IEFIS MX1 Installation Manual

Preliminary document
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General

The IEFIS MX1 consists of one or more panels and optional interface and sensor devices as may be required by the application.

The iEFIS MX1 panel itself provides the following:

Portrait mode sunlight readable color display with projected capacitive touch panel.
4 clickable rotary controls assigned to various functions.
Micro SD card slot for file transfer and firmware updates as well as flight data recording.
Altimeter to 35.000ft with local pressure adjustment (QNH)
Low speed ASI sensor with pitot port and static port (shared with altimeter). Up to 200knots.
High speed ASI sensor with dedicated pitot port and static port. Up to 600knots. Ports can be shared with low speed sensor or used with dedicated probes depending on aircraft airflow.
Angle of attack sensor can be used with single ended or differential ports. It is also possible to use external AOA sources via a user programmable analog input (requires iEFIS Extender).
Built in AHRS using three axis gyroscope and three axis accelerometer. External AHRS sensors may be used in applications where it is not possible to use the internal AHRS.
Built in high grade WAAS GPS receiver with anti-jamming ability.
Built in "Black box" flight data recorder contains approximately the last 60 minutes of flight data.
Internal real time clock with optional automatic synchronization to GPS time.
Internal rechargeable battery for time and data keeping during power off time.
Internal battery NOT based on lithium technology.
4 x RS232 ports. With Extender a total of 8 RS232 ports are available.
CAN bus with CANFD operation for inter-panel communications.
Amplified Audio output for voice annunciation and system sounds.
Input for OAT sensor (LM335 based)
"Keep Alive" power input to assist internal power storage (rechargeable battery).

As of writing of this document the following MGL devices are compatible with the iEFIS MX1 system:

Up to 8 panels may be connected in a single system via CAN bus.

SP-6 CAN: Compass/Magnetometer (up to 2 units)
SP-7 CAN: AHRS (up to 4 units) - Note: in addition to built in AHRS.
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 and RDAC XF MAP: Engine monitoring interface (up to 4 units/engines)
RDAC XG: 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 V16: COM radio (remote control radio)
MGL N16: Navigation radio (VOR,ILS)
MGL T16: Mode-S transponder
MGL ECB system (up to 4 units, 48 breakers)

MGL Autopilot servos (Bank, Pitch, Yaw)
MGL/Trig TT21 and TT22 mode-s transponder
Sandia STX165 remote transponder
Remote transponders via MGL CAN bus interface (check for availability with MGL)
Remote COM radios via MGL CAN bus interface (check for availability with MGL)

MGL iEFIS Extender provides additional 5 RS232 ports, 8 Analog/Digital inputs, 4 user assignable outputs and 1 alarm output.

Additional iEFIS Extender may be connected to CAN bus providing a further 8 Analog/Digital inputs and 4 outputs.

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

Garmin SL40, GTR-200, GTR255 and compatible COM radio
Garmin SL30, GNC-255 and compatible NAV/COM radio
Traffic systems: GDL90 ADSB, FLARM
ADSB UAT receivers or transceivers via GDL90

External autopilots able to use RS232 NMEA feed for lateral navigation can be used as well for all GPS based navigation sources (except simulated VOR).

The rear panel

This image shows the rear of the iEFIS MX1 panel.
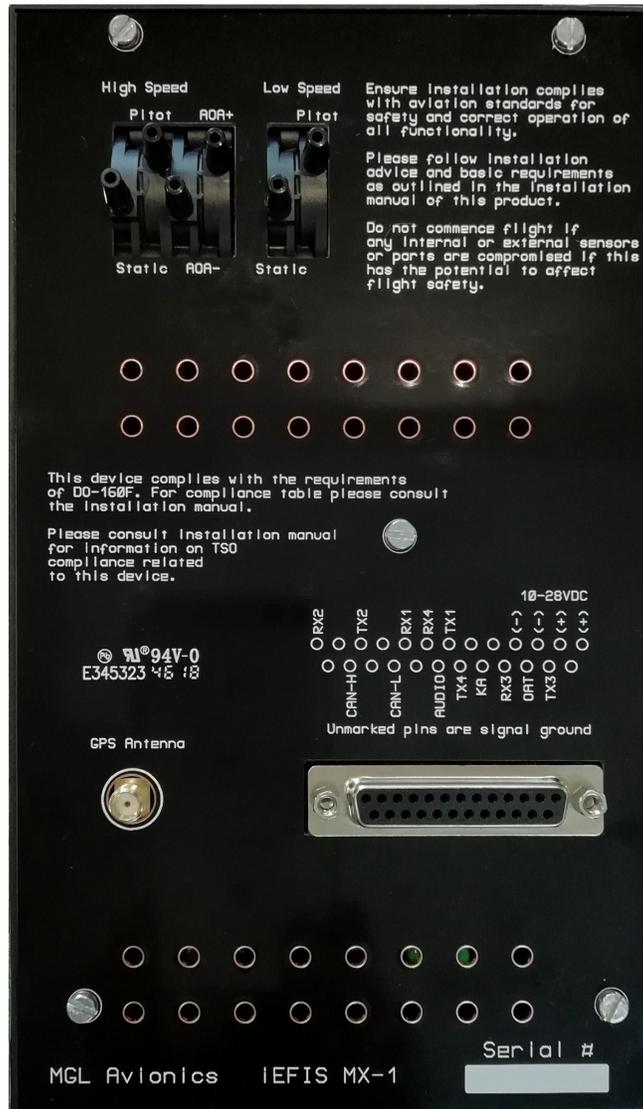
Ensure that ventilation holes on top and bottom are not blocked in your installation. These holes provide convection cooling for the internal electronics.

The rear panel provides a single DB25 female connector providing power input, CAN bus and four RS232 ports, audio output, OAT sensor input and Keep Alive power input.

A SMA female connector provides a 3V powered antenna input for a GPS active antenna.

Low and high speed ASI ports are provided with independent static ports and pitot ports. Low speed static port is also used for the altimeter. Finally a two port AOA sensor solution is provided.

Example system design
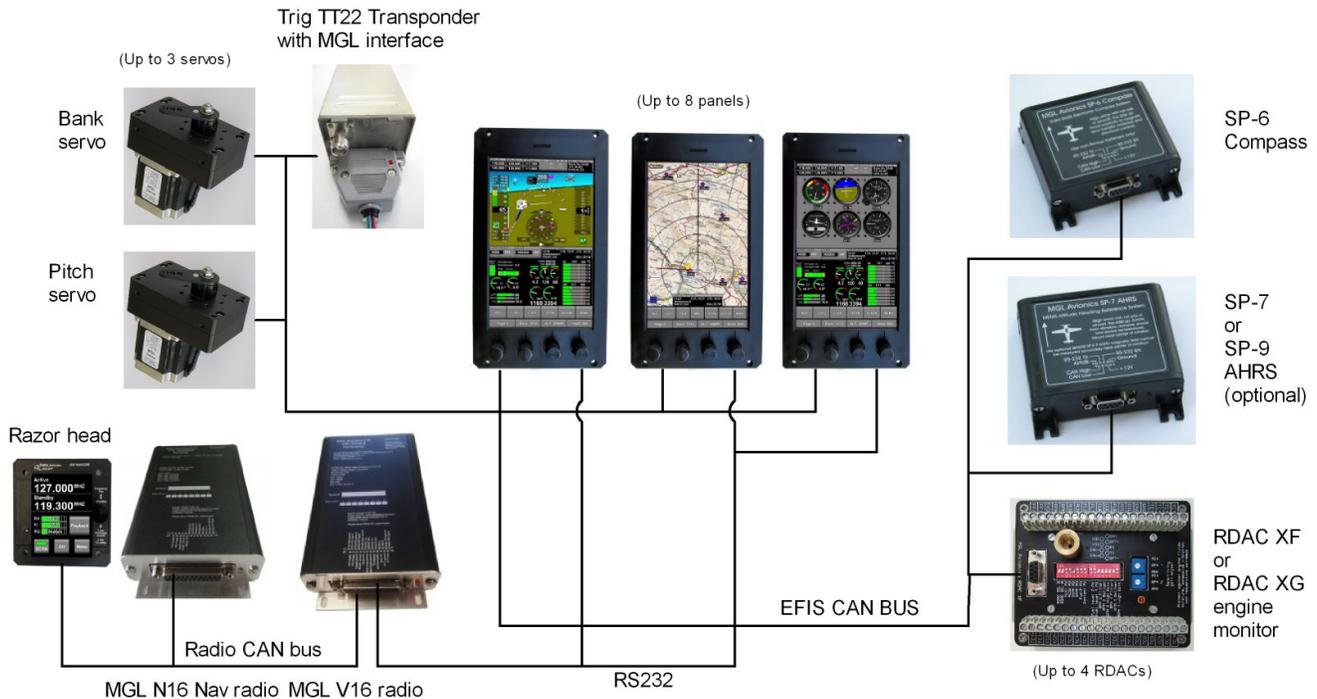
Example iEFIS MX1 system layout for a three panel solution, showing main communications bus connections.

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

Most MGL devices are connected to the MX1 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 ohms) while shorter runs (less than 9 ft) work happily with just a single resistor of the same value.

The CAN bus is wired to all three panels – the panels will use the bus to exchange information between each other – for example if you change local pressure on one panel the others will follow.

In such a system one panel is the master. This panel can perform setups to the various devices, runs the autopilot and generally controls everything. The other panels mostly "listen" to data but can ask the master panel to perform certain functions (for example engage the autopilot). Each panel is assigned an address from 1 to 8 in the operations setup menu. The lower the number the higher the priority. The panel with the highest priority assumes the master status. This is shown just next to the rotary control showing the current page selected on a panel. Each panel must have its own address.

Interestingly, it is possible to wire RS232 devices in parallel to all panels. Normally this is not possible as you may not connect two RS232 transmitters together. With the MX1 system

however only the master panel switches its RS232 transmitters on while the secondary panel(s) disconnect their transmitters (but leave the receivers connected so they can still see data).

It is quite possible to construct systems where RS232 devices are partially or fully local to panels as well. It just depends on the needs of the particular system.

Generally the CAN bus is connected to all panels so all devices can be shared. However it is of course possible to construct two independent systems, each with their own devices for redundancy purposes and private CAN bus runs.

The MX1 is well suited to simple single panel systems without further devices connected right up to highly complex multi-panel systems.

IEFIS MX1 Panel terms

Master panel

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

You can send the current setup of your master panel to connected slave panels using the "Broadcast setup" function in the setup menu. There is generally no need to configure each panel individually.

Secondary panel

All panels that are not "master" are "secondary". They still behave like normal panels but cannot configure the system. They do not actively navigate or control any connected devices. Should a "secondary" panel require an action to be performed (for example, change of a radio frequency), this request is sent to the "master" panel for execution.
"secondary" panels can be seen as "passive" - they can do certain permitted functions via the "master" panel and can monitor data as it flows on the CAN and RS232 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.

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 a 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.

Panel address is set in each panel using its "Operation setup menu".

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 "master" panel. You can easily identify the master panel – it shows the letter "M" (next to the page number selection on the page Rotary control. If only a single panel is used in a system this letter does not show).

Settings of your master 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) Tap on 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

Once you have completed basic setups, you can select your desired screen design. You may choose from the following options:

1) Use the built in screen designs and use the "Screen layout menu" menu to select appropriate engine and fuel system layouts.

2) Choose from provided alternative layouts if available. Each of these is provided as a "DFILE" layout - a simple, single file preinstalled on your internal SD card. Each of these files may provide a complete custom layout and may even provide several individual layouts within this file. You can select any of these options, if available, using the "Screen layout menu".

3) Install and use custom screen layouts provided by others.

4) Design your own screen layouts either by modifying existing screen layouts or starting from scratch. You can perform these tasks with the free MX1 Screen designer and simulator.

Please refer to the iEFIS alteration guide document for guidance on how to design your own screens.

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.

Setups are stored in an internal Flash memory device. You can export these settings for backup purposes or if you want to transfer settings to another EFIS.

All setups can be exported to a SETUP.DAT file on your external SD Micro card.

You can import settings from your external SD card as well.

Note that the import and export of the SETUP.DAT file is also functional on the MX1 Simulator and screen designer application allowing you to transfer setups in both directions.

It is highly recommended that you perform a backup of your system once everything is fully installed and configured.

System backup – cloning the internal disk

Your MX1 provides you with a function to clone the internal disk. This disk will hold information such as navigation databases, maps and flight plans. You will find the cloning function under System Setup Menu → System basic setup functions → SSD cloning and system restore menu.

Cloning the internal disk to an external SD Microcard makes a sector by sector copy of the internal disk so you have a faithful copy. This operation can take some time.

You will require a SD Micro card with at least 16GBytes capacity in order to perform the clone.

As alternative you can also use the internal File Manager from the menu to copy files to and from the internal disk.

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 "Master" panel. All other panels may have certain functions suppressed as they are not permitted to be executed in such a panel.

System setup menu	
→ Broadcast/Accept functions and setup	→ Flight data recording setup
→ Time/date/Hobbs setup	→ Voltage/Current setup
→ System units setup	→ Setup Autopilot (Internal AP)
→ System operation setup	→ Autopilot servo test & checks
→ Engine monitoring setup	→ Serial port routing/allocations
→ Fuel related setup	→ ADS-B setup menu
→ Flight instruments setup	→ Transponder setup menu
→ Analog inputs setup	→ COM radio setup
→ Digital inputs setup	→ Flap indicator and control setup
→ Flap warning setup	→ Pitch trim indicator and control setup
→ Enable AOA calibration functions	→ Roll trim indicator and control setup
→ Setup AHRS sensor	→ Tone generator setup
→ Setup compass sensor	→ Equipment enables
→ Rotor craft instruments setup	→ Screen layout setup menu
→ MGL ECB Breaker setup	→ Upload firmware to MGL device
→ ECB Alarm enable setup	→ Load Extender firmware from SD card
→ Setup Navigation	→ System basic setup functions
→ Setup GPS and NMEA port operation	→ Internal Sensor setup
→ ILS/GLS/GVOR setup	
→ Traffic monitoring setup	

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.

Fuel related setup

In the fuel related setup menus you will find setting for physical fuel tanks (based on level senders), virtual fuel tanks (based on fuel flow), Fuel flow setup and Fuel pressure measurement setup.

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 inputs setup

Here you can setup names for your 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.

Inputs, when used as digital inputs can be assigned a variety of functions such as page switching, autopilot engage and many others.

Each input may be used either in an analog fashion or a digital state.

Note: Analog/digital inputs require the connection of an optional iEFIS Extender module.

Digital outputs setup

Here you can setup names and functionality for your digital outputs. These outputs can be used to switch power to devices or utilized for other purposes.

Note: Digital outputs require the connection of an optional iEFIS Extender module.

Flap warning setup

This section allows you to configure a flap position waring indicator. This can trigger audio warnings if your airspeed is too high for a given flap position. This requires use of a flap position sensor connected to the EFIS.

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.

MGL ECB Breaker setup

Here you can configure a MGL Electronic circuit breaker system if used.

ECB Alarm enable setup

Here you can enable alarms attached to circuit breakers.

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.

ILS/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.

Traffic monitoring setup

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

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.

Flight data recording setup

Here you can create an empty flight data recording file on an inserted SD card and enable flight data recording. Note that this only applies to external flight data recording. The internal flight data recording is always active if flight detect setup detects an active flight.

You can also copy the internal recording to the external SD card here.

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 ports 1 to 4 are internal ports. These are mandatory for use for certain data connections such as GDL-90 ADSB.

Should you have an iEFIS Extender connected you must use port 4 for the extender. In this case your internal ports are 1 to 3 and ports on the extender are 4 to 8.

After you have selected ports for your desired functions, please restart the system so changes are applied system wide. You must exit the menu system completely to store any changes before cycling power to restart the system.

ADS-B 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.

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.

Tone generator setup

Here you can enable a Vario tone generator (Vario tones are often used on gliders to assist the pilot with vertical speed information). Note that once enabled here there is a second switch in the action menu where you can switch the vario tone on and off as needed.

You can also configure the built in AOA tone generator. Note that it is also possible to customize tones and sequences based on AOA using a small text file that describes the desired tones. The file is described in the appendix.

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.

Internal sensor setup

This menu gives you an interface to the internal sensors. Here you can adjust calibration of pressure sensors such as altimeter and ASI sensors as well as OAT sensor adjustments.

Upload firmware to MGL Device

Using this function you can update the firmware of connected MGL devices via the CAN bus or RS232 port. Firmware files are available for download from the MGL Avionics website. They are copied onto the external SD card and this function can then be used to transfer the firmware to the relevant device.

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 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 CAN bus. 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. You do this in the Broadcast/Accept functions and setup menu

Engine monitoring setup

The engine monitoring setup is available from the Setup menu. It is recommended that you perform
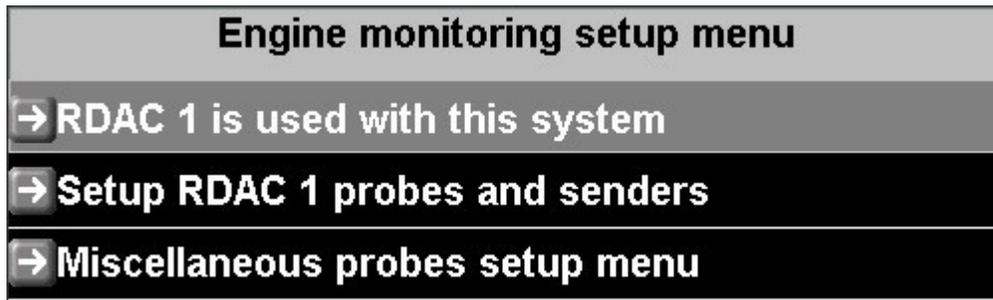
Select how many RDAC units (up to 4) are connected to this system. Typically you would have one RDAC per engine but you can also use more than one RDAC for a single engine. Use of the various probes and senders would be determined by your screen design.

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.

RDAC 1 setup menu
→ AUX2 temperature setup menu
→ Manifold pressure setup menu
→ Temp/TC probe 1
→ Temp/TC probe 2
→ Temp/TC probe 3
→ Temp/TC probe 4
→ Current sensor setup menu
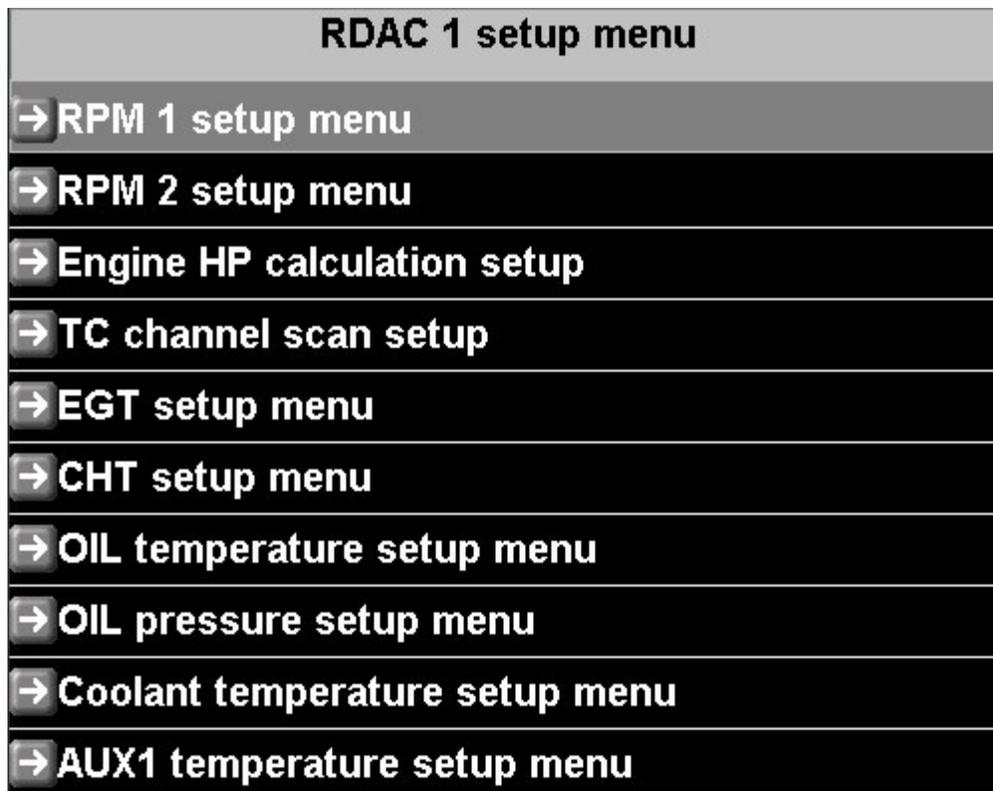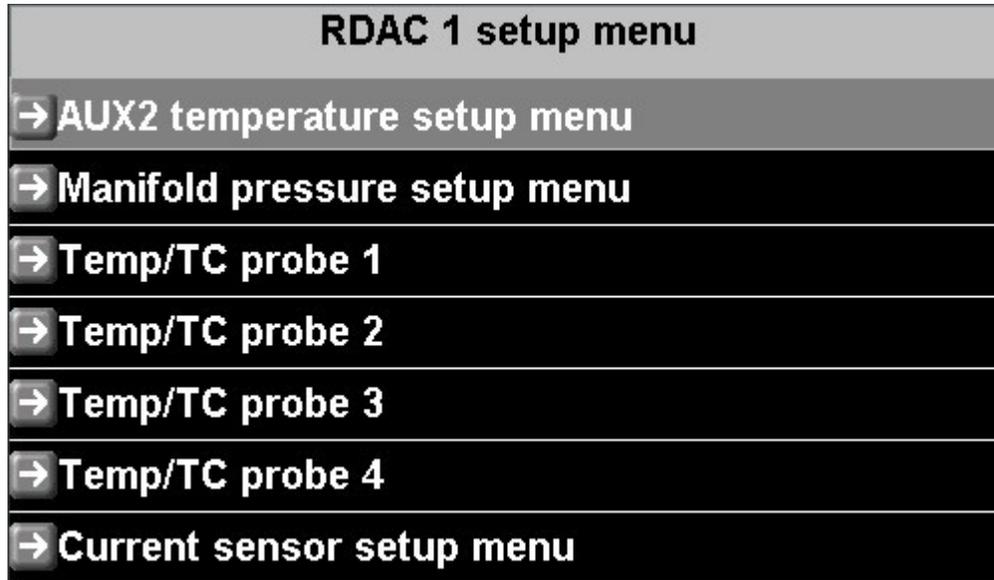
RPM 1 and RPM 2 setup menu

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.

Engine HP calculation setup menu

→ Engine HP calculations enabled

→ Max sea level HP at max MP: 260

→ Max sea level RPM at max MP: 2700

→ Max sea level MP at rated RPM: 968mB

→ Engine factor 1: 1.2100

→ Engine factor 2: 1.0450

→ Engine factor 3: -0.6950

→ Engine factor LOP: 0.2000

HP RDAC1 :267, 103%
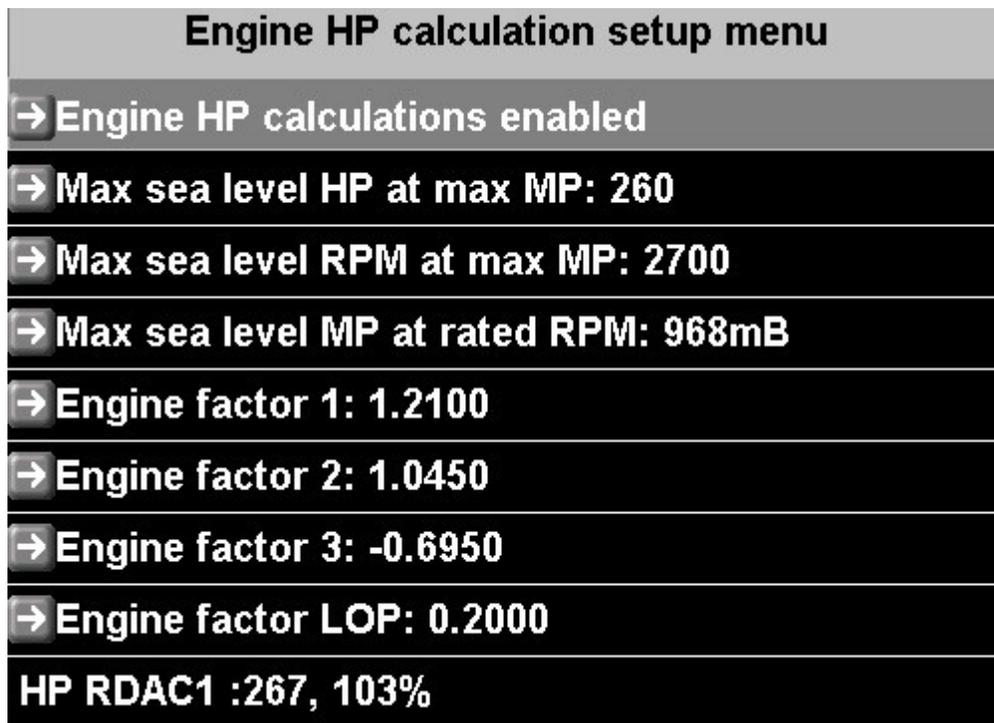
Typical engine HP calculation screen. Please consult documentation for suitable values for your aircraft. The above values are typical for a Lycoming O320.

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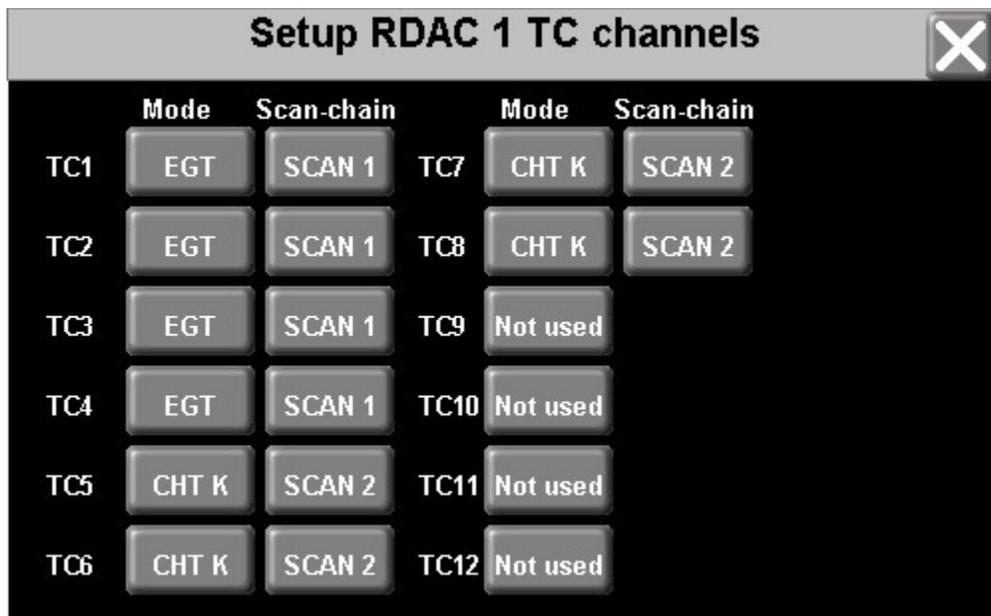
This setup is relevant for your EGT and CHT functionality. The RDAC has 12 thermocouple inputs. Here you select which channels are used for EGT, which channels are for EGT and you can also assign up to 4 unrelated TC channels for general purpose temperature monitoring functions.

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 12 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.
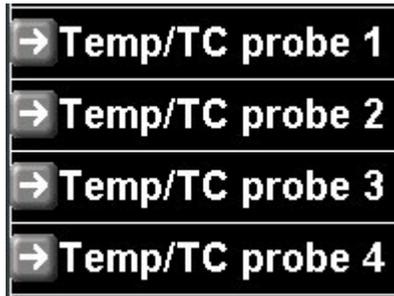
In order to display temperature values on the screen you need to create a custom screen design and place indicators and readouts as required for your application.

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

EGT setup menu

- → Highest temperature for display: 900
- → Alarm temperature: 850 ☑
- → Caution temperature: 800 ☑
- → Caution low temperature: 450 ☐
- → Alarm low temperature: 400 ☐
- → Lowest temperature for display: 300
- → Alarm enabled ☑

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

```
                    OIL temperature setup
    → Probe type: Standard NTC

    → Highest temperature for display: 150
    → Alarm temperature: 135                          ☑
    → Caution temperature: 130                         ☑
    → Caution low temperature: 70                      ☐
    → Alarm low temperature: 50                        ☐
    → Lowest temperature for display: 40
    → High Alarm disabled                              ☐
    → Low Alarm disabled                               ☐
```

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

```
                    Oil pressure setup
    → Probe type: Rotax 4-20mA
    → Probe pressure range: 10.0 Bar

    → Highest pressure for display: 10.0 Bar
    → Alarm high pressure: 8.0 Bar                     ☐
    → Caution high pressure: 7.0 Bar                   ☐
    → Caution low Pressure: 2.0 Bar                    ☑
    → Alarm low Pressure: 1.5 Bar                      ☑
    → Lowest pressure for display: 0.0 Bar
    → High Alarm disabled                              ☐
```

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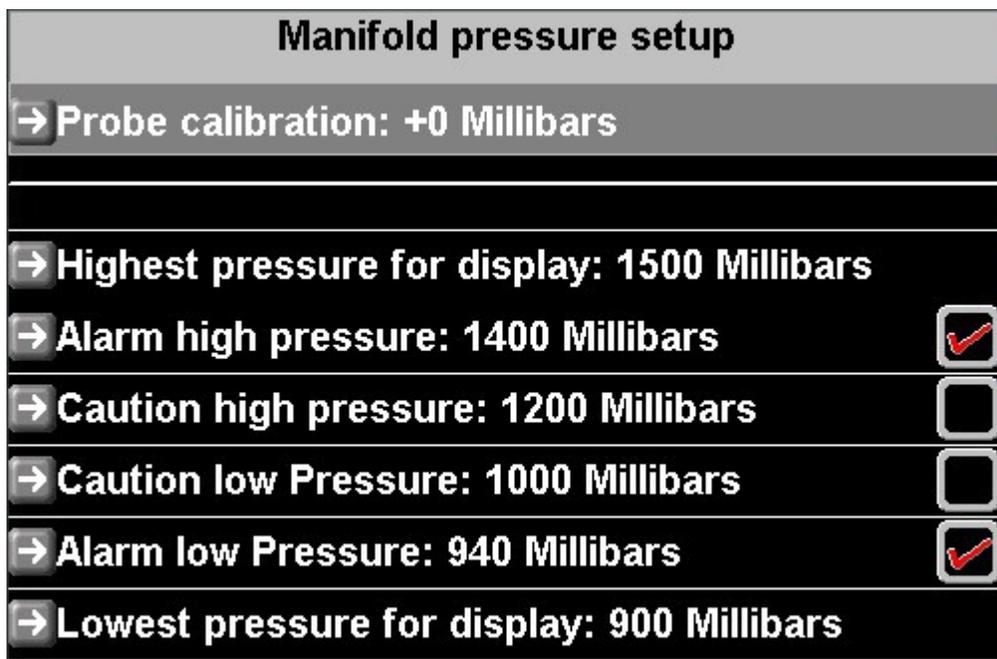
Manifold pressure is measured by the built in pressure transducer of the RDAC XF MAP engine monitoring module.

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 to 12 setup

You can utilize up to 12 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
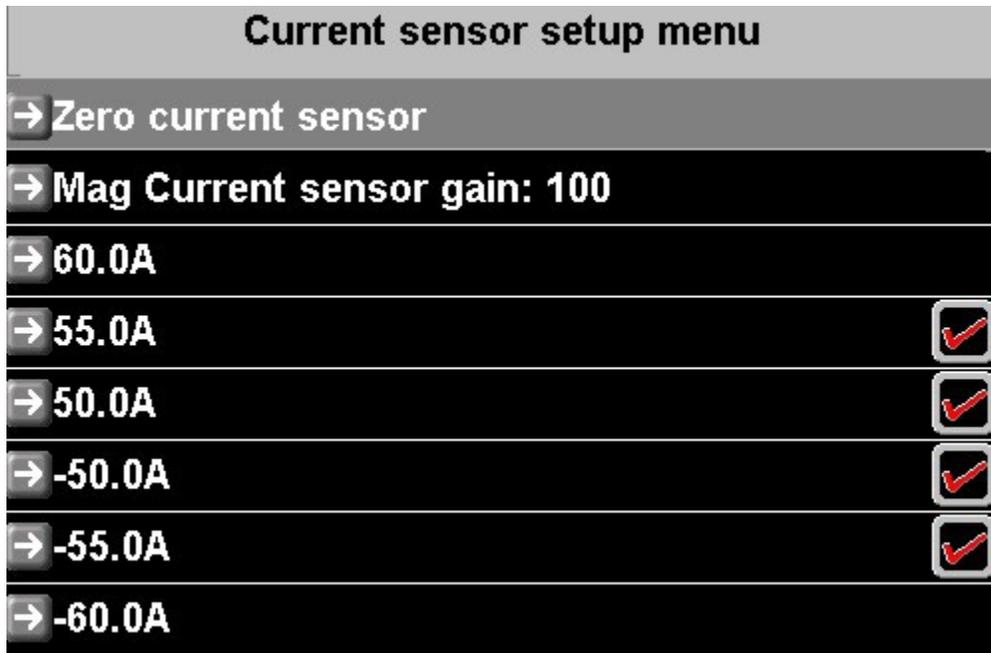
You can connect a current sensor to the RDAC XF current monitoring input.

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 related setup

Fuel related setup menu

→ Fuel range/endurance setup

→ Setup RDAC 1 fuel probes and senders

→ Fuel level sender damping: Off
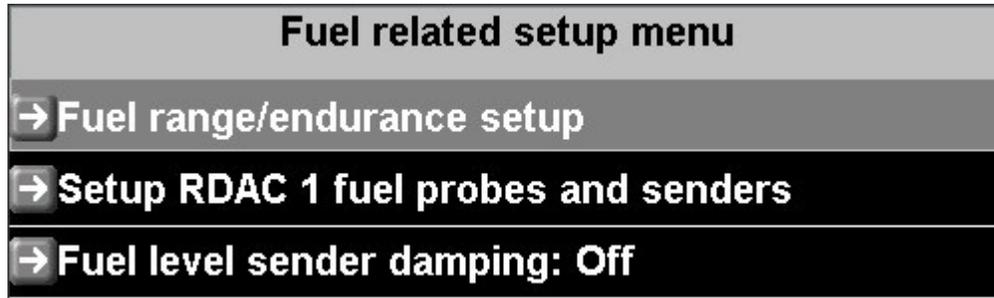
Fuel range/endurance setup

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).
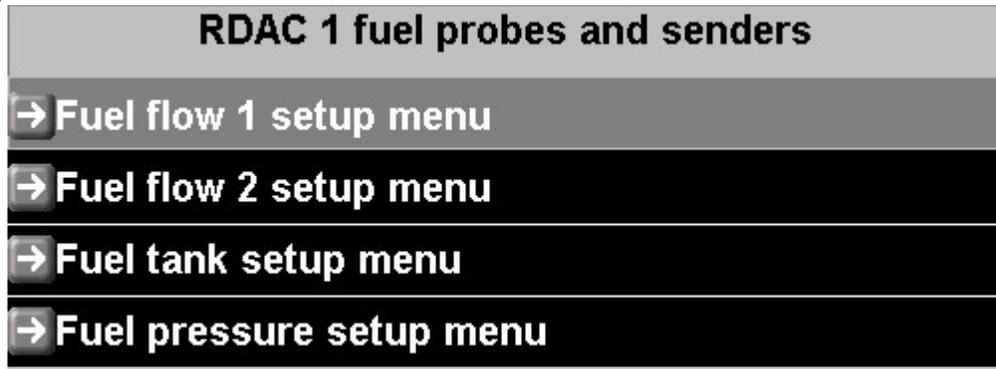
Fuel flow 1,2 setup menu

Fuel flow 1 setup menu

→ Flow sender type: Turbine
→ Flow sender K-Factor: 0
→ FF1 and FF2 are independent flow systems
→ Highest flow for display: 50 Liters
→ Fuel flow high alarm: 35 Liters
→ Fuel flow high caution: 30 Liters
→ Fuel flow low caution: 6 Liters
→ Fuel flow low alarm: 5 Liters
→ Lowest fuel flow for display: 0 Liters

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

Fuel tank setup menu

→ RDAC 1 virtual tank 1 size: 50 Liters

→ RDAC 1 virtual tank 1 low: 10 Liters ✔

→ RDAC 1 virtual tank 2 size: 50 Liters

→ RDAC 1 virtual tank 2 low: 10 Liters ✔

→ RDAC 1 tank 1 size: 50 Liters

→ RDAC 1 tank 1 low: 10 Liters ✔

→ RDAC 1 tank 1 calibration

→ RDAC 1 tank 2 size: 50 Liters

→ RDAC 1 tank 2 low: 10 Liters ✔

→ RDAC 1 tank 2 calibration
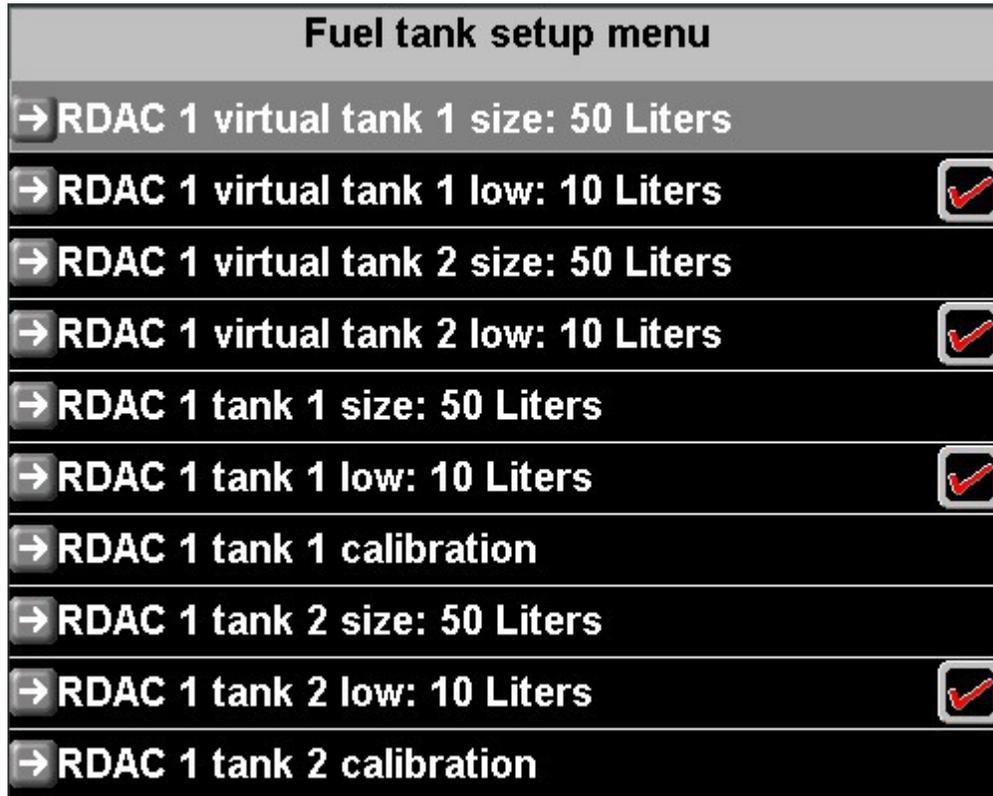
This menu provides the functions needed to set up your physical and virtual fuel tanks.

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.

Fuel Tank calibration RDAC 1 tank 1

Current tank raw level reading: 0

→ 0 Liters level at reading: 1198

→ 10 Liters level at reading: 812

→ 20 Liters level at reading: 650

→ 30 Liters level at reading: 541

→ 40 Liters level at reading: 463

→ 50 Liters level at reading: 287
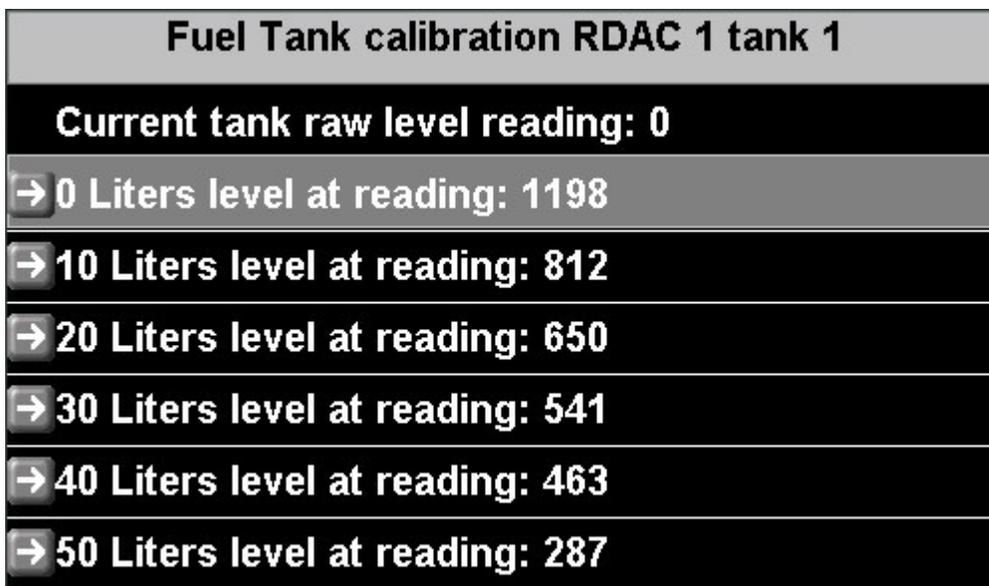
A tank calibration consists of a six point calibration table. Perform the calibration **AFTER** you have set the correct tank size.

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

→ Flight instruments setup

Flight instruments setup

→ Airspeed indicator setup

→ VSI is normal

→ VSI TE compensation factor: 33

→ VSI bar range 1500ft/min 7.5m/s

→ AOA probe type: Relative (1 port)

→ GForce levels setup menu

Airspeed indicator setup

ASI setup. All speed units in Miles

→ ASI instrument scale (round): 120

→ ASI instrument resolution (tape): 25 Pix/10

→ Use ambient temp sensor for TAS

→ ASI Vne (never exceed speed): 112

→ ASI Vno (max manouvering speed): 100

→ ASI Vf (max flap speed): 70

→ ASI Vs1 (Stall, clean config): 40

→ ASI Vs0 (Stall, landing config): 31

→ Vne: Alarm disabled ☐

→ Vs: Alarm enabled+Audio+iBOX alarm out ☑

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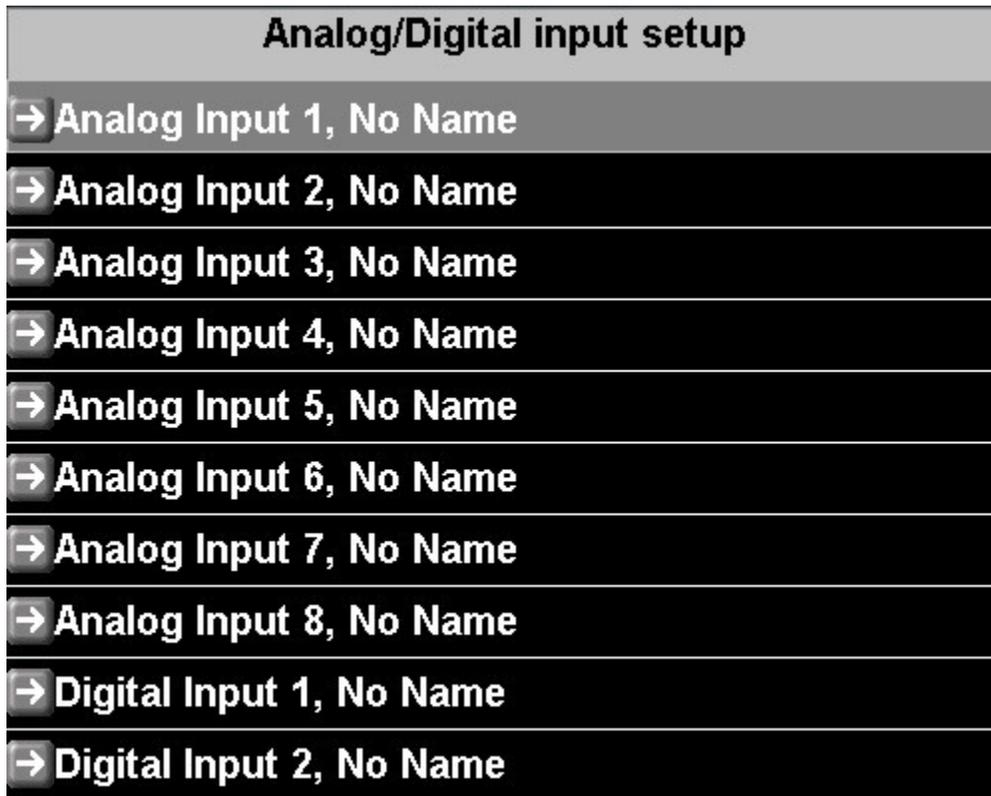
The Extender, if you have one connected provides 8 user inputs. Each input can be used in analog or digital fashion. A digital input is on or off. The analog input returns a an analog value of between 0 and 4095 for a voltage applied from 0 to 16V.

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".

Note: You can connect a further Extender to the CAN bus. This gives you a further 8 analog/digital inputs and 5 outputs.

Setting up the analog channels

Analog input 1 setup

→ Name for this input: No Name

→ Highest value for display: 4095

→ Alarm value: 4000

→ Caution value: 3000

→ Caution low value: 2000

→ Alarm low value: 1000

→ Lowest value for display: 0

→ Current raw value from iBOX: 0

→ Multiply with 1

→ Then divide by 1

→ Then add 0

→ Use 0 decimals in final value

→ Current scaled value: 0

→ High Alarm enabled+iBOX alarm out ✓

→ Low Alarm disabled

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

Digital input 5 setup

→ Name for this input: No Name

→ Active level is high, Current: Inactive

→ Alarm disabled

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.

Flap warning setup

Flap warning setup

→ Flap pos 1 warning is enabled

→ Flap warning 1 if airspeed above 85mph

→ Flap pos 2 warning is enabled

→ Flap warning 2 if airspeed above 65mph

→ Flap pos 3 warning is enabled

→ Flap warning 3 if airspeed above 55mph

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.

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.

Flaps indicator and control

→ Data source: MGL FT controller

→ Reading: 0

→ Flaps up position: 100

→ Flaps position 1: 133

→ Flaps position 2: 166

→ Flaps down position: 200

→ Move flaps up

→ Move flaps down

→ Flap control fault status: No fault

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.

Flaps indicator and control

→ Data source: IBOX analog 1

→ Reading: 0

→ Flaps up position: 100

→ Flaps position 1: 133

→ Flaps position 2: 166

→ Flaps down position: 200

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.
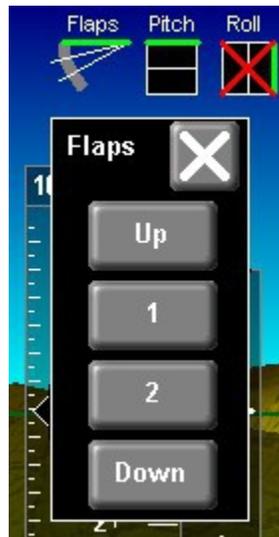
Pitch trim indicator and control

Pitch trim indicator and control

→ Data source: IBOX analog 2

→ Reading: 0

→ Pitch trim up position: 100

→ Pitch trim neutral position: 150

→ Pitch trim down position: 200

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.

Pitch trim indicator and control

→ Data source: MGL FT controller

→ Reading: 0

→ Pitch trim up position: 100

→ Pitch trim neutral position: 150

→ Pitch trim down position: 200

→ Move pitch trim up

→ Move pitch trim down

→ Pitch trim control fault status: No fault

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.

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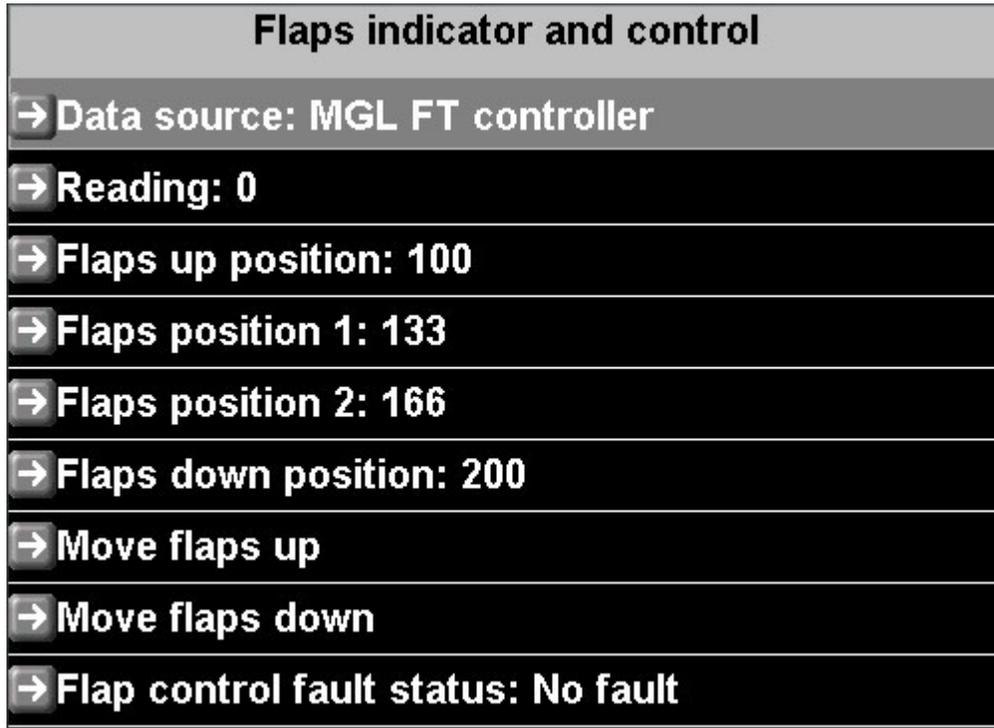
If you have a MGL Avionics Flap/Trim control module connected to the CAN bus, you will connect the roll trim position sensor to the control modules position sensing port. You can view the measured position value at the "Reading" entry.

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.

Internal 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.

Altimeter offset calibration

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

This calibrates the offset of the altimeter. It is usually performed at close to sea level if possible or at your home airfield base. When you perform this calibration the MX1 also takes note of the ambient pressure you are performing the calibration at. This is used for the altimeter gain calibration. If you want to perform the gain calinration you must first perform the offset calibration. The gain calibration should be performed at a much higher altitude using a calibrated Pitot/Static reference source. Note: Gain calibration is only performed under exceptional circumstances.

ALT Sensor gain

This calibration is performed as a percentage where 100.00% is nominal (no deviation from sensor factory calibration). Using this calibration you can perform fine adjustments to the sensor gain at an altitude that must be very different to that used to perform the altimeter offset calibration.

Example: Offset calibration close to sea level (under 1000 ft) and gain calibration at 20.000 ft using calibrated pitot/static test set. You may use different altitudes for both calibrations and it is OK if the altitude used for gain calibration is less than that used for the offset calibration. Try and have at least a 10.000ft difference between the two calibration points to allow sufficient resolution.

Using the ALT sensor gain and offset calibration you can perform a two point calibration of the altimeter.

Note: In most cases the ALT sensor gain is set to 100.00% which then equals the calibration performed at the factory where the sensor was created (this calibration is stored permanently in the sensor as part of the sensor chip manufacturing process).

Zero ASI and AOA sensors

This important function is performed after installation of the MX1 is completed. The pressure sensors used are extremely sensitive and will react even to changes of orientation. Once your MX1 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 the first 6 months to cancel out the effects of aging on the sensor membranes and then at every annual maintenance interval.

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.

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

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".

Internal IMU setup

This allows access to basic calibration and setup of the internal AHRS:
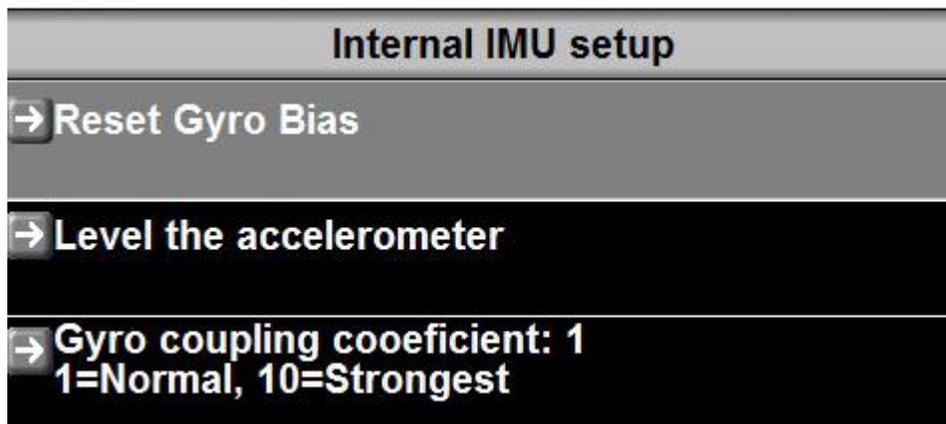
Reset Gyro Bias

Your AHRS gyros bias point is the point where your gyros report that you are not rotating around any axis. Gyro bias may drift over time as the gyro chip ages. This function resets the bias to the current reading and is performed with the aircraft on the ground, preferably in a hangar with no wind rocking the aircraft. The aircraft may be in any attitude but must remain perfectly still during this procedure. After you activate this procedure it takes about 30 seconds to complete it. Keep the aircraft perfectly still during this operation. You can check the results of this in the AHRS diagnostics (look at the bank, pitch and yaw rates reported with the aircraft at rest – the numbers should bounce around +/-0 degrees per second. Sensor noise is typically around +/-0.1degrees/second at ambient temperature.

Level the accelerometer

This function can be used to level the AHRS. It levels bank and pitch and sets the Z axis (up

down) to 1G. Note that this function is different to the similar function in the AHRS setup menu (also under system setup).

The functions in the AHRS setup menu are used to cancel small installation errors or allow a larger pitch tilt to be set for installation. These functions do not affect sensor calibration at all.

The accelerometer level function here MUST be performed with the EFIS perfectly level, i.e. display in normal orientation at 90 degrees from the horizontal in both pitch and bank. This function "tweaks" the accelerometer sensor using the Earths gravity as a reference.

This function takes around 10 seconds to execute. Keep the EFIS perfectly still until completed.

Note: The EFIS will refuse to perform this operation if it detects a flight (airspeed not zero or flight logging active) or if real EFIS bank or pitch angle is greater than 10 degrees.

Gyro coupling coefficient

This is a number from 1 to 10. "1" is the default.

This number determines how "strongly" the AHRS will force the gyro derived horizon estimate to coincide with that of the accelerometer based level calculations which are based on gravity.

"1" causes a very slow correction. This is the normal state and used most often.

"10" is the highest correction speed. This is usually used if the AHRS is used in unfavorable conditions.

Background:

Gyros can only tell you if you are rotating around any axis (you have three of them). Gyros cannot tell your attitude, they can only tell you how your attitude is changing.

Accelerometers can tell you your attitude – but only if you are not accelerating. That includes a turn as this involves acceleration (constant change of direction). In addition accelerometers will react to any movement of your aircraft caused by turbulence etc.

So – basically accelerometers can sometimes tell you your attitude while gyros can tell you how your attitude has changed – but with errors as measurements are never 100% accurate – so the longer you rely only on the gyros the worse it gets.

To a large extent the AHRS can estimate accelerations acting on your aircraft as it knows the aircraft's velocity. This means it can estimate a reasonably valid attitude from the accelerometers that is "noisy" even in accelerated flight. For this to be possible it has to assume how your aircraft moves through space. So it is mostly correct but sometimes not.

The coupling coefficient allows you to trade between the two.

Usually a panel mounted AHRS is affected by vibrations from engines (gyros don't like vibrations). This is the largest error source for a typical AHRS. If your installation suffers from that a higher coupling number may assist as gyro errors are larger than normal.

If this does not help you will have to either try and reduce vibrations affecting the panel or install an external AHRS like the SP-7 or high grade SP-9. This allows locating the AHRS in a more suitable and protected area. If the MX1 detects an external AHRS it will automatically

use it. External AHRS is connected onto the CAN bus.

Load Extender firmware from SD card

From time to time new firmware for the iEFIS Extender 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 Extender connected to a RS232 port. The new firmware will be used by the Extender once the firmware has transferred successfully. The Extender will restart and be offline for a few seconds.

Note: You can only update Extenders on the RS232 link (on RS232 port 4). Should you have a second Extender connected to the CAN bus to increase the number of analog channels available you will need to temporarily move it to the RS232 port for update if needed.

Serial port routing/Allocations

→ Serial port routing/allocations

The MX1 provides 4 serial RS232 ports. If you are using an iEFIS Extender this is connected to RS232 port 4 and the Extender itself has 5 RS232 ports leaving you with a total usable number of ports of 8. To enable the Extender you select it in the Equipment enables setup menu. You do not configure the extender in this menu.

RS232 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 and vs versa.

MX1 RS232 ports 1 to 4 are high speed ports. These can be used for any device, including low speed.

High speed devices cannot be connected to the Extender if you have one fitted.

High speed devices:

ADS-B receiver/transceiver, MGL blackbox data feed

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.

Serial port routing/allocations

→ RS232 port 1: MGL COM 1 radio

→ RS232 port 2: MGL COM 2 radio

→ RS232 port 3: FLARM Traffic system

→ RS232 port 4: ADS-B GDL-90
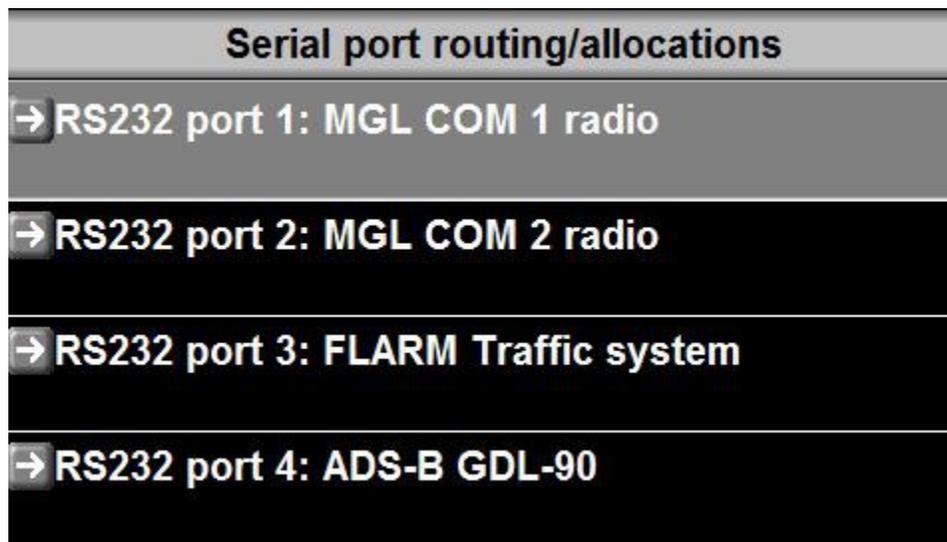
Flight data recording setup

The MX1 system supports three different methods of flight data recording, commonly referred to as "black box flight data recording".

1) Internal recording. Each MX1 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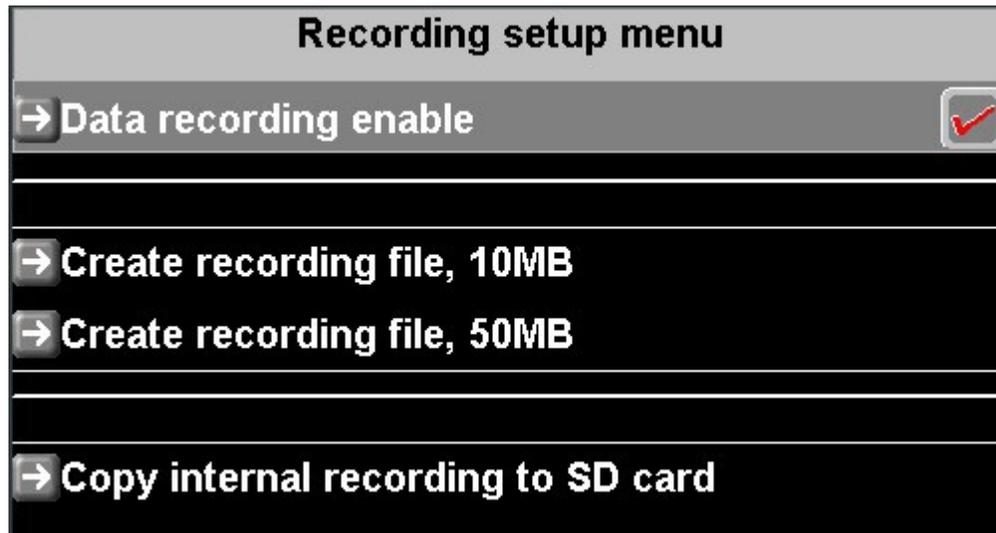. Recording files are simply large, fixed sized files starting with all bytes in the file set to zero. Recording commences at the file start and wraps back to the beginning when the end of the file is reached. Fixed size files are well suited to SD card as there is no wear on the directory structure 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.

Setup GPS and NMEA port operation
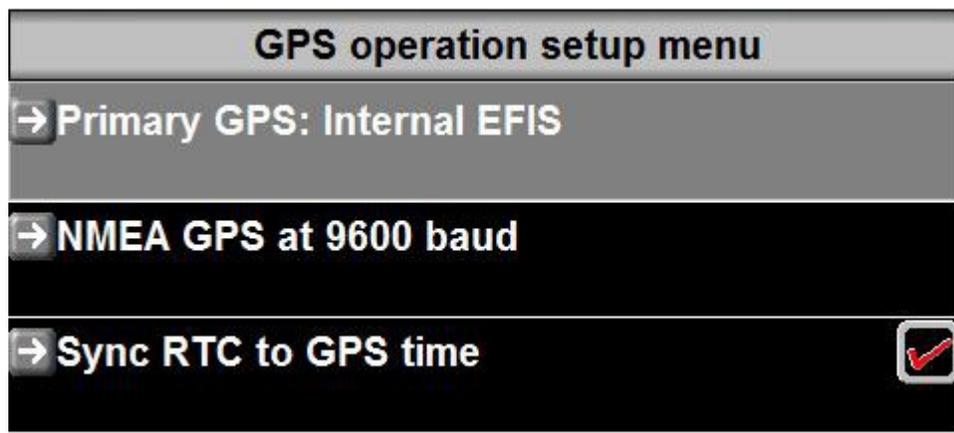
Selecting the GPS source

You can select from three GPS sources:

a) Internal GPS refers to the GPS engine in the MX1. This source is qualified to SIL/SDA of 1/1 according to the requirements of TSO-C199 and is RAIM capable.

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

c) SP-12 GPS connected via CAN bus. This External GPS provides a TSO-C199 GPS source qualified to SIL/SDA of 2/3.

It is recommended to use the internal GPS source if possible. It provides the best performance as a high quality GPS engine is used.

NMEA GPS at...

If you dedicated a RS232 port as NMEA port you select the baudrate to use here. The MX1 will continuously transmits a number of standard NMEA sentences on this port. You can choose the baudrate of this port from 4800, 9600,19200,38400,57600,115200 bits per second. The baudrate selection must be compatible with that selected on the receiving device.

NMEA port output messages

The NMEA port on the iBOX outputs the following messages:

GPGBS, GPGGA , GPGSV, GPGSA, GPGLL, GPRMB, GPRMC

Sync RTC to GPS time

Tick this box if you would like your internal real time clock to be synchronized to GPS time. Your UTC offset entered into the "Common Tasks menu" will be taken into account. Synchronization happens about one minute after a valid GPS fix to allow time correction data to be received from the satellites as the actual time sent has now drifted significantly due to relativistic effects.

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.

GPS redundancy

The MX1 will use your choice of primary GPS as its preferred GPS source, however if no valid position is available from this source it will attempt to obtain a position from an alternative source if one is available.

The following priority scheme is used:

Primary is Internal GPS

First alternative: CAN/TABS

Second alternative: NMEA

Primary is NMEA GPS

First alternative: Internal

Second alternative: CAN/TABS

Primary is CAN/TABS GPS

First alternative: Internal

Second alternative: NMEA

GPS and ADS-B

Please refer to the separate document "iEFIS GPS.pdf" from the MGL Website with more in-depth information about the GPS system.

Please refer to the separate document "ModeS-ADSB.pdf" from the MGL Website for detail information on how to use the SP-12 GPS module with an iEFIS and a compatible mode-s transponder for ADS-B compliance.

Screen layout setup menu
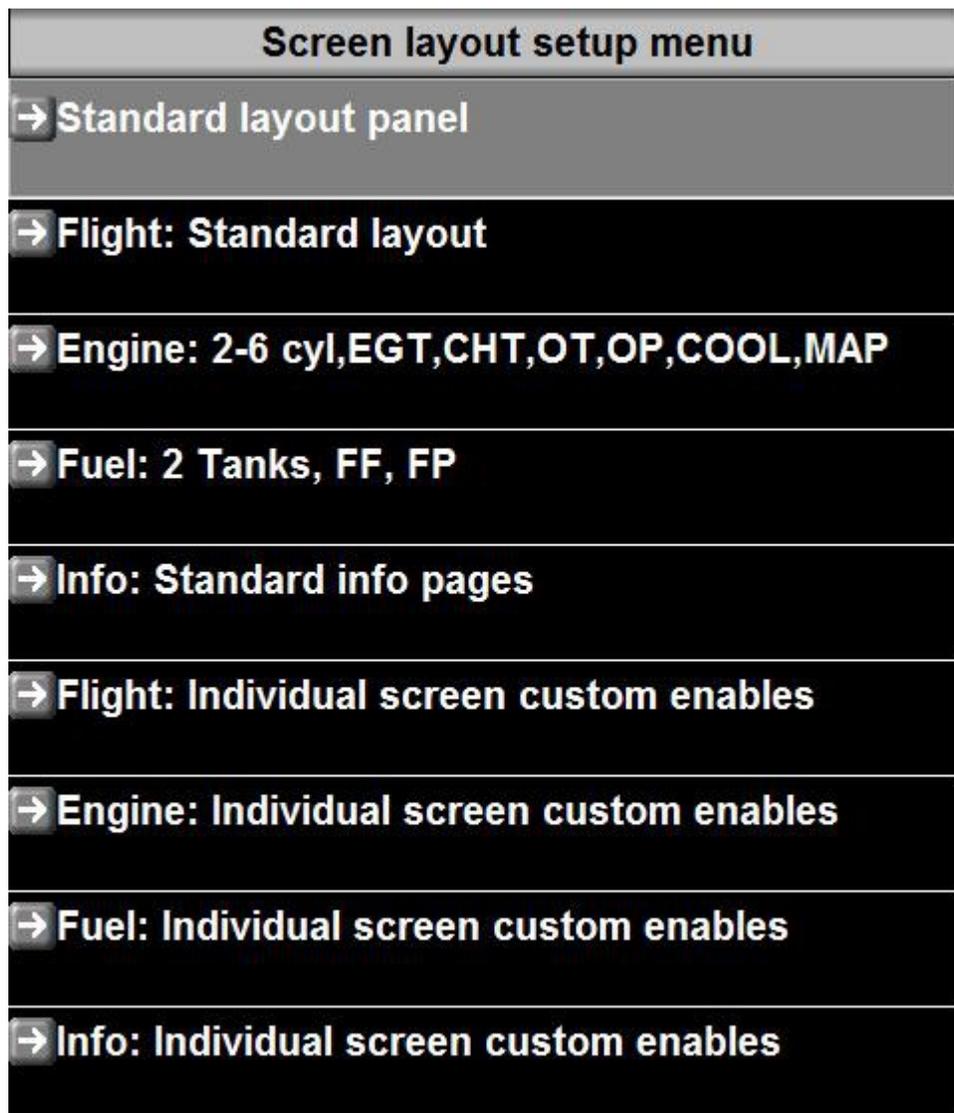
This menu allows you to select from a number of screen layout options that are built into your MX1 or you can select to use your own custom screen layouts.

For information on how to create your own screens or modify existing screens please read the "iEFIS alteration guide.pdf" document available from the MGL Avionics website.

There is also another useful document called "MGL iEFIS Rotor craft setup.pdf". Even if you do not have a rotor craft – this document shows very nicely how to create a rotor craft instrument and add it to a page from start to finish.

A brief description of the screen system

Each screen is made up of "items". Items are collected in "screen files". Each page is made from one or more screen files. The filenames of the screen files tell the EFIS which page the file is for and what the function of the items in this file are.

Screen files are:

FlightN.sdf
EngineN.sdf
FuelN.sdf
InfoAN.sdf, InfoBN.sdf,...

The letter "N" in the above list is a number from 1 to 9. This is the page this file is to be used on.

For a page to be visible the file "FlightN.sdf" for that page must exist, even if it is empty.

Items in a screen file are drawn from first item to last in that order. That can sometimes be used to create special effects.

Screen files are created and edited using the MX1 Screen designer and simulator application that can be downloaded from the MGL Website.

Screen files can be created from scratch or you can modify the built in screen files (The screen designer has a function where you can extract the current selection from the layout setup menu into editable screen files.

Screen files are created in your simulators currently active project in the "Screens" folder. The same folder also exists on your MX1 EFIS. Once your design is done – all you need to do is copy the screen files from your screen designer to your EFIS using an SD Micro card. The MX1 has a convenient "install screen files" function in the "Installation setup menu" for this or you can use the built in file manager.

It is also possible to build a "Dfile.bin" file using the screen designer. This is a powerful way to replace the built in sceen system including user selectable options.

Note that the "Script library" option described in the iEFIS Alteration guide does not apply to the MX1.

Using the Screen layout setup menu

The built in system offers only the "Standard layout panel" so no further selections are possible here. An external dfile.bin system if installed can offer more than one layout option.

For Flight you can opt to select the built in Flight screen design or custom for all pages.

For Engine and Fuel you have several built in options to choose from or you can select custom for all pages.

For Info you have the option of using the built in screen design or custom for all pages.

In addition to the above, you can also choose to used custom screens on a per-page bases using the "Individual screen custom enables".

All built in Engine and Fuel system choices are based on a single RDAC (engine monitoring device). The MX1 however can support up to four of them. In these cases you would create custom screens for engine monitoring.

Upload Firmware to MGL Device

This menu function allows you to upload firmware revisions to compatible MGL devices such as COM and NAV radios, various sensors, ECB, Flap and trim controllers etc.

Devices can be located on the CAN bus or on RS232 ports.

Firmware updates are downloaded as single file. For example the update file for a SP-12 GPS module is "SP12Firmware.bin".

The firmware file is copied into the root folder of an SD-Micro card. Using this function you can then select the file and the EFIS will attempt to locate the device. If there is an option of more than one device of the same type you will be asked to choose one.

If the update device is connected to an RS232 port you will be asked to remove and apply power from the device during the update procedure so make sure you can do this.

Should you have an update file for a device, the device is connected and functioning but the EFIS update program cannot find the device it may be that your device is an older version that does not have the ability to be updated via the EFIS. In this case you may have to consider having it updated by MGL Avionics or one of its technical support locations should this be required.

Rear panel connections

GPS Antenna

A standard SMA female connection is provided for the GPS antenna. The antenna type required is an active GPS antenna powered by a DC voltage of 3V-3.6V. Please mount the antenna in the correct orientation facing the sky in an area where visibility is not restricted by

any conductive surfaces or materials that attenuate RF signals. The antenna should also be installed as far from any potential interference sources as possible.

Do not shorten or lengthen antenna cables as the amplifiers in the antenna are designed to compensate for the length of the antenna cable.

Any excess antenna cable should by coiled and once completed the coil should be flattened in the center using a cable tie. The result will approximate a figure of eight.

The MX1 EFIS is shipped as standard with a GPS antenna fitted with 5 meters of antenna cable.

DB25 connector

All electrical connections with the exception of the GPS antenna are accessible on a single DB25 female connector. Pin functions are provided for convenience on the rear cover of the MX1.

Pin 1	Positive power supply 12V to 24V volt DC nominal
Pin 2	Internally connected to pin 1
Pin 3	Power supply ground
Pin 4	Internally connected to pin 3
Pin 5	
Pin 6	
Pin 7	RS232 port 1 TX
Pin 8	RS232 port 4 RX
Pin 9	RS232 port 1 RX
Pin 10	
Pin 11	RS232 port 2 TX
Pin 12	
Pin 13	RS232 port 2 RX
Pin 14	
Pin 15	RS232 port 3 TX
Pin 16	Outside air temperature sender (OAT)
Pin 17	RS232 port 3 RX
Pin 18	Keep Alive power input
Pin 19	RS232 port 4 TX
Pin 20	Audio output
Pin 21	
Pin 22	CAN-L

Pin 23	
Pin 24	CAN-H
Pin 25	

Unmarked pins

All unmarked pins may be used as convenient signal ground points or for other uses. Please note that these pins are NOT INTERNALLY CONNECTED. Any signal grounds, where required should be connected to pins 3 and/or 4 (Power supply ground). This way no damaging ground currents can flow through the EFIS in case of an external ground fault.

RS232 serial ports

The MX1 provides 4 serial ports using RS232 signals. The signals are identified as TX (transmitter) and RX (receiver).

You assign the desired function for each RS232 port in the Serial Port setup and routing menu. You can assign functions freely. Example use would be to connect a V16 COM transceiver.

TX lines are connected to the RX input on the device.

RX lines are connected to the TX output on the device.

Note: Should you wish to use an iEFIS Extender module this must be connected to RS232 port 4 and the Extender function must be enabled in the Equipment enables setup menu. Connect RS232 port 4 TX to the extender RS232 port 1 RX and the RS232 port 4 RX to the extender port 1 TX pin. On the extender RS232 port 1 is on the DB9 connector.

If you have the extender connected RS232 ports 1 to 3 are available on the MX1 as before. RS232 ports 4 to 7 are now available on the extender DB25 connector.

In case of a multipanel system you may connect all RS232 ports to their counterparts, i.e. all RX lines of port 1 are connected to each other. All TX lines of port 1 are connected together. The same for all other ports. In a multi-panel system only one panel is the master and only the master will be using its TX signals – all other panels will switch their TX drivers off.

This implies that should you be using an iEFIS extender that it will be connected to port 4 of all panels. Information from the extender is thus available to all panels.

Note: Do not connect any RS232 grounds between devices on your aircraft unless the devices are on separate, isolated power supplies. Should you wish to use shielded cable, connect the shield to signal ground on one end of the cable only so no DC current can flow between grounds.

Wiring grounds between equipment other than dedicated power supply grounds may induce destructive ground currents passing through devices. This can cause severe equipment damage in case of a ground fault on your aircraft.

CAN bus

The MX1 uses a two wire CAN bus to connect between panels in a multi-panel system as well as to a large range of peripherals. Typical CAN bus peripherals include RDAC engine monitoring modules, SP-6 magnetometer (magnetic compass), SP-7 or SP-9 AHRS, Electronic circuit breaker modules (ECB) and transponders such as the MGL Avionics T16, Trig Avionics TT21 and TT22 (fitted with MGL transponder interface).

The CAN bus uses twisted wire and uses differential signaling. The twist provides immunity against interference and also reduces interference emitted by the connection.

Essential to the operation of the CAN bus are two termination resistors of 120 ohms each. The CAN bus typically starts at a device and is then wired from device to device until the final device is reached, The resistors are placed on each end of the CAN bus.

Please consult the extensive literature on the CAN bus available on the Internet for details on how the CAN bus works and should be wired.

OAT sensor

This input is intended for a LM335 semiconductor temperature sensor. Such a sensor is included with your MX1.

The sensor is polarity sensitive – the positive terminal connects to the OAT input. The negative terminal must be connected to the power supply ground pin on the MX1DB25 connector (Pin 3 or 4).

Using any other ground connection may introduce significant errors in the temperature reading.

KA (Keep Alive) power input

Connect this input to your aircraft's battery positive terminal. This will draw a very small amount of current from your aircraft's battery when everything is powered down. The current draw is a few microamps only and well below the self discharge rate of your battery.

This current is used to keep your MX1 internal memory and real time clock battery charged. This battery is also recharged when your MX1 is switched on.

Audio output

Connect this output to your aircraft's intercom system (usually an auxiliary audio input). The output will contain voice annunciations and other sounds (for example AOA or vario tones if enabled).

Voice sounds originate from the file "Sounds.esd" that is preinstalled on your MX1 internal disks root folder. You can create your own sounds file using the Enigma Voice application available for download from the MGL Avionics website. It converts standard audio WAV files into the Sounds.esd file.

The audio output has a low inpedance (8 ohms) and is able to drive a small speaker directly. If your intercom system is not able to handle a high level sound input please use a resistive

divider to lower the level. It may also be a good idea to route the audio via a toggle switch on your panel so you can easily mute the sound if desired.

Audio signals may be noisy on certain installations – this tends to be caused by slightly different grounds between devices – these differences add themselves to the signal. One easy way to work around this is to use a small 1:1 audio transformer to isolate the grounds. Some intercom systems also provide so called noise canceling inputs – these have their own isolated grounds. If you have one of these, please connect the audio input ground from your intercom auxiliary input to any of the power supply ground pins on the MX1.

Note: Most audio transformers are intended for 600 ohm impedance. These work fine but due to the low output impedance of the audio output you can also consider low impedance transformers. You can also use transformers that do not have a 1:1 winding ratio. Using these you can step up or step down the voltage of the audio signal.

Low speed ASI ports

The low speed ASI port provides the static port for your altimeter and vertical speed indicator and well as low speed airspeed sensor.

The pitot port should connect to the pitot tube on your aircraft.

High speed ASI ports

A separate high speed airspeed sensor is provided. For applications where your aircraft's maximum airspeed cannot exceed 250 mph under normal circumstances you can leave these ports open.

Should you need to use the high speed sensor – please connect both pitot ports from the low and high speed sensor together using a suitable pneumatic T-connector. Do the same for the two static ports.

Using the high speed sensor the speed range for your airspeed extends to MACH 1 at sea level (approximately 600 knots).

Note that it is possible to use the high speed sensor independently from the low speed sensor. This means you can use a dedicated pitot tube and static port for high speed applications while maintaining ports more suitable for low speed flight at the same time.

AOA sensing

The MX1 provides three different methods of AOA measurement. The first involves the IEFIS Extender using one of the analog inputs configured to interface to a traditional airflow vane sensor.

The AOA sensor provided here can be used in one of two modes: Single ended and differential. You choose the mode of operation in the AOA setup menu.

Single ended AOA pickups are the more common – here you have a pitot tube with a second opening at an approximate 30 degree downwards angle. Connect this opening to the AOA+ port and the AOA- port is connected to your low speed ASI static port using a suitable

pneumatic T-connector. Should you have a low speed aircraft without a static port you will simply vent all your static ports into the cockpit (i.e. leave them unconnected).

Differential AOA pickups consist of a small hole near the wing leading edge on top of the wing and one similar hole at the bottom of the wing. The AOA sensor is used to measure the pressure difference between top and bottom of the wing. For this method connect the AOA- to the top port and the AOA+ to the bottom port.

For either pressure based AOA sensing a calibration test flight is performed. This involved placing the AOA system in calibration mode (can be done before flight commences).This enables the calibration functions in the menu. The simple procedure is described in this manual under the AOA calibration.

Appendix

AOA Tone generator custom file format

It is possible to customize the tones created for AOA angle conditions. Create a text file with the name AOATABLE.txt using a suitable text editor such as notepad in Windows. The file is copied into the "OTHER" folder using the file manager.

Here is a sample text file. Lines starting with a ";" are comments and not evaluated.

;User AOA tone sequence table

;Minimum indicated airspeed to activate AOA tone followed by maximum airspeed. Speed in MPH.

30,90

;Each line consists of 5 numbers in the following order:

;Frequency

;Tone duration in milliseconds

;Pause between tones in milliseconds (if tone repeat > 0)

;Repeat count (set to a value of 10 or greater for continous), Tone parameters will be updated at a rate of 8 Hz in EFIS.

;Volume Attenuator 0,1,2,3 (0=High volume -> 3=low volume, each step is 6db)

;

;This table must have exactly 38 lines. This covers the AOA range from 0 to 18 degrees in 1/2 degree steps.

```
0,0,0,0,0   ;0
0,0,0,0,0   ;0.5
0,0,0,0,0   ;1
0,0,0,0,0   ;1.5
0,0,0,0,0   ;2
0,0,0,0,0   ;2.5
0,0,0,0,0   ;3
0,0,0,0,0   ;3.5
0,0,0,0,0   ;4
0,0,0,0,0   ;4.5
0,0,0,0,0   ;5
0,0,0,0,0   ;5.5
400,1000,0,0,3 ;6
400,1000,0,0,3 ;6.5
400,1000,0,0,3 ;7
400,1000,0,0,3 ;7.5
600,1000,0,0,2 ;8
600,1000,0,0,2 ;8.5
1000,1000,0,0,2      ;9
1000,1000,0,0,2      ;9.5
1500,1000,0,0,1      ;10
1600,1000,0,0,1      ;10.5
1700,1000,0,0,1;11
1800,1000,0,0,1;11.5
1800,100,100,10,1   ;12
1800,100,100,10,1   ;12.5
1800,100,100,10,1   ;13
1800,100,100,10,1   ;13.5
1800,100,100,10,1   ;14
1800,100,100,10,1   ;15.5
1800,100,100,10,1   ;15
1800,100,100,10,1   ;15.5
1800,100,100,10,1   ;16
```

1800,100,100,10,1   ;16.5

1800,100,100,10,1   ;17

1800,100,100,10,1   ;17.5

1800,100,100,10,1   ;18

1800,100,100,10,1   ;18.5

CAN bus primer

The CAN bus (Controller Area Networking) was defined in the late 1980 by Bosch, initially for use in automotive applications.
It has been found to be very useful in a wide variety distributed industrial systems and is becoming popular in avionics applications due its robustness and ease of use.
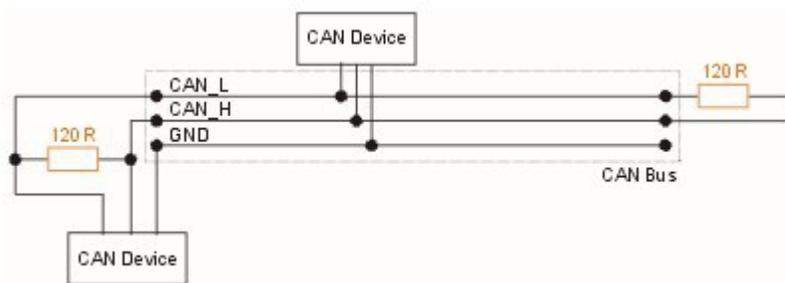
The connection uses two wires which are twisted around each other. This forms a "balanced transmission line". It helps to reduce emissions and also makes the link more robust against external interferences.

The CAN bus is always implemented as a single cable allowing only short stubs to connect to equipment along the route. Never implement a CAN bus as a "star" or other wiring topology. There can be many devices on a single CAN bus. Each connection to a device is called a "node".

The CAN bus requires termination resistors at each end of the bus. These are to be 120 ohm resistors. 1/4W or 1/8W resistors are usually used here. The resistors must be installed at each end of the bus, not in the center or anywhere else.

For short CAN runs (less than three meters) it is possible to install a single resistor of lesser value (not less than 60 ohms) at any location in the cable run.

The two wires are referred to "CAN High" and "CAN Low". These must connect to the corresponding lines at the devices. Never swap these connections (I.e. Never connect CAN H to CAN L at any device) as the CAN bus will not be able to function.

Never run the CAN bus connection inside a wire harness next to sensitive connection such as audio or signal wires. Never run the CAN bus next to RF cables.

You may use shielded wire as well, for example a twin core shielded cable. In this case please connect the shield to ground at ONE location only. Doing this prevents the possibility

of currents flowing via the shield which can lead to interference (ground loop effects).

Making twisted wire

It is very easy to make your own twisted wire. Simply take two equally long wires (for example 5 meters) in parallel and tie one end (both wires) to a fixture (a door handle works well). Insert the other end (both wires) into a drill. Stretch the wires so they are straight. Run the drill for a few short bursts at slow speed and you have a created a perfect twisted pair !

Note: There are never more than two resistors on a CAN bus. The resistors are always at the END of the bus. A CAN bus can only have exactly two ends.

Any devices that are not located at the ends of the bus connect to the bus either directly or via SHORT wire stubs. The stubs should not be longer than about 2 feet or 60cm.

The combined parallel resistance of the CAN bus termination resistors may never be less than 60 ohms (two 120 ohms in parallel).

Do not mix up CAN-H and CAN-L wires. Mark them or preferably use colored wire.