Installation / Operation Manual

EMU 912iS evo / EMU 9xiS

Engine Management Unit

Version: 2.12

Contents

1. Preface

Thank you for purchasing an RS Flight Systems Engine Management Unit. We are pleased that you have chosen our product and are confident that it will meet all your expectations. In case of questions or problems with the unit, feel free to contact us:

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2. System Description

The second generation Rotax 912iS / 915iS Engine Management Unit family comprises two cockpit mounted engine monitoring, data logging and propeller control devices called EMU 912iS evo and EMU 9xiS. Both offer the same internals, software and functionality:

- Seamless integration into the Rotax 912iS / 915iS engine wiring harness
- Minimum installation effort (single device, 2 connectors and 6 wires for basic functionality)
- Indication of all available engine parameters, engine status and ECU faults
- Indication of additional sensor inputs (e.g. optional fuel pressure sensor)
- Automatic propeller speed control for single lever engine operation (in combination with MT Propeller governor, optional)
- Sunlight-readable backlit display with a wide viewing angle range
- Simple and self-explanatory operation (three push buttons, one rotary knob)
- Dual optically isolated CANaerospace data bus interfaces for retained redundancy
- Continuous monitoring and health checking of both ECU display buses
- Georeferenced data recording of all parameters at 10 Hz over up to 2,000 hours
- Simple data transfer and software update via an integrated memory card slot
- Sophisticated visualization and processing tool for recorded data (Windows, Linux, MacOS)
- Google Earth file export for recorded data including GNSS and engine data
- Additional input and output channels for future system upgrades
- Configurable for the use of different unit systems (metric/US customary)
- Suitable for 14 V and 28 V aircraft electrical systems
- Preassembled wiring harnesses available as accessory
- Highly customizable software (on request)
- High level of manufacturing and quality control
- Engineering and production exclusively done in Germany


OIL
EGT/CHT
THROTTLE
FUEL
ECU/ACU
7.9 bar
138 C
845 C
115 C
81.6%
--- bar
24.6 l/h
13.8 V
23.7 V
B:SBY
CHECK OIL PRESSURE
A:ACT
POWER
R5800
000
MAN
x100
RPM
x1000
1076
GEN->CHK
5350
Card OK
MCR
INFO
SYST
CONF

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RS FLIGHT SYSTEMS
OIL
EGT/CT
THROTTLE
FUEL
ECU/ACU
4.0 bar
85 C
765 C
95 C
95.0%
3.0 bar
25.0 l/h
13.8 V
13.9 V
B:SBY
A:ACT
ECO
R5800
001
MAN
x100
RPM
x1000
1000
GEN OK
5000
Card OK
MCR
INFO
SYST
CONF

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3. Technical Specifications

	EMU 912 iS evo	EMU 9xiS
Mechanical Dimensions (width, height, depth)	146 x 120 x 82 mm 5.75 x 4.72 x 3.23 in	139 x 104.5 x 78 mm 5.47 x 4.11 x 3.07 in
Panel Cutout Dimensions	128 x 116 mm 5.04 x 4.57 in max. corner radius 1.5 mm (0.06 in)	127 x 103 mm 5.0 x 4.055 in max. corner radius 0.5 mm (0.02 in)
Mounting Depth excl. connectors	74 mm 2.91 in	71 mm 2.8 in
Mounting	Four M4 screws 136.2 x 85.7 mm 5.36 x 3.37 in	Four M3 screws 133.5 x 79.5 mm 5.26 x 3.13 in
Total Mass	0.99 kg 2.18 lbs	0.81 kg 1.78 lbs
Housing	Machined Aluminum, surface anodized to aerospace standard	
Supply Voltage	9 to 32 Volts DC, according to EN2282	
Power Consumption	typ. 8.4 W (0.6 A at 14 V, 0.3 A at 28 V) without external load	
CANaerospace Interfaces	According to ISO 11898-2, optically isolated	
Analog I/O	4 inputs (±10 V)	
Digital I/O	2 parallel outputs, driving up to 3.9/4.0 A	
Positioning	Combined GPS/Galileo Sensor (Navilock NL-603P), 4 Hz update rate	
Display	5 inch Active Color Matrix TFT, 640 x 480 pixels, dimmable LED backlight, maximum brightness 600 cd/m^2	
Electronics	Xilinx Spartan-3 FPGA with dual Microblaze processors, PicoMod1 Display Controller	
Storage	Single front mounted SD/SDHC-Card, up to 32 GB	
Operating		

4. Mechanical Installation

Upon delivery, undertake visual inspection of the package contents for signs of transport damage and verify the information on the type plate sticker against your order. Do not open the device housing.

For longer storage of the device, select a dry and clean environment. Make sure that the device is not stored near strong heat sources and that no metal chippings or other dirt can get into the device or its connectors.

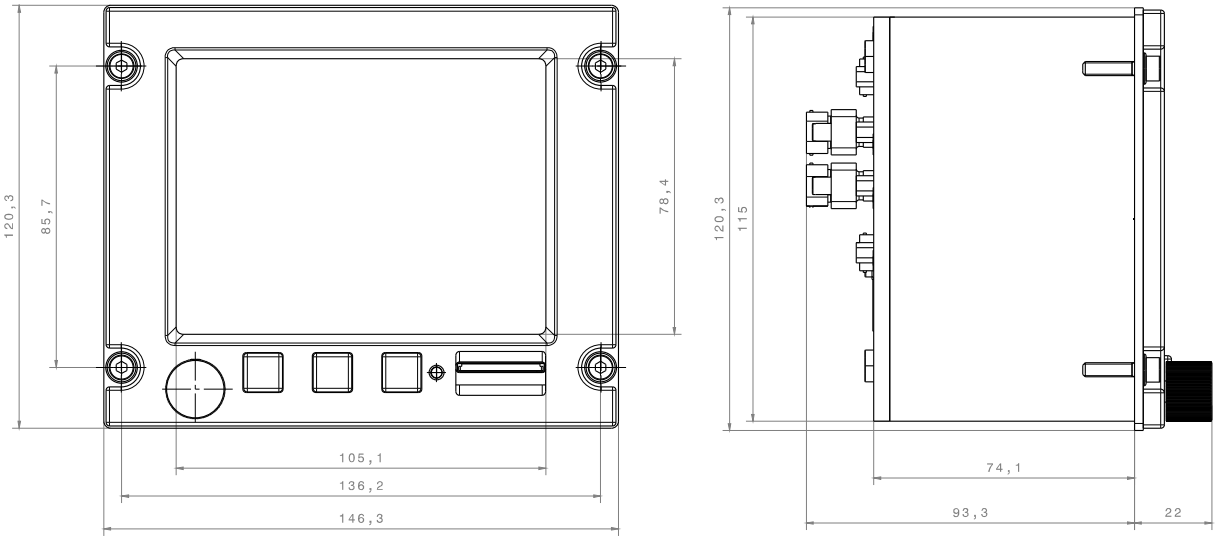
Both EMU variants are mounted onto the instrument panel using a rectangular cutout (dimensions in Table 3-1) and four metric screws included in the package. The screw hole positions are symmetric to the cutout in both axes and can be taken from Figure 4-1 and Figure 4-3. If you are using fixed female threads in the panel instead of nuts, provide a minimum thread length of 4 mm. Always secure your mounting joint.

Three-dimensional CAD-models of the units and the cutouts are available at:
https://www.rs-flightsystems.com/product-page/emu-912xis

As waste heat is dissipated via free convection, leave at least a 5 mm gap from the aluminum surfaces to any other object. Forced cooling is not necessary.

The installation must be in accordance with the appropriate guidelines approved by the respective aviation authority. The person installing the device is responsible for compliance with all applicable legislation.

2 9 Drawings EMU 912iS evo



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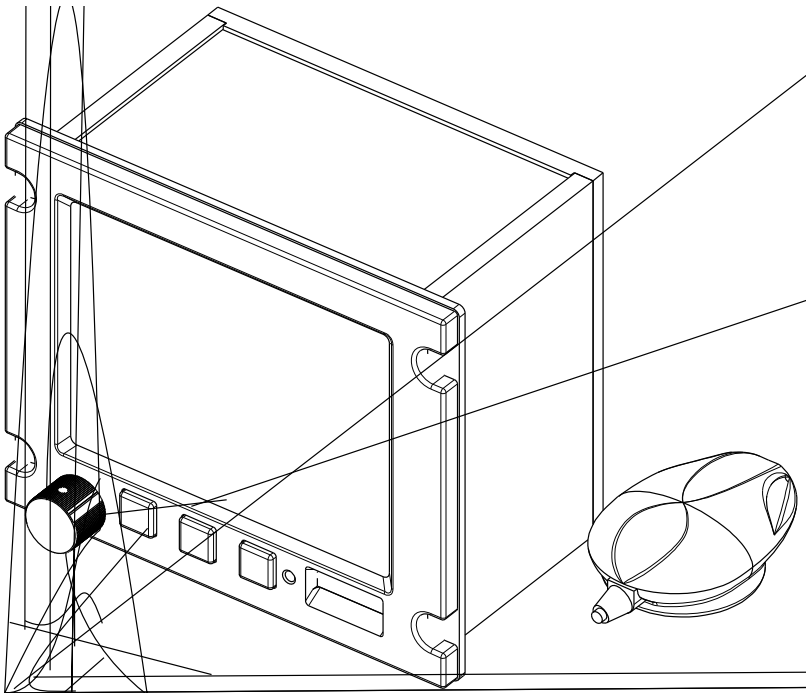

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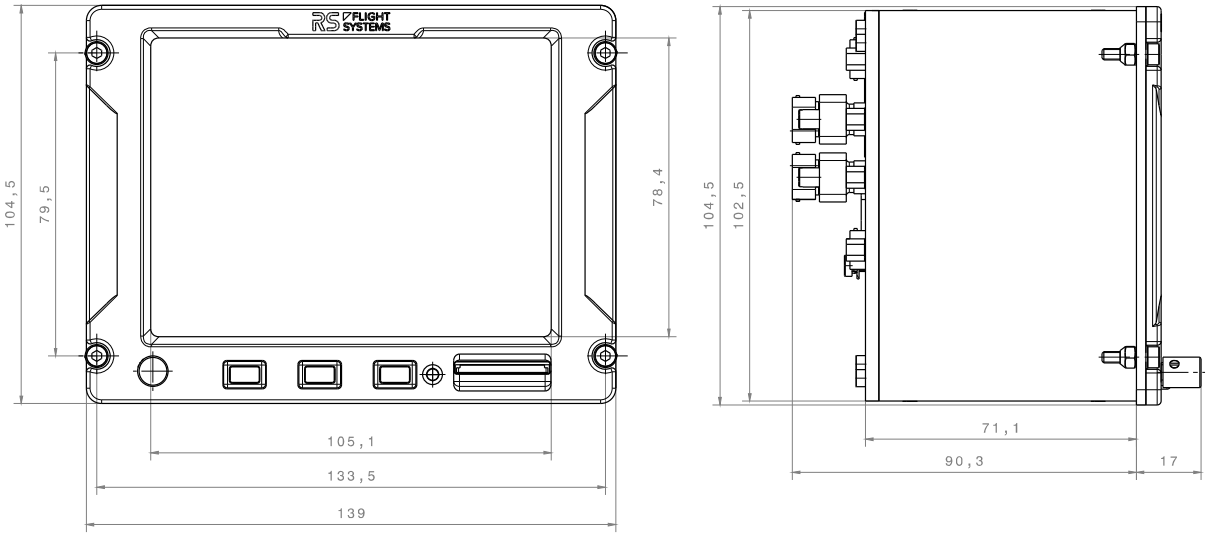
2 0 Drawings EMU 9xiS



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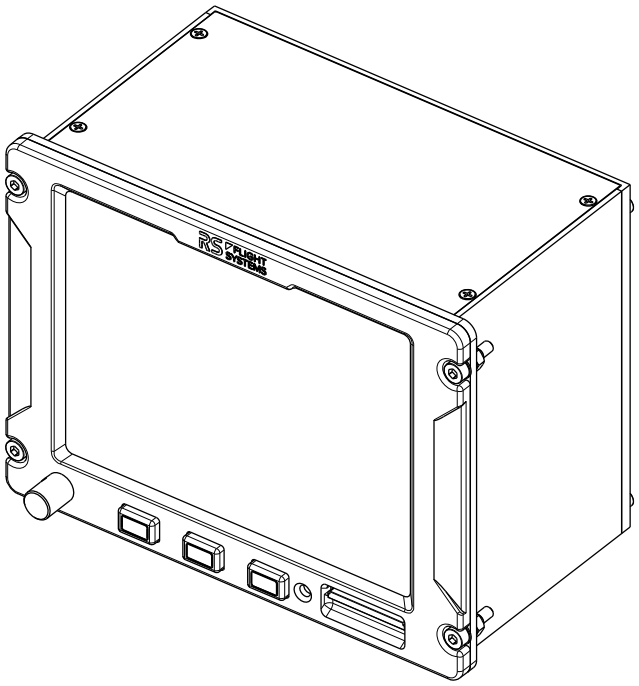

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5. Electrical Installation

The Engine Management Unit has five connectors on the rear side. Four of them are standard density D-Sub connectors with 4-40 UNC threaded fastening. Both CAN Connectors (“Lane A” and “Lane B”) are equipped with a filter adapter to enhance signal quality. Do not remove these filters. The remaining DIN-style connector for the GNSS Antenna is secured with two safety wires.

Connector	Label	Connector Type	Usage
AUX	“Auxiliary”	DA15S (female 15-pin D-Sub)	I/O
CANaero_A	“Lane A”	DE9P (male 9-pin D-Sub)	CAN Bus, Power Supply
CANaero_B	“Lane B”	DE9P (male 9-pin D-Sub)	CAN Bus
SYSTEM	“RS-232”	DB9S (female 9-pin D-Sub)	Diagnosis
GNSS	none	Female Mini-DIN 6	GNSS Antenna

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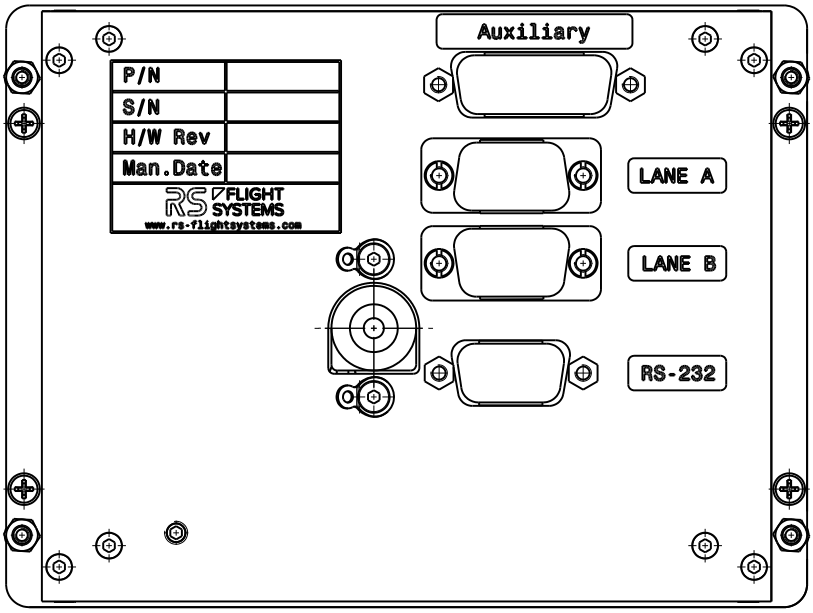

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Place the GNSS antenna in a spot where it has maximum optical visibility of the sky, e.g. the glare shield on top of the instrument panel. Poor GNSS reception has no adverse impact on the operation of the unit yet may impair recordings of position, ground speed and UTC data.

Only use self-extinguishing cables suitable for installation in aircraft; e.g. SAE-AS22759 or SAE-AS27500. AWG22 (0.34 mm²) is a sufficient cross section for power supply of the EMU. Preassembled wiring harnesses are available as an accessory for simplifying the installation. For part numbers see Chapter 5.4 or contact RS Flight Systems directly.

Figure 5-2 shows an overview of all standard connections.

Carefully check your wiring before powering up the unit for the first time.

3 9 Lane A / Lane B Connector

Lane A Connector carries the power supply pins of the EMU (Pins 1 and 5) and Display CAN Lane A (Pins 2 and 7). Table 5-2 specifies its pinout. Reverse polarity and voltage surge protection are implemented on the Lane A connector, therefore power must be supplied there. Install a 3 A circuit breaker or quick fuse in the positive supply line. For CAN wiring, use shielded twisted pair cables with an impedance of 120 Ω. Do not connect either of the CAN Ground Pins on the two Harness Interface Connectors. Since termination resistors are built into the ECU as well as the EMU, no additional resistors are necessary.

Pin Number	Signal Name	Function
1	PWR_IN	positive EMU power supply
2	CANL_A	CAN Low, connect to HIC A, Pin 5
3	FB_CLOCK	do not connect
4	CANH_A	do not connect
5	GND	negative EMU power supply, ground
6	TERM	do not connect
7	CANH_A	CAN High, connect to HIC A, Pin 6
8	FB_DIN	do not connect
9	FB_SHIFT	do not connect

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Lane B Connector carries the second Display CAN Lane of the ECU on Pins 2 and 7. This setup guarantees full redundancy of all data paths to the EMU. Table 5-3 specifies its pinout.

Pin Number	Signal Name	Function
1	PWR_IN	positive power supply (Backup)
2	CANL_B	CAN Low, connect to HIC B, Pin 7
3	FB_CLOCK	do not connect
4	CANH_B	do not connect
5	GND	negative power supply, ground (Backup)
6	TERM	do not connect
7	CANH_B	CAN High, connect to HIC B, Pin 8
8	FB_DIN	do not connect
9	FB_SHIFT	do not connect

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3 0 Auxiliary Connector

The Auxiliary Connector is used for general I/O purposes. It offers regulated 12 V (Pin 13) and 5 V (Pin 11) reference voltages for sensors and can supply a maximum of 100 mA each. Both supplies are referenced to a common ground (Pins 5 and 12) isolated from the aircraft supply potentials. The analog inputs also refer to the same potential. The maximum analog input voltage is ±10 V. Note that higher voltages can permanently damage the unit as no protection is implemented on these inputs. It is recommend to use the analog inputs as shown in Table 5-4 and Figure 5-2.

It is recommended to place the optional fuel pressure sensor either as close as possible to the fuel pressure regulator on the fuel rail of the left cylinder bank (Cylinders 2 and 4) or on the outflow port

of the fuel filter. The available adapter (Chapter 5.4) allows mounting it in both these places. A fuel pressure sensor with the following specifications is available as an accessory and supported by the standard software (see Chapter 5.4):

- Pressure range: 1 to 11 bar absolute pressure
- Supply voltage: 5 or 12 VDC
- Output voltage: 0.5 VDC to 4.5 VDC

The MOTOR+/MOTOR- (Pins 7 and 8) and the DOUT+/DOUT- (Pins 9 and 10) outputs are driven by the same signals but have different drivers installed. Therefore, they cannot be used independently. The standard software is designed to drive an electric MT-Propeller P-853 constant speed governor via the MOTOR+ and MOTOR- pins (function available on request). The exact variant of the governor depends on the specific aircraft configuration. Please contact RS Flight Systems for further details. A prewired harness is available as an accessory (see Chapter 5.4).

For the SLPC function, a 390 Ohm resistor must be installed between Pin 4 and Pin 11 of the Auxiliary Connector (see Figure 5-2) on units with the following serial numbers:
EMU 912iS evo: SN 0100 – SN 0312
EMU 9xiS: SN 0001 – SN 0019
For higher serial numbers, this modification is integrated in the EMU and the 390 Ohm resistor must not be installed.

The START_PWR relay output drives up to 500 mA of inductive load and is referenced to the aircraft ground (Pin 15). The EMU uses this output to drive an external start power relay to simplify the engine start procedure. Using the Start Power relay, the ECU is automatically connected to the battery power during engine startup as opposed to the pilot activating a spring loaded “Start Power” switch. The function is activated only after startup of the EMU until the engine reaches 1500 rpm for the first time. As soon as this condition is met, the ECU is supplied by one of the internal generators. A separate, mechanically locking “Battery Backup” toggle switch is still necessary in order to fulfil all safety requirements (e.g. for engine restart in flight). An extinguishing diode across the relay coil is typically not needed and a suitable relay is available as an accessory (see Chapter 5.4). Feel free to contact RS Flight Systems for different sensor configurations.

Pin Number	Pin Name	Function
1	AIN0	Analog Input 0 (Fuel Pressure)
2	AIN1	Analog Input 1
3	AIN2	do not connect
4	AIN3	Analog Input 3 (Governor Limit)
5	AGND	Analog Input Reference Ground
6	START_PWR	Start Power Relay Output
7	MOTOR+	Propeller Governor H-Bridge Driver Output (High Side)
8	MOTOR-	Propeller Governor H-Bridge Driver Output (Low Side)
9	DOUT+	Discrete Output, High Side (derived from MOTOR+)
10	DOUT-	Discrete Output, Low Side (derived from MOTOR-)
11	5V	5 V Analog Reference Voltage

12	AGND	Analog Input Reference Ground
13	12V	12 V Analog Reference Voltage
14	ACSUP	Aircraft Power Supply (9-32 VDC)
15	ACGND	Aircraft Power Supply Ground

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3 1 RS-232 Connector

The RS-232 Interface is reserved for future enhancements and diagnosis. Therefore, no connections must be made on this connector for routine operation. Currently, the only data transmitted via RS-232 is status information on startup. It is configured at 115.2 kBd, 8 Data bits per character, single stop bit and no parity. All reference power supply pins are restricted to the same limitations as on the auxiliary connector (Chapter 5.2)

Pin Number	Signal Name	Function
1	12V	12 VDC Power Supply
2	TXD	RS-232 Transmit Data
3	RXD	RS-232 Receive Data
4	3V3	3.3 VDC Power Supply
5	GND	Reference Ground
6	5V	5 VDC Power Supply
7	GPS_RX	GPS Receive Data
8	GPS_TX	GPS Transmit Data
9	GND	Reference Ground

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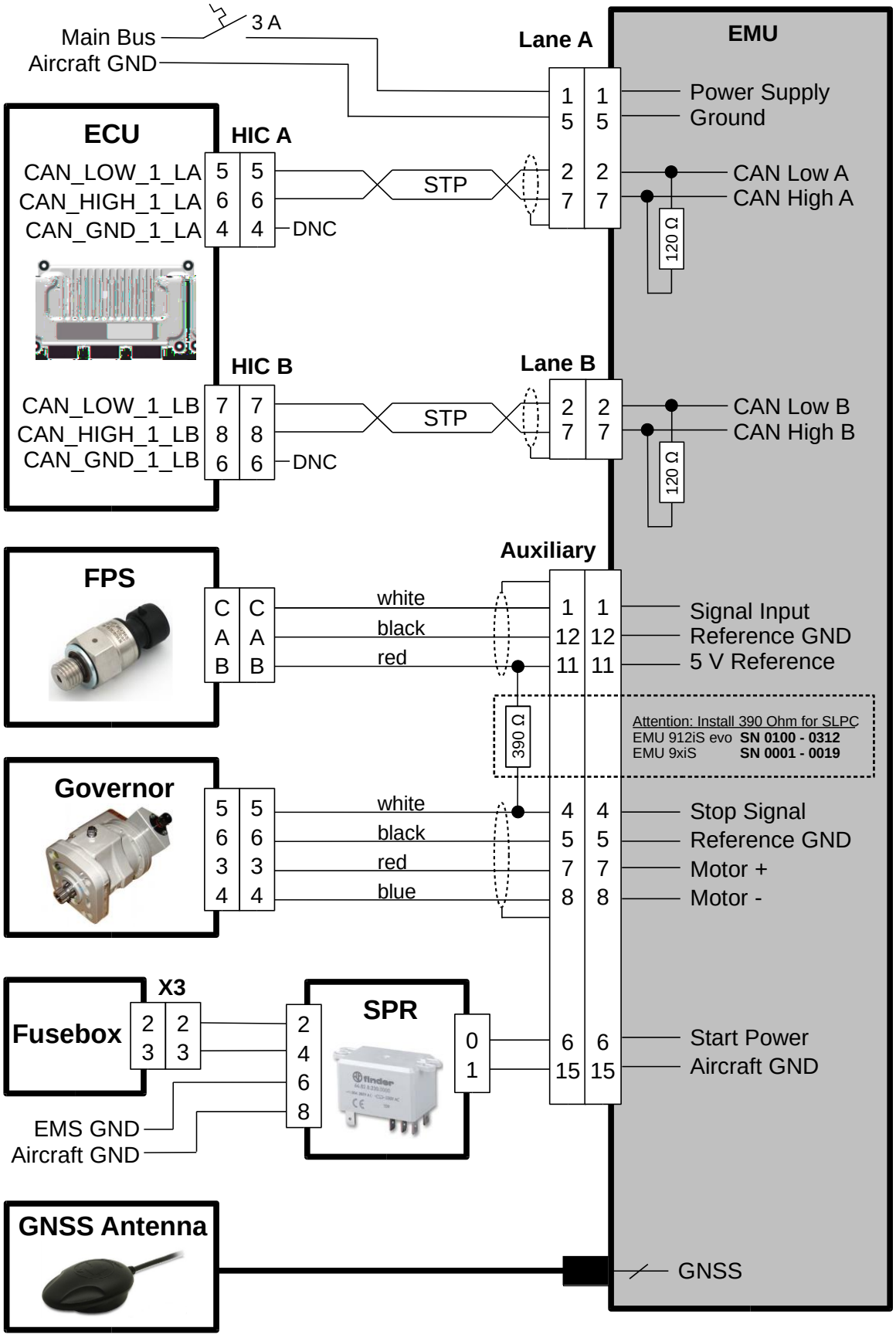
Main Bus
Aircraft GND
3 A
Lane A
EMU
ECU
HIC A
CAN_LOW_1_LA
CAN_HIGH_1_LA
CAN_GND_1_LA
STP
DNC
Power Supply
Ground
CAN Low A
CAN High A
120 Ω
HIC B
Lane B
CAN_LOW_1_LB
CAN_HIGH_1_LB
CAN_GND_1_LB
CAN Low B
CAN High B
Auxiliary
FPS
white
black
red
Signal Input
Reference GND
5 V Reference
390 Ω
Attention: Install 390 Ohm for SLPC
EMU 912iS evo SN 0100 - 0312
EMU 9xiS SN 0001 - 0019
Governor
Stop Signal
Reference GND
Motor +
Motor -
Fusebox
X3
SPR
Start Power
Aircraft GND
EMS GND
Aircraft GND
GNSS Antenna
GNSS

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3 2 Available Accessories

Part No.	Name	Description
21008-713	Connection Harness EMU	Prewired shielded harness for Lane A and B connectors Includes power supply wires Open ends on HIC side to allow for custom integration Length 2 m / 6.5 ft
10-110	Start Power Relay Kit	Kit for integration of the start power relay Includes relay and cables for connection to the EMU Open ends on EMU side to allow for custom integration Length 1 m / 3.3 ft.
10-072	Fuel Pressure Sensor Kit	Includes the following items: • 664365 BRP Rotax Fuel Pressure Sensor • 10-070 Harness Fuel Pressure Sensor • 10-806 Hollow Screw
664365	Fuel Pressure Sensor	Original BRP Rotax Fuel Pressure Sensor with a range of 1 to 11 bar.
10-070	Harness Fuel Pressure Sensor	Prewired shielded harness for fuel pressure sensor. Open end on EMU side to allow for custom integration. Length 2 m / 6.5 ft
10-806	Hollow Screw	Adapter for mounting the fuel pressure sensor on the fuel rail.
10-085	Auxiliary Connector	Manufacturing kit for Auxiliary connector Includes shell, connector housing and contacts Requires M22520 crimping tool
21008-716	SLPC Connection Harness	Prewired shielded harness for governor control Open end on EMU side to allow for custom integration. Length 3 m / 10 ft.
10-140	Start Key Switch 9iS	Starter Key Switch for Rotax 912iS / 915iS engines. Switching of: LANE A / LANE B, Fuel Pumps MAIN and AUX, EMU/SCU, Ground Shortcut (OFF) and Starter
10-111	Auxiliary Harness	Custom harness for the auxiliary connector Fully prewired on both ends Includes 390 Ω pull-up resistor for SLPC Cable length and configuration information needed
10-193	Power Supply Unit	Ground power supply unit with mating connector. Powers up the EMU without installation in the aircraft
P-853-12	Propeller Governor 912 iSC	MT Propeller governor for SLPC function. 12 V version.
P-853-95	Propeller Governor 915 iS	MT Propeller governor for SLPC function. 12 V version.
10-225	Mounting Set Governor	Mounting set with 4 screws for mounting the MT governor on Rotax iS engines
10-234	Mounting Tool Governor	Mounting tool for MT propeller governors
10-273	Backup Power Switch	2-pole Switch for the Rotax iS Backup Power function
10-274	Toggle Switch	Switch for power supply of the EMU

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6. Operation

This chapter describes operational procedures only for the standard software version of the EMU.

4 9 Startup

The EMU starts up as soon as soon as sufficient supply voltage is provided. The status LED on the front panel confirms startup by illuminating in red for 10 seconds while the device boots up. The subsequent startup screen is shown for 5 seconds and gives details about the current software version while internal testing routines are performed to ensure correct operation of all electronic components. Actuating the device buttons does not have any effect during startup.

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4 0 Start Power Relay Functionality

For the Rotax 912iS / 915iS engine, the spring-loaded “Start Power Switch” (SPS), as specified in the BRP-Powertrain installation manual, has to be activated prior to engine start. As soon as START has been commanded and the engine is running, the SPS has to be released. The function of the SPS is to temporarily feed aircraft battery power to the Engine Control Unit (ECU), so that engine start is possible. Remove this connection after the engine is running, so that during regular operation the ECU is exclusively supplied through its assigned alternator.

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In order to improve the aircraft handling during the engine start process, the EMU provides a switch function which accomplishes automatic start power using an external relay wired in parallel to the SPS. This relay is activated as soon as the EMU is powered up (below 1 sec.) and remains activated until the engine reaches 1500 rpm for the first time. As soon as this happens, the relay is deactivated and is never activated again, until the EMU is turned off. Using this function, engine start can be commanded through a Start Key Switch, whose START position is spring-loaded. The aircraft installation of the relay with reference to the BRP-Powertrain documentation is shown in Figure 5-2.

The connection of the Start Key Switch 9iS, which is available as an accessory, is described in the “Installation / Operation Manual Start Key Switch 9iS”.

4 1 Main Page

Upon completion of the startup process the display shows the MAIN page, which is an overview of the most important engine parameters, the active ECU and generator lanes, system status (e.g. power or economy mode) as well as caution and alarm messages. An exemplary view of the MAIN page is shown in Figure 6-5 and Figure 6-6. Other pages may be selected through the three bottom push buttons. Rotating the knob on the left-hand side (MCR) adjusts the TFT brightness between 2% and 100%. The initial brightness after power-on is 100%.

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Data is displayed in two different ways on the MAIN page: dials and alphanumeric indicators. Dials are used for engine speed and manifold pressure, these two being the most important engine power indicators. Green (normal), amber (cautionary) and red (limit exceeded) arc sections allowing for a quick evaluation of parameters. Dial indicators for more precise readouts are combined with a white alphanumeric display at the bottom. Secondary parameters are only displayed alphanumerically close to the upper edge of the screen. They are grouped in pairs and their values change alert color for the same reasons as the dial indicators do. All color ranges are shown in Table 6-1a. In case of sensor failure, the display of the associated signal will revert to dashes ("---") thus immediately indicating the failure situation.

The rectangles labeled "A" and "B" indicate the error status of the ECU lanes by changing alert color from green (operational) to amber (non-fatal error) to red (inoperational). “ACT” marks the active lane controlling the engine, while “SBY” marks the inactive lane.

Parameter	Color Ranges 912 iS		Color Ranges 915 iS	
Engine Speed	0 to 1400 rpm	Amber	0 to 1800 rpm	Amber
	1400 to 5500 rpm	Green	1800 to 5500 rpm	Green
	5500 to 5800 rpm	Amber	5500 to 5800 rpm	Amber
	> 5800 rpm	Red	> 5800 rpm	Red
Throttle Position	0 to 100 %	Green	0 to 100 %	Green
	> 100 %	Amber	> 100 %	Amber
Manifold Air Pressure	All	Green	< 60 hPa	Red
	-	-	60 to 1730 hPa	Green
	-	-	> 1730 hPa	Red
Boost Pressure	-	-	< 410 hPa	Red
	-	-	410 to 1730 hPa	Green
	-	-	> 1730 hPa	Red
Oil Pressure	< 0.8 bar	Red	< 0.8 bar	Red
	0.8 to 2 bar	Amber	0.8 to 2 bar	Amber
	2 to 5 bar	Green	2 to 5 bar	Green
	5 to 7 bar	Amber	5 to 7 bar	Amber
	> 7 bar	Red	> 7 bar	Red
Oil Temperature	< 50 °C	Red	< -20 °C	Red
	-	-	-20 to 50 °C	Amber
	50 to 110 °C	Green	50 to 110 °C	Green
	110 to 130 °C	Amber	110 to 130 °C	Amber
	> 130 °C	Red	> 130 °C	Red
Fuel Pressure	< 2.5 bar	Red	< 2.5 bar	Red
	2.5 to 2.8 bar	Amber	2.5 to 2.9 bar	Amber
	2.8 to 3.2 bar	Green	2.9 to 3.1 bar	Green
	3.2 to 3.5 bar	Amber	3.1 to 3.5 bar	Amber
	> 3.5 bar	Red	> 3.5 bar	Red
Fuel Flow	All	Green	All	Green
Manifold Air Temperature	< 60 °C	Green	< 50 °C	Green
	> 60 °C	Red	> 50 °C	Red
Coolant Temperature	< -20 °C	Red	< -20 °C	Red
	-20 to 120 ° C	Green	-20 to 120 °C	Green
	> 120 °C	Red	> 120 °C	Red
Exhaust Gas Temperature	< 950 °C	Green	< 950 °C	Green
	> 950 °C	Red	> 950 °C	Red
Ambient Air Pressure	All	Green	< 410 hPa	Red
	-	-	> 410 hPa	Green
Ambient Air Temperature	All	Green	< -40 °C	Red
	-	-	-40 to 50 °C	Green
	-	-	> 50 °C	Red
AC/ECU Voltage	< 9 V	Red	< 9 V	Red
	9 to 12.7 V	Amber	9 to 12.7 V	Amber
	12.7 to 14.8 V	Green	12.7 to 14.8 V	Green
	> 14.8 V	Red	> 14.8 V	Red
Engine Faults	Color corresponding to severity of fault condition			

4 2 Central Warning Area

The central warning area in between the rectangles A and B displays informational messages when engine parameters are out of range. Messages displayed in the central warning area will disappear when confirmed by pressing the rotary knob. It is labeled "MCR" (Master Caution Reset) as soon as error messages show up.

All warnings with their respective priority stages are listed in Table 6-2.

Priority Stage	Warning text	Description
0 (highest)	NO ECU DATA	CANaerospace CBIT test failed
1	CHECK OIL PRESSURE	Oil pressure out of limits and RPM > 100
2	CHECK OIL TEMPERATURE	Oil temperature out of limits and RPM > 100
3	GEN FAIL / CHECK BATTERY VOLTAGE	Generator 2 in use and RPM > 1500
4	COLDSTART: THROTTLE 28 - 38 %	Oil temperature < 0 °C and RPM < 100
4	COLDSTART: THROTTLE 42 - 52 %	Oil temperature < -10 °C and RPM < 100
5	CHECK COOLANT LEVEL	Coolant temperature > 150 °C
6	CHECK COOLANT TEMPERATURE	Coolant temperature > 120 °C and < 150 °C
7	CHECK EGT	Any EGT out of limits
8 (lowest)	CHECK AIRCRAFT VOLTAGE	Aircraft voltage out of limits and RPM > 10 and < 1500

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In Figure 6-7 the warning “NO ECU DATA” is shown. “NO ECU DATA” is displayed in red in the Central Warning Area. All sensor values are displayed with “---” in white. In Figure 6-8 the warning “CHECK FUEL PRESSURE” is shown. “CHECK FUEL PRESSURE” is displayed in red in the Central Warning Area. The sensor value (2.0 bar) is displayed in red in the value box.

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In Figure 6-9 a high oil temperature is indicated. The sensor value (115 °C) is displayed in yellow in the value box. No warning is shown in the Central Warning Area. In Figure 6-10 the warning “CHECK OIL TEMPERATURE” is shown. “CHECK OIL TEMPERATURE” is displayed in red in the Central Warning Area. The sensor value (135 °C) is displayed in red in the value box.

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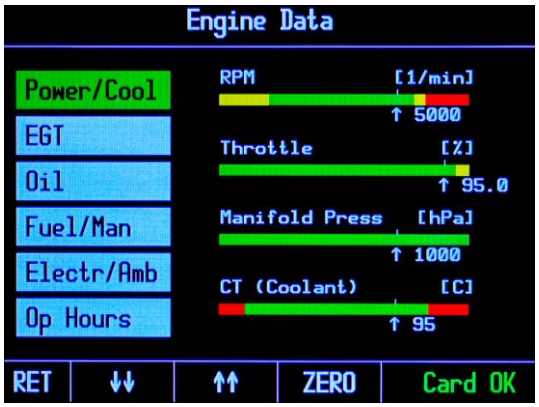
4 3 Engine Data Information (INFO) Page

The Engine Data Information page is accessible from the main page by pressing the push button marked “INFO”. It displays selected engine data in parameter groups with colored bars indicating the current values and their associated operational warnings and limits. The desired parameter group may be selected by operating the two leftmost push buttons. The one selected is highlighted in green. Every single parameter value is shown with an arrow underneath the color bar and has a drag indicator (white horizontal lines above the color bar). These can be reset for the entire group via the push button marked “ZERO”. They do not self-reset. Pressing the return (RET) button brings up the MAIN page regardless of the currently selected parameter group.



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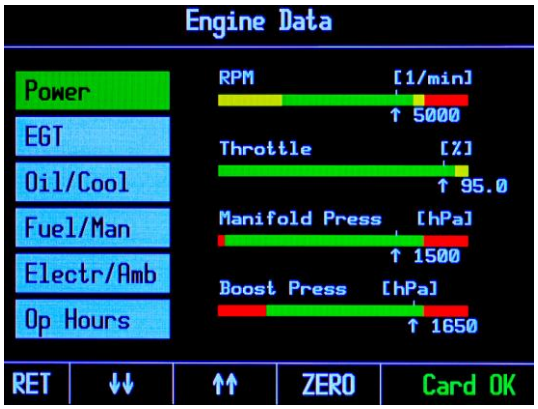

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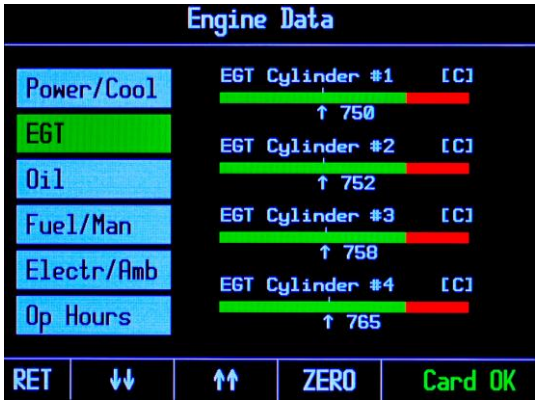

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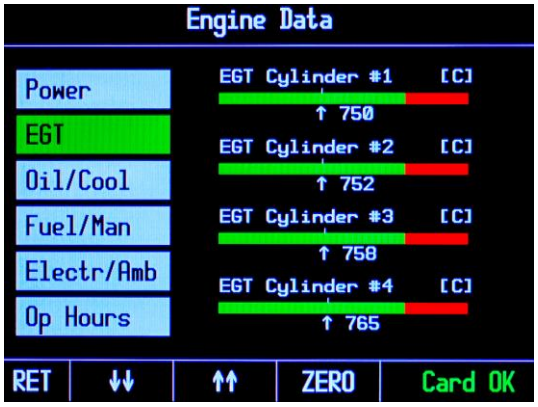

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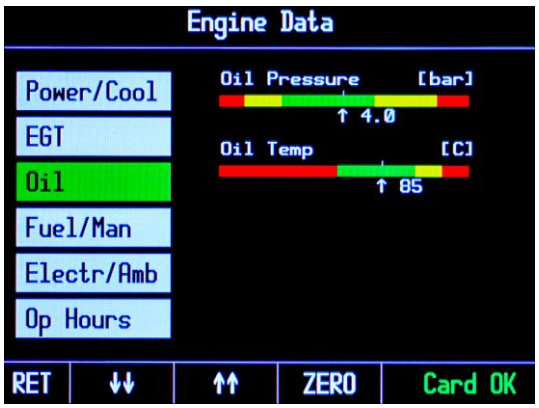

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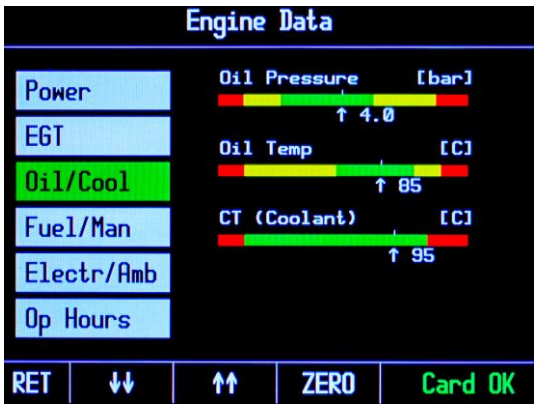

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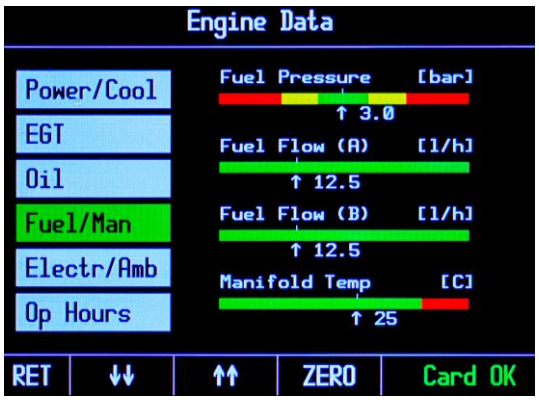

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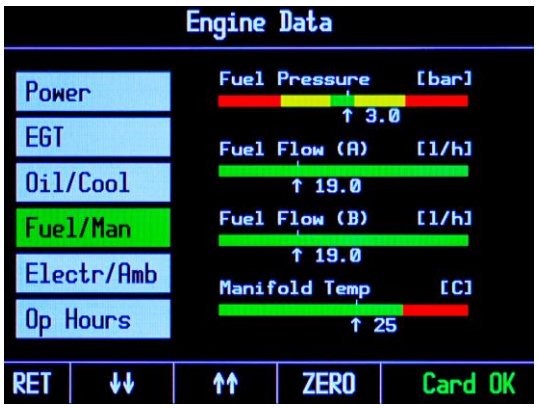

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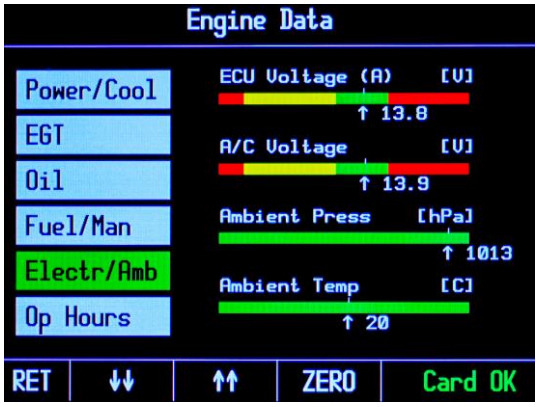

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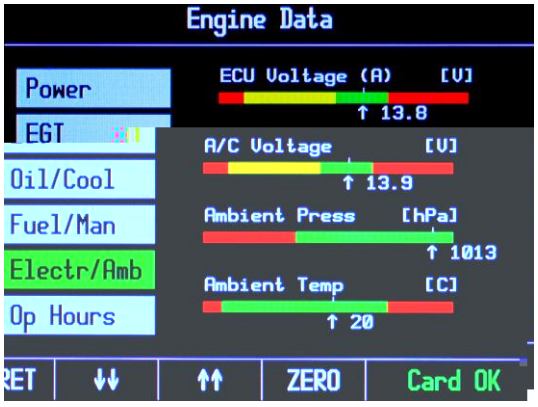

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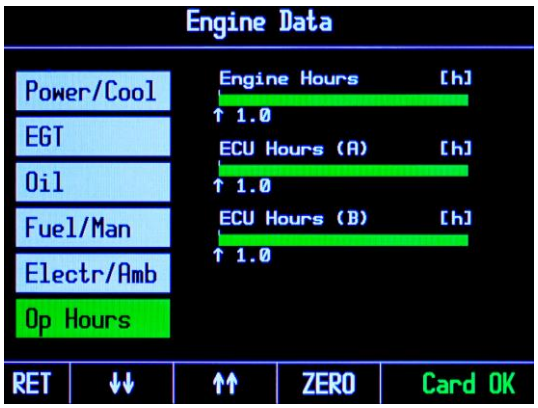

4 09,
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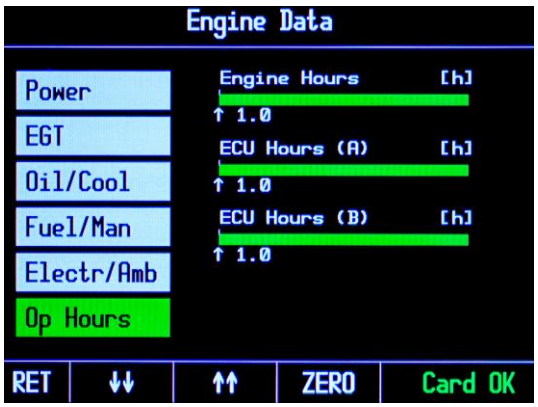

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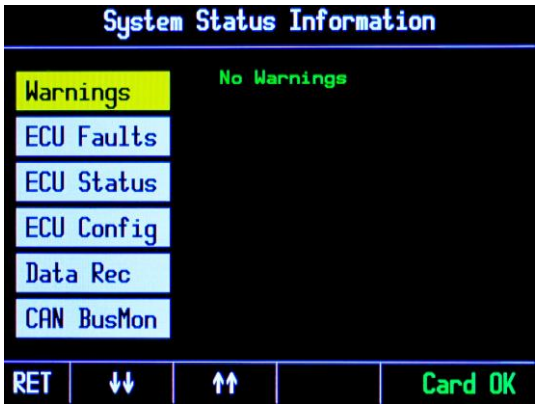
4 4 System Information (SYST) Page

The system information page is accessible from the MAIN page by pressing the push button marked "SYST". It provides six subpages that can be selected using the two leftmost push buttons marked "↑↑" and "↓↓". The one selected is highlighted in green or amber (for the "Warnings" and ECU Faults" subpages).

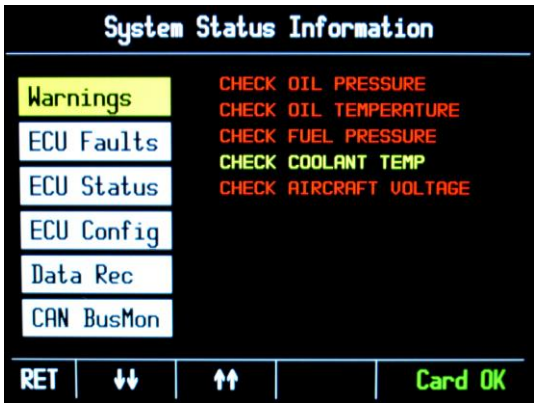
- The "Warnings" subpage shows warnings generated by the EMU color marked (green/amber/red) in accordance with their severity, e.g. for parameters exceeding limits from Table 6-1.
- The "ECU Faults" subpage shows system faults detected by one or both ECU Lanes. These are also color marked (green/amber/red) to indicate urgency and are displayed in reference to the respective ECU lane.
- The „ECU Status" subpage lists operational status conditions of the ECU in clear text form.
- The "ECU Config" subpage lists information specific to the installation, such as serial numbers or software versions.
- The "Data Rec" subpage shows the current status of the data recording, such as the current file name and size as well as information about the GNSS receiver.

- The “CAN BusMon” subpage shows the output of the internal bus monitoring device. This may be used to troubleshoot installation and wiring problems. Clean installations should read zero errors for reception and transmission. The received and transmitted (Rx/Tx) number of messages on the two lanes is also shown for a timeframe of 100 ms.

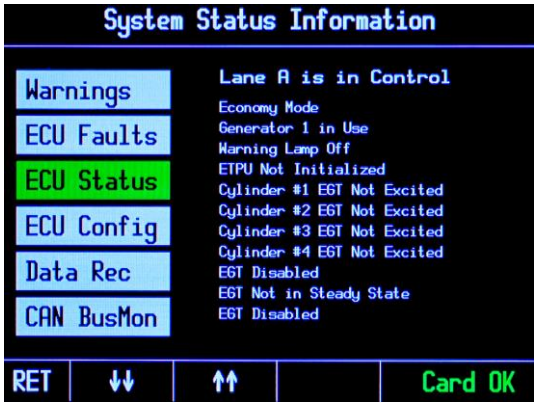
Pressing the RET button brings up the MAIN page regardless of other selections. The layout of the SYST subpages is shown in the following figures:



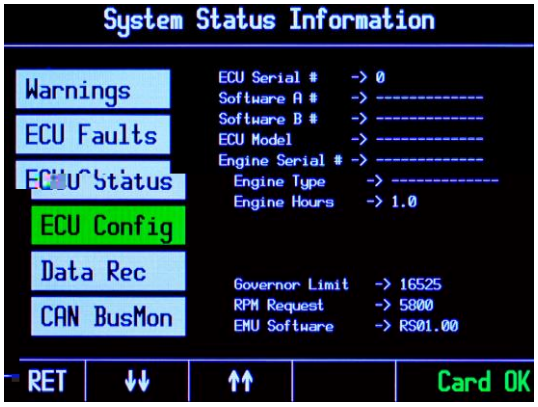
4 01,



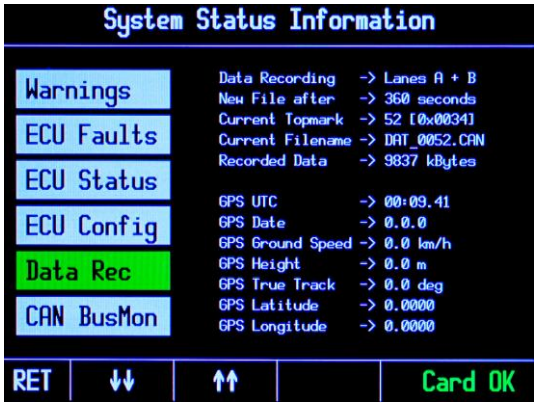
4 02,



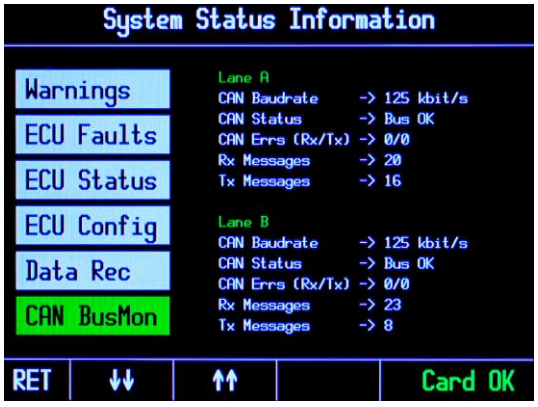
4 03,



4 04,



4 05,



4 04,

4 5 Configuration (CONF) Page

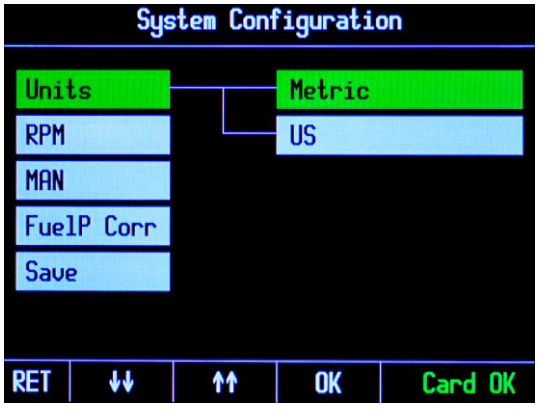
The configuration page is accessible from the MAIN page by pressing the push button marked “CONF” and allows the user to view, modify and store the EMU configuration settings on an SD card. The desired configuration item may be selected using the two leftmost push buttons marked “↑↑” and “↓↓” and is highlighted in green after selection.

Currently the EMU supports the following selections:

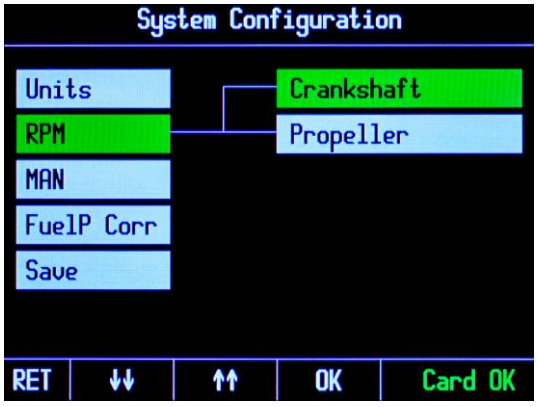
- Metric or US customary units for all alphanumerically displayed parameters (e.g. temperatures)
- Engine speed indication referenced to crankshaft or propeller.
- Manifold pressure values in hectopascals or inches of mercury.
- Offset addition to fuel pressure sensor value in order to compensate for sensing errors and position. This adjustment requires a calibrated pressure gauge.

Selected configuration settings become effective immediately and may be stored permanently on the SD card through the push button marked “SAVE” at any time. The file on the memory card containing the settings is named "EMU912IS.CFG". This file is in readable ASCII format and may also be edited on a desktop or laptop computer.

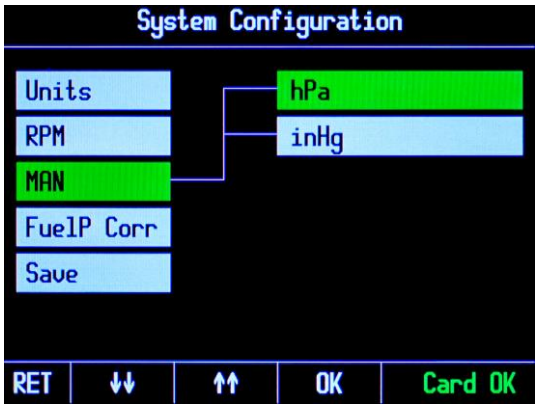
The layout of the SYST subpages is shown in the following figures:



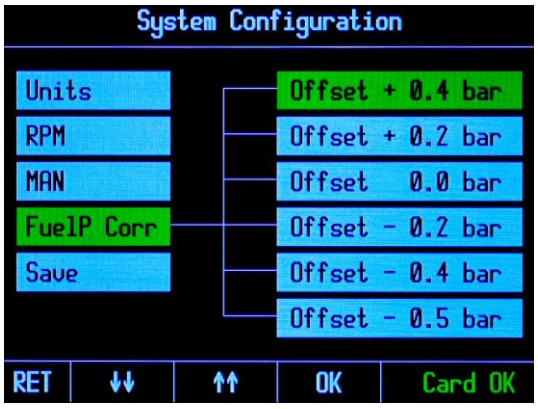
4 07,



4 16,



4 19,



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4 4 Single Lever Power Control

Below the central warning area there are two more fields. The first field indicates whether the engine is operating in POWER (rich fuel mixture) or ECO (lean fuel mixture) mode. The second field shows the engine speed commanded by the SLPC function. This function is only available in software versions with SLPC. The status of the generators is shown in a third field near the bottom of the display, in between the two supplemental numeric displays for the power parameters.

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Two SLPC test versions are available: RS01.0A for the 912iS and RS11.0A for the 915iS. In both versions the requested RPM value can be selected with the rotary knob. The brightness function is deactivated, and the brightness is set to 100 %.

In the customized SLPC software versions, the requested RPM value is automatically set. The requested RPM value is calculated from the throttle position, the manifold and the air density. The resulting control curve is adapted to each type of aircraft. Standard versions are available for touring aircraft, STOL and seaplane. Feel free to contact RS Flight Systems for different SLPC configurations.

4 7 Flight Data Recording

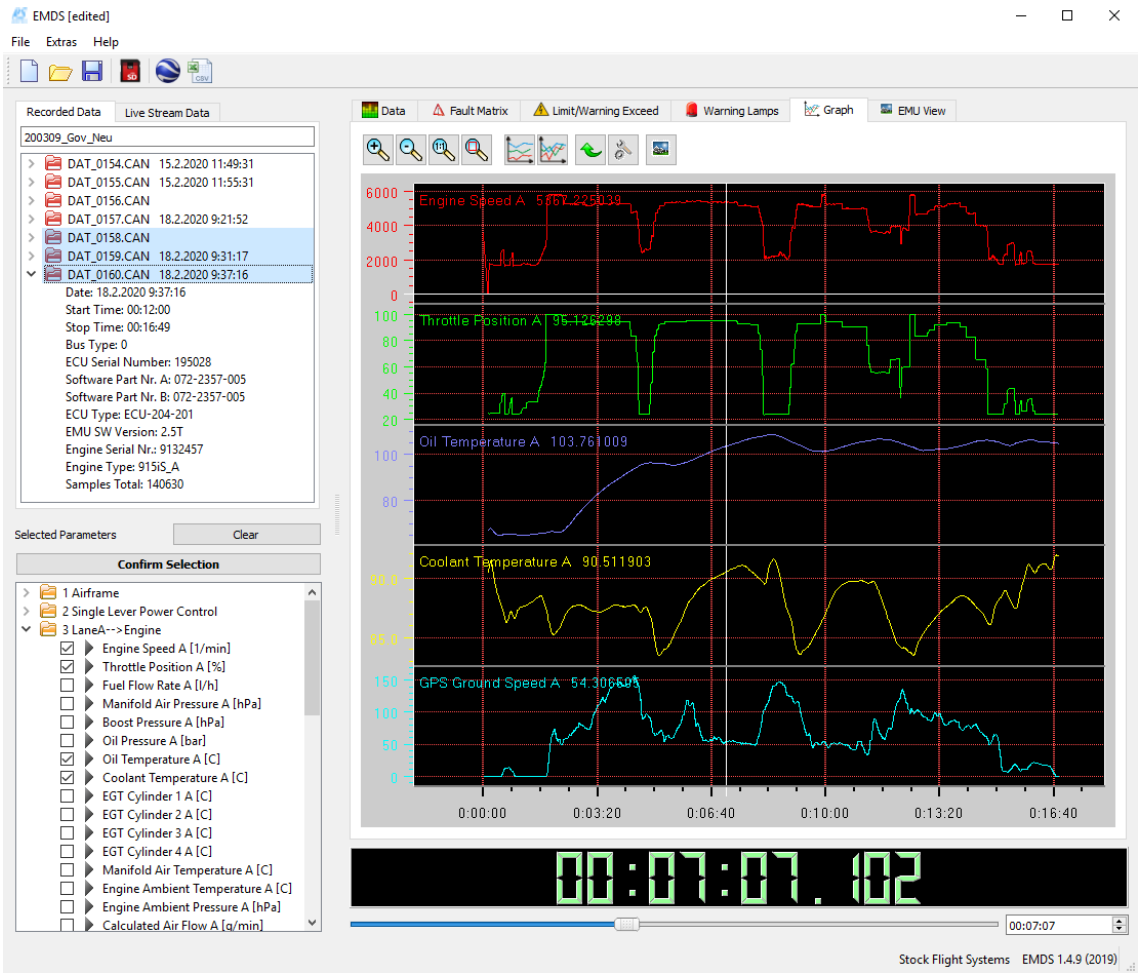
The EMU records all data transmitted by the ECU over both lanes and their respective CANaerospace interfaces. This function is only active as long as an SD card is inserted. For each restart of the EMU or every 6 minutes (0.1 recording hours) of runtime, a new file is created and the previous one is closed. The file naming convention is:

DAT_0001.CAN

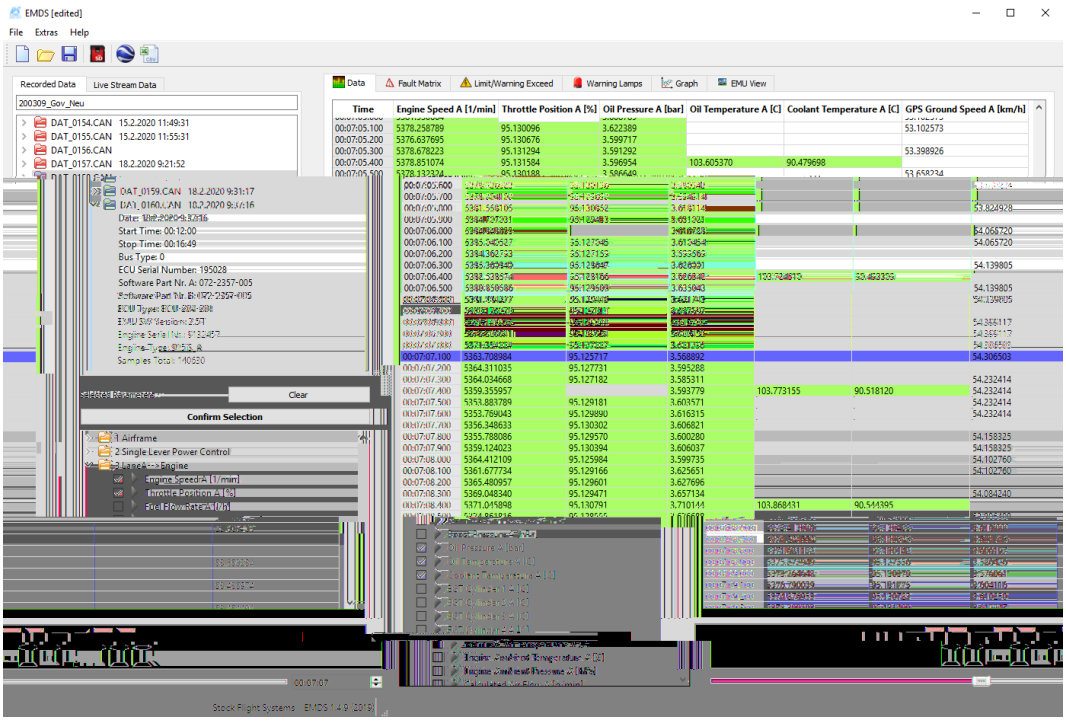
with 0001 being the decimal number, which is incremented by one for each new file and allows for 9999 different files to be created, named and stored. The number of the last file which has been closed and written to the SD card is stored as a 4-character ASCII string in the file "TOPDAT.CFG", which is also written to the card. Most of the data is transmitted 10 times per second and a typical data rate is 12 kilobytes per second. Using a 32 GB SDHC memory card, this results in a maximum recording time of 760 hours.

A powerful Engine Management Debriefing Station (EMDS) software for the Microsoft Windows, SuSE Linux and Apple MacOS X operating systems is delivered with the EMU. This tool (see Figure 6-35 to Figure 6-40) allows for visualization and post-processing of the recorded data as well as a three-dimensionally georeferenced data conversion to Google Earth compatible files.

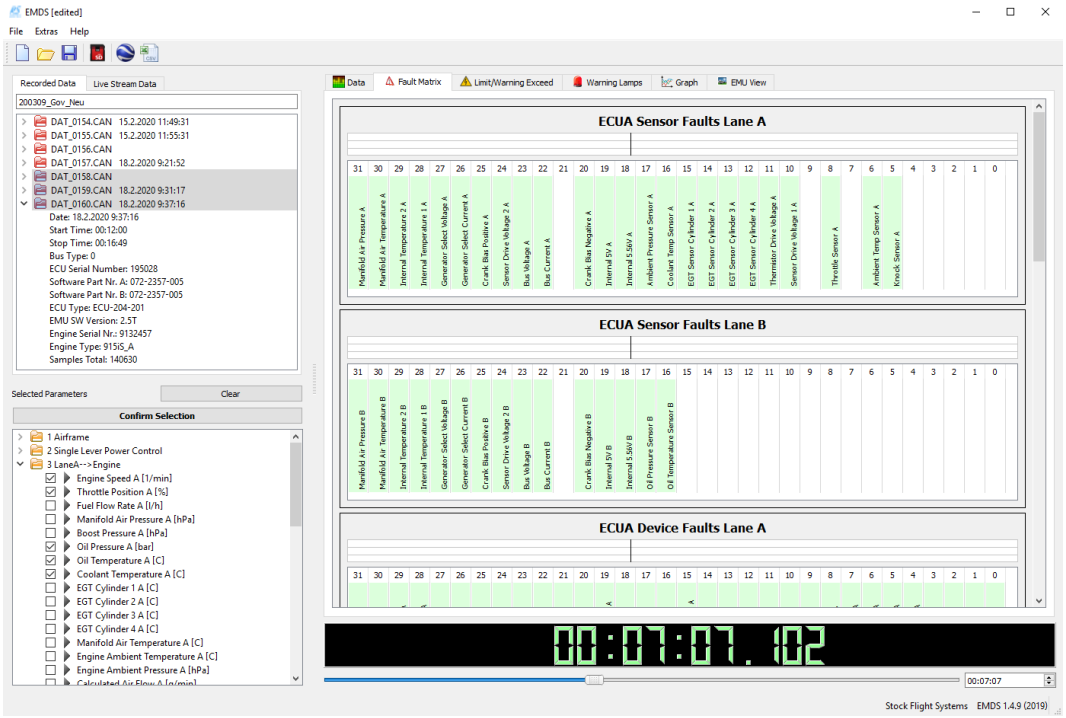
The EMDS software is available on the following server:
https://www.rs-flightsystems.com/product-page/emu-912xis



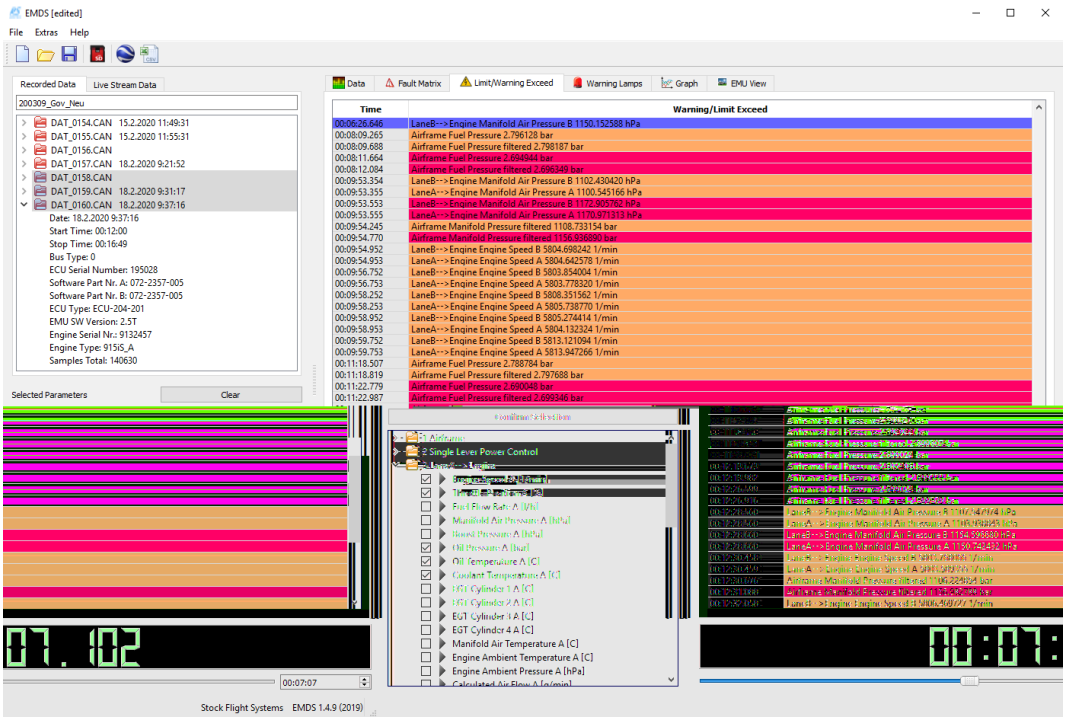
4 13,


EMDS [edited]
File Extras Help
Recorded Data
Live Stream Data
200309_Gov_Neu
DAT_0154.CAN 15.2.2020 11:49:31
DAT_0155.CAN 15.2.2020 11:55:31
DAT_0156.CAN
DAT_0157.CAN 18.2.2020 9:21:52
DAT_0159.CAN 18.2.2020 9:31:17
DAT_0160.CAN 18.2.2020 9:37:16
Date: 18.2.2020 9:37:16
Start Time: 00:12:00
Stop Time: 00:16:49
Bus Type: 0
ECU Serial Number: 195028
Software Part Nr. A: 072-2357-005
Software Part Nr. B: 072-2357-005
ECU Type: ECU-204-201
EMU SW Version: 2.5T
Engine Serial Nr.: 9132457
Engine Type: 915iS_A
Samples Total: 140630
Clear
Confirm Selection
1 Airframe
2 Single Lever Power Control
3 LaneA-->Engine
Engine Speed A [1/min]
Throttle Position A [%]
Data
Fault Matrix
Limit/Warning Exceed
Warning Lamps
Graph
EMU View
Time
Engine Speed A [1/min]
Throttle Position A [%]
Oil Pressure A [bar]
Oil Temperature A [C]
Coolant Temperature A [C]
GPS Ground Speed A [km/h]
Stock Flight Systems EMDS 1.4.9 (2019)

4 14,


EMDS [edited]
File Extras Help
Recorded Data
Live Stream Data
200309_Gov_Neu
DAT_0154.CAN 15.2.2020 11:49:31
DAT_0155.CAN 15.2.2020 11:55:31
DAT_0156.CAN
DAT_0157.CAN 18.2.2020 9:21:52
DAT_0158.CAN
DAT_0159.CAN 18.2.2020 9:31:17
DAT_0160.CAN 18.2.2020 9:37:16
Date: 18.2.2020 9:37:16
Start Time: 00:12:00
Stop Time: 00:16:49
Bus Type: 0
ECU Serial Number: 195028
Software Part Nr. A: 072-2357-005
Software Part Nr. B: 072-2357-005
ECU Type: ECU-204-201
EMU SW Version: 2.5T
Engine Serial Nr.: 9132457
Engine Type: 915iS_A
Samples Total: 140630
Selected Parameters
Clear
Confirm Selection
1 Airframe
2 Single Lever Power Control
3 LaneA-->Engine
Engine Speed A [1/min]
Throttle Position A [%]
Fuel Flow Rate A [l/h]
Manifold Air Pressure A [hPa]
Boost Pressure A [hPa]
Oil Pressure A [bar]
Oil Temperature A [C]
Coolant Temperature A [C]
EGT Cylinder 1 A [C]
EGT Cylinder 2 A [C]
EGT Cylinder 3 A [C]
EGT Cylinder 4 A [C]
Manifold Air Temperature A [C]
Engine Ambient Temperature A [C]
Engine Ambient Pressure A [hPa]
Data
Fault Matrix
Limit/Warning Exceed
Warning Lamps
Graph
EMU View
ECUA Sensor Faults Lane A
ECUA Sensor Faults Lane B
ECUA Device Faults Lane A
00:07:07.102
00:07:07
Stock Flight Systems EMDS 1.4.9 (2019)

4 15,


EMDS [edited]
File Extras Help
Recorded Data
Live Stream Data
Data
Fault Matrix
Limit/Warning Exceed
Warning Lamps
Graph
EMU View
Time
Warning/Limit Exceed
Selected Parameters
Clear
Stock Flight Systems EMDS 1.4.9 (2019)

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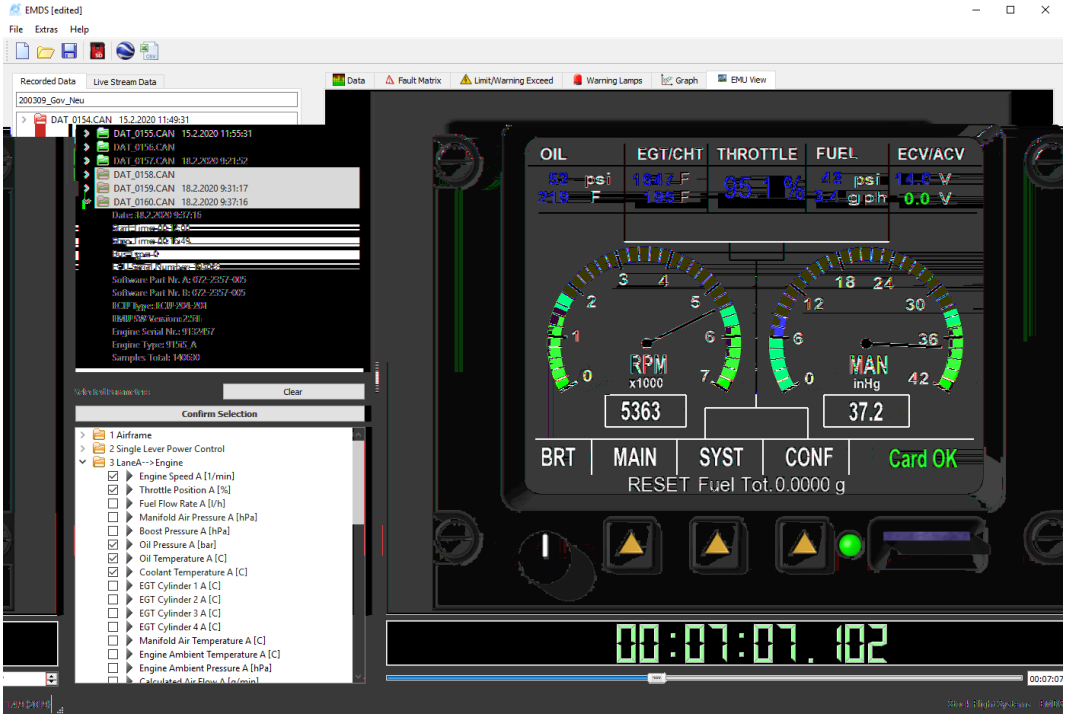
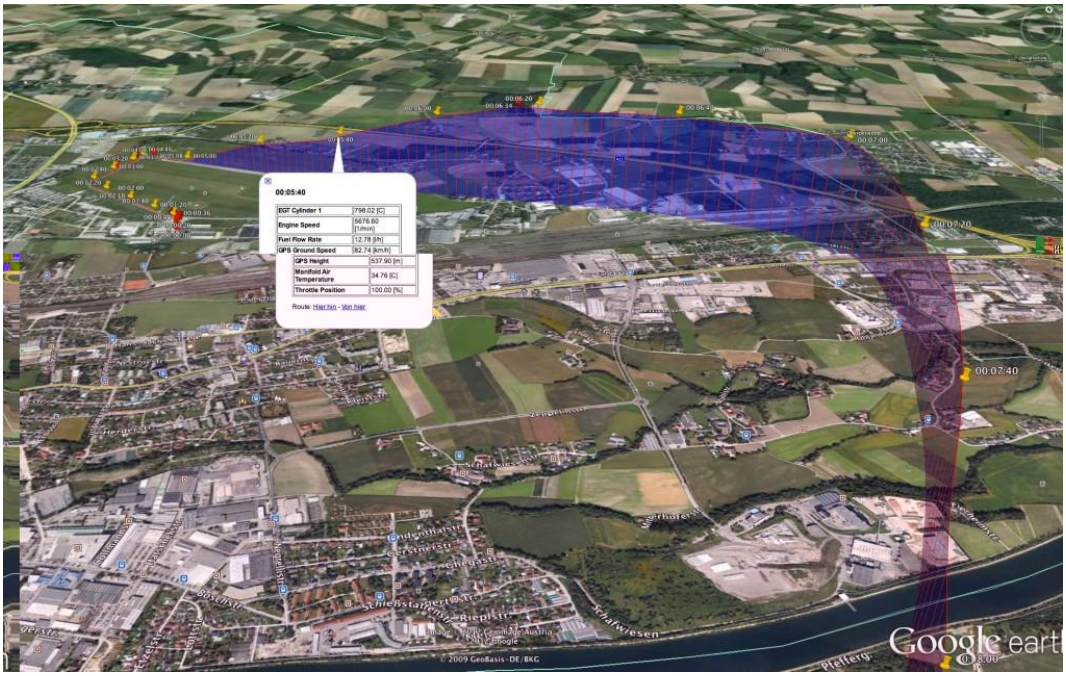

EMDS [edited]
File Extras Help
Recorded Data
Live Stream Data
Data
Fault Matrix
Limit/Warning Exceed
Warning Lamps
Graph
EMU View
Clear
Confirm Selection
OIL
EGT/CHT
THROTTLE
FUEL
ECV/ACV
RPM
x1000
MAN
inHg
5363
37.2
BRT
MAIN
SYST
CONF
Card OK
RESET Fuel Tot.0.0000 g
00:07:07.102

4 17,



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4 96 Software Update

The EMU allows for easy conduction of software updates through the SD memory card interface. The software is delivered in compressed .zip-files with the following exemplary structure:

EMU_915iS_SW_RS11.00.zip -> EMU_915iS_SW_RS11.00 -> mb0.srd, mb1.srd

The binary software upgrade files (mb0.srd, mb1.srd) have to be stored on an SD memory card which is then inserted (contacts up) in the slot in the main unit. The binary files are recognized by the EMU each time power is applied and the device boots up. When update files are detected, the content is automatically programmed into flash memory and the device starts up using the new software. An installation logfile ("INSTALL.LOG") is created and stored on the memory card and the update files are deleted.

The standard software versions are listed in Table 6-3. Feel free to contact RS Flight Systems for customized software versions with individual SLPC algorithms.

Software Version	Engine	Description
RS01.xx	912iS	Std. software for Rotax 912iS without SLPC
RS01.xA	912iS	SLPC test software for manual propeller adjustment
RS01.xG	912iS	SLPC ground test software
RS11.xx	915iS	Std. software for Rotax 915iS without SLPC
RS11.xA	915iS	SLPC test software for manual propeller adjustment
RS11.xG	915iS	SLPC ground test software
CH11.xx	915iS	Helicopter version with RPM output and intercooler fan control

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7. Abbreviations and Terms

Abbreviation	Description
ACT	Active
ACV	Aircraft Voltage
AUX	Auxiliary
AWG	American Wire Gauge
BRT	Brightness
CAD	Computer Aided Design
CAN	Controller Area Network
CHK	Check
CHT	Cylinder Head Temperature
CONF	Configuration
CT	Coolant Temperature
DC	Direct (non-alternating) Current
DNC	Do Not Connect
ECU	Engine Control Unit
ECV	ECU Voltage
EGT	Exhaust Gas Temperature
EMDS	Engine Management Debriefing Station
EMU	Engine Management Unit
EN	European Norm
FPGA	Field Programmable Gate Array
FPS	Fuel Pressure Sensor
GB	Gigabyte
GEN	Generator
GND	Ground
GNSS	Global Navigation Satellite System (e.g. GPS, Galileo, GLONASS)
HIC	Harness Interface Connector
ISO	International Organization for Standardization
I/O	Input/Output
LCD	Liquid Crystal Display
LED	Light Emitting Diode
MAN	Manifold Pressure
MCR	Master Caution Reset
RET	Return
RPM	Revolutions per Minute (Engine Speed)
RS-232	Recommended Standard 232
RX	Reception
SAE	Society of Automotive Engineers
SBY	Standby
SD	Secure Digital (type of memory card)
SDHC	Secure Digital – High Capacity (type of SD card)
SLPC	Single Lever Power Control
SPR	Start Power Relay
STP	Shielded Twisted Pair
SYST	System
TFT	Thin Film Transistor (type of LCD)
TX	Transmission
UNC	Unified National Thread - Coarse
UTC	Coordinated Universal Time

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EMU | Version: 2.12