

MGL Avionics EFIS G2 and iEFIS



Guide to using the MGL RDAC CAN interface
with the LAD AERO Injection Kit on ROTAX 912-912S



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General

The RDAC CAN LAD interface forms the bridge between the LAD AERO ECU and an MGL Avionics EFIS system. The RDAC CAN emulates the RDAC XF system.

The RDAC CAN LAD can extract the following engine data from the ECU CAN bus stream:

- a) Engine RPM
- b) Manifold air pressure
- c) Water temperature
- d) Oil pressure
- e) Oil temperature
- f) Fuel pressure
- g) Fuel Flow
- h) OAT
- i) VOLTS
- j) Lambda
- k) TPS %

The standard LAD AERO injection kit wiring loom does not include wiring for oil pressure, oil temperature, fuel pressure senders. It may be more convenient to connect senders to the corresponding inputs on the RDAC-CAN D25 connector. See page 5.

Selection of the data source (ECU or D25 connector) is done with switches 3 to 6, see page 7.

The RDAC CAN LAD interface provides the following physical interfaces:

- a) Single CAN Interface to LAD AERO ECU (1Mb, 29bit ID).
- b) Single CAN Interface to iEFIS (250Kb, 11bit ID).
- c) Two fuel level sender inputs with internal pullups suitable for resistive senders. Pullup resistors can be disabled allowing senders with a voltage output to be connected.
- d) One Oil pressure input suitable for use with a 4-20mA or 0-5V voltage output electronic sender.
- e) One Oil pressure input suitable for use with resistive sender (e.g. VDO 10B)
- f) One Oil Temperature input suitable for connection to Rotax912 NTC Oil Temperature sender
- g) One Fuel pressure input suitable for use with 0-5V voltage output electronic sender (e.g. UMA 7PSI)
- h) One input for a DC current monitor centered around 2.5V (range 0.5-4.5V).

Data connections

Connect the CAN ECU of the RDAC CAN interface to the CAN bus of the LAD AERO ECU. Fit termination resistor of 60-100 ohms value between the CAN High and CAN Low wires (in case of a single resistor, CAN bus length <= 2 meters).

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

Observe CAN bus termination resistor recommendations for this connection as written in the EFIS installation manual. Also read the “CAN bus primer” at the end of this manual, page 8.

Note: Do NOT connect the two CAN buses together. They are two separate buses each running at their own communications speed and using their own data exchange protocols.

LAD AERO ROTAX 912 engine data from ECU

The RDAC CAN provides the following engine data from ECU:

Engine RPM (from ECU)

Please configure your EFIS for 1.0 pulses per revolution.

Note: For EFIS screen designs this reading is available as RPM1.

Note: The RPM value of 9001 will be shown on the EFIS if the interface is connected to the EFIS but no data is being received from the ECU.

Manifold air pressure (from ECU)

No EFIS configuration is needed other than setting of desired indicator ranges. Please set manifold calibration to zero unless you have an accurate reference source. In that case you may use the calibration as needed.

Note: For EFIS screen designs this reading is available as MAP

Water temperature (from ECU)

Please configure your EFIS for "Probe type: LM335 semiconductor".

Note: For EFIS screen designs this reading is available as COOLANT. It is also available as TC 4 configured as K-Type probe.

Oil pressure (from ECU)

SW3 ON

Please configure your EFIS for "Probe type: Linear 0-5V"

Note: For EFIS screen designs this reading is available as Oil Pressure.

Oil temperature (from ECU)

SW5 = ON

Please configure your EFIS for "Probe type: LM335 semiconductor".

Note: For EFIS screen designs this reading is available as "Oil Temperature".

Fuel pressure (from ECU)

SW6 = ON

Please configure your EFIS for "Probe type: Linear 0-5V"

Note: For EFIS screen designs this reading is available as "Fuel Pressure".

Fuel Flow (from ECU)

Please configure your EFIS for "Probe type: Turbine" and "K-Factor=7000".

Note: For EFIS screen designs this reading is available as "Fuel Flow1".

OAT (from ECU)

The LAD AERO ECU provides an OAT reading. This is mapped to TC3 (as K-Type probe). The EFIS uses its own OAT sender. The LAD AERO engine OAT is used as cold junction reference for all TC channels (even though no thermocouple probes are used).

VOLTS (from ECU)

The LAD AERO ECU provides a supply voltage reading. This is mapped to Volts.

Note: For EFIS screen designs this reading is available as VOLTS.

Lambda (from ECU)

The LAD AERO ECU provides a Lambda reading.

This is mapped to TC11 (as K-Type probe).

TPS % (from ECU)

The LAD AERO ECU provides a TPS (Throttle Position Sensor) reading in %.

This is mapped to TC12 (as K-Type probe).

Functions provided by the RDAC CAN

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

Fuel level sender inputs

These inputs are marked "FL1" (D25 pin 13) and "FL2" (D25 pin 12).

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.

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 D25 pin 8. 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.

Oil pressure sender (4-20mA)

SW3 OFF; SW4 OFF

Connect pressure sender to D25 pin 7.

Rotax 4-20 mA oil pressure sender: Connect a 100Ω resistor between input (pin7) and ground.

Configure your EFIS for "Probe type: 4-20mA". Pressure sender range is 10 bars.

Note: setup for standard ROTAX 912 oil pressure sender. Any sender compatible with a DC input range of 0-5V and within selection options in the EFIS setup may be used.

Note: For EFIS screen designs this reading is available as "Oil Pressure".

Oil pressure sender (resistive)

SW3 OFF; SW4 ON

Connect pressure sender to D25 pin 10.

Rotax resistive (10-180Ω) oil pressure sender.

Internal pull-up resistor 1.0KΩ to internal 3.3V.

Configure your EFIS for "Probe type: Automotive resistive". Sender range is 10 bars.

Quick test: A 120 ohm resistor between input and interface ground should result in a pressure reading of approximately 6.3B.

Note: For EFIS screen designs this reading is available as "Oil Pressure".

Oil temperature sender (resistive)

SW5 OFF

Connect Oil temperature sender to D25 pin 11.

ROTAx Oil Temperature sender (resistive VDO 150°C NTC to ground).

Internal pull-up resistor 1.5KΩ to internal 3.3V.

Note: For EFIS screen designs this reading is available as “Oil Temperature”.

Configure Oil Temperature probe type as Standard NTC.

Quick test: A 120 ohm resistor between input and interface ground should result in a temperature reading of approximately 76 degrees Celsius.

Fuel pressure (from sender)

SW6 = OFF

Connect Fuel pressure sender (0-5V) to D25 pin 11.

Configure your EFIS for “Probe type: Linear 0-5V”

Note: For EFIS screen designs this reading is available as “Fuel Pressure”.

Diagnostics

Please consult the EFIS diagnostics functions for raw measurement information. CAN RDAC ECU information for this engine will show largely as blanks as no information is available from the engine.

Connector pins

DB9 connector (Female on device, plug is male)

- 1 Ground (Power supply negative).
- 2 +12V DC power supply for interface.
- 3 No connection
- 4 No connection
- 5 No connection
- 6 EFIS CAN Low
- 7 EFIS CAN High
- 8 ECU CAN Low
- 9 ECU CAN High

DB25 connector (female on device, plug is male)

- 1-6 No connection
- 7 Oil pressure sender input (4-20mA, connect 100Ω resistor from input to ground)
- 8 Current sensor input (voltage centered at 2.5V for “no current”)
- 9 Fuel Pressure sender input (0-5V)
- 10 Oil pressure sender input (resistive)
- 11 Oil temperature input 1 (ROTAx 150°C NTC)
- 12 Fuel level sender 2 input
- 13 Fuel level sender 1 input
- 14-19 No connection
- 20 No connection
- 21-25 Ground (same ground as power supply ground on DB 9).

Grounding the RDAC CAN

As the RDAC can needs to refer to sensors that are grounded on the engine block, the RDAC power supply ground and any other ground on this device must be connected to the engine block. Note that you should provide a single, secure ground connection to the engine block. The engine block must then have its own ground connection to the aircraft's power supply negative (battery, alternator etc).

Do NOT wire more than one ground connection from the RDAC (for example one wire to the battery negative, other to the engine block). Only one connection to the engine block.

Failure to adhere to this can result in incorrect sensor readings.

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

RDAC Address

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

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

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



RDAC inputs

RDAC CAN inputs can be configured by means of DIP switches 3 to 8.

Switch	ON	OFF	Function
3	ECU	D25-7 or 10	Oil Pressure Source
4	D25-10	D25-7	Oil Press Type: Resistive / 4-20mA
5	ECU	D25-11	Oil Temp Source
6	ECU	D25-9	Fuel Press Source
7	470Ω	None	Fuel Level 2 pullup
8	470Ω	None	Fuel Level 1 pullup

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 the 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 ECU for one second, all values will be transmitted as “zero” (except for the RPM which is transmitted as 9001).

Tip: If the RPM overspeed 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.



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.

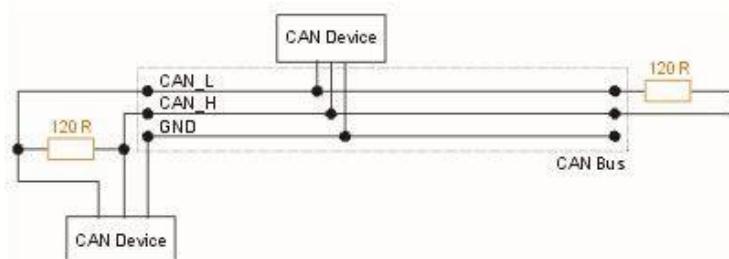
The CAN bus is always implemented as a single cable allowing only short stubs to connect to equipment along the route. Never implement a CAN bus as a "star" or other wiring topology.

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 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.