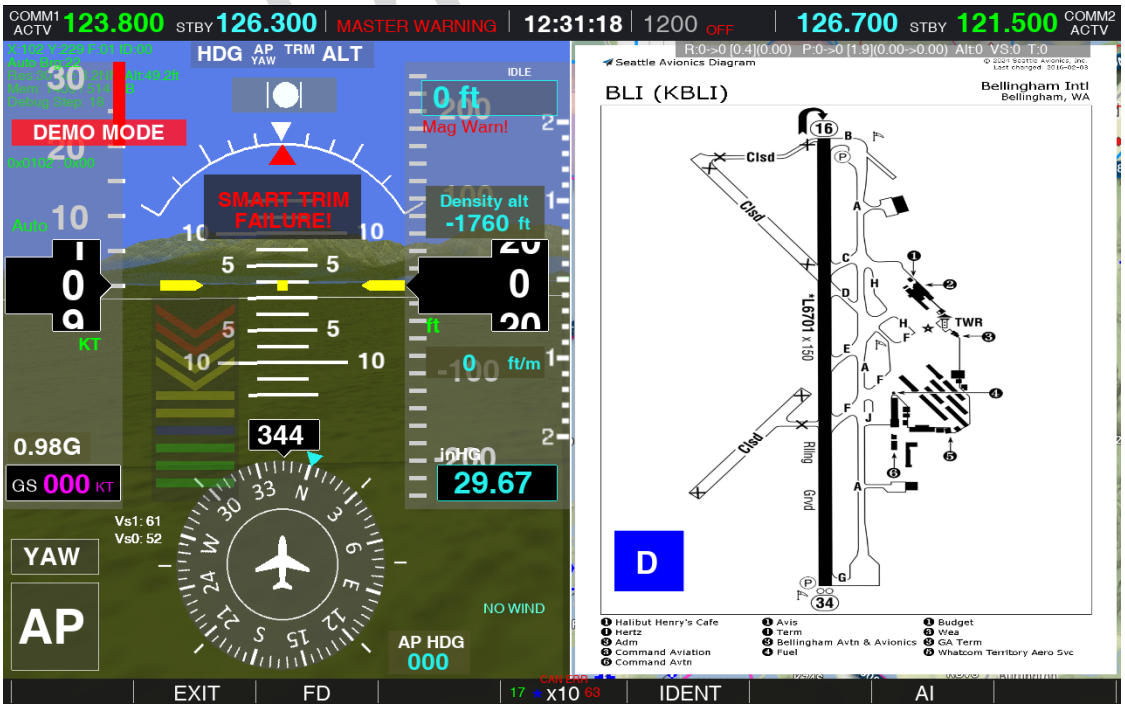
The **Runways** tab displays runway information, including runway length, width, surface, and available lighting.

The **Frequency** tab displays available airport radio frequencies.

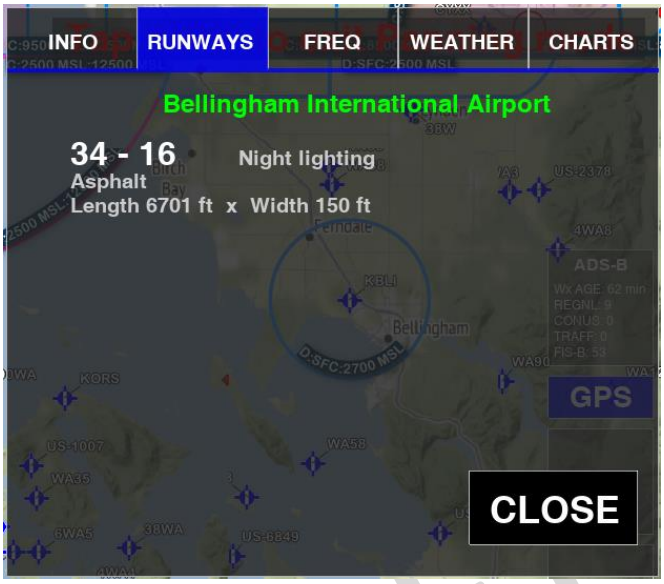
The **Weather** tab displays airport weather information received through ADS B, when available. If weather for the selected airport is not available, weather from a nearby airport may be shown instead.

The **Charts** tab displays all available airport charts, including IFR approach plates.

When the **D** button is available in the lower left corner of the Info tab, touch it to show or hide the airport taxi diagram.

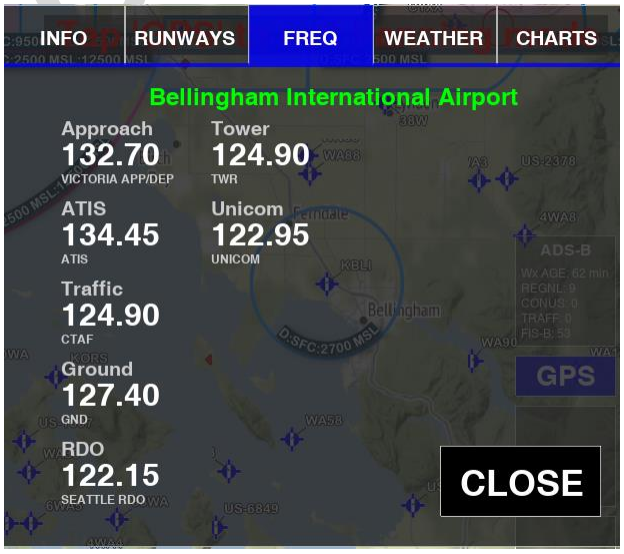


Runways tab



This tab includes details about airport's runways, their length, width and surface.
For each runway, if it is equipped for night landing, appropriate message will be shown.

Frequencies tab



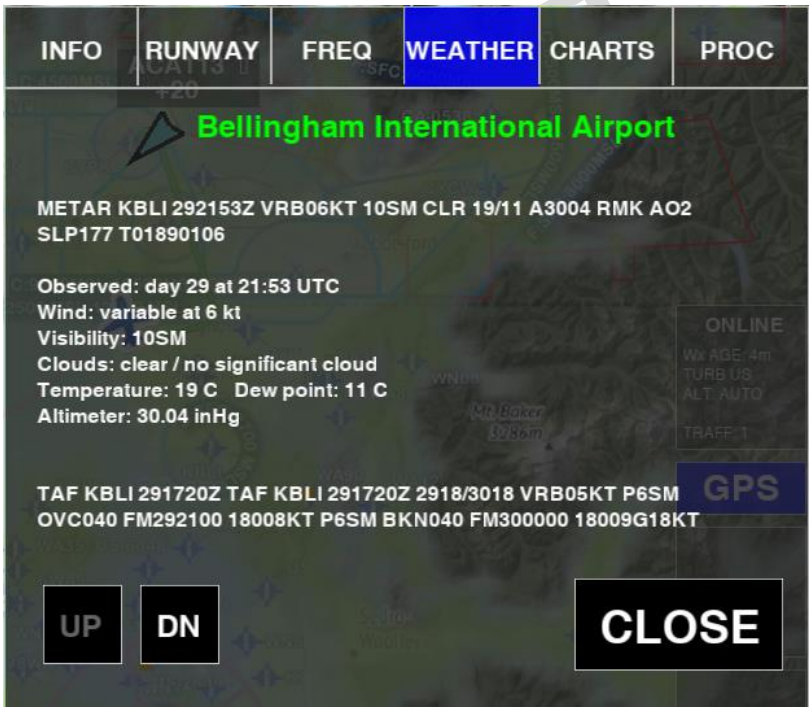
This tab shows information about all radio frequencies available for selected airport. If EFIS connected with compatible COMM radio, by touching the frequency with finger pilot can send desired selected frequency as a stand-by frequency to COMM radio.

While *Frequencies tab* is selected button 3 'COMM' in EFIS will cross switch standby and active frequencies in COMM radio.

The normal usage flow would be:

1. Touch desired frequency in the tab, so it gets send to COMM radio as a standby freq.
2. Push (or touch) button 3 'COMM' in EFIS to switch between active and standby freqs.

Airport Weather Tab



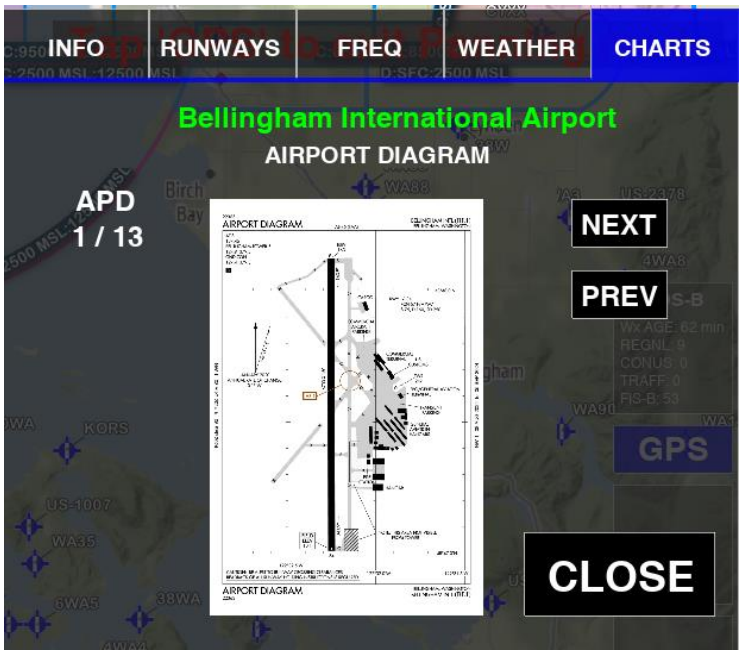
When weather information for selected airport is available from ADS-B it will popup under *Weather tab*.

Information may include METAR, TAF, PIREP, WINDS and other data received from ADS-B receiver.

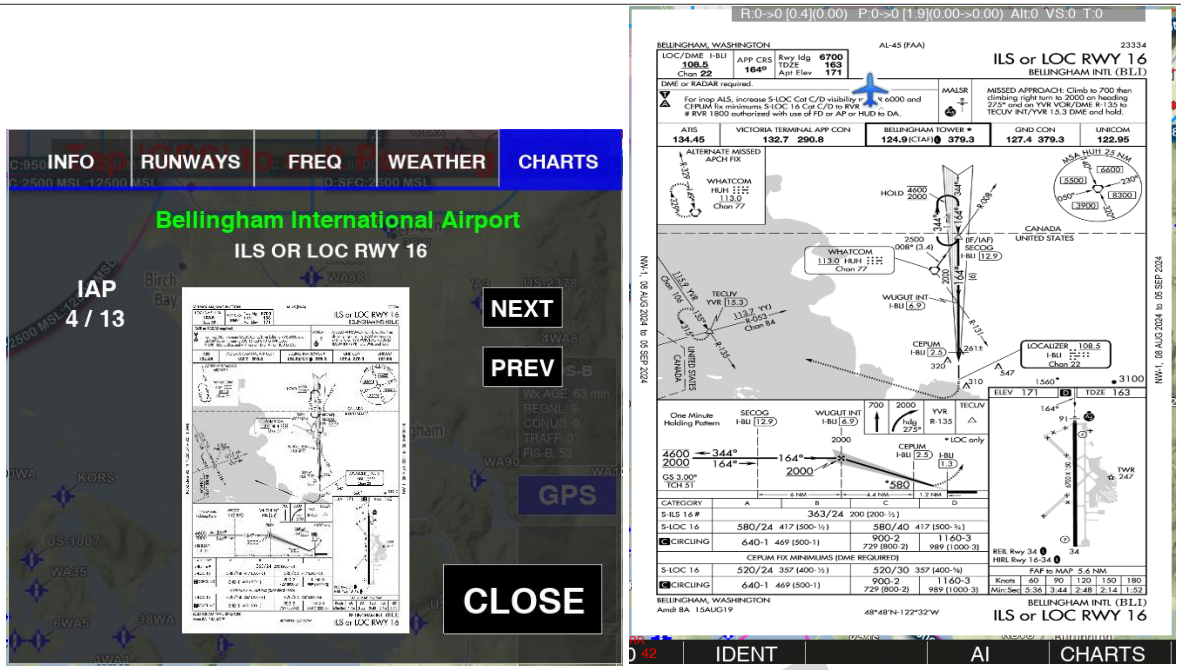
In case if ADS-B weather is not available for selected airport it will search for weather from airports in the area around selected airport and in case if found it will show it as well.

If Internet weather option set to Enabled in settings menu and EFIS has a live connection with internet you should be able to see the METARs from the airport (subject to availability and reporting)

Airport Charts Tab

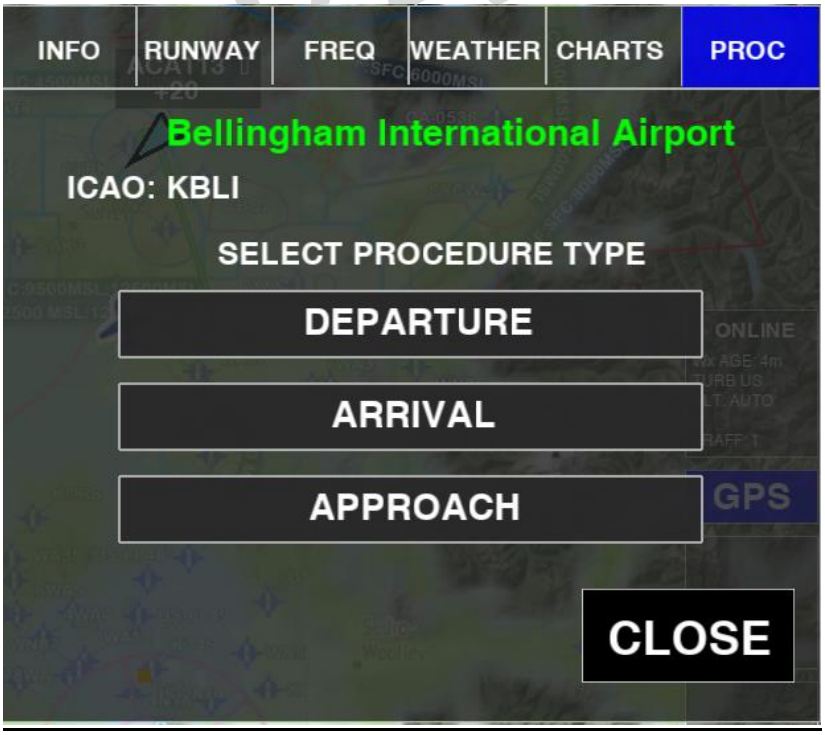


This tab allows seeing all charts available for the airport in EFIS database. Use buttons NEXT and PREV to scroll through available charts. Touch the chart in the middle of display to show it in full screen.



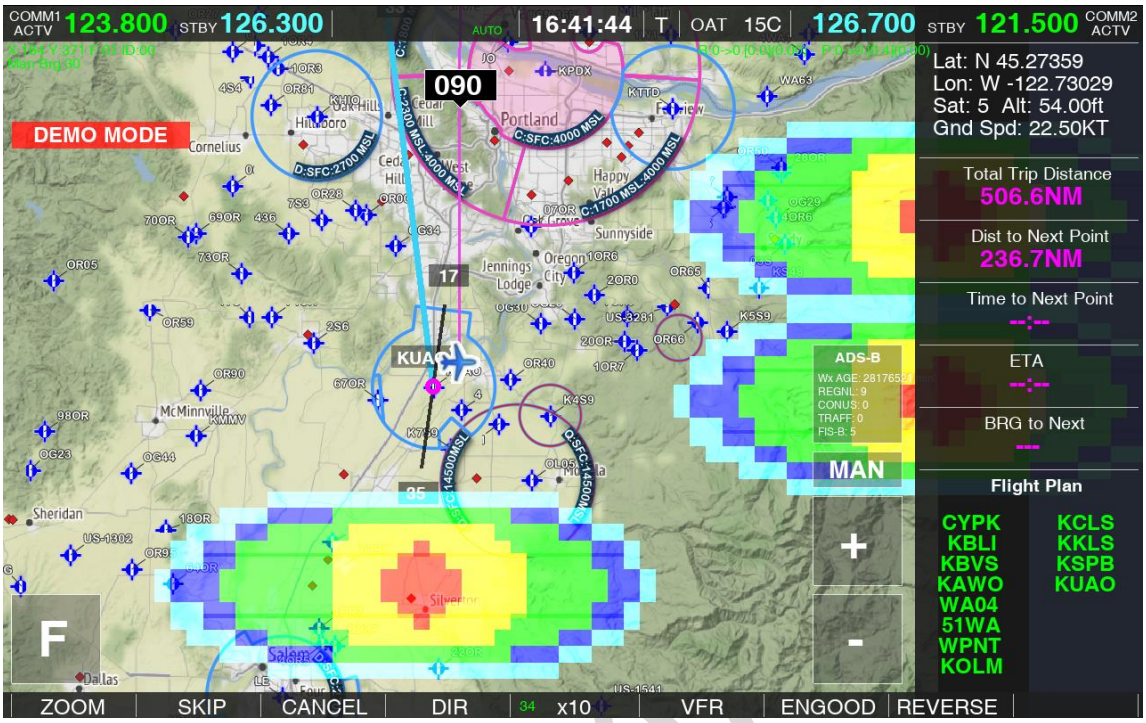
Use fingers to move the chart on display and zoom-in/zoom-out (two finger swipe)

Airport Procedures tab



This tab provides available procedures for this airport

ADS-B Weather on the map



Whenever weather from ADS-B (NexRad CONUS or Regional) is received it will become visible on the map. The composite reflectivity of NexRad product is coded using standard color philosophy.

For information about color-coding refer to section 3.8.2 (Table 3-2) of RTCA DO-267A.

Intensity values 0 and 1 are ignored as considered to be a background (no precipitation).

WEATHER MAP

The EFIS can display multiple weather products directly over the moving map. Weather information may be received through an online weather subscription or through a compatible ADS-B receiver, depending on aircraft configuration and available services.

Weather layers are selected from the **LAYERS** menu.

Opening the Weather Layers Menu

From the MAP page, touch **LAYERS**.

The Map Layers menu contains aeronautical map selections, online weather products, weather overlays, and ADS-B weather products.

Touch the desired weather product to enable it. The selected product is indicated by a check mark.

Only one primary graphical weather layer should normally be selected at a time. Additional overlays such as TFRs, AIRMETs, SIGMETs and NOTAMs can be displayed together with the primary weather product.

Online Weather Setup

Online weather requires:

- an active Internet connection,
- an active weather-data subscription,
- valid API access credentials entered into the EFIS.

To configure the weather subscription, open the **LAYERS** menu and touch **API**.

The API page allows the pilot or installer to enter the access credentials provided with the weather subscription.

Enter the required credentials and confirm the settings.

After the credentials are entered, the EFIS attempts to connect to the weather service.

The API status indication shows whether communication with the weather service is available.

If the connection or credentials are not valid, online weather products may remain unavailable or may be displayed in gray.

Normally, API credentials only need to be entered during initial setup unless the subscription credentials are changed.

Online Weather Products

The ONLINE section provides graphical weather information downloaded through the Internet.

Available products may include:

RADAR NA
Displays current North American precipitation radar.

RADAR GLOBAL
Displays radar information with broader geographical coverage.

RADAR FCST
Displays forecast radar information showing expected precipitation movement.

SATELLITE IR
Displays infrared satellite imagery. This can be useful for identifying cloud systems and large-scale weather patterns during both daytime and nighttime operations.

TURBULENCE US
Displays turbulence forecast information for the United States.

TURBULENCE GLOBAL
Displays global turbulence forecast information.

ICING US
Displays forecast icing information for the United States.

ICING GLOBAL
Displays global icing forecast information.

CLOUD CEILING
Displays the forecast height of the lowest broken or overcast cloud layer. This is particularly useful for VFR flight planning and evaluating areas where low ceilings may affect the planned route.

WINDS ALOFT
Displays forecast wind information at the selected altitude.

RADAR TRIAL
Displays the available trial radar product when supported.

Weather products that are currently unavailable may appear in gray.

Selecting an Altitude

Some weather products depend on altitude.

When an altitude-dependent product is selected, use the **ALT** control to select the required altitude.

Typical altitude-dependent products include:

- Winds Aloft
- Turbulence
- Icing

Touch **ALT**, then select the altitude closest to the intended flight altitude.

For example, when planning a flight between 6,000 and 8,000 feet, the pilot can compare winds, turbulence or icing at nearby available altitude levels before selecting the preferred cruising altitude.

Changing the selected altitude causes the EFIS to request weather information for the newly selected level.

Forecast Time Selection

Forecast weather products may contain multiple valid forecast times.

Touch **TIME** to select the desired forecast period.

Select **NOW** to display the forecast period closest to the current time.

Future forecast periods can be selected to evaluate expected weather later during the flight.

This can be useful before departure when reviewing:

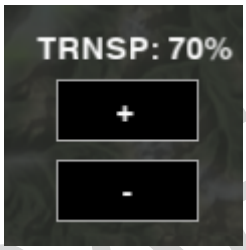
- expected wind changes,
- developing turbulence,
- icing conditions,
- cloud ceilings,
- precipitation movement.

The displayed forecast time represents the valid time of the weather information.

Weather Transparency

Weather information is drawn over the moving map.

Use the **TRNSP** control to adjust the transparency of the selected weather layer.



Increasing transparency allows more of the underlying map to remain visible.

Decreasing transparency makes the weather layer more prominent.

The pilot should adjust transparency so that important map information remains clearly visible, including:

- airports,
- airspace,
- terrain,
- flight-plan lines,
- waypoints,
- navigation information.

A medium transparency setting is normally a good starting point.

The transparency setting can be changed at any time while the weather layer is displayed.

Weather Overlays

The OVERLAYS section allows additional aviation weather information to be displayed over the selected graphical weather layer.

Available overlays may include:

TFRs
Displays Temporary Flight Restrictions.

AIRMET / SIGMET
Displays active aviation weather advisories affecting the displayed area.

NOTAMs
Displays available NOTAM information.

PIREPs
Displays available pilot reports.

Touch an overlay to enable or disable it.

More than one overlay may be enabled at the same time.

Overlay availability depends on the selected weather source and the information currently available.

ADS-B Weather

When a compatible ADS-B receiver is connected, the EFIS can display supported weather products received through ADS-B.

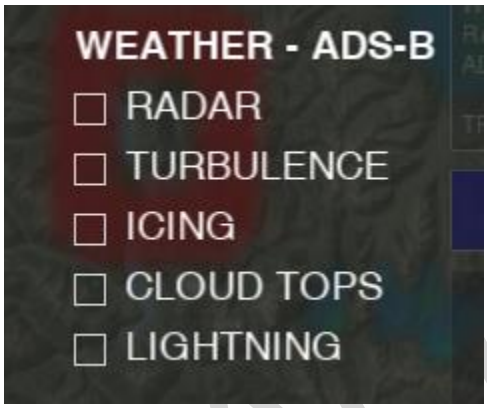
An Internet connection is not required for ADS-B weather reception.

Available ADS-B products may include:

- Radar
- Turbulence
- Icing
- Cloud Tops
- Lightning

Availability depends on the connected receiver, reception conditions, and the weather products currently being transmitted.

ADS-B weather products can be selected from the ADS-B section of the LAYERS menu.



Online Weather and ADS-B Weather

The EFIS may support both online and ADS-B weather sources.

Online weather generally provides access to a larger selection of graphical forecast products.

ADS-B weather provides in-flight weather information without requiring an Internet connection when a compatible receiver is installed and receiving data.

Some overlays may be available from either source.

The pilot should always verify which weather source is currently being used.

Panning and Zooming the Map

Weather information remains geographically positioned over the moving map.

The pilot can pan or zoom the map normally while weather is displayed.

After the map is moved to another area, the EFIS automatically requests updated online weather information for the newly displayed region when required.

The weather layer may take a short period to refresh after:

- moving the map,
- changing map range,
- selecting a different weather product,
- changing altitude,
- changing forecast time.

During an update, the previously downloaded weather image may remain visible until the new weather information is received.

Weather Product Availability

The EFIS monitors whether requested online weather products are successfully received.

A weather product displayed normally is available for selection.

A weather product displayed in gray may indicate that:

- the product is currently unavailable,
- the Internet connection is unavailable,
- the weather subscription does not include that product,
- the API credentials are incorrect,
- the weather service did not return valid data.

If several online products are unavailable, verify the Internet connection and the **API** status.

Recommended Pilot Use

Weather layers are intended to improve situational awareness and assist with flight planning.

For VFR operations, useful combinations may include:

- Radar + TFR/AIRMET/SIGMET overlays
- Cloud Ceiling
- Winds Aloft at planned cruise altitude
- Turbulence at planned cruise altitude
- Satellite IR for large-scale cloud systems

Before departure, pilots can use the altitude and forecast-time controls to compare expected conditions along the planned route.

During flight, weather layers can be changed as required without affecting normal navigation or flight-plan operation.

Important Weather Information

Graphical weather information may be delayed, forecast, incomplete, or temporarily unavailable.

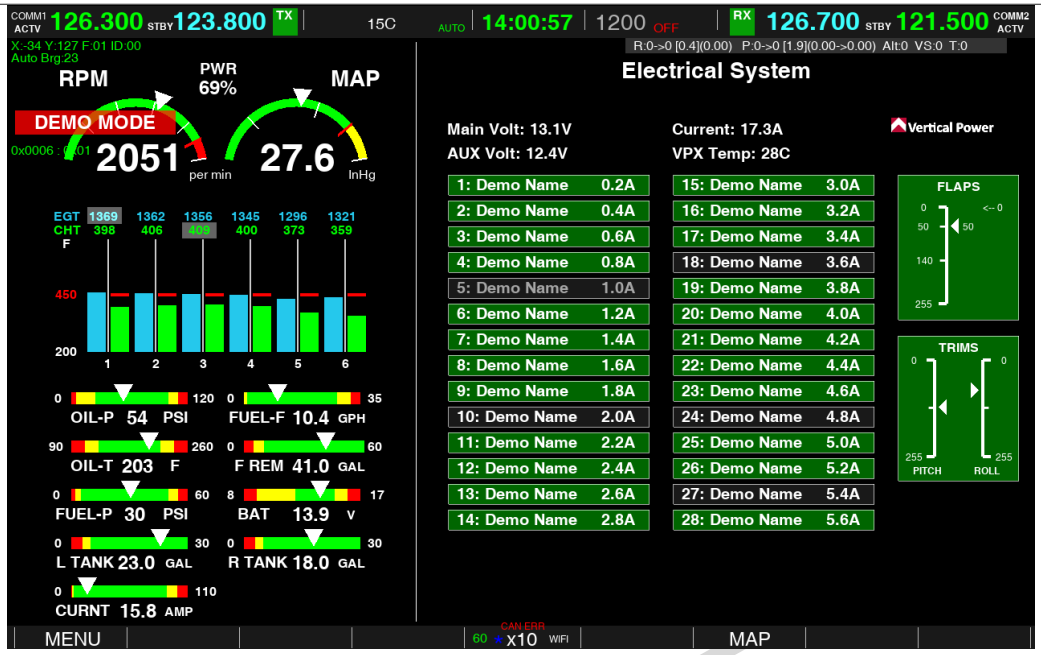
Forecast products represent predicted atmospheric conditions and should not be considered real-time observations.

Weather radar, satellite imagery, forecast products, ADS-B weather and graphical overlays should be used for situational awareness and flight planning only.

Pilots should always use appropriate official aviation weather information, current observations, forecasts and applicable flight-planning resources when making operational decisions.

Vertical Power VP-X Electronic circuit breaker support (VPX Sport and Pro models)

EFIS supports a connection to VP-X ECB models Sport and Pro using RS232 port.
Set under Settings -> External Devices -> COMx port mode to Vert Power VP-X and speed for this port to 57600. Recommended ports are Port2, 3 or 4.



By touching desired circuit breaker, you should be able to see more details about it such are current, status and other.

From the Warnings menu, you should be able to enable the warning for VPX system in case of digital circuit breaker failure. This warning will pop-up as a message on all screens while EFIS is in use.

Audio Panel functionality support

EFIS also supports an audio panels from PS Engineering using RS232 port.
Set under Settings -> External Devices -> COMx port mode to PS Eng Audio Panel and speed for this port to 9600. Recommended ports are Port2, 3 or 4.

New button under “pressure preset” box will appear: “AUDIO”. Pressing this button will activate the audio panel menu on display. In top info line green boxes next to COMM1 and 2 frequencies will show the TX/RX state of each audio channel in panel.

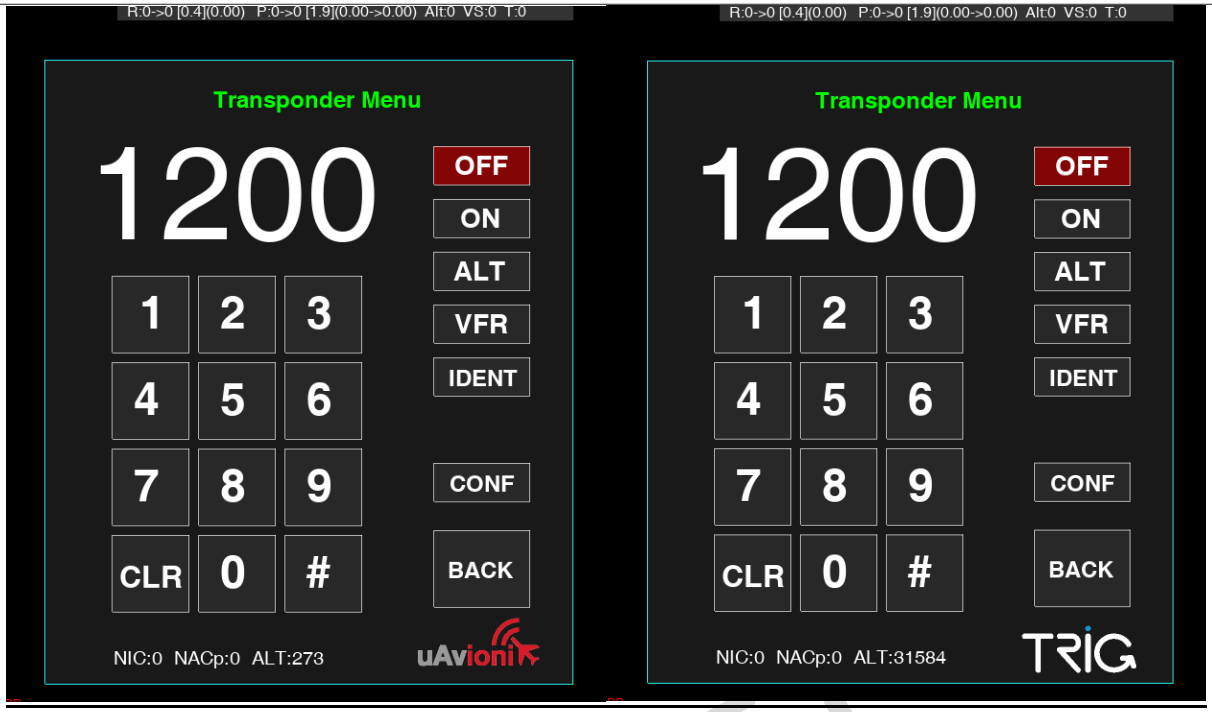
Supported audio panel models are: PMA450 series both remote and panel mount models

Transponder support

EFIS supports remote control for uAvionix TailBeaconX and Trig TT21/22 transponders.

uAvionix TailBeaconX – Set under Settings -> External Devices -> COMx port mode to uAvionix BeaconX and speed for this port to 2400. Recommended ports are Port2, 3 or 4.

Trig TT21/22 - Set under Settings -> External Devices -> COMx port mode to Trig XPonder and speed for this port to 38400. You can only choose port 1 (ELM800) or port 1,2 (ELM1000). Connect transponder to RS485 A and B lines (J2 connector in the back of EFIS).



Please see appropriate section of this document for detailed connection diagrams.

WiFi functionality

When compatible WiFi USB dongle is connected to the EFIS via the front USB port the WiFi menu will become accessible. Also the label “WIFI” will appear in the bottom info line near center.

WiFi menu will allow you to connect to local WiFi access point or compatible ADSB source.

Press Search button to show all available networks.

Select the WiFi network name from the menu by touching it. For password protected network enter the password using on-screen keyboard. Once connected you will see a message on the screen and connection details in the top left corner of the WiFi menu.

Green WiFi sign will appear in the bottom info line near center.

Telemetry functionality

When internet connection is available to EFIS it is capable of sending live data to the ground server via specific time periods. This allows storing all flight parameters including engine data on the ground and review these live while flight is conducted or after landing. This feature can be useful for flight school units where timely access to the airplane engine information, airplane current position and others is important.

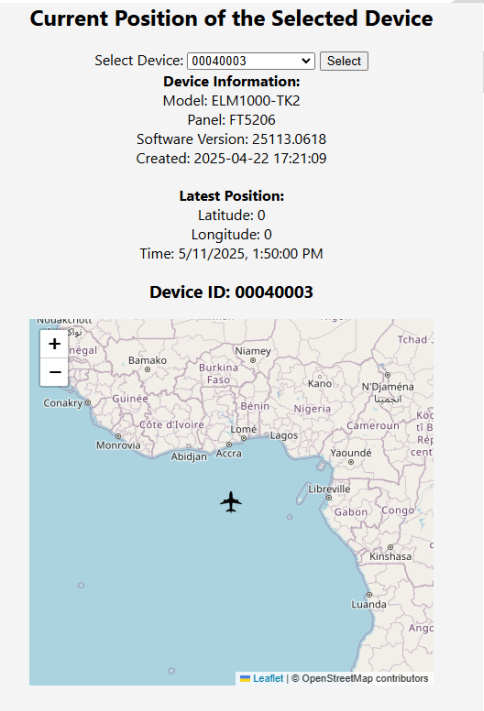
As an example of the internet source in the air can be a Starlink Mini with specific plan which allows to use data while in motion at high speeds. Alternatively, WiFi internet source (phone) can be used.

In the Settings menu, under General set Telemetry to In-flight (sends data only when airplane is airborne) or Engine Running (sends data as engine is started). Set the Telemetry Time to desired time frames when data gets send.

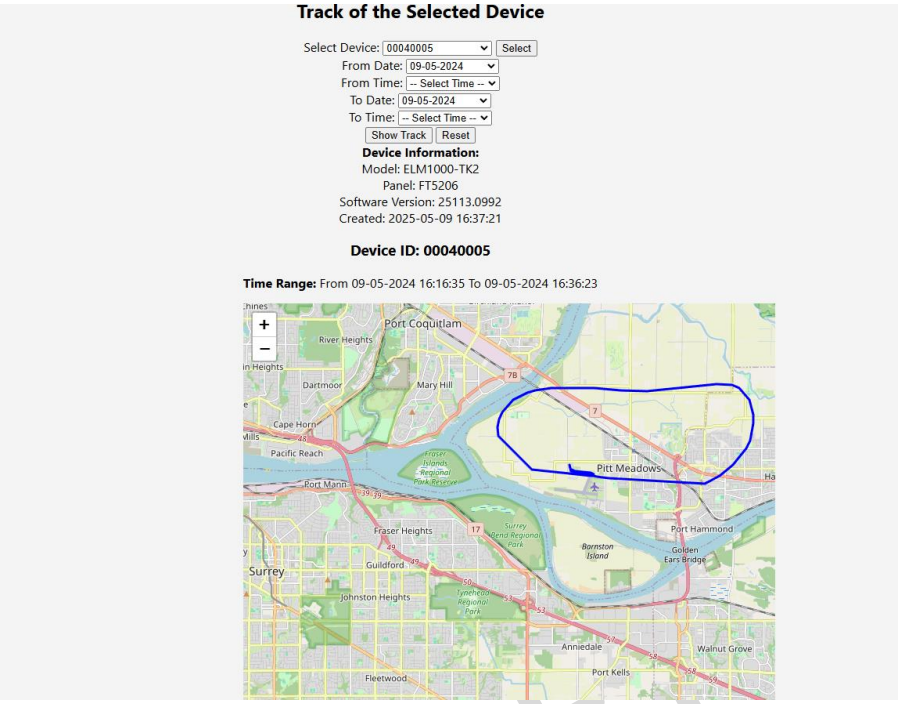
Open: https://www.360avionics.com/telemetry and register an account. Send us an email and request to add your EFIS unit to your account. Once this is done you should be able to use your online Telemetry access.

When logged you will see a menu:

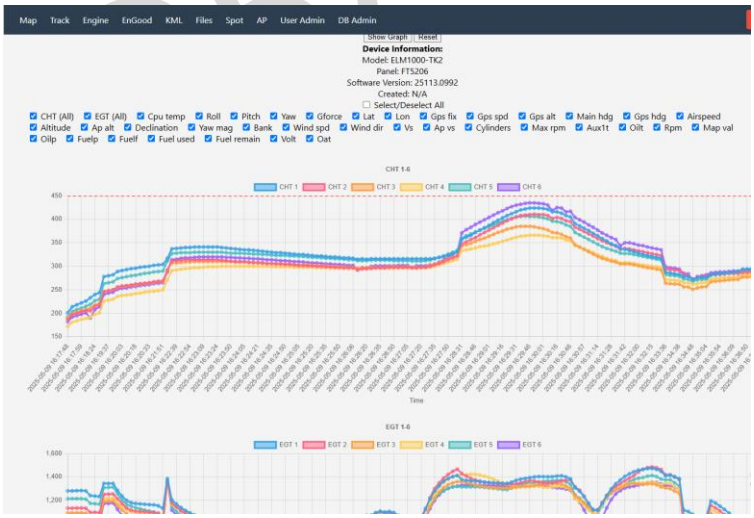
Map – this will show you live position of your aircraft with EFIS



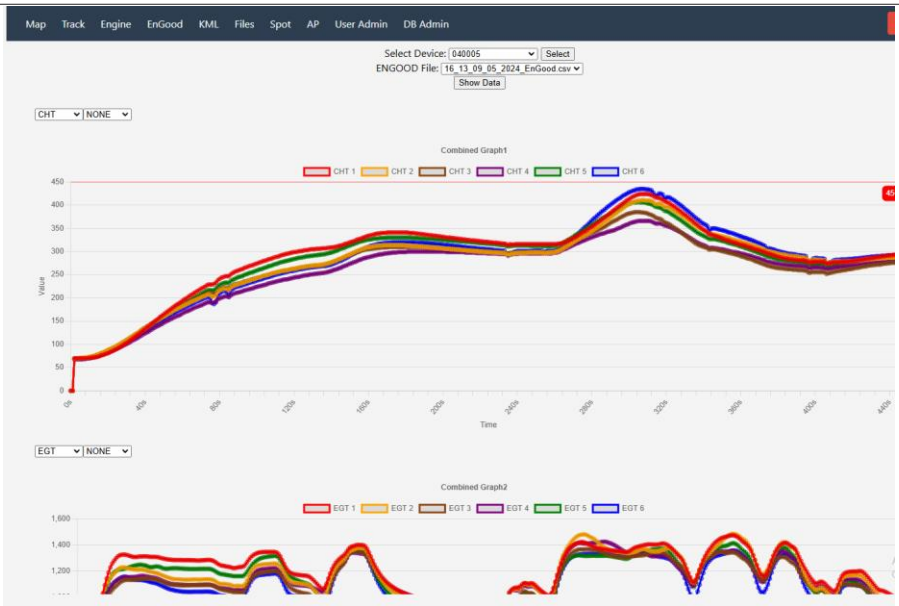
Track – this will show you current position and will draw a track of your trip



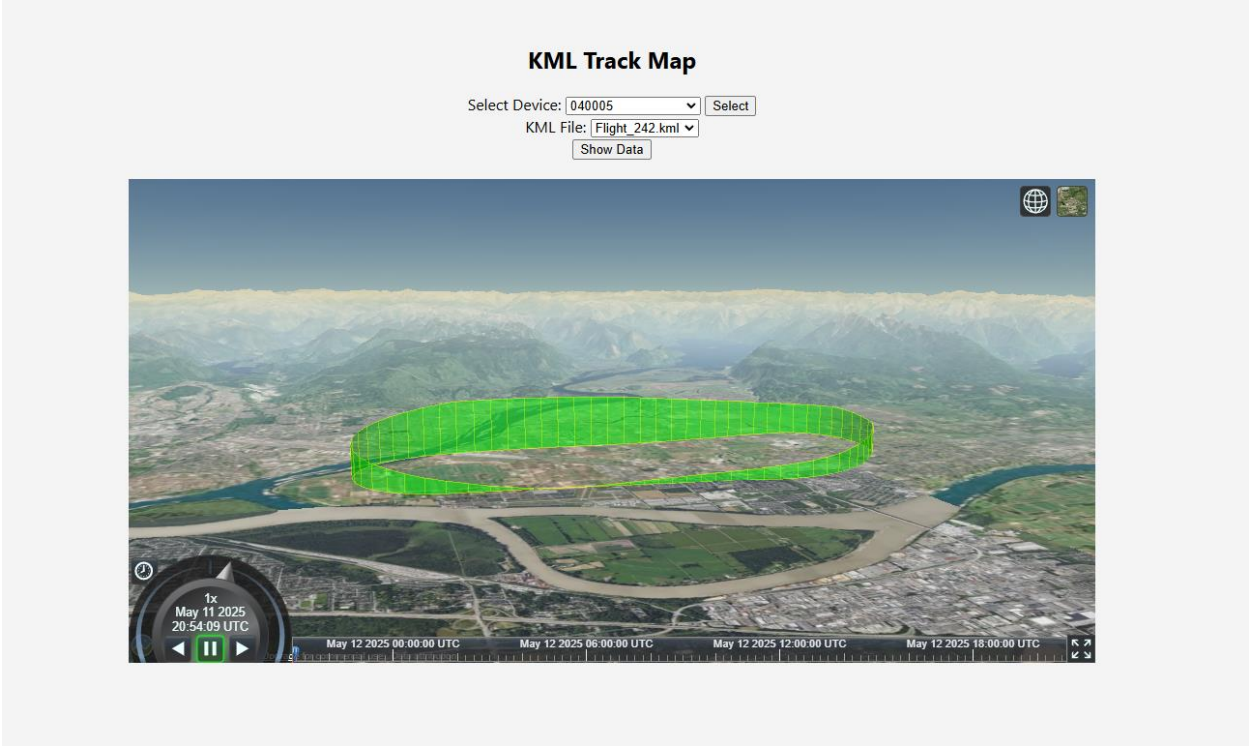
Engine – this will show you all current engine parameters



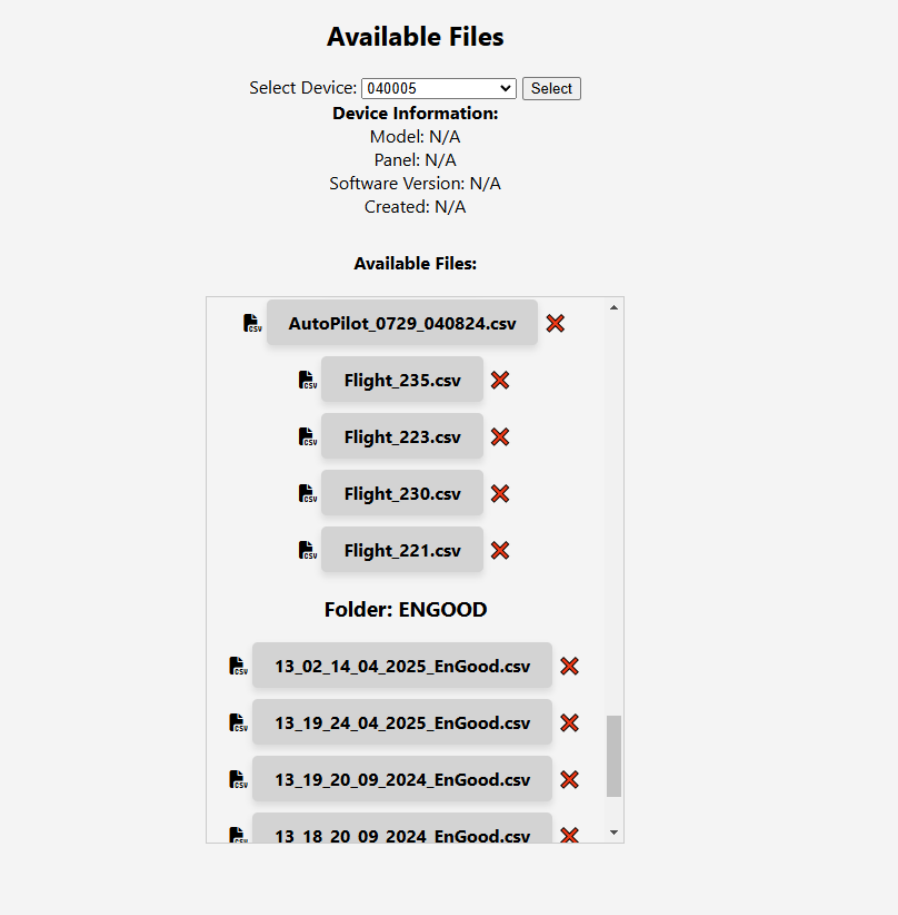
EnGood – this allows you to review your offloaded (via Blackbox-Offload Data menu) engine data from previous flights



KML – this allows you to review your flight path in 3D

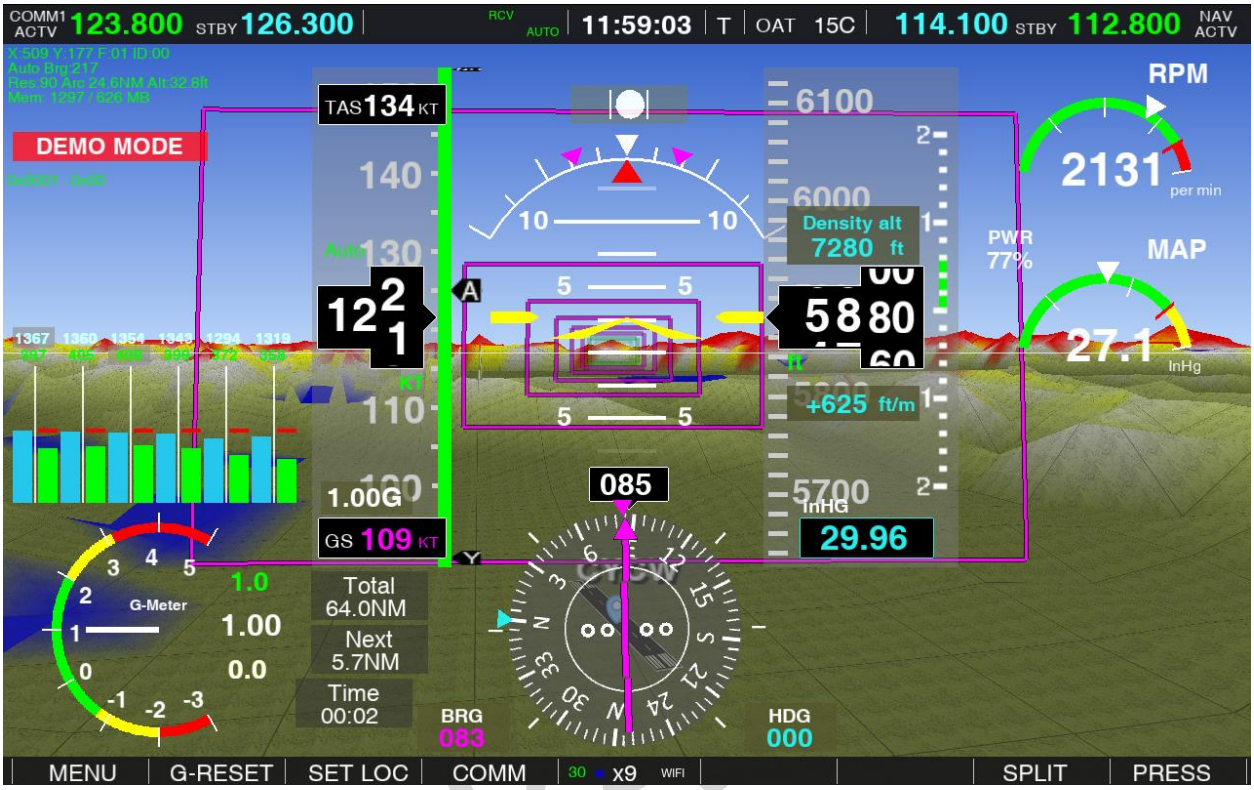


Files – this allows you to access to all your offloaded files. Files can be deleted or downloaded to your local PC.



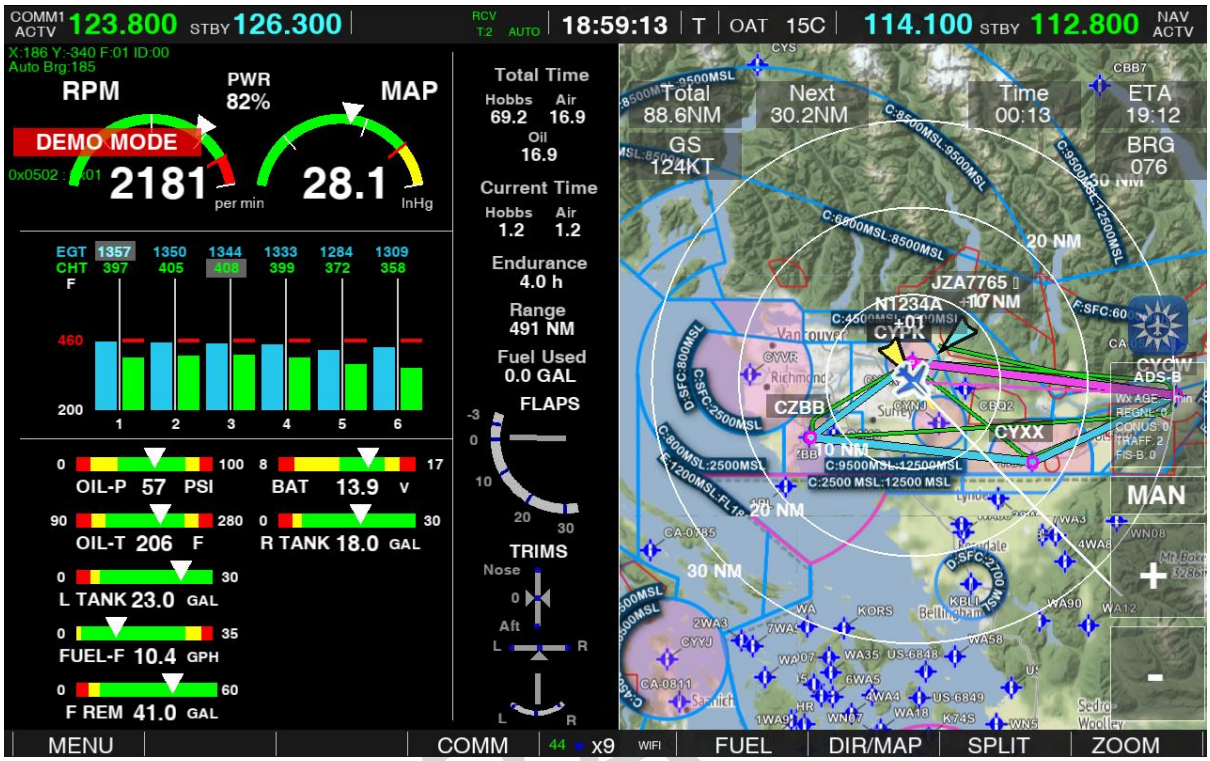
Telematics is a newly developed feature, which will be supported in all upcoming EFIS models.

HITS Highway In the Skies Functionality



When flying toward the destination waypoint with HITS enabled, a virtual tunnel is displayed in synthetic vision, providing a clear and intuitive path that is easy to follow by keeping the aircraft within the tunnel. It can be enabled under Settings -> Display -> HITS

MAP with Engine Monitor Split Functionality

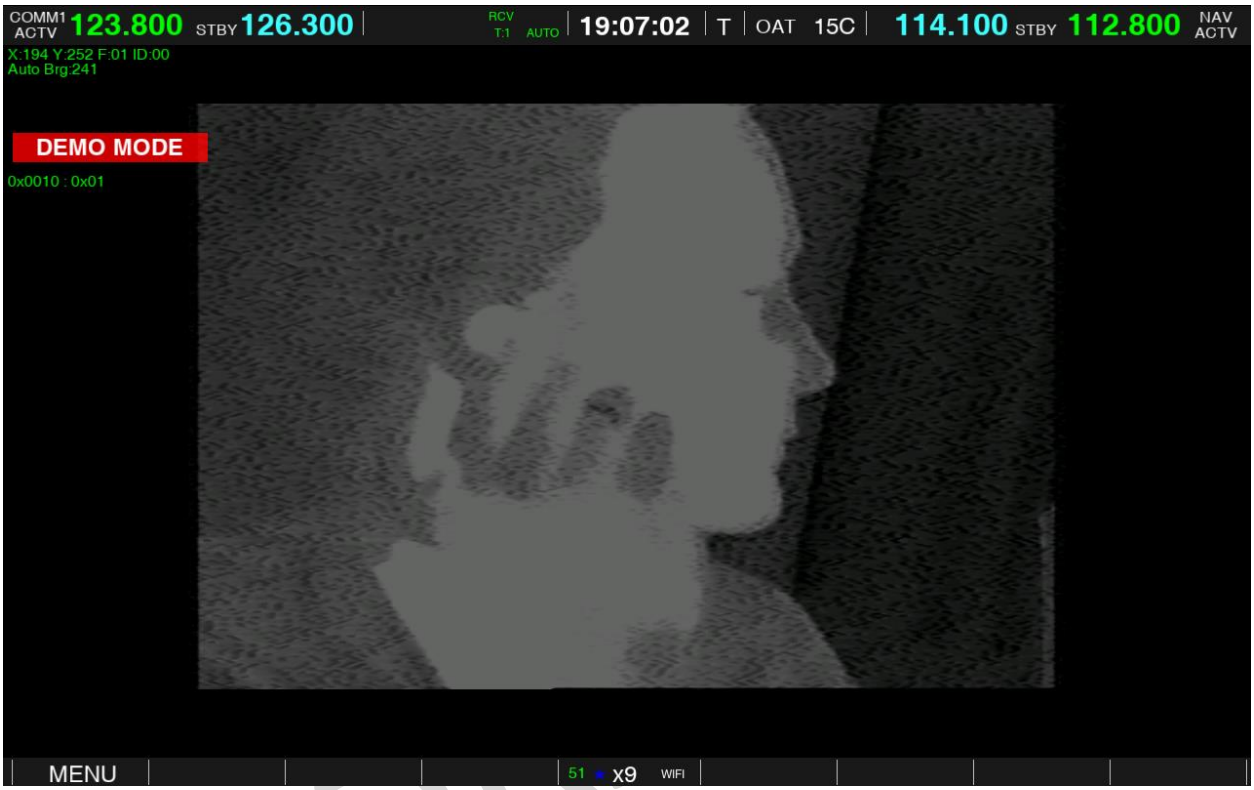


When the EFIS is used as an MFD or PFD, the display can be switched to engine monitor and map split mode. This allows navigation and engine monitoring at the same time, while on the PFD the pilot can focus on all other critical flight parameters.

Day/Night Artificial horizont simulation functionality

When enabled under Display then Synth Visual Sun, the synthetic vision background automatically changes based on day or night time, creating a more realistic three dimensional perspective view.

Analog Camera functionality



This mode allows a standard NTSC camera feed to be displayed on the screen. This function is available only on ELM1000x models.

Engine Intelligent Analysis

The Engine Intelligent Analysis function is designed to help the pilot recognize meaningful changes in engine behavior by comparing current engine operation with the aircraft's own previous flight history. Instead of relying only on fixed alarm limits, the system learns what is normal for a specific aircraft, engine installation, sensor package, and style of operation. During each flight, the system monitors engine and aircraft data during different phases of operation, including taxi, takeoff, climb, cruise, descent, and landing. The analysis is performed separately for each phase of flight, because normal engine behavior during takeoff or climb is very different from normal engine behavior during cruise or descent. For example, high fuel flow and high cylinder head temperatures may be expected during takeoff and climb, while lower power and different exhaust gas temperatures may be normal during descent. By comparing each phase only with the same phase from previous flights, the system provides a more meaningful trend comparison.

The system monitors installed and enabled engine sensors only. If a sensor is not installed, not enabled, or not providing valid data, it is not used for analysis. This allows the same intelligent analysis function to be used on aircraft with different engine-monitoring configurations. For example, one aircraft may have complete engine instrumentation with CHT, EGT, fuel flow, fuel pressure, oil temperature, oil pressure, voltage, and current monitoring, while another aircraft may only have CHT, EGT, oil temperature, and oil pressure. The analysis automatically follows the available sensor configuration and does not create advisories from missing equipment.

For each completed phase of flight, the system evaluates the engine data collected during that phase and compares it with previous matching phases from earlier flights. The analysis includes per-cylinder cylinder head temperature trends, per-cylinder exhaust gas temperature trends, fuel flow behavior, oil temperature, oil pressure, fuel pressure, main electrical voltage, and other available monitored parameters. Cylinder head temperature is evaluated both by average behavior and by peak temperature, helping identify changes in engine cooling, power setting, or cylinder-specific heat patterns. Exhaust gas temperature is analyzed per cylinder because EGT changes can be an early indication of ignition, spark plug, mixture distribution, injector, or combustion-related changes. For engines with two spark plugs per cylinder, a failed or weak plug may not stop the engine from running, but it can change the burn characteristics and cause an abnormal EGT trend on the affected cylinder. The system is intended to help highlight these changes by comparing each cylinder's behavior with the aircraft's own established history.

Fuel flow is treated as an important trend parameter, especially during takeoff and climb. During high-power operation, fuel flow should normally be repeatable for the same engine and power setting. A fuel flow value that is lower than expected during takeoff or climb may indicate a restriction, blocked filter, pump issue, calibration problem, or another fuel-system concern that should be investigated. When available, the system considers engine power information such as RPM and manifold pressure so that fuel flow comparison is made more fairly between flights. This helps reduce unnecessary advisories when the aircraft is operated at slightly different power settings.

Oil pressure and fuel pressure are evaluated with special attention to minimum values during a phase of flight, because a short pressure drop may be more important than the average value. Oil temperature is compared as a trend over time and may be considered along with outside air temperature, since normal oil temperature can vary with ambient conditions. Main electrical voltage is also monitored when installed, allowing the system to identify lower-than-normal electrical system behavior compared with previous flights. These comparisons are intended to provide trend awareness and support early detection of changes before they become obvious failures.

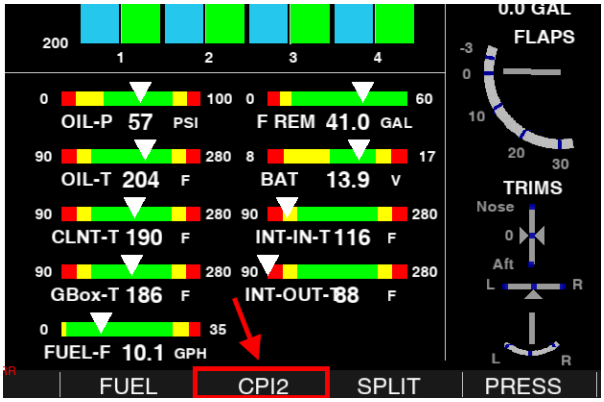
The system uses the aircraft's configured maximum engine RPM and current engine operation to help identify the phase of flight. Takeoff and climb detection are based on high-power operation relative to the configured engine capability, rather than a single fixed RPM number. This allows the analysis to adapt better to different engine installations. Vertical speed changes are also filtered so that brief gusts or turbulence do not immediately cause incorrect phase detection. For example, a momentary downward movement caused by turbulence should not be treated as a true descent phase unless it continues long enough to represent actual aircraft behavior.

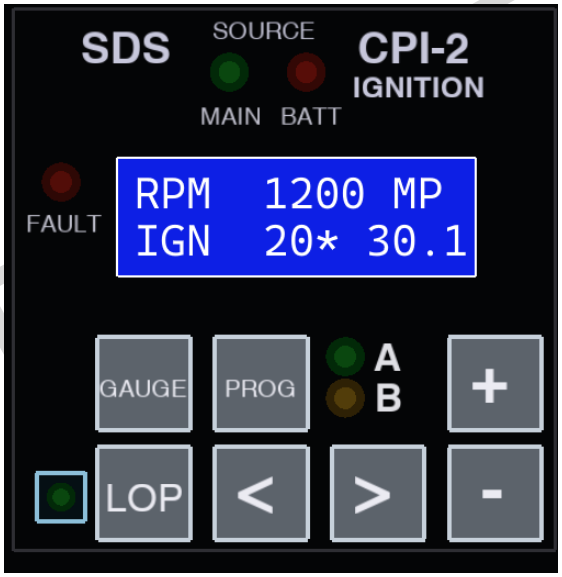
The Engine Intelligent Analysis function produces simple pilot-facing results such as Learning, Normal, Watch, or Unusual. "Learning" means the system does not yet have enough previous matching flight history for a reliable comparison. "Normal" means the current phase appears consistent with previous operation. "Watch" means the system found a noticeable difference that should be reviewed. "Unusual" means the difference is stronger and should receive greater

attention from the pilot or maintainer. The system may also identify which parameter changed, such as a specific CHT or EGT cylinder, fuel flow difference, oil pressure trend, fuel pressure trend, oil temperature trend, or voltage trend.

This function is intended as a trend-monitoring and awareness tool. It does not replace the pilot's responsibility to monitor engine instruments, follow operating procedures, comply with engine manufacturer limitations, or investigate any abnormal engine indication. Fixed engine limits and active engine alarms remain the primary protection for immediate exceedances. The intelligent analysis function adds another layer of information by showing how the engine behaved compared with its own previous history. Over time, this can help the pilot notice changes in engine performance, cooling, combustion, fuel delivery, electrical behavior, and pressure trends that may otherwise be difficult to recognize from a single flight alone.

CPI-2 Display Support (unofficial)





When the optional CPI-2 Gateway Module is connected between the EFIS and an SDS CPI-2 electronic ignition system, the EFIS can emulate the original SDS CPI-2 control head directly on the display. The EFIS receives and displays the CPI-2 control-head information, including LCD data and available status/LED indications. Virtual on-screen controls allow the pilot to operate the same CPI-2 functions normally accessed through the physical control head, including navigation, programming, gauge, LOP, and adjustment buttons. This allows CPI-2 operation without requiring installation space for the separate SDS display/keypad unit in the instrument panel. This feature is unofficial and is not affiliated with, endorsed by, or supported by SDS EFI.

This feature must be enabled under: Settings -> External Devices -> SDS EFI CPI2: Installed

Lidar Altimeter

The ELM EFIS supports the Benewake TF03 LiDAR Altimeter module (specially configured for ELM EFIS use), available in **100 m (320 ft)** and **180 m (550 ft)** versions. When installed, the LiDAR continuously measures the distance between the aircraft and the terrain directly below, providing highly accurate Above Ground Level (AGL) information during the most critical phases of flight, including approach, landing, takeoff and low-level operations.

The LiDAR should be installed underneath the aircraft fuselage or wing with the optical window pointing vertically downward toward the ground. Ensure that the sensor has an unobstructed view of the terrain and is mounted securely to minimize vibration.

Electrical Connection

Connect the LiDAR to the EFIS using the DB15 connector as follows:

Pin1 - +12...14VDC, **Pin10** – CAN High, **Pin11** – CAN Low, **Pin15** - GND

EFIS Configuration

After installation, configure the EFIS as follows:

- **Settings → Sensors → LiDAR Mode → Benewake TF03**
- **Settings → Info / Warnings → LiDAR Altimeter → Enabled**

Once enabled, the EFIS will display real-time LiDAR altitude and provide LiDAR-based altitude callouts (if configured).

Operational Limitations

The LiDAR measures the distance to the highest object directly below the aircraft and has the following limitations:

- Measurements over water may be unreliable or unavailable, especially over calm surfaces.
- Dark or low-reflectivity surfaces and adverse weather (rain, snow, fog, smoke, or dust) can reduce measurement range and accuracy.
- Vegetation, such as tall grass or tree canopies, will be measured instead of the ground beneath.
- Accuracy may decrease during steep bank angles when the sensor is no longer pointing directly downward.
- The LiDAR is a supplementary situational awareness aid only and must not be used as the sole source of altitude or terrain clearance information.

Six pack display mode

The ELM1000 EFIS provides an optional Six-Pack display mode designed to reproduce the familiar appearance and arrangement of traditional aircraft flight instruments on the electronic Primary Flight Display. This presentation is particularly useful for pilots transitioning from conventional mechanical instrumentation to a modern glass-cockpit environment. The familiar round-gauge layout allows important flight information to be interpreted using an instrument presentation that many pilots have used throughout their flight training and previous flying experience. Airspeed, altitude, heading, vertical speed, turn information, and attitude are presented in the traditional six-pack arrangement while using the ELM800/1000 electronic sensor and display system. The Six-Pack mode therefore combines the familiarity of conventional flight instrumentation with the advantages of an integrated electronic flight display. Pilots may use this mode permanently or as an intermediate step while becoming familiar with the standard ELM800/1000 glass-cockpit presentation. Similar presentation concepts have been used in modern EFIS systems to help pilots transition from traditional analog panels to electronic flight displays. The selected presentation does not change the underlying flight-data sources; it changes primarily how the information is visually presented to the pilot. The ELM1000 Artificial Horizon display can be configured for either the modern **Classic** presentation or the traditional **Six-Pack** presentation. To select the desired mode, open **Settings → Display → AI Display Mode** and select either **Classic** or **Six-Pack**. The selection may be changed whenever the pilot prefers a different Primary Flight Display presentation.

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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