
	EM-m system use, installation and maintenance manual	document E-DMA.IO2.1	
		Edition A	Revision 1



EM-m system use, installation and maintenance manual

	EM-m system use, installation and maintenance manual	document E-DMA.I02.1	
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In-flight use of the EM-m instrument certifies that the user has read and understood the contents of the installation manual and the operating manual. Failure to follow the instructions contained herein can cause serious injury and even death. Refer to the aircraft instruction manual for additional information.

All information, illustrations, instructions and technical data contained in this manual has been upgraded before printing. MWfly reserves the right to modify, correct or upgrade general data at any time without any obligation or prior consent from third parties. Publication of any part of this document without written consent of MWfly is strictly prohibited.

This Manual forms part of the EM-m system and must be kept safe. It must accompany the EM-m in case of sale to a new owner. The original document is written in Italian and this language will be used to settle any dispute of a legal or technical nature.

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2. INTRODUCTION

Please read this manual carefully before using the engine and apply all safety standards contained in it, in addition to those that your experience and common sense suggest.

Remember that regular maintenance and a thorough inspection before take-off are essential safety factors.

MWfly will be happy to provide you with further information and all the assistance you may need.

2.1. Premise

Before using the EM-m, it is necessary to understand all the contents of this manual.

In case any passage is difficult to understand or in case of doubts, please contact MWfly or an authorized centre in writing, requesting clarification.

It is also necessary to add to the contents of this chapter with what is prescribed and recommended by the aircraft manufacturer as well as suggested by one's own experience.



This EM-m instrumentation has not received any certification for suitability for aeronautical use. Its use is intended exclusively for experimental or non-certified aircraft, on which any engine failure does not compromise flight safety.



Use the propeller in accordance with the rules and laws in force.

2.2. Notes for Consultation

The original language in which this document was issued is Italian: Italian is the reference language for any dispute.

The manual is divided into sections; each section is divided into chapters; each chapter is divided into paragraphs; within each paragraph there may be a further subdivision into topics. The title of each section, chapter, paragraph or topic is highlighted as follows.

SECTION

Chapter

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Paragraph

Topic

The numbering of the contents of the manual consists of an alpha-numeric code that follows the following criterion.

6.1.3.

- The first number indicates the section.
- The second number indicates the chapter of each section.
- The third number indicates the paragraph of each chapter; it is not always present.

The naming of the figures follows the same criteria for the first two parts; the third part invariably represents the cardinal numbering of the figure itself; the letter P is added at the end of the code (e.g. 5.2.2.P).

The naming of the tables follows the same criteria for the first two parts; the third part invariably represents the cardinal numbering of the table itself; the letter C is added at the end of the code (e.g. 4.3.1.C).

The measurement system used in the manuals is the technical system (ST); in the tables the unit of measurement of the quantities represented is indicated enclosed in square brackets [].

The symbols used in the manuals are as follows.



WARNING: Not following this instruction can cause severe personal injury or loss of life.




CAUTION: Not following this instruction could cause severe damage to the propeller.



INFORMATION: Refers to supplementary information to completely or fully understand the instruction.

1., 2., ... This numbering is used to list tools and consumables needed to run an installation or maintenance; it is also used to bring in parts lists or engine parts shown in the illustrations.

a., b., ... This lettering is used to indicate a list of actions or subjects with relation to inclusion: all of the actions or options listed must be verified.

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- This symbol is used to indicate a list of actions or subjects with relation to exclusion: only one of the actions or options listed with this symbol must be verified.
- This symbol is used to list the general characteristics of the EM-m, component specifications or options for installation or maintenance.

2.3. Identification Data

The serial number of the EM-m control instruments is printed on an indelible label applied to the rear of the instrument and consists of an 8-digit numeric code of the type:

YY.WW.NNNN

Where:

- YY is the year of production
- WW is the weak of production
- NNNN is a progressive number

Changing or deleting this code causes the immediate revocation of the guarantee and frees MWfly from any obligation towards the user.

For any request for information or spare parts it is necessary to indicate the model and serial number of the product.

2.4. Tools

The standard workshop tools and tools (not included with the propeller supply) specifically designed to carry out installation and routine maintenance on the propeller are listed below. The same equipment is listed and numbered at the beginning of each paragraph describing operations: the number will be recalled in square brackets to indicate the use of the associated equipment, in the specific action; in the case of combined use of several tools, they will be recalled separated by the semicolon sign; in the case of combined use of torque wrench and insert, they will be recalled separated by the + sign

- Standards workshop tools
- Allen key 4 mm

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If the use of a torque wrench is prescribed in the description of the maintenance operations, the corresponding inserts necessary to perform torque tightening must be added to all the tools listed.

2.5. Consumables

Use only the specified components and consumables, or technically equivalent components and materials for carrying out maintenance work; spare parts must be original in order not to void the warranty and not to compromise reliability and safety.



When using chemical materials, it is necessary to comply with the local legislation in force for disposal, as they are special waste. When using, take the utmost care to protect yourself and the environment from possible contamination.

- Weak threadlocker
- Medium threadlocker
- Vaseline

The consumables are also listed and numbered at the beginning of each paragraph describing maintenance operations and referred to during the description of the maintenance phases.

2.6. MWfly Authorized Service Centres

For further information on maintenance or spare parts service, please contact the nearest MWfly service centre.

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3. **SAFETY**

3.1. **Premise**

Just reading this manual will not eliminate the hazards connected with the installation and use of the product. However, the understanding and application of the information herein is essential to use the propeller in a proper and safe way, and reduces the causes of potential risk.

The information, components, system descriptions, pictures, tables and technical data contained in the present manual are correct at the time of publication. MWfly, however, maintains a policy of continuous improvement of its products without imposing upon itself any obligation to install them on its products previously manufactured: should such an eventuality arise, MWfly, through its distribution and assistance network, as well as through the website www.mwfly.it, will disclose the mandatory nature of any update.

The choice to install and use this EM-m instrument is entirely subject to the discretion and responsibility of the manufacturer, assembler and owner of the aircraft: MWfly cannot guarantee the suitability for use of the product on each specific type of aircraft due to the variety of design and project to which the aircraft themselves are subject; for this reason MWfly is not responsible, nor can it issue any form of guarantee regarding components, accessories or parts of the aircraft that may be damaged during the installation or operation of the propeller. The user assumes all risks arising from the use of the product and acknowledges that he is aware of the above.

MWfly reserves the right to make changes at any time, without notice and without incurring any obligation. No part of this publication may be reproduced without written permission.

3.2. **Security Elements**

For your safety, here are some important tips, suggested by common sense and by the usual norms of prudence, without however being able to include all of the situations or behaviours that constitute opportunities for potential risk.



The prescribed tightening torques must be strictly observed to avoid the risk of detachment of components during the use of the engine: non-compliance invalidates all forms of warranty and automatically releases MWfly from any liability.



Always carry out an adequate inspection before starting the engine: this helps prevent accidents or damage. In case of doubt about the efficiency of EM-m instrument, do not fly.



Never leave the aircraft while the engine is running.



Always keep the EM-m system in perfect working order by following the maintenance table contained in the maintenance manual and carrying out the servicing at the scheduled intervals



Write down any operating anomalies in the propeller logbook. Never fly before you have solved the problem and noted the correction in the logbook.



To use the EM-m system, strictly comply with all national and local laws and regulations



This EM-m system has received no airworthiness certification. Its use is intended exclusively for experimental or non-certified aircraft, on which any failure does not compromise flight safety. The user assumes all risks arising from the use of the propeller and acknowledges that he is aware of the above.



The EM-m system must be used only by users trained and authorized for the purpose, as well as informed about the potential hazards arising from its use.



The description and illustration of components or parts of the propeller refers to the configuration at the time of publication of the manual. The sole purpose of the illustrations is to allow the identification of the parts and to assist in the operations: they are therefore not to be interpreted as technical drawings or as representations of reality..

If there are divergences between what is specified in this manual and the current technical legislation, you must proceed according to the most stringent rule.

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3.3. Use of technical documentation

The technical documentation and the directives are to be considered the necessary tool for personal training, but they cannot in any way replace an adequate specific instruction, both theoretical and operational.

The information provided in the propeller manuals contain procedures and checks that can be carried out by qualified professionals operating in the sector under normal operating conditions.

The information relating to the propeller can be found in the following documents.


- Installation, use and maintenance manual: contains the information necessary for installation, use and scheduled maintenance of the propeller. It also contains the list of spare parts available.
- Overhaul manual: contains the information necessary to perform a complete overhaul of the propeller following the achievement of the maximum hours of use (TBO) or serious damage.
- Service Letter: Contains information aimed at improving the product or its use.
- Service Bulletin: reports the replacements, checks or warnings to be applied by the indicated deadline.
- Alert Bulletin: reports the replacements, checks or warnings to be applied compulsorily before the next flight



Frequent technical modifications and the variety of installations may make the information contained in the aforementioned manuals inapplicable, inadequate or insufficient.

The illustrations in this manual do not represent the details of the product in detail, but provide an indication of their function and structure: for this reason, it is not possible to obtain dimensional information or verify details from the published illustrations.

All further documentation that may be required is available at MWfly authorized service centre.

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4. DESCRIPTION

The MW engines of the **SPiRiT** series can be equipped with the EM-m instrument.

The EM-m instrument is an 8" display for viewing engine data. The instrument has been designed to connect directly to the CAN line of the engine control units that are on the MWfly engines receiving the data transmitted by the control units.



The engine control units are on the MW engines use a proprietary CAN protocol and therefore this tool cannot be used on other engines.

In addition to displaying engine data, the EM-m instrument integrates the following information or function:

- Integrated data acquisition
- View ECU diagnostics
- Visualization of engine technical data
- Display of calculated data (such as consumption, flight time, etc.)
- Alarms
- Recall of scheduled maintenance
- Setting of RPM target for MWfly VPP
- HSI (optional)
- AHRS (optional)
- CAN AEROSPACE output (optional)

Some of the information or functions indicated are accessible from the main page, others on other pages described below.


4.1. The system

The system consists of:

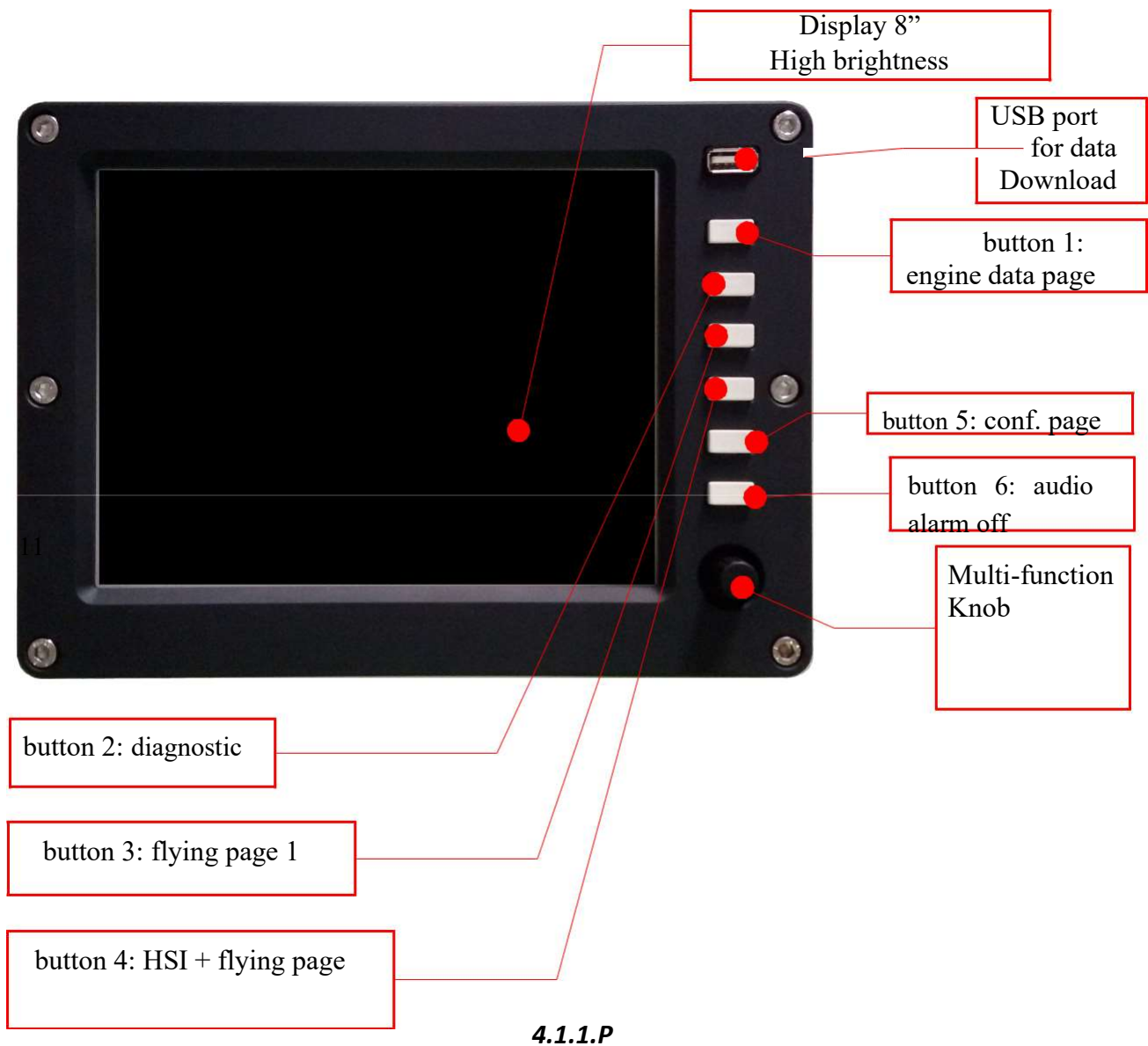
- EM-m display: user interface
- AUXBOX unit : additional channel expansion and control module
- AHRS (optional): inertial platform and differential pressure sensor for pitot tube

4.1. User interface

The EM-m instrument is a panel instrument designed for displaying engine data and other information. In order to make access to all the information easy, the instrument has 6 buttons on the front of the dashboard, each with a specific function, and a multi-

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turn encoder. Also, on the front of the instrument there is a USB socket for downloading the acquisition data or for updating the instrument SW.



The following commands are found on the front of the instrument:

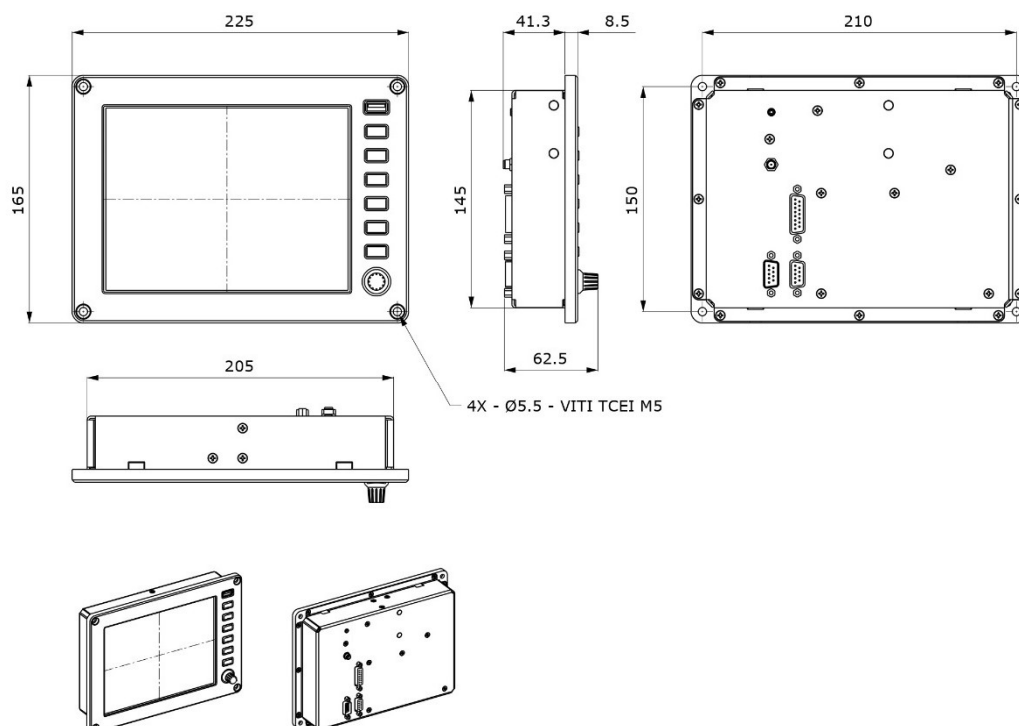
name	Funtion
Button 1	Access page 1 "engine data"
Button 2	Access page 2 "diagnostics"
Button 3	Access page 3 "flight page"
Button 4	Access page 4 "flight page + HIS"
Button 5	Access page 5 "configuration"
Button 6	Temporary deactivation of audio alarm
Knob	Multi-turn encoder for menu navigation and engine speed target adjustment
USB	Port for data download and SW update

4.1.1.C


4.3. Mechanical and electrical characteristics

4.3.1. Dimensions display EM-m

The following drawing shows the dimensions of the instrument, in paragraph 5.2 The dimensions for the cut to be made on the instrument panel for installing the instrument.



4.3.1.P

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The weight of the EM-m display is 1.210 g

4.3.2 *Electrical characteristics of the EM-m display*

The electrical characteristics of the EMS instrument:

- 12V power supply (range 9 .. 16 V) max 2.5A
- Secondary power input
- Operating temperature from -20 to +50°C
- 2 inputs for resistive level sensors and 5 analog inputs
- 3 inputs for NTC temperature sensors (one is dedicated to air temperature)
- 10 digital inputs including 2 rpm sensors
- 2 digital outputs 1 npn 1 pnp
- CAN bus communication
- Sensor and GPS unit power supply redundancy
- Internal backup to ensure correct saving of data even in the event of a sudden power failure
- Dedicated mast RPM sensor input
- Optional integrated GPS (external antenna).
- Integrated pressure sensors for altitude and speed
- Connection to the AHRS inertial unit
- Audio output for alarms
- External button for page change
- LTE connection for remote log
- Additional independent 32Gb logger

Since the EM-m is a panel instrument, all the electrical connections are located on the rear side of the instrument itself.


The following connectors are located on the back of the EM-m:

**4.3.3.P**

name	type	description
POWER	DB 9 way male	Instrument power supply
MAIN	DB 15 ways female	For connection to the CAN line of the control units and AUXBOX and for the connection of the generator light and Shunt
AHRS	DB 9 ways female	For connecting external AHRS

4.3.1.C

The pin out of the connectors is available in the "installation" chapter

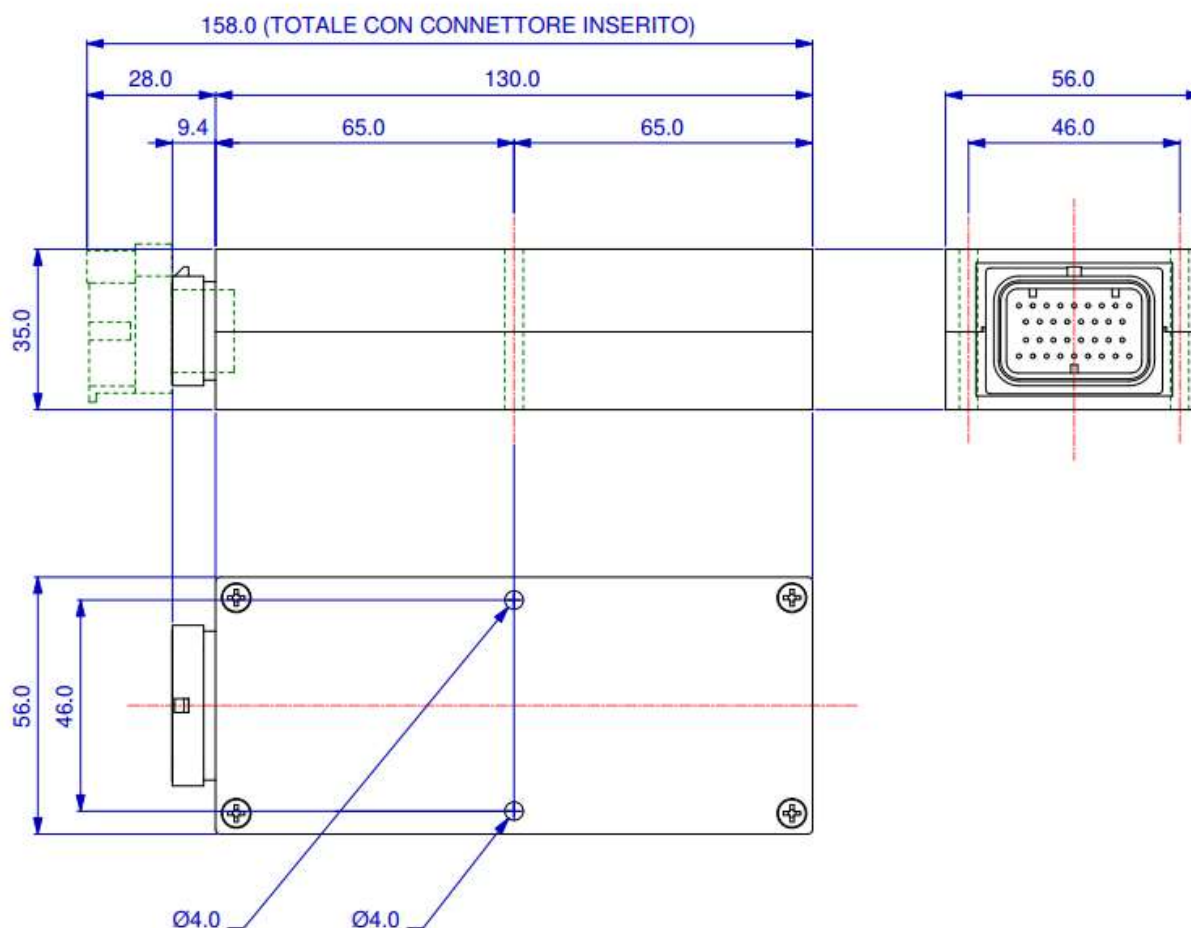
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4.3.3 *AUXBOX dimensions*

The AUXBOX is a module that has the following functions:

- expansion of analogue and digital channels
- variable pitch propeller control (optional feature)
- throttle control for helicopter applications (optional feature)

the dimensions of the AUXBOX are shown in the following figure:

**4.3.3.P**

the weight of the AUXBOX is 250g.

4.3.4 AUXBOX electrical characteristics

The electrical characteristics of the AUXBOX are:

- 12V power supply (range 9 .. 16 V) max 2.5A
- Secondary power input
- Operating temperature from -20 to +50°C
- 2 inputs for resistive level sensors and
- Fuel pressure input
- Oil pressure input
- Map pressure sensor input (only for B22 and B25 engine version)

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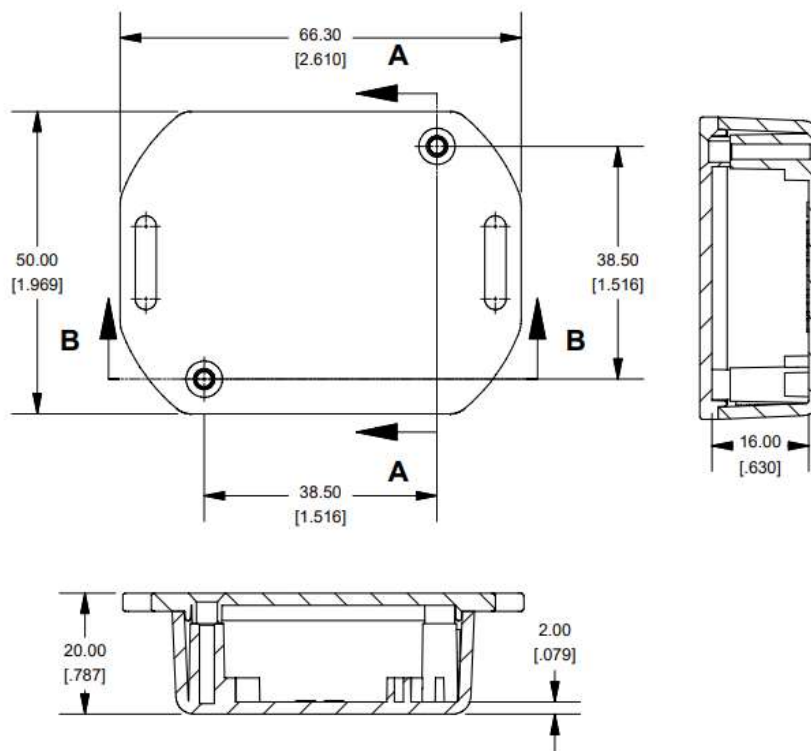
- 2 programmable analog inputs
- Gear oil temperature input
- Fuel temperature sensor
- 1 additional NTC input
- 5 digital inputs including 2 RPM sensors
- 2 digital outputs (1NPN 1 PNP)
- STEPPER motor control integrated
- CAN bus communication
- Serial communication port
- Dedicated rotor RPM sensor input
- LTE connection for remote log

The pin out of the connector is available in the "installation" chapter

4.3.5 AHRS Dimension

AHRS (Altitude and Heading Reference System) is a module which integrates a differential pressure sensor to be connected to the static and dynamic pressure of a pitot tube, and an inertial platform. Through the information transmitted by the AHRS module, the EM-m instrument is able to determine the quantities that are displayed in the two flight pages (see chapters 4.6 and 4.7).

The dimensions of the AHRS are indicated in the figure below

**4.3.5.P**

The weight of the AHRS is 90 g.

4.3.6 Electrical Characteristics AHRS

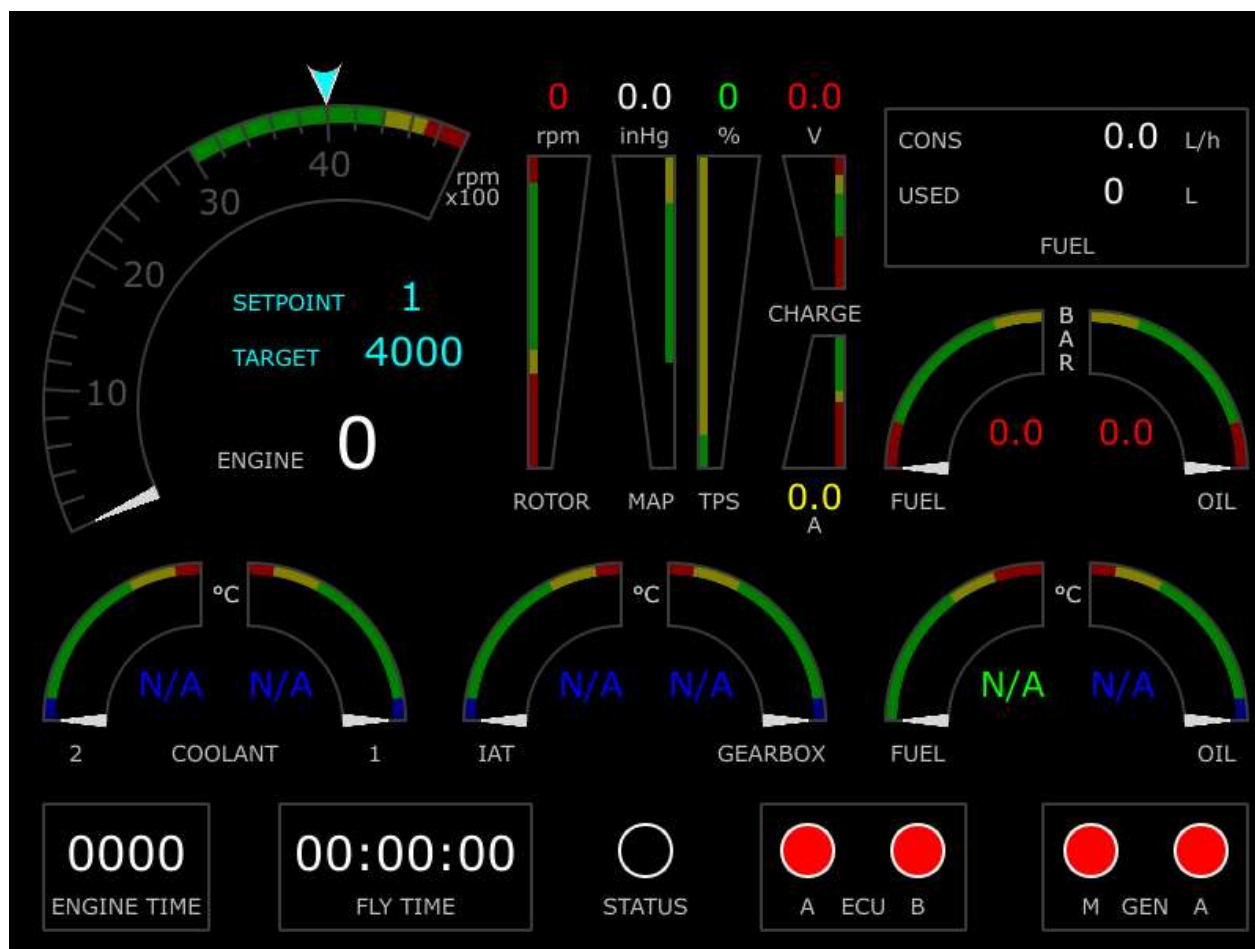
The electrical characteristics of the AHRS module are:

- 12V power supply (range 9 .. 16 V) max 2.5A
- Operating temperature from -20 to +50°C
- CAN bus communication
- Integrated pressure sensors for altitude and speed
- LTE connection for remote log

The pin out of the connector is available in the "installation" chapter.

4.4. Page 1 "engine data"

When the instrument is switched on, page 1 of the engine data is displayed. It is possible to return to page 1 from any other viewing page by pressing the button Nr. 1.



4.4.1.P

This page displays the following data (starting from the top right):

nome	Type of indication	Short description	Origin of the data
ENGINE	numerical value + bar graph	Engine RPM	CAN line from ECUA and ECUB
SETPOINT	Numerical value (1,2,3)	Number of setpoint	Internal data from EM
TARGET	Numerical value + cursor on engine rpm bar	RPM Target for VPP control system	Internal data from EM
ROTOR	numerical value + bar graph	Rotor RPM (for gyro and helicopter application)	CAN line AUXBOX
MAP	numerical value + bar graph	Manifold Air Pressure	CAN line from ECUA and ECUB
TPS	numerical value + bar graph	Throttle Position Sensor	CAN line from ECUA and ECUB
CHARGE V	numerical value	Battery voltage	CAN line from ECUA

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	+ bar graph		
CHARGE A	numerical value + bar graph	Power consumption/recharge	CAN line from internal CAN module
CONS	numerical value	Real time fuel consumption	Calculated data
USED	numerical value	Total amount of used fuel	Calculated data
FUEL	numerical value + bar graph	Fuel pressure	CAN line from AUXBOX
OIL	numerical value + bar graph	Engine oil pressure	CAN line from AUXBOX
COOLANT 2	numerical value + bar graph	Coolant temperature engine bank 1	CAN line from ECUB
COOLANT 1	numerical value + bar graph	Coolant temperature engine bank 1	CAN line from ECUA
IAT	numerical value + bar graph	Inlet Air Temperature	CAN line from ECUB
GEARBOX	numerical value + bar graph	Gerabox oil temperature	CAN line from AUXBOX
FUEL	numerical value + bar graph	Fuel temperature	CAN line form AUXBOX
OIL	numerical value + bar graph	Engine oil temperature	CAN line from ECUA
ENGINE TIME	numerical value	Total engine running time	Calculated data
FLY TIME	numerical value	Total flying time	Calculated data
STATUS	LED	Status light	Calculated data
ECUA	LED	ECUA ON light	CAN line from ECU A
ECUB	LED	ECUB ON light	CAN line from ECU B
GEN M	LED	Main generator light	CAN line from internal CAN module
GEN A	LED	Aux generator light	CAN line from AUXBOX

4.4.1.C

Below are some notes on the channels displayed

4.4.1. SETPOINT and TARGET data

The SETPOINT, TARGET data are optional and are displayed only if the "type A with target function" or "type B with target function" option is selected on the "Motor type" page (see chapter 4.7.10).



These data are activated in case the instrument is used as VPP control (see chapter 4.7.10).

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4.4.2. ROTOR datum

The ROTOR datum is optional and is displayed only if it is enabled in the "Tools configuration" page.



This datum is typically activated when the instrument is used on helicopters and gyrocopters, to display the rotor speed

4.4.3. GEN A LED

The "GEN A" LED is an optional light and is displayed only if it is enabled in the "Tools configuration" page.



This light is activated if the engine is equipped with a booster generator.

4.4.4. CONS datum

The value of the instantaneous consumption "CONS" is calculated by the instrument taking into account the value of injection time and the fuel pressure. However, this calculation can be affected by errors due to various factors, therefore it is possible to correct the calculation using a corrective coefficient which can be found by accessing the "Tools configuration" page.

4.4.5. USED datum

The "USED" value is the calculation of the total fuel consumed since engine start-up. The value is calculated using the value of the "CONS"



When the instrument is switched on, this field displays the last value stored, i.e. the quantity of fuel consumed in the previous session



The USED value is a calculated value and therefore is affected by error. It should therefore not be used for calculating fuel remaining.

4.4.6. LED STATUS

This warning light may be off or it may be lit in blue, green or red. Each of these states of the STATUS light indicates a different state of the engine and therefore the pilot must comply with the provisions in this manual.



Ignoring the indications provided for each state of the STATUS light could cause serious damage to the engine.

LED STATUS off

When switching on the instrument, if the STATUS light is off, it indicates that no anomalies have been recorded in the system or in the use of the engine and therefore it is possible to proceed with starting the engine.

Conversely, if anomalies have been recorded, or if in the memory of the control units and use of the engine outside the limits has been recorded, or finally if some alarm is active when the instrument is switched on, the warning light will not be off but lit in red



Do not start the engine if the warning light is red and correct the problem before starting the engine

LED STATUS lit Blue

If the warning light has remained off when the instrument is switched on, then when the engine is started, the STATUS warning light turns blue and remains blue for the entire engine warm-up period. After the engine oil and water temperatures reach the green zone for at least 30 seconds and with throttle below 10%, the status light turns green to indicate that the engine is ready for take-off.



During the warm-up phase, the throttle must not be opened beyond 10.2% for more than 2 seconds. If this condition is not respected, the STATUS light will turn red



If starting with a warm engine, the STATUS light will remain blue for 30 seconds and then turn green

LED STATUS lit green

After the warm-up phase, the STATUS light turns green to indicate that the engine is ready for flight, and will remain green until an alarm condition, or anomaly, or engine use outside the operating limits occurs. If any of these events occur the light will turn red during flight.



Do not attempt to take off before the STATUS light turns green. If this warning is not respected the status light will turn red.

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LED STATUS lit red

The red status light indicates that an event has occurred for which an engine check must be carried out at an authorized service centre before making another flight.



Do not take off with the red light on.



If the red light comes on during the flight, it is mandatory to land as soon as possible

The LED STATUS turns red in the following cases:

- exceeding the 10.2% throttle limit for more than 2 seconds during warm-up
- Upon exceeding the 28.5 MAP threshold during flight (rpm above 2200 rpm) for more than 5 minutes
- Flying the same despite being required to carry out the planned service. The planned service occurs after 25 hours of flying hours (with a tolerance of 1 hour) with a new engine, subsequently, however, occurs every 50 of flying hours (with a tolerance of 5 hours)
- if an event involving engine use outside the permitted limits has been recorded in the memory of the ECUs
- if you start a flight with an active alarm or if an alarm goes on in flight for more than 20 seconds



The instrument is unable to recognize the flight condition therefore it is programmed that exceeding the 2200 rpm threshold for more than 30 seconds identifies the flight condition.

Each time one of the above conditions occurs, a counter in the instrument's memory is incremented.

If the counter is greater than zero when the instrument is switched on, the status light will be red and will remain red until the engine is checked by an authorized workshop.



Do not operate the engine if the STATUS light is red. Using the engine in these conditions voids the engine warranty and releases MWfly from any obligation or liability

	EM-m system use, installation and maintenance manual	document E-DMA.I02.1	
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4.4.7. LED status ECUA

This LED indicates whether control unit A is on (green LED) or off (red LED).



In the event of an "ECUA MISSING" error, the LED can no longer give correct information on the status of the control unit. Therefore, refer to the position of the ECUA switch on the panel.

4.4.8. LED status ECUB

This LED indicates whether control unit B is on (green LED) or off (red LED).



In the event of an "ECUB MISSING" error, the LED can no longer give correct information on the status of the control unit. Therefore, refer to the position of the ECUA switch on the panel.

4.4.9. LED status "GENERATOR M"

This LED indicates the correct operation of the main generator, and turns red in the event that there is a malfunction of the voltage regulator. If the generator status LED is red it means that the battery recharging system is not working, and this can also be verified by the ammeter indicator (CHARGE A) which will be in a red field.



If the generator status LED turns red, carry out the emergency manoeuvres indicated in the operating manual.



When the recharging system works correctly, the "GENERATOR M" status LED is off

4.4.10. LED status "GENERATOR A"

The "GENERATOR A" LED is optional and is displayed only if it is enabled in the "Tools Configuration" page.

The "GENERATOR A" LED indicates the generator status and turns red if the auxiliary generator is not working properly.



When the recharging system works correctly, the "GENERATOR A" status LED is off

4.4.11. CHARGE A datum

The "CHARGE A" data is connected to the shunt which is integrated in the control unit group.

This instrument indicates the status of the difference between the recharge of the generator and the applied electrical loads. Therefore, the value will be positive if the recharge is greater than the applied electrical loads.



When the CHARGE A value is positive it means that the generator is recharging the battery

Conversely, if the applied loads are greater than the recharge, the value will be negative



When the value is negative it means that the charging system is not sufficient to recharge the battery, and therefore the battery is running low.



It is normal for the CHARGE A value to be negative with the engine idling. If this is not the case, the connection between the shunt and the instrument may have been reversed



In order for the instrument to give a reliable indication, it is essential that all minor loads of the aircraft are connected upstream of the shunt. Follow the instructions in the engine installation manual.

4.4.12. Unit of measure

The unit of measurement is indicated for each data displayed, with the exception of ENGINE TIME which is in flight hours and FLYTIME which is in hh.mm.ss.



The units of measure do not change even if the system of measure changes in the "Display System" page

The units of measure are

name	unit
ENGINE	RPM
TARGET	RPM
ROTOR	RPM
MAP	inHg
TPS	%
CHARGE V	Volt
CHARGE A	Amp

	EM-m system use, installation and maintenance manual	document E-DMA.I02.1	
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CONS	L/h
USED	L
FUEL (P)	Bar
OIL (P)	Bar
COOLANT 2	°C
COOLANT 1	°C
IAT	°C
GEARBOX	°C
FUEL (T)	°C
OIL (T)	°C

4.4.2.C

4.4.13. Bar graphs (blue-yellow-green-red arc)

Each graphic bar is divided into sections with different colours

- Blue: this section is only for the temperature sensors and indicates a low temperature, which generally occurs in the first engine warm-up phase
- Green: the green coloured section is the range within which there is correct use of the engine
- Yellow: the yellow coloured section is normally a section before the red section, it indicates an interval in which the engine can work but the pilot must intervene to bring back into the green area.
- Red: the section marked in red indicates that has been exceeded the permitted limits and therefore the pilot must act promptly to bring the engine back to operation in the green area.



A prolonged period of operation in the red zone is memorized in the instrument and in the control units and will be signalled by the switching on of the red STATUS light.



A period of engine operation in the red zone can cause serious damage to the engine itself. Therefore, after an event of this type, it is necessary to subject the engine to adequate checks



In the event that any operation of the pilot has not brought the engine back into the green zone, it is necessary to land as soon as possible.

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In any case, once landed it is necessary to make a careful inspection of the engine to detect any damage, and in order to understand the causes of the event.



Do not make any other flights until the causes have been identified and resolved.

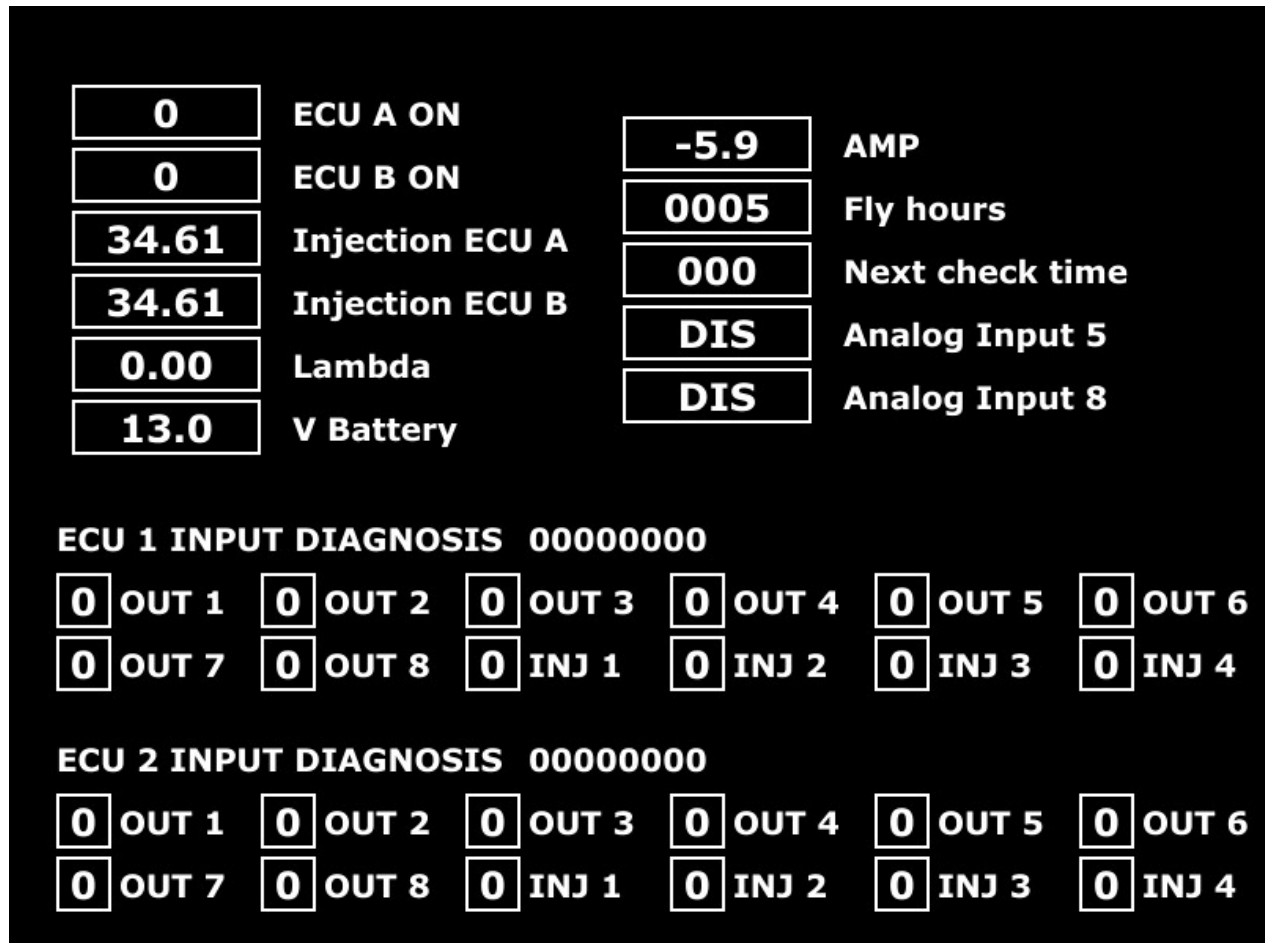
The units of measurement are

name	field	Blue arc	Green arc	Yellow arc	Red arc
ENGINE RPM (direct)	0-4000		2200-3300	3300-3500	>3500
ENGINE RPM (type A)	0-4500		3000-4000	4000-4200	>4200
ENGINE RPM (type B)	0-5000		3000-4400	4400-4700	>4700
ROTOR	0-650		250-600	200-250	<200;>600
MAP	15-30		20-27.7	27.7-30	
TPS (engine off)	0-100		0-10	10-100	
TPS (engine on >500rpm)	0-100		0-70	70-100	
CHARGE V	9-16		11.8-14	14-15	<11.8;>15
CHARGE A	-30-30		5-30	0-5	-30-0
FUEL (P) (engine start)	2-4.5		2.7-3.6	>3.6	<2.7
FUEL (P) (>500Rpm)	2-4.5		3.0-3.6	>3.6	<3.0
OIL (P) (<2200 rpm)	0-5.0		0.8-4.5	>4.5	<0.8
OIL (P) (>2200 rpm)	0-5.0		1.5-4.5	>4.5	<1.5
COOLANT 1	30-120	<72	72-98	98-102	>102
COOLANT 2	30-120	<72	72-98	98-102	>102
IAT	0-100	<10	10-65	65-75	>75
GEARBOX	30-150	<50	50-120	120-130	>130
FUEL (T)	-10-70		-10-55	55-65	>65
OIL (T)	30-150	<50	50-120	120-130	>130

4.4.3.C

TRANSLATED	FREE DISCLOSURE	Page 30 of 99
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4.5. Page 2 "diagnostics"



4.5.1.P

The data contained in this page is used to diagnose the injection system, verify correct operation and identify any anomalies.



This page is reserved for assistance centres. In the event of an engine malfunction, or in the case of the STATUS light coming on, or in the event of an alarm turning on, the user can report the data to a service centre for easier identification of the problem.



It is possible that the data shown on this page is not sufficient to identify a problem. The assistance centre is responsible for assessing the problem and the activities to be done.

	EM-m system use, installation and maintenance manual	document E-DMA.IO2.1	
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The following table shows the data displayed on the diagnostic page and a brief description

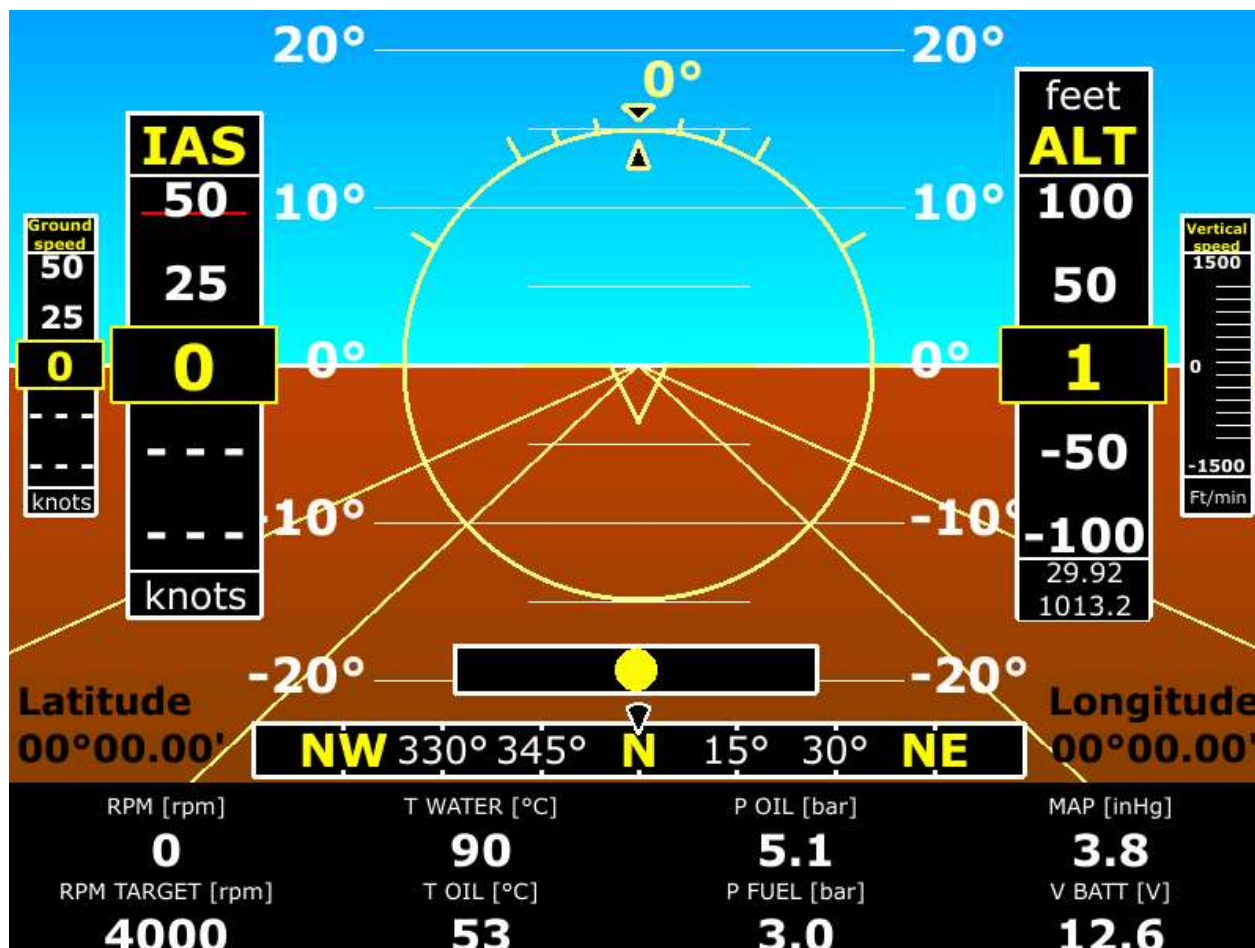
data	description
ECU A ON	Elapsed time ECU A
ECU B ON	Elapsed time ECU B
INJECTION ECUA	Injection time ECU A
INJECTION ECUB	Injection time ECU B
Lambda	Lambda
V BATT	Battery voltage
AMP	Charging/absorption current
Fly hours	Total flying hours
Next check time	Time remaining for next routine maintenance
Analog input 5	Analog input N.5
Analog input 8	Analog input N.8
ECU 1 INPUT DIAGNOSIS	ECUA input diagnostic binary code
OUT 1 (ECUA)	Diagnostic output 1 ECUA
OUT 2 (ECUA)	Diagnostic output 2 ECUA
OUT 3 (ECUA)	Diagnostic output 3 ECUA
OUT 4 (ECUA)	Diagnostic output 4 ECUA
OUT 5 (ECUA)	Diagnostic output 5 ECUA
OUT 6 (ECUA)	Diagnostic output 6 ECUA
OUT 7 (ECUA)	Diagnostic output 7 ECUA
OUT 8 (ECUA)	Diagnostic output 8 ECUA
INJ 1 (ECUA)	ECUA injector 1 control diagnosis
INJ 2 (ECUA)	ECUA injector 2 control diagnosis
INJ 3 (ECUA)	ECUA injector 3 control diagnosis
INJ 4 (ECUA)	ECUA injector 4 control diagnosis
ECU 2 INPUT DIAGNOSIS	ECUB input diagnostic binary code
OUT 1 (ECUB)	Diagnostic output 1 ECUB
OUT 2 (ECUB)	Diagnostic output 2 ECUB
OUT 3 (ECUB)	Diagnostic output 3 ECUB
OUT 4 (ECUB)	Diagnostic output 4 ECUB
OUT 5 (ECUB)	Diagnostic output 5 ECUB
OUT 6 (ECUB)	Diagnostic output 6 ECUB
OUT 7 (ECUB)	Diagnostic output 7 ECUB
OUT 8 (ECUB)	Diagnostic output 8 ECUB

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INJ 1 (ECUB)	ECUB injector 1 control diagnosis
INJ 2 (ECUB)	ECUB injector 2 control diagnosis
INJ 3 (ECUB)	ECUB injector 3 control diagnosis
INJ 4 (ECUB)	ECUB injector 4 control diagnosis

4.5.1.C

4.6. Page 3 "flight instrument"




4.6.1.P



This page is activated only by enabling the AHRS function and connecting the AHRS module and the GPS to the instrument


The data available on this page is:

data	description
AI	Attitude indicator (in the background), orientation (pitch and roll) of the aircraft with respect to the earth's horizon
IAS	Airspeed indicator
ALT	Altitude indicator
QNH	Atmospheric pressure traced back to the mean sea level, by means of the pressure-height relationship of

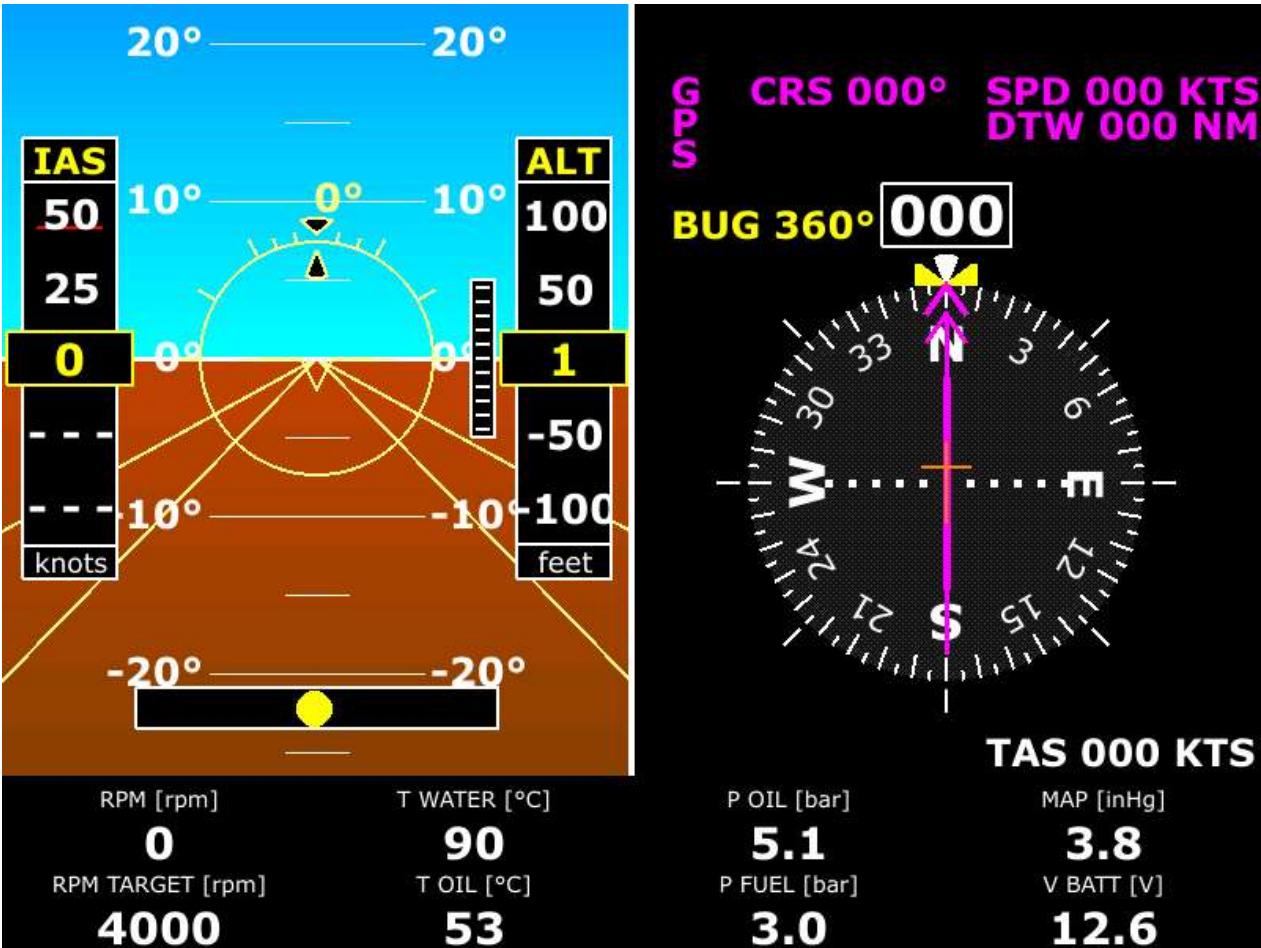
	EM-m system use, installation and maintenance manual	document E-DMA.I02.1	
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	the typical air. The QNH is modified using the knob, it is therefore possible to adjust the starting altitude.
Ground speed	Ground speed measured with GPS
Vertical Speed	Rate of climb (rate of climb or descent)
Inclinometer	Inclinometer
Compass	Compass
Latitude	Latitude
Longitude	Longitude

4.6.1.C

	EM-m system use, installation and maintenance manual	document E-DMA.IO2.1	
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4.7. Page 4 “flight instrument + HSI”



4.7.1.P




This page is activated only by enabling the AHRS function and connecting the AHRS module and the GPS to the instrument

Page four is a split screen page showing flight data on the left and the HSI (Horizontal Situation Indicator) instrument on the right.

For description of flight data see chapter 4.6.


The HSI is based on GPS data only. It helps in horizontal navigation. To make it work, set the destination coordinates in the "Destination" item from page 5 "configuration page" chap. 4.8.8.

	EM-m system use, installation and maintenance manual	document E-DMA.IO2.1	
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The data displayed on the page are indicated in the following table:

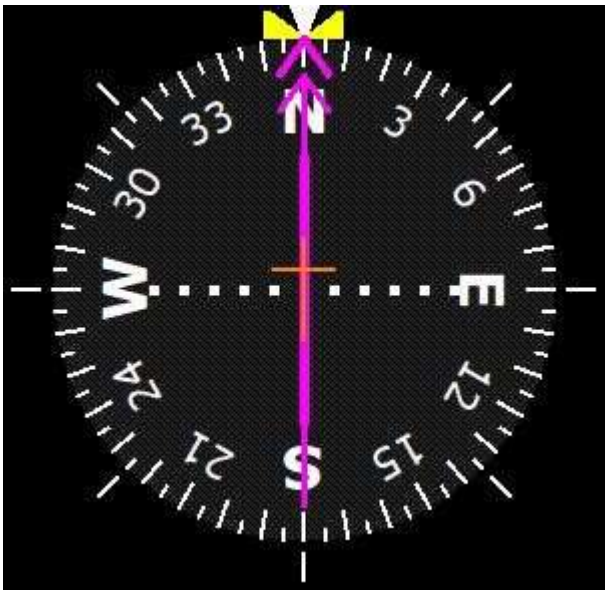
datum	description
CRS	direction to destination
SPD	Ground speed (GPS speed)
DTW	Distance to destination
BUG	direction set by the pilot
Compass	Compass
TAS	True Air Speed

4.7.1.C




Direction can be adjusted using the rotary knob (press to enable/disable this function)

Inside the HSI tool is the CDI tool. A Course Deviation Indicator (CDI) is used to show the lateral position of the aircraft relative to the course.



4.7.2.P

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The following symbols are contained in the CDI tool:



4.7.3.P

This symbol represents the aircraft



4.7.4.P

This symbol represents the direction to the destination point



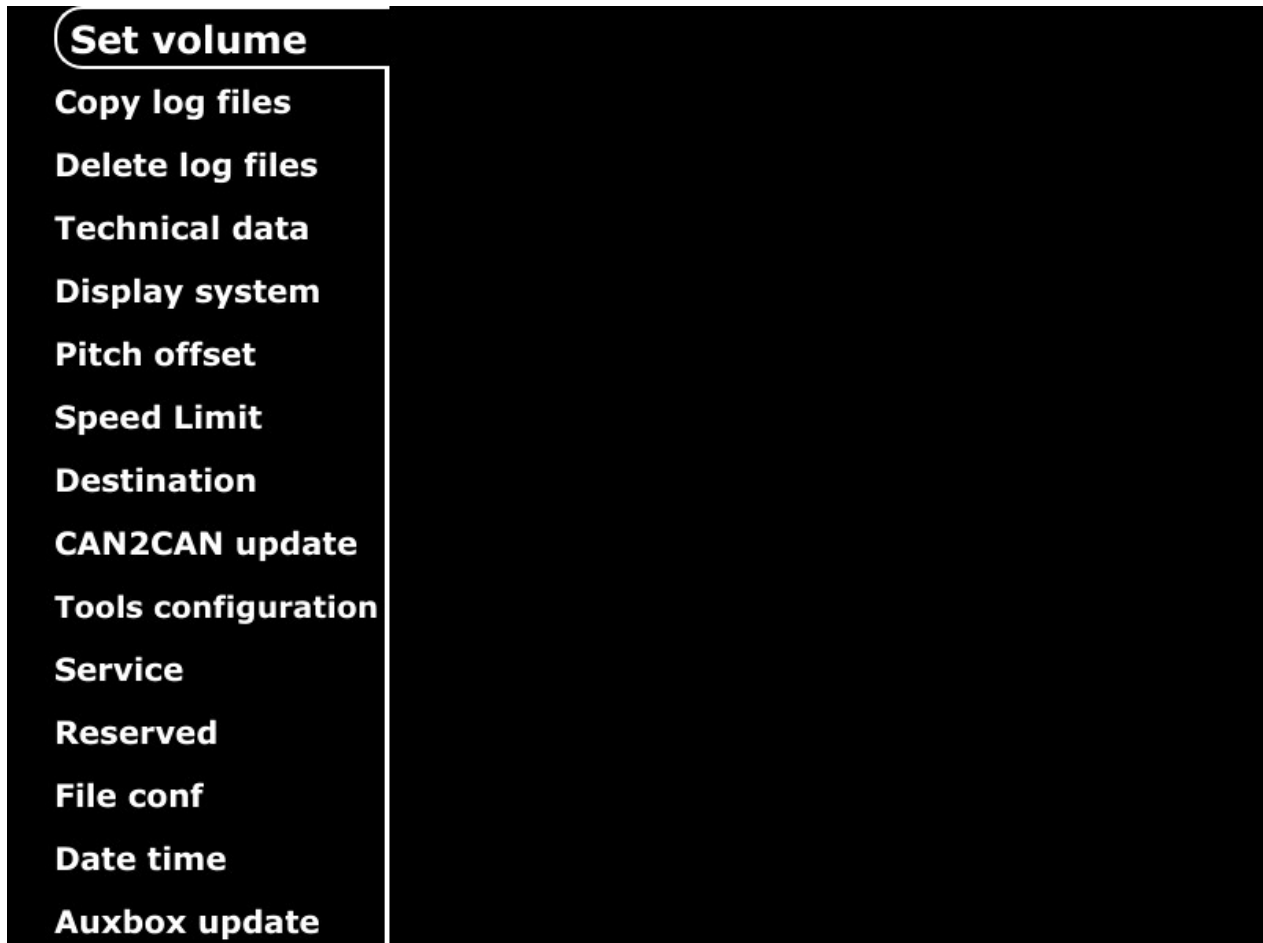
4.7.5.P

The bar indicates the direction of the route from the starting point to the destination point



the aircraft position on the centre bar shows the distance travelled by the aircraft from the set course (5 NM full scale)

4.8. Page 5 "system configuration"



4.8.1.P


This page presents a menu through which you can configure the system or access other system functions.



To scroll the cursor in the menu, turn the knob on the instrument, while to select a menu item, press the knob.


The menu items are listed in the table below:

menu	Short description
Set volume	To adjust the volume of the alarms
Copy log file	To download log files
Delate log file	To delate log files
Technical data	To view system, engine and GPS technical data

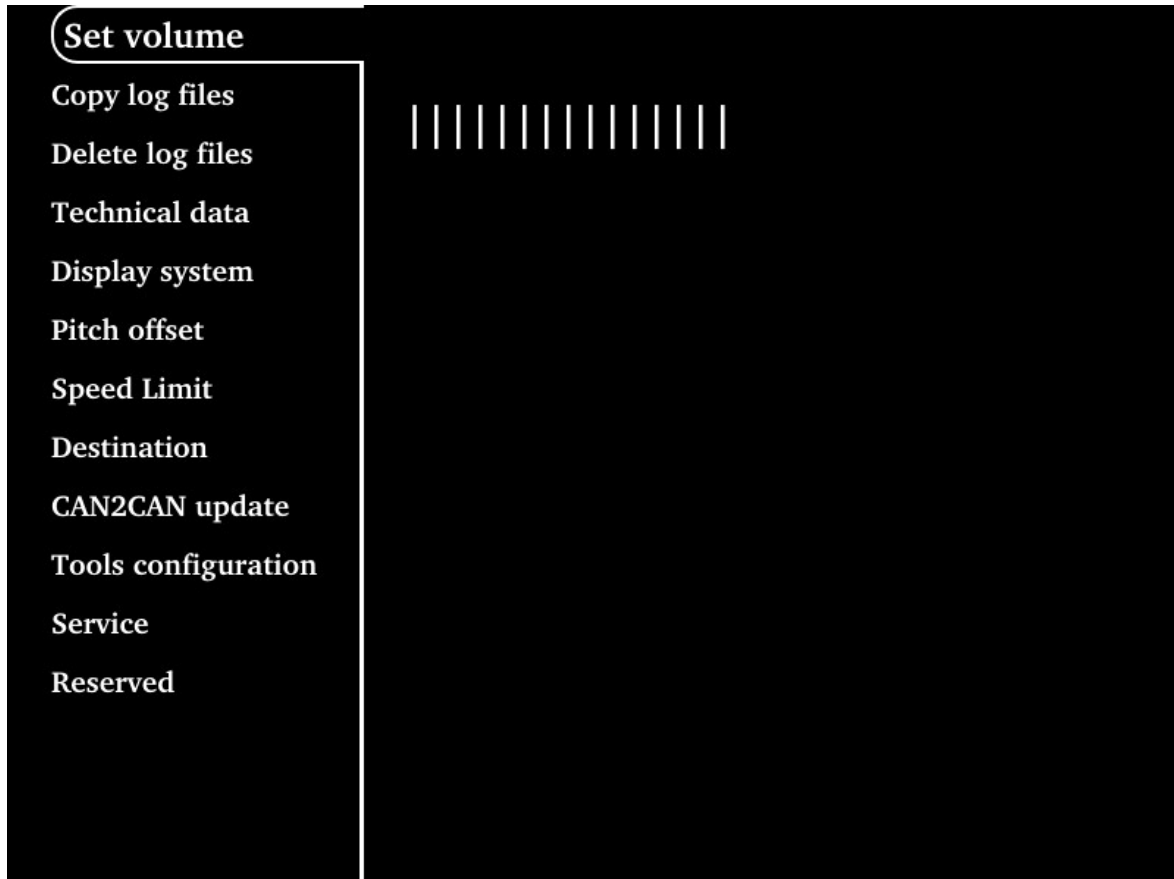
	EM-m system use, installation and maintenance manual	document E-DMA.I02.1	
		Edition A	Revision 1

Display system	To change the system units (flight pages only)
Pitch offset	To set the pitch angle of the aircraft (for AHRS)
Speed limit	To set the maximum speed of the aircraft (VNE)
Destination	To set the destination data
CAN2CAN upgrade	To update the CAN AEROSPACE output
Tools configuration	For system setup
Service	Reserved for engine service information
Reserved	Page reserved for the service centre
File Config	Page reserved for the service centre
Data time	For setting the time and date
Aubox updated	For updating the AUXBOX

4.8.1.C

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4.8.1. Set volume



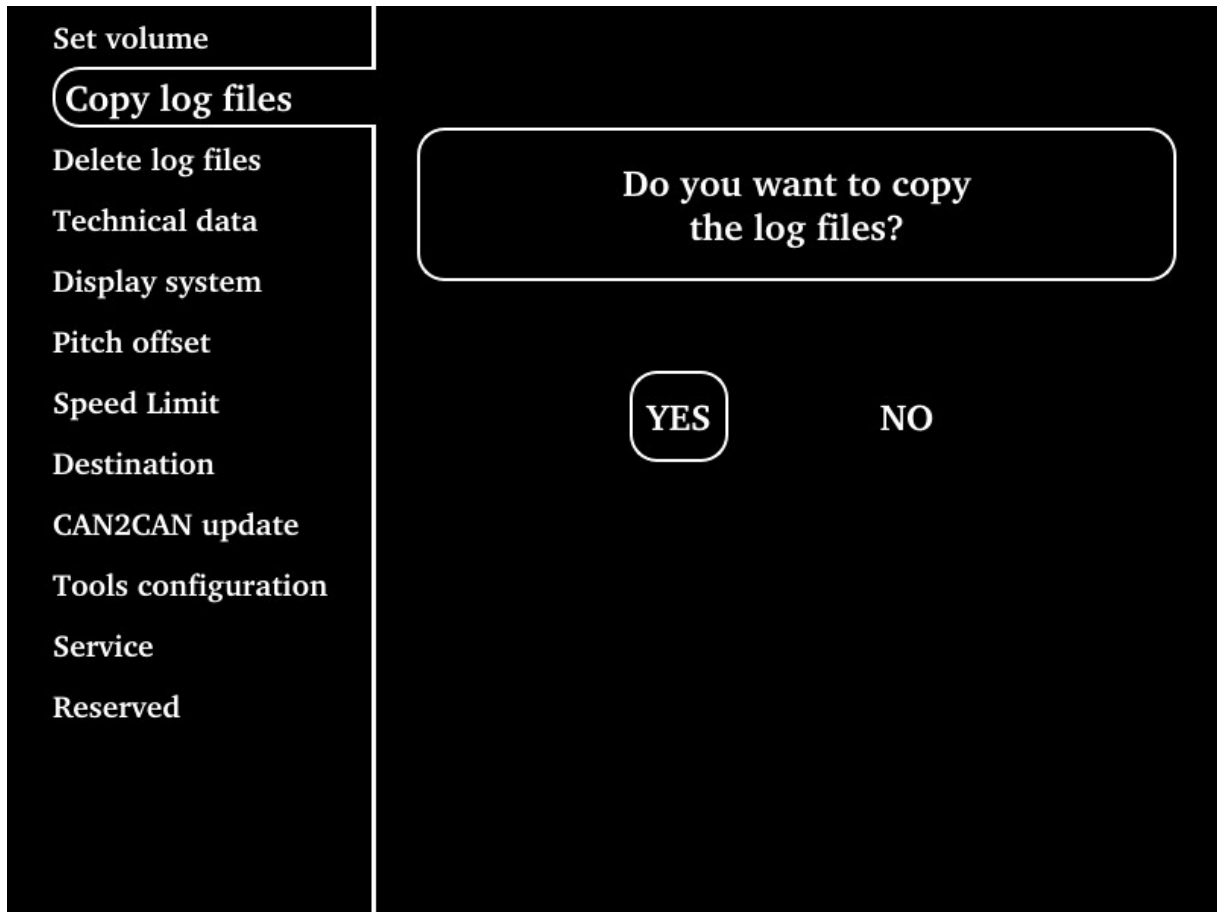
4.8.2.P

In this page it is possible to set the volume for the alarm warnings, the range goes from 5 to 31.



to change the volume level in this page it is necessary to rotate the knob. To confirm and exit the page, press the knob

4.8.2 Copy log file



4.8.3.P


To be able to download the data from the dashboard, enter this page and follow the procedure below:

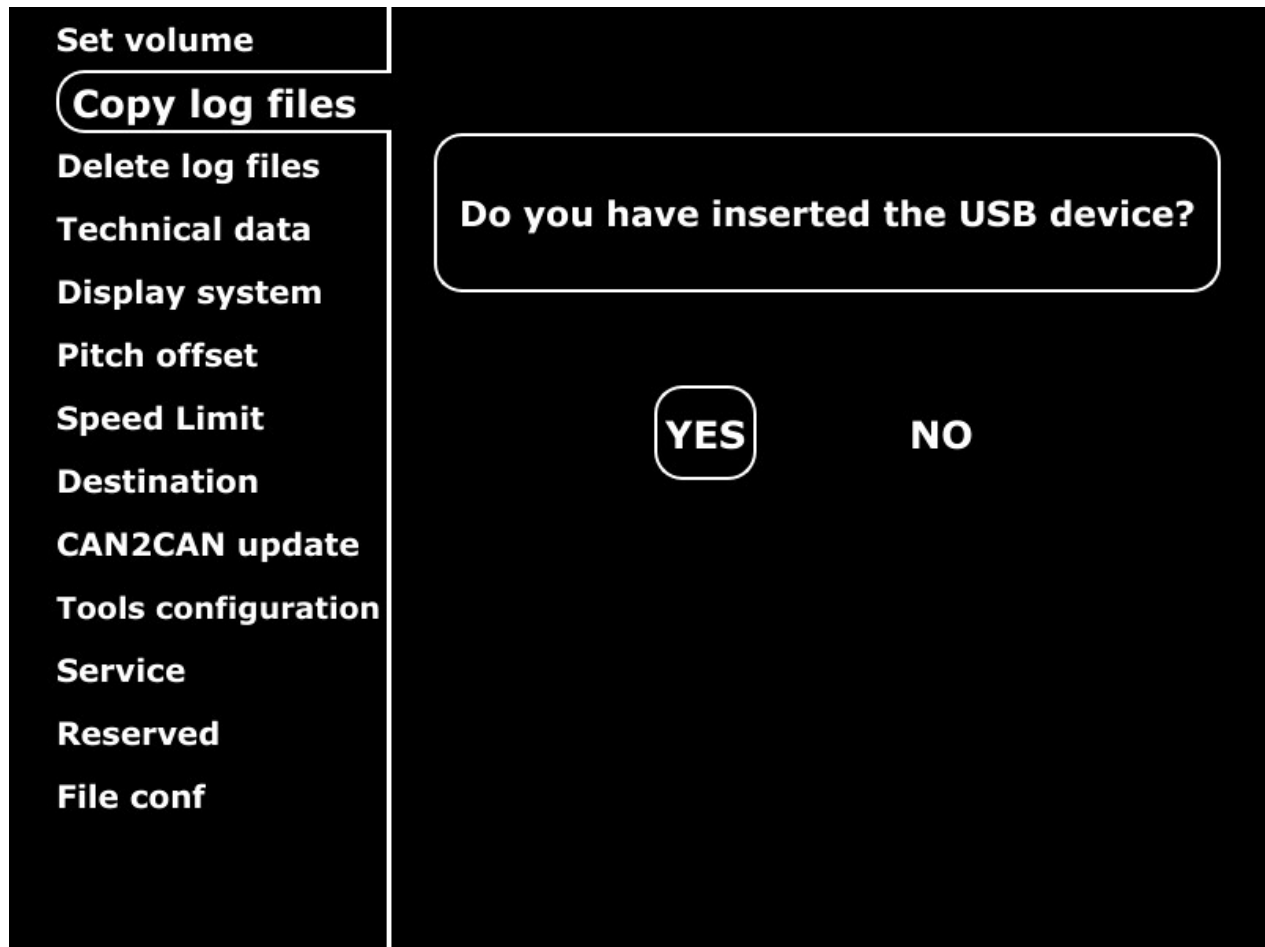
- a.** insert a USB memory key into the USB port



Before inserting the USB memory, check that it is empty and formatted FAT32


- b.** use the knob to select "YES" and by pressing the knob the page that requires you to insert the USB memory into the USB port will be displayed

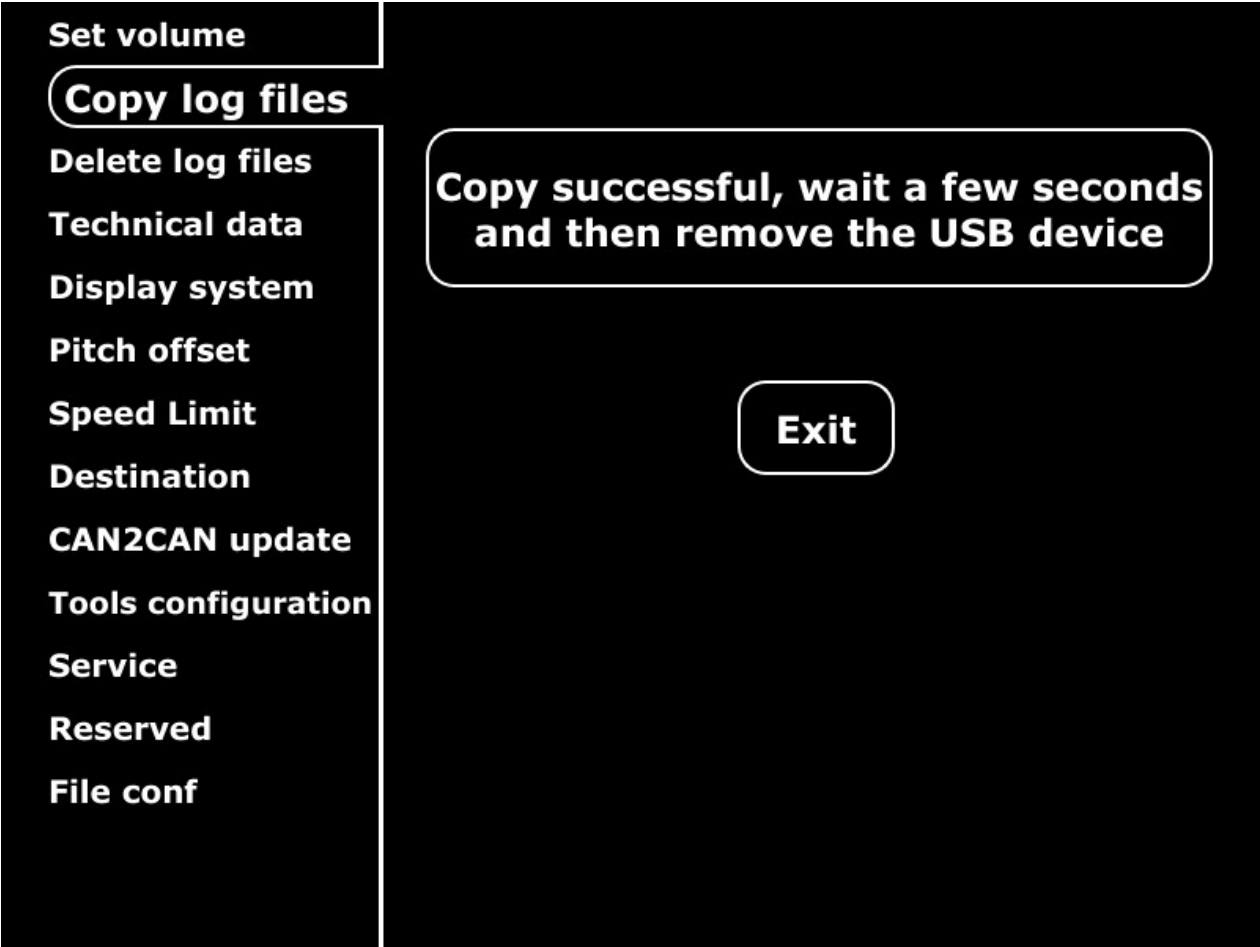
	EM-m system use, installation and maintenance manual	document E-DMA.I02.1	
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4.8.4.P

- c.** If the mass memory is inserted in the USB port select "YES" with the knob and press the knob, otherwise insert the mass memory, select "YES" and press the knob

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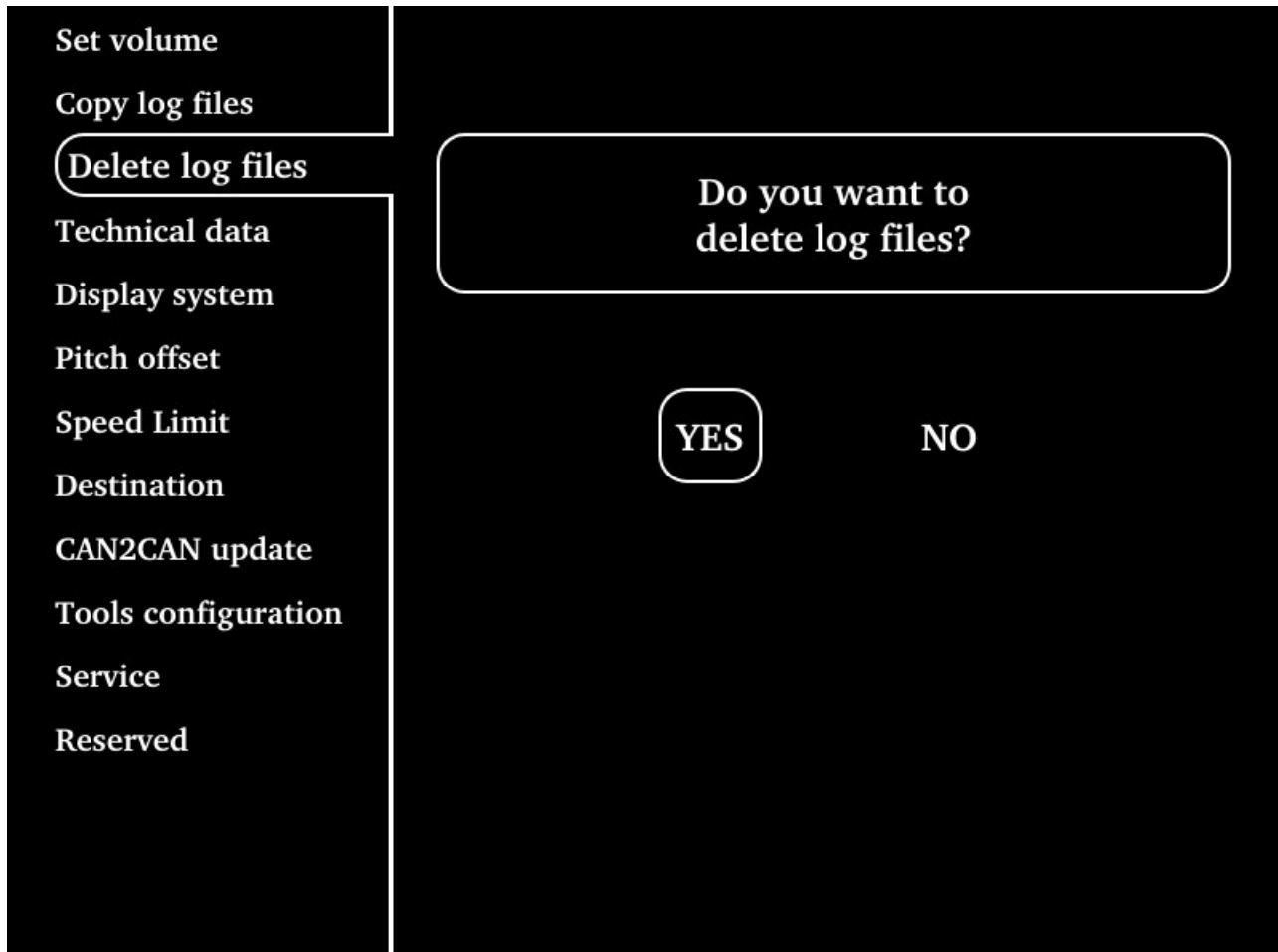


4.8.5.P



After pressing the knob, the system starts downloading the files into the USB memory, this procedure takes a few seconds at the end of the procedure a message will appear confirming that the data download has been completed

4.8.3 Delete log files



4.8.6.P

Only service centres are authorized to delete data from the memory, by selecting the Delete log file function.



When the free memory drops below 50 Mbyte, the 5 oldest acquisition files are deleted. When the free space of the internal memory of the instrument is less than 100 Mbyte, the yellow alarm lights up, "MELORY FULL"



La funzione di "delete log file" è accessibile solo a motore spento.



EM-m system use, installation and maintenance manual

document
E-DMA.I02.1

Edition
A

Revision
1

4.8.4 Technical data

Set volume	<input type="text" value="XXX"/> EMS S/N	<input type="text" value="XXX"/> Motor S/N
Copy log files	<input type="text" value="4.7"/> Software vers	<input type="text" value="9.2"/> Firmware user
Delete log files	<input type="text" value="0"/> ECU 1 rpm	<input type="text" value="0"/> ECU 1 baro
Technical data	<input type="text" value="0.00"/> ECU 1 P fuel	<input type="text" value="-56"/> ECU 1 T oil
Display system	<input type="text" value="0.00"/> ECU 1 inject	<input type="text" value="0"/> ECU 1 crank
Pitch offset	<input type="text" value="OFF"/> ECU 1 kill	<input type="text" value="0.0"/> ECU 1 on
Speed Limit	<input type="text" value="0.00"/> ECU 1 lambda	<input type="text" value="0"/> ECU 2 rpm
Destination	<input type="text" value="-56"/> ECU 2 T air	<input type="text" value="-56"/> ECU 2 T water
CAN2CAN update	<input type="text" value="OFF"/> ECU 2 kill	<input type="text" value="0.0"/> ECU 2 on
Tools configuration	<input type="text" value="00°00.00'"/> GPS latitude	<input type="text" value="00°00.00'"/> GPS longitude
Service	<input type="text" value="00:00:00"/> GPS time	<input type="text" value="00-00-00"/> GPS date
Reserved	<input type="text" value="0"/> GPS num sat	<input type="text" value="0"/> GPS quality
File conf	<input type="text" value="0"/> V generator	<input type="text" value="0"/> A generator
Date time	<input type="text" value="0.0"/> FW Auxbox	<input type="text" value="0.0"/> FW can2can
Auxbox update		

4.8.7.P

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This page displays the following technical data:

nome	Descrizione
EMS S/N	EM-m serial number
Motor S/N	Engine serial number
Software version	EM-m SW version
Firmware user	EM-m fW version
ECU1 Vbatt	V batt. from ECU1
ECU1 rpm	RPM from ECU1
ECU1 baro	Baro pressure from ECU1
ECU1 water	Water temperature from ECU1
ECU1 Pfuel	Fuel pressure from ECU1 (engine before 2017)
ECU1 Toil	Engine oil temperature ECU1
ECU1 mapping	Engine Map ECU1 (1 standard; 2 ECHO)
ECU1 injector	Fuel injection time ECU2
ECU1 Crank	Crank status ECU1 0 engine stop 1 engine run, RPM signal not identify 3 engine run, RPM signal identify waiting for synchro 4 engine run , RPM synchronized
ECU1 TPS	TPS from ECU1
ECU1 kill	Kill switch ECU1 (ON/OFF)
EC1 on	Elapsed time ECU1
ECU2 Poil	Oil pressure ECU2 (only engine version <2017)
ECU1 lambda	Lambda from ECU1 (optional)
ECU2 rpm	RPM from ECU2
ECU2 injection	Fuel injection time ECU2
ECU2 Tair	Air intake temperature from ECU2
ECU2 T water	Water temperature from ECU2
ECU2 crank	Crank status ECU1 0 engine stop 1 engine run, RPM signal not identify 3 engine run, RPM signal identify waiting for synchro 4 engine run , RPM synchronized
ECU2 Kill	Kill switch ECU2 (ON/OFF)
ECU2 on	Elapsed time ECU2
ECU2 TPS	TPS from ECU2
GPS- latitude *	Latitude
GPS- longitude *	Longitude

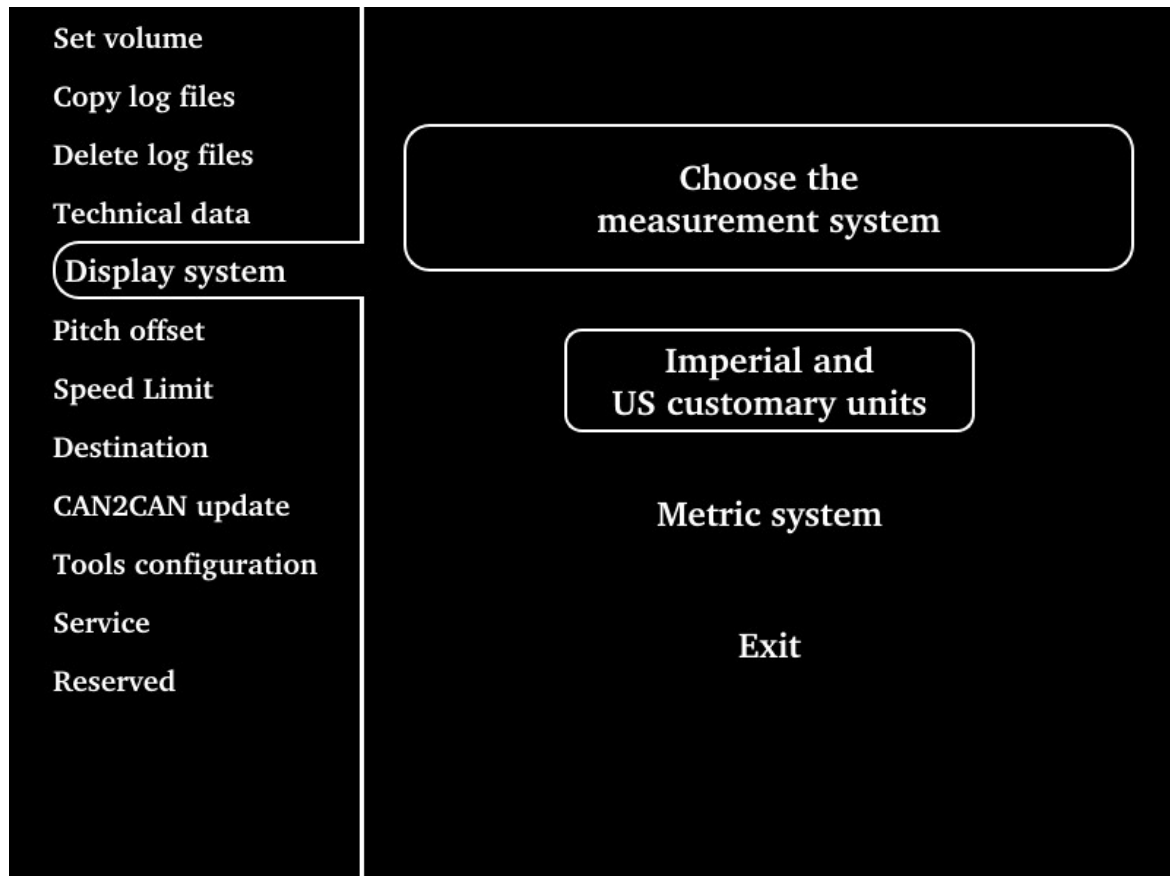
	EM-m system use, installation and maintenance manual	document E-DMA.I02.1	
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GPS-time *	GPS time
GPS-date *	GPS date
GPS num sat *	Num of SAT
GPS Quality *	GPS Fix 0= no Fix, 1=fix, 2 = differential
Capacitor	Internal capacitor status
V Generator	Voltage
A generator	Current (shunt)
Status counter	Status counter
FW auxbox	Auxbox firmware version
FW can2can	Internal can2can firmware version

Note: *only with AHRS+GPS abilitation

4.8.2.C

4.8.5 Display system



4.8.8.P

In this page the user can select the measurement system:

- Anglo-Saxon System "Imperial and US customary unit"
- Metric system "Metric System"



The system selection affects only the two flight instrument pages

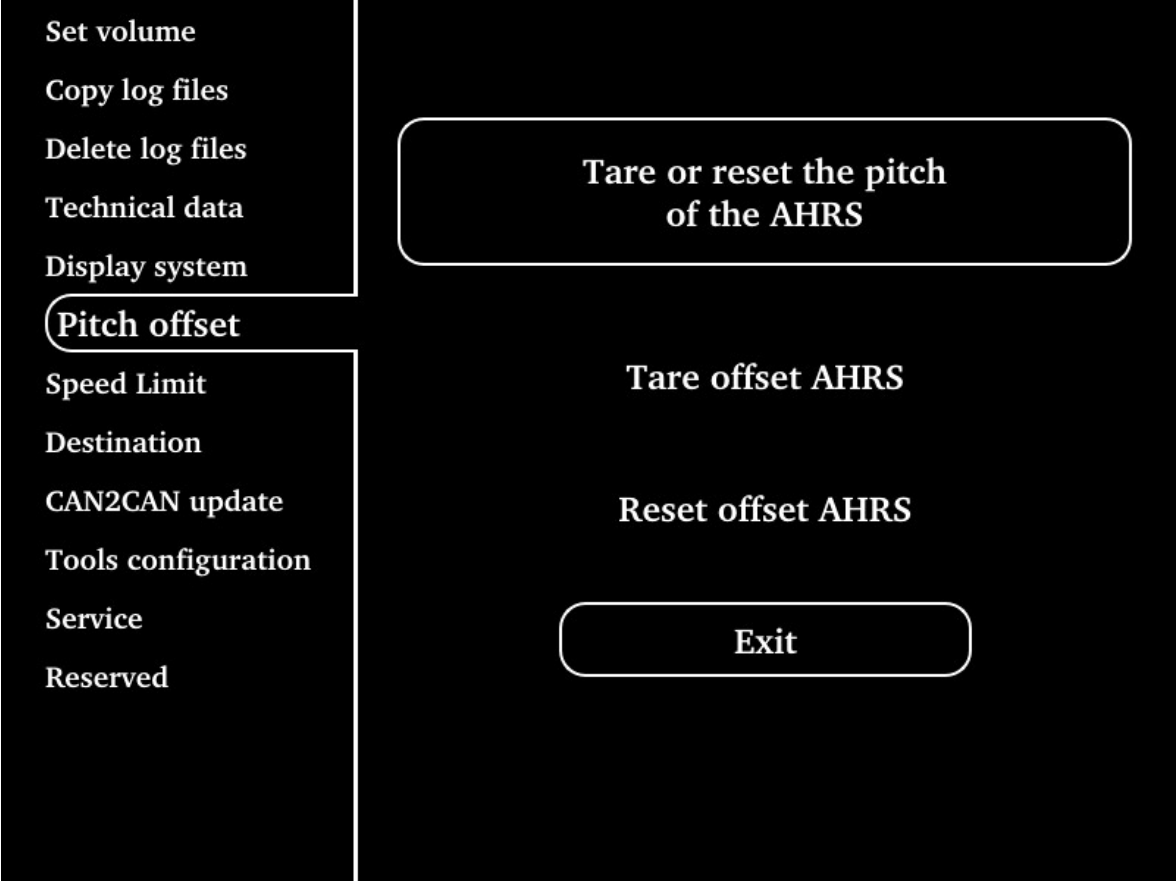


To select, turn the knob, to confirm the selection, press the knob.



The measurement system setting is only accessible with the engine off.

4.8.6 Pitch offset



4.8.9.P

Pitch is the pitch angle of the AHRS sensor, to be calibrated to 0° after installation, before calibrating by levelling the aircraft.



This page is accessible only with the activation of the AHRS+GPS function

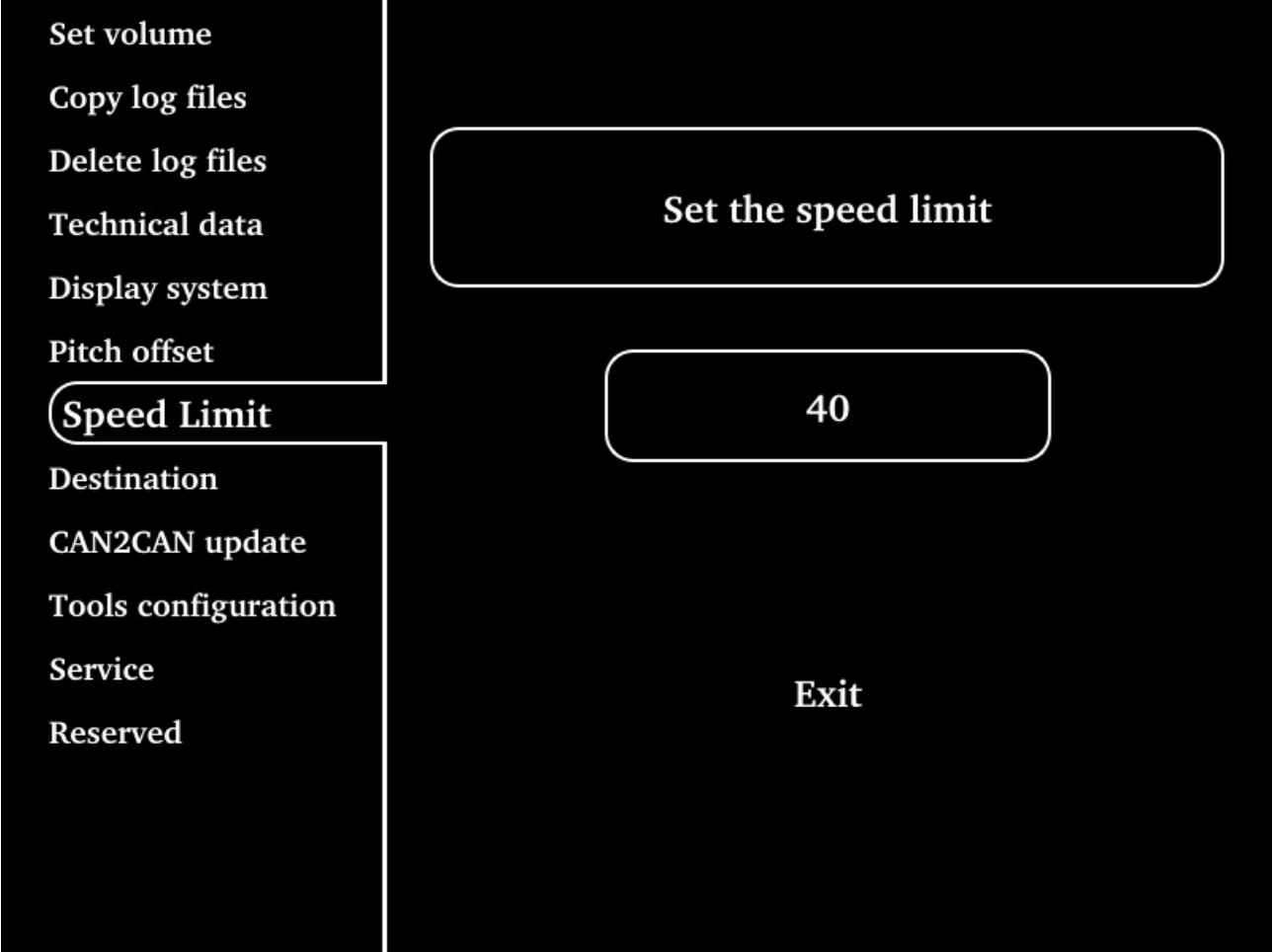


To select, rotate the knob, to confirm the selection, press the knob.







The “Pitch offset” setting is only accessible with the engine off.

4.8.7 Speed limit



4.8.10.P

the "speed limit" is the maximum IAS threshold of the aircraft, also called VNE.

- 
When the set threshold is exceeded, the IAS indicator turns red, but no alarm is generated
- 
This page is accessible only with the activation of the AHRS+GPS function
- 
To change the speed limit value, turn the knob, to confirm the selected value, press the knob.
- 
The "Speed limit" setting is only accessible with the engine off.

4.8.8 Destination

<div> Set volume Copy log files Delete log files Technical data Display system Pitch offset Speed Limit Destination CAN2CAN update Tools configuration Service Reserved </div>	<div> Set the destination point </div> <div> Latitude 0 ° 0 . 0 ' </div> <div> Longitude 0 ° 0 . 0 ' </div> <div> Exit </div>
--	---

4.8.11.P

In this page It is possible to enter the coordinates of the destination for the CDI tool described in chapter 4.7

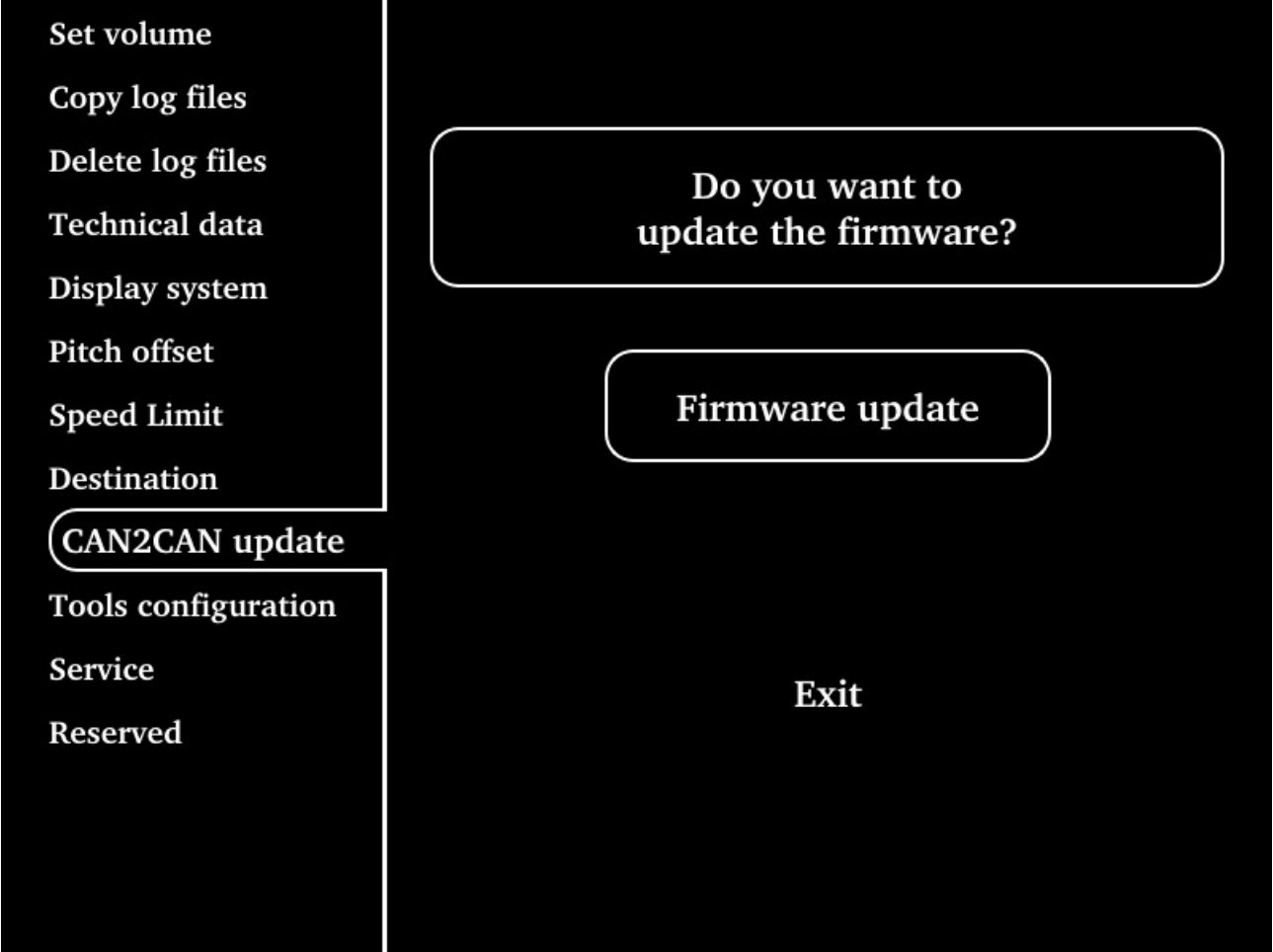


This page is accessible only with the activation of the AHRS+GPS function






To modify the value of each box, rotate the knob, to confirm the selected value, press the knob.

4.8.9 CAN2CAN update



4.8.12.P

On this page it is possible to update the data transmission table on the CAN AEROSPACE.

-  The CAN AEROSPACE function is an optional function
-  The update can only be done by authorized personnel or by a MWfly service centre
-  The “CAN2CAN” update function is only accessible with the engine off.

4.8.10 Tools configuration

Set volume Copy log files Delete log files Technical data Display system Pitch offset Speed Limit Destination CAN2CAN update Tools configuration Service Reserved	<div>Customize tools</div> <div> <div>Motor type</div> <div>Rotor</div> <div>Current</div> <div>Aux generator</div> <div>Setpoint 1</div> <div>Setpoint 2</div> <div>Setpoint 3</div> <div>Correction coefficient injection time</div> </div> <div>Exit</div>
---	---

4.8.13.P

On this page it is possible to configure the system according to the engine and its application and the accessories of the engine itself.



This configuration page is only accessible with the engine off.

The parameters that can be configured on this page are shown in the following table

menu	Description	value
Motor type	Engine type	Type A, type B, Direct drive, Type A with target function, Type B with target function
Rotor	Rotor	YES/NO
Current	shunt	YES/NO

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Aux generator	Aux genenerator	YES/NO
Setpoint 1	Setpoint 1 for VPP	Take off RPM Value
Setpoint 2	Setpoint 2 for VPP	Climb RPM Valore
Setpoint 3	Setpoint 3 per controllo VPP	Cruise RPM Valore
Correction coefficient Injection time	Correction coefficient for consumption calculation	Value from 0.7 to 1.29

4.8.3.C



To select, rotate the knob, to confirm the selection, press the knob.

To select the type of motor to which the instrument is connected, proceed as follows:

- a.** From the menu of the "Tools configuration" page select "Motor type"

Set volume Copy log files Delete log files Technical data Display system Pitch offset Speed Limit Destination CAN2CAN update Tools configuration Service Reserved	<div style="border: 1px solid white; border-radius: 15px; padding: 10px; text-align: center; margin: 10px 0;"> Choose your engine type installed </div> <div style="display: flex; justify-content: space-around; margin: 10px 0;"> <div style="text-align: center;">Type A</div> <div style="text-align: center;">Type A with target function</div> </div> <div style="display: flex; justify-content: space-around; margin: 10px 0;"> <div style="text-align: center;">Type B</div> <div style="border: 1px solid white; border-radius: 15px; padding: 10px; text-align: center;"> Type B with target function </div> </div> <div style="display: flex; justify-content: space-around; margin: 10px 0;"> <div style="text-align: center;">Type direct</div> <div style="text-align: center;">Back</div> </div>
---	--

4.8.14.P

b. Select the motor type according to the following table

Engine type	sceltion	note
All diredt version	Direct type	set RPM bargraph
Spirit 140 PSRU, Spirit 122 PSRU	Type A	set RPM bargraph
Spirit 135 PSRU, Spirit 160 PSRU	Type B	set RPM bargraph
Spirit 140 PSRU+VPP, Spirit 122 PSRU + VPP	Type A with target function	set RPM bar graph and activate the VPP control function
Spirit 135 PSRU + VPP, Spirit 160 PSRU +VPP	Type B with target function	set RPM bar graph and activate the VPP control function

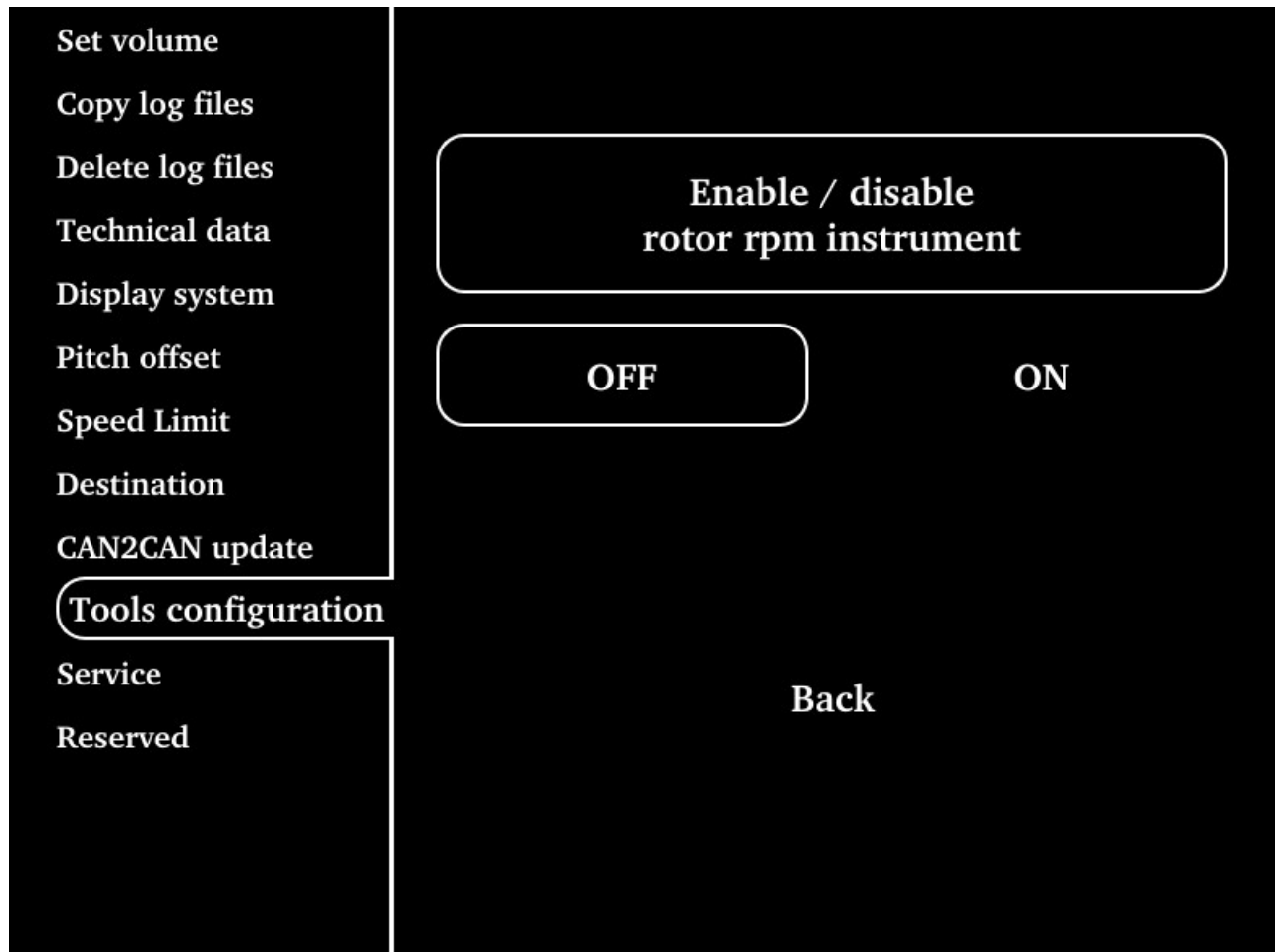
4.8.4.C



To select, rotate the knob, to confirm the selection, press the knob.

For applications of the engine on autogyro or helicopter it is possible to visualize the speed of the rotor on the display, to do this proceed as follows:

a. from the menu of the "tools configuration" page select "rotor"



4.8.15.P

- b.** select "ON", the rotor speed bar will automatically appear on page 1 "engine data".



To select, rotate the knob, to confirm the selection, press the knob.


- c.** Connect the rotor speed sensor as per diagram 5.1.3.P

You can select the current indicator display.



In all SPIRIT series motors the shunt (current sensor) is integrated in the control unit module, for the B22 and B25 motor series the shunt is an optional of the EH-m module

To activate or deactivate the display of this data on page 1 "engine data", proceed as follows:

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- a.** From the menu of the "tools configuration" page select "current".
- b.** Select "ON" if you want to view this data or "OFF" if you do not want to view this data.



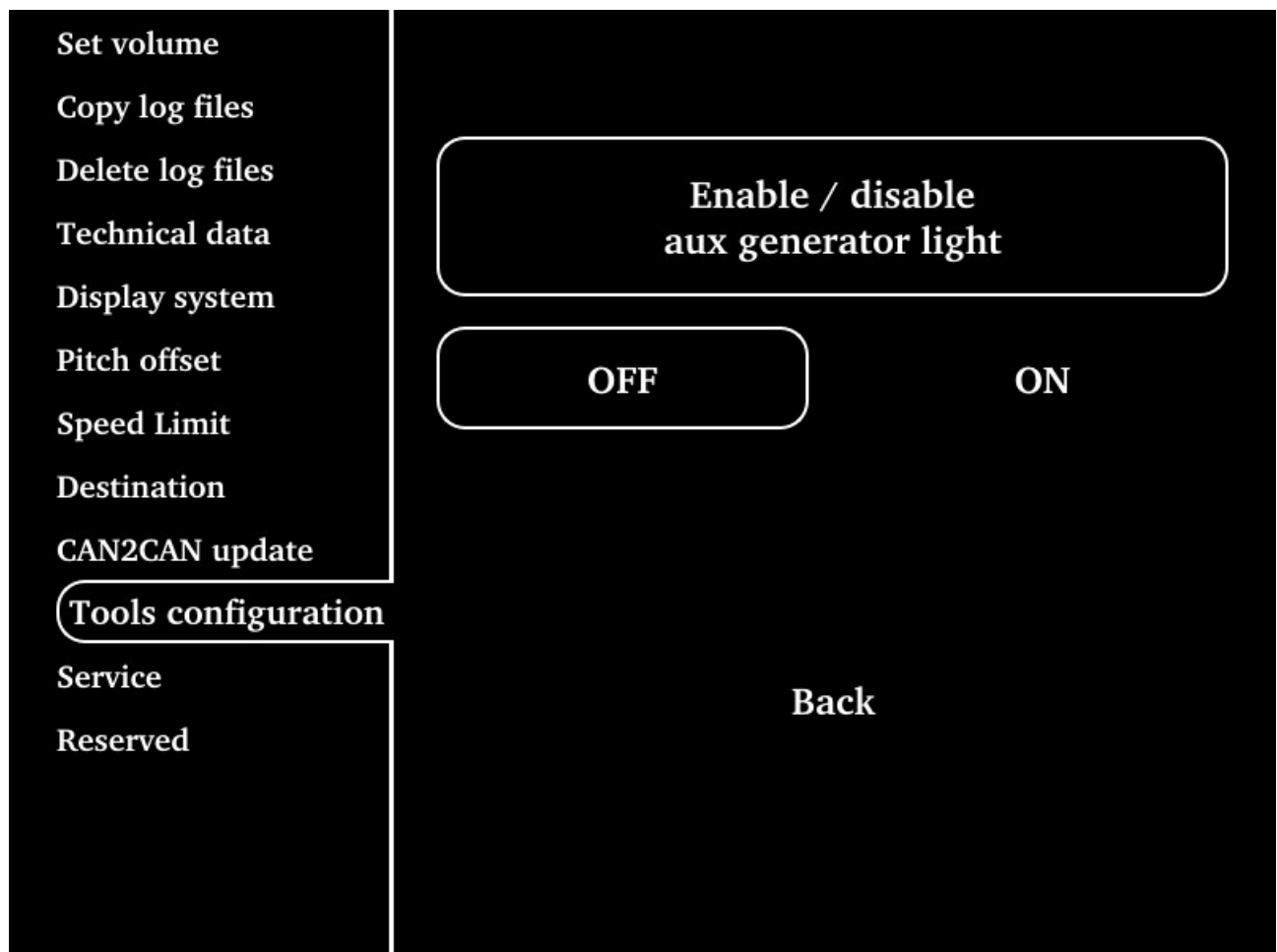
To select, rotate the knob, to confirm the selection, press the knob.



if the data is deactivated, the alarm connected to this data is also deactivated

If the auxiliary generator is installed on the engine, it is possible to activate the display of the auxiliary generator warning light, proceed as follows:

- a.** From the "Tools configuration" menu select "Aux generator".



4.8.16.P

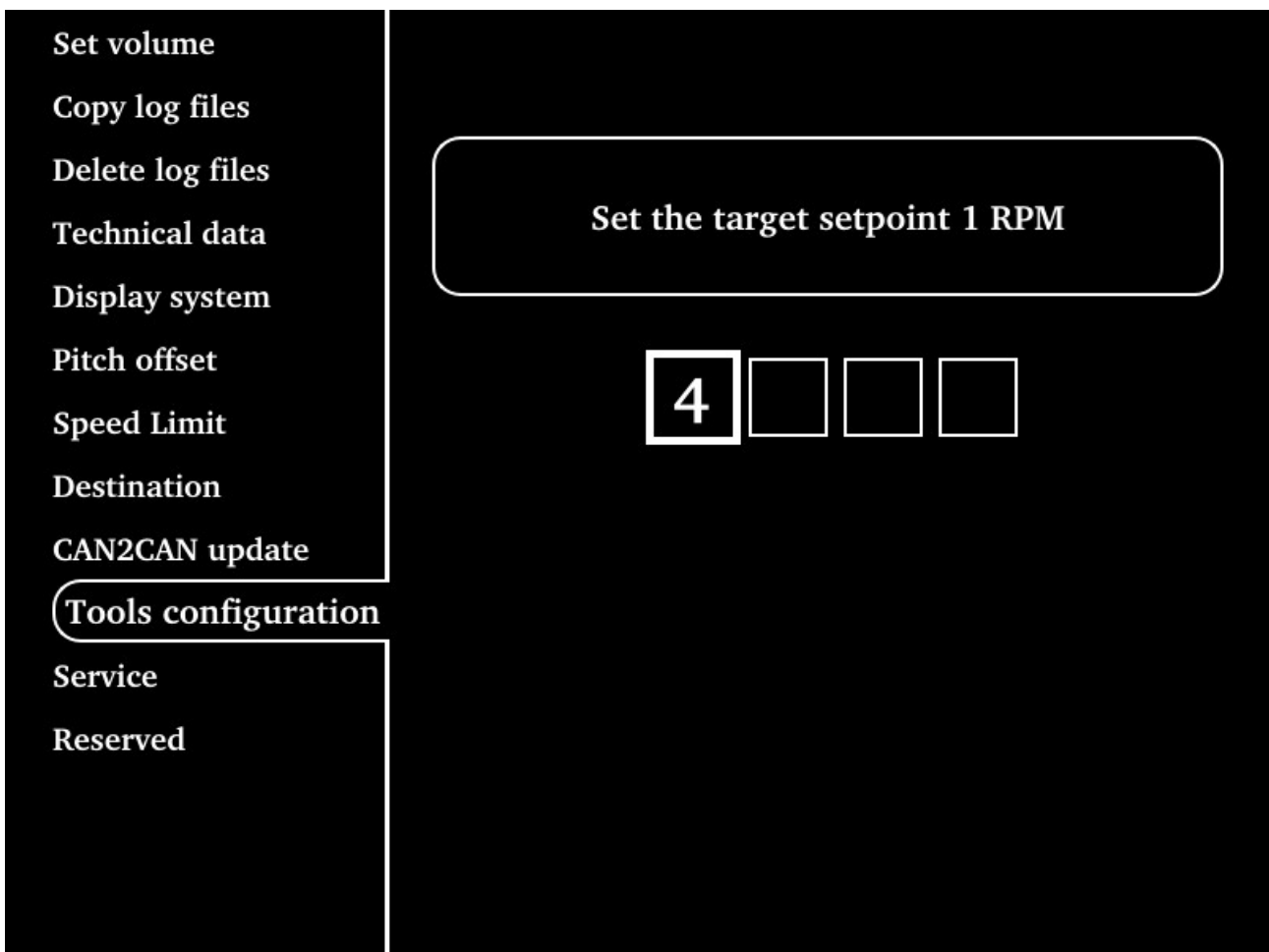
- b.** to activate the light, select "ON".



To select, rotate the knob, to confirm the selection, press the knob.

If the instrument is used to control the VPP (see engine type configuration) it is possible to program the values of the three setpoints from the "Tool configuration" page. To do this, proceed as follows:

- a.** From the menu of the "Tool configuration" page select "setpoint 1".




4.8.17.P

- b.** Enter the value of setpoint 1 (Take off RPM value).



To modify the value of each box, rotate the knob, to confirm the selected value, press the knob. Once selected, the cursor will automatically move to the next box

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For more information on the meaning of the setpoint, consult the manual "Installation, use and maintenance manual for variable pitch propeller control systems"

- c.** Confirm the entered value.


Set volume
Copy log files
Delete log files
Technical data
Display system
Pitch offset
Speed Limit
Destination
CAN2CAN update
Tools configuration
Service
Reserved
File conf

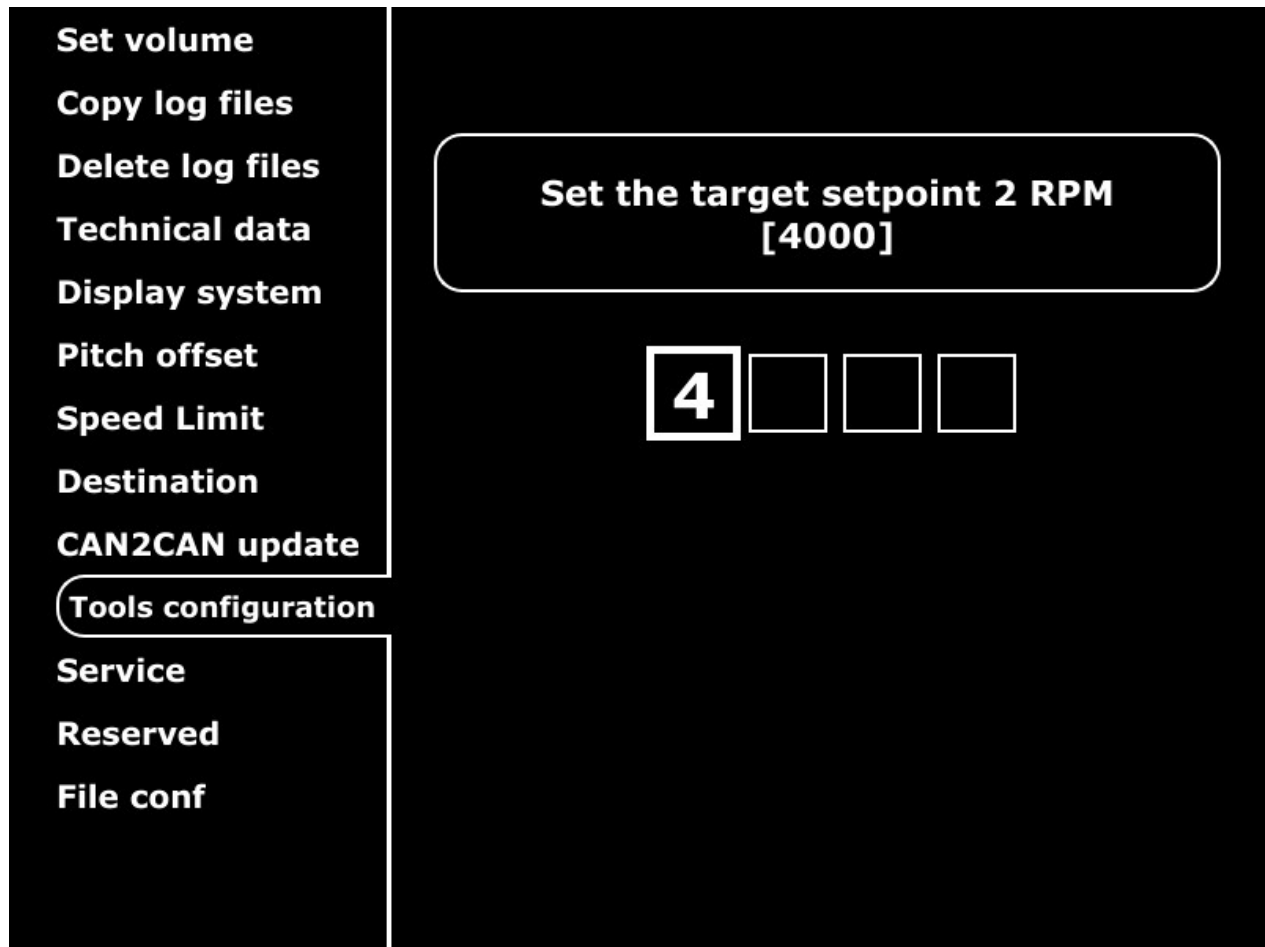
Set target SETPOINT 1
RPM to 4000?

YES NO

4.8.18.P

- d.** From the menu of the "Tool configuration" page select "setpoint 2".

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4.8.19.P

- e.** Enter the value of setpoint 2 (climb RPM value).




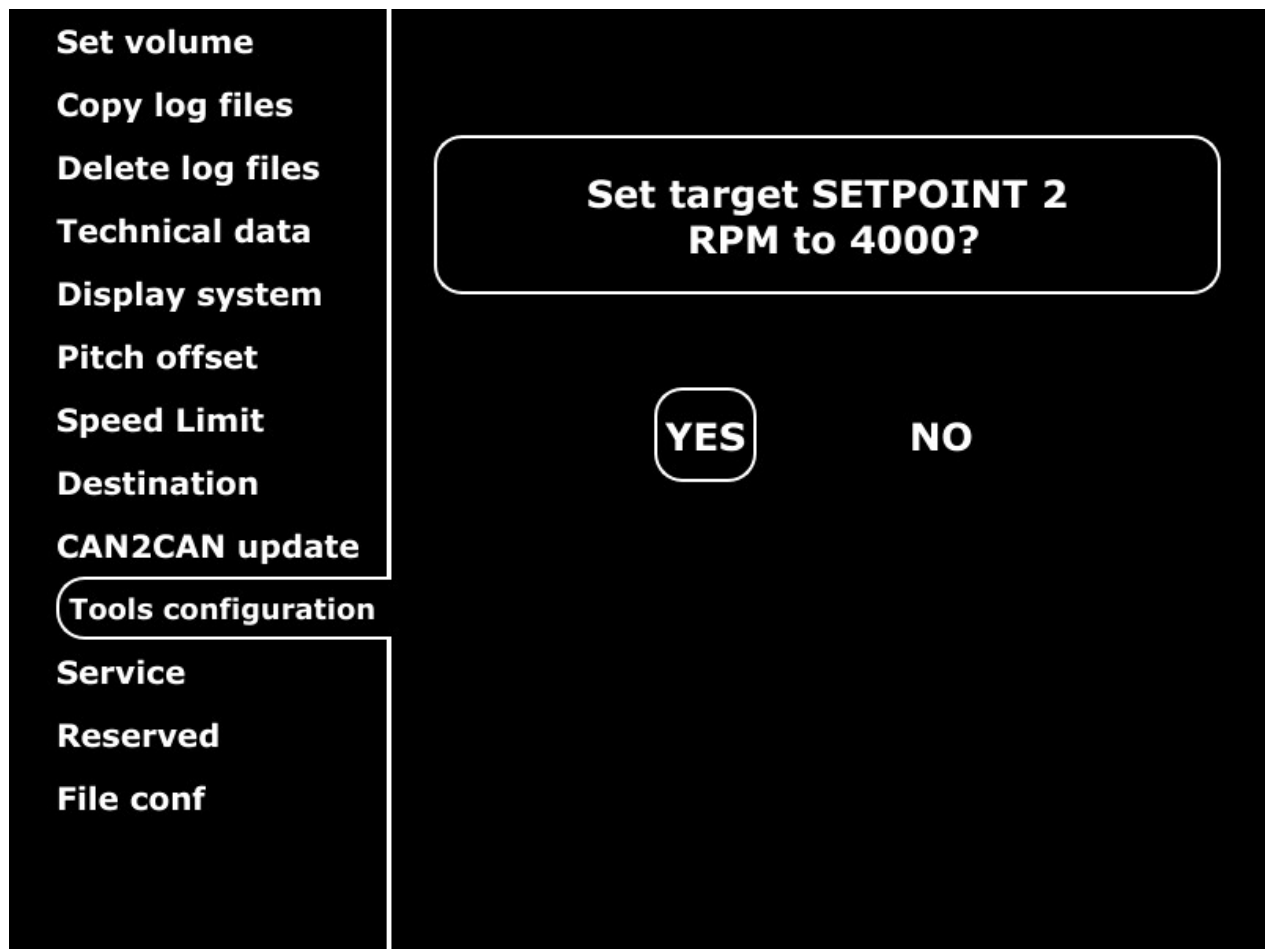
To modify the value of each box, rotate the knob, to confirm the selected value, press the knob. Once selected, the cursor will automatically move to the next box



For more information on the meaning of the setpoint, consult the manual "Installation, use and maintenance manual for variable pitch propeller control systems"


- f.** Confirm the entered value.

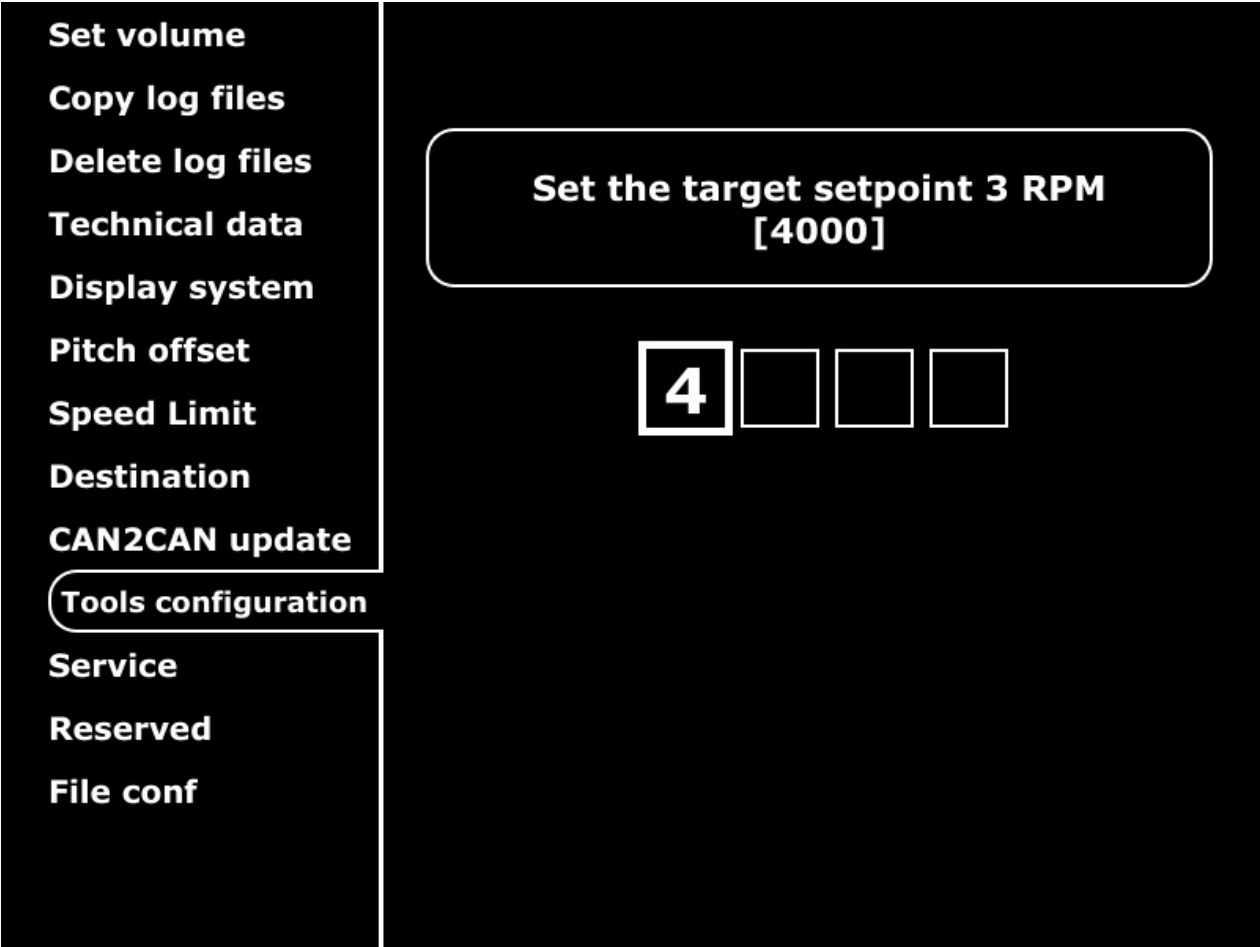
	EM-m system use, installation and maintenance manual	document E-DMA.I02.1	
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4.8.20.P



- g.** From the menu of the "Tool configuration" page select "setpoint 3".

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4.8.21.P

h. Enter the value of setpoint 4 (cruise RPM value).

-  To modify the value of each box, rotate the knob, to confirm the selected value, press the knob. Once selected, the cursor will automatically move to the next box
-  For more information on the meaning of the setpoint, consult the manual "Installation, use and maintenance manual for variable pitch propeller control systems"

i. Confirm the entered value.

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Set volume

Copy log files

Delete log files

Technical data

Display system

Pitch offset

Speed Limit

Destination

CAN2CAN update

Tools configuration

Service

Reserved

File conf

Set target SETPOINT 3
RPM to 4000?

YES

NO

4.8.22.P

4.8.11 Service

Set volume
Copy log files
Delete log files
Technical data
Display system
Pitch offset
Speed Limit
Destination
CAN2CAN update
Tools configuration

Service

Reserved

0

 EMS S/N

0

 Motor S/N

0

 Engine time

0

 Service time

10

 Next service in

0

 Status counter

Service reset

Status reset

Exit

4.8.23.P

This page displays the following data:

data	description
EMS S/N	EM-m serial number
Engine S/N	Engine serial number
Engine time	Total engine time
Service time	Elapsed hours from last service
Next service in	Hours to next service
Status counter	Error counter

4.8.6.C

On this page it is possible to reset the “service time” and the “status counter”.

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The "service time" and "status counter" reset function is reserved for MWfly and MWfly authorized service centres



The reset of the "service time" will be performed by the MWfly authorized assistance centre at the end of the ordinary maintenance operations

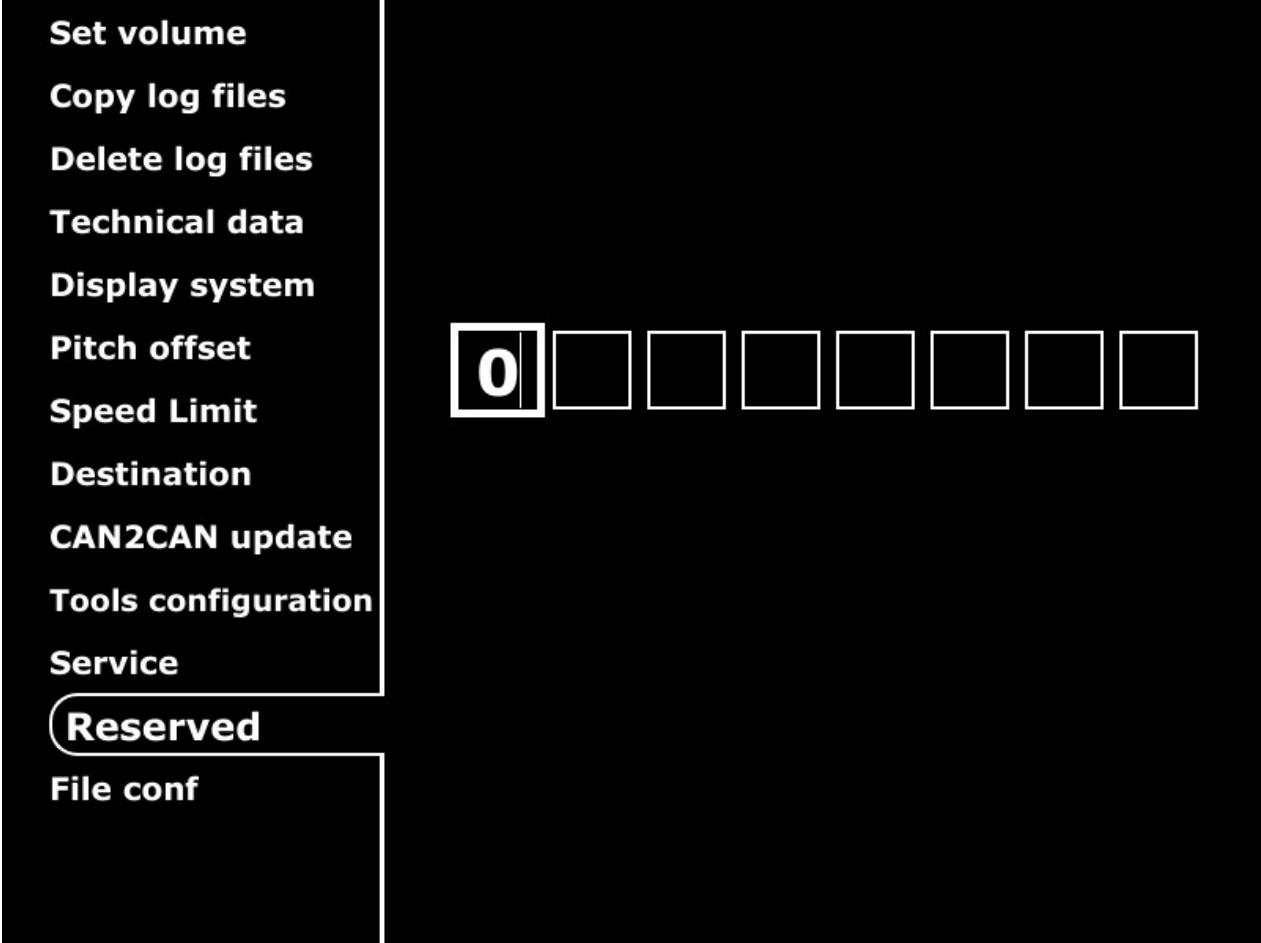


The "status counter" will be reset by the MWfly authorized assistance centre at the end of the ordinary maintenance operations, or at the end of maintenance carried out following the switching on of the alarm lights or the status light.



The "service" page is only accessible with the engine off.

4.8.12 Reserved




4.8.24.P



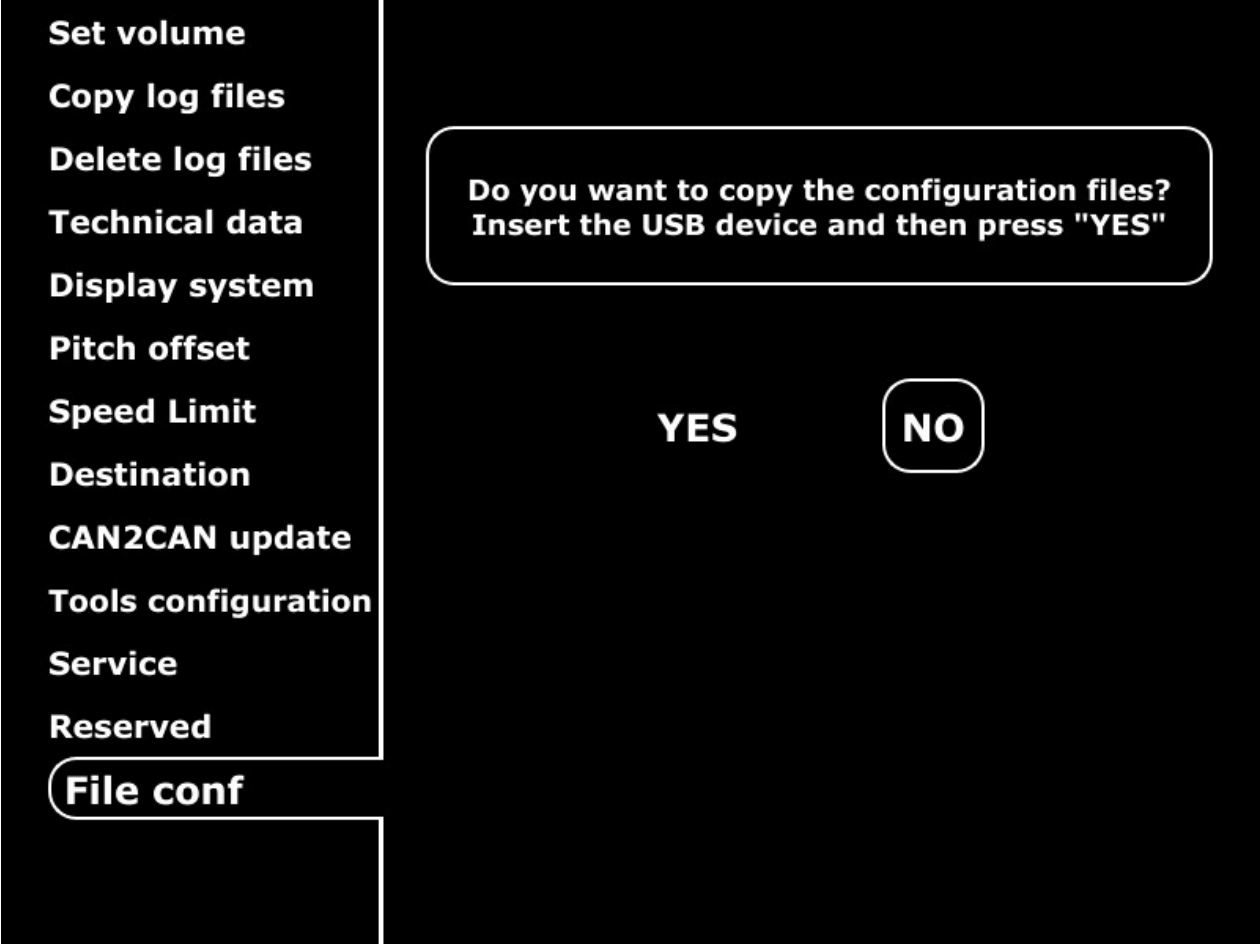
This page is reserved for MWfly and can only be accessed with a password.



This page is only accessible with the engine off.

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4.8.13 file conf



4.8.25.P



This page is reserved for MWfly and can only be accessed with a password.



This page is only accessible with the engine off.

4.8.14 Data time

<ul style="list-style-type: none"> Set volume Copy log files Delete log files Technical data Display system Pitch offset Speed Limit Destination CAN2CAN update Tools configuration Service Reserved File conf Date time Auxbox update 	<div>Set UTC date and time</div> <div>15 - 05 - 23</div> <div>06 : 37</div> <div>Exit</div>
--	--

4.8.26.P

In this page it is possible to set UTC time and date.

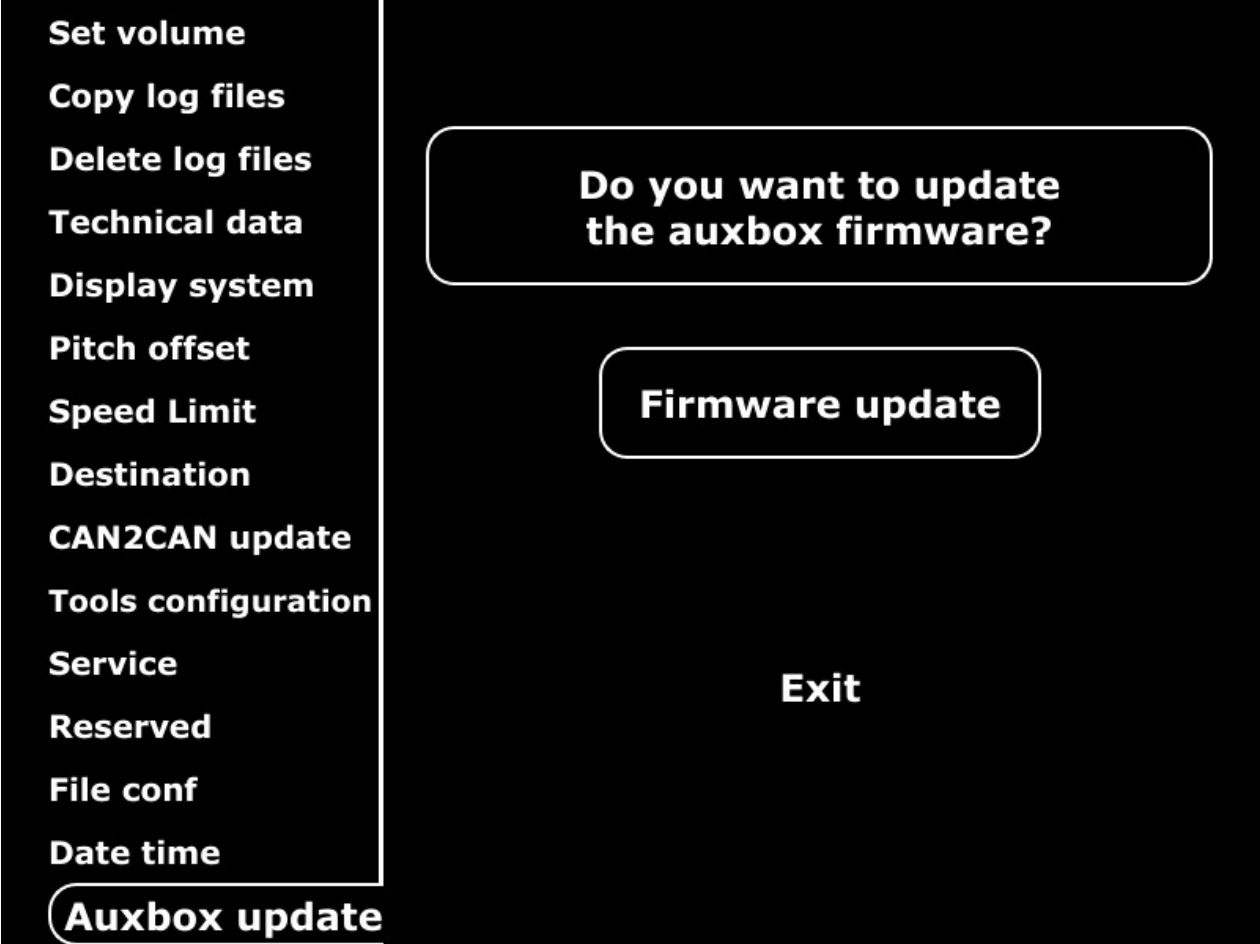


To change the value of each box, turn the knob, to confirm the selected value, press the knob. Once selected, the cursor will automatically move to the next box, select EXIT to exit the page



This page is only accessible with the engine off.

4.8.13 Auxbox update



4.8.27.P

From this page it is possible to update the SW of the AUXBOX.



This page is reserved for MWfly



This page is only accessible with the engine off.

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4.9. Alarm

If an alarm condition occurs, it is highlighted in the upper part of the screen on pages 1, 2 and 4 with an error message as shown in the figure. There are two types of alarm:

- Major alarm – alarm in red field
- Minor alarm – alarm on a yellow field

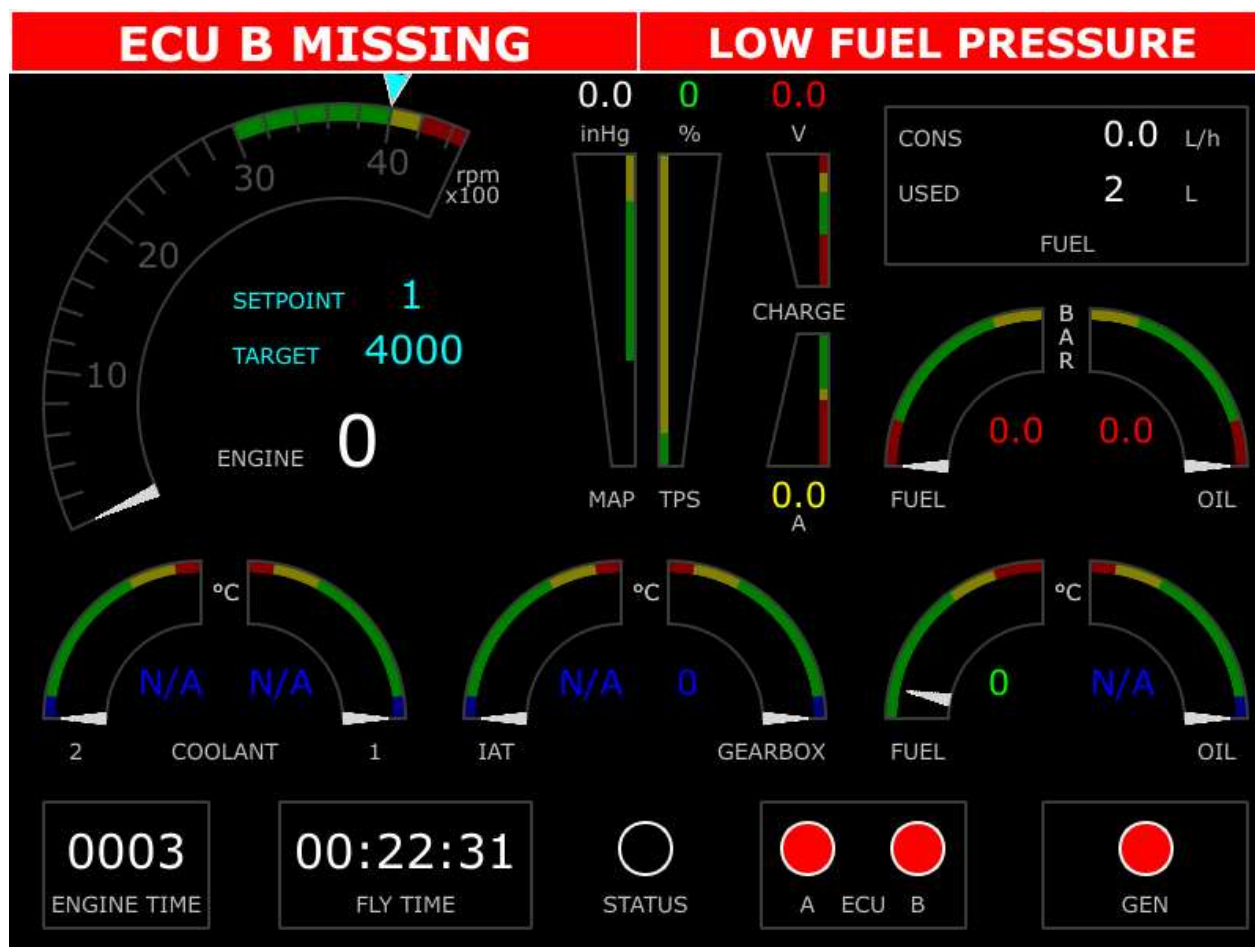


In the event of a red alert, flight safety conditions are no longer guaranteed, so it is mandatory to land as soon as possible.



If a yellow warning light comes on, flight safety conditions are not compromised but it is advisable to pay attention to the flight parameters and, if possible, modify the use of the engine so as to recover from the yellow alarm condition.

In any case, after the activation of an alarm, it is advisable to have the engine inspected by qualified personnel, in order to identify and resolve the cause, and to verify that the alarm condition has not caused permanent damage to the engine.



4.9.1.P

The following table shows the list of messages and their meaning of the alarms that appear in the pop-up on the left:

message	Type of alarm	event	Note
ECU A MISSING	Red	The instrument does not receive data from the ECUA, in this case for all the data arriving from control unit A (see table 4.4.1C) N/A is indicated instead of the numerical data	This situation could be caused by a breakage of the control unit, by the interruption of the power supply of the control unit or by the interruption of the CAN line of the control unit
ECU B MISSING	Red	The instrument does not receive data from the ECUB, in this case for all the data	This situation could be caused by a breakage of the control unit, by the interruption of the power

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		arriving from control unit B (see table 4.4.1C) N/A is indicated instead of the numerical data	supply of the control unit or by the interruption of the CAN line of the control unit
SENSOR MISSING –	Red	The instrument does not receive data from the AUXBOX, in this case all the data arriving from the AUXBOX (see table 4.3.1.P) are set to 0	This situation could be caused by a break in the AUXBOX, by an interruption in the power supply of the AUXBOX or by an interruption in the CAN line of the control unit
12 VOLT MONITOR MISSING	Red	The instrument is not receiving generator light and shunt data from the onboard CAN module	Breakdown of the internal module of the CAN module.
SERVICE	Red	Warns that a service is to be performed (for the first service there is an hour's notice for subsequent services there is 5 hours' notice)	

4.9.1.C



The SERVICE alarm turns on:
-after the first 25 hours of operation
-every 50 hours of operation

The following table shows the list of messages and their meaning of the alarms that appear in the pop-up on the right:

message	Type of alarm	Event	note
OVER REV	Red	The engine RPM exceed 4700 (in the case of engine type B) or 4300 (in the case of engine type A) or 3500 in the case of direct drive engine.	


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SENSOR TEMP WATER 1 FAULT,	Red	The water temperature of bank 1 is below -40°C or above 145°C.	This alarm could indicate a broken sensor or wiring or a disconnected sensor.
SENSOR TEMP WATER 2 FAULT	Red	The water temperature of bank 2 is below -40°C or above 145°C.	This alarm could indicate a broken sensor or wiring or a disconnected sensor.
SENSOR TEMP OIL FAULT	Red	The oil temperature is below -40°C or above 145°C.	This alarm could indicate a broken sensor or wiring or a disconnected sensor.
SENSOR TEMP IAT FAULT	Red	The air intake temperature is below -40°C or above 145°C.	This alarm could indicate a broken sensor or wiring or a disconnected sensor.
SENSOR TEMP GEARBOX FAULT	Red	The gear oil temperature is below -40°C or above 165°C.	This alarm could indicate a broken sensor or wiring or a disconnected sensor.
SENSOR TEMP FUEL FAULT	Red	The fuel temperature is below -40°C or above 145°C.	This alarm could indicate a broken sensor or wiring or a disconnected sensor.
LOW FUEL PRESSURE	Red	The fuel pressure value drops below the green threshold.	The drop in fuel pressure can be caused by a problem with the fuel pumps, or a clogged fuel filter or by a problem on the delivery line of the fuel circuit.
LOW OIL PRESSURE	Red	The oil pressure value drops below the yellow threshold.	The loss of oil pressure can be caused by a problem with the oil pump, an oil level that is too low, a clogged oil filter or a problem in the lubrication circuit.
LOW BATT	Red	The power supply voltage value of the control unit drops below 10V.	This can happen due to a problem with the recharging system or a battery failure.
UNDER ROTOR REV	Red	The rotor RPM drops below 200 RPM (this alarm is active only with ROTOR selected).	
OVER ROTOR REV	Red	The rotor RPM rises above the green threshold (this alarm is active only with ROTOR selected).	
HIGH TEMPERATURE WATER 1	Yellow	The water temperature of bank 1 exceeds the green threshold.	

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HIGH TEMPERATURE WATER 2	Yellow	The water temperature of bank 2 exceeds the green threshold.	
HIGH IAT TEMPERATURE	Yellow	The air temperature exceeds the green threshold.	
HIGH FUEL TEMPERATURE	Yellow	The fuel temperature exceeds the green threshold.	
HIGH OIL TEMPERATURE	Yellow	The oil temperature exceeds the green threshold.	
HIGH GEAR BOX TEMPERATURE	Yellow	The gear oil temperature exceeds the green threshold.	
HIGH MAP	Yellow	The MAP value exceeds the green threshold.	
MEMORY FULL	Yellow	The free space of the instrument's internal memory is less than 100 Mbyte. When the free memory drops below 50 Mbyte, the 5 oldest acquisition files are deleted.	
BLACK BOX FAULT	Yellow	The system has identified problems on the internal memory.	
TGEAR TABLE FAIL	Yellow	Loading of the gearbox temperature calibration table failed or file is missing.	
TFUEL TABLE FAIL	Yellow	Loading of fuel temperature calibration table failed or missing file.	
AIN5 TABLE FAULT	Yellow	loading of the calibration table of the sensor connected to analog input 5 failed or missing file.	
AIN8 TABLE FAULT	Yellow	loading of the calibration table of the sensor connected to analog input 8 failed or missing file.	

4.9.2.C

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4.10 VPP Control

The system has been designed to also function as a user interface for controlling the pitch of the propeller.



To use the instrument as a user interface for controlling the variable pitch propeller, refer to the relative manual

4.11 log files

The system is equipped with an internal memory for data acquisition

Below is the list of acquired data, in the order in which they are saved:

- RPM 1 [rpm]
- BARO 1 [mbar]
- BATTERY 1 [V]
- FUEL PRESS [bar]
- OIL TEMP [°C]
- WATER 1 TEMP [°C]
- INJECT 1 [us]
- PICK UP 1
- MAPPING ON
- ECU 1 ON (ON 0: OFF 128)
- ECU 1 ON [ms]
- TPS 1 [%]
- LAMBDA
- RPM 2 [rpm]
- BARO 2 [mbar]
- BATTERY 2 [V]
- OIL PRESS [bar]
- AIR TEMP [°C]
- WATER 2 TEMP [°C]
- INJECT 2 [us]
- PICK UP 2
- ECU 2 ON (ON 0: OFF 128)
- ECU 2 ON [ms]
- TPS 2 [%]
- MAP 2 [inHg] (if configured with MAP from ECU)
- MAP [inHg] (if configured with MAP fro Auxbox)
- FUEL TEMP [°C]
- GEARBOX TEMP [°C]
- ROTOR [rpm]
- ROLL [°]
- PITCH [°]
- YAW [°]
- G FORCE [G]

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- IAS [knots]
- ALT [feet]
- LATITUDE
- LONGITUDE
- GPS SPEED [knots]
- GPS ALT [feet]
- FIX
- NUM SAT
- I GEN [A]
- SENS ERR
- ECU ERR
- RPM target
- PID E
- PID P
- PID I
- PID D
- PID U
- PID FF



All the indicated data are acquired even in the absence of GPS, AHRS or VPP control

The data are acquired with a frequency of 10 Hz, the data acquisition start when the engine revolutions exceed 500 revolutions and stop when the engine stop. The data is saved in files with the .CSV extension. These files can be read with a program such as Word or with a spreadsheet such as Excel.

The file names are divided into three parts

TTTTTT_DDMMYYYY_HHMMSS.cvc

Dove:

TTTTTT: is the flight start time expressed in seconds, understood as the time calculated since the last maintenance and therefore since the last reset of the instrument.

DDMMYYYY: is the date of acquisition of the file, in the case of instrument with GPS integrated the date will be acquired from the GPS, in the case of instruments without integrated GPS the date corresponds to the GMT date indicated in the page "Data time".

HHMMSS: is the time of acquisition of the file, in the case of instrument with GPS integrated the time will be acquired from the GPS, in the case of instruments without integrated GPS the time corresponds to the GMT date indicated in the page "Data time".

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The system has a 32Gbyte memory for data acquisition, when 100Mbyte of memory remain available a yellow "MEMORY FULL" alarm lights up, when the memory space drops below 50Mbyte the system deletes the first 5 files of acquisition (the oldest acquisition files in order of time)



It is possible to download the acquisition files only with the engine off



Downloaded acquisition files are not deleted



The acquisition files can only be deleted by MWfly authorized personnel.

5. INSTALLATION



The EM-m instrument is a reliable system, nevertheless, it may happen that a malfunction or breakage can occur even during the flight. It is the user's responsibility to fly safely and install alternative equipment on the aircraft.
The EM-s tool is uncertified, so it is not intended for certified aircraft.



The A.M.E. s.r.l. provides warranty under the following conditions.

If, during the period of two (2) years following the purchase of the instrument, defects in materials or functioning are found, A.M.E. s.r.l. takes care of the repair or replacement of the product, without charging the customer costs.

Normal wear and tear and maintenance are not covered under warranty. Any intervention on each device, by third parties, or attempts to open or tamper with it cancels any warranty right.

Installation errors or improper use are not covered under warranty. Contact the A.M.E. s.r.l. to ensure correct installation and correct use of the device.

Repairs or replacements may involve the updating of some parts of the system, SW or HW for which the functionality of the product could undergo changes, in any case these will be compatible with the original system.

The A.M.E. s.r.l. does not bear any shipping costs or removal or installation or inspection by third parties, unless communicated and authorized in advance.

Shipped devices must be suitably packed and protected, defects attributable to carelessness of shipment are not covered by warranty

5.1. AUXBOX



5.1.1.P

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The AUXBOX module is the module to which the following auxiliary sensors are connected:

- engine oil pressure sensor
- fuel pressure sensor
- fuel temperature sensor
- MAP sensor (only for SW version dedicated to B22 and B25 series engines)
- reduction gear oil temperature sensor (only for versions with reduction gear)
- RPM rotor sensor
- AUX Generator Alarm
- 2 aux analogue sensor

The same module can contain the electronics needed to drive the stepper actuator for the movement of the slide valve of the variable pitch propeller control system, or it can contain the control electronics of the electronic throttle.

The module must be fixed in the cabin or, as a second choice, to the firewall: in this case it is important to check that it is protected from splashes of water and away from sources of excessive heat, such as exhausts or radiators; in the case of installation on the firewall, after installation it is necessary to check that the temperature of the module does not exceed 80°C (5.4.2.).



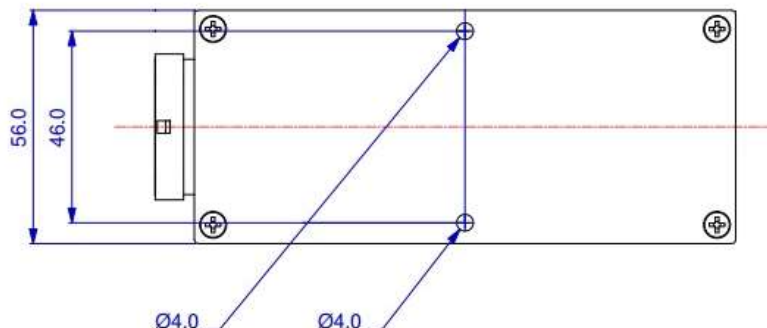
Exposing the module to temperatures above 80°C or getting water or moisture inside it can cause it to malfunction or stop suddenly.

The module can be fixed both on a surface and on a wall, oriented in any direction.

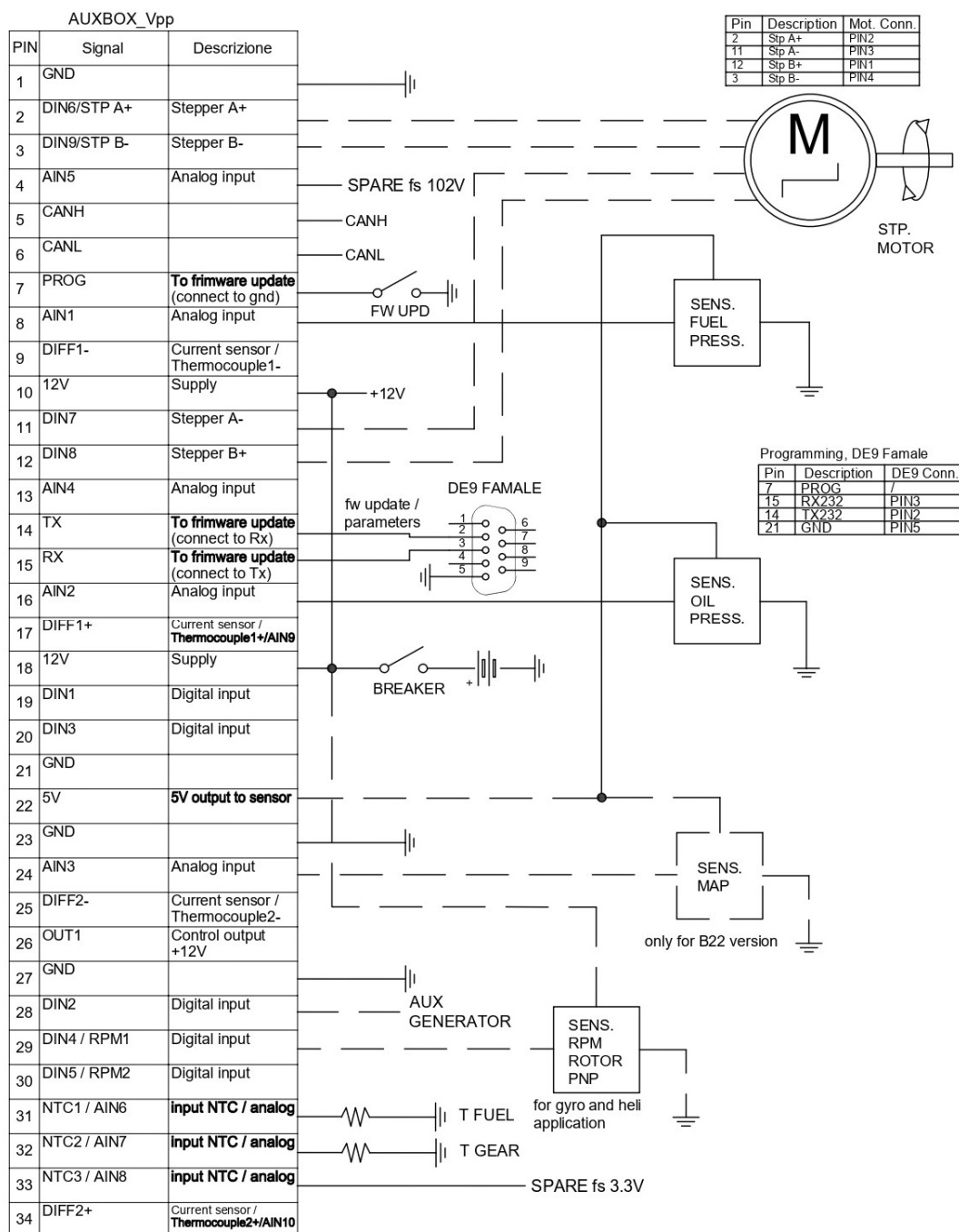
Necessary material

1. Pencil
2. 4.5mm drill bit
3. 4 mm Allen key
4. Torque wrench 0-25Nm

- a. After choosing the location, mark [1] the drilling points using the template in the following figure.

**5.1.2.P**

- b.** Drill [2] in the two foreseen points with the foreseen bit.
- c.** Insert the fixing screws into the module.
- d.** Fix the module [3], tightening [4+3] to 4 Nm.
- e.** In the case of fixing outside the cabin, carry out the checks set out in paragraph 5.4.2. before making the first flight.
- f.** Complete the installation by making the electrical connections referring to the following diagram



5.1.3.P

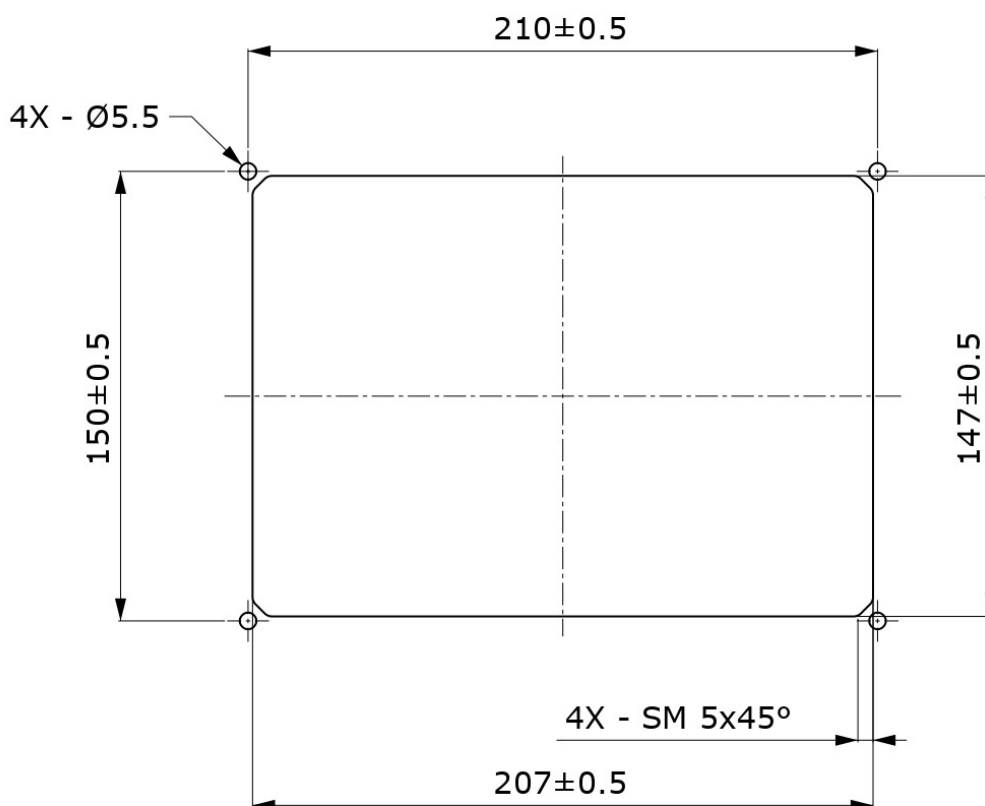
5.2 Instrument EM-m

The EM-m instrument is a panel instrument, which must be fixed to the instrument panel of the aircraft by approaching it from the front: in order to fix the instrument, the panel must therefore not be removed.

Necessary material

1. Pencil
2. 5.5mm drill bit
3. Tool according to the type of fastening screws chosen
4. Torque wrench 0-25Nm

- a.** After choosing the location, mark [1] the drilling points using the template in the following figure.



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5.2.1.P – Dima di foratura EM-m

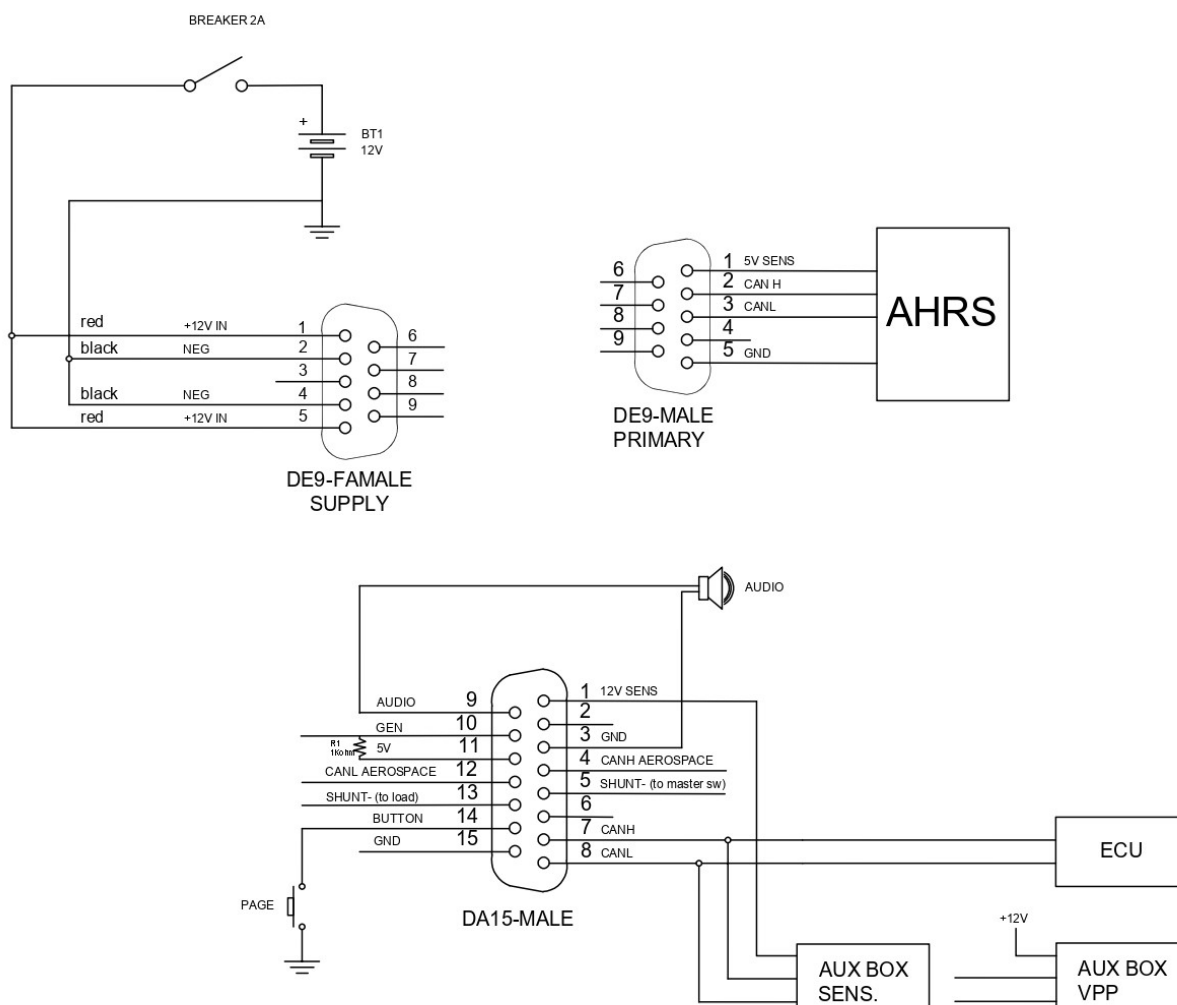


The position must be chosen considering the fact of being able to easily reach the engine speed setting knob and the function selection button during flight.

- b.** Drill [2] the instrument panel.
- c.** Using 4 M5 screws of suitable length, fix the instrument to the panel.
- d.** Tighten [3+4] the screws to 6 Nm.
- e.** Complete the installation by making the electrical connections.



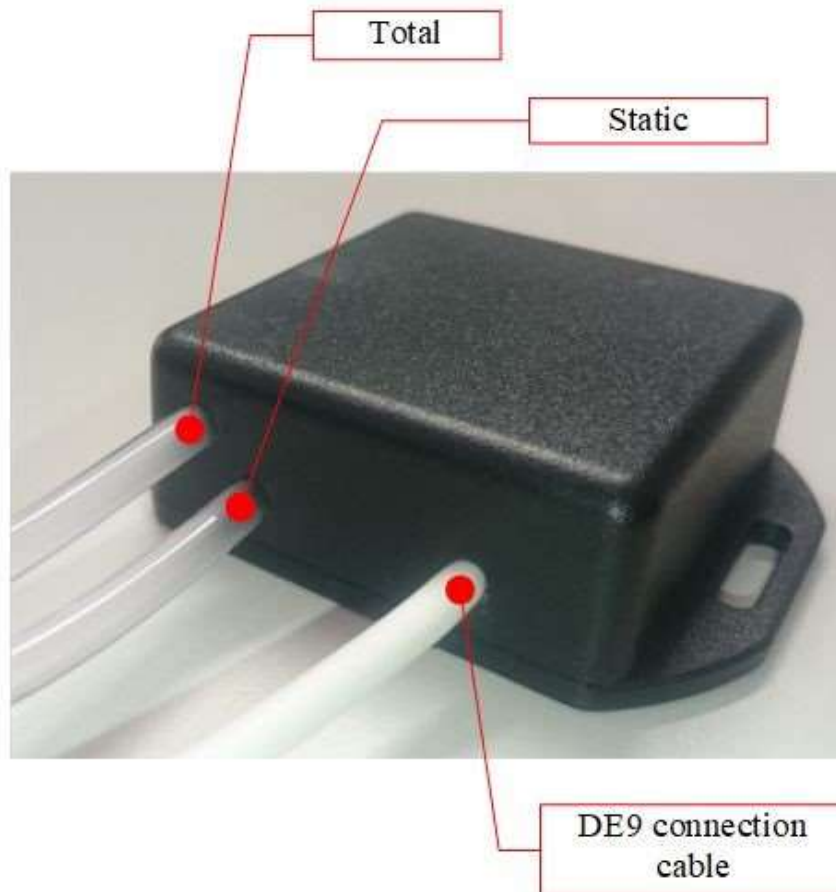
The external button only allows switching between the main page and the two flight pages, therefore it has no function if the flight pages have not been enabled.



5.2.2.P

5.3. AHRS

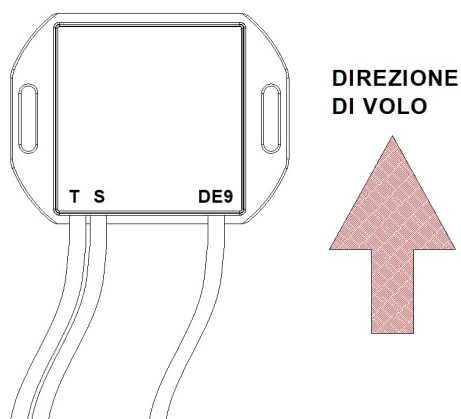
For correct system operation, the device must be positioned away from magnetic or ferromagnetic parts, power cables and electromagnets, install the sensor on a flat surface following the correct orientation of the aircraft, only pitch errors can be compensated for by calibration.

**5.5.1.P**

The module must be fixed in the cabin.

The module can be fixed either on a plane, oriented as indicated in the following image.

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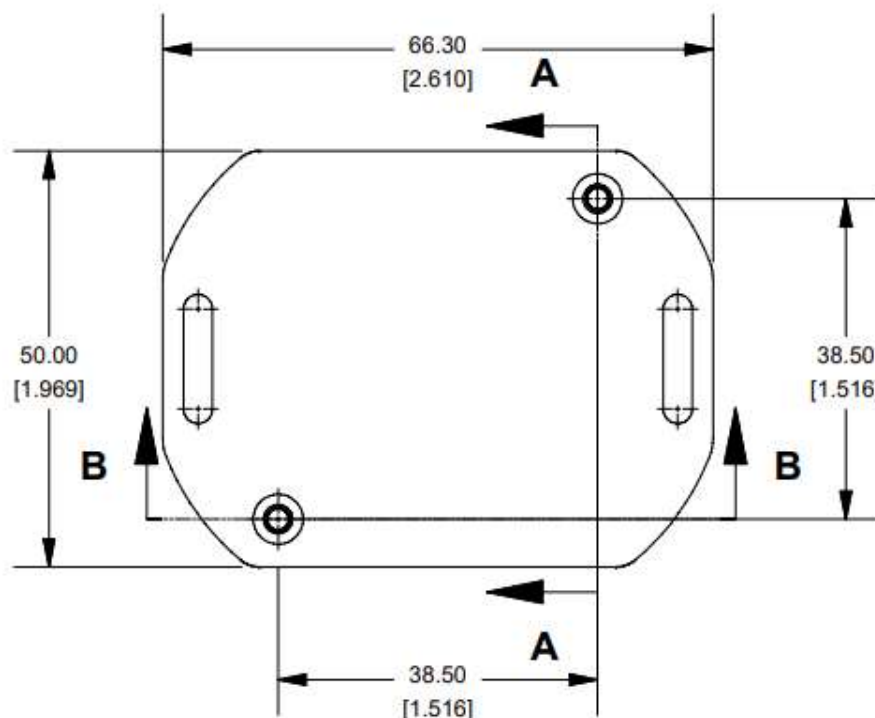


5.5.2.P

Necessary material

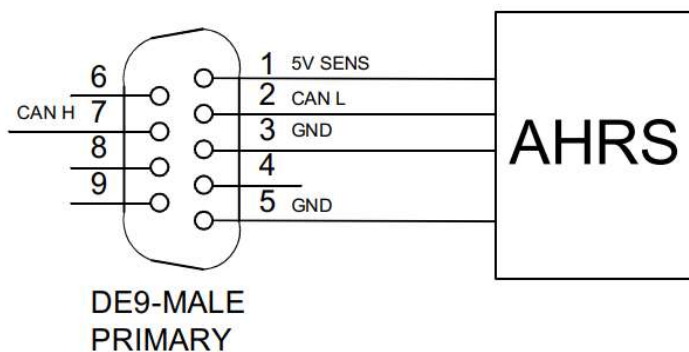
1. Pencil
2. 4.5mm drill bit
3. 4 mm Allen key
4. Torque wrench 0-25Nm

a. After choosing the location, mark [1] the drilling points using the template in the following figure.




5.5.3.P

- b.** Drill [2] in the two foreseen points with the foreseen bit.
- c.** Insert the fixing screws into the module.
- d.** Fix the module [3], tightening [4+3] to 4 Nm.
- e.** Complete the installation by making the electrical connections referring to the following diagram



5.5.4.P

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- f.** Connect the pitot tubes to the pressure inputs

5.4. Settings and checks



The following checks relate only to the functions of the system as an EM-m instrument, if it is used as a VPP or electronic throttle control instrument, refer to the checks indicated in the relative manuals.

5.4.1. Check functions

- a.** Operate the master relay of the aircraft: the instrument must turn on. If the instrument does not turn on, check that it is connected correctly to the power supply.
- b.** When switched on, after the initial phase, page 1 opens on the instrument. If suitable values do not appear in the fields shown, check the connection of the instrument to the CAN line.
- c.** Verify that by pressing the keys it is possible to view the other pages of the instrument.

5.4.2. Check auxbox module temperature

- a.** Place an irreversible liquid crystal adhesive thermometer (thermotape) on the control module.
- b.** Close the hood of the aircraft in flight configuration.
- c.** Place the aircraft outdoors, firmly securing it to the ground so that it cannot move.
- d.** Start the engine; after having warmed up, gradually open the accelerator control and bring the engine to a speed of 3000.
- e.** Keep the engine at 3000 rpm for 5 minutes, then switch off the engine.
- f.** Immediately after turning off the engine, check the temperature reached by the thermometer: the value must be lower than 80°C. If the temperature is higher, one of the following actions is required:
 - provide for ventilation of the control module;
 - provide a shielding of the control module;
 - move the control module.

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The check must be carried out immediately after turning off the engine: in fact, after turning off the engine, the temperature of the engine compartment, but, for the purpose of checking the operating temperature of the control module, this is not significant as in this condition the module is off or inactive.

5.4.3. *First flight*

- a.** After having carried out the checks described in this chapter and having carefully read the operating instructions given in section 6 of this manual, carry out the first flight, keeping on the airfield.
- b.** During the flight, check the values indicated on the instrument.

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6. OPERATING INSTRUCTIONS



Before fly, it is necessary to check the correct functioning of the system on the ground.



If the system is also used to control the pitch of the propeller, follow the safety regulations indicated in the relative manuals.



Before flying, you must have read and understood this manual. Carrying out the first take-off automatically confirms that the user manual of the system has been read.

6.1. General criteria of use



In the event of anomalies found during the pre-flight checks, do not fly before having solved them.

Before taking off, it is necessary to check the correct functioning of the system. Operate as follows.

6.1.1. Before starting



Risk of burns: always perform the pre-flight checks with a cold engine.



Always make sure, before proceeding with the checks, that the engine on/off switch is in the off position.

Check electrical wiring, and verify that there are no hot or abraded sections.

6.1.2. Before take off

- a.** Turn on the engine.
- b.** Check that all data read are consistent with engine operation.



In the event of problems on the CAN line, the system signals a connection error and instead of a numeric value of the data, the message N/A will appear to indicate the absence of information.

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- c.** Check that the data display is constant and that there are no interruptions.



If the data display is not constant, avoid taking off until the problems have been resolved.

6.1.3. *In flight*

During the flight, check that the data display is constant and that there are no interruptions and that the data is consistent with engine operation.



If your data visualization is not constant, and you don't have backup tools, it is recommended to land as soon as possible.



In the event that the instrument indicates a red alert, it is advisable to land as soon as possible

6.2. Communication of operating anomalies

Each anomaly must be identified and resolved before proceeding to a new mission.

In order to improve and solve any recurring defects, the user is welcome to communicate any anomalies found and their resolution, or any other consideration that could improve the safety in using the EM-m system or the clarity of the information contained in this manual.

The communications must be produced by filling in the form reproduced below, which can be downloaded at www.mwfly.it, and sent to the most convenient authorized MWfly assistance centre, or directly by e-mail to info@mwfly.it.

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7. MAINTENANCE



Any interventions performed with criteria other than those described below can be very dangerous for safety and harmful to the integrity of the system, and should be absolutely avoided.

Non-compliant maintenance interventions involve the revocation of the guarantee on the system and its components and free MWfly from any obligation or liability.



Only qualified technicians trained in the particular pitch variation system are authorized to carry out maintenance and repair work



At the end of the maintenance operations, both ordinary and extraordinary, it is necessary to test the system on the ground (C.5.4.).

Also consider the directives contained in the service bulletins according to their priority with respect to what is described in the manuals.

7.1. Premise

This section lists the periodic inspections to be performed after a certain number of operating hours have expired.

The 10-hour inspection must be performed only after the first 10 hours of operation from a new or overhauled propeller.

Periodic inspections of 50, 100, 200, 400 hours are to be carried out at the end of the hours indicated and at the respective multiples of hours; in detail:

- 50-hour inspection: carry out at 50, 100, 150, 200,.... hours
- 100-hour inspection: carry out at 100, 200, 300, 400,.... hours
- 200-hour inspection: carry out at 200, 400, 600, 800,.... hours
- 400-hour inspection: carry out at 400, 800, 1200,... hours

At each periodic inspection, the checks envisaged by all the scheduled inspection intervals or by multiples of the same must be carried out: for example, at the 200-hour inspection, the checks provided for by the 200-hour inspection must be carried out, but also those provided for by the inspection of 100 and 50.

The prescribed intervals are applicable to propellers used in temperate climates and with operating cycles that comply with the specifications in the manuals: in the case of

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intensive use (for example piloting schools) or in areas with extreme climates (arid areas or areas with a harsh climate) the intervals should be halved.



In addition to these checks, it is necessary to carry out the pre-flight checks specified in paragraph 6.1.2. and as recommended by common aeronautical practice.

7.2. General Rules for Maintenance

The interventions envisaged in the scheduled maintenance table must be carried out according to the criteria specified below.


- All controls are visual unless otherwise specified.
- All activities must be carried out within the maintenance deadline, with a maximum tolerance of 10 hours
- If the tolerance hours are in excess, they cannot be combined: this means that, for example, if the 100-hour surgery was performed at 110 hours, the next 200-hour operation cannot be performed at 210 + 10 hours, but at most at 200 + 10 hours.
- If the hours of tolerance are lacking, the subsequent intervention must be performed at a maximum interval of hours equal to what there would be without considering that the tolerance has been applied: this means that, for example, if the intervention of 100 hours is was performed at 90 hours, the next 200-hour intervention cannot be performed at 200 ± 10 hours, but at most at 190 ± 10 hours.
- All the activities foreseen in the maintenance table must be carried out in compliance with what is specified in this manual. If in doubt, it is necessary to integrate the information with what is reported in other manuals or contact an authorized service centre.
- All spare parts of the propeller (gaskets, bearings, sliding bushings) must be original and found at the MWfly service network: the use of non-original spare parts automatically invalidates any form of warranty.

7.3. System logbook

The system logbook is delivered together with each system and must also accompany it in case of sale.



The loss of the logbook or the incomplete compilation of the same causes the revocation of any form of guarantee, as it makes the operational and maintenance history uncertain.

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The following information must be noted in the appropriate spaces in the propeller logbook.

- Scheduled maintenance interventions
- Unscheduled maintenance interventions
- Total or partial revision
- Adjustments and balances values
- Replacement of components not included in the scheduled maintenance plan
- Change of ownership
- Application of service bulletins or alert bulletins

System or system's components eventually disembarked from the aircraft and sent to the service centres for maintenance or overhaul must be accompanied by the logbook.

7.4. Control Tightening Torques

Table 7.4.1.C is provided below, which indicates the tightening torques of the propeller: for the check it is necessary to use a torque wrench and make sure that the ambient temperature (and of the propeller) is between 10 and 30 ° C.



Check the tightening torque by applying the torque in the normal direction of screwing.

Legend

- WT = Weak Threadlocker
- MT = Medium Threadlocker

Type of screw or nut	Tightening torque [Nm]
Instrument fixing screw (M5)	6 +FM

7.4.1.C

7.5. Scheduled Maintenance

Perform the checks and replacements listed in Table 7.5.1.C at the intervals indicated.

Legend

- X = execute when the indicated hours are reached
- P = pre-flight check
- 10 = carry out after the first 10 hours of operation from new or after disassembly

Activity	Termine (ore)					
	P	10	50	100	200	1000
Check of the electrical system (wiring)	X		X			
Check of connections	X		X			
Check of fastening			X			
Check pitot tube connection (only in case of AHRS)			X			

7.5.1.C

Maintenance must be carried out at the intervals specified in the maintenance schedule. These deadlines must be met with a tolerance of plus or minus ten hours.

WARNING: Only expert personnel trained for the purpose are authorized to carry out maintenance operations. Any maintenance operation carried out in an unsuitable manner or with unsuitable equipment can generate risk situations, and for this reason must be avoided.

Maintenance equipment

The following equipment should be prepared before performing system maintenance:.

- 1 Allen key 4mm
- 2 Allen key 5 mm

7.6. Unscheduled maintenance



All adverse events that produce unscheduled maintenance interventions must be noted in the system logbook.




In the event of failures or non-compliant events during operation of the Em-m system, it is necessary to carry out a thorough check before the next flight..


7.6.2. Electrocutation

In the event that, during the flight, there is a suspicion that lightning has struck the aircraft:

- a.** Land as soon as possible.

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- b.** Check the correct functioning of the instrument and consistency of the data displayed by the instrument.

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8. SIGNATURES AND LIST OF REVISIONS TO THE DOCUMENT

Filled out and checked on

from

Signature

26/08/2023

Guido FANTINI



Approved on

da

Firma

26/08/2023

Stefano MARELLA



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