

MGL Avionics EFIS G2 and iEFIS



Guide to using the MGL RDAC CAN interface with the UL Power engines



General

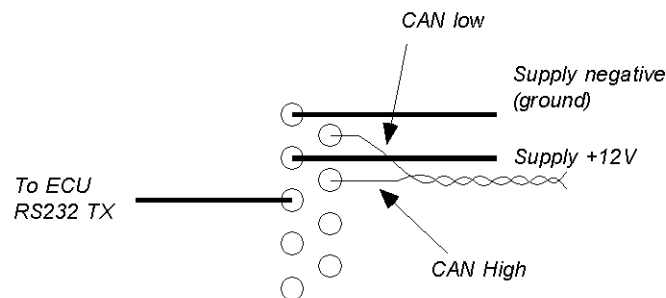
The RDAC CAN interface forms the bridge between the UL Power ECU and an MGL Avionics G2 EFIS system and iEFIS systems.

The RDAC CAN interface provides the following:

- CAN bus Interface to ULP ECU A with fallback to ECU B on ECU A failure
- Interface to ULP ECU system via RS232 port
- 2 fuel level sender inputs with internal pullups suitable for resistive senders. Pullup resistors can be disabled via dip switch allowing senders with a voltage output to be connected.
- Input for a DC current monitor centered around 2.5V (range 0.5-4.5V).

The RDAC CAN emulates the RDAC XF system.

Data connections:



CAN bus to iEFIS Lite, XTreme EFIS or iBOX

Note: CAN bus must be terminated with 120 ohm resistor (not shown here).

*One 120 ohm resistor on each end of the bus.
Never fit more than 2 120 ohm resistors.*

Connect the RDAC EFIS CAN to the CAN interface of the EFIS.

Observe CAN bus termination resistor recommendations for this connection.

UP Power engine data

The RDAC CAN provides the following engine data from the UL Power interface:

RPM

Please configure your EFIS for 1.0 pulses per revolution.

Fuel flow rate

Please configure your EFIS for a K-factor of 7000 using the “turbine” option.

Manifold air pressure

No EFIS configuration is needed. Please set manifold calibration to zero unless you have an accurate reference source. In that case you may use the calibration as needed.

Note: This item requires an optional engine monitoring module available from UL Power.

Oil pressure

Please configure your EFIS for “Probe type: Linear 0-5V”. Pressure sender range is 10 bars.

Oil temperature

Please configure your EFIS for “Probe type: LM335 semiconductor”.

EGT 1,2,3,4,5,6

No configuration is needed other than the usual range settings. The EGT senders are mapped to channels TC1,2,3,4,5 and 6.

Note: These items require an optional engine monitoring module available from UL Power.

CHT 1,2,3,4,5,6

No configuration is needed other than the usual range settings. The EGT senders are mapped to channels TC7,8,9,10,11 and 12.

Note: These items require an optional engine monitoring module available from UL Power.

Engine ambient temperature

This signal is mapped to AUX2. Configure AUX 2 as LM335 probe.

Throttle position

A value from 0-100. This value can be observed in the diagnostics.

Engine ambient pressure

This value can be observed in the diagnostics. It is displayed in Hpa.

Fuel pressure

Please configure your EFIS for “Probe type: Linear 0-5V” and a suitable range for the fuel pressure (from your engine specifications).

Functions provided by the RDAC CAN

The RDAC CAN provides a number of additional sensor monitoring inputs on the D-25 connector.

Fuel level sender inputs

These inputs are marked “FL1” and “FL1”.

These are intended for connection to resistive fuel level senders. The RDAC CAN provides internal pullup resistors (470 ohms to 3.6V). These pullup resistors are switched into the circuit if the internal DIP switch array 7 and 8 are in the “ON” position.

If the switches are “OFF” it is possible to connect electronic level senders with a voltage output provided the output voltage is in the range of 0V to about 3.3V.

The fuel level sender readings are presented to the EFIS in a fashion compatible with the RDAC XF.

DC current monitoring input

Connect a DC current monitoring sensor to input “Curr2”. The current sensor should produce a voltage of around 2.5V for a zero current and increase or decrease this voltage depending on the magnitude and direction of the current. Range is 0-5V.

Perform zero and gain calibration in the EFIS Voltage/Current setup as required.

Connector pins

DB9 connector

- 1 Ground
- 2 +12V
- 3 RS232 RX (connect to RS232 TX from ECU)
- 4 No connection
- 5 No connection
- 6 CAN EFIS Low
- 7 CAN EFIS High
- 8 CAN ECU Low
- 9 CAN ECU High

Note: Should both the RS232 as well as the CAN ECU be wired and data is received on both, data sent to the EFIS will be that received on the CAN side.

DB25 connector

- 1-7 No connection
- 8 Current sensor input
- 9 Not used (reserved for future use)
- 12 Fuel level sender 2 input
- 13 Fuel level sender 1 input

10,11,14-20 No connection
21-25 Ground (same ground as power supply ground on DB 9).

LED states

The RDAC CAN has a LED lamp next to the DB-9 connector. This LED can be used to diagnose fault and connection issues.

The LED has a two second period in which it flashes once, twice or three times depending on condition.

LED flashes once:

RDAC CAN has power and processor is working. No communications to either ECU or EFIS.

LED flashes twice rapidly:

RDAC CAN has power and processor is working. Receiving data from ECU (either via CAN or RS232) . Not connected to EFIS.

LED flashes twice slowly:

RDAC CAN has power and processor is working. Receiving data from EFIS. Not receiving data from ECU (Engine RPM transmitted as 9001 in this case to inform pilot).

LED flashes three times:

RDAC CAN has power and processor is working. Receiving data from ECU and EFIS.

LED is off:

RDAC CAN is not powered or faulty.

LED is on:

RDAC CAN is powered but processor is not working or halted. The halted condition may occur in some cases if CAN wiring is incorrect preventing the processor from joining the CAN network after application of power (In this case the wiring is such that the network appears "busy" all the time. In this case try powering the RDAC after removing the CAN network - if the LED flashes then please check the CAN network wiring).

Grounding the RDAC CAN

Engine ground is deemed to be hazardous to EFIS systems. For this reason ensure that there is no direct ground connection between the engine block and the RDAC CAN device.

Connect the RDAC CAN to the engine only by means of the two CAN data lines. This assumes that the engine block is grounded to the battery negative and the avionics supply bus also has a connection to the same battery negative. There must not be any other ground connection between the engine and the avionics as this could cause large currents to flow in the avionics grounds and this in turn can cause serious damage.

If you are using a shielded cable to connect the RDAC CAN to the ECU, ensure that the shield is grounded on one side only so it does not form an electrical ground connection between the RDAC CAN and the engine block.

Power supply requirements for the RDAC CAN

Nominal 12V DC. Range: 8.5V to 36V. Voltages above 16V may only be applied short term (less than 30 seconds below 20V, less than 5 seconds to 36V).

Power supply must be filtered and free of surges, spikes and noise.

Current consumption: 50mA typical, maximum 70mA with fuel level senders grounded and pull up resistors switched on.

RDAC CAN dipswitch assignment

The RDAC CAN may be assigned as RDAC 1,2,3 or 4 by means of DIP switches 1 and 2.

Note: Odyssey/Voyager support only RDAC 1 and 2.

Switch	RDAC 1,2	RDAC 3,4
1	off or on	off
2	off	on

DIP switch 2 is used to select RDAC 3 or 4 unless “Both ECUs” is selected

Switch

3	off	Send data as RDAC 1 or 3 (depending on switches 1,2)
3	on	Send data as RDAC 2 or 4 (depending on switches 1,2)

The normal mode of operation is switch 3 “Off”.

Dip switch 4 selects the ECU if not set to “Both Lanes”

4	off	ECU A, fall back to ECU B if ECU A fails
4	on	ECU B, fall back to ECU A if ECU B fails

Dip switch 5 selects “Exclusive lane mode”

5	off	Normal mode, use fall back in case of failure
5	on	Dedicate RDAC to Lane (Dip switch 4), never send data of other ECU.

Dip switch 6 selects “Both Lanes”.

6	on	Mode selected as above
6	off	Both ECUs. Dip switches 3,4,5 are ignored.

Typical connection for a UL Power engine (Single engine aircraft):

Switch 1 on. Switches 2,3,4,5,6 off. Data appears as two RDACs (RDAC 1 and RDAC 2) for ECU A and ECU B. Configure the EFIS to show RDAC 2 data as needed.

Alternative:

Switches 1,6 on, switches 2,3,4,5 off

Data appears as RDAC 1. ECU B data will be sent if ECU A fails.

“Both ECUs” operation

The RDAC CAN behaves as two RDAC units (RDAC 1 and 2 or RDAC 3 and 4 depending on switches 1 and 2).

ECU A is RDAC 1 or RDAC 3

ECU B is RDAC 2 or RDAC 4

If ECU A data fails, ECU B data is sent as ECU A (I.e. It is duplicated).

If ECU B data fails, no data is sent on ECU B.

Status LED

The RDAC CAN has a green status LED indicator.

Single flash: RDAC CAN is powered and working but there is not data received on the ECU CAN bus.

Double flash: RDAC CAN is powered and working, data is being received on the ECU CAN bus.

Error codes

The RDAC CAN interface transmits the value 9001 as RPM in case there is no data received from a UL Power ECU.

As the EFIS should be setup for 1.0 pulses per revolution (RPM setup menu) this results in the value 9001 displayed on the EFIS in this case.

If no data is received from the Rotax ECU for one second, all values will be transmitted as “zero” (except for the RPM which is transmitted as 9001).

Tip: If the RPM overs peed alarm is set and enabled, this will trigger the alarm on the EFIS.

G2 EFIS setup

The G2 EFIS (Odyssey/Voyager) have two RDAC inputs intended for use with MGL's traditional RDAC systems.

Starting from RDAC model XF, the CAN bus is favored for the RDAC data feed connection.

The G2 needs to be told that you would like to use the CAN bus for the RDAC. You do this in the “Engine monitoring setup”:



There is no setup required for the iEFIS as the iEFIS uses only the CAN bus for RDAC connections.

With the traditional RDAC devices fuel pressure input and current sensor inputs used spare RDAC inputs and this required selection of the inputs as needed.

With the CAN based RDAC units this is not required as the CAN based systems have dedicated inputs for these senders and the input selections are blanked out.

Note: G2 RDAC on CAN bus is supported from software version 1.1.0.0 or higher.

UL Power ECU diagnostics

The UP Power ECU transmits various status messages. These can be observed in the "RDAC CAN ECU status information" in the diagnostics menu.

The engine type identification number in the ECU diagnostics is "100".

Device status 1 right most byte:
(ULP ignition status)

00000000	all on
00000100	ignition 1 off
00001000	ignition 2 off
00001100	all off

Sensor status 1 right most byte:

00000001	Airtemp sensor fault
00000010	Throttle position sensor fault
00000100	MAP sensor fault
00001000	Oil temp sensor fault

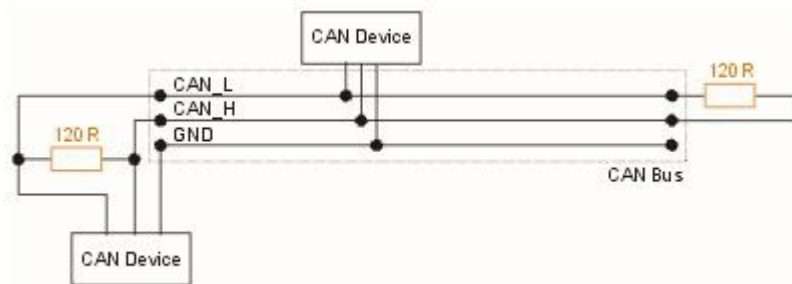
Above states can be combined in case of multiple sensor faults.

Note: All other status, hour counters etc fields in the diagnostics are not used with the ULP engines at this point and read zero.

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.

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.

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 !

Shielded, twisted wires

It is possible to purchase shielded, twisted wire. This can be used in applications where there may be electrical noise issues. In this case we advise to connect the shield to ground AT A

SINGLE LOCATION ONLY. This prevents creating a “ground loop” which can cause EMI issues.

Basic wiring checks

You can use a volt meter to perform basic checks on a CAN connection.

With at least one device connected and powered you should be able to measure voltages of around 1.0 – 3.0 volts on each cable with respect to ground. The voltage should appear very similar on each connection.