

MGL Avionics EFIS G2 and iEFIS



Guide to using the MGL RDAC CAN interface with the Rotax 912iS



General

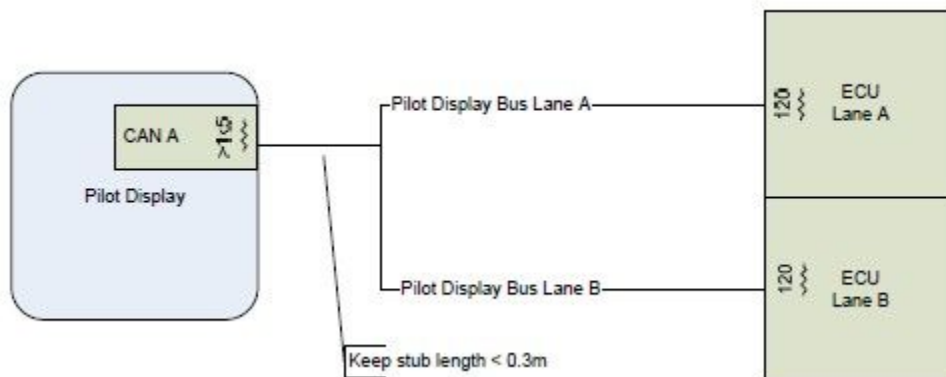
The RDAC CAN interface forms the bridge between the Rotax 912iS ECU and an MGL Avionics G2 EFIS system and iEFIS systems.

The RDAC CAN interface provides the following:

- a) Interface to Rotax ECU Lane A with fallback to Lane B on Lane A failure.
- b) 2 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.
- c) Fuel pressure input suitable for use with a voltage output electronic sender.
- d) 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:



As shown on this diagram, connect the CAN bus ECU lanes A and B together and then connect to the RDAC CAN “CAN ECU” inputs.

Do **NOT** add CAN termination resistors to this connection as both ECUs have these built in.

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

Observe CAN bus termination resistor recommendations for this connection.

Rotax 912iS engine data

The RDAC CAN provides the following engine data:

RPM

Please configure your EFIS for 1.0 pulses per revolution.

Fuel flow rate

Please configure your EFIS for a K-factor of 3500 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.

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”.

Coolant temperature

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

EGT 1,2,3,4

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

Manifold air temperature

This signal is mapped to AUX1 and appears as the previous Rotax 912 CHT 1 (There is no CHT measurement for the 912iS).

No probe configuration is needed.

Engine ambient temperature

This signal is mapped to AUX2 and appears as the previous Rotax 912 CHT 2 (There is no CHT measurement for the 912iS).

No probe configuration is needed.

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.

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.

Fuel pressure sender input

Use input “Curr1” to connect to a 0-5V or 0.5-4.5V DC output fuel pressure sender. Select the corresponding sender type in your EFIS fuel pressure configuration menu.

It is also possible to use a resistive pressure sender. In this case connect the pressure sender to the fuel pressure sender input (the other end of the fuel pressure sender variable resistor is connected to ground via the engine block).

Also connect a pull-up resistor of 2.7KOhms from the fuel pressure input to the 12V supply this will energize a typical 200 ohm VDO sender.

Select “Resistive sender” in the setup for a 200 resistance and “pressure increases with resistance”.

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 No connection
- 4 No connection
- 5 No connection
- 6 CAN EFIS Low
- 7 CAN EFIS High

- 8 CAN ECU Low
- 9 CAN ECU High

DB25 connector

- 1-7 No connection
- 8 Current sensor input
- 9 Fuel pressure sender input
- 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).

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 lanes” 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 LANE if not set to “Both Lanes”

| | | |
|---|-----|---|
| 4 | off | Lane A, fall back to Lane B if Lane A fails |
| 4 | on | Lane B, fall back to Lane A if Lane 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 lane. |

Dip switch 6 selects “Both Lanes”.

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

Typical connection for a Rotax 912iS 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 Lane A and Lane 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. Lane B data will be sent if Lane A fails.

“Both Lanes” operation

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

Lane A is RDAC 1 or RDAC 3

Lane B is RDAC 2 or RDAC 4

If Lane A data fails, Lane B data is sent on Lane A (i.e. It is duplicated).

If Lane B data fails, no data is sent on Lane 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 Rotax 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 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.

Rotax ECU diagnostics

The Rotax ECU transmits various status messages. These can be observed in the “RDAC CAN ECU status information” in the diagnostics menu.

The following Tables 6 and 7 represent the bitmaps of the Sensor and Device Status words. During normal operation, these should report a zero (0), indicating there are no errors detected. Should there be an error detected, the specific bit in the status word will be set to one (1).

Table 6: Sensor Status Decoder

| Bit Position | 31 MSB | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|--------------|-----------|-------------------------------|-------------------------------|------------------------|------------------------|--------------------------|--------------------------|----------------------|------------------------|-------------|-------------|----------|----------------------|----------|----------|--------------------------------------|---------------------|------------------------------------|------------------------------------|------------------------------------|------------------------------------|--------------------------|------------------------|----------|-------------------|----------|----------------------------|----------|----------|---|---|---|
| Common | | Manifold Air Pressure | Manifold Air Temperature | Internal Temperature 1 | Internal Temperature 2 | Generator Select Voltage | Generator Select Current | Crank Sensor Fault 1 | Sensor Drive Voltage 2 | Bus Voltage | ECU Current | Reserved | Crank Sensor Fault 2 | Reserved | Reserved | Lane Specific Sensors (see below) | | | | | | | | | | | | | | | | |
| | Lane A | Common Sensors (see above) | | | | | | | | | | | | | | Engine Ambient Pressure | Coolant Temperature | Exhaust Gas Temperature Cylinder 1 | Exhaust Gas Temperature Cylinder 2 | Exhaust Gas Temperature Cylinder 3 | Exhaust Gas Temperature Cylinder 4 | Thermistor Drive Voltage | Sensor Drive Voltage 1 | Reserved | Throttle Position | Reserved | Engine Ambient Temperature | Reserved | Reserved | | | |
| | | Lane B | Common Sensors (see above) | | | | | | | | | | | | | | Oil Pressure | Oil Temperature | Sensor Drive Voltage 1 | Reserved | | | | | | | | | | | | |

Table 7: Device Status Decoder

| Bit Position | 31 MSB | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|-------------------|-----------|----------------|----------------|---------------------------|-------------------------|--------------|---------------------|---------------------|---------------------|---------------------|-------------------------|-------------------------|------------------------------|-------------------------------------|---------------------|---------------------|----------------------|---------------------------------|-------------------|------------------|----------------|-----------------------|---------------------|----------|---------------------------------|-------------------------|-------------------------|-------------------------|-------------------------|---------------|----------|---|
| lane A/ Lane B | | Internal Flash | External Flash | Ignition/Injection Driver | Generator Select Switch | Engine Stall | Injector Cylinder 1 | Injector Cylinder 2 | Injector Cylinder 3 | Injector Cylinder 4 | Ignition Cylinder 1 / 2 | Ignition Cylinder 3 / 4 | Engine Speed Limiting Active | No Data Received From Opposite Lane | Warning Lamp Lane A | Warning Lamp Lane B | Lane Synchronization | Interlane Communication Failure | Generator Failure | Internal Logging | Internal Timer | Pilot Display CAN Bus | Maintenance CAN Bus | Reserved | Internal Flash CRC Verification | EGT Injector Cylinder 1 | EGT Injector Cylinder 2 | EGT Injector Cylinder 3 | EGT Injector Cylinder 4 | Reset Occured | Reserved | |

Table 8: Engine Status Decoder

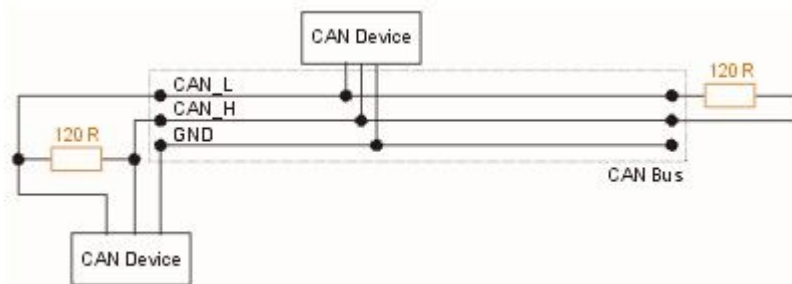
| Bit | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|-----|----------|----------|----------|----------|----------|----------|----------|----|----|---------------------|----|----|----|----|----|----------|----|----|----|----|----------|----|---|----------|---|--------------------|---|----------|-------------------------------|----------------------|----------------------|---|
| | Reserved | Reserved | Reserved | Reserved | Reserved | Reserved | Reserved | | | Engine Speed Status | | | | | | Reserved | | | | | Reserved | | | Reserved | | Warning Lamp State | | Reserved | Generator Select Switch State | Power / Economy Mode | This Lane In Control | |

| | | |
|------------|-----------|--|
| Bits 0-11 | Bit 0 | <p>This Lane In Control 1 = Lane is in control of Generator. 0 = Lane is not in control of Generator. If this bit is set, this is the active lane that is controlling the engine mounted generators.</p> |
| | Bit 1 | <p>Power / Economy Mode (PLA mode) 0 = Power Mode 1 = Economy Mode</p> |
| | Bit 2 | <p>Generator Select Switch State 1 = Lane is commanding Generator A. 0 = Lane is commanding Generator B.</p> |
| | Bit 3 | Reserved |
| | Bits 4-5 | <p>Warning Lamp State 0x2 = Warning Lamp On 0x1 = Warning Lamp Flashing 0x0 = Warning Lamp Off</p> |
| | Bits 6-7 | Reserved |
| | Bits 8-11 | Reserved |
| Bits 12-19 | | Reserved |
| Bits 20-23 | | <p>Engine Speed Status 1 – Stall: No crankshaft teeth detected 2 – Waiting for Gap: Teeth detected and awaiting valid sync 3 – Half Sync: ECU is synchronized to crankshaft position 4 – Full Sync: ECU is synchronized to crankshaft position and opposite Lane.</p> |

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.