iEFIS G4 Diagnostics

Table of Contents

General

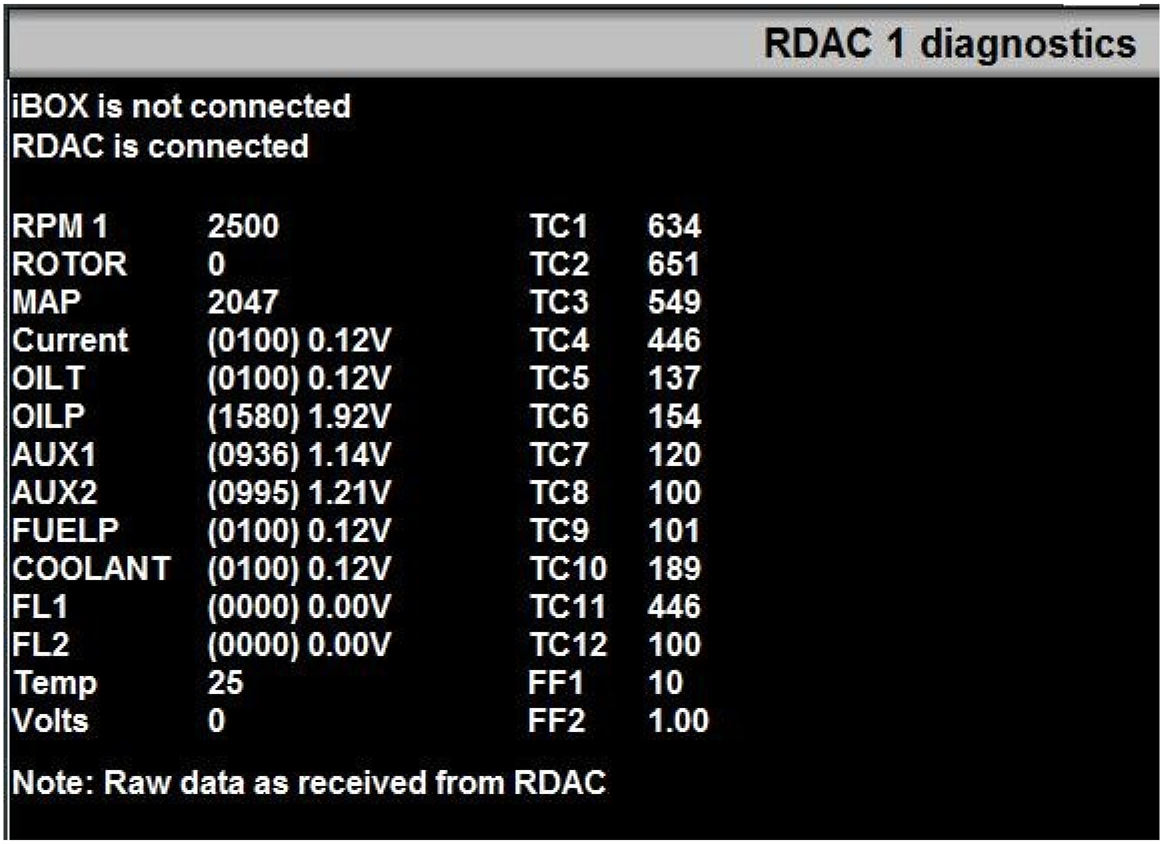
The iEFIS G4 contains a rich collection of diagnostics functions to assist in locating and solving installation issues.

Some of these functions have minor differences depending if you are diagnosing a full iEFIS system or a Lite system.

Diagnostics menu	
RDAC 1 diagnostics	ARINC 429 bus analyser
Active iBOX sensor diagnostics	ARINC 429 activity
Inactive iBOX sensor diagnostics	Flap and Trim controller diagnostics
Active iBOX sensor ADC	CAN loopback diagnostics
Audio test	CAN bus activity tracker
Extender on CAN bus diagnostics	Start ARINC label recording
Serial ports	AOA diagnostics
Wind speed/direction calculation diagnostics	Mode-S installation checks
Compass diagnostics	
AHRS diagnostics	

Diagnostics menu	
RDAC 1 diagnostics	AOA diagnostics
Internal sensor diagnostics	Mode-S installation checks
Audio test	Lite System Diagnostics
Extender on CAN bus diagnostics	
Serial ports	
Wind speed/direction calculation diagnostics	
Compass diagnostics	
AHRS diagnostics	
Flap and Trim controller diagnostics	
CAN bus activity tracker	

RDAC 1-4 Diagnostics



The iEFIS supports up to 4 RDAC units, currently either RDAC XF and RDAC XG models.

The diagnostics shows the data received from the RDAC. Either RPM1 and RPM 2 inputs are shown or RPM 2 may be replaced by rotor RPM in case of Lite systems if Rotor has been enabled (This is done by setting the number of pulses per revolutions in the RPM2 setup menu to zero – in this case it will take the pulses per revolution from the Rotor setup menu).

RPM is shown after taking the pulses per revolution setup into account.

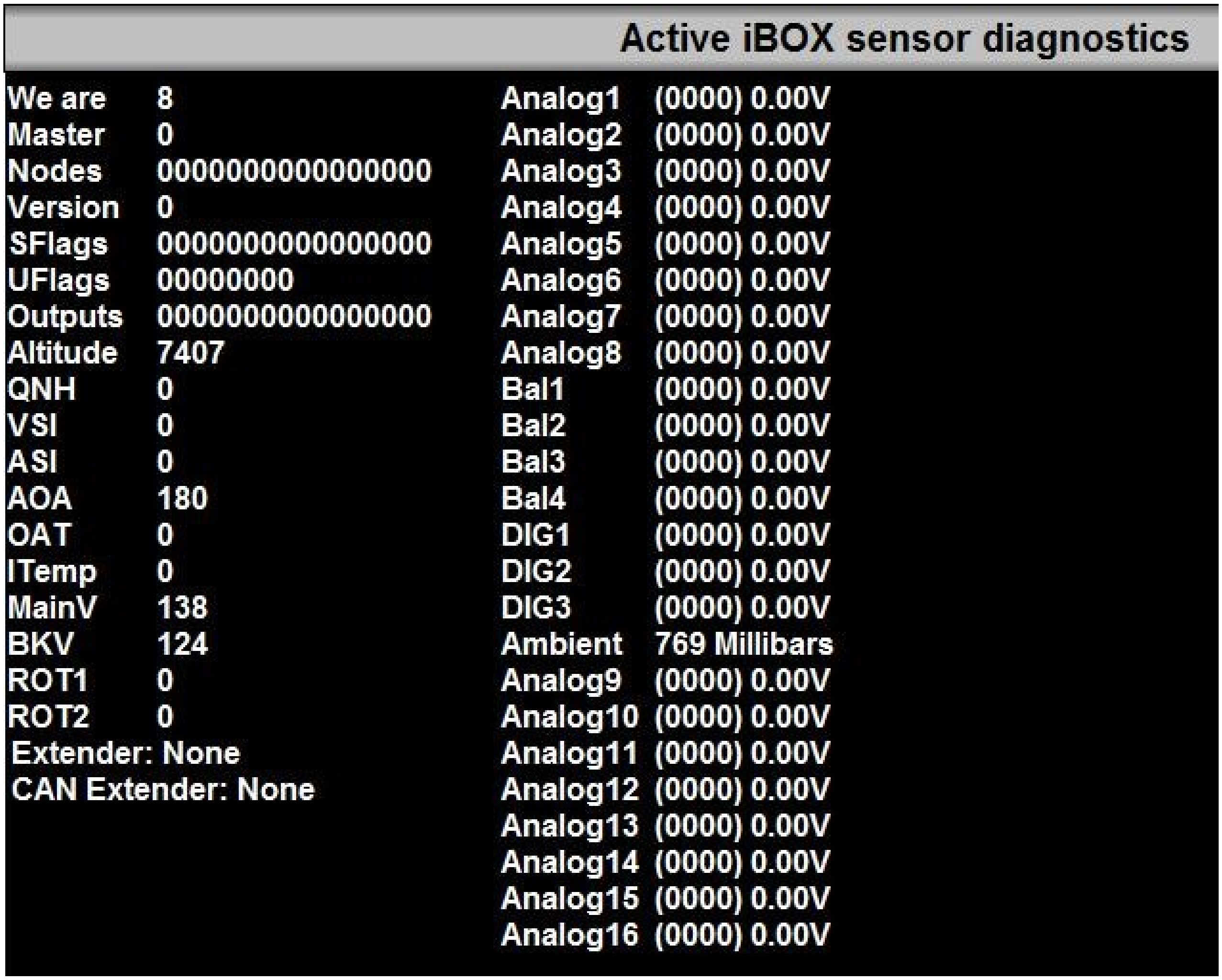
MAP – the manifold pressure sensor is only available with the RDAC XF MAP.

Analog inputs are shown as raw ADC reading from 0-4095 (This is 12 bits regardless of actual ADC resolution in the device to maintain compatibility between various RDAC systems and generations). For convenience this is translated into voltage. This should correspond closely to the voltage on the actual RDAC input. Some inputs have a range close to 0-5V while others around 0-3V.

Fuel flow as reported is shown after taking the k-factor for the input into account. K-Factor is the number of pulses generated for a liter of liquid flow through the sender.

Thermocouple inputs TC1 to TC12 (TC1 to TC8 in case of RDAC XG) show temperature in degrees C as uncompensated value – this is the relative reading from hot to cold end of the thermocouple probe. The “Temp” value is the temperature very close to the TC connectors on the RDAC and this is added to arrive at the absolute temperature value.

Active iBOX/Standby iBOX or Internal sensor diagnostics



Active iBOX sensor diagnostics

We are	8	Analog1	(0000) 0.00V
Master	0	Analog2	(0000) 0.00V
Nodes	0000000000000000	Analog3	(0000) 0.00V
Version	0	Analog4	(0000) 0.00V
SFlags	0000000000000000	Analog5	(0000) 0.00V
UFlags	00000000	Analog6	(0000) 0.00V
Outputs	0000000000000000	Analog7	(0000) 0.00V
Altitude	7407	Analog8	(0000) 0.00V
QNH	0	Bal1	(0000) 0.00V
VSI	0	Bal2	(0000) 0.00V
ASI	0	Bal3	(0000) 0.00V
AOA	180	Bal4	(0000) 0.00V
OAT	0	DIG1	(0000) 0.00V
ITemp	0	DIG2	(0000) 0.00V
MainV	138	DIG3	(0000) 0.00V
BKV	124	Ambient	769 Millibars
ROT1	0	Analog9	(0000) 0.00V
ROT2	0	Analog10	(0000) 0.00V
Extender: None		Analog11	(0000) 0.00V
CAN Extender: None		Analog12	(0000) 0.00V
		Analog13	(0000) 0.00V
		Analog14	(0000) 0.00V
		Analog15	(0000) 0.00V
		Analog16	(0000) 0.00V

This display varies between a full system (with iBOX) and a Lite system. The display for the Lite system does not show items that do not exist on such a system.

Of interest are the “We are: Master and Nodes display – This applies to systems with iBOX but also to Lite systems running in MX1 compatibllity mode. Here we can verify our node address, which system is currently the master (in control of autopilot and data communications to peripherals) and which nodes are connected.

In multi-panel systems nodes may never be duplicate – each panel must have a unique node number. On some panels this is set via a dipswitch array, on some you enter the panel node number in the setup.

Outputs refer to the on/off state of switchable outputs on iBOX or iEFIS Extender.

The first 8 analog channels are from the iBOX or iEFIS Extender on the RS232 port – the second group of 8 inputs are from a second iEFIS extender on the CAN bus. Shown are raw ADC readings and the voltage at the input.

Active iBOX sensor ADC

This function is used to verify raw measurement data inside the iBOX – used to diagnose sensor issues within the iBOX.

Audio test

Use this to play back all audio phrases in an endless loop. This is helpful to set amplifier volumes and generally work with the audio output from either iBOX or Lite panel.

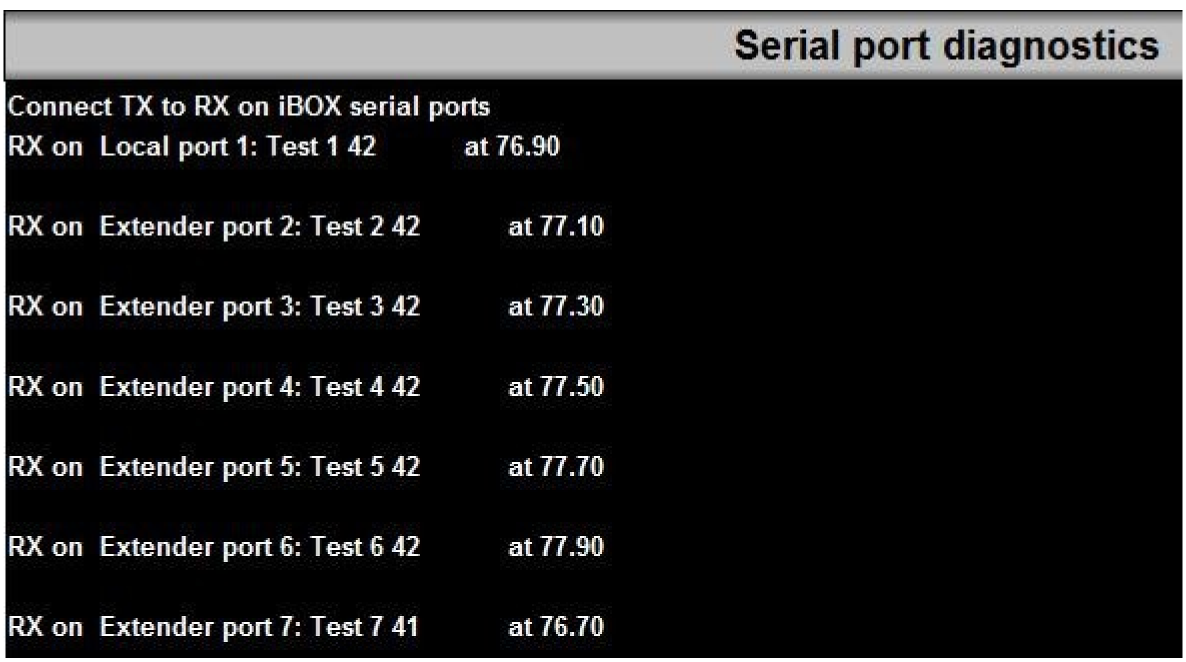
Note: For iBOX systems you need to install the sound file to get an output. Two sound files are available with male and female voice and you can even create your own.

For Lite systems the sound file is simply copied to the /efis folder (same location that contains the exp4 EFIS program file).

Extender on CAN bus diagnostics

This allows you to verify operation of an iEFIS extender connected to the CAN bus.

Serial Ports



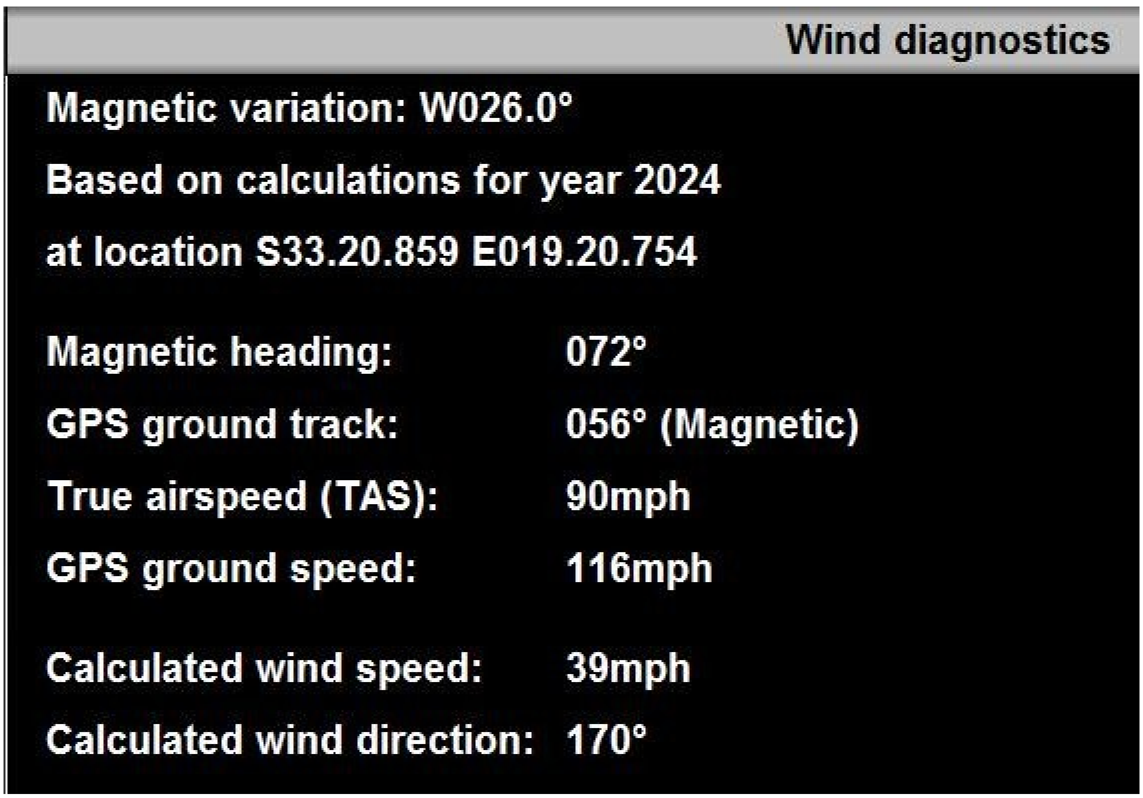
In order to test a serial port either on the panel itself, iBOX or iEFIS Extender use this function.

Use a simple wire bridge to connect TX to RX. The display shows the data received. Any non-printable characters are shown as “?”. The test sends a unique message on each port about every second. The message consist of the word “Test” followed by the port number followed by the number of the test. If received you will see this message at the corresponding port as well as a receive time in seconds from start of the test.

Note that you can bridge any TX to any RX so you can test any port against any other port.

The number of ports depends on the system and ranges from two to nine ports.

Wind speed/direction calculation diagnostics



This function shows the results of the built in wind triangle calculations.

This is available if you have a valid GPS fix, a magnetic heading (typically from a SP-6 magnetometer), ground and air speed.

The system calculates local magnetic variation based on published tables for the Earths magnetic field and how it changes over time. This is then used to derive a corrected magnetic heading relative to true north.

The Wind triangle formula takes ground track, and true heading plus ground speed and true airspeed to calculate wind speed and wind direction.

Usually if the calculation does not give you a correct wind speed or heading the magnetic heading from your compass is not correct due to installation / calibration issues related to deviation caused by ferro magnetic materials – both soft and hard iron sources.

Compass diagnostics

Compass sensor diagnostics

Magnetic variation: W025.1°
Based on calculations for year 2024
at location S32.11.926 E020.07.958
GPS ground track: 055° (Magnetic)
System mag heading: 072°

This function is useful to ensure the correct calculation of the local magnetic variation as well as display the currently measured magnetic heading from your compass.

The GPS ground track is shown (if available) corrected for variation so your magnetic heading and the corrected GPS heading should read the same provided you are flying straight (no slip) and there is no wind at all pushing you sideways.

You can use this to verify the accuracy of your compass installation.

AHRS Diagnostics

AHRS sensor diagnostics

AHRS is internal Gyro and Accelerometer
AHRS is MK1

XG	+0.000
YG	+0.000
ZG	+1.000
TG	+0.000
Bank rate	+0.0
Pitch rate	+0.0
Yaw rate	+0.0
Bank angle	+0.00
Pitch angle	+0.00
Voltage	05.0
Temperature	+0
Status	00000000

Using this function you can monitor raw AHRS data as received from the device. You can see the three axis accelerometer G force measurements. These are used to detect the direction of gravity to aid your AHRS when no other accelerations are present (total G-Force is 1G). Gyro rates are shown as degrees per second unfiltered (MEMS gyros are quite noisy so you will see a lot of jitter around zero when there are no rotations). Pitch and bank angle are the calculated angles based on the accelerometer and gyro inputs.

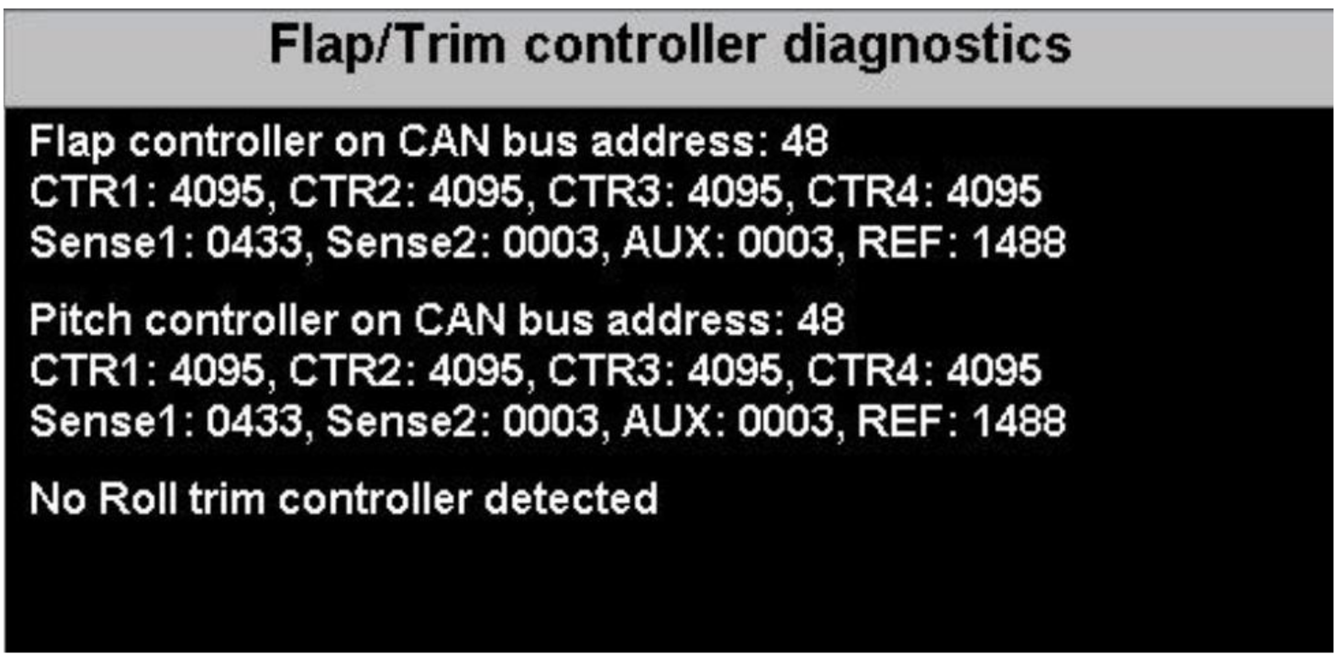
Calculations of the final bank and pitch angles are performed in the AHRS module itself. The algorithms used for this are complex and also take velocity into consideration. Velocity is supplied to the AHRS from the EFIS.

In most cases poorly functioning AHRS systems are the result of incorrect mounting in the airframe. AHRS systems are limited in the rate of rotation that can be measured (about 300 degrees per second) and accelerometers are affected by vibrations as vibrations are also accelerations. Higher frequency vibrations can also affect gyros resulting in false rotation measurements.

Another cause is mounting the AHRS in a way that it moves independent from the airframe (usually during turbulence) but can also be the result of mounting the AHRS on a structure affected by buffeting such as the aircraft skin and prop-wash.

A good mounting would prevent high frequency vibrations from affecting the AHRS while the mounting is stiff enough so it cannot move independently from the airframe (no movement, not even a small amount). The AHRS must be able to follow the general movement of the airframe as a whole without any other movement that does not belong.

Flap and Trim controller diagnostics



Please consult the SP-10 Flap and Trim controller manual for detailed information on how to use this diagnostics function.

CAN bus activity tracker

This function occupies two pages you can switch between.

The first page shows general CAN bus usage and gives you the bandwidth used as a percentage. This shows how busy the CAN bus is. Further information shows the number of bits of data sent and received. Typically in a system the bandwidth seldom exceeds 20% ensuring low latency of messages sent.

The second page breaks down the bandwidth by device. You can use this to see which devices are connected and at what rate they are sending data. This is a quick way to diagnose any problematic device – either it does not appear at all or it can consume excessive bandwidth as it may try to force a message through that is not getting any acknowledgment as it is never received intact.

All devices on the CAN bus should show regular message transmissions with little variance over time. You will see bandwidth occupied by the device but also number of messages sent per second.

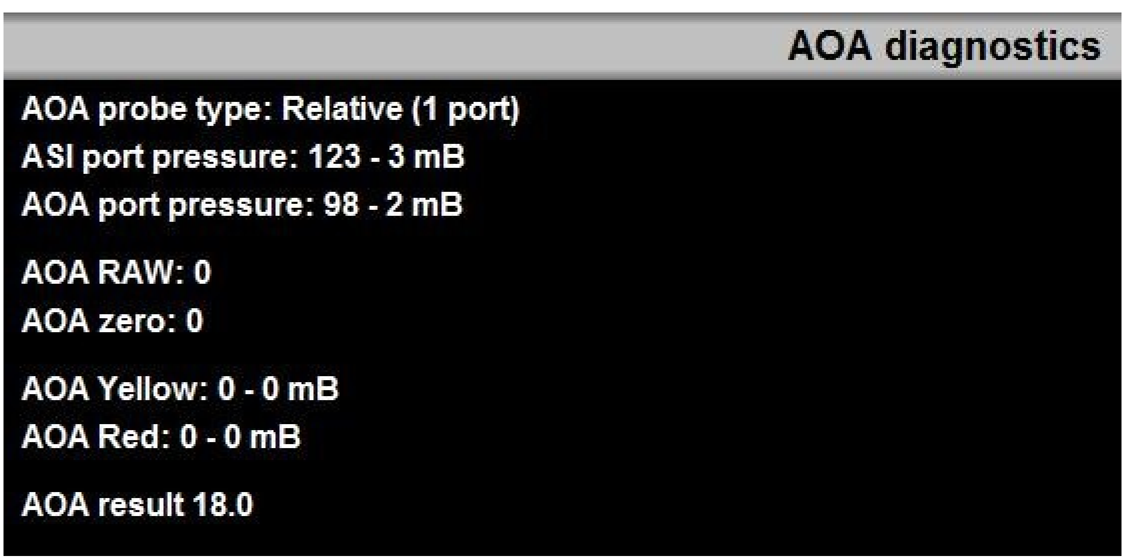
CAN bus loopback test

This function is used to verify the operation of the two independent CAN bus ports on the iBOX.

For this test connect the two ports together (no other peripherals are connected). Connect CAN-H to CAN-H and CAN-L to CAN-L then connect a termination resistor between CAN-H and CAN-L. You can use values between 60 and 120 ohms (for example two 120 ohm resistors in parallel equals 60 ohms total resistance).

The function transmits test messages to and from each port and shows the result.

AOA Diagnostics



Angle of Attack measurements based on air pressure relies on either a differential system or a single ended system.

Differential systems use two pressure ports – one ontop of the wing and one on the bottom placed in strategic locations. The idea is that the pressure ontop of the wing decreases while the pressure at the bottom increases with angle of attack.

Single ended systems use a single port similar to a pitot port but bent downwards relative to the pitot port at an angle typically around 30 degrees, Both pitot as well as AOA tubes are at the same location. The idea is that as angle increases pressure at the pitot tube drops while the pressure of the AOA port increases.

In both cases actual pressure differentials are then compensated by airspeed so the relative reading is independent of airspeed.

A calibration flight is performed resulting in measuring and storing the pressure differentials for zero (very low differential), yellow (start of clean stall) and red (start of stall in landing configuration).

This function shows the result of the calibration flight (as well as current raw reading of the pressure differential). It shows the current pressure of ASI and AOA tubes (or AOA differential) in millibars. Finally the estimated angle of attack.

Mode-s installation checks

This function is relevant for a Garrecht or Trig Avionics transponder connected to the EFIS via a MGL interface – the EFIS controls the transponder.

This function has no relevance if you connect the EFIS NMEA GPS output to a transponder that is controlled by it’s own head or face plate.

Please consult the document “Mode-s ADSB.pdf” for details on this diagnostics function.

ARINC 429 bus analyzer

This function is available for full systems using the iBOX. The iBOX provides three RX channels – Channel 1 and 3 are low speed and channel 2 is high speed.

In most cases only channels 1 and 3 are used.

This function shows the labels (data) received on each channel.

ARINC 429 activity

This function shows the labels 121 and 122 as well as 104.

These are relevant for ARINC based autopilot control. These labels are either “Passthrough” or created by the EFIS depending on the ARINC setup.

If the EFIS creates these labels the data sent is effectively taken from the flight director which forms part of the built in autopilot.

The internal autopilot needs to be enabled in “flight director only” mode – in this mode the actual built in autopilot is not activated but the flight director bars on the screens are alive if enabled in the 3D setup menu.