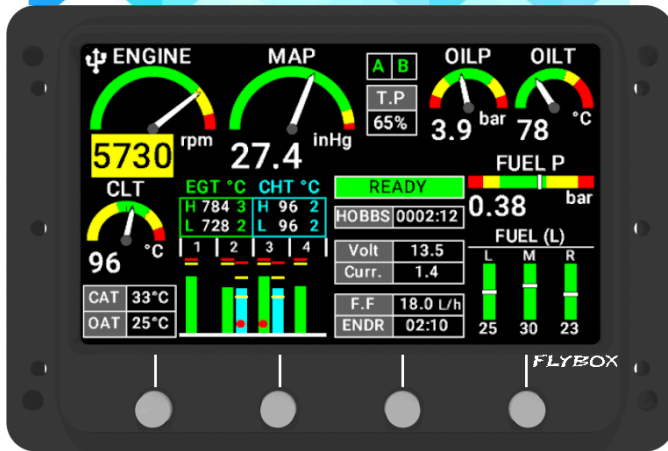


FLYBOX®



EngiMaster

Engine Information System
Installation Manual

Installation Manual, Safety Instructions and Warning Booklet

This manual is for Authorized Installers only.

This manual is distributed by Microel directly to installers and no part of this manual may be reproduced, copied, transmitted, disseminated, downloaded or stored on any storage medium for any purpose without the prior written consent of Microel.

**This product is not TSO'd and cannot be installed
into traditional FAA Part 23 and similarly Type-
Certificate Aircraft**

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For firmware version 1.13

This booklet is suitable for printing in A5 format.

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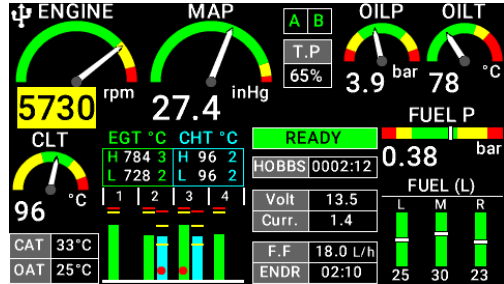
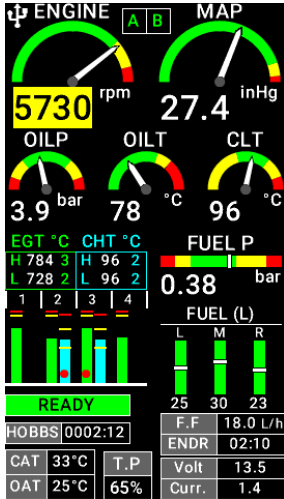
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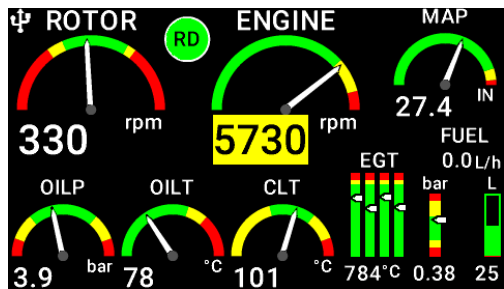
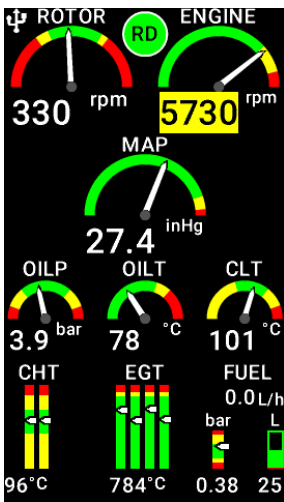
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DISCLAIMER

Examples of available screens



Engine main data: Airplane



Engine main data: Rotorcraft

Thank you for purchasing a Flybox® **EngiMaster** instrument.

The **EngiMaster** instrument is available in 2 different models: *landscape* and *portrait* mounting. This manual describes the installation of all of the 2 models.

Our intention in developing the **EngiMaster** was to create a product that is light and compact, powerful and easy to use.

The **EngiMaster** features a highly visible display and a powerful 32-bit microcontroller. The owner has the option of keeping the instrument software up-to-date by downloading the latest revision available on www.flyboxavionics.it and installing it via a USB pen drive.

We are confident that our products will be satisfactory and make your flying experience enjoyable.

Symbols used in the User Manual

NOTE: Used to highlight important information.



CAUTION: Used to warn the user, it indicates a potentially hazardous situation or improper use of the product.



WARNING: Used to indicate a dangerous situation that can cause personal injury or death if the instruction is disregarded.

FAILURE TO DO SO MAY RESULT IN SERIOUS
INJURY OR DEATH.



WARNING: These instructions must be read and respected by installers, and retained for ready reference. The installer must read, understand (or be explained) and heed all instructions and warnings supplied with this product and with those products intended for use in association with it. Always keep a copy of the Installation and User Manual, Safety Instructions and Warning Booklet on the aircraft. In case of change of ownership, the Installation and User Manual, Safety Instructions and Warning Booklet must be delivered together with all of the other papers.



WARNING: Read the Installation and User Manual, Safety Instructions and Warning Booklet before installing the device in the aircraft and follow the procedure described therein.









WARNING: This device is intended to be installed on NON-TYPE CERTIFIED AIRCRAFT ONLY, as it does NOT require any air operator's certificate. Refer to your national aviation authorities to check if this device can be installed on your aircraft.



WARNING: It is the owner's responsibility to test this device before operating the aircraft and to make sure nobody is using it unless properly instructed and authorized to do so.



WARNING: Once the installation process is completed, it is extremely important to test the device before taking off to make sure it works properly. Therefore, we strongly suggest to double check all of the electronic instruments available on the aircraft and to turn them on to verify they function correctly.

-  **WARNING:** This device is operated through a software which from time to time can be updated and/or subject to change. Please, always refer to the Installation and User Manual, Safety Instructions and Warning Booklet for the last updated version of the software available on www.flyboxavionics.it
-  **WARNING:** It is the responsibility of the installer to properly install the device on the aircraft. In case of calibration, or any technical or functional customization of the device, the responsibility lies with the individual who carried out such operation.
-  **WARNING:** If this product is not used correctly, or it is subjected to additions or alterations, the effectiveness of this device may be considerably reduced.
-  **WARNING:** Alterations, additions, or repairs not performed by the instrument manufacturer or by a person or organization authorized by the manufacturer shall negate any warranty.
-  **WARNING:** The unit isn't waterproof. Serious damage could occur if the unit is exposed to water or spray jets.
-  **WARNING:** Installation and configuration of this instrument should only be carried out by trained and authorised professionals. See the Flyboxavionics website for a list of authorised installers.



NOTE: The consumer decides of his own free will if the purchased product is suitable and safe for his need. If the consumer does not agree with the notices contained in this Installation and user Manual, Safety Instructions and Warning Booklet, do not install this instrument in his aircraft.



NOTE: Flybox Avionics reserves the right to change or improve its products as well as terms, conditions, and notices under which their products are offered without prior notice.



NOTE: The Installation and User Manual, Safety Instructions and Warning Booklet will be updated annually if needed.

All changes or updates will be published on our website www.flyboxavionics.com in the "support" section.



NOTE: Check the website www.flyboxavionics.it periodically for software and manual updates.



NOTE: For some products, registration may be required to receive important news or information on available firmware updates or to receive security information.

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6.0 Instrument Use61

1.0 System Overview

CONSTRUCTION FEATURES

The **EngiMaster** front panel is built from solid aluminum alloy, CNC milled and powder coated to last a long time over the years always showing a new appearance. The other parts of the housing are made of corrosion-protected aluminium.

No plastic parts are used.

ELECTRONICS

The **EngiMaster** use a powerful 32 bit microcontroller to ensure reliability and accuracy over time. Thanks to its feature, it can interface with all types of latest-generation engines.

ERGONOMICS

- Large TFT display, 480x272 Pixels, 1000 nits, antiglare surface, sunlight readable, wide temperature range.
- Push buttons for easy access to all features.
- Automatic backlight dimming function thanks to external light sensor.

EASY SOFTWARE UPDATE

The user can download any new firmware, when available from Flybox website, connect a USB pen drive to the instrument and freely update it with the last features.

EASY DATALOG SAVING

Easy logging of the data for debug purpose. If needed, the **EngiMaster** unit can save a last flight log on the internal memory, easily exportable to an USB pen drive. The user can then send the log via e-mail to the installer for a help/support request.

ABOUT SAFETY

EngiMaster has been designed with safety in mind. Thanks to the processor's calculation speed, the user is quickly alerted in the event of engine faults.

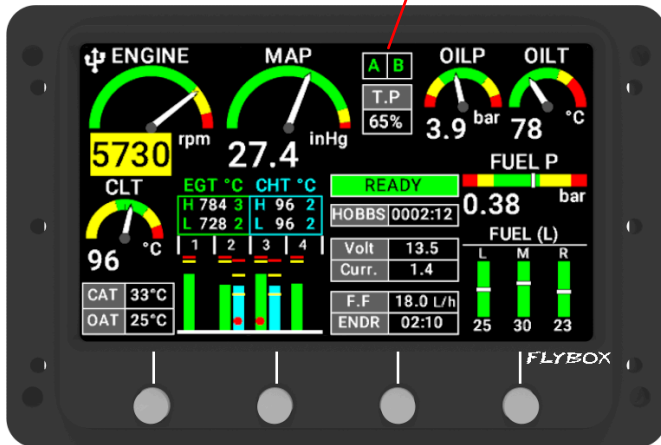
REMOTE MODULE

The **Remote Module** is built from solid aluminum alloy, CNC milled and powder coated to last a long time over the years always showing a new appearance. The other parts of the housing are corrosion-protected.

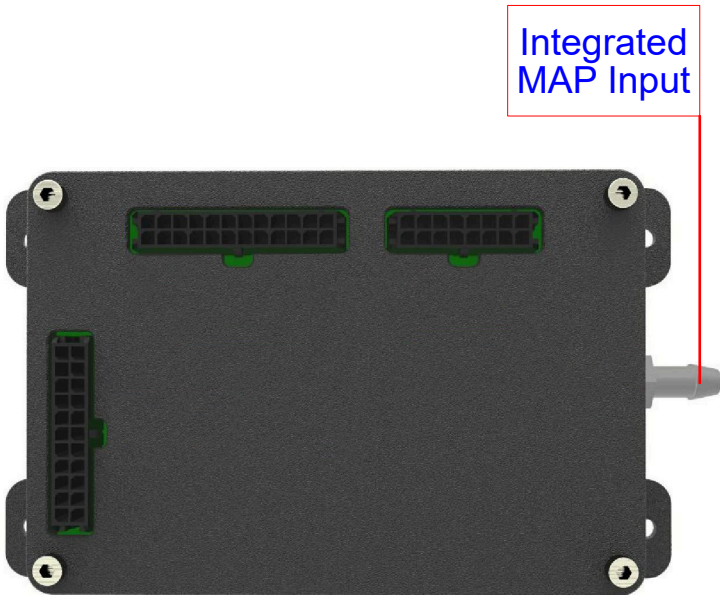
The user can download any new firmware, when available from Flybox website, and easily update the **Remote Module** directly from the main unit.

2.0 Panel Indicators & Commands

High
Brightness
Color
Display



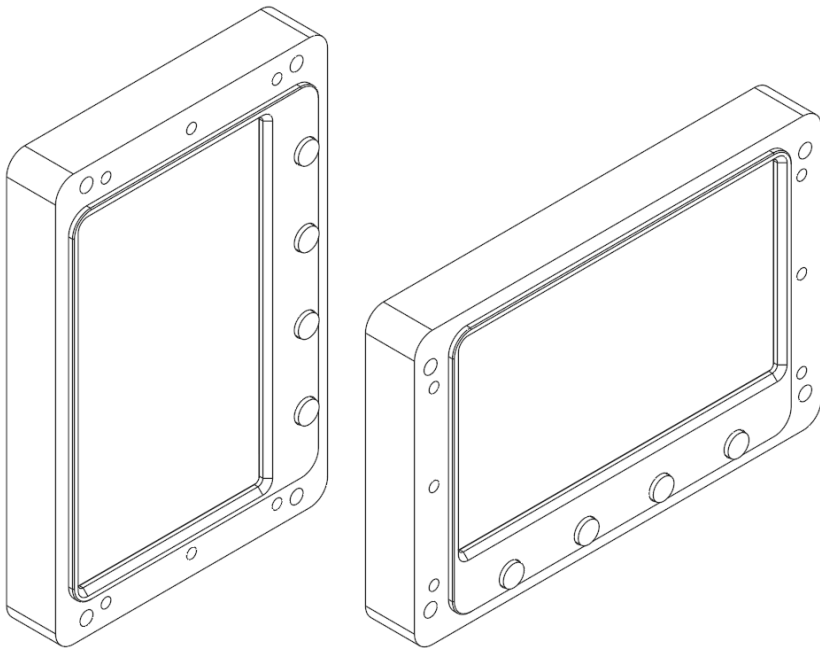
Pushbuttons

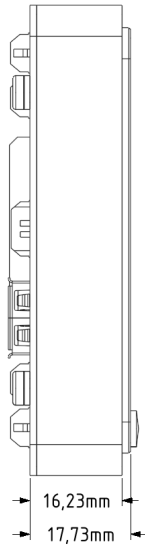
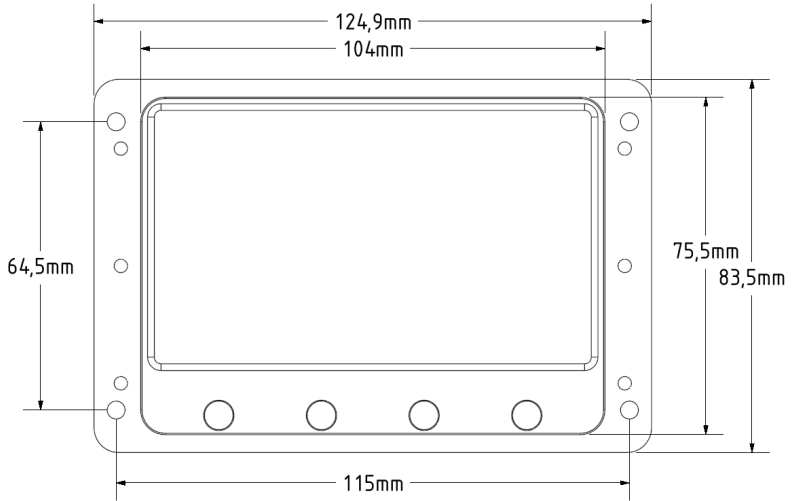


3.0 EngiMaster Mechanical Installation

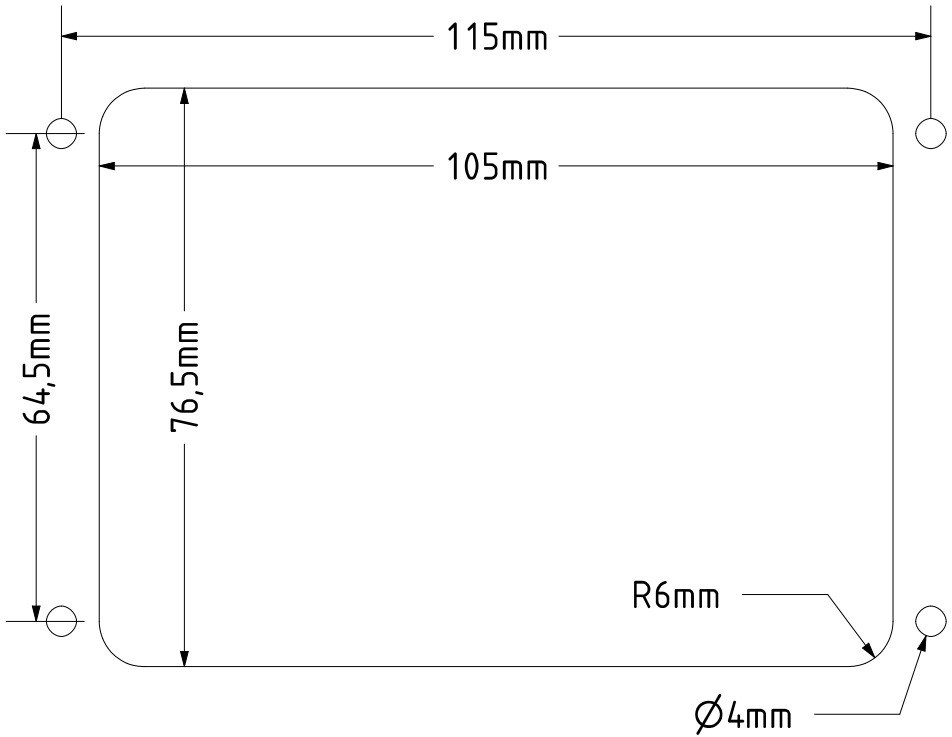
It's recommended to choose a position that permits optimal display visibility. The instrument is supplied with four M4X10mm screws to install it to the panel, if you use other screws consider that **the maximum thread length inside the instrument body is 10mm.**

Screws longer than 10mm will damage the instrument and void the warranty.





3.0.1 Panel Cut-Out



Scale 1:1

3.1 Remote Module Mechanical Installation

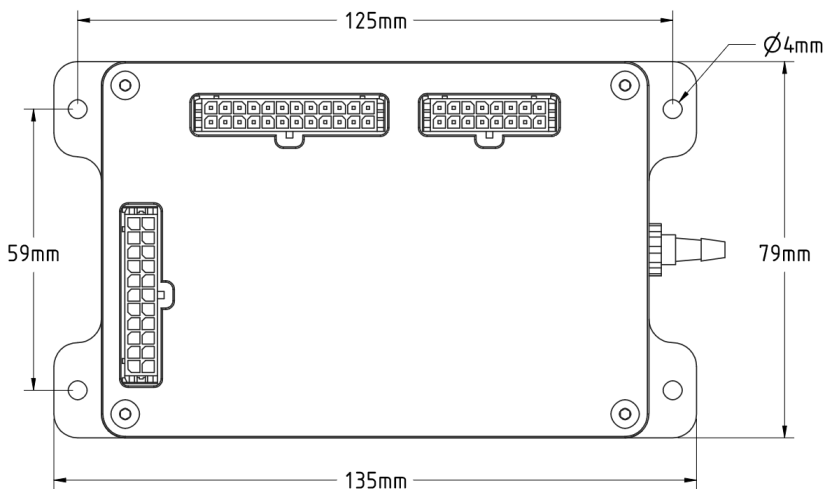
The remote module can be installed using the four holes in the mounting tabs; the holes are suitable for M4 screws.

The max length of the CAN-bus that connects the remote module to the EngiMaster is 20 meters.

When choosing a location where to install the remote module, consider that the operating temperature range is -20~+70°C.

Choose a location protected from dust and atmospheric agents such as sun and rain.

Do not rivet the remote module to the aircraft as this will hinder future removal if necessary.



4.0 Electrical Installation

POWER SPECIFICATIONS

EngiMaster and remote module are capable of operating at either 14 or 28 VDC. On the following table are listed the power requirements for EngiMaster and remote module; the specified current draw is measured with the EngiMaster display backlight set to maximum brightness and without any sensor attached to the remote module.

Power Supply	EngiMaster	Remote Module	Total (EM+R.M.)
14 V	210 mA 2.94 W	50 mA 0.7 W	260 mA 3.64 W
28 V	115 mA 3.22 W	25 mA 0.7 W	140 mA 3.92 W



CAUTION: Voltage peaks on the supply line that exceeds the operating limits can damage the device.

General wiring hints:

- It is recommended that EngiMaster and remote module be installed prior to constructing the wiring harnesses and cables.
- Use aeronautic cable for the wiring.
- Take care to properly insulate any exposed wire to avoid short circuits between them.
- All cable routing should be kept as short and as direct as possible.

- Do not solder thermocouple wires terminations. If it is necessary to split in separable harnesses the thermocouples connections, you must use proper cables and connectors, available also from Flybox® (see chap.5.14 for further details).
- Check that there is ample space for the cabling and mating connectors.
- Avoid sharp bends in cabling.
- Avoid routing near aircraft control cables.
- Avoid routing cables near heat sources, RF sources, EMI interference sources, power sources or near power for fluorescent lighting.

The installer shall supply and fabricate all of the cables, unless a pre-wired cable has been ordered.

If no pre-wired cable has been ordered, the required connectors and associated crimp contacts are supplied with the EngiMaster.

Contacts for the connectors must be crimped onto the individual wire of the wiring harness.



CAUTION: To avoid damage to the EngiMaster/Remote module, take precautions to prevent Electro-Static Discharge (ESD) when handling connectors and associated wiring. ESD damage can be prevented by touching an object that is on the same electrical potential as the EngiMaster/Remote module before handling them.



CAUTION: Check wiring connections for errors before connecting any wiring harnesses. Incorrect wiring could cause internal component damage.

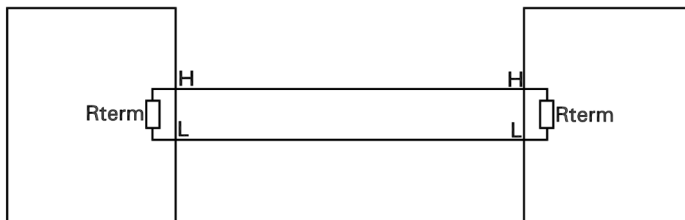
CAN-BUS INFORMATIONS

EngiMaster has two CAN bus (Controller Area Network) interfaces.

The first is used to communicate with the remote module while the second is used to communicate with the engine ECU (this one is applicable only for certain engines, for example Rotax 912iS).

The basic electrical architecture of a CAN bus consists of a single twisted or shielded wire pair with a device connected at each end. Each end must be terminated with a 120 ohm resistor, that in the case of EngiMaster and remote module is integrated inside the instruments so that the installer should simply connect together two pin on the connector to perform the required terminations.

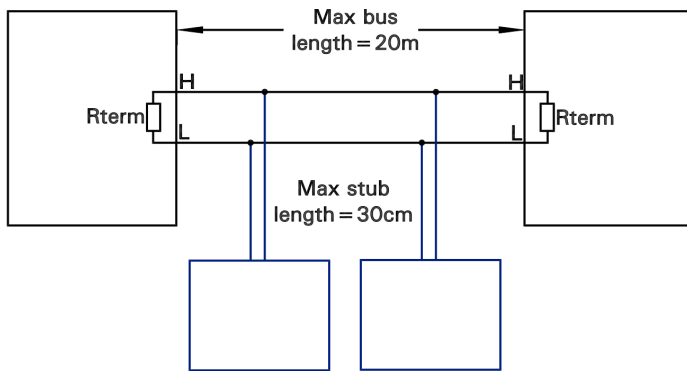
The maximum length from end to end of the CAN bus is 20 meters.



Basic CAN bus architecture

Other devices can be connected to the bus through short stub (also called “node”) connections. This device must not be terminated with the resistor and the maximum length should not exceed 30cm.

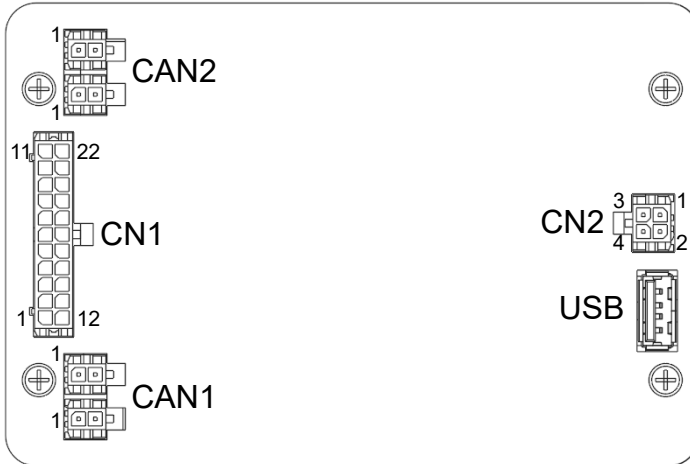
One stub or node must serve to connect only one device; multiple devices must be connected to the bus in a daisy-chain configuration as in this examples picture:



CAN bus node connections

The wiring for the CAN bus connections can be twisted pair or shielded twisted-pair. We recommend the use of shielded wires for better performance, connecting the shield to the ground of both devices on the terminated ends of the bus. It's important also that all the devices connected to a CAN bus share the same power ground reference. This means that the power ground of the various devices must be connected to a single ground point (do not use aircraft structure as a power ground).

4.1 EngiMaster Electrical Installation



Rear view

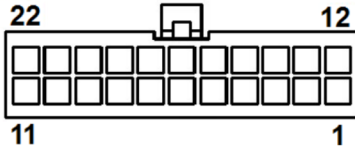
The required connectors and terminals are supplied with the instrument. The manufacturer's codes are:

- Molex P/N 43025-0200 (2 pole housing)
- Molex P/N 43025-0400 (4 pole housing)
- Molex P/N 43025-2200 (22 pole housing)
- Molex P/N 43030-0001 (female crimp terminal)

The terminals can be crimped with:

- Flybox Professional Crimping Tool cod. 603000
- Molex tool P/N 63819-0000

4.1.1 CN1 22 Pole Connector



22 pin Molex Micro-Fit Receptacle P/N 43025-22000. View from wires insertion side.

PIN #	Type	Description	Note
1	In	GPS Input	
2	/	Not Used / Reserved	
3	Out	+Power out for sensor supply	Max 500mA*
4	Out	GND	
5	Out	GND	
6	Out	GND	
7	Out	GND	
8	In	External switch 2	
9	Out	+5V for sensor supply	Max 300mA
10	Out	+Power out for sensor supply	Max 500mA*
11	In	+Positive Main supply	Max 10-30 VDC
12	/	Not Used / Reserved	
13	/	Not Used / Reserved	
14	Out	GND	
15	/	Not Used / Reserved	
16	Out	Audio line Out	
17	Out	GND for Audio line Out	
18	Out	NPN open collector Out 1	Max 300mA (Not protected)
19	Out	NPN open collector Out 2	Max 300mA (Not protected)
20	In	External switch 1	
21	In	Ambient ligh sensor input	
22	In	GND Main supply	

Signals explanation

- **Power supply (PIN#11):**

The EngiMaster is capable of operating at either 14 or 28 VDC, AWG22 wire is enough. It's recommended to insert a 2A circuit breaker on the positive wire that supply both EngiMaster and remote module.

- **GPS input (PIN#1):**

The EngiMaster supports all GPS with RS232 output and NMEA183 sentecens (RMC, RMB, GGA).

- **Audio line out(PIN#16):**

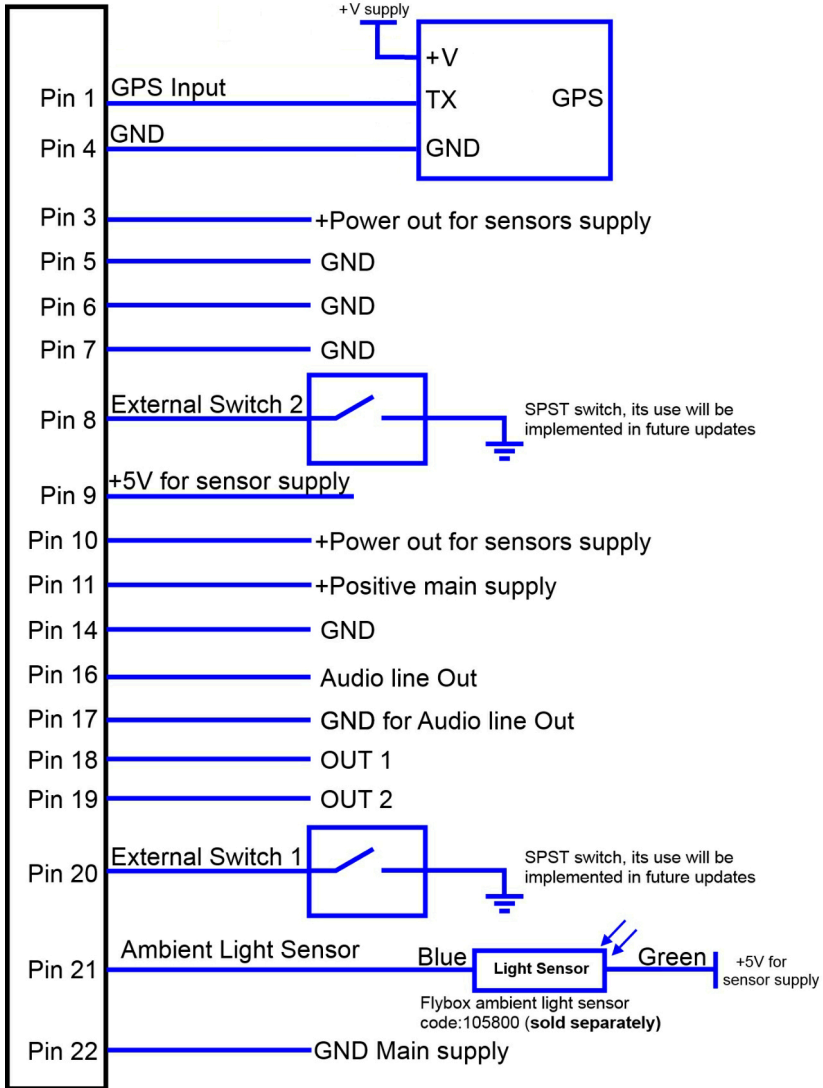
Used to transmit aural messages to the intercom input

- **Open collector out (PIN#18-19):**

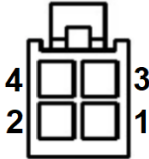
Used to connect the negative pin of any external buzzers or LEDs.

***NOTE:** Pin#3,10(+Power out for sensors supply) have the same voltage of the power supplied to the instrument, so if you power the instrument with 12 Volt, these outputs will be 12 Volt, if you power the instrument with 24Volt, these outputs will be 24 Volt (minus a small voltage drop due to protection diode and PTC fuse). The max current of 500 mA is the total sum of the current supplied by all the pins marked with "+Power out for sensors supply", including Pin#3,10 of CN1 connector. So, for example, if you sink 500mA on a single pin, no more current can be supplied on the other pins.

CN1 Wiring Connections



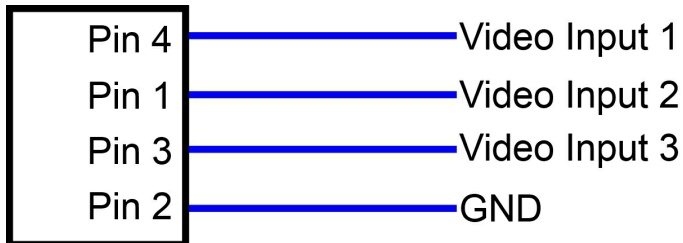
4.1.2 CN2 4 Pole Connector



4 pin Molex Micro-Fit Receptacle P/N 43025-0400. View from wires insertion side.

PIN #	Type	Description
1	In	Video Input 2
2	In	GND
3	In	Video Input 3
4	In	Video Input 1

CN2 Wiring Connections



4.1.3 CAN Connector



2 pin Molex Micro-Fit Receptacle P/N 43025-0200. View from wires insertion side.

2 Poles **CAN1** Upper connector

PIN #	Type	Description
1	I/O	CAN 1 H Internally connected with the Pin 1 - CAN 1 H (Lower connector)
2	I/O	CAN 1 L Internally connected with the Pin 2 - CAN 1 L (Lower connector)

2 Poles **CAN1** Upper connector

PIN #	Type	Description
1	I/O	CAN 1 H Internally connected with the Pin 1 - CAN 1 H (Upper connector)
2	I/O	CAN 1 L Internally connected with the Pin 2 - CAN 1 L (Upper connector)

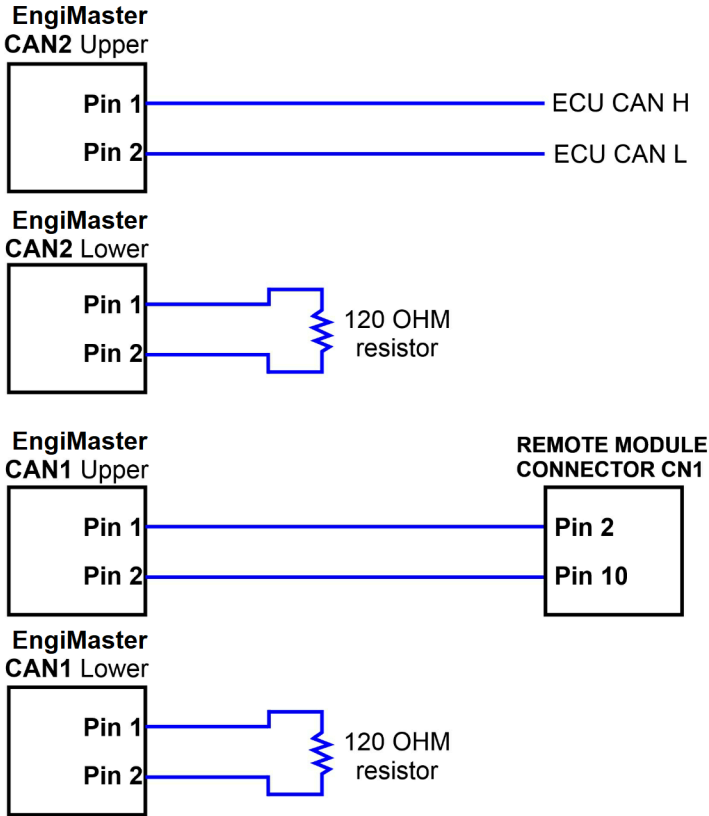
2 Poles **CAN2** Upper connector

PIN #	Type	Description
1	I/O	CAN 2 H Internally connected with the Pin 1 - CAN 2 H (Lower connector)
2	I/O	CAN 2 L Internally connected with the Pin 2 - CAN 2 L (Lower connector)

2 Poles **CAN2** Upper connector

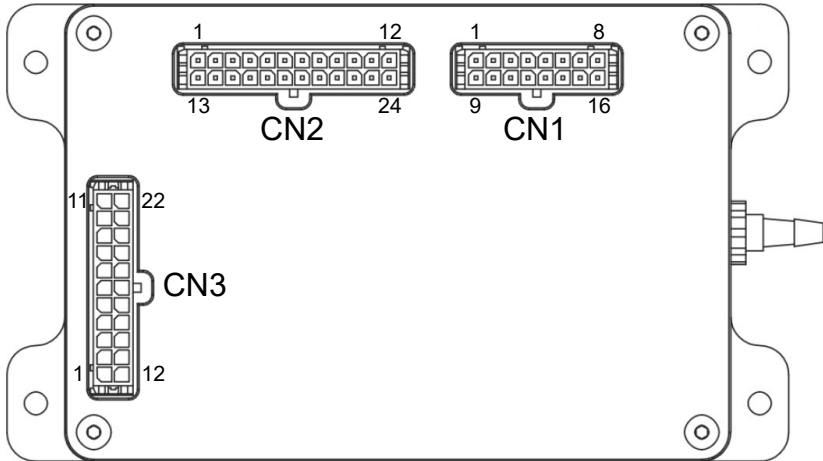
PIN #	Type	Description
1	I/O	CAN 2 H Internally connected with the Pin 1 - CAN 2 H (Lower connector)
2	I/O	CAN 2 L Internally connected with the Pin 2 - CAN 2 L (Lower connector)

CAN Wiring Connections



NOTE: For Rotax 91XiS series, can be connected CAN 1 or CAN 2 or both, as indicated in the table. Connecting both CAN 1 and CAN 2 lines ensures that engine measurements are read in case one of the two CAN lines is disconnected.

4.2 Remote Module Electrical Installation



Rear view

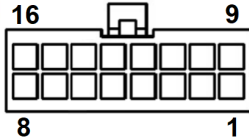
The required connectors and terminals are supplied with the instrument. The manufacturer's codes are:

- Molex P/N 43025-1600 (16 pole housing)
- Molex P/N 43025-2200 (22 pole housing)
- Molex P/N 43025-2400 (24 pole housing)
- Molex P/N 43030-0001 (female crimp terminal)

The terminals can be crimped with:

- Flybox Professional Crimping Tool cod. 603000
- Molex tool P/N 63819-0000

4.2.1 CN1 16 Pole Connector



16 pin Molex Micro-Fit Receptacle P/N 43025-16000. View from wires insertion side.

PIN #	Type	Description	Note
1	/	Flybox bus termination	
2	I/O	Flybox bus H signal for EngiMaster connection	
3	/	Not Used / Reserved	
4	/	Not Used / Reserved	
5	In	RPM signal Input	
6	/	Not Used / Reserved	
7	/	Not Used / Reserved	
8	In	+Positive Main supply	Max 10-30 VDC
9	/	Flybox bus termination	
10	I/O	Flybox bus L signal for EngiMaster connection	
11	/	Not Used / Reserved	
12	/	Not Used / Reserved	
13	In	Rotor tachometer Input	
14	/	Not Used / Reserved	
15	Out	GND	
16	In	GND Main supply	

Signals explanation

● Power supply (PIN#8-16):

The remote module is capable of operating at either 14 or 28 VDC, AWG22 wire is enough. It's recommended to insert a 2A circuit breaker on the positive wire that supply both EngiMaster and remote module.

To avoid errors in the measurements it is essential that the ground of the remote module share the same ground of all the engine sensors (so that there is virtually no measurable voltage between these grounds). Be sure that any ground wire of the remote module is routed to the engine block, and the engine block must have a connection to the negative of the battery.

● FLYBOX BUS (PIN#1-2-9-10):

This bus is used exclusively for communication with EngiMaster; use shielded or twisted wire pair, AWG24 is enough. Max length of this bus is 20 meters.

The Flybox bus termination (jump wire pin#1 with pin#9) is required.

● RPM signal input (PIN#5):

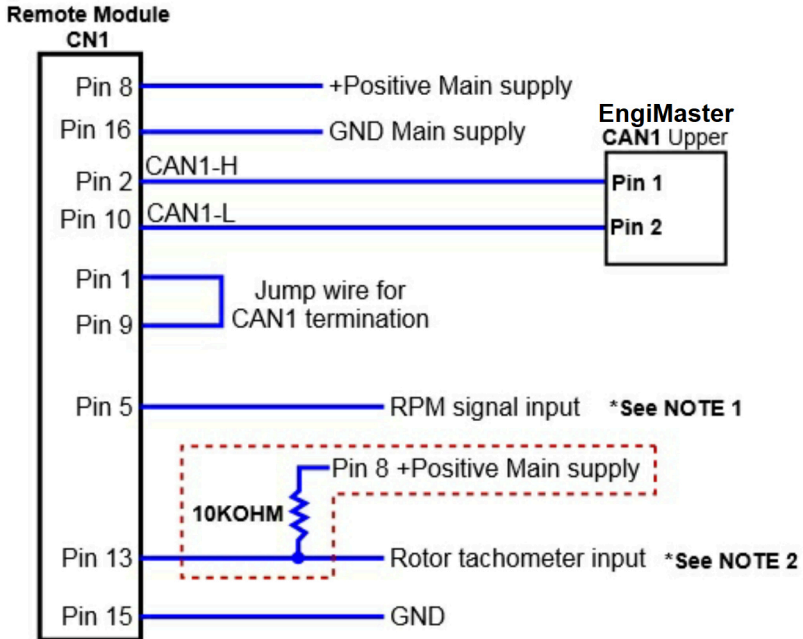
This RPM input support Rotax 912/914 pickup and other similar types of tachometer transducer.

Connect the transducer output to pin #5 of CN1 remote module connector and transducer ground to aircraft ground (Rotax pickup has a single wire to be connected to pin #5 of CN1 remote module connector).

● Rotor tachometer input-for helicopter only (PIN#13):

This rotor tachometer input support push-pull type sensors with 0-12volt output. It's possible also to use open-collector type sensors but it's required to connect a 10 Kohm pull-up resistor between this signal and +12V.

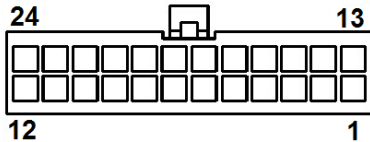
CN1 Wiring Connections



NOTE 1: This RPM input support Rotax 912/914 pickup and other similar types of tachometer transducer. Connect the transducer output to pin #5 of CN1 remote module connector and transducer ground to aircraft ground (Rotax pickup has a single wire to be connected to pin #5 of CN1 remote module connector).

NOTE 2: This rotor tachometer input support push-pull type sensors with 0-12volt output. It's possible also to use open-collector type sensors but it's required to connect a 10 Kohm pull-up resistor between this signal and +12V.

4.2.2 CN2 24 Pole Connector



24 pin Molex Micro-Fit Receptacle P/N 43025-24000. View from wires insertion side.

PIN #	Type	Description
1	In	CHT6 thermocouple J (-) (connect to ground for other sensor types)
2	In	CHT5 thermocouple J (-) (connect to ground for other sensor types)
3	In	CHT4 thermocouple J (-) (connect to ground for other sensor types)
4	In	CHT3 thermocouple J (-) (connect to ground for other sensor types)
5	In	CHT2 thermocouple J (-) (connect to ground for other sensor types)
6	In	CHT1 thermocouple J (-) (connect to ground for other sensor types)
7	In	EGT6 thermocouple K (-)
8	In	EGT5 thermocouple K (-)
9	In	EGT4 thermocouple K (-)
10	In	EGT3 thermocouple K (-)
11	In	EGT2 thermocouple K (-)
12	In	EGT1 thermocouple K (-)
13	In	CHT6 sensor input: Rotax, PT1000 or thermocouple J (+) / Coolant temperature sensor
14	In	CHT5 sensor input: Rotax, PT1000 or thermocouple J (+)
15	In	CHT4 sensor input: Rotax, PT1000 or thermocouple J (+)
16	In	CHT3 sensor input: Rotax, PT1000 or thermocouple J (+)

PIN #	Type	Description	Note
17	In	CHT2 sensor input: Rotax, PT1000 or thermocouple J (+)	
18	In	CHT1 sensor input: Rotax, PT1000 or thermocouple J (+)	
19	In	EGT6 thermocouple K (+)	
20	In	EGT5 thermocouple K (+)	
21	In	EGT4 thermocouple K (+)	Max 0-2.5 V
22	In	EGT3 thermocouple K (+)	Max 0-2.5 V
23	In	EGT2 thermocouple K (+)	Max 0-2.5 V
24	In	EGT1 thermocouple K (+)	Max 0-2.5 V

Signals explanation

● CHT negative inputs (PIN#1-2-3-4-5-6):

The negative inputs of the CHT is used only if using J-type thermocouples. For the other type of sensor, included Rotax standard sensors, these pins must be connected to ground (connect it to the same ground that supply power to the remote module).

● CHT positive inputs (PIN#13-14-15-16-17-18):

Connect to these pins the single wire of the Rotax CHT sensors, one wire of the PT1000 resistive sensors (the other wire must be connected to ground) or the positive wire of the J-type thermocouple.

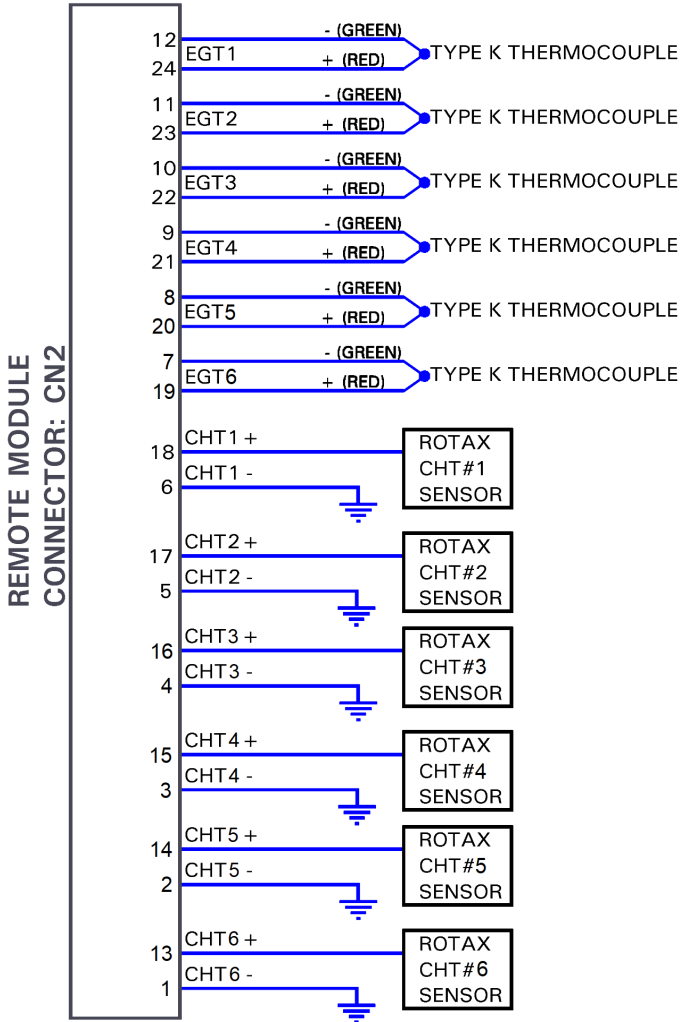
● EGT negative inputs (PIN#7-8-9-10-11-12):

Connect to these pins the negative wire of the thermocouples.

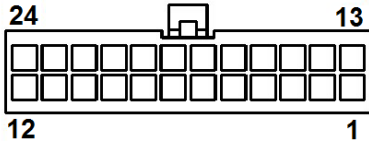
● EGT positive inputs (PIN#19-20-21-22-23-24):

Connect to these pins the positive wire of the thermocouples.

CN2 Wiring Connections



4.2.3 CN3 22 Pole Connector



22 pin Molex Micro-Fit Receptacle P/N 43025-22000. View from wires insertion side.

PIN #	Type	Description	Note
1	/	Not Used / Reserved	
2	/	Not Used / Reserved	
3	/	Not Used / Reserved	
4	In	Left tank fuel level sensor input	Res: max 300 OHM; Volt:0~5 V
5	/	Main tank fuel level sensor input	Res: max 300 OHM; Volt:0~5 V
6	/	Connect to pin#17 if using 4-20mA oil pressure sensor	
7	In	Oil temperature sensor input	Res: max 36 KOHM; Volt:0~5 V
8	In	OAT sensor input (PT1000)	0-5 V
9	In	CAT sensor input (PT1000)	Res: max 36 KOHM; Volt:0~5 V
10	Out	GND	
11	Out	+Power out for sensors supply	Max 300mA
12	/	Not Used / Reserved	
13	/	Not Used / Reserved	
14	/	Not Used / Reserved	
15	/	Right tank fuel level sensor input	Res: max 300 OHM; Volt:0~5 V
16	In	Oil pressure sensor input	Res: max 10 KOHM; Volt:0~5 V ; Amp: min 4 max 20 mA (internal 200 ohm)

PIN #	Type	Description	Note
17	/	Connect to pin#6 if using 4-20mA oil pressure sensor	
18	/	Not Used / Reserved	
19	In	Current sensor signal input	0-5 V
20	In	Fuel pressure sensor input	0-5 V
21	Out	GND	
22	Out	+Power out for sensors supply	Max 300mA

Signals explanation

● **Fuel level sensor inputs (PIN#4-5-15):**

This fuel level sensor inputs support resistive (with max resistance of 300 ohm) or capacitive (0-5V) sensors. If you install only 1 tank fuel level sensor (Main Tank) connect it to pin #5 of CN3 connector; if you install 2 tank fuel level sensors (Left and Right Tanks) connect the Left on pin #4 and the Right on pin #15 of CN3 connector.

● **Jumper wire for oil pressure selection (PIN#6-17):**

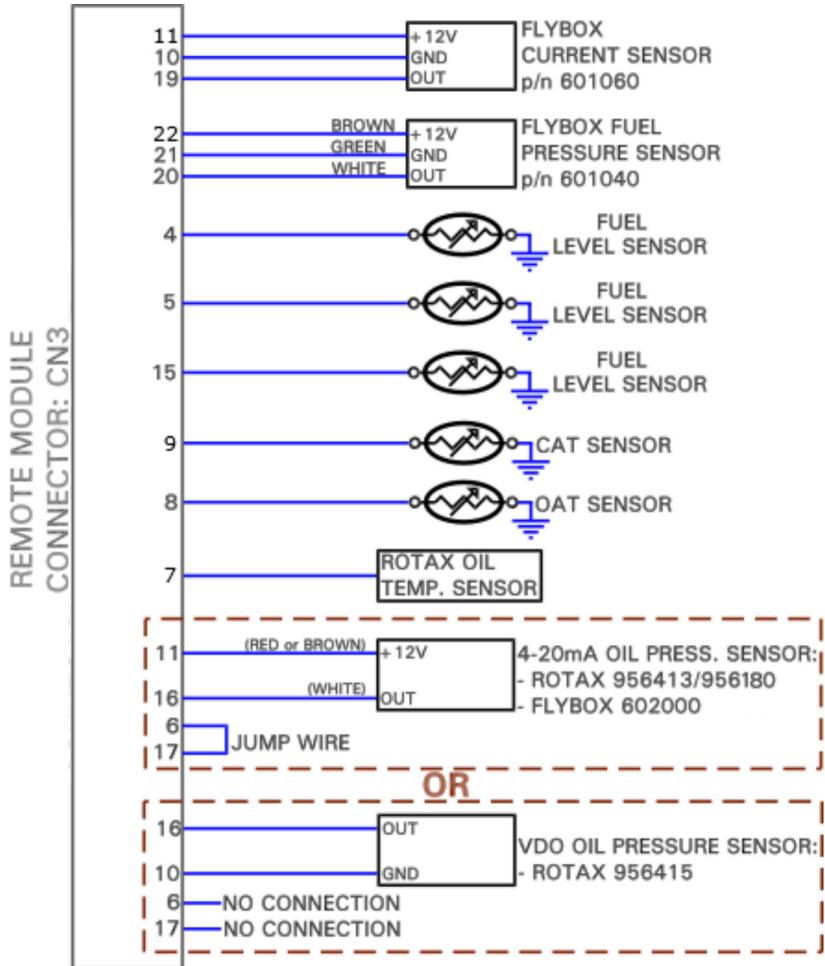
If you use 4-20mA type oil pressure sensor (Rotax 956413 or Flybox 602000) connect pin6 with pin17 with a jumper wire. If you use VDO type oil pressure sensor (Rotax 956415) leave unconnected both pin6 and pin17.

● **Oil pressure sensor input (PIN#16):**

Support Rotax, Jabiru and Flybox sensors. See chap.5.4 for further details.

- **Oil temperature sensor input (PIN#7):**
Support Rotax, Jabiru and PT1000 sensors. See chap.5.3 for further details.
- **OAT - Outside air temperature (PIN#8):**
Support PT1000 sensors. See chap.5.5 for further details.
- **CAT - Carburetor/Airbox temperature (PIN#9):**
Support PT1000 sensors. See chap.5.6 for further details.
- **Current sensor signal input (PIN#19):**
Support Flybox 601060 sensor. See chap.5.7 for further details.
- **Fuel pressure sensor input (PIN#20):**
Support Flybox 601041 sensor. See chap.5.10 for further details.

CN3 Wiring Connections



5.0 Sensors Installation

Carefully follow the instructions in the following paragraphs for the correct installation of the sensors. Check the compatibility of your sensors prior to installation.



NOTE: It is essential that all the engine sensors and the remote module share the same ground, and that there is virtually no measurable voltage between these grounds. Be sure that any ground wire of the remote module is routed to the engine block, and the engine block must have a connection to the negative of the battery. Errors in the measurements are usually caused by points in the aircraft where there is insufficient grounding.

5.1 CHT Sensors

In the remote module up to 6 CHT sensors can be connected; the supported types of sensor are:

- **ROTAX 912/914 preinstalled CHT sensors**

Rotax install 2 CHT sensors with a single wire each. Connect the first sensor to pin #18 of CN2 remote module connector; connect the second sensor to pin #17.

- **ROTAX 912iS**

No additional sensors are required: with Rotax 912iS the coolant temperature is measured by the ECU and sent, using the CAN bus connection, to the EngiMaster.

Only if you need to install additional coolant or cylinder head temperature sensors you can use the free inputs CHT2-CHT3-CHT4.

- **J-type thermocouples**

Thermocouple probes have a two wires connection: positive wire and negative wire. The positive wire are connected to pins #13 to #18 (CHT6 to CHT1) of CN2 remote module connector, the negative wires are connected to pins #1 to #6 (CHT6 to CHT1).

- **PT1000 resistive sensors**

This two wire resistive sensors must be connected between ground (GND) and pins #13 to #18 (CHT6 to CHT1) of CN2 remote module connector.



NOTE: It's not possible to mix different type of CHT sensors (i.e. 2 Rotax + 2 thermocouples).

5.2 EGT Sensors (not required for ROTAX 912iS)

In the remote module up to 6 EGT sensors can be connected; the supported types of sensor is:

- **K-type thermocouples**

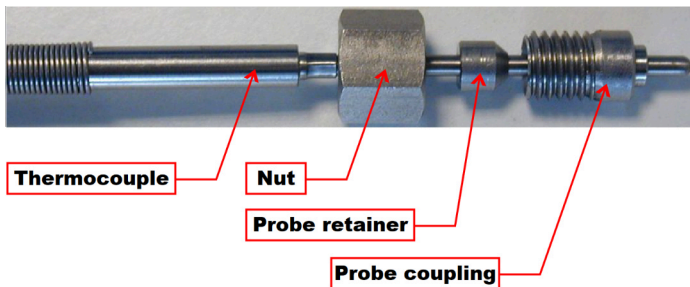
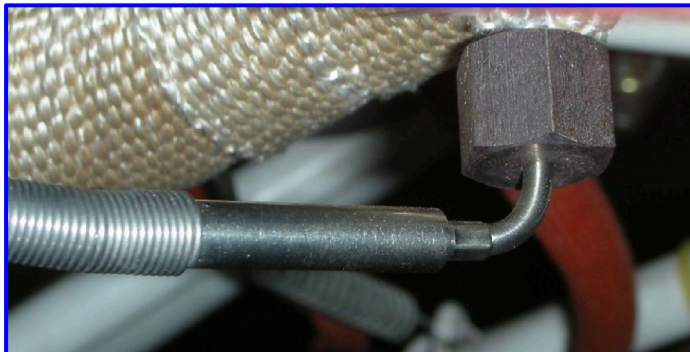
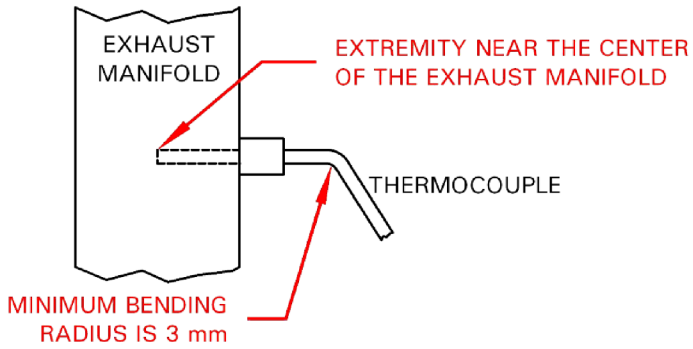
Thermocouple probes have a two wires connection: positive wire and negative wire. The positive wire are connected to pins #19 to #24 (EGT6 to EGT1) of CN2 remote module connector, the negative wires are connected to pins #7 to #12 (EGT6 to EGT1).

5.2.1 Flybox® EGT thermocouples

Flybox® EGT thermocouples are K-type; positive wire is RED, negative is GREEN.

INSTALLATION NOTES:

1. Drill a 6 mm diameter hole in the exhaust manifold (at the position indicated by the engine's manufacturer) and weld the furnished probe coupling.
2. Insert the thermocouple (with the nut and the probe retainer) in the probe coupling and position its extremity near the center of the exhaust manifold.
3. Fix the thermocouple in this position by blocking the nut. Note that if required the thermocouple can be bended but with a minimum radius of 3 mm.



5.3 Oil Temp. Sensor (not required for ROTAX 912iS)

The supported types of oil temperature sensors are:

- **ROTAX preinstalled sensor**

Rotax oil temperature sensor has a single wire. Connect it to pin #7 of CN3 remote module connector.

- **JABIRU preinstalled sensor**

Jabiru oil temperature sensor has a single wire. Connect it to pin #7 of CN3 remote module connector.

- **PT1000 resistive sensor**

This two wire resistive sensor must be connected between aircraft ground (GND) and pin #7 of CN3 remote module connector.

5.4 Oil Press. Sensor (not required for ROTAX 912iS)

The supported types of oil pressure sensors are:

- **ROTAX 4-20mA (P/N 956413)**

Installed on 912/914 engines produced after 2008/05. Connect red wire to pin#11 of CN3 remote module connector; connect white wire to pin#16. Connect pin#6 to pin#17 of CN3 remote module connector.

- **Flybox[®] P/N 602000**

Compatible with the Rotax 4-20mA sensors. Connect brown wire to pin#11 of CN3 remote module connector; connect white wire to pin#16. Connect pin#6 to pin#17 of CN3 remote module connector.

- **ROTAX resistive sensors (ROTAX P/N 956415)**

Installed on 912/914 engines produced before 2008/05. Connect signal wire to pin#16 of CN3 remote module connector; connect ground wire (if present) to pin#10 of CN3 remote module connector.

- **JABIRU oil pressure sensor**

Connect signal wire to pin#16 of CN3 remote module connector.

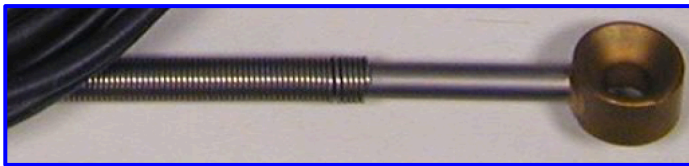
5.5 Outside Air Temperature Sensor (OAT)

The supported types of OAT sensors are:

- **PT1000 resistive sensors**

Connect one wire to pin #8 of CN3 remote module connector and the other wire to aircraft ground.

- **Flybox[®] OAT sensor (P/N 601020)**



Flybox[®] OAT sensor is a PT1000 and can be fixed with a 5 mm countersunk screw.

For optimal outside temperature indication it must not be installed in direct sunlight locations or near heat sources.

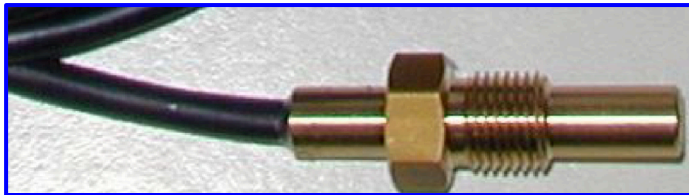
5.6 Airbox/Carburetor Temperature Sensor (CAT) (not required for ROTAX 912iS)

The supported types of CAT sensors are:

- **PT1000 resistive sensors**

Connect one wire to pin #9 of CN3 remote module connector and the other wire to aircraft ground.

- **Flybox[®] CAT sensor (P/N 601030)**

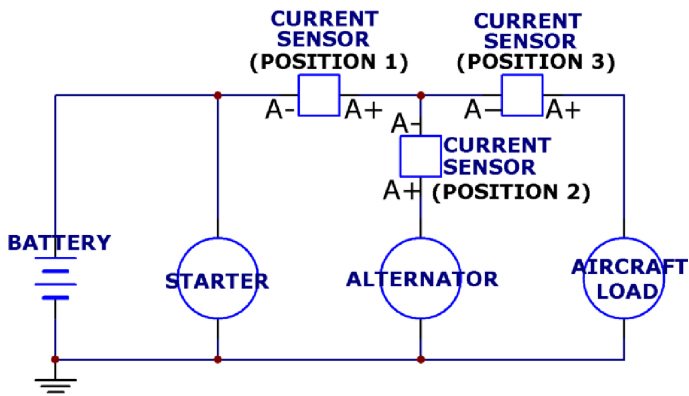


Flybox[®] CAT sensor is a PT1000 with a M10x1 thread.

5.7 Current Sensor

The current sensor supplied by Flybox® (P/N 601060) is able to measure current between -50 and +50 Amperes. It must not be installed between battery and starter circuit because of the high current flowing into this path.

The current sensor can be installed in one of the three locations as shown in the simplified electrical diagram below:

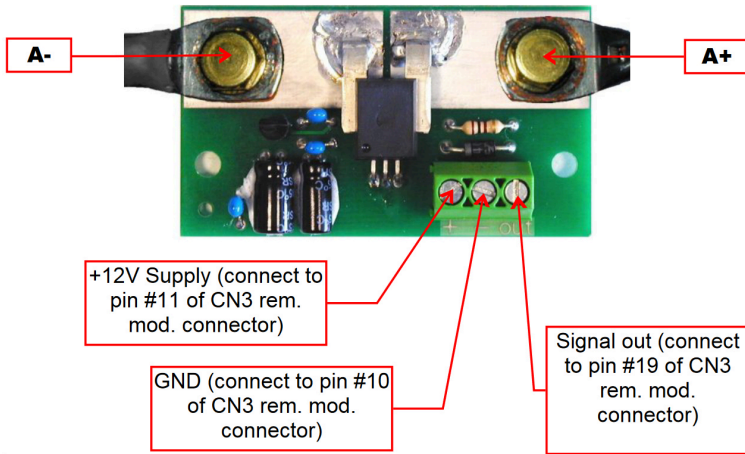


Position 1: in this position the current sensor measure current flow into or out of your battery (indicator show both positive and negative currents).

Position 2: in this position the current sensor measure only the current that the alternator supply to both battery and aircraft loads.

Position 3: in this position the current sensor measure the current flowing into the aircraft loads.

5.7.1 Current sensor connections



5.7.2 Current sensor auto-calibration

The auto-calibration is useful to eliminate eventual reading errors caused by harness or sensor itself.

The procedure is the following:

1. Connect only the 3 wire from the current sensor to the EngiMaster and leave disconnected the 2 cable "A+" and "A-".
2. Turn-on the EngiMaster.
3. Go in the MAIN MENU → INSTRUMENTS → AMPERE → OFFSET and click "ENTER" to auto-set the value; EngiMaster has now stored the calibration value and you can turn it off and restore the harness, by reconnecting the two cable to the current sensor.

5.8 Fuel Flow Sensor

The remote module has 2 fuel flow sensor inputs.

If your installation includes a flow of fuel returning to the tank, you can install the second flow meter obtaining a differential measurement.

The input 1 is dedicated to measuring fuel flowing from the tank to the engine and the input 2 is dedicated to measuring fuel returning from the engine to the tank. The flow of sensor 2 is subtracted from the flow measured by sensor 1 and the resulting amount represents the instantaneous flow of fuel burned.

EngiMaster accepts all flow meters as long as they meet the following characteristics:

- amplitude range: 5 - 30 Vpp
- frequency range: 2 Hz - 10 KHz
- min. pulse duration: 50 us

To install the fuel flow sensors, follow the manufacturer's instructions included in the sensor package, together with the general recommendations below.



Recommendation of installation and use:

- Install the sensor with the wires pointing up.
- Respect the IN and OUT port labelled on the sensor body.
- Do not install the sensor close to high temperature objects like the exhaust system or others and if needed protect the sensor with firesleeve material.
- Do not use teflon tape for the inlet and outled ports, use liquid sealant only.

- Never clean the sensor with compressed air.
- Install a filter in the fuel line before the sensor.
- The tubes before and after the sensor should be straight for at least 4/5 cm to avoid turbulence in the fuel and inaccurate flow data.
- Check for leakage after system starts.
- Do not clamp the sensor directly to the engine, vibrations could damage it.
- Follow the instructions supplied from the sensor manufacturer.
- Inspect the fuel sensor every year or every 100 hours of aircraft use for leakage and aging.
- The fuel flow transducer must be installed before the carburetor and after the eventual return line (Vapor lock).
- Install the transducer lower than the carburetor, or no more higher than 10 cm every 30.

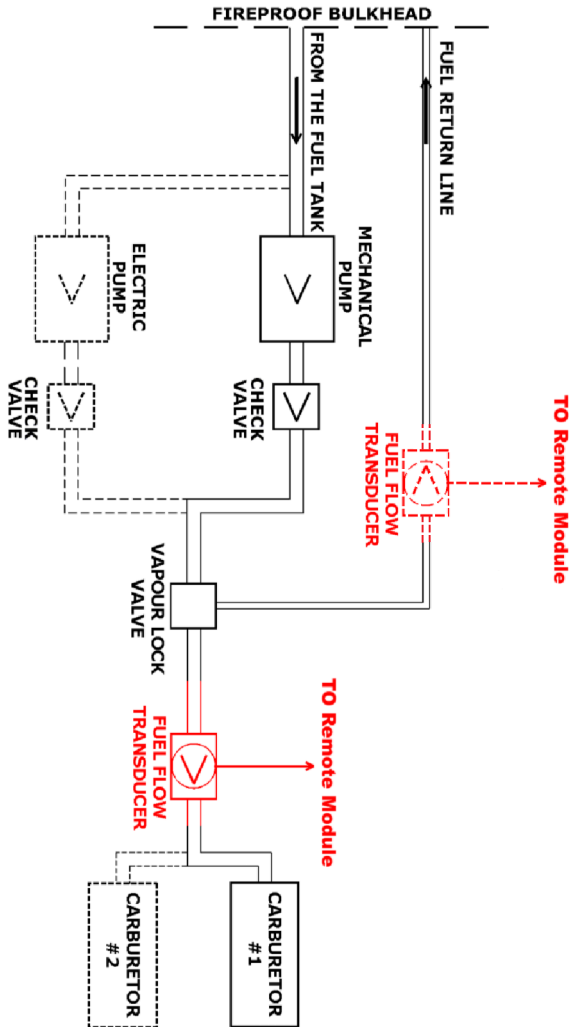


NOTE: the second flow sensor is not recommended for small flows in the return line, e.g. Rotax 912. Consider it instead for fuel-injected engines that have a significant return fuel flow.



WARNING: After completing the installation, verify that the engine is working properly at every RPM speed; verify also that at full RPM the fuel pressure after the fuel flow transducer never drop below the minimum pressure indicated in your engine's manual.

Typical example installation of the fuel flow transducer on carbureted engines:



5.9 Fuel Level Sensors

The remote module has 3 fuel level inputs that can be connected to both resistive sensors (with max resistance of 300 ohm) and capacitive sensors (with output voltage of 0~5 Volt).

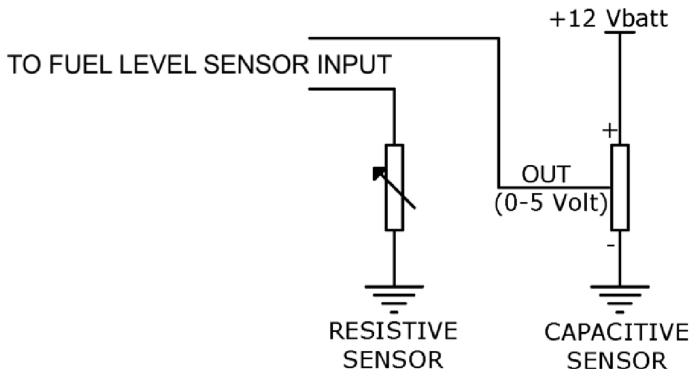
Resistive sensors can be of two types, both supported by the remote module: resistive sensors that increase resistance as you add fuel and resistive sensors that decrease resistance as you add fuel.

It's also possible to install a mixed type of sensors (i.e. 1 resistive + 1 capacitive).



CAUTION: Resistive type fuel level sensors connected to EngiMaster must not be connected to any other instrument. Disconnect any previously used instrument.

5.9.1 Fuel level sensors connections



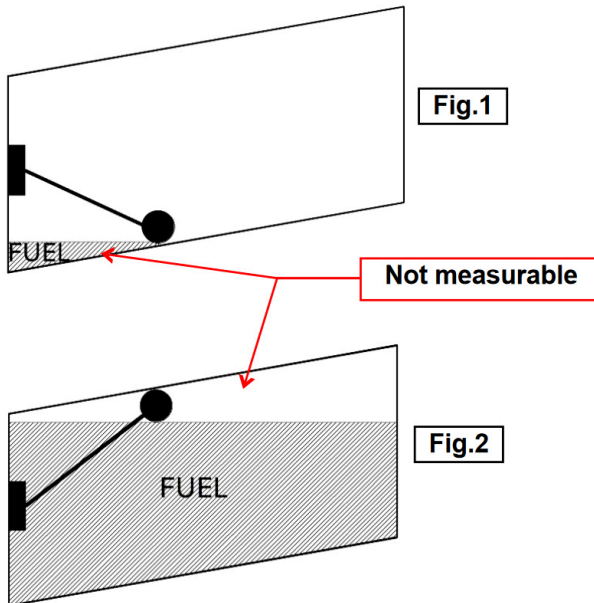


NOTE: Refer to fuel level sensors manual for the detailed electrical and mechanical installation.

Make sure that the fuel level sensors are mounted so that all the fuel in the tank can be measured. If the fuel sensor cannot measure completely the fuel in the tank, the instrument will display inaccurate readings.

For example (**fig.1**) if a fuel sensor cannot measure the lowest part of the tank that contains 7 liters, the instrument will display “0” (zero) for fuel level of 7 liters and below.

Another example (**fig.2**) is if a tank can hold 40 liters of fuel but at 25 liters the fuel is at the top of the sensor, the maximum that the instrument will display is 25 liters.



5.10 Fuel Pressure Sensor

The fuel pressure transducer+fitting is supplied by Flybox[®] (P/N 601041); the electrical connections are:

BROWN WIRE: +12V Supply (connect to pin #22 of CN3 remote module connector).

GREEN WIRE: GND (connect to pin #21 of CN3 remote module connector).

WHITE WIRE: signal out (connect to pin #20 of CN3 remote module connector).

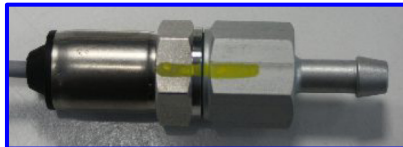
The pressure range accepted is from 0 to 4 bar.



NOTE: an improper wiring can cause damage to the fuel pressure transducer.

Mechanical installation hints:

- Screw tight the transducer to the fitting; no other seal material is required because the sealing is ensured by the green fuel-resistant gasket of the transducer.
- To check that no screw out occur you must mark with a permanent pencil the transducer and fitting:



5.11 MAP Connection (not required for ROTAX 912iS)

Connect the pipe fitting on the remote module to the manifold pressure lines; the pipe fitting of the remote module is suitable for pipe with internal diameter of 4 mm.

With the MAP connected the pressure line must never exceed the pressure of 400kPa/118inHg to avoid damage to the sensor.



CAUTION: Take care to properly executing this connection because an improper installation can cause fuel vapour leakage.

It's recommended to insert a restrictor valve to the pipe so that only little quantity of fuel vapour can exit in case of leakage.

5.12 RPM Pickup Input (not required for ROTAX 912iS)

Standard RPM input support Rotax 912/914 pickup and other similar types of tachometer transducer. Connect the transducer output to pin #5 of CN1 remote module connector and transducer ground to aircraft ground (Rotax pickup has a single wire to be connected to pin #5 of CN1 remote module connector).

5.13 Rotor RPM Input

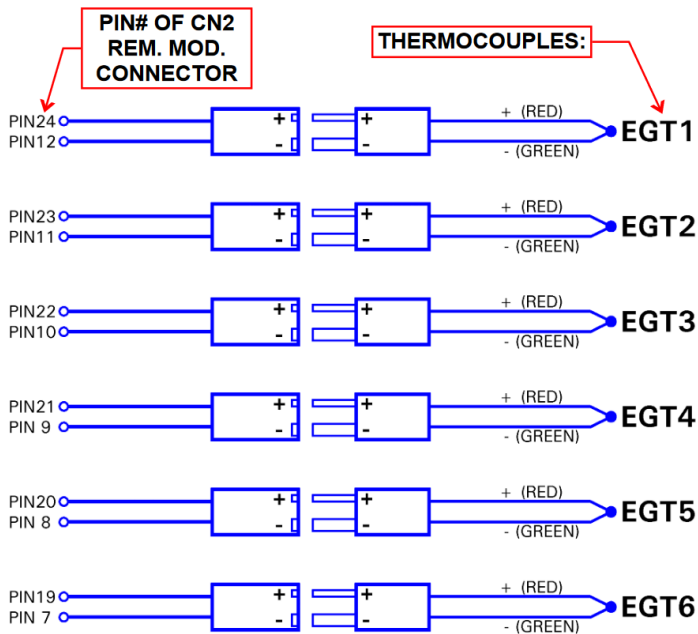
Rotor tachometer input support push-pull type sensors with 0-12volt output. It's possible also to use open-collector type sensors but it's required to connect a 10 Kohm pull-up resistor between this signal and +12V.

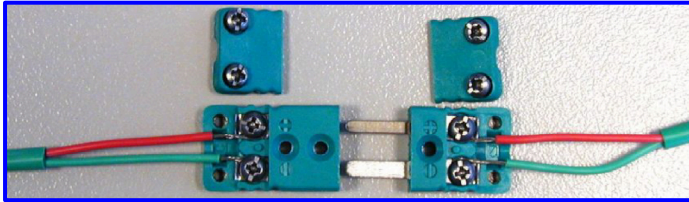
It is possible to purchase sensors from Flybox® with ord. cod.105896.

5.14 Separable Connections for Thermocouples

If it is necessary to split the thermocouples connections in separable harnesses, you must use proper cables and connectors, available also from Flybox[®] with ord. cod.651012.

The connections are the following:





NOTE: Wires' color are referred to Flybox® supplied thermocouples, other thermocouples may have different colors coding. In case of wrong wiring the temperature indication will not be correct.

5.15 Camera Input

The EngiMaster has 3 camera inputs supporting PAL format. Cameras must be powered directly from the battery bus.

It is possible to purchase cameras from Flybox[®] with ord. cod.601070/601071.



NOTE: the instrument does not make video recordings or capture images.

6.0 Instrument Use

Always refer to the Operating Manual for any information that is not related to the installation itself, e.g. how to navigate through the menus, how to make settings, how to perform backups and restores, how to update the software, etc. etc.

Technical specifications

ENGIMASTER

- Graphic TFT LCD with backlight and coated glass, 4.3"
- Powder painted aluminium case
- Dimensions: 124.9 x 83.5 x 17.8 mm (body)
- Weight: 200 g
- Supply voltage: 10 ~ 30 V=
- Power supply: ~3 W
- Operating temperature range: -20 ~ +70°C
- Humidity: 90% max (without condensation)
- Communication through 2 CAN bus
- Up to 3 composite PAL camera input
- USB port: for USB 2.0

REMOTE ENGINE MODULE

- Dimensions: 135 x 79 x 20 mm
- Weight: 185 g
- Supply voltage: 10 ~ 30 V=
- Supply current: 50mA Max
- Operational temperature range: -20 ~ +70°C
- 1 CAN Bus communication interface
- 4 programmable outputs (active low, 300mA / 4W max)

Sensor Inputs:

- Current input from Flybox® sensor
- 2 Fuel flow inputs from Flybox® transducer
- Fuel pressure from Flybox® transducer
- RPM tachometer input
- Rotor tachometer input for helicopter version
- Oil pressure from Flybox®, ROTAX or JABIRU sensors
- 2 Oil temperature inputs from ROTAX, JABIRU or PT1000 sensors
- Carburetor/Airbox from PT1000 sensor
- Outside air temperature from PT1000 sensor
- 6 Cylinder head temperature from ROTAX, J-type thermocouples or PT1000 sensors
- 6 Exhaust gas temperature from K-type thermocouples
- 3 Inputs for fuel level sensors: resistive (300 ohm max) or capacitive (0-5V)

CLEANING

The screen is very sensitive to some cleaning materials and should be cleaned with a clean, damp cloth only.

One Year Warranty:



- the product will be covered by warranty **ONLY** if registered exclusively by filling out the appropriate form on the Flybox website, which can be reached from the instrument page <http://www.flyboxavionics.it/login.html>.
- registration of the product must be carried out by the Installer no later than 10 days from the date of installation.
- for instruments that will not be registered, no warranty will be recognized and the same will not be accepted in case of necessary repair.

Product support and warranty information can be found at www.flyboxavionics.it.

Flybox® warrants the registered Product to be free from defects in materials and workmanship for 12 months from date of delivery. The inactivity of the Products determined by periods of repair does not involve the extension of the warranty period. This warranty covers only defects in material and workmanship found in the products under normal use and service when the product has been properly installed, maintained and registered. This warranty does not cover failures due to abuse, misuse, accident, improper maintenance, failures to follow improper instructions or due to unauthorized alterations or repairs or use with equipments with which the Products is not intended to be used. Flybox®, after verification of the complaint and confirmation that the defect is covered by warranty, at its sole discretion, will either replace or repair the Products at no costs for the customer. Alterations, additions, or repairs not performed by the manufacturer shall negate any warranty. This warranty doesn't cover cosmetic or incidental damages. Shipping costs, taxes, custom fee, any other duties and any costs incurred while removing, reinstalling or troubleshooting the Products, shall be at customer's charge.

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Date	Revision	Description
November 2023	1.0	First release

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Important

Do not send your instrument for repair until you have filled out the request form on the support page at www.flyboxavionics.it. After filling out the form you will receive an authorization email with the RMA number.

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Flybox® is a registered brand of Microel s.r.l.- Italy
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EngiMaster - Installation Manual,
Safety Instructions and Warning Booklet