IEFIS panel installation manual

This document details hardware installation and system configuration of an iEFIS panel.

This document is applicable for the following iEFIS panels and iBOX devices:

IEFIS Discovery – 7” panel.

IEFIS Explorer – 8.5” panel.

IEFIS Challenger – 10.4” panel.

IBOX V1 – full function EFIS interface unit

IBOX V2 – low cost EFIS interface unit

Preliminary document

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General

IEFIS consists of one or more panels, one or two iBOX units as well as sensors and control interfaces as required.

As of writing of this document the following MGL devices are compatible with the iEFIS system:

Up to 8 panels may be connected in a single system

iEFIS Discovery: 7” screen size panel
iEFIS Explorer: 8.5” screen size panel
iEFIS Challenger: 10.4” screen size panel

iBOX V1: Full feature, central interface for an iEFIS system (up to 2 units)
SP-6 CAN: Compass/Magnetometer (up to 2 units)
SP-7 CAN: AHRS (up to 4 units)
SP-8 CAN: SP-6 and SP-7 in one housing (up to 4 units)
SP-9 CAN: High grade AHRS (up to 4 units)
SP-10 CAN: Flap, trim and gear controller (up to 6 units, up to 2 functions/unit, 6 functions max)
RDAC XF: Engine monitoring interface (up to 4 units/engines)
RDAC CAN: ECU interface (up to 2 units/engines)
MGL V6: COM radio (including full remote control)
MGL V10: COM radio (including full remote control)
MGL ECB system (up to 4 units, 48 breakers)
MGL iEFIS wireless node (one per system)
MGL iEFIS wired node (up to 8 – including iEFIS panels)
MGL Autopilot servos (Bank, Pitch, Yaw)
MGL/Garrecht mode-s transponder

The following third party products are compatible with the iEFIS system:

Garmin SL40 COM radio
Garmin SL30 NAV/COM radio
Garmin G430W and newer GPS/NAV/COM systems
Sandia aerospace STX-165R mode-c transponder
Vertical power VPX

Traffic systems compatible with ARINC 735 (TIS, TCAS, ADSB with TIS output)
Traffic systems: NAVWorx ADSB, FLARM, XRX PCAS

Transponders requiring greycode (gillman code) altitude encoder can be connected, using the iBOX altimeter as alticoder source.

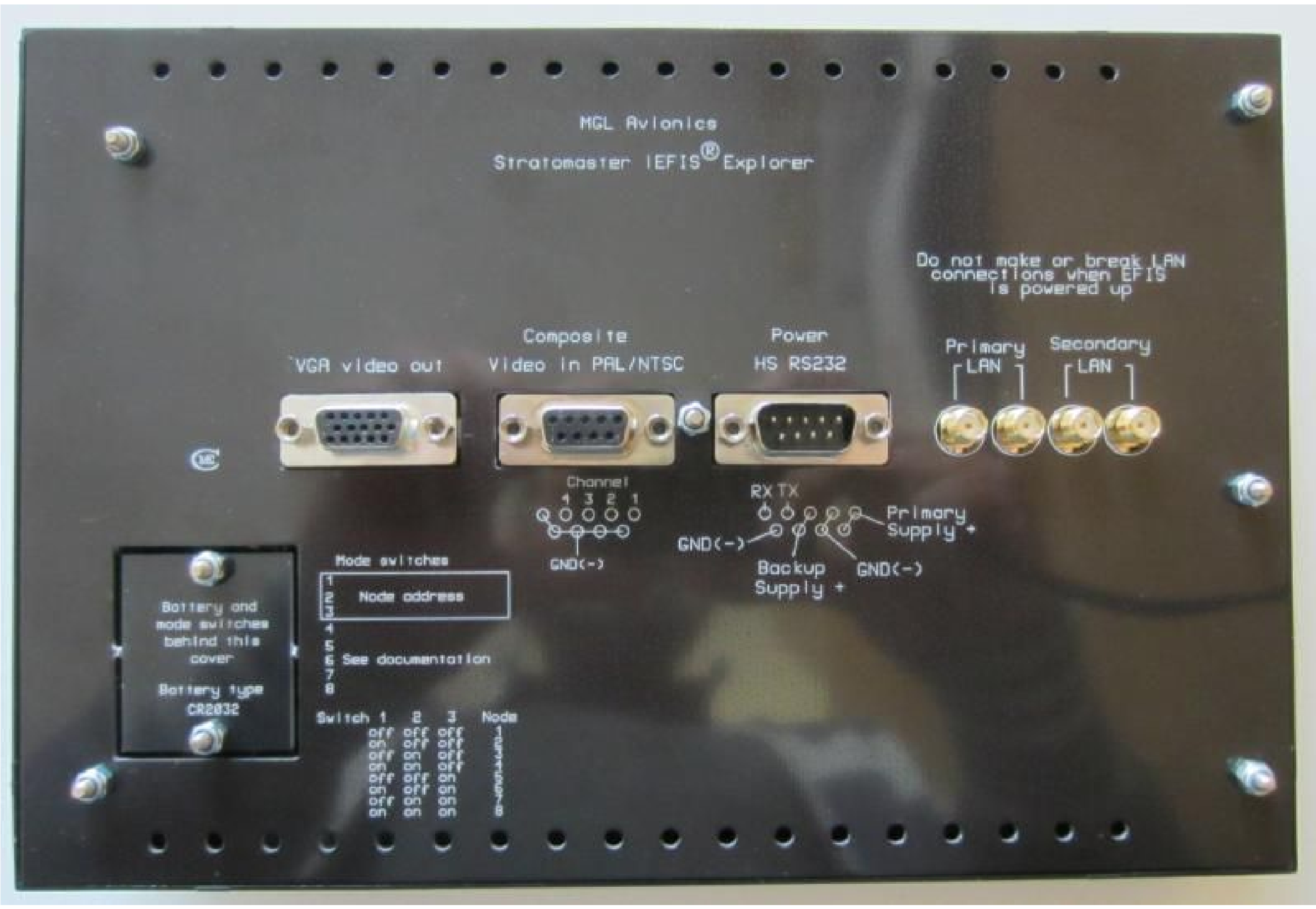
Older navigation systems (VOR/ILS) using +/-150mV differential outputs to drive indicators can be connected as navigation source.

External autopilots can be connected to NMEA (RS232 port 6 on the iBOX) or connected to ARINC steering signals.

Example rear panel (Explorer EFIS)

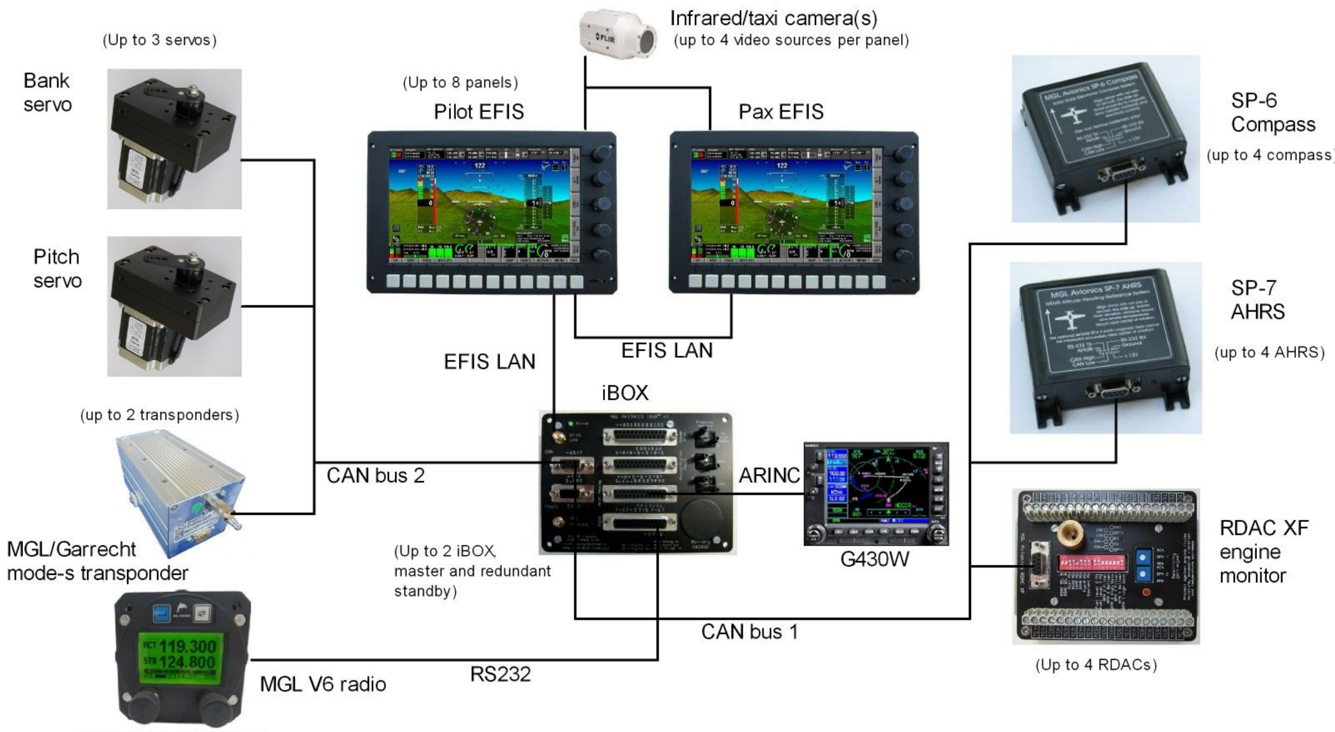
This image shows the rear of a iEFIS panel.

Primary LAN: Two SMA connectors for the primary iBOX LAN
Secondary LAN: Two SMA connectors for the secondary iBOX LAN
Power: Male D9 socket for power, also provides a high speed RS232 port
Video: Female D9 socket provides four composite video inputs for cameras
VGA: Female D15 standard VGA socket provides video output. Note: Video timing may be non-standard on some panels due to configuration. Please check if monitor can accept non standard frame rates. Frame rates may vary depending on product from 30 to 60 Hz.
Access cover for internal lithium battery and DIPSWITCH array to set LAN node address.



Ensure that ventilation holes on top and bottom are not blocked in your installation. These holes provide convection cooling for the internal electronics.

Example system design



Example iEFIS system layout for a typical two panel solution, showing main communications bus connections.

The above image shows a typical small dual panel system with a single iBOX. It serves well to illustrate the simplicity of the distributed system and ease of hardware installation.

Most MGL devices are connected to the iBOX using the CAN interface. The CAN bus uses a simple two wire connection. A twisted pair wire is used for this. The CAN bus is simply connected to each devices CAN interface terminals. The two wires are identified as “CAN H and CAL L” and these connect to the corresponding terminals. Longer CAN bus runs require a termination resistor on each end (120-180 ohms) while shorter runs (less than 9 ft) work happily with just a single resistor of the same value.

Two CAN interfaces are available. These are exactly equivalent so you can connect any MGL device to any of the two interfaces. The above image suggests to separate “sensors” and “devices” onto the two CAN busses.

Note: Do NOT join CAN bus one to CAN bus two. They MUST remain independent.

Note: If you have two iBOX units, the CAN buses are joined between them: CAN bus one to CAN bus one and CAN bus two to CAN bus two. The two iBOX units will use the CAN bus to exchange data and status information.

The iBOX installation

Please consult the iBOX installation manual for specifics on the hardware installation of the iBOX system.

The iEFIS LAN

The transmission media for data between panels and iBOX is RG174 coaxial cable using SMA connectors. Data is transmitted using a propriety, deterministic protocol at 2Mb/s. Principles of the protocol are routed in the industrial ARCNET network topology with some modifications. The protocol uses a token passing system in a TDM environment. The iEFIS system lends itself to a communications master based protocol. The master is the iBOX as no system makes sense without an iBOX.
A further utilization of the iEFIS network cable is the transfer of backup power during system shutdown from the aircraft's battery via the iBOX “keep alive” wire. This greatly prolongs the life time of panels built in user replaceable lithium backup battery. The backup battery is used to maintain non-volatile memory in the panels.

Each panel supports two LAN connections, a primary and a secondary LAN. The secondary LAN is only used if a second, redundant iBOX is used (this is optional).

Each LAN connection has two connectors. The two connectors are joined and provide a simple means to extend the LAN cable to several panels. For example, in a two panel system with a single iBOX, you would connect the iBOX LAN to the EFIS primary LAN on one panel and then use the second primary LAN connector on the panel to connect to the primary lAN panel of the second panel.

Image showing Primary LAN connected. Each group of two connectors are simply connected internally to each other. This implies that both connectors are equivalent. These connectors eliminate the need to create cable splices or use T-couplers.

Note: Never mix up the Primary and Secondary LAN. They must remain separate. Never join the two LAN systems. They must remain independent.

IEFIS LAN terms

Primary LAN

The LAN connecting all of the primary LAN connectors at the back of the panels to the main iBOX unit.

Secondary LAN

The LAN connecting all of the secondary LAN connectors at the back of the panels to the standby iBOX unit (this connection and the standby iBOX are optional).

Active panel

In the iEFIS system, one and only one panel is the “active” panel. The active panel has special privileges such as being able to configure all of the system. The active panel also controls the autopilot and is responsible for navigation and similar tasks.

Inactive panel(s)

All panels that are not “active” are “inactive”. They still behave like normal panels but cannot configure the system. They do not actively navigate or control any connected devices. Should an “inactive” panel require an action to be performed (for example, change of a radio frequency), this request is sent to the “active” panel for execution.
“Inactive” panels can be seen as “passive” - they can do certain permitted functions via the “active” panel and can monitor data as it flows on the LAN so essentially they behave in many ways just like an active panel.

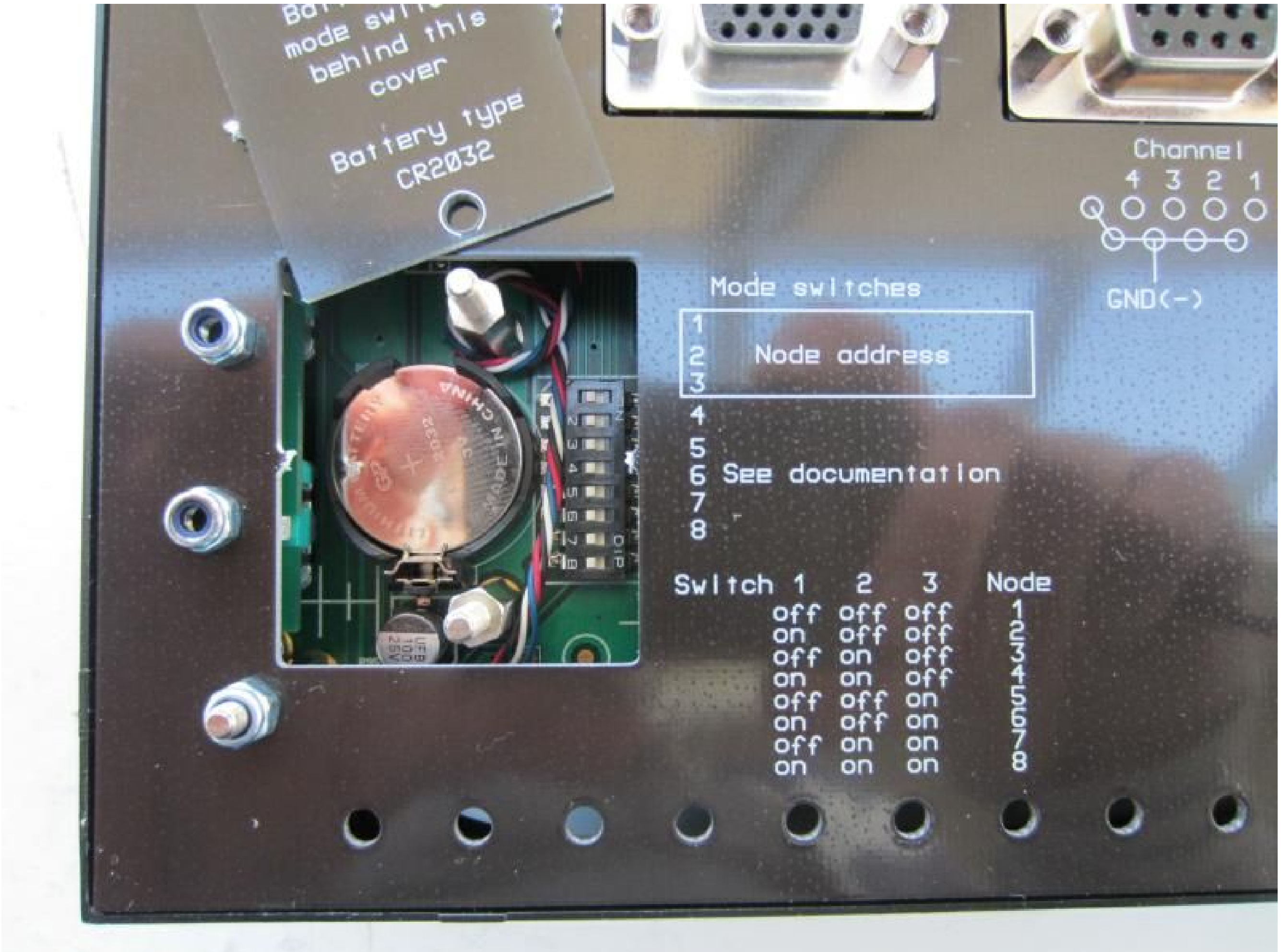
Assigning iEFIS panel addresses.

Before a system with more than one panel can be used, each panel must be assigned an “address”. Addresses are simply numbers from 1 to 8 (for eight possible panels in a system).

You assign the address for a panel during installation. Remove the Back cover as shown in this image and select the address on the DIPSWITCH array. A ballpoint pen works very well to slide the switches.

Panel addresses assign a panels “priority”. The lower the number, the higher the priority. This matters. The panel with the highest priority will be the “active” panel. Normally, you should assign the highest priority to the panel in front of the pilot (I.e address “1”).

No two panels on the LAN may have the same address. This will cause a malfunction and corresponding alerts will be shown on the affected panels.



Node addresses are set using switches 1,2 and 3. The remaining switches are not currently used but should be left in the "off" position to ensure compatibility with future software functionality extensions that may use these switches.

Configuration of the iEFIS system

This section refers to the configuration of the software side of the system once the hardware has been installed. Here you will select the various operating modes and settings and tell the iEFIS system what is connected and where it is connected.

If you have more than one panel, your configurations will be done on the panel that is the "active" panel. You can easily identify the active panel – it has the iBOX status field in the top left corner of the display shown with a white surround.

Settings of your active panel are not automatically distributed to your other panels. You can however "broadcast" your settings, once done, to the other panels. On each panel, you can select what types of settings it should accept from the active panel. There may be cases where you do not want the same settings on each panel so you are in complete control.

Navigating the menus

This document follows this example convention:

Menu -> System Setup -> Engine monitoring setup -> Setup RDAC 1 probes and senders

This means:

1) Press the menu button
2) Tap on the “System setup” field or use the navigation buttons to select it.
3) Tap on the “Engine monitoring setip” field or use the navigation buttons.
4) Tap on the “Setup RDAC 1 probes and senders” field or use the navigation buttons.

Configuring a system for the first time

The first time you configure a system you will start by calibrating the tap screen.

You may do this at any time. The main reason you will calibrate the screen is the shape of your finger. The system will measure the force you are pressing on the screen and will determine the point you pressed the screen. Every finger is different and the center of force will vary. Perform the calibration so you are happy the system detects the tap point where you want it.

You may elect to have the tap point visible (I.e. Slightly above the point you press your finger) or underneath your finger as you prefer. Experiment a little to find the best solution for you.

You can activate the touch screen calibration by clicking any of the top 3 rotary controls and holding the control in the clicked position (press towards the panel) and then switch the panel on (apply power) – hold until the system starts – it will now go straight into the tap screen calibration function. This is also available in the setup menu.

To calibrate, follow the instructions in the center of the screen. Tap each of the three points in turn – they are numbered 1,2 and 3. Then test the result by tapping on the screen and observing where the hand pointer that appears points to. If you are in agreement, you can confirm the new calibration or you can request a new attempt.

Once your tap screen calibration has been completed, it is time to choose one of the built in options for the display layout. You may also use your own screen designs if you have prepared them using the screen designer application. If you have obtained custom designed screens from a third party, please refer to them for installation and configuration instructions as they may differ from those presented here. In general however, most configuration should be similar no matter what the screens look like.

You choose a general screen layout, engine display layout, fuel system layout and info screen layout.

General layouts refer to the general appearance of the screen. You can choose from a complex panel with pop down items on the top (such as radios) to a simple panel for a basic system.
Engine layouts relate mainly to typical single engined systems and you will choose what items

to monitor. For fuel tank layout your choice is how many fuel tanks and if you use fuel pressure sensor and fuel flow sensor.

Custom screen designs are usually installed by executing a provided script file which includes all screens and related items right down to individual setups. It is however also possible to copy screen files individually to the systems “screens” folder. Any relevant screen file in this folder automatically replaces any chosen “built-in” option.

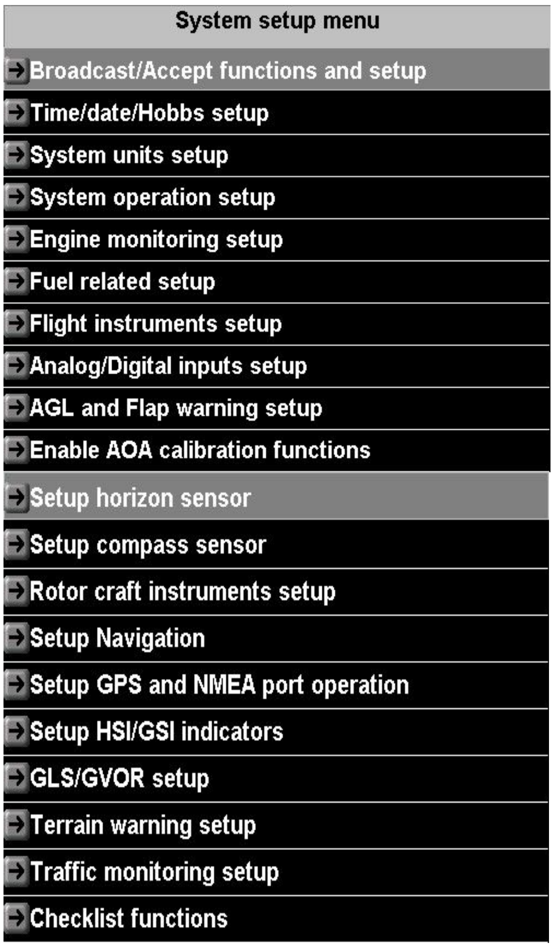
Once your screen layout selection has been completed, it is time to configure the individual settings. Here we start by setting the “real time clock” to the current time, setting up the “hobbs”, “maintenance” and “tach” timers to their desired starting values, choosing the system “units” (for example, you may want airspeed in miles per hour or knots) and attending to the many individual settings that will dictate how the system will operate. These are outlined in the following sections.

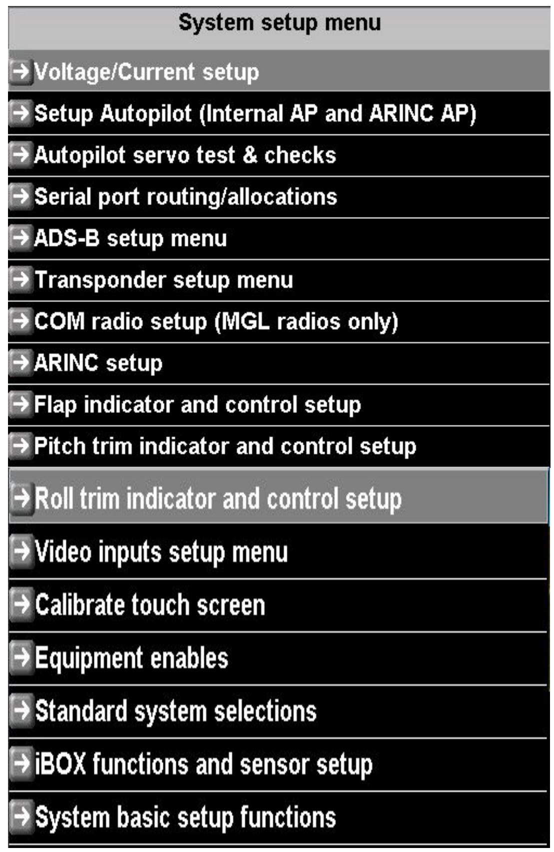
The “system setup” menu

Menu -> System setup

This is the central place in your iEFIS system where you control how the system operates. This is the largest menu in the system.

Note: All setup functions are available in the “active” panel. All “inactive” panels may have certain functions suppressed as they are not permitted to be executed in such a panel.





Broadcast/Accept functions and setup

Here you select if a panel may accept certain data from other panels. You can select to allow setups to be accepted and what type of setups may be accepted.
You can also choose if a panel may accept navigation from other panels. Depending on your requirements you may want to keep a panels navigation private to that panel. This will allow you to setup a system where you can have two (or more) independent active navigation solutions active at the same time.

This menu also contains a function allowing you “broadcast” your current setup. This provides a quick way to send setups from your current panel to other panels. Example: Assume you have just changed the EGT temperature limits. You could now go and perform the same changes on the other panels or you could simply broadcast your changes. Ensure that the other panels have been setup to allow acceptance of such broadcasts.

Time/Date/Hobbs setup

Here you set your current system time, hobbs, tach, maintenance timer and airframe timer values.

Note: all of these items are maintained in the iBOX so any changes are immediately available to other connected panels.

If you have a dual iBOX system, ensure that both iBOX units are connected or else only one iBOX will receive the updated values.

Note: You can use the iBOX status control to switch iBOX units at any time should you need to confirm settings.

As a general rule, the standby iBOX will obtain all of these values from the main IBOX on system startup if this is possible. For this reason both IBOX units must have at least one functional CAN bus interface connected between them.

System units setup

Here you select the various units of measurement used in the system, for example liters/gallons, mph/knots etc.

Note: By screen design some readouts may be fixed to a certain unit of measurement. This does not apply to any of the built in screens, only custom designed screens.

System operation setup

Here you will find several fundamental setups like aircraft registration, automatic flight detect settings etc. Please view and select all items in this menu as per your requirements:

Note: Aircraft registration entered here will be broadcast on “ADSB out” and mode-s transponders.

Engine monitoring setup

This large setup item has a chapter of its own and is not described here.

Flight Instruments setup

Here you select basic flight instruments functionality such as V speeds for your airspeed indicator, G-force meter ranges, VSI related functions etc.

Analog/Digital inputs setup

Here you can setup names for your iBOX analog and digital inputs. You can also setup scaling for your inputs so input readings can be translated to meaningful readouts. You can

also program alarm limits or states.
On-screen indications for these inputs require custom screen designs. Inputs can be "connected" to bargraph and other analog displays or status displays for digital inputs.

Note: some inputs may be used for flap/trim position indicators – in those cases this is setup in the relevant menus later in this section. The built in screens have displays for these that you can enable.

AGL and Flap warning setup

This section allows you to configure a flap position indicator or select and configure a flap controller (either VPX or MGL). You can also select a AGL warning limit that will result in a voice alert "Ground proximity" if you have your iBOX audio output connected to your intercom system.

Enable AOA calibration functions

Selecting this menu enables the AOA calibration flight items in the menu. These items depend a little of the type of AOA system selected (Flight instruments setup).

Typically you calibrate lowest AOA (close to maximum speed straight and level flight), flaps retracted stall and full flap stall. The latter two are referred to as "yellow" and "red" stall limits as shown in the AOA indicator.

Note: The AOA indicator is a standard part of the built-in screen design. It is suppressed until enabled.

Setup horizon sensor

Here you will find basic calibration functions for your AHRS. You can set bank/pitch angles to zero and also slip to zero. This can be used to cancel out minor installation inaccuracy.
Please note: This should only be used to cancel out minor errors. If you detect larger angle errors – please confirm that your AHRS sensor is correctly aligned with the airframe.

Setup Compass sensor

This section contains compass calibration functions. This is described in a separate document common to all MGL EFIS systems.

Rotor craft instruments setup

This section contains mainly setup for the combined rotor craft engine and rotor RPM instrument available with custom screen designs. Even if that is not used, basic rotor RPM setups are found in this section.

Setup Navigation

Here you will find many setups directly related to navigation.

If you have multiple navigation databases installed, you can select the currently active database here. Also view the separate document “MGL Avionics map and database installation”.

Setup GPS and NMEA port operation

Select GPS source used for position, heading and track if you have multiple sources. The standard source is the iBOX (it has a built in GPS).
You can also select several optional NMEA sentences to be sent over the NMEA port. The NMEA port is RS232 port 6 on the iBOX.

Setup HSI/GSI Indicators

Select which navigation sources you have connected in your system. Only navigation sources you have enabled here can be selected using the HSI/GSI setup menus and functions.

GLS/GVOR setup

Here you setup details on how you would like the simulated ILS/Glideslope and simulated VOR to work.

ILS/Glideslope is available as “GLS”. This uses the GPS in combination with runway geographical data to emulate ILS and glide slope. Runway data is contained in your active navidata file.

Please select the desired glide slope and runway intercept distance from the threshold. Typical values may be 3 degrees and 300 feet for smaller aircraft.

VOR is simulated using the known geographic locations of VOR beacons in your navidata database. DME is also simulated based on this data.

For VOR you can select a fixed maximum range of the simulated VOR beacon.

Terrain warning setup

Please select how you would like the GPS based terrain warning system to work. Terrain warning requires that you install terrain data.

Traffic monitoring setup

Select details on the traffic monitoring system. For example, set up horizontal and vertical distances before a traffic warning is activated.

Checklist functions

Here you can create and edit checklists. These are then available as you select the “check” softkey. Checklists are text files you can also create using a suitable text editor (for example note pad). Checklists may contain up to 32 lines (check items). Please use short descriptors for every check item and verify that the lines will fit into the space provided.

Tip: For sophisticated checklists consider creating a custom screen. Create checklists as images and convert these as MIF files using the available MGL Avionics MIF converter. You can then insert these checklist images as background to “info” pages (up to 10 pageable info pages per screen). The checklists you create this way can then be mixed with any of the available screen items.

Voltage/Current setup

Voltage monitoring and current measurement calibration functions.

Currents are calibrated by setting the “zero” point – this is the value measured at the current monitoring port when no current is flowing through the current monitoring device. In addition a “gain” value is entered so correct current is shown for the voltage deviation caused by the current at the current measurement port.

Setup Autopilot

Please refer to the autopilot document for details on the autopilot setup.

Differences to the document:

iEFIS supports only MGL Avionics servos on CAN bus. For this reason selection of other servo types is not available.

Autopilot servo tests and checks

This functions is used to engage and position servos for purposes of installation and maintenance. It is not available if the aircraft is in “flight mode” or airspeed is not zero.

Serial port routing and allocations

Select what you have connected to the various serial RS232 ports available.

Note: Port 1 and Port 2 are high speed ports favored for devices like the VPX ECB and Navworx ADSB system. If these systems are not used, these ports may be used for any other device.

Port 6 is reserved and used as NMEA port so it is not available for general use.

After you have selected ports, please restart the system so changes are applied system wide.

ADSB setup menu

Select which kind of ADSB system you have connected. You can use passive (receiver only) as well as transceivers (ADSB-OUT). In case of ADSB out, you need to enter various kinds of fixed information that will be transmitted by your ADSB system.

Please do not activate your ADSB transceiver until you have entered all of the data correctly. Failing to do so will result in your unit transmitting incorrect data. ATC is not going to like that !

Recommendation: Consider activating the ADSB/Transponder slave function if you are also using a remote controlled transponder (mode-c or mode-s). If slaved, you can enter squawk codes and activate ident on any device and the other will be synchronized automatically.

Transponder setup menu

Select the type of transponder connected to your system. For a mode-s transponder you need to enter your ICAO code (entry is in Octal) and various other types of information like your aircraft type and speed range.

Please do not activate your transponder until you have entered all of the data correctly. Failing to do so will result in your transponder transmitting incorrect data. ATC is not going to like that !

COM radio setup

This applies for MGL radios only. Select if you want to use 25Khz or 8.33Khz frequency spacing. Please note that you also need to set the desired spacing in your radios setup so both match. If 8.33Khz spacing is selected, frequencies on the EFIS follow common guidelines. Frequencies shown do not necessarily coincide with actual frequencies:

Example here for the 120 Mhz block:

120.000 is 120.000 Mhz with 25Khz bandwidth requirements

120.005 is 120.000 Mhz with 8.33Khz bandwidth requirements

120.010 is 120.00833 Mhz

120.015 is 120.01666 Mhz

120.025 is 120.025 Mhz with 25Khz bandwidth requirements

120.030 is 120.025 Mhz with 8.33Khz bandwidth requirements

120.035 is 120.0333 Mhz

120.040 is 120.0416 Mhz

120.050 is 120.050 Mhz with 25Khz bandwidth requirements

120.055 is 120.050 Mhz with 8.33Khz bandwidth requirements

120.060 is 120.0583 Mhz

120.065 is 120.0666 Mhz

120.075 is 120.075 Mhz with 25Khz bandwidth requirements

120.080 is 120.075 Mhz with 8.33Khz bandwidth requirements

120.085 is 120.0833 Mhz

120.090 is 120.09166 Mhz

The column to the left is what you would enter on the radio/EFIS and what you would see displayed. This is also the frequency you will find published in the AICs.

The column to the right shows the actual frequencies used. Note that this is compatible with the 25Khz spacing as the radio knows what bandwidth requirements to apply.

ARINC setup

Select how your ARINC system is used.

ARINC TX label setup

Select which labels to enable for your ARINC transmitter.

Flap, pitch and roll trim indicator and control setup

Here you select the type of indicator (including indicator control). For MGL control systems you also set the positions here based on measurement feedback of the controller. For VPX systems, flap positions are programmed using a separate utility available from Vertical Power.

Enabling the indicator/controller also enables the corresponding indicator display on the standard EFIS screens.

Video inputs setup menu

You may connect up to 4 composite video inputs.

Each input may be selected to be a PAL or NTSC video source. You can give each input a short name. This name will be used in the video source selection.

Note: Video input 1 is used as background image source for the AHRS. This is used mainly for FLIR cameras (Forward looking infrared cameras).

You may also elect to connect a different type of camera as video source 1 but ensure that it is forward looking so it can be used as AHRS background.

Sources 2,3 and 4 may be used any way you like. Suggestions: Taxi camera, tail camera, survey camera (downwards facing) or rear view camera.

The standard EFIS screens include video support for screens 1 and 3. Video selection icon is only shown if at least one video source is enabled.

Calibrate Touch Screen

This function allows you to select the desired touch screen activation force and it allows you to calibrate the touch screen according to your preferences.

Note: The touch screen calibration is also available at system start up if you hold the top right rotary control down (push towards the panel). This may be used if for some reason the touch screen calibration has been lost. One way this may happen if the setup.dat file has been erased or replaced with a version from another system by a file copy rather than using the provided import function (which prevents private settings from being altered).

Equipment Enables

This function allows you to enable individual items of the radio panel. These items will still be shown if not enabled but you cannot operate them. In addition, items that are not enabled will be marked with a grey cross to show that they are not available.

Items that are enabled here but are not connected or communicating with the system will be shown with a red cross.

Standard System selections

This is one of the most important selections for a first installation. Here you select from the provided, pre-made screen layouts that are included with any standard system.

You select the screen layout type (horizontal, vertical and “no engine”), you can choose from several equipment levels, you choose the engine monitoring needed, fuel monitoring needed and you can select info screen types.

All engine monitoring in the standard screens assume a single RDAC (single engine). Popular engine types are supported.

Should no suitable built in screen selection be available, you can create a custom design using the MGL Avionics Screen designer and simulator application. You can base your design on existing screens or you can start from scratch, providing every detail of your own screen design.

Please refer to the iEFIS alteration guide for instructions on making your own screens.

Note: Engine or fuel selections do not alter any of the engine and fuel setups such as number of cylinders, temperature and pressure limits etc.

You need to set these in the engine and fuel setup menus according to your needs. Consult the engine manufacturers information on temperature and other limits and ensure that you select the correct probe types.

IBOX functions and sensor setup

This menu gives you an interface to the iBOX sensors. Here you can adjust calibration of pressure sensors and you can also replace iBOX firmware if a new version needs to be installed.

System Basic setup functions

Basic system functions such as internal disk format, import and export of the setup.dat file. The setup.dat file located on the internal disk contains all of the panels setups from the various menus.

Using the functions available here it becomes possible to easily transfer settings between systems.

Please use the “Load setup from SD card” function to import the setup.dat file This will ensure that private settings such as the panels touch screen calibration will not be altered.

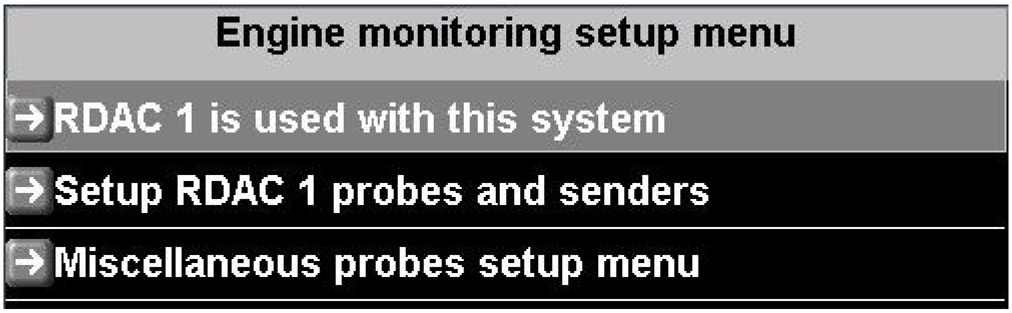
<u>Do not use the file manager to replace the internal setup.dat file.</u>

Tip: You can broadcast your setup when you are done to other panels via the LAN. This takes only an instant and does not alter any panels private settings.

You can setup on each panel if and what type of setups to accept from other panels.

Engine monitoring setup

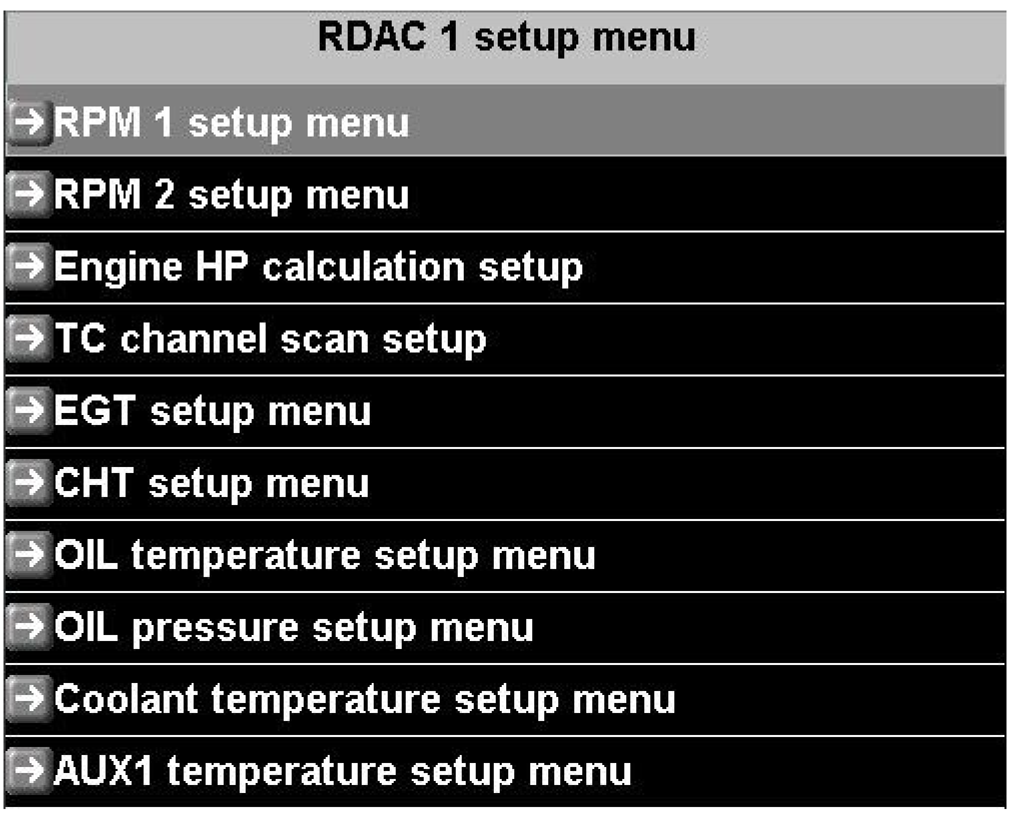
The engine monitoring setup is available from the Setup menu. It is recommended that you perform

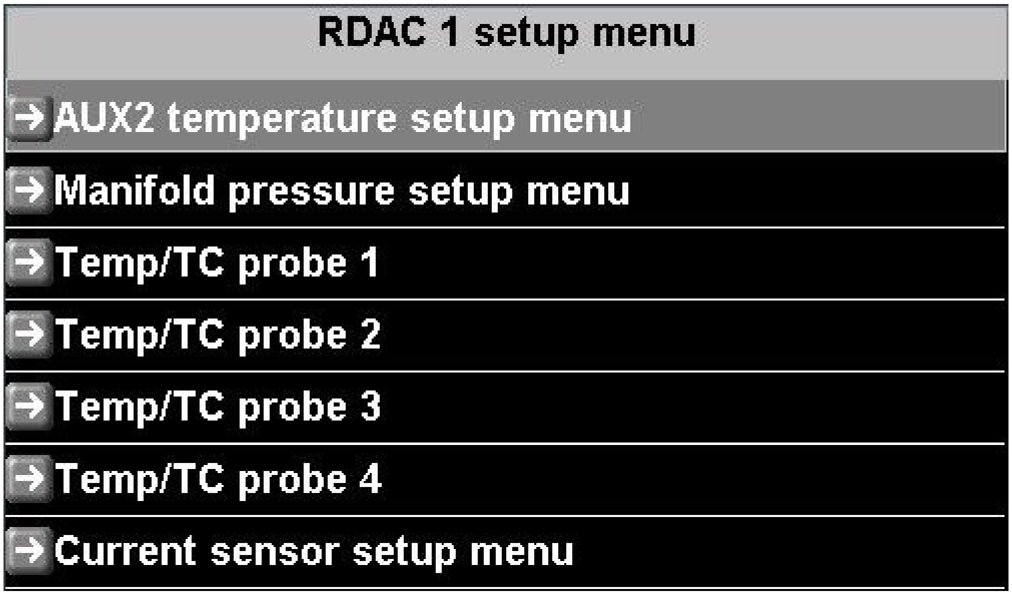


Select how many RDAC units (up to 4) are connected to this system. Typically you would have one RDAC per engine but you can also use more than one RDAC for a single engine. Use of the various probes and senders would be determined by your screen design.

The standard, built in screens assume a single engine and one RDAC as shown above.

The miscellaneous probes and senders setup menu provides access to sender calibration for PT100 probes and also allows you to define a custom NTC temperature probe.





RPM 1 and RPM 2 setup menu

The RDAC has two RPM inputs. You would typically use only one of them. If you are monitoring RPM via p-lead connection, the RPM will drop out when the magneto is shorted during the mag test. In this case you should connect both RPM 1 and RPM 2 to either magneto system so that one of the inputs always has an RPM signal.

The iEFIS will display a single RPM taking as the highest RPM value from any of the two inputs.

Setup the number of pulses per revolution and specifics for your analog displays and alarm/caution levels.

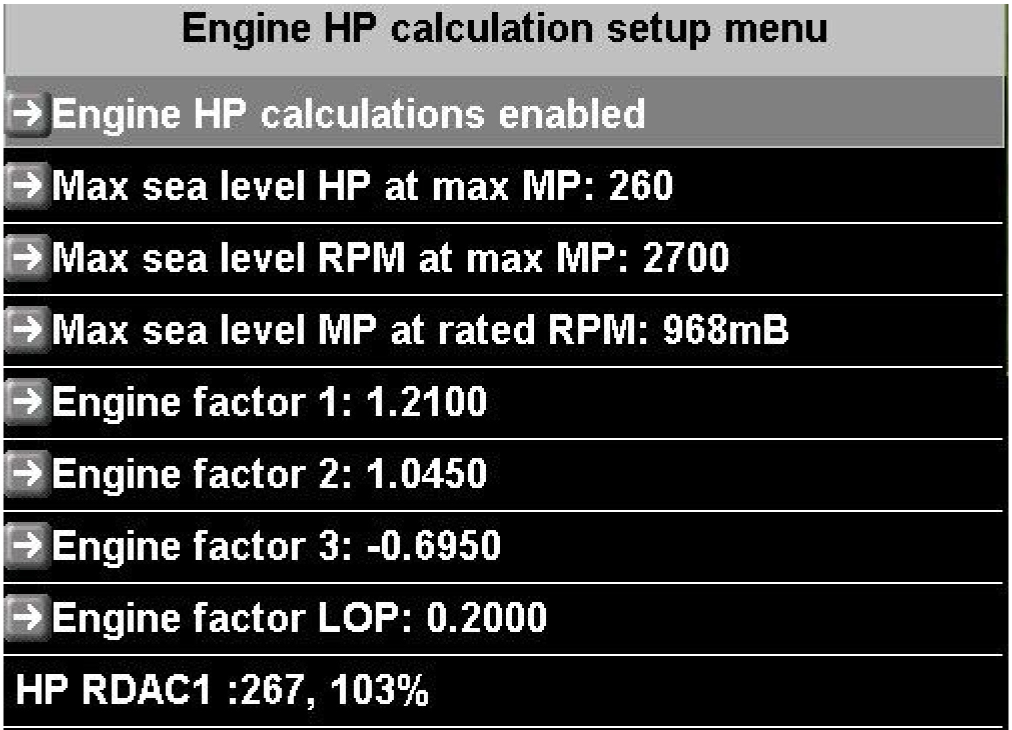
You can also enable the RPM over speed alarm.

Tip: You can observe the RPM reported by the RDAC for both channels in the RDAC diagnostics (Diagnostics menu at the end of the main menu).

Engine HP calculation setup

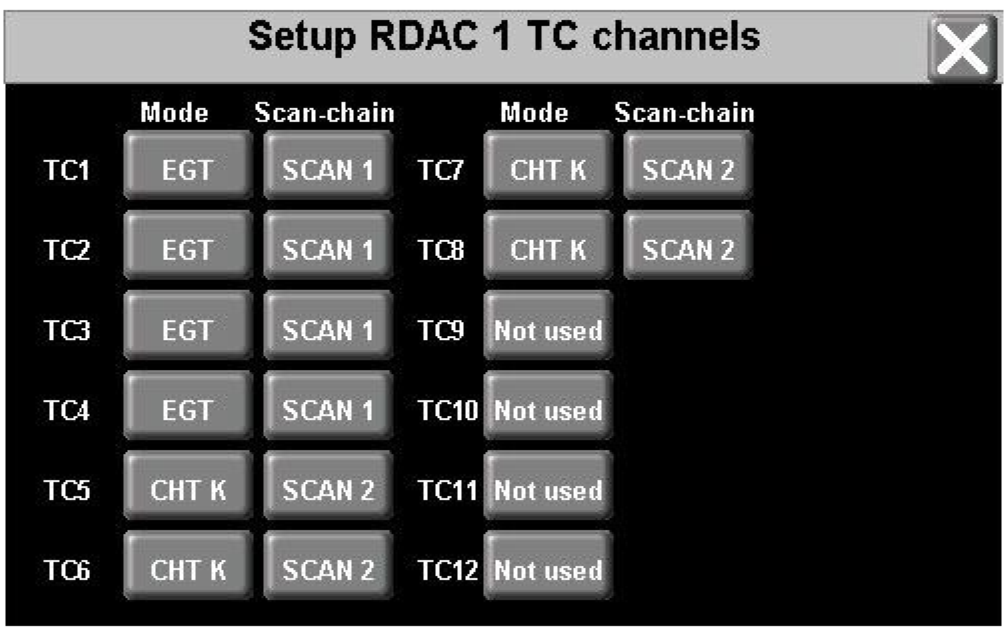
Please consult the documentation available at www.MGLAvionics.co.za – EFIS documents.

You can configure HP calculations accurately based on ambient temperature, density altitude, manifold pressure etc. Engine power can be displayed in % of 100 and actual HP. Display of these values requires a custom screen design for your engine.



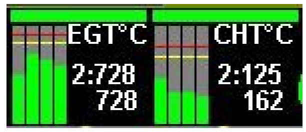
Typical engine HP calculation screen. Please consult documentation for suitable values for your aircraft. The above values are typical for a Lycoming O320.

TC Channel scan setup



This setup is relevant for your EGT and CHT functionality. The RDAC has 12 thermocouple inputs. Here you select which channels are used for EGT, which channels are for EGT and you can also assign up to 4 unrelated TC channels for general purpose temperature monitoring functions.

EGT and CHT channels are “multi-channel” - the setting in this example will result in a screen display like:



EGT and CHT channels are assigned to “scan chains”. The EFIS will scan the channels in the order specified to determine if any channels are in an alarm condition and will also determine the current highest temperature of the scan chain.

EGT has 4 independent scan chains.

CHT has 4 independent scan chains.

Any scan chain can span more than one RDAC (but this is seldom used).

If you have two or more engines, you would assign independent scan chains for every engines EGT and CHT. For example you may use scan chain 1 for EGT and CHT for engine one and scan chain 2 for EGT and CHT for engine two.

You also select CHT probe types in this setup. You can select J type or K type probes for any CHT probe and you may mix the types if required.

To summarize:

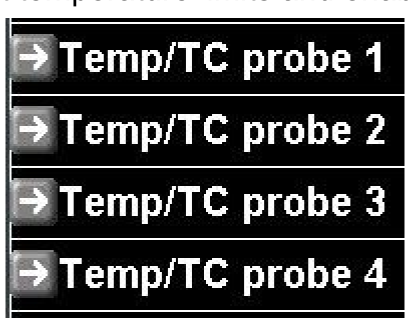
The scan chain tells the EFIS which probes are connected to which input on the RDAC and how to group the probes into one or more EGT or CHT displays.

Using universal TC channels:

You can assign up to 4 independent thermocouple channels for general temperature monitoring. Here we assigned TC11 and TC12 on the RDAC for channels 1 and 2.

Probe types for universal TC use are assumed to be K types.

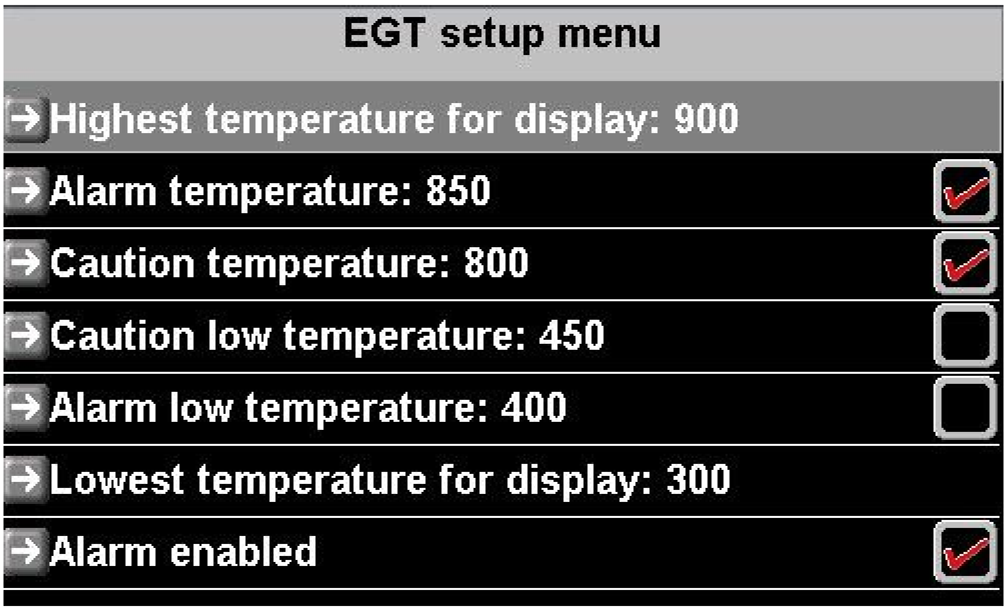
Each probe has a separate setup menu. Here you can assign a name to the probe, for example “Gearbox”, set temperature limits and enable alarms.



In order to display temperature values on the screen you need to create a custom screen design and place indicators and readouts as required for your application.

Note for Rotax 912/914 applications:

Should you use the two built in CHT probes, these are wired to AUX 1 and AUX 2. They are not thermocouples but NTC resistors. Please set up these probes in the AUX 1 and AUX 2 setup menus.



EGT setup menu

Setup temperature ranges for display and alarm enables as needed.

Caution level is the threshold from green to yellow. Alarm level is the threshold from yellow to red.

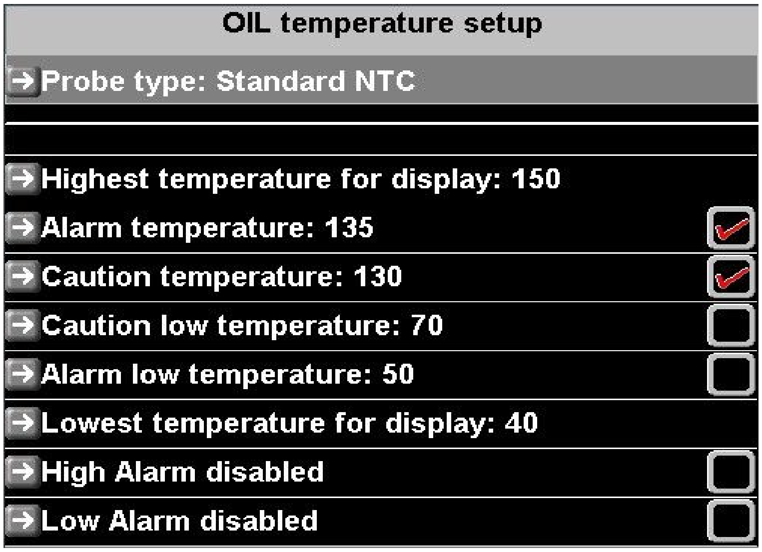
If the box next to the level is checked, alarm or caution function is enabled for that level threshold. If the box is not checked then the level is ignored and the corresponding color is not drawn.

Please note that there is no low level alarm for the EGT but you can enable a red or yellow area to be displayed on the screen for low temperatures if desired.

CHT setup menu

Please refer to the EGT setup menu. Functions are identical.

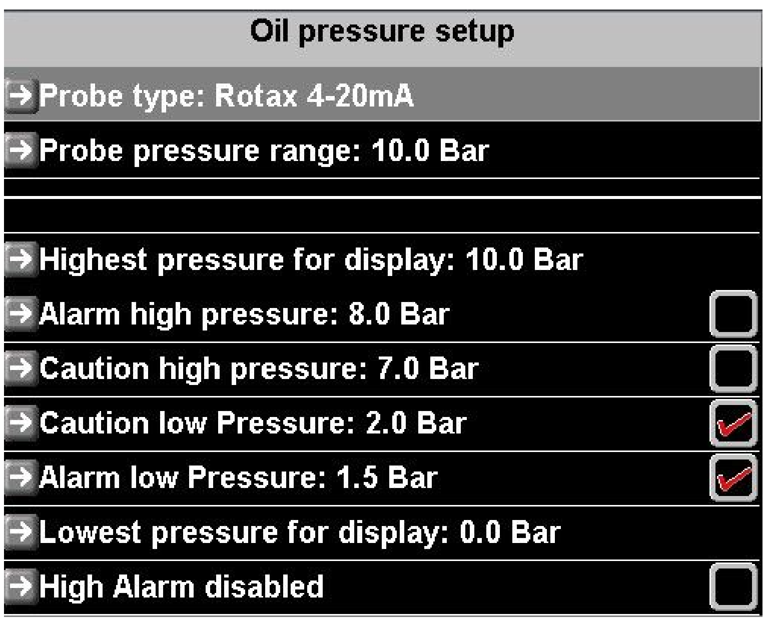
Oil temperature setup menu



Please refer to the EGT setup menu for description on level setup.

Select the desired probe type used for monitoring the oil temperature. Standard NTC is the most common type – this is a standard VDO sender.

Oil pressure setup menu



Similar to the oil temperature setup menu, please select the relevant oil pressure probe type and set the pressure range of the probe.

Level setups are similar to other probe setups.

Coolant temperature setup menu

Please refer to Oil temperature setup menu. This is very similar.

AUX1 temperature setup menu

Please refer to Oil temperature setup menu. This is very similar.

The AUX1 temperature channel is typically used as CHT 1 on a Rotax 912/914 installation which uses NTC probes to measure cylinder head temperatures.

For a Rotax engine you would select the “Standard NTC” probe (Standard VDO). Please refer to the Rotax manuals for operational temperature limits.

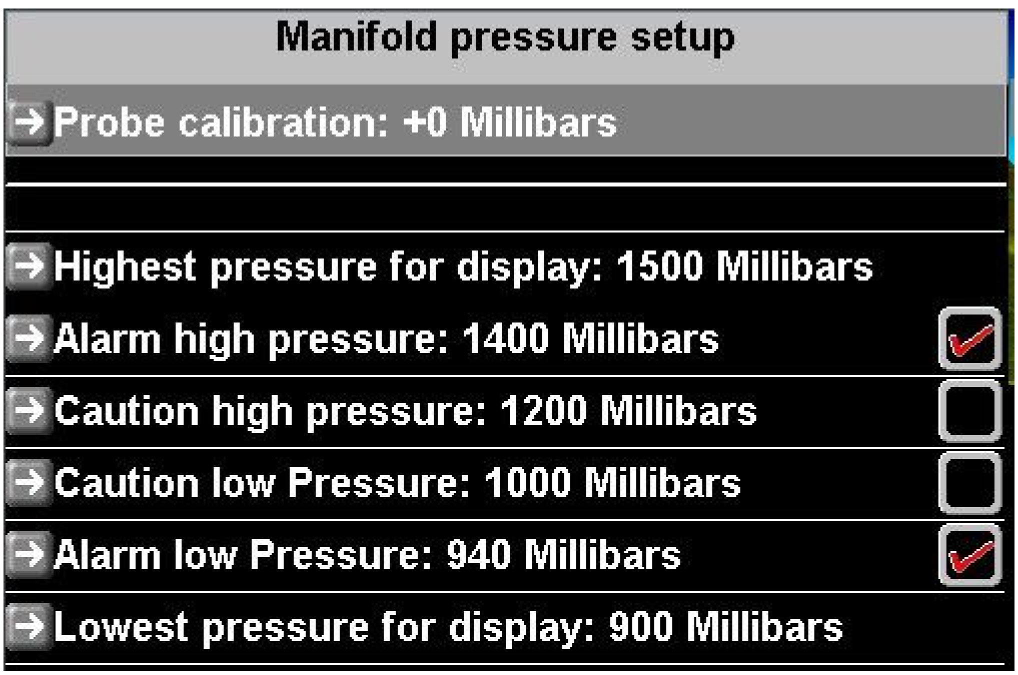
AUX2 temperature setup menu

Please refer to Oil temperature setup menu. This is very similar.

The AUX2 temperature channel is typically used as CHT 2 on a Rotax 912/914 installation which uses NTC probes to measure cylinder head temperatures.

For a Rotax engine you would select the “Standard NTC” probe (Standard VDO). Please refer to the Rotax manuals for operational temperature limits.

Manifold pressure setup menu



Manifold pressure is measured by the built in pressure transducer of the RDAC XF MAP engine monitoring module.

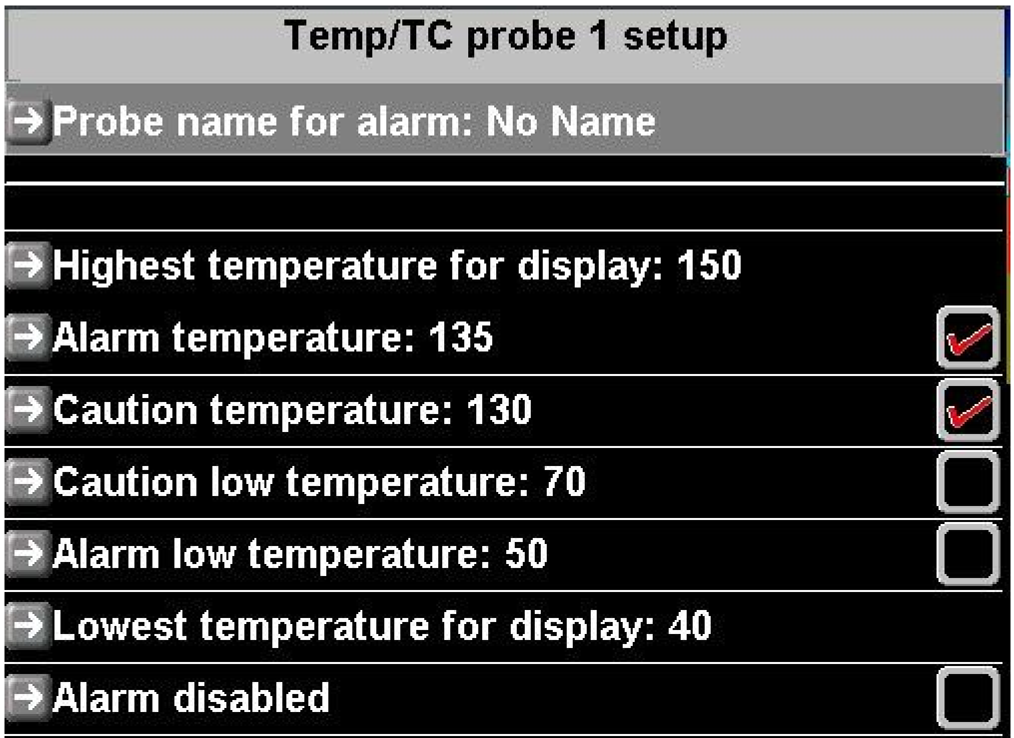
This can measure absolute pressures in the range 0.2 to 2.5 Bar. The probe can be calibrated against ambient pressure. You can obtain the current ambient temperature from the “Active IBOX Sensor Diagnostics” screen. Diagnostics is available at the end of the main manu (press the menu softkey).

Set the probe calibration to equal the ambient pressure shown in the diagnostics when the engine is not running.

Tip: The manifold pressure system can also be used to measure other pressures. In this case you may want a custom screen design so indication shows the medium measured.

The probe can be used for any non-aggressive medium. Fuel vapor is not a problem but do not expose to liquid fuel containing alcohol as this may damage the sensor flourosilicon encapsulation in the long term.

Temp/TC 1,2,3,4 setup

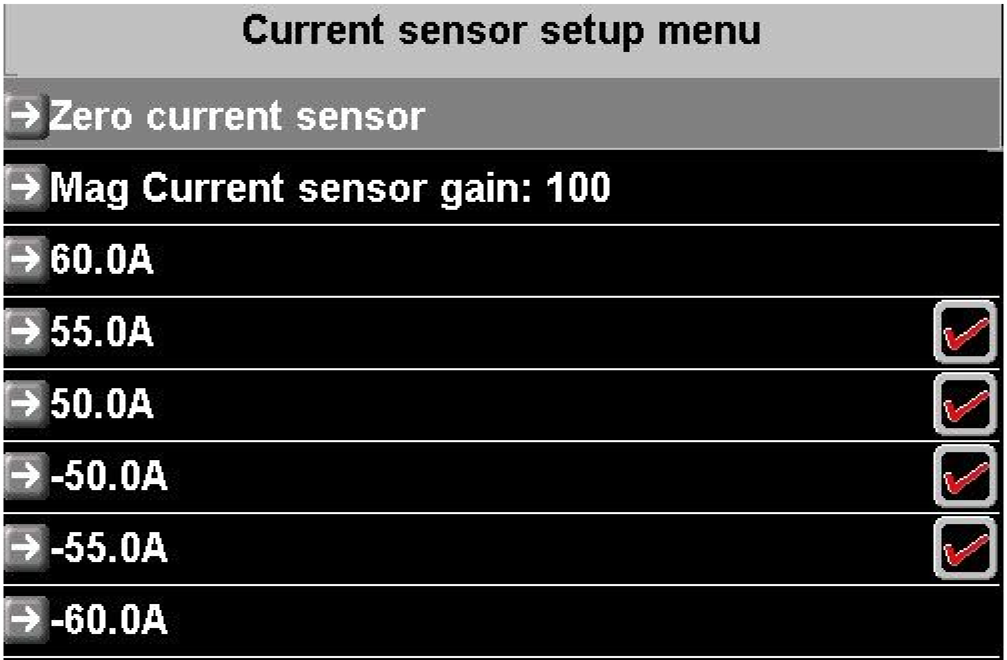


You can utilize up to 4 RDAC TC channels for every RDAC connected as general purpose temperature monitoring channels.

K-Type probes are assumed. Give the probe a suitable name, for example “Gearbox” and set temperature limits and alarm enable to your needs.

If you require indication on the screen such as readouts and graphic displays, you need to create a custom screen. Refer to the “iEFIS alteration guide”.

Current sensor setup menu



You can connect a current sensor to the RDAC XF current monitoring input.

This input expects a system that will settle at approximately 2.5V if no current is detected. Any current flowing will increase or decrease this voltage depending on the direction of the current (for example battery charge/discharge).

As current sensors have a small amount of tolerance we need to calibrate the zero current point.

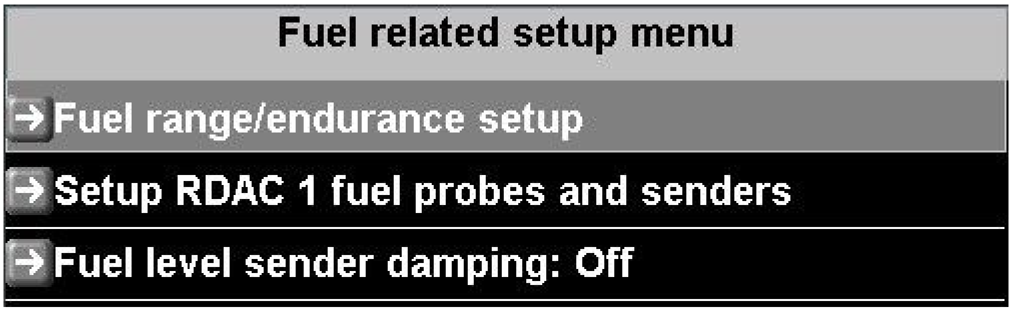
Ensure that the sensor system is powered but no current is flowing through the sensor (or past the sensor if a magnetic system is used). Then apply the “zero current sensor” function.

Apply the correct gain figure so that the current readout is correct. If the gain number for your sensor is not known, you can connect a amp-meter in series with your current sensor and then find the correct gain by comparing the reading of your amp meter with that of the EFIS. If the two readouts agree you have the correct gain setting.

Finally adjust the range numbers so the graphical current readouts are scaled according to the expected current range.

Note: These setups are stored in the EFIS setup.dat file. Once your calibration is completed, please broadcast your settings to other panels if you have more than one panel connected.

Fuel related setup



Fuel range/endurance setup

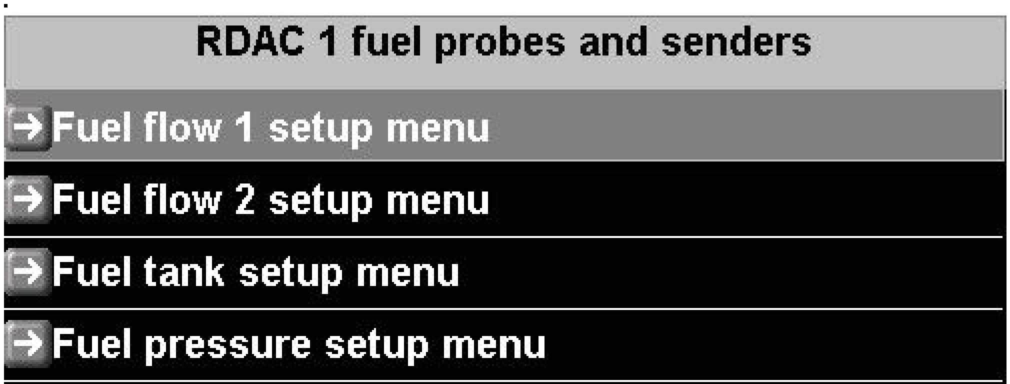
Here you select which of your fuel quantity measurement sources contribute to the aircraft's range. For example, you may have a physical tank but also a virtual tank. The virtual tank is based on fuel flow and a entered starting value. Is the virtual tank a separate tank or is it a backup indication of the physical tank ?

Fuel level sender damping

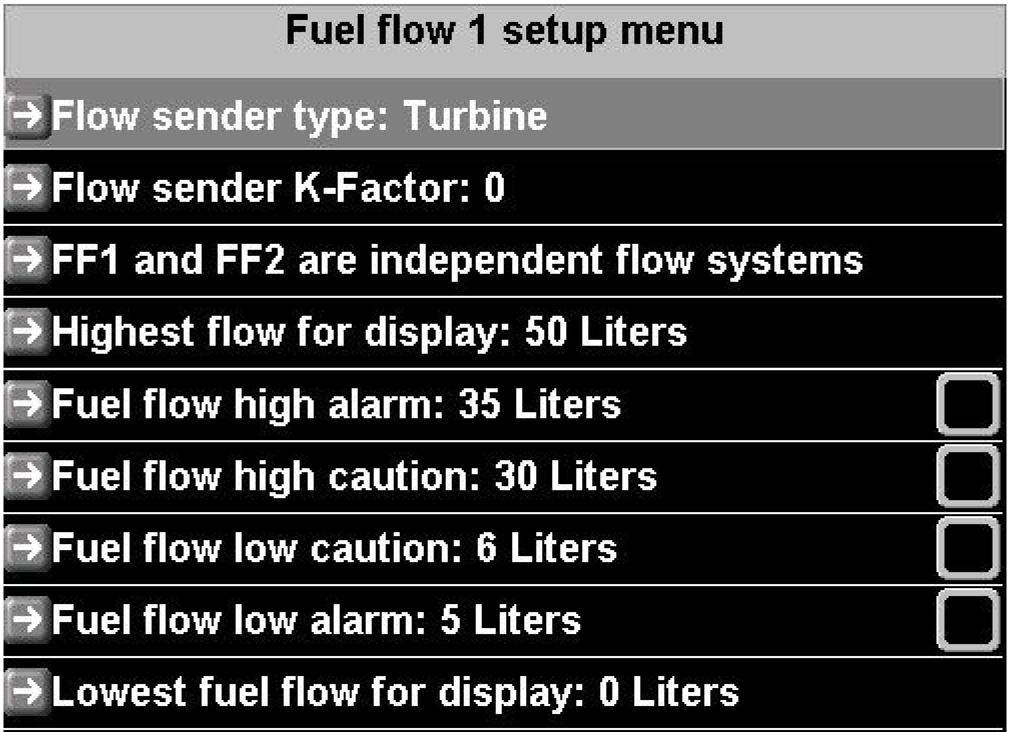
This system wide setting affects how rapidly your physical fuel level sender readings will react to changes. You may need to select a longer damping period if your fuel levels are affected by aircraft dynamics such as turbulence. Damping causes averaging of the level over time. A high setting equates to a damping time of around one minute while a low setting is a few seconds.

Setup RDAC 1,2,3,4 fuel probes and senders

The RDAC XF has two fuel flow sender inputs. You can use them as two separate fuel flows (and associated virtual tanks) or as a single, differential flow system where (Total flow = Flow 1 – Flow 2).



Fuel flow 1,2 setup menu



Select the type of flow sender. Turbine refers to a typical flow sender that has a built in impeller that rotates with flow.

You can also connect either high or low side firing electric fuel injectors.

The K-factor refers to the number of pulses for 1 liter of flow. Typical values for most senders range from 5000 to 15000. Please check with the supplier of your flow sender or refer to the flow sender documentation to find the correct K-factor.

You may find that you need to adjust the K-factor for your system. Measuring fuel flow accurately can sometimes be a challenge as flow is not even. Fuel pumps, air leaks or fuel evaporation can cause significant errors in readings. Should your final K-factor not agree with that of the manufacturers within an acceptable tolerance, you should locate and fix the cause. Do not simply adjust the K-factor until it seems right. It will most likely not be very constant or repeatable.

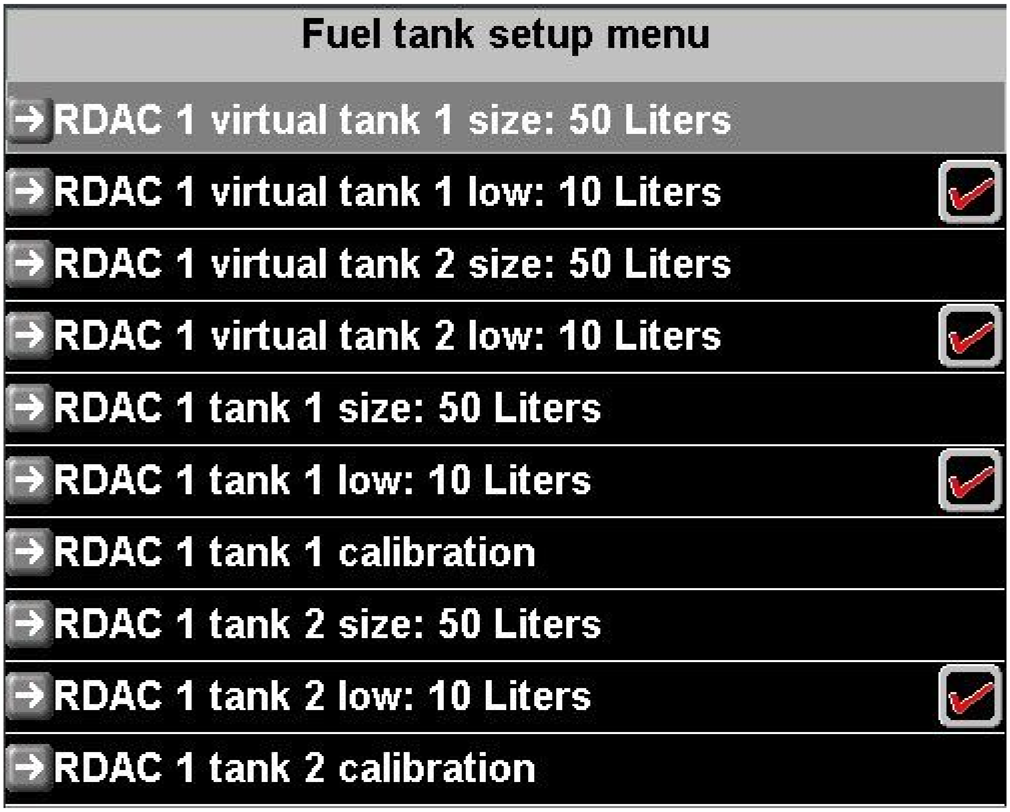
If you are using an electric fuel injection system, fuel flow can be derived by integration of injector opening times. In this case the K-factor acts as a multiplier. Ajust the K-factor until the reading is correct. If you find the reading increases when it should decrease with engine power variation, you have the wrong type of injector system selected (high side vs low side). Most injector systems are low side fired (signal is grounded to open the injector).

Flow 1 menu allows you to select dual or differential flow sender use.

Use the RDAC diagnostics to verify correct operation of your differential flow system.

Note: All flow measurement related items are stored in the iBOX. All items related to levels and display are stored in the panel. Broadcast any changes here to other panels.

Fuel tank setup menu



This menu provides the functions needed to set up your physical and virtual fuel tanks.

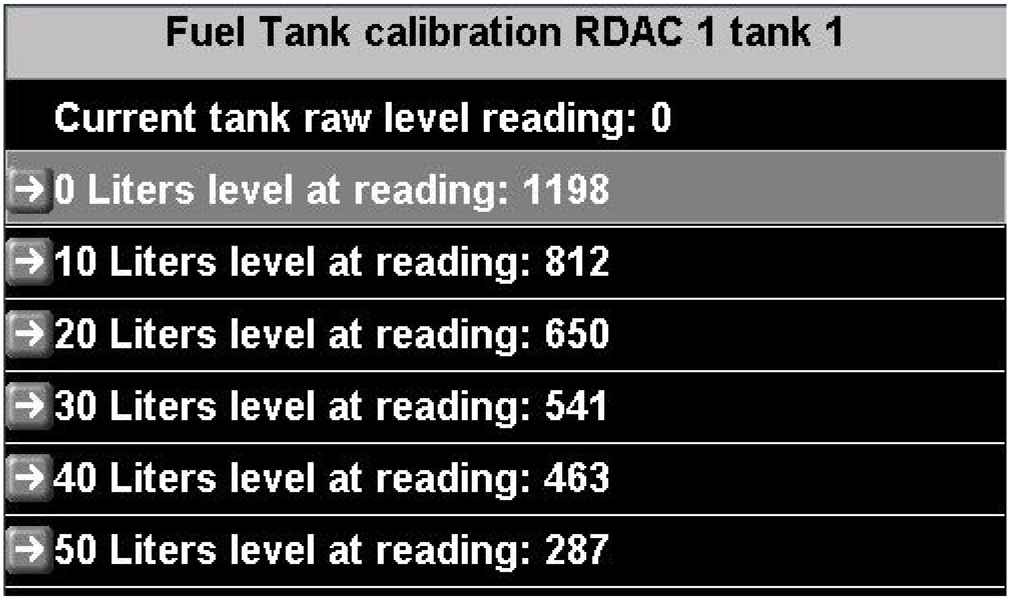
Here you set your virtual tank sizes and alarm levels and enables.

You set your physical tank sizes and alarm levels and enables.

You gain access to the physical tank multi-point calibration tables.

Note: Each RDAC provides two physical tank level measurement inputs.

Physical tank multi point calibration



A tank calibration consists of a six point calibration table. Perform the calibration **AFTER** you have set the correct tank size.

Fill the tank starting from empty or reserve level and take note of the raw tank level reading shown in the top line. This reading is the actual raw ADC reading from your RDAC.

Make a note of every tank reading at the various calibration points as you fill your tank with a measuring device (for example a calibrated container).

After this has been completed, enter the raw measurement values into their correct slots.

Note: The numbers must increase or decrease from full to empty tank. The numbers may not do both !!!

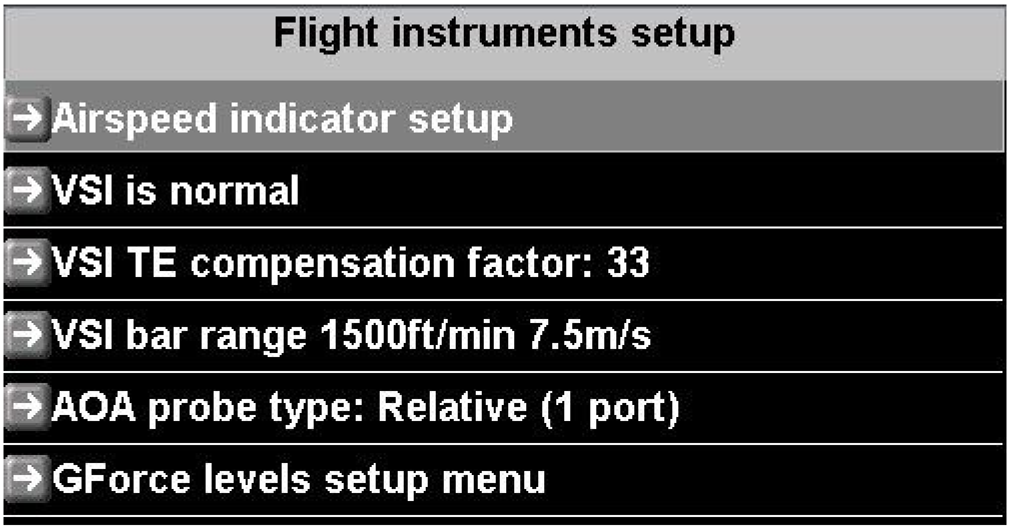
Ensure that the raw reading is consistent with fuel level. If the number is not consistent or does not readily change with fuel level you may have a level sender issue such as a bad electrical contact or a sticky sender.

Tank 1 and tank 2 calibration procedure is identical.

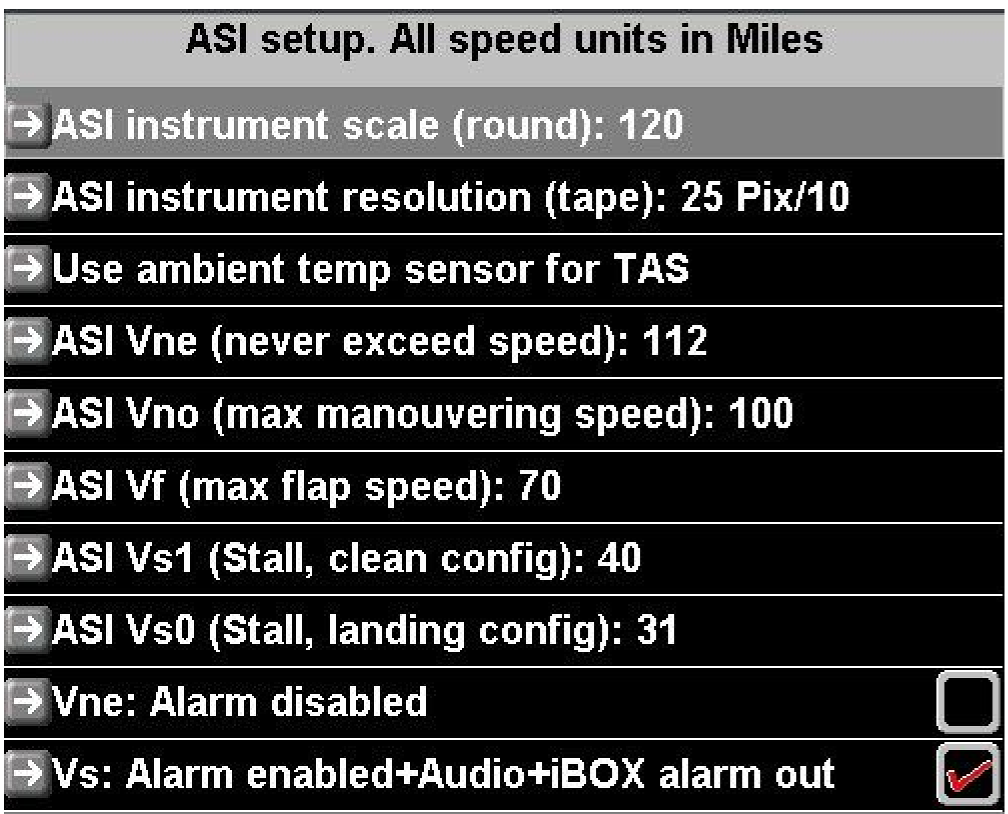
Note: Tank calibrations are stored in the iBOX. Tank sizes are stored in the EFIS. Broad cast any tank size changes to other panels if required.

Flight instruments setup

Here you setup details of ASI, VSI, AOA and GForce indicators



Airspeed indicator setup



Enter speed range for the round analog airspeed indicator (can be used in custom screen designes). ASI resolution for your airspeed indicator tape – set this according to the speed range of your aircraft. The default setting of 10 km/h/mph/knots per 25 vertical pixels is usually sufficient for most applications.

If you have the ambient temperature sensor (OAT) connected to your iBOX and accuractely calibrated, you should select “Use ambient temp sensor for TAS”. This tends to provide a more accurate result for TAS calculations compared to use of the “standard atmospheric model” which does not use the ambient temperature sender but assumes standard temperatures and lapse rates.

Enter your aircraft's various V speeds. These will be used to fill in the colored sections of your airspeed indicator.

Vne and Vs also set your alarm levels.

Enable Vne and Vs alarms as required.

VSI type and compensation factor

The VSI can be set to “TE compensated”. This refers to a “total energy” compensated VSI. This is used mostly in gliders to cancel out “stick” induced VSI readings. Gliders tend to use a second, carefully aligned pitot tube to compensate the VSI on changes of the aircraft AOA.

The method here attempts to use changes in measured airspeed to do the same. For this a “compensation factor” is entered.

Calibration is done in flight.

The correct compensation factor is speed dependent and depends on the dynamics of the aircraft (mass and aerodynamic properties).

Fly the typical thermaling speed or cruising speed and move the stick forwards and aft slightly. Observe the VSI. The uncompensated VSI should show increase in vertical speed. If the compensation factor is correct the VSI will remain close to zero during these maneuvers. The idea is to show only “real” vertical speed changes caused by thermals . Short term changes are filtered out based on changes to airspeed.

AOA probe type

The system can measure angle of attack in three different ways. Two of these are “real” measurements using AOA pressure based measurements, a third way is presented that uses a “calculated” approach based on airspeed, vertical speed and AHRS measurements.

Relative (1 port)

This method uses a second pitot port at a downwards angle from the normal pitot port. While angle of attack increases, pressure at this port also increases as it becomes more aligned with airflow. Typical angles are around 20 degrees downwards compared to the actual pitot tube. Pressure is measured relative to static pressure. Normal pitot tube must be installed and operational as impact pressure of the pitot tube is also used in the measurements.

Differential (2 port)

This method uses two ports, a positive and a negative pressure port. Pressures are normally measured at the wing leading edge, a small hole above and a small hole below the cord line. The best positions should be obtained from the aircraft manufacturer. Do not place these holes too close to the leading edge.

Low pressure is measured above the cord line, high pressure below the cord line.

This system still uses static pressure as reference.

Virtual (AHRS, TAS, VSI, GPS)

This method uses AHRS, vertical speed and airspeed to derive a calculated AOA. This AOA is only valid during relatively level flight such as during an approach.

The calculated AOA should never be used as “real” AOA and must not be used as pilot aid during landings or maneuvers. It is included here for experimental use only.

Please install a proper pressure based system if you intend serious use of the AOA indication.

AOA not used in system

Select this if no AOA system is installed. This will suppress the AOA display in the standard screens.

Calibrating the AOA system

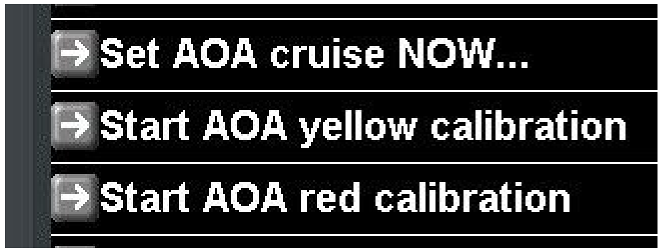
Regardless of AOA system, you need to perform a calibration flight. You calibrate three points:

1) The lowest possible angle of attack – this would be maximum speed, straight and level flight.
2) Stall point, clean. Flaps retracted. Fly to just before the stall break.
3) Stall point, landing configuration. Fly to just before the stall break.

The differential system requires that points 2 and 3 are performed, all others require all points.

In order to calibrate the AOA, place the system in AOA calibration mode. Select:

Once this has been performed, the AOA calibration functions are available in the menu:



Set AOA cruise NOW...

This menu item will only show if you have a single port AOA sensor selected (relative sensor mode, setup in “Instruments setup”).

The single port sensor measures a pressure relative to static pressure and needs to have a “zero” reference. This is done at any time in flight, usually before AOA Yellow or Red calibration is done. The procedure is simple: Fly straight and level at a high cruise speed below your VNE. The idea is to fly with a low angle-of-attack. When this is achieved, select the “Set AOA cruise NOW...”. Your EFIS will make a snapshot measurement of AOA and Pitot tube pressures and use the ratio of the two as AOA zero indication. Any AOA higher than this will result in your AOA indicator rising.

Start AOA yellow calibration

This is the main calibration function for your AOA yellow region. You calibrate the top end of the green region which is your clean stall (flaps,gear retracted).

When safe to do so fly the aircraft to the beginning of the clean configuration stall buffet. Do not actually stall the aircraft. For example, if your aircraft wants to break into the stall at 50 mph, you should slow down to perhaps 53 mph. Once completed you should end the yellow calibration in flight. If in doubt, please have a second pilot assist if at all possible.

This calibration sets the AOA indicator to the border between Green and Yellow areas.

Start AOA red calibration

This is the main calibration function for your AOA red region. You calibrate the top end of the yellow region which is your landing configuration stall (full flaps, gear out).

When safe to do so fly the aircraft to the beginning of the landing configuration stall buffet. Do not actually stall the aircraft. For example, if your aircraft wants to break into the stall at 50 mph, you should slow down to perhaps 53 mph. Once completed you can end the AOA red calibration.

This calibration sets the AOA indicator to the border between Yellow and Red areas.

Testing AOA calibration

Verify that the AOA indicator reads zero with the aircraft stationary. When in flight with a dual port AOA probe, you should find the indicator roughly in the bottom third to center of the green area. With a single port probe the indicator will be towards the lower end of the green area during normal cruise. Your aircraft should enter the stalling regime when the indicator crosses into the yellow area. In landing configuration with full flaps your aircraft should stall when crossing from yellow to red.

The AOA calibration can be repeated as often as you like should it not operate as you expect. Some sensitivity towards AOA probe types and placement exists, so sometimes a little experimentation is required for optimum results.

For usage of the angle of attack indicator, refer to your aircraft manufacturer recommendations.

A correctly used AOA indication can significantly increase flight safety during times of reduced airspeed such as during landings or during steeply banked turns. AOA shows actual angle of attack and is completely independent of aircraft weight and density altitude. Your wing will always stall at the same angle of attack in a given configuration. The EFIS will issue a single voice warning "Angle, Angle" whenever you pass close to the green-yellow border and again close to the yellow-red border.

During a typical landing at slowest speeds you would perhaps get "Angle, Angle" just before you drop to landing configuration flaps. In this configuration another "Angle, Angle" will put you dangerously close to full flap stall. Push the stick forward immediately and increase engine power if required to prevent altitude loss.

We recommend that you practice AOA based flying with a flight instructor at a safe altitude in a way that an inadvertent stall will not put aircraft or occupants in any danger.

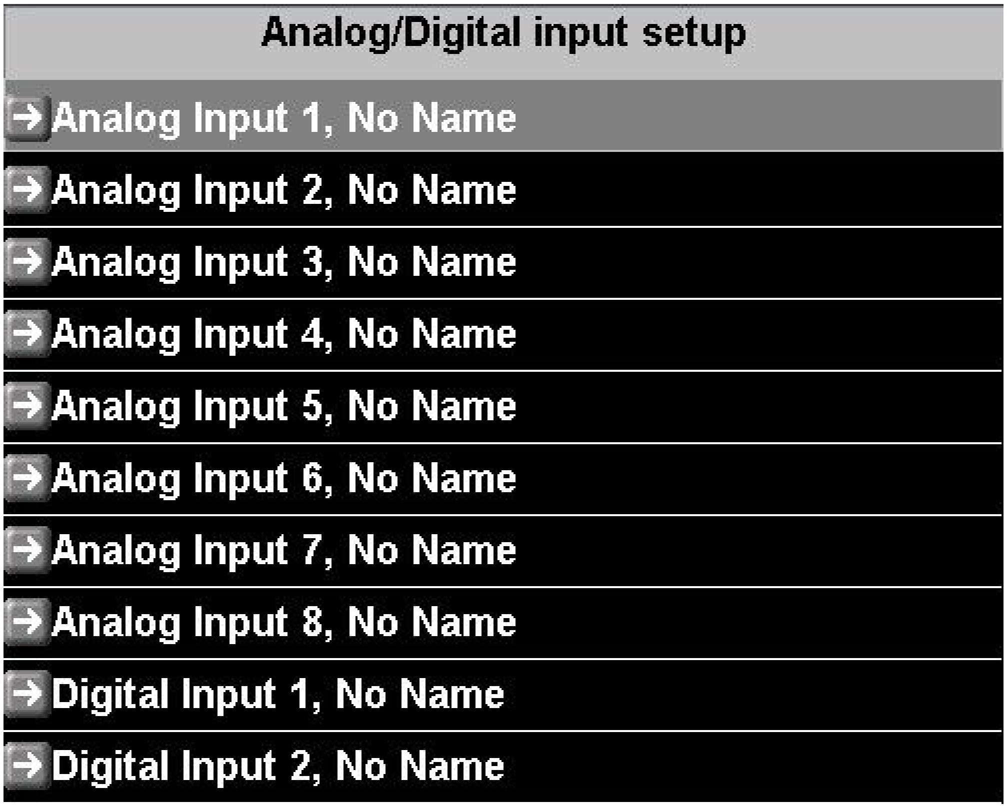
Verify that the AOA indicator works as expected after installation of a AOA probe and consequent calibration. Test the AOA frequently by flying close to the stall break and verifying correct AOA display. Recognize that a AOA probe that is impeded with insects, leaky plumbing or incorrect alignment will not work as expected.

GForce level setup menu

Here you set up the levels for your G-Force graphical indicators.

Note: The standard screens contain a G-Force indicator roughly in the screen center. This indicator will show if G-Forces are below 0.5G (including negative) or above 1.5G.

Analog/Digital inputs setup



The iBOX V1 provides 8 user inputs. Each input can be used in analog or digital fashion. A digital input is on or off. The analog input returns a an analog value of between 0 and 4095 for a voltage applied from 0 to 16V.

The usage of each inputs depends on your application. You would usually create a custom screen to show indicators as you need them.

Inputs can be be given a name such as “Gear 1”, “Oil level”, “Door latch”.

Note: Analog input 1-8 are the same physical inputs as digital inputs 1-8 and could be used simultaneously.

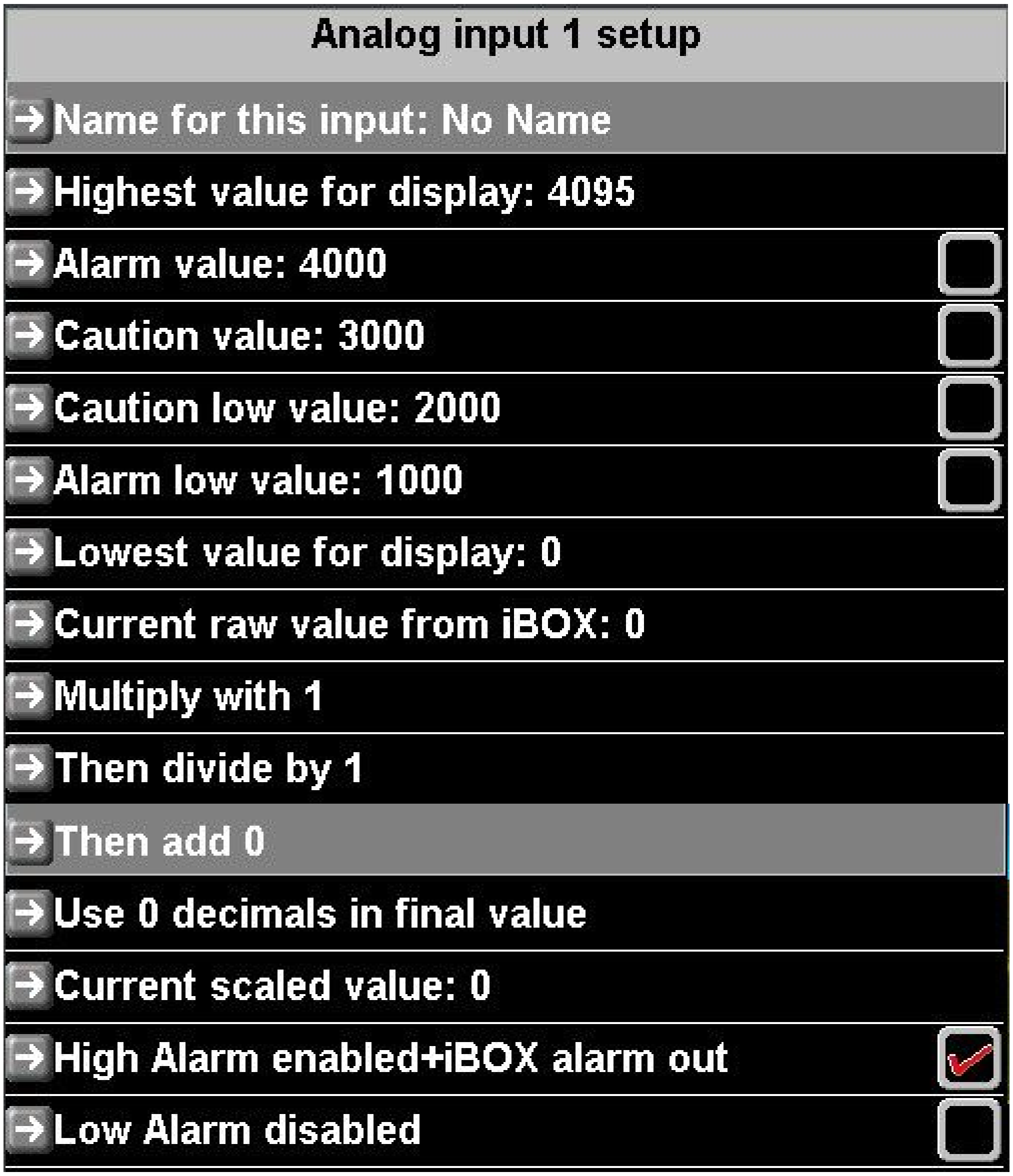
Analog inputs 1-4 may have alarms. Digital inputs 5-8 may have alarms.

Analog inputs 5-8 are for passive indication only, no alarms are available for these inputs.

Digital inputs 1-4 are for passive indication only, no alarms are available for these inputs.

Digital threshold is the value 400 (about 1.6 volts). Values below this are “low”, above this are “high”.

Setting up the analog channels



Give the input a descriptive name. You may set levels for analog displays on the screen (for example a bargraph).

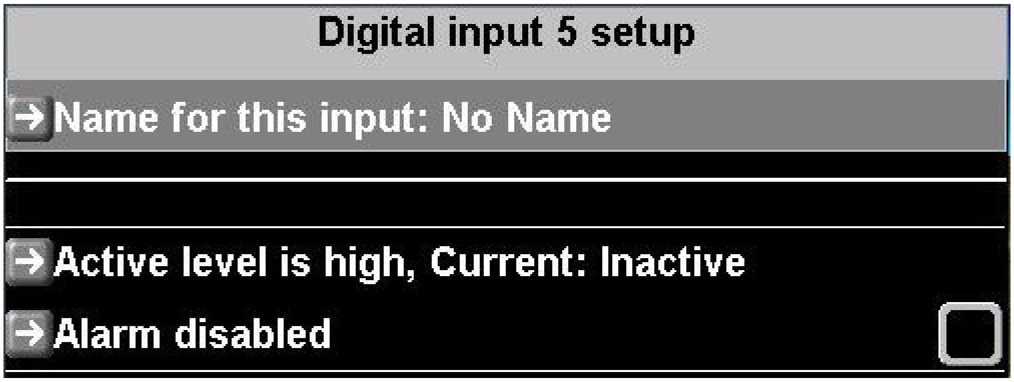
You can observe the current raw value reading from the iBOX. ADC values range from 0 to 4095.

You may scale this value. Result = Multiply then divide then add. Factors may be positive or negative. Divide may not be zero.

You can observe the current result of the scaling. The scaled result is used for alarms and applies to the levels you set for the analog displays. The scaled value is used for numeric readouts.

Enable high or low level alarms as required (Analog input 1-4 only).

Setting up digital channels



Give the input a descriptive name.

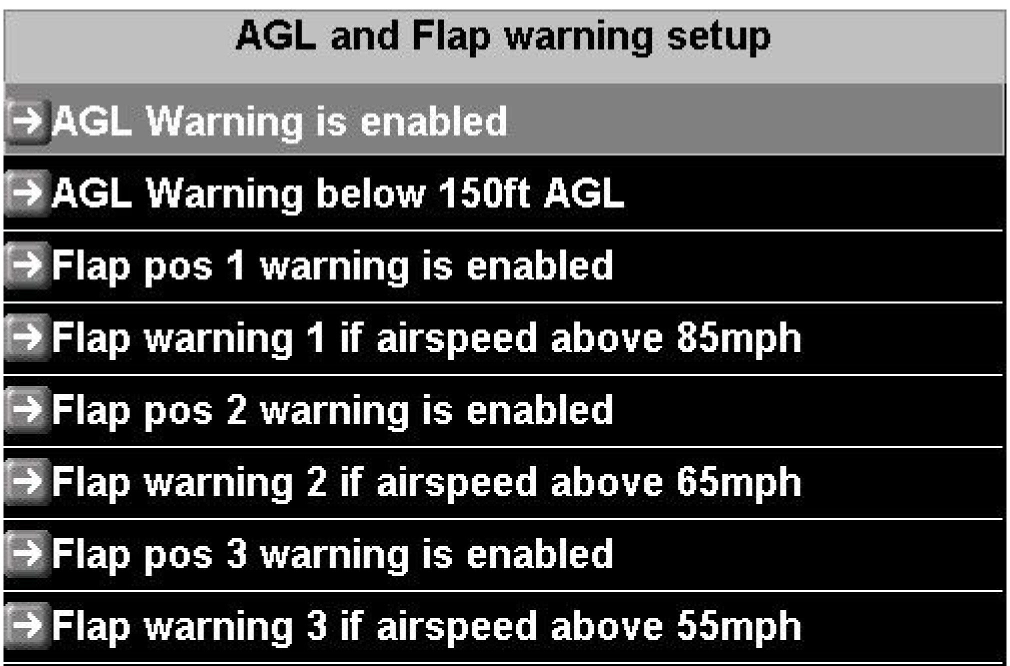
Set the input to be active if level is high (>1.6V) or low (<=1.6V).

The current active state is shown.

Enable the alarm on active level if desired. Please note: Digital alarms are available on inputs 5-8 only.

Please refer to the iEFIS alteration document should you want to create custom screens showing analog or digital inputs in graphical form on the screen.

AGL and Flap warning setup



Here you can select altitude above terrain, based on the terrain database and your pressure altitude, below which you will get the “Ground Proximity” warning. Not that this should not be confused with “terrain” or “pull-up” warning which is based on TAWS limits. “Ground proximity” should be set to a reasonably low level and may be used as reminder to extend your landing gear.

Up to three flap position warnings may be enabled based on flap position and airspeed.

Flap position 3 is “full flaps” and would have the lowest maximum speed.

Flap positions are obtained from the source selected in the “Flap indicator and control” setup and may be obtained from any analog input, Vertical Power VPX and the MGL Flap/Trim controller module.

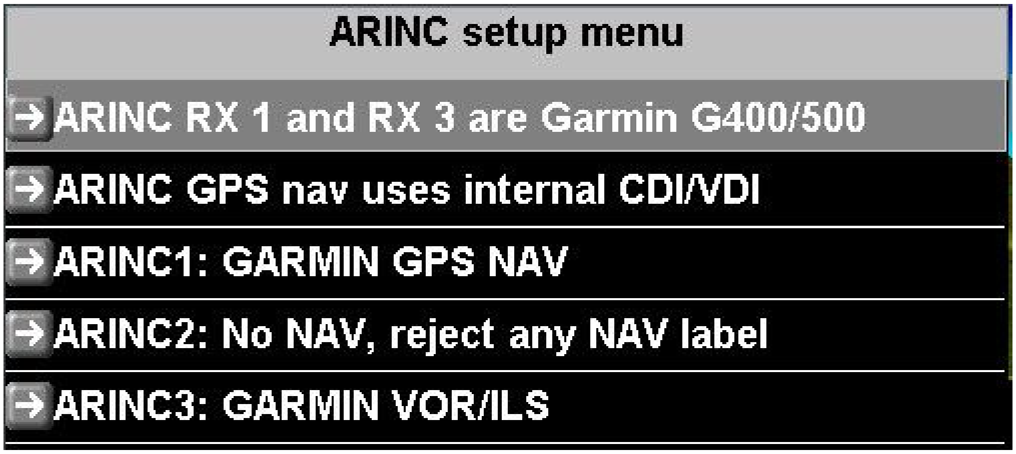
Flap positions are given a upper tolerance of 20 counts, I.e. The flap position is deemed reached even if it is still shy of the value entered in your setup. This caters for mechanical tolerances. Make sure your flaps will settle within 20 counts of the given value in flight.

Flap warnings will trigger if you have a particular flap position selected and airspeed is above the set limit.

The Flap warning is reset if no flap speed is exceeded and will reoccur the next time a flap speed has been exceeded.

ARINC setup

The IEFIS system can connect to ARINC 429 based navigation radios and GPS systems. Either generic systems can be selected (which use ARINC labels as specified in the ARINC specification) or Garmin 400/500 can be selected. The Garmin system uses some of the labels in a different way to the specification in order to resolve some issues with a combined GPS NAV and Radio NAV system.



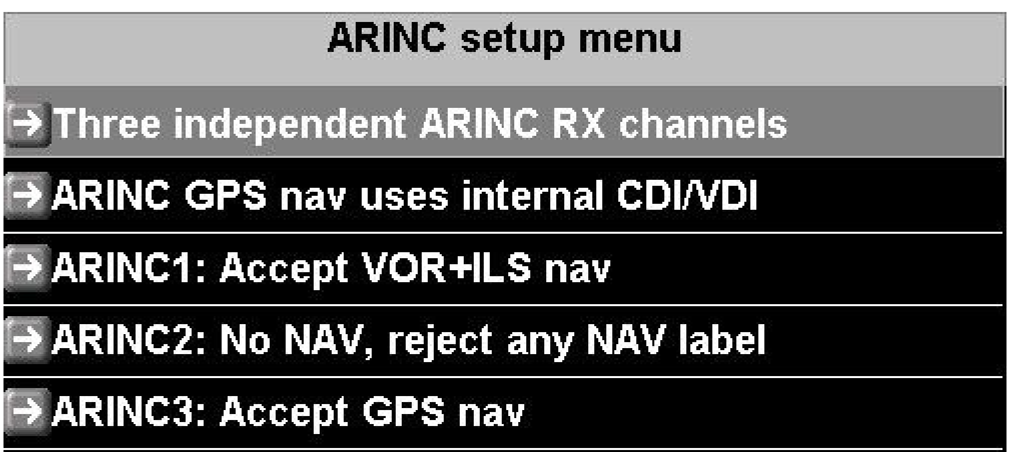
If Garmin is selected, you can still use ARINC RX 2 any way you wish. Typically it is used for connection to a traffic system such as TCAS or TIS. Some ADSB systems also output in this format.

Choose if you would like the EFIS to calculate CDI and VDI (vertical deviation) based on the navigation labels from the Garmin device or if you want to use the CDI and VDI as transmitted by the Garmin device.

In most cases you would select to use the Garmin provided CDI and VDI information.

Independent ARINC channels. In this case ARINC 1 has been selected to receive VOR and ILS information from a Navigation radio. ARINC 3 is connected to a ARINC GPS.

Please note that the system will use its internal GPS for all internal uses as it has a far greater accuracy and resolution. It will use external GPS NAV information only and so fulfills the requirements dictated by the FAA related to the use of a certified GPS system for approaches.



Please refer to the document “Odyssey/Voyager G2 ARINC integration guide” available at www.MGLAvionics.co.za (EFIS documents) for details on configuring the Garmin system.

Setup of a Odyssey/Voyager system is slightly different to that presented here as use of the RX ports has been fixed to simplify setup.

In order to complete the ARINC setup for navigation, please enable the relevant sources in the HSI/GSI setup menu so you can select them for navigation.

ARINC transmitted labels

The following labels are transmitted by the iEFIS system for use by a Garmin system.The labels are transmitted regardless of type of ARINC system selected:

100 (Selected track OBS)

320 (Magnetic heading)

204 (Altitude – Baro corrected)

203 (Altitude – Pressure altitude)

210 (True airspeed)

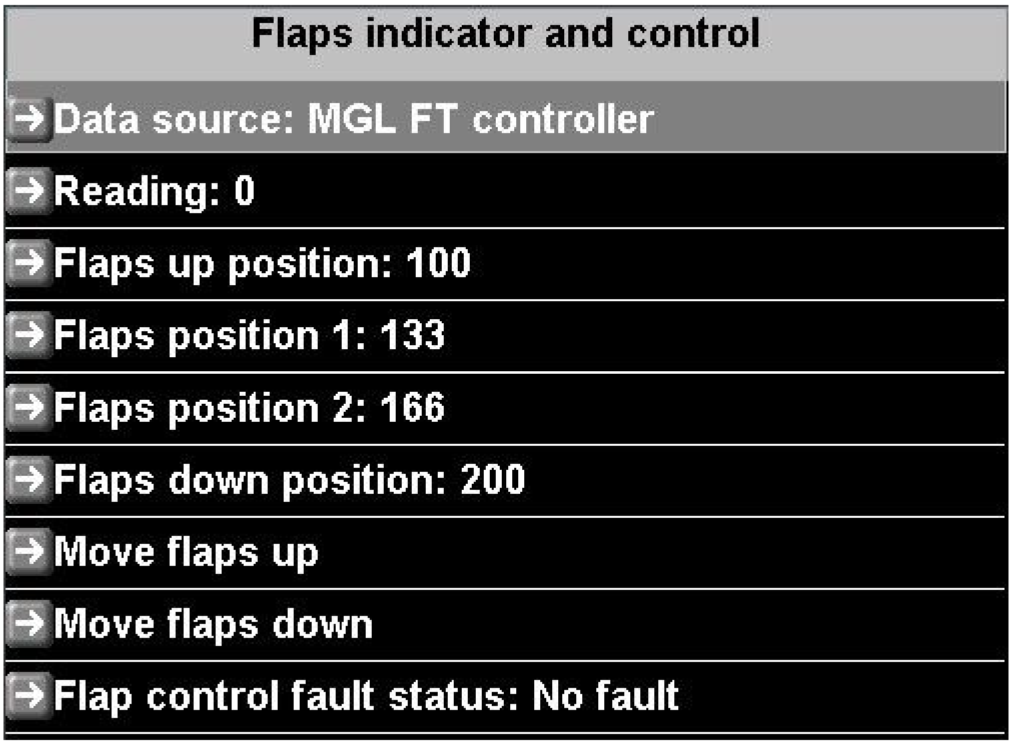
211 (OAT)

Flap indicator and control setup

You can display flap position and control flaps if you have a suitable system connected:

For a passive indicator (no control) select one of the available analog inputs. It is recommended to use analog input 1 as flap indicator source but this is not mandatory.

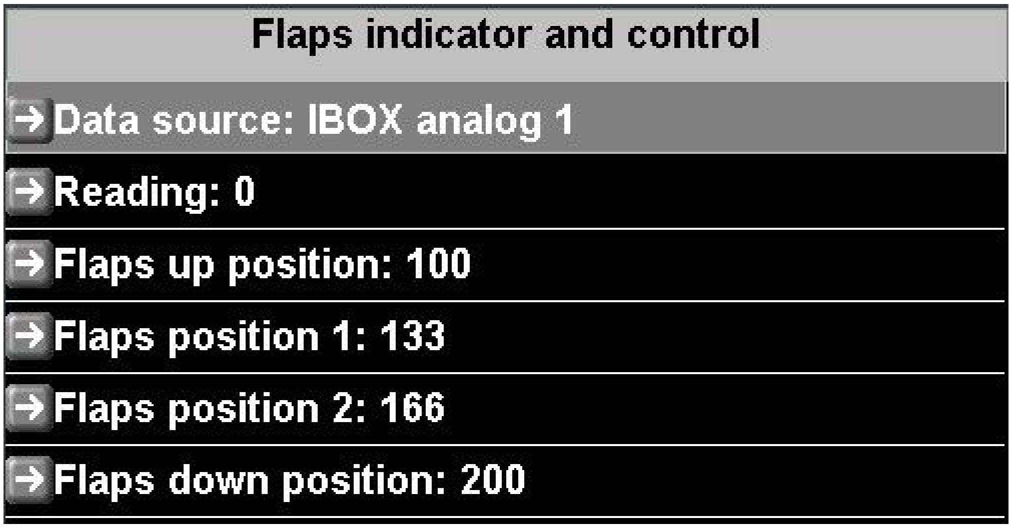
Once you have your flap sensor connected you can view the raw measurement value at the "reading" field. Move the flaps into the various positions and note the reading. Enter the readings into the 4 flap positions. These settings will be used to range the flap position indicator on the screen and show the intermediate positions.



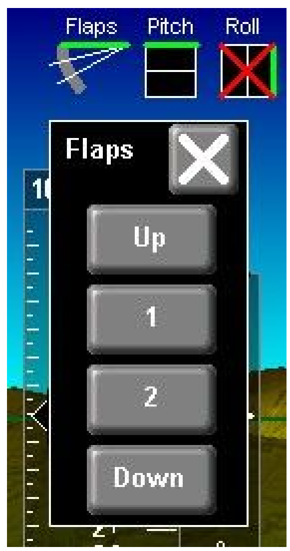
If you have a MGL Avionics Flap/Trim control module connected to the CAN bus, you will connect the flap position sensor to the control modules position sensing port. You can view the measured position value at the "Reading" entry.

Assure that you have configured your MGL Flap/Trim controller as "Flap controller" using the dipswitches (accessible after removing two screws and sliding out the PCB).

Move the flap to the required positions and take note of the readings. Copy the readings into the relevant slot position.

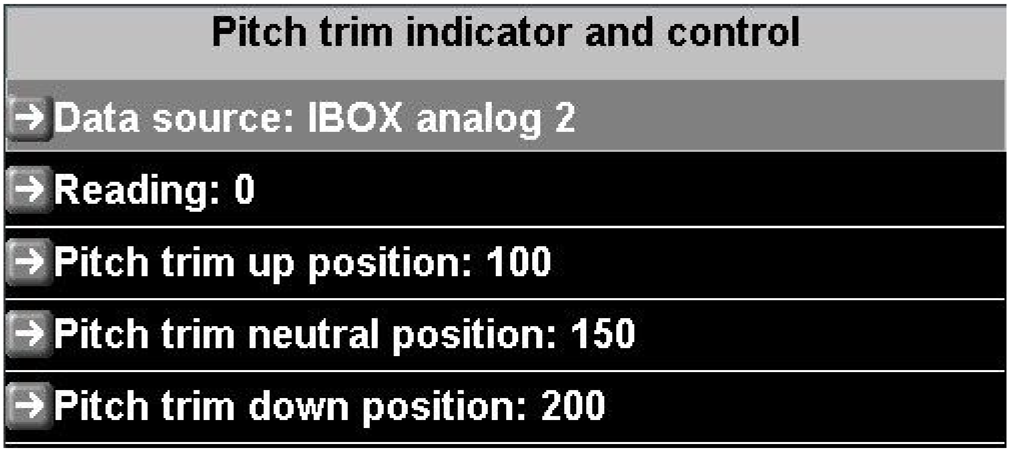


Controlling the flaps during flight is done by tapping the flap position indicator on the screen. This brings up a pop-up that allows you to set the flap position.



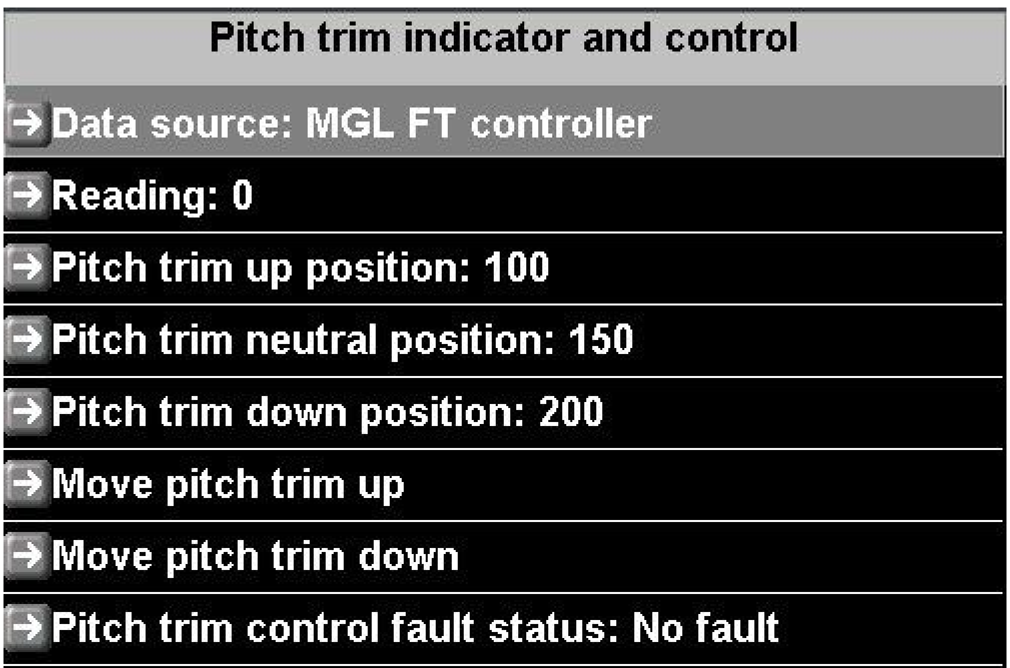
If you have a vertical power VPX system selected you can control the flaps position using up/down functionality only. Commanding a set position is not possible.

Pitch trim indicator and control



For a passive indicator (no control) select one of the available analog inputs. It is recommended to use analog input 2 as pitch trim indicator source but this is not mandatory.

Once you have your pitch trim sensor connected you can view the raw measurement value at the “reading” field. Move the trim into the various positions and note the reading. Enter the readings into the 3 trim positions. These settings will be used to range the pitch trim position indicator on the screen.



If you have a MGL Avionics Flap/Trim control module connected to the CAN bus, you will connect the pitch trim position sensor to the control modules position sensing port. You can view the measured position value at the “Reading” entry.

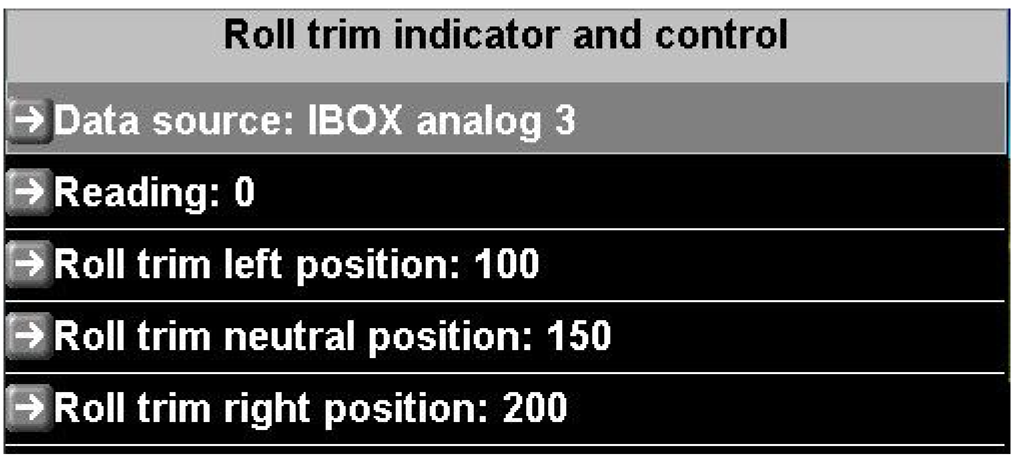
Assure that you have configured your MGL Flap/Trim controller as “Pitch trim controller” using the dipswitches (accessible after removing two screws and sliding out the PCB).

Move the pitch trim to the required positions and take note of the readings. Copy the readings into the relevant slot position.

Controlling the pitch trim during flight is done by tapping the pitch trim position indicator on the screen. This brings up a pop-up that allows you to set the trim position.

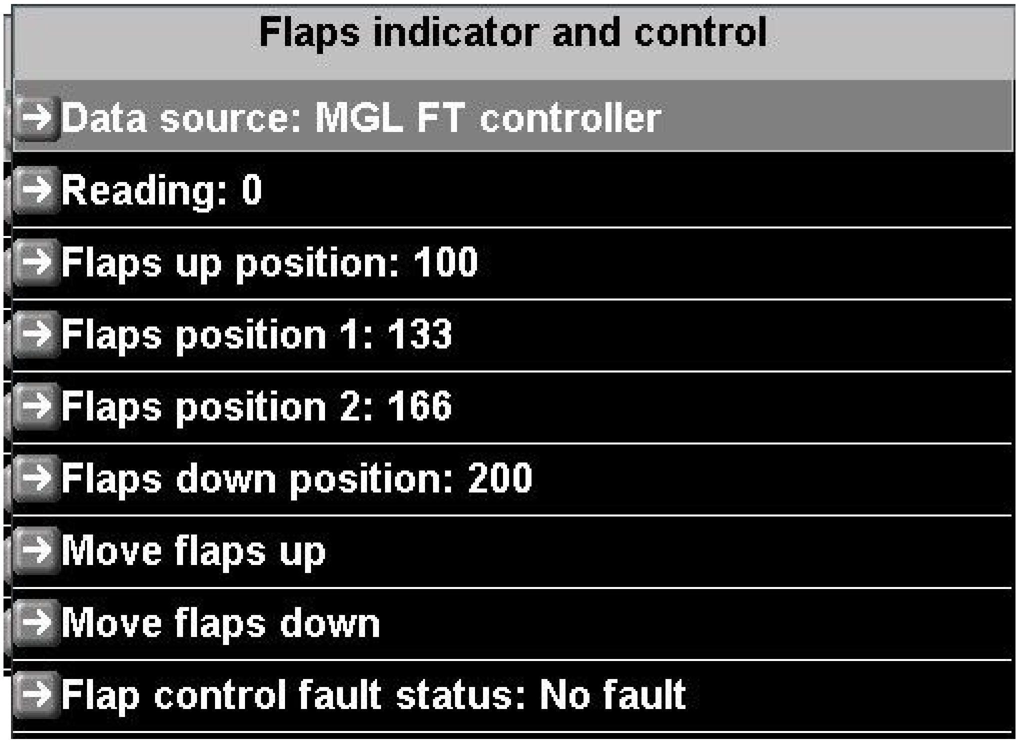
If a Vertical Power VPX system is selected, you can also control pitch trim using the touch screen. You set the pitch trim positions using the interface application from Vertical Power. Positions will be shown in the setup menu but you cannot change them from the EFIS.

Roll trim indicator and control



For a passive indicator (no control) select one of the available analog inputs. It is recommended to use analog input 3 as roll trim indicator source but this is not mandatory.

Once you have your roll trim sensor connected you can view the raw measurement value at the “reading” field. Move the trim into the various positions and note the reading. Enter the readings into the 3 trim positions. These settings will be used to range the roll trim position indicator on the screen.



If you have a MGL Avionics Flap/Trim control module connected to the CAN bus, you will connect the roll trim position sensor to the control modules position sensing port. You can view the measured position value at the “Reading” entry.

Assure that you have configured your MGL Flap/Trim controller as “Roll trim controller” using the dipswitches (accessible after removing two screws and sliding out the PCB).

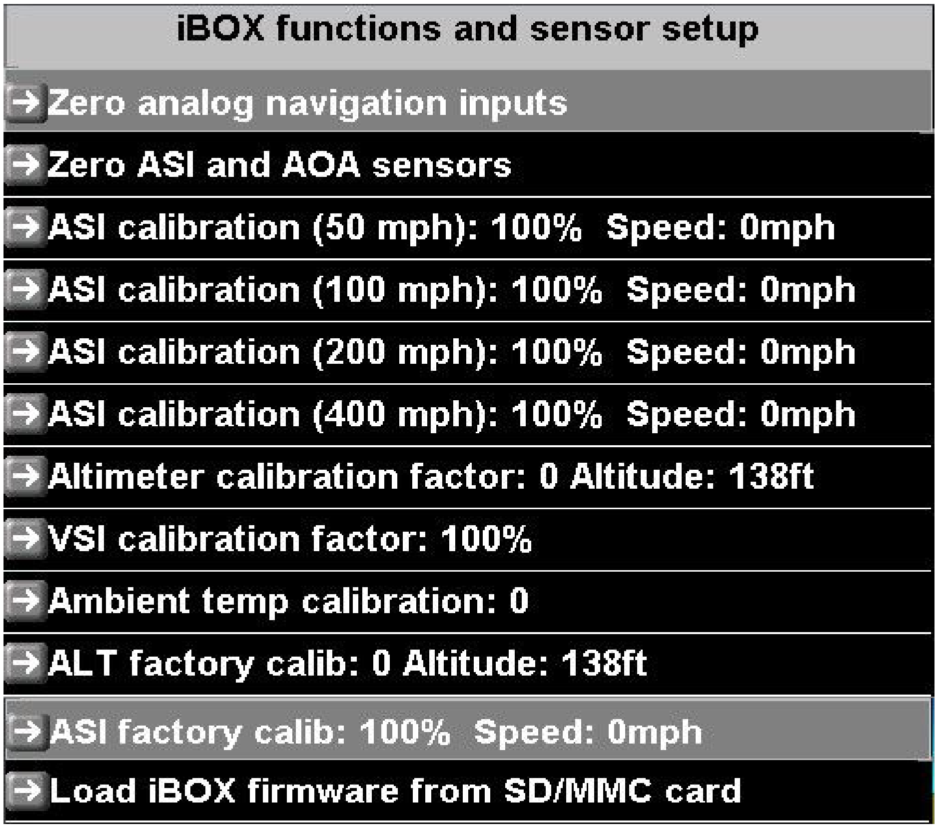
Move the roll trim to the required positions and take note of the readings. Copy the readings into the relevant slot position.

Controlling the roll trim during flight is done by tapping the roll trim position indicator on the screen. This brings up a pop-up that allows you to set the trim position.

If a Vertical Power VPX system is selected, you can also control roll trim using the touch screen. You set the roll trim positions using the interface application from Vertical Power.

Positions will be shown in the setup menu but you cannot change them from the EFIS.

IBOX functions and sensor setup



This menu deals directly with setups stored in the IBOX. Several of the functions have to be performed during first system installation as described here.

Zero analog navigation inputs

The iBOX has 4 differential +/-150mV analog inputs intended to be connected to older navigation radios that use these types of signals to directly drive needle based instruments such as CDI and glide slope.

This function should be used before such instruments are connected. It automatically calibrates the iBOX inputs to the “zero” deflection state, I.e. No voltage applied.

The raw values from the analog inputs can be observed in the iBOX diagnostics.

Zero ASI and AOA sensors

This important function is performed after installation of the iBOX is completed. The pressure sensors used are extremely sensitive and will react even to changes of orientation. Once your iBOX is in a fixed position, ensure that the sensors are not exposed to any differential pressures and perform the zero procedure.

This procedure should be repeated after 6 months to cancel out the effects of aging on the sensor membranes.

This procedure may also be performed if the aircraft is operated in great temperature extremes as ambient temperature has a slight effect on the mechanical properties of the sensors.

ASI calibration

The ASI sensor can be calibrated at various speeds. Calibration is as a percentage at the given speed. Between the speeds, linear interpolation is used.

Note: The 400 mph calibration also applies if your iBOX is the low speed version as your iBOX can measure speeds of up to 250mph.

Multiple speed calibration entries are available to be able to compensate for airflow variances at speeds around your aircraft.

Note: The ASI factory calibration works at all speeds. This calibration is entered at the factory based on an ideal pitot pressure. You can change the factory calibration if required.

Altimeter calibration factor

The altimeter calibration factor adds or subtracts about 7ft for every count at sea level.

Please note that there is a similar factory calibration. Do not change the factory calibration unless there is a good reason. If you have to calibrate, use the user calibration.

VSI Calibration factor

This calibrates the VSI indicator. A nominal 100% factor results in a very accurate VSI readout. It is not usually required to calibrate this readout. It is included here for completeness rather than necessity.

Ambient temp calibration

This adds or subtracts in one degree steps to your ambient temperature sensors current reading. If you have an accurate reference temperature indication you can calibrate your AOA to that reference.

Tip: If you have an accurate AOA you should select "Use ambient temp sender for TAS" in the Instrument setup menu -> ASI setup. This will result in a more accurate TAS readout compared to using the "standard atmospheric model".

ALT/ASI Factory calibration

Values are entered here during factory calibration. Do not change them unless you have a good reason to do so.

Load iBOX firmware from SD/MMC card

From time to time new firmware for the iBOX may be released by MGL Avionics. This firmware may be obtained by a free download from the MGL Avionics website.

This function allows you to download the new firmware to the iBOX. The new firmware will be used by the iBOX the next time the iBOX restarts so you need to power cycle the iBOX after downloading the new firmware.

Your IEFIS may give a message on start up if the current version of the iBOX firmware is not suitable for the current version of software running on the EFIS panel.

This may happen if the EFIS expects a new function to be available on the iBOX but the current iBOX does not have this function available.

You can view the current iBOX firware version number in the iBOX diagnostics.

Notes on changing settings in the iBOX

This menu deals with the currently active iBOX only. If you have two iBOX systems connected, you may need to repeat setups for each iBOX. The two iBOX systems are independent systems. While they will synchronize many settings between them, they will not synchronize any settings in this menu.

If you need to perform settings to the standby iBOX, please select the standby as active iBOX using the iBOX status display (top left corner of any main EFIS screen).

Serial port routing/Allocations

The iBOX V1 provides 6 serial RS232 ports. The iBOX V2 provides 3 serial RS232 ports.

These ports consist of a data transmit and a data receive line (TX and RX). A TX line is connected to the corresponding RX line on the device.

The iEFIS panel provides a further, private RS232 serial port.

IBOX V1 RS232 port 6 and V2 RS232 port 3 have a fixed function that you cannot change. These ports are used as NMEA ports. They provide GPS NMEA data in a standard format for use by other devices such as transponders or external autopilots.

The internal RS232 port and the external iBOX ports can be freely assigned conditional to the following restrictions:

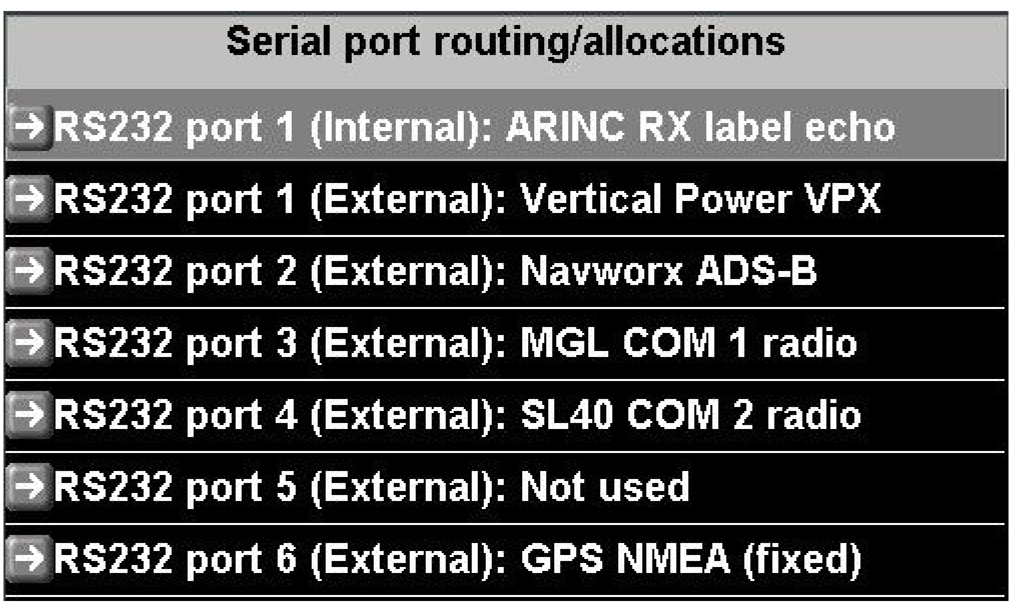
iBOX RS232 ports 1 and 2 are high speed ports. These can be used for any device, including low speed. If you require to connect a high speed device, use ports 1 or 2 or the internal RS232 port.

Note: NMEA port on the iBOX V2 is port 3. Ports 1 and 2 are equivalent to iBOX V1. Ports 2,3 and 4 do not exist on the iBOX V2. Assigning these ports has no effect.

High speed devices:

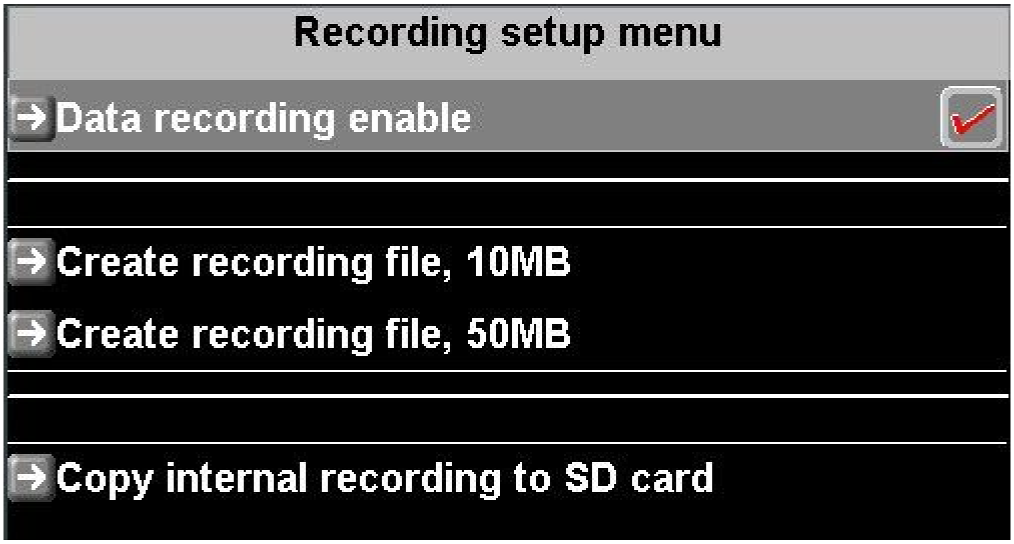
ADS-B receiver/transceiver, VPX electronic circuit breaker.

Allocate each port from the list of options to match the actual wiring of your devices. Unused ports must be set to “Not used”.



This image shows a typical serial port setup.

Flight data recording setup



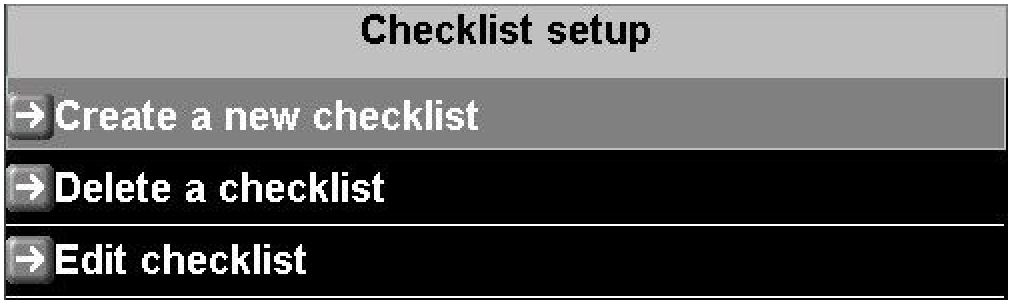
The iBOX system supports three different methods of flight data recording, commonly referred to as “black box flight data recording”.

1) Internal recording. Each iEFIS panel records all available flight, engine, fuel and navigation data on a once per second bases to an internal data flash memory. This memory holds around 1 hour worth of data. This memory is mainly intended to assist in the event of an aircraft accident by retaining the last hour of operations. Flight data is recorded as soon as a flight is active. Internal data recording cannot be disabled.
2) External recording to SD card can be enabled/disabled in this menu. Recording is to a fixed size recording file if an SD card is inserted that has a recording file located in the root folder of the card. The file name of the recording file is “iEFIS.rec”. You can create a 10 or 50mB recording file from the EFIS using this menu. You can also create larger recording files using the Screen designer / Simulator application. Recording files are simply large, fixed sized files starting with all bytes in the file set to zero. Recording commences at the file start and wraps back to the beginning when the end of the file is reached. Fixed size files are well suited to SD card as there is no wear on the directory structure during writing (SD card have a limited number of write cycles to the same sector). As rough rule of thumb, about 2MB if data is needed for every hour of recording, a 50 MB file thus gives you about 25 hours. Recording is active if a flight is active.
3) External recording device connected to a serial port. The serial port should be configured as “MGL blackbox data feed”. If the serial port is configured, recording data transmission is active when a flight is active. It cannot be disabled.

Data format of the recording is placed in public domain. You can use the MGL Avionics iEFIS black box data viewer to view recordings.

You can extract the internal recording to SD card using this menu. Exported file name is “iEFISBB.DAT”. It has the same file format as the conventional SD card recording and is about 2 MB in size.

Checklist setup

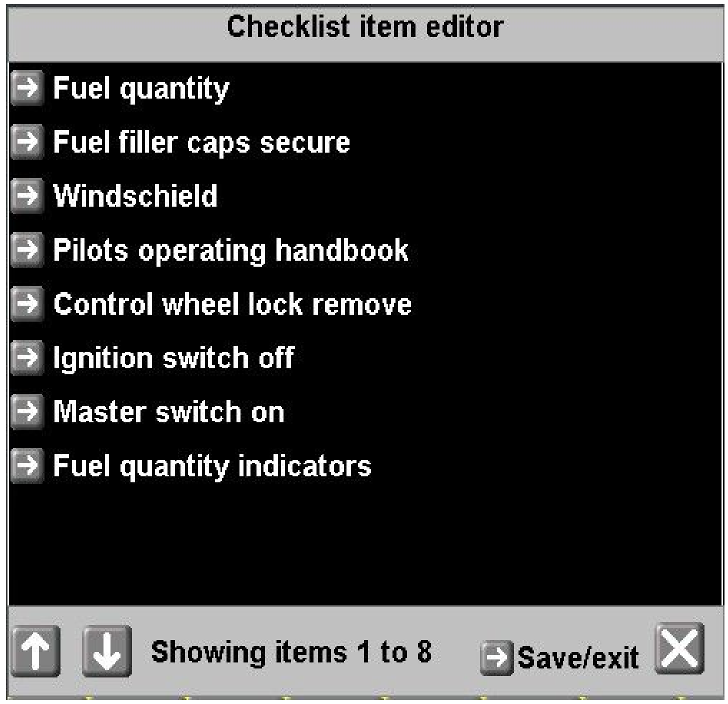


You can create checklists on the system. These are simple text files, each containing up to 32 lines.

Create a new checklist by giving it a name (1 to 8 characters in length):

Then edit the new file.

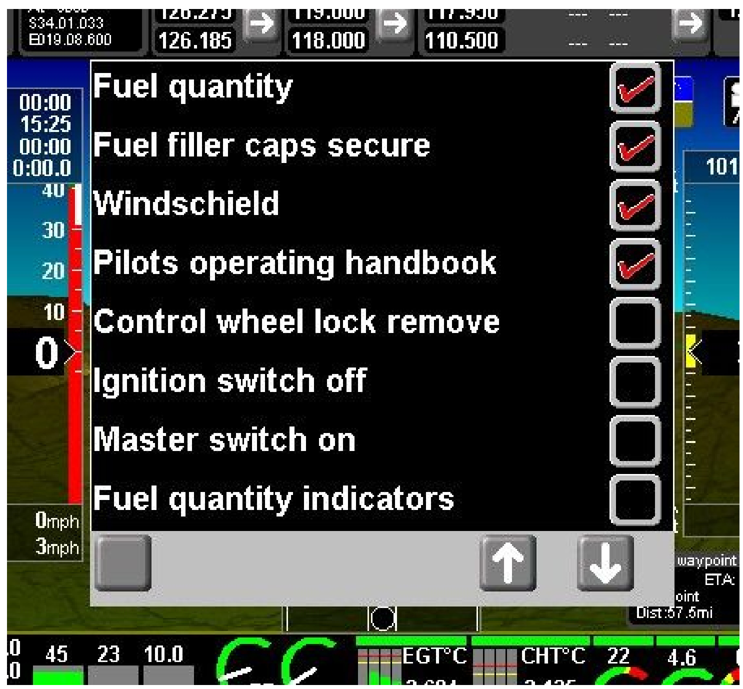
Create a file for every category of checks needed such as “Preflight”, “Pre-Takeoff”, “Pre-manouvering”, “Landing” etc – as required for the aircraft.



The pilot can call up any of the check lists using the “check” soft key as needed and “check” each item visually by tapping on the item on the screen.

Checklist files are stored in the “Checks” folder. These are ordinary text files that can also be created using a text editor on a PC. For example you may use Notepad.

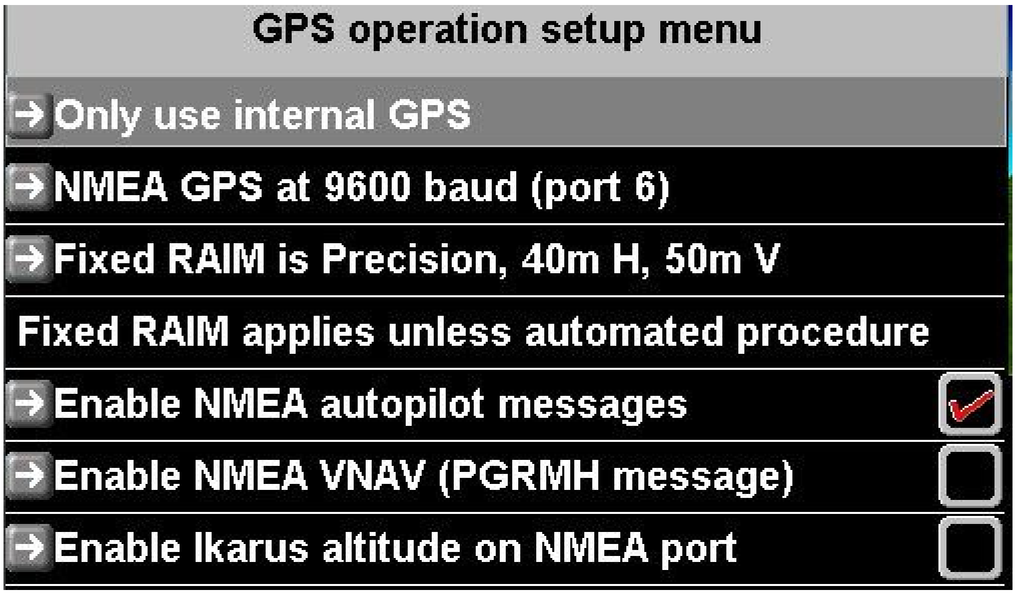
You can copy checklists using the file manager from your SD card into the “Checks” folder.



Tip: Avoid making entries too long – they may require some space to write. Be short an to the point. Verify them on the actual instrument before flight.

The pilots display of checklists is fixed width – ensure that your check items fit the available width. Capital letters use more space than lowercase letters.

Setup GPS and NMEA port operation



Selecting the GPS source

You can select from three GPS sources:

a) Internal GPS refers to the GPS engine in the iBOX. If you have two iBOX units connected then you have two internal GPS systems, one of which is active at any one time (selected by means of the iBOX status display on the screen or via automated changeover on a failure).

b) GPS connected to the NMEA port. You can connect a standard GPS that provides at least the GGA and RMC sentences.

c) GPS connected to the ARINC port. You can connect a GPS to the ARINC port. Note however that ARINC GPS is restricted to a reduced set of information. Only position, ground speed and track are available. Position has limited resolution when compared with modern solutions.

NMEA port on iBOX

RS232 port 6 is a dedicated NMEA port. The iBOX continuously transmits a number of standard NMEA sentences on this port. You can choose the baudrate of this port from 4800, 9600 and 19200 bits per second. The baudrate selection must be compatible with that selected on the receiving device.

RS232 port 6 input (RX) can also be used as NMEA input to connect an external GPS.

RAIM selection

RAIM (Receiver autonomous integrity monitoring) is a system designed to identify satellites giving erroneous information that would result in a worsening of the current calculated position. Such satellites can be excluded from the calculations in order to preserve accuracy of the GPS solution.

RAIM is able to warn when estimated position errors, howsoever caused, exceed a set limit.

For aviation use, there are several limits.

a) En-Route – Horizontal navigation only, 2NM limit

b) Terminal – Horizontal navigation only 1NM limit

c) Non-precision approach – Horizontal navigation only, 0.3NM limit

d) Precision – 40 meters horizontal, 50 meters vertical limit

You may also elect to switch the RAIM alert “off” if you do not intend using it.

The limits you select here are fixed. This means they apply regardless of the flight phase. We recommend that you select “Precision”, the highest grade and suitable for any flight phase.

Should any published procedure be activated via Flight plan (using the navigation database SIDS and STARS selection), required RAIM limits will be selected automatically regardless of your selection unless you have disabled RAIM alerts.

Note: Should you be using a NMEA based external GPS connected to the iBOX NMEA port, please ensure that the GPS system is able to provide the “GBS” NMEA message to enable RAIM alert functionality.

Enable NMEA autopilot messages

Should you wish to connect a NMEA based autopilot to the iBOX, enable the autopilot message “RMB”. This message provides track and CDI information to the autopilot.

Note: Some ARINC based autopilot systems may require connection to the NMEA data stream with the message “RMB” enabled to obtain current track information.

Enable NMEA VNAV

This is a propriety vertical navigation NMEA message “PGRMH”. At current, it is not known if any autopilot systems use this message.

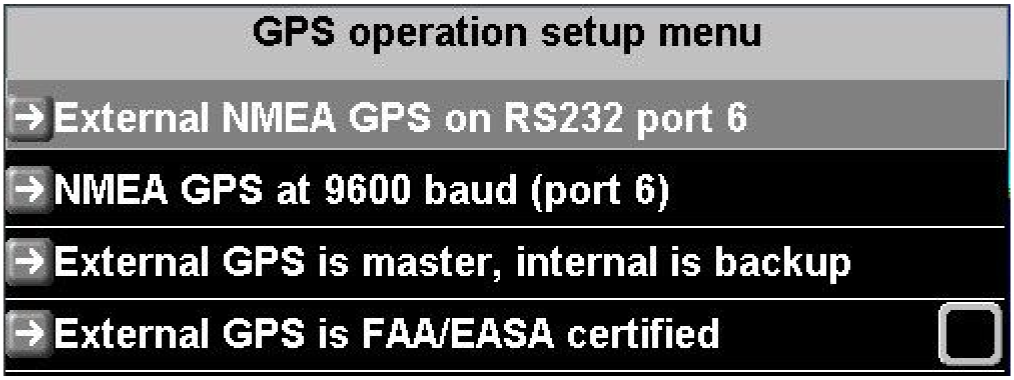
Enable Ikarus altitude

You can enable the standard Ikarus altitude message to be inter-spaced into the NMEA data stream.

Note: Should you enable any additional messages onto the NMEA stream (in addition to the standard messages) it is recommended to set the NMEA baudrate to at least 9600 to allow sufficient bandwidth availability.

Using an external GPS receiver

You can connect an external GPS receiver to either the NMEA or ARINC port. Note that NMEA is preferred as it gives more data and higher precision.



External GPS is master, internal is backup

This mode selects the external GPS as master GPS. The system will use the external GPS data from the NMEA port if it is available. It will revert to the internal GPS if the external GPS data feed fails for two seconds or longer.

External GPS is backup, internal is master

This mode uses the internal GPS. Only if the internal GPS fails will an attempt be made to use external GPS data.

Note: "Internal GPS failure" includes actual hardware failure of the GPS as well as not acquiring a position. In other words, if the internal GPS cannot at least supply a 2D quality fix regardless of cause, the EFIS will attempt to obtain a position from the external GPS.

External GPS is FAA/EASA certified

Enable this function if your external GPS is certified. In this case the external GPS will be used for ADSB-OUT (extended squitter on mode-s transponders connected and controlled through the EFIS).

Special case operation with external, certified GPS

Select External GPS (NMEA or ARINC).

Select External GPS is backup, internal is master

Select External GPS is FAA./EASA certified

In this case the EFIS will use its internal GPS as normal, however it will use the external GPS data as feed for ADSB-OUT if the external feed exists.

Note: In case of the ARINC external GPS, altitude information as well as GPS fix quality information will be taken from the internal GPS as this information is not available on the

ARINC data feed. For ARINC operation to be successful in this mode, you need to have an operating internal GPS.

NMEA port output messages

The NMEA port on the iBOX outputs the following messages:

GPGBS, GPGGA , GPGSV, GPGSA, GPGLL, GPRMC

In addition the following messages can be selectively enabled in this setup menu:

GPRMB, PGRMH, IKARUS

Using External GPS as master

Ensure that the external GPS is able to provide navigation solutions at a sufficient rate. At least to position updates are required per second. Slower updates will affect the usability of the system. 4 updates or more are recommended.

Ensure that the NMEA link has sufficient bandwidth if using an external GPS. A setting of 19200 is highly recommended. Insufficient bandwidth will result in message loss.

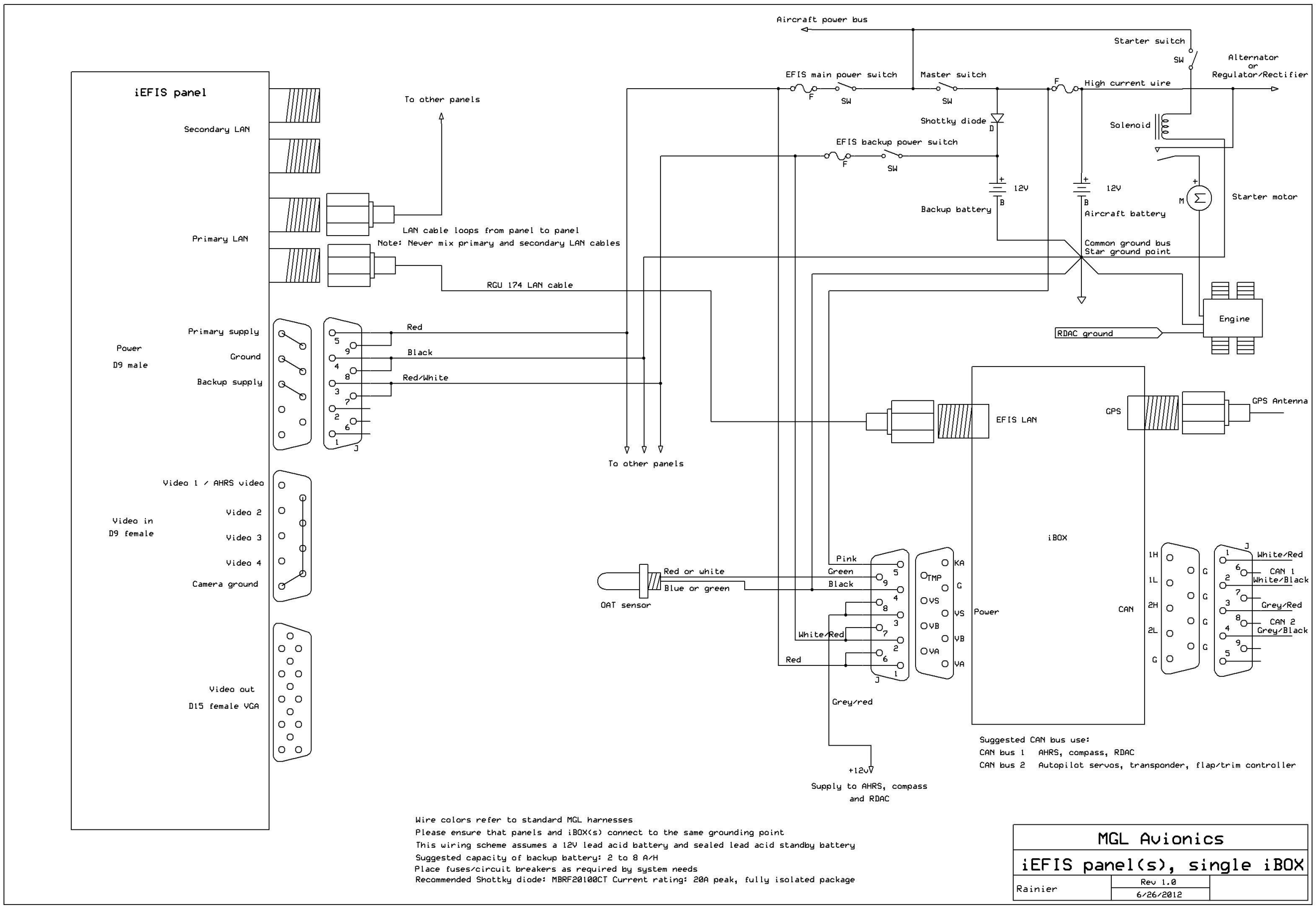
Important considerations

If you plan on using the internal autopilot, please ensure that the internal GPS is operational regardless of any use of external autopilot. The autopilot will use certain information from the internal GPS which is not available from an external source.

If you are planning on using the GPS Flightpath “attitude” using the built in GPS, note that the internal GPS must be operational. The required information cannot be obtained from an external GPS. In this case we recommend that you use an AHRS connected to the EFIS rather than using the internal GPS based flightpath attitude emulation system.

Should you be using an external, certified navigation systems such as a Garmin 430W or similar connected via ARINC it is advised to use the internal GPS as master and external (ARINC) GPS as backup. This will not invalidate the purpose of the certified system as all navigation is performed on the certified system and only navigation indicators (such as the HSI) are slaved to the external system. Internal GPS position is of far higher accuracy and quality compared to the ARINC based system and should be used as source for the synthetic vision and internal functions that rely on GPS such as autopilot stabilization. Note that the autopilot follows navigation inputs and does not use the internal position if you are using the external navigation system.

Sample wiring diagrams



This diagram shows the principle wiring of a single or multi panel iEFIS system using a single iBOX.

Take note of the grounding scheme. This is refered to as a “star” ground. All equipment ground is wired to a single point, usually a copper bus bar. This ensures that all equipment “sees” exactly the same ground potential. The ground bus bar would be wired to the battery negative terminal using a thick, short, low resistance cable.

The highest current would typically be drawn by the starter motor. The starter motor uses the engine block as ground return path and a thick, short cable is needed as ground return path to the battery negative. The return path from the engine block should not be routed through the ground bus bar but go straight to the battery.

Take note that the RDAC ground connection should go to the engine block and NOT to the ground bus bar. This is very important. The RDAC must see the actual ground potential of the engine block as several sensors may use the engine block as ground return path. If the RDAC is wired to a different ground point, it is possible that measurement errors will be introduced. These measurement errors can be significant.

Supply for AHRS, compass sensors and RDAC are taken from the “Vs” output of the iBOX. The “Vs” output is the “secured supply” output and this provides power from either the “VA” or

“VB” depending on which has the higher voltage. Note that this output has maximum current limitations. It is intended only for the listed sensors. Do not use this output to provide supply to radios or other avionics as you may damage the iBOX by drawing too much current.

Note the “Keep alive” connection or “KA” from the iBOX power connector to the aircraft battery positive terminal without any switch in line. This connection should remain alive at all times. It provides very small amounts of backup current to internal systems of the iBOX as well as connected iEFIS panels via the LAN cable. Using this connection, iBOX and panels are not required to utilize their own, built in backup batteries resulting in a long life of these items. Currents flowing into the KA pin are measured in millionth of an amp (Micro-amp) and have no effect on the charge life of the aircraft battery.

This diagram assumes a 12V system, common on modern day aircraft. A small, sealed lead acid battery is suggested as emergency power supply. It is charged via a shottky barrier diode. Shottky diodes are available with very low forward voltage drops. This ensures that the standby battery will achieve full charge. Ensure that the diodes current rating is sufficient to withstand the highest possible current which may flow if the standby battery is fully discharged. The recommendation is a 20A diode which is inexpensive and provides sufficient margin.

MGL recommends the type MBRF20100CT from “On Semiconductor”. It comes in a fully isolated package that can be screwed onto a firewall or metal member for cooling. It has a low forward voltage drop of less than 0.2 volts at lower currents and also provides sufficient, low reverse current figures so the standby battery will not be drained if the main system cannot hold power.

The battery backup scheme in this drawing requires use of a panel switch (or circuit breaker) to engage. This is the preferred method as it allows simple control and verification of the backup power system by the pilot.

The LAN cable is based on RG174 cable and SMA screw type connectors providing a very secure, yet easy to use connection.

The LAN provides a data link between panels and ibox and panels. The same cable is also used to transfer backup power from the iBOX “KA” terminal to the panels when the main power is switched off.

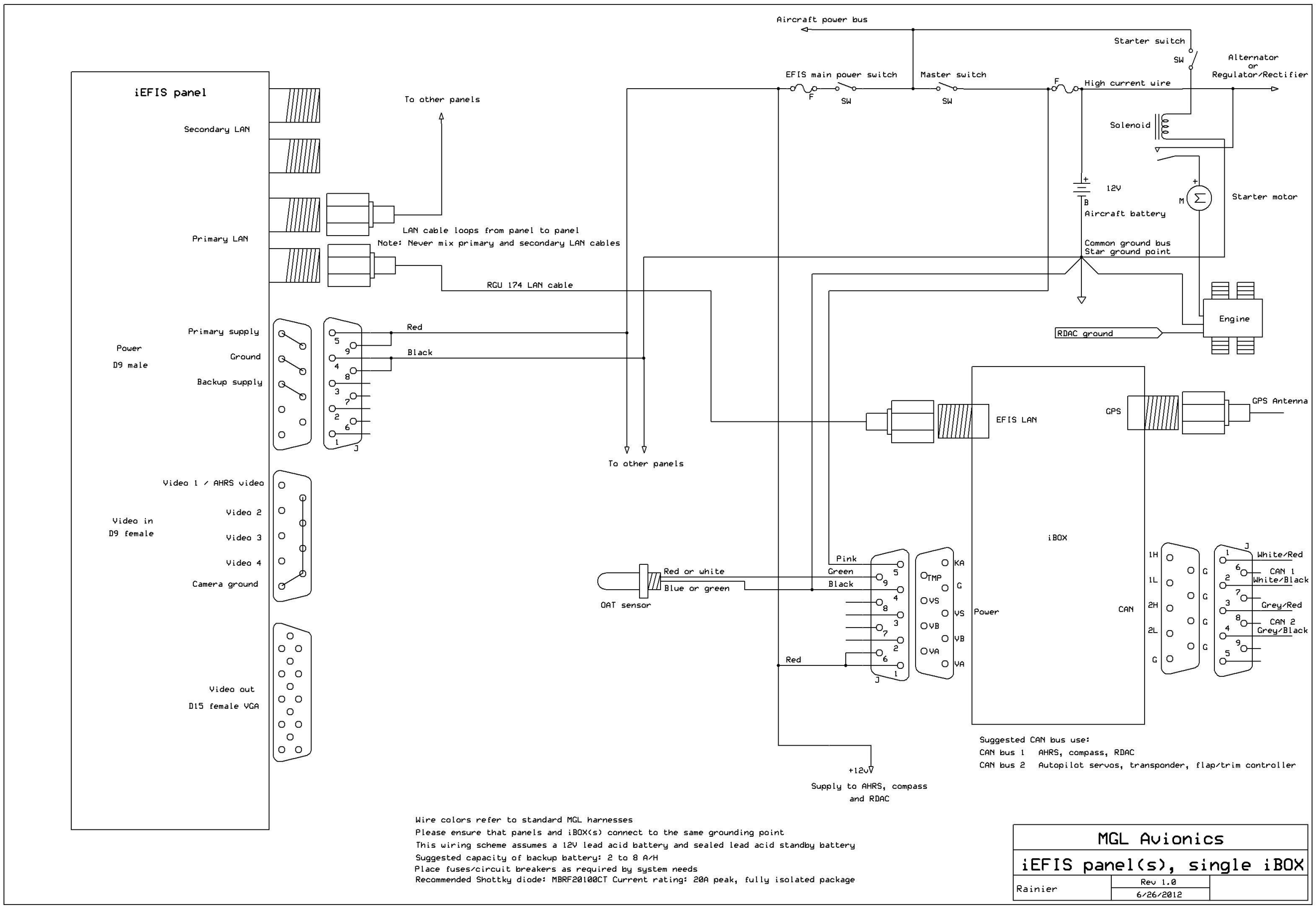
The LAN originates at the iBOX and simply loops from panel to panel. Please note that primary and secondary LAN cables may never be mixed.

Single iBOX systems use only the primary LAN and the secondary LAN remains unconnected on all panels.

Dual iBOX systems connect the main iBOX to the primary LAN and the standby iBOX to the secondary LAN.

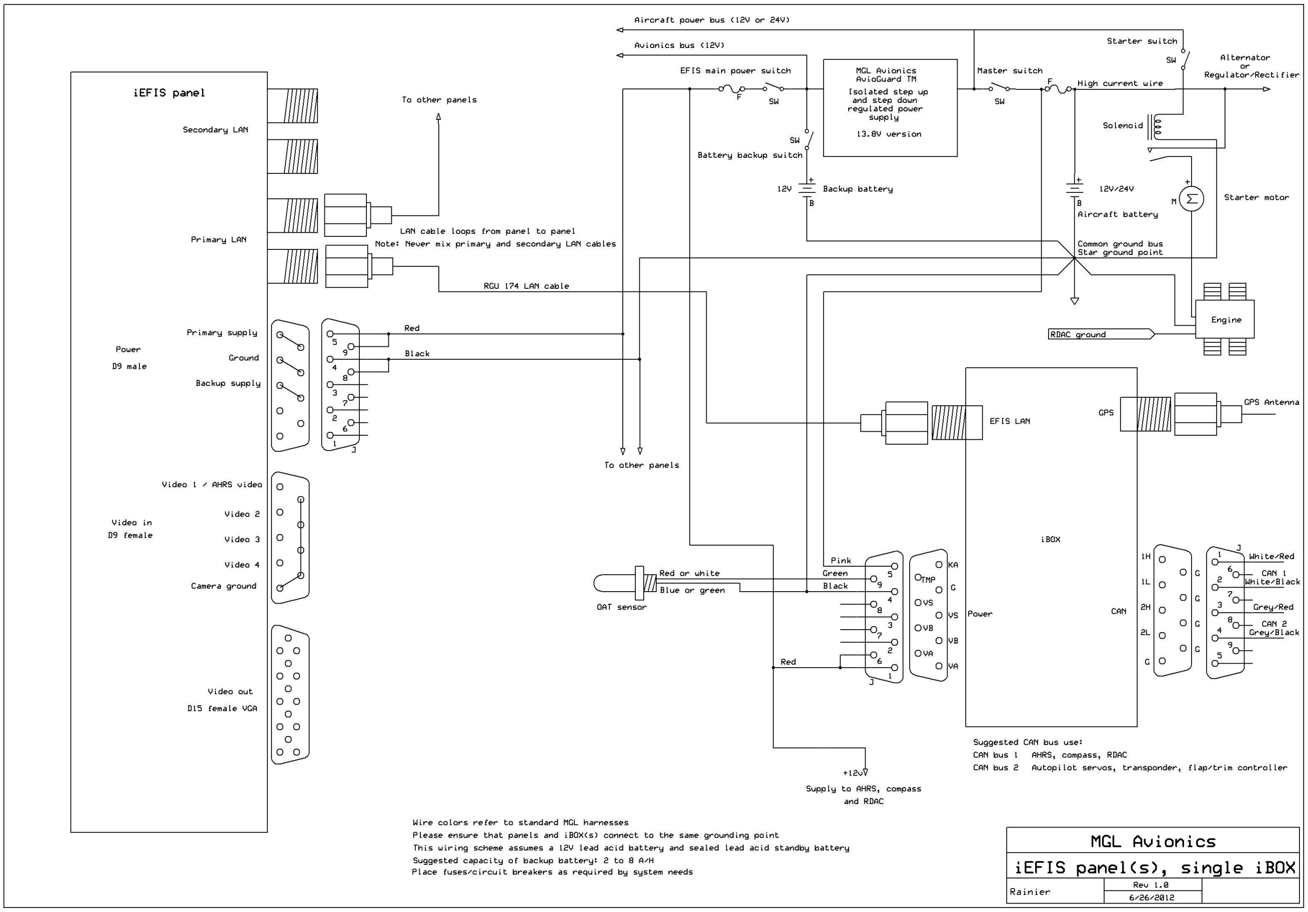
If LAN cables are made up to length, please ensure that the SMA connectors are securely connected to the cables and that there are no shorts between the shield of the cable and the core of the cable. A short will result in drainage of the backup batteries and loss of data communications. Please use only correct, good quality tools to make up SMA cables.

If alternate backup supply systems are in place or backup is not needed, the backup system may be omitted as in this diagram:



In this case the “secure supply” or “Vs” output of the iBOX is not used as there is no reason. Items such as AHRS and compass sensors can be directly connected to the single EFIS supply.

12V or 24V systems with AvioGuard ™

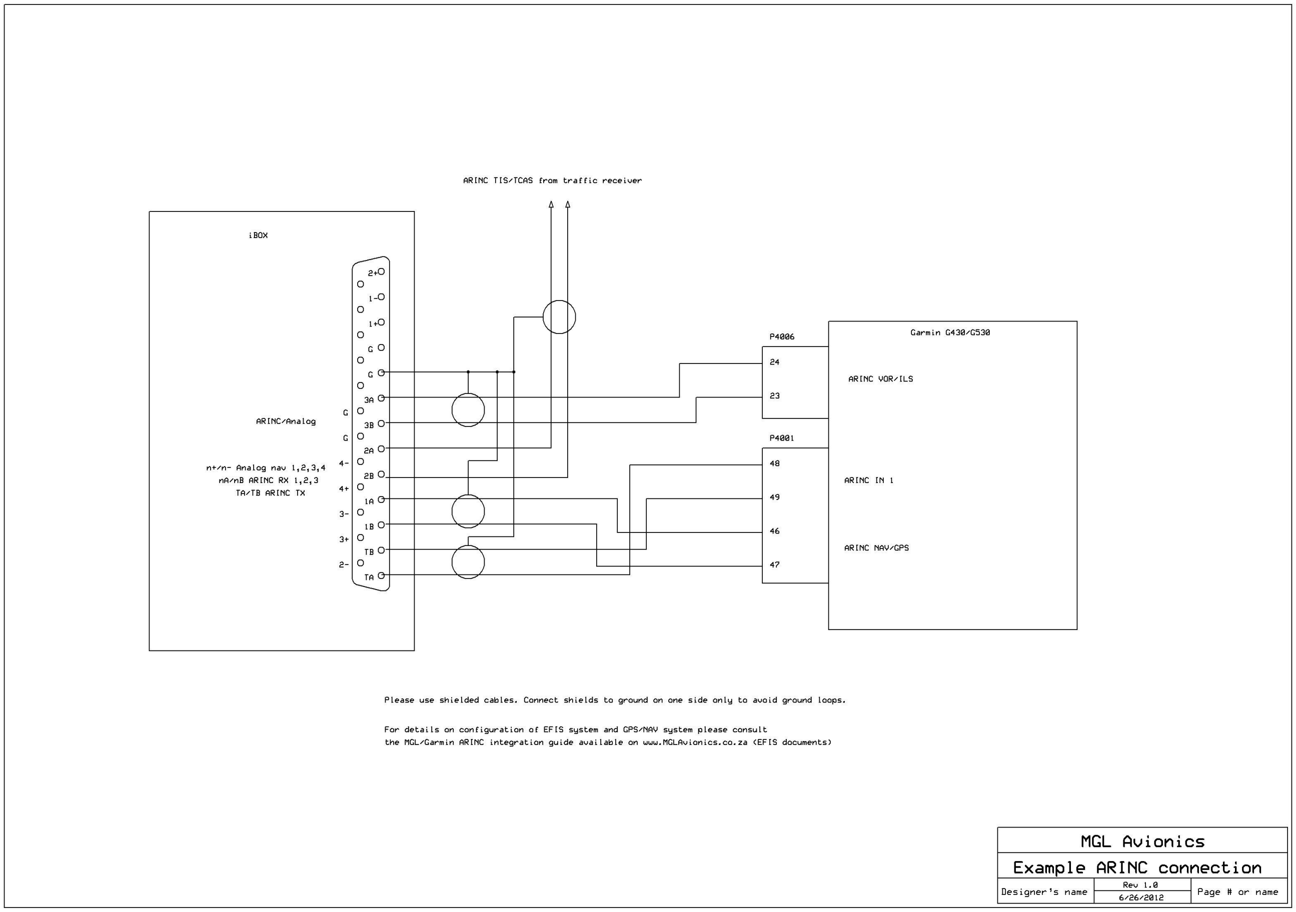


AvioGuard provides a fully galvanically isolated power suppy solution. It is recommended as pre-regulator for 24V systems but is also recommended for mission critical applications requiring the utmost quality of power supply. Avioguard converts incomming power which may be contaminated by noise or spikes into a magnetic field. The field is then converted back into electrical power using a very fast regulator – this results in perfectly clean power. However, due to the isolation provided, it also effectively disconnects the avionics from the aircraft power system.

AvioGuard achieves very high power conversion efficiency and can deliver up to 8A of DC current making it well suited as avionics bus supply solution.

As a further benefit, if the 13.8V version of the AvioGuard is used, fitting a backup battery is simplicity itself. Only a backup switch on the panel is required. This switch will remain on during flight, providing battery charge and instant power availability from the battery without losses should main power fail.

Example iBOX ARINC connections



This diagram assumes a typical Garmin G430 as a navigation device. It consists of a GPS part and a NAV radio part.

The GPS part can provide GPS bases position and track information to the EFIS in addition to its own GPS system. The provides GPS information can be used as an internal cross check. In addition to basic GPS data, the link also provides GPS navigation information including flight plans (routes) from the Garmin system to the EFIS.

The NAV radio link provides VOR and ILS/Glideslope information to the EFIS.

The EFIS in turn transmits information to the Garmin system such as magnetic heading (if available).

For a Garmin system, the use of the iEFIS ARINC ports is fixed as the Garmin system uses its own versions of certain ARINC labels and the corresponding system needs to know what data to expect.

IBOX ARINC port RX 1 – Connect to the GPS data feed of the Garmin.

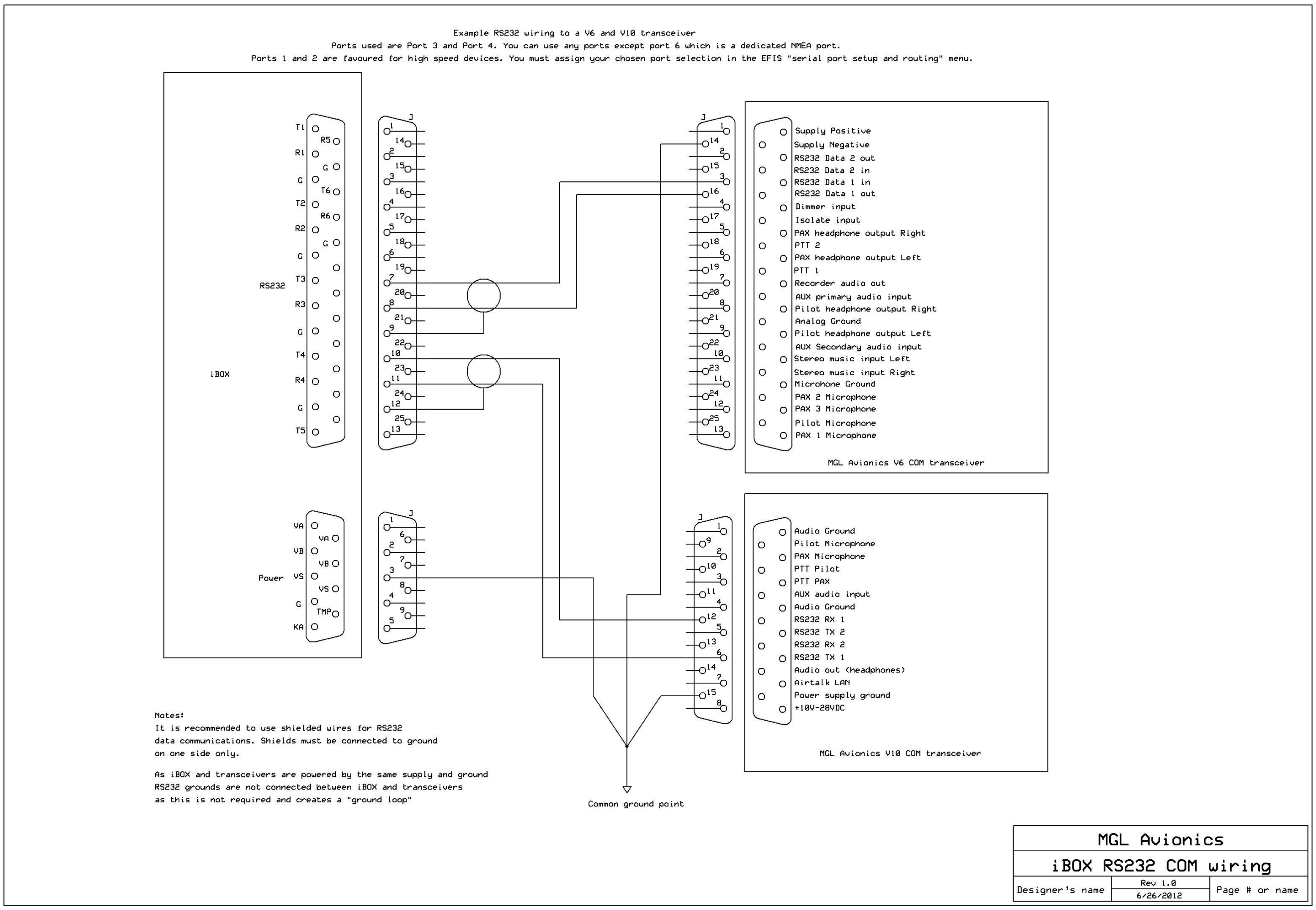
IBOX ARINC port RX 3 – Connect to the NAV radio data feed of the Garmin.

IBOX ARINC port RX 2 – This link is available for use as TCAS or TIS traffic information data feed. Please use RX 2 for this function even if you are not using RX 1 and RX 2.

IBOX ARINC port TX – This is the transmit output of the iBOX. Connect to the Garmin receive port 1.

Please consult the MGL/Garmin integration manual available on www.MGLAvionics.co.za (EFIS documents) for details on how to setup the EFIS and Garmin system.

Example iBOX RS232 wiring



This schematic shows RS232 wiring required if you would like to remotely set frequencies and control MGL COM transceivers. In this example we selected ports 3 and 4. You would need to select these ports in the EFIS setup menu (Serial port setup and routing menu).

Note the grounding. Everything needs to be wired to a common ground point using separate ground wires, even if they will run next to each other. This ensures correct grounding for all devices and prevents interference.

Also note that shielded wires are recommended for the RS232 wires. Please connect the shield on one side only to prevent ground loops. This also prevents currents flowing through the shield which may cause noise radiation.

Note: MGL transceivers may be fully remote controlled including setups, volume and squelch levels. Compatible transceivers from third parties can only set frequencies from the EFIS.