

Operation manual



Kanalstr. 32

D - 76356 Weingarten

Telefon: ++49/(0)7244 - 706445

Telefax: ++49/(0)7244 - 706446

e-mail: info@schicke-electronic.de

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1. General


1.1. Description

The SMART-MIP is the next step of evolution into a new generation of engine control instruments. It enables the pilot to fully concentrate on flying, while always keeping him supplied with the latest engine and fuel data on just one screen. Thus it superceeds the permanent monitoring of a "clock shop" called cockpit.

It combines all necessary instruments for engine control, fuel management, engine time registration and flight log in one compact case.

The pilot chooses the data of interest on one of the engine screens, but will always be informed (optically and -by option- also acustically) if any one of the critical values exceeds its predefined range.

The SMART-MIP is an engine control instrument that is designed especially for the Smart-engine. It communicates directly with the engine control box via a CAN-bus and collects all important engine data this way: rpm, fuel consumption, intake pressure and temperature, coolant temperature. In addition to that external sensors supply data for oil pressure, oil temperature, ambient temperature, battery voltage, fuel pressure (optional) and fuel level in the tank(s) (optional).

The values are displayed onscreen digitally as well as analog in form of bar charts. Due to clarity not all of the data can be displayed at the same time, so the engine monitoring is split into two screens, that can be altered by pressing the -key. These screens are split in the middle into a left and a right area. On the left side the most important engine data (rpm, fuel consumption and fuel tank content) is permanently displayed, on the right side a collection of secondary data (intake pressure and temperature, coolant temperature, oil pressure, oil temperature, ambient temperature, battery voltage, fuel pressure) may be chosen.

All readings on screen are marked by easily recognizable symbols. For bar charts the ranges "green", "yellow" and "red" are marked by the pixel filling degree "empty", "half" and "full".

In addition to the engine control, the SMART-MIP contains a flight log. It records for every flight or engine run: date, take off time, touch down time, duration of flight, engine hours, pilotname and exceedings of operational limits. The flight log can hold up to 240 entrys. Beyond that the next flight will overwrite the oldest entry.

Easy handling

Due to a reduction of the number of input keys, an acoustic feedback to any key depression, logically arranged menus and a clear user interface the SMART-MIP is very easy to use.

Integration of many single values

On the main screen of the SMART-MIP the following single data are clearly shown:

On the left side: rpm, fuel consumption, content of fuel tank(s)

On the right side: intake pressure and temperature, coolant temperature, oil pressure, oil temperature, ambient temperature, battery voltage, fuel pressure (optional).

High visibility with illuminated display

The large graphic display with its bar graphs makes it possible, that the pilot can check up to 7 values with only one glimpse. Also the large fonts and the additional illumination facilitate the monitoring of the engine data at all lighting conditions, including direct sun exposure.

Integrated flight log

The flight log stores all necessary data: date, take off time, touch down time, duration of the flight, engine time, exceedings of operational limits of the engine and the name of the pilot. These data can be read out to a smartcard using the integrated smartcard interface.

Security by using a smartcard

A smartcard can also be used for authentication combined with blocking the starter, just like an ignition key.

Security of data during flight

During engine runs it is not possible to alter any data in the system-setup-menu.

High data precision

Since the SMART-MIP communicates directly with the engine control box of the Smart engine, very precise data is available. Usual inaccuracies of flow rates etc. are overcome, thus providing additional security. The flight endurance is computed automatically.

For different engine types

The SMART MIP was successfully tested with the following engine versions:

60 HP gasoline, 80 HP gasoline, 100 HP gasoline, and cdi-diesel.

High variability

By optionally available additional sensors the SMART-MIP can be adapted to nearly any individual needs.

Standard readings are: rpm, fuel consumption, intake pressure and temperature, coolant temperature, oil pressure, oil temperature, ambient temperature, battery voltage

Optionally available: fuel gauge(s), fuel pressure sensor, low fuel sensor.

Fuelmanagement for two seperated tanks

The SMART MIP allows you to monitor up to two different tanks at the same time on one display. The tank contents are indicated digitally as total quantity, and individually by bar chart.

1.2. Conventions in this manual

In this manual illustrations of the displays are shown frequently. These illustrations are meant only in principle and thus the herein shown values can deviate from the data actually occurring in the flight.



Instead of a description of every individual key operation, appropriate symbols for the keys are used. These symbols you will also find on the front panel of your SMART-MIP.

Each depressing of a key is acknowledged by a short beep signal, which will not be mentioned in this manual. Only double beeps which occur if a key is depressed for more than approx. 0,5 sek will be mentioned.

(==> **chapter X.X**) This refers to different chapter in the manual, which contains further explanations.

1.3. Function of input keys





With the screen key the different screens are altered. By pressing the key shortly, the display changes from any screen directly to the first engine screen. If you are already on one of the two engine screens, it will change to the other one.

If the key is held depressed for longer (**doubletone**) the screen will change in the following sequence: engine screen 1, engine screen 2, flight log and setup screen.



While the cursor is blinking these keys are used to alter the number or character at the cursor position, in other cases you can move selection areas up and down, switch the pages of the flight log or inside the engine screens you can change the status line from current time to flight endurance or the used fuel.



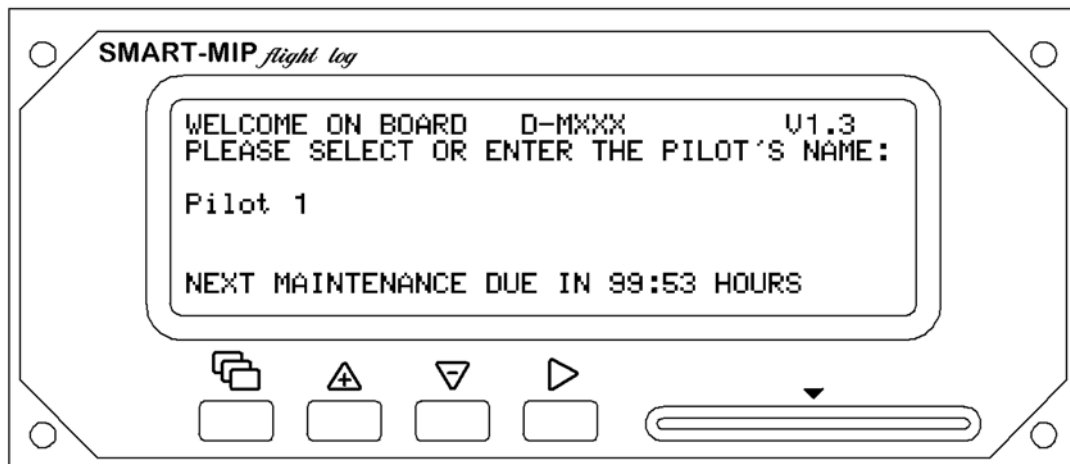
With the „enter“-key you start editing a selected area, confirm values that were entered or altered with  or  and move the cursor to the next value. After the last value the selected area is automatically left by the last depression of the key.

1.4. Display illumination

Simultaneous depressing of  and  toggles the display illumination on/off.

2. Start-up

2.1. Welcome screen



After power on the device comes up with a welcome screen. In the center of the first line the aircraft registration is indicated (adjust: ==> *chapter 2.6*).

In the upper right corner you can see the actually programmed software revision. It may be needed for bug reports or inquiries at your vendor or the manufacturer of the device.

In the middle of the screen there is a list of registered pilots (clearing the list ==> *chapter 2.5*). If the pilots name is already in that list, use the $\triangle\triangledown$ -keys to select it and proceed to engine screen 1 by pressing \square .

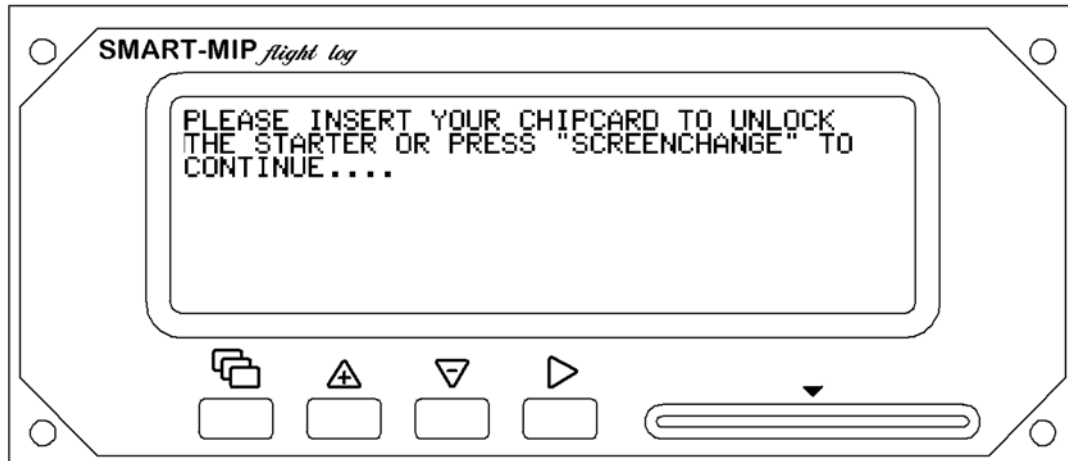
If the pilot's name is not in the list, please proceed as follows:

Choose a free selection area using $\triangle\triangledown$. With \triangleright you enter the edit-mode and the cursor starts blinking at the first character. With $\triangle\triangledown$ you can go through the complete list of characters and symbols from up to down or vice versa. Large/small letters, numbers and special characters are available . When you have found the desired character confirm it with \triangleright . You may enter up to 12 characters. After the last character is entered the cursor stops blinking and the area switches back to selection mode.

The lowermost line shows the remaining runtime to the next engine maintenance. The maintenance interval is predefined by software to 100:00 hours. If this time is exceeded the following message will appear: „**MAINTENANCE XX:XX HOURS OVERDUE**“ . (Reset the maintenance counter ==> *chapter 2.5*)


2.1.1. Blocked starter

If the option to block the starter without smartcard authentication is enabled (==> *chapter 2.5*), the following screen appears:



Please insert a valid card (formatted for this aircraft) to release the starter. This will be confirmed by the message „UNLOCKED...” for a few seconds on the screen. Then the device will proceed to engine screen 1

Hint: The smartcard has to be inserted with the chip contacts pointing up and to the front!


You can override the smart card authentication process by pressing the  key without inserting a valid smart card, but then the starter remains blocked. Besides of that the SMART-MIP will operate normally. (More information about the smart card==> *chapter 2.7*)


2.2. Engine screens

Both screens are divided into a left and right area, in which all data is displayed both as numerical values and as vertical bar charts with arrows pointing at the corresponding point of the scale.

In the **left area** both screens show the most important data (from left to right): **rpm, fuel consumption and content of fuel tank(s)**.

If two separate tanks are set in the setup menu or if the SMART-MIP recognizes two fuel gauges attached, then the fuel level bar graph shows up with two arrows indicating the relative levels of both tanks. (==> *chapter 2.4 and 2.6*)

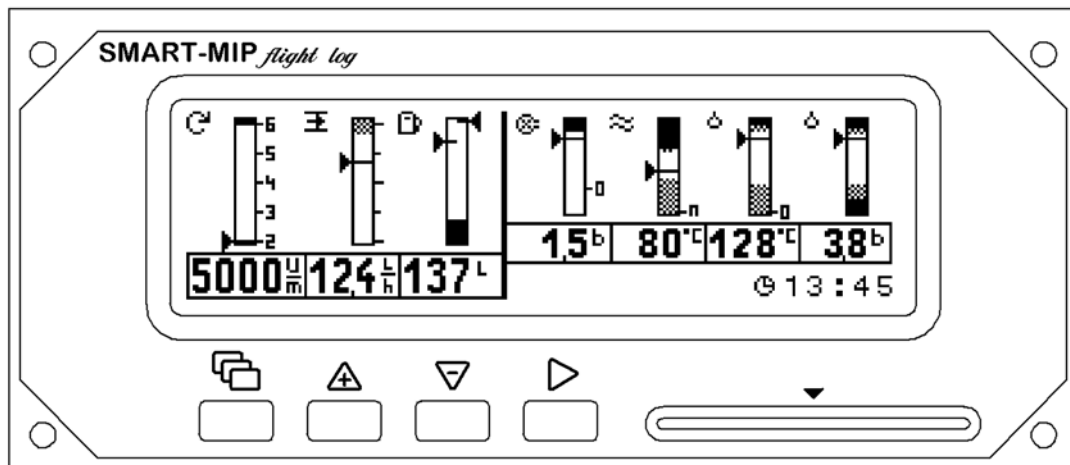
In the **right upper area** the two screens only differ by the data shown. (==> *chapter 2.2.1 and 2.2.2*)
You can switch the screens by a short press on the -key.

In the **right lower area (info line)** both screens do normally show the **current time** but with the -key you can alter that to the **flight endurance** (computed from the current fuel content (one or both tanks) and momentary consumption) or the **amount of fuel used** since power on of the SMART-MIP.

If any engine parameter exceeds its permissible range or another problem arises, this area will switch to displaying an appropriate information or warning message (==> *chapter 3*). At the same time the SMART-MIP will change automatically to the appropriate engine screen where the concerned value will be shown flashing. Also the alarm output will be activated.

The limits of all the measuring ranges, the normal ranges and the threshold values for the alarms are listed in (==> *chapter 4.3*)

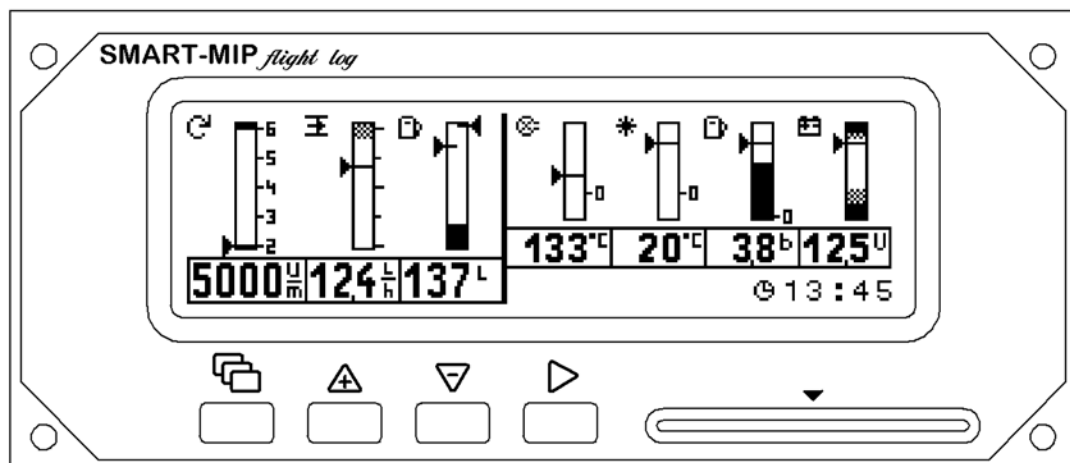
2.2.1 Engine screen 1



Screen 1 shows in the left area (from left to right) **rpm (U/min)**, **fuel consumption (litre/h)** and **content of fuel tank(s) (litre)** and in the right area (from left to right) **intake pressure (bar)**, **coolant temperature (°C)**, **oil temperature (°C)** and **oil pressure (bar)** .

Change to engine screen 2 by pressing  shortly

2.2.2 Engine screen 2









Screen 2 shows in the left area (from left to right) **rpm (U/min)**, **fuel consumption (litre/h)** and **content of fuel tank(s) (litre)** and in the right area (from left to right) **intake temperature (°C)**, **ambient temperature (°C)**, **fuel pressure (bar)** (optional) and **battery voltage (V)**.

Change to engine screen 1 by pressing  shortly

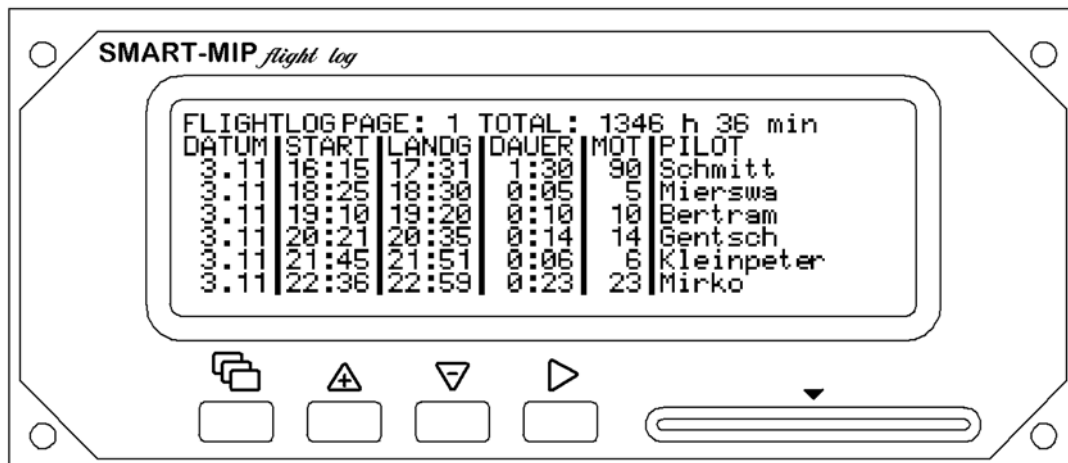
2.2.3 Symbols in the info line

In the line underneath the right engine screen area one of the following symbols can show up:

-  current time
-  flight endurance
-  fuel consumed since power on of the device
-  warning message (remains active until the cause of the warning is resolved)
(==> chapter 3.2)
-  info message, can be turned off by the pilot by pressing 
(==> chapter 3.3)



To proceed to the flight log screen press  long enough to hear the doubletone.

2.3.Flight log screen:



The **uppermost line** shows the number of the **page you are on** (1..40) and the **total elapsed engine running time**.

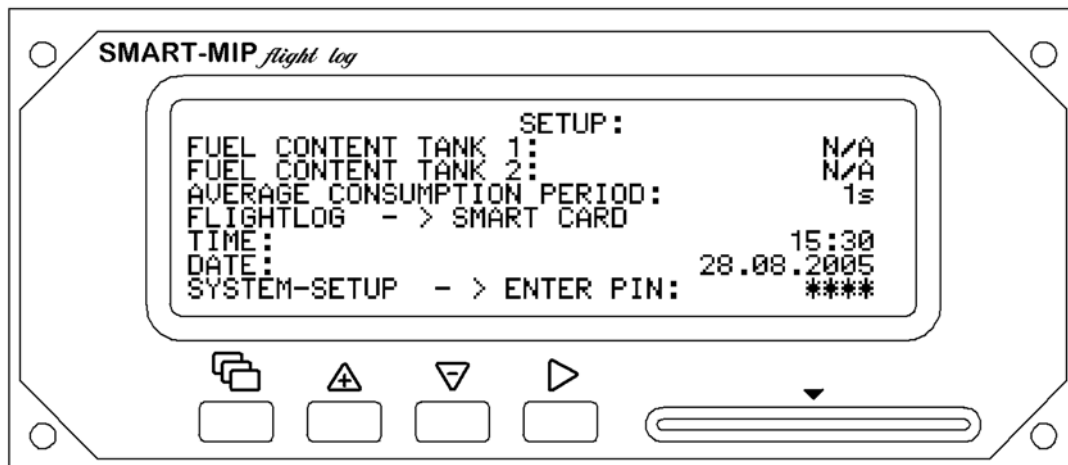
The next line titles with **DATUM** = date, **START** = Take off, **LANDG** = touch down, **DAUER** = flight duration, **MOT** = engine run time, **PILOT** = pilot name.

With   you can go through the pages. Any differences between the columns „DAUER“ and „MOT“ are due to the fact that the engine run time includes ground engine times (Taxiing, etc.).

Hint: A take off is recognized by the SMART-MIP if a dynamic pressure corresponding to 50 km/h or more is applied to the pressure port for more than 10 seconds. If the pressure drops below that for more than 10 seconds the SMART-MIP will assume touch down.

To proceed to the setup screen press  long enough to hear the doubletone.

2.4. Setup screen



This screen contains all settings, that may have to be altered before take off.

To set any value first select the corresponding line with \triangle / ∇ , then press \triangleright to enter the edit mode. Next is to change the value at the cursor using \triangle / ∇ again. After confirming the character or digit with \triangleright the cursor will jump to the next position. All input data will be entered digit by digit from left to right. After confirming the last digit or character of the input area the cursor will stop blinking and the SMART-MIP will return to the selection-mode. At this point the input data will be stored. You may leave the edit mode and return to the engine screens at any time by pressing \square .

Hint: If you leave the edit mode by pressing \square while the cursor is still flashing, the changes made in this area will not be saved.

1. **Fuel Content Tank1:** (0...199l) Enter the actual value after refuelling. If the field shows "N/A" (= not available), a fuel gauge is installed in the tank. In this case any entry of data is not necessary / impossible.
2. **Fuel Content Tank2:** (0...199l) Like tank 1 if there is a second tank specified in system setup.
3. **Average Consumption Period:** (0...199s) The bigger the value, the slower the fuel consumption will react to changed throttle settings. Normally the default setting of 0s is sufficient and needs not be altered.
4. **Flightlog - > Smart-Card:** Transfers the flight log to a smartcard. To accomplish that follow the onscreen instructions. Note: only correctly preformatted smartcards can be used. (==> chapter 2.7)
5. **Time:** Current time
6. **Date:** Current date
7. **System-Setup - > Enter Pin:** To enter the system setup screen a valid PIN must be entered. By default it is set to "0000".

2.5. System setup screen page 1



1. **Starter locked w/o smartcard:** (Block starter, if there has been no authentication by smartcard): Value „Y“ => authentication by smartcard is necessary to operate the starter. Value „N“ => no authentication necessary (default = “N”) (smartcard ==> *chapter 2.7*)
2. **Format Chipcard:** To use a smartcard with the SMART-MIP for authentication or to read out the flight log, it has to be formatted first. During this procedure the aircraft registration is written to the card. Thus the smartcard will be personalized. (==> *chapter 2.7*)
3. **Erase Flight Log:** „Y“ or „N“. To erase the flight log select „Y“ and press ▷. Next „**RUNNING**“ will appear on the screen and after all data are erased, „**DONE**“.
4. **Erase Pilot List:** „Y“ oder „N“. To erase the pilot list select „Y“ and press ▷. Next „**RUNNING**“ will appear on the screen for a moment and after complete erasure „**DONE**“.

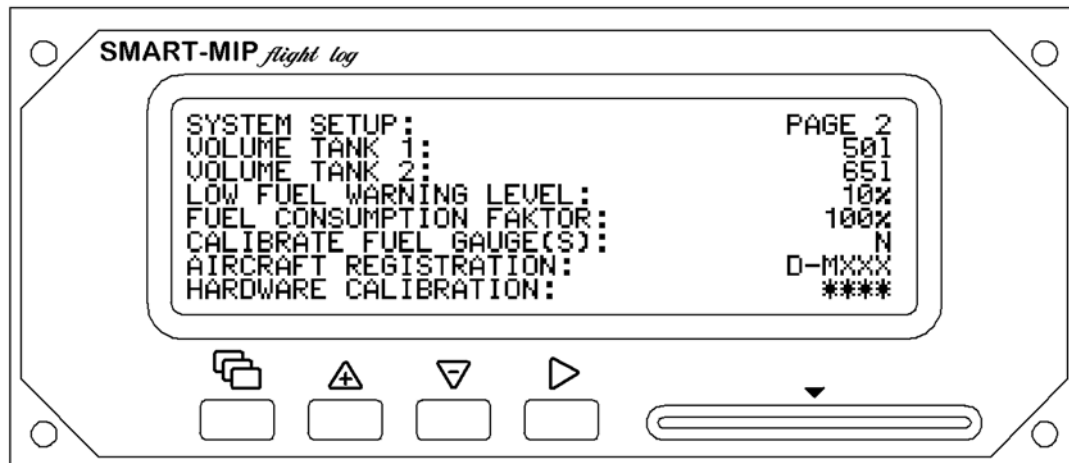
Note: By erasing the pilot list, the names of the pilots in flight log will not be erased.
5. **Reset Maintenance Time Counter:** „Y“ oder „N“. After engine maintenance this is the place to reset the maintenance time counter. Select „Y“ and confirm with ▷.
6. **Set new PIN:** Change the PIN and confirm it by repeating.

Note: Please do not forget the new PIN. If it will be lost it is necessary to send the SMART-MIP back to the manufacturer for a reset.

Default PIN: 0000

Hint: The PIN protects the access to the system setup and safety-relevant settings
7. - > **Page 2...** (switch to page 2 with the ▷ -key)

2.6. Systemsetup screen page 2



1. **Volume Tank 1:** Please enter the usable fuel capacity of tank 1.
2. **Volume Tank 2:** Please enter the usable fuel capacity of tank 2. If there is no second tank, please enter „0“.
3. **Low Fuel Warning Level:** Please set the desired reserve level in percent, at which a low fuel warning message will be issued. If a dedicated reserve sensor is installed in the tank this signal will be used instead. In this case please enter „0“. (default: „10“)
4. **Fuel Consumption Factor:** Do alter this value only if the really consumed fuel does not match the calculated fuel consumption. Due to the accuracy of the data from the Smart engine control box „100%“ will be perfect in most of the cases. If ever it should be necessary to readjust this value, the new value can be calculated by the following formula:

$$\text{Factor} = (\text{real amount of consumed fuel}) / (\text{displayed amount of consumed fuel}) \times 100$$
5. **Calibrate Fuel Gauge(s):** If fuel gauge(s) are installed in the tank(s) it is necessary to calibrate the SMART-MIP with them to obtain maximum precision. This has to be done only once when a gauge is installed or replaced. First drain the tank(s) and then select „Y“ to perform the automatic calibration sequence. It is also possible to take the fuel gauges for calibration out of the tank so simulate an empty tank. But keep in mind that this procedure might cause errors due to not consumable fuel remains in the tank(s). In this case the low fuel warning may be incorrect.
 If no fuel gauges are attached to the SMART-MIP "N/A" will be displayed.
6. **Aircraft Registration:** Alter the aircraft registration accordingly. It will be displayed on the welcome screen and will be written to a smart card while being formatted. (default: D-MXXX)
7. **Hardware Calibration:** This page is protected by a special PIN and thus only accessible for factory maintenance.

2.7 Smartcard

At the right side of the SMART-MIP front panel there is a slot for inserting a smartcard. Do not try to use other cards than those specified by the manufacturer of the SMART-MIP!

Before you can use a new card either for authentication or flight log readout purposes it is necessary to (re)format it in that SMART-MIP it is supposed to be used with:

2.7.1 Formatting

To format a card insert it into the slot with the chip contacts pointing upwards and to the front. Go to the the first page of the system setup (==> *chapter 2.5*), then select „**FORMAT CHIPCARD**“ and press \triangleright . Change the flashing „**N**“ with $\triangleup\triangledown$ to „**Y**“ and confirm with \triangleright . The card will be formatted while the „**RUNNING**“ message is displayed. Do not remove the card during this procedure! When „**DONE**“ appears on screen the card may be removed and is ready for use.

2.7.2 Transferring the flight log

Insert a smartcard into the slot with the chip contacts pointing upwards and to the front. Enter the setup screen, select „**FLIGHTLOG -> SMART-CARD**“ and confirm with \triangleright . The following messages will appear on screen one after the other:

„**COPYING... VERIFYING... FINISHED**. Do not remove the card before copying is finished! After successful completion there will also be a long beeping sound.

Note: If the smartcard is not formatted or not writeable there will be an error message.

2.7.3 Using the data on a pc

You can read the data of the flight log with every standard card reader for smartcards on your pc. For installation please follow the vendor instructions of the card reader. To evaluate the data a specific program is necessary.

3. Display messages

3.1 Smartcard related messages

These messages only appear in conjunction with the use of the smardcard.


INSERT CARD	insert Smart-Card with chip contacts on top and front
CARD ERROR	card not readable, please insert correctly
CARD ID ERROR	missing or wrong formatting
COPYING...	data of the flight log is transferred
VERIFYING...	transferred data is verified
VERIFY ERROR	data error please try again
... FINISHED	data transfer finished
READING...	card is being read

3.2 Warning messages

These messages are warning messages and marked in the info line with << ! >> . They are permanent until their cause is resolved.

OVERSPEED	engine speed too high
WATER TEMP	coolant temperature too high
OIL TEMP	oil temperature too high
OIL PRESSURE	oil pressure too high or low
FUEL PRESSURE	fuel pressure too low
TC PRESSURE	intake (turbo charger) pressure too high
BATTERY OVERCH	battery voltage too high
BATTERY LOW	battery voltage too low
ENGINE SERVICE	error message from engine control box, please contact Ecofly!

3.3 Information messages

These messages are information messages and marked in the info line with i >>. They may be acknowledged by pressing  and then disappear.

MOTRONIC OFF	no connection to the engine control box
FUEL LOW	fuel level below reserve level (if there is only one tank)
TANK 1 FUEL LOW	fuel level tank 1 below reserve level (if there are 2 fuel tanks)
TANK 2 FUEL LOW	fuel level tank 2 below reserve level (if there are 2 fuel tanks)
NO AIR TEMP	no connection to the sensor, sensor maybe broken
NO OIL TEMP	no connection to the sensor, sensor maybe broken
NO OIL PRESS	no connection to the sensor, sensor maybe broken

4. Technical specifications

4.1 Display unit

weight (approx.) :	0,55 kg
dimensions (WxHxD):	188x81x54 mm
operating voltage:	9...15 V
current consumption max.:	0,25...0,8 A (display illuminated)
operating temperature range	-10...+70 °C

4.2 Measuring resolution

Measuring range	Resolution	Unit
rpm	25	U/min
coolant temperature	1	°C
oil temperature	1	°C
ambient temperature.	1	°C
intake pressure	0,1	bar
oil pressure	0,1	bar
fuel flow	0,1	litre/h
fuel content	1	litre
fuel pressure	0,1	bar
voltage	0,1	V

4.3 Limits

pilot list	max. 12 names
flight log	max. 240 flights
fuel tank volume 1 and 2	0...199 l
fuel tank reserve	min. 0%, max 25% (==> chapter 2.6)

4.4 Warning thresholds

	display range	warning threshold
rpm	9999 U/min	threshold value see below
cooling liquid temperature	-40 ... +200 °C	110°C
intake pressure	2 bar	2 bar
intake temperature	-40 ... +200 °C	
oil temperature	150°C	120°C
oil pressure	min 0,3 at 1000, 3,3bar at 6000rpm	see below
voltage	15V	> 14,7V & <11,5V
fuel pressure		> 4,1 bar & < 3,5 bar

RPM overspeed threshold

At the 60-HP-version the rpm threshold value is variable and depends on the altitude. Below 1000m it is at 6000 rpm, above 1000m it decreases by 50 rpm every 100 meters in altitude.

At the 82-HP-version the max. rpm over altitude is governed by the engine control box, thus overspeeding is impossible.

Oil pressure

The minimum oil pressure is related to engine speed, so the warning threshold shifts accordingly.

5. Error tracing

error	possible reason
The SMART-MIP is turned on, but doesn't display anything	Check current supply: <ul style="list-style-type: none">- is the battery connected correctly?- has the ground cable connection to the negative pole of the battery ?- is the fuse broken ?
When turnig off the SMART-MIP all date / time data get lost	The internal backup battery is depleted, please send the unit to manufacturer for replacement.
The displayed fuel flow doesn't match the real fuel consumption	Change calibration factor in the setup menue
Flight log function does not work	<ul style="list-style-type: none">- is the dymamic pressure applied to the port at the backside of the SMART-MIP ?- if the rpm indication does not work, the log won't work either

6. Warranty conditions

The warranty period for the SMART-MIP including sensors is:

2 years starting from date of purchase

Requirements for any restitution:

- any seals at the SMART-MIP or the sensors are intact
- the device was properly installed and supplied with the correct operating voltage
- a correct fuse was installed in the supply line
- sending of the devices free of charge

Excluded from the restitution are:

- transport damages
- damages caused by brute force (e.g. switches broken, display scratches, crash, etc.)
- damages caused by normal wear
- damages caused by inappropriate installation (e.g. broken or abraided wires, etc.)
- damages caused by high tension (e.g. failure of the regulator)

In case of warranty claim please return the defective device together with a brief description to:

Schicke electronic
Kanalstr. 32
D-76356 Weingarten