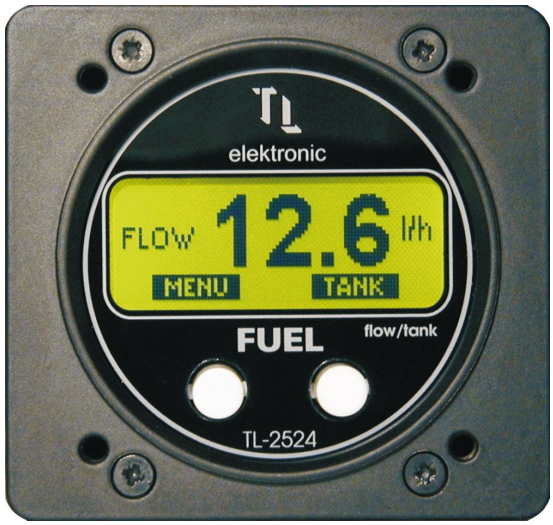
TL-2524
USER`S MANUAL



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Non TSO approved

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Please, send your e-mail address to customer@tl-elektronic.com to receive the latest information about software upgrade.

Send your ideas to innovation@tl-elektronic.com.
We will evaluate your suggestion and provide an update.

Record of revision

Revision	Revision date	Description	ECO#	Insertion date	By
A	1/6/03	Initial Release	---		
B	1/7/04	Language correction	0001		

TABLE OF CONTENTS

1. GENERAL DESCRIPTION

1.1. INTRODUCTION

This manual describes the physical, mechanical and electrical features and functions of the TL-2524 Fuel Computer.

1.2. INSTRUMENT DESCRIPTION

The TL-2524 is complete fuel management. The instrument incorporates an input for the flow sensor, two inputs for the fuel quantity sensors, an input for the pressure sensor, and also an input and an output to the GPS, which enables the transmission of the actual fuel flow from the TL-2524 and receiving the actual ground speed for the calculation of the consumption per 100 km (flow per 100 miles).
The TL-2524 incorporates a 2,000-line long-term memory and SchecK memory (see page 5-4) for storing the measured values at 0.1 to 60 second sample rate.
The TL-2524 checks all measured values at two levels - for a warning and an alarm limit signalization. When the alarm warning has been activated, the instrument will display a Service message with a code of the exceeded values after the next turn-on to inform the user to contact an engine service.
The User button can be programmed in the main set-up for the quick display of any measured value or for the quick switch to another function. It is possible to download the measured values from the instrument via the serial cable RS-232c into your PC.

1.3. TECHNICAL SPECIFICATIONS

The producer guarantees all stated technical parameters only when the instrument is installed by an authorized service or an aircraft manufacturer.

1.3.1 Physical characteristics

Width	71mm (2.795 inches)
Height	67mm (2.637 inches)
Depth	82mm (3.228 inches) including connectors with cover
Panel hole	57mm (2.244 inches) diameter
TL-2524 Weight	0.25 kg (0.77 lbs)
TL-2524 Harness	0.05 kg (0.11 lbs)

1.3.2 General Specifications

Operating Temperature Range	**-20°C to +70°C**
Humidity	**95% non-condensing**
Altitude Range	**4600 meters max.**
Power Range	**10.0 to 32.0 Volts**
Max. Signalization	**30 Volts, 1 Ampere**
Power Consumption	**0.15 Ampere @ 14 VDC without sensors**
Backlight Consumption	**0.08 Ampere max when ext. power is used**
Vibration	**5 to 500 Hz**
Show Rate (LCD Refresh)	**1 second**

1.3.3 Long-term Memory and Communication

Storing Rate	**0.1 to 60 seconds user selectable**
Memory Capacity	**Scheck® method**
Stored Values	**Flow, Tank level, Pressure (when are used)**
Data Saved Endurance	**30 years**
Rolling Memory life-time	**100 000 hours @ 1 second storing rate**
Communication	**RS-232c**
Communication Speed	**38400 bps**

1.3.4 Sensor Parameters

Flow sensor	**Any type with positive pulses 8 to 16 Volts**
Fuel quantity sensor passive	**Any resistive sensor with 0 to 500 ohm range**
Fuel quantity sensor active	**Any type with output 0.5 to 4.5 Volts FS with +12 Volts power supply**
Fuel pressure sensor passive	**Any resistive sensor with 0 to 500 ohm range**
Fuel pressure sensor active	**Any type with output 0.5 to 4.5 Volts FS with +5 Volts power supply**

1.3.5 Instrument Measured Range / Resolution

Flow per hour	**0 to 400L/h @ 8450 K_factor / 0.1 liter/hour (0.26US-Gallon/hours)**
Flow per dist.	**0 to 400L/h @ 8450 K / 0.1 liter/100km (0.26US-Gallon/100 miles)**
Fuel quantity	**0 to 999 Liters / 0.1 liter/hour (0.26US-Gallon/hours)**
Fuel pressure	**0 to 5 bars (72.5PSI) / 0.01 bar (0.14PSI)**
Engine Hours	**0 to 9999.5 hours / ±2 seconds @ 1 hour**

1.4. LIMITED CONDITIONS

1.5. LIMITED WARRANTY

The TL elektronic company warrants this product to be free from defects in materials and manufacture for three years from the date of purchase. TL elektronic will, at its sole option, repair or replace any components that fail in normal use. Such repairs or replacement will be made at no charge to the customer for parts or labour. The customer is, however, responsible for any transportation costs. This warranty does not cover failures due to abuse, misuse, accident or unauthorized alteration or repairs.

THE WARRANTIES AND REMEDIES CONTAINED HEREIN ARE EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES EXPRESS OR IMPLIED OR STATUTORY, INCLUDING ANY LIABILITY ARISING UNDER ANY WARRANTY OF ENCHANT ABILITY OR FITNESS FOR A PARTICULAR PURPOSE, STATUTORY OR OTHERWISE. THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, WHICH MAY VARY FROM STATE TO STATE.

IN NO EVENT SHALL TL ELEKTRONIC BE LIABLE FOR ANY INCIDENTAL, SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES, WHETHER RESULTING FROM THE USE, MISUSE, OR INABILITY TO USE THIS PRODUCT OR FROM DEFECTS IN THE PRODUCT. SOME STATES DO NOT ALLOW THE EXCLUSION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATIONS MAY NOT APPLY TO YOU.

To obtain warranty service, call the TL elektronic Customer Service (+420 49 548 23 92) for a returned merchandise tracking number. The unit should be securely packaged with the tracking number clearly marked on the outside of the package and sent freight prepaid and insured to a TL elektronic warranty service station. A copy of the original sales receipt is required as the proof of purchase for warranty repairs. TL elektronic retains the exclusive right to repair or replace the unit or software or offer a full refund of the purchase price at its sole discretion.

SUCH REMEDY SHALL BE YOUR SOLE AND EXCLUSIVE REMEDY FOR ANY BREACH OF WARRANTY.

1.6. LIMITED OPERATION

This product is not TSO approved as a flight instrument, therefore, the manufacturer will not be held responsible for any damage caused by its use.
The selectable quantity fuel datum cannot be used as the only datum and the aircraft must be equipped with a proper fuel indicator. The same counts for the remaining flight time datum, which cannot be used as decisive.

2. INSTALLATION

2.1 INTRODUCTION

Careful planning and consideration of the suggestions in this section are required to achieve the desired performance and reliability from the TL-2524.

2.2 RACK CONSIDERATION

Plan a location that gives the pilot complete and comfortable access to the entire keypad and that is plainly visible from the pilot's perspective. Check that there is adequate depth for the rack in the instrument panel. A location away from heating vents or other sources of heat generation is optimal.

2.3 INSTALLATION OF ACCESSORIES

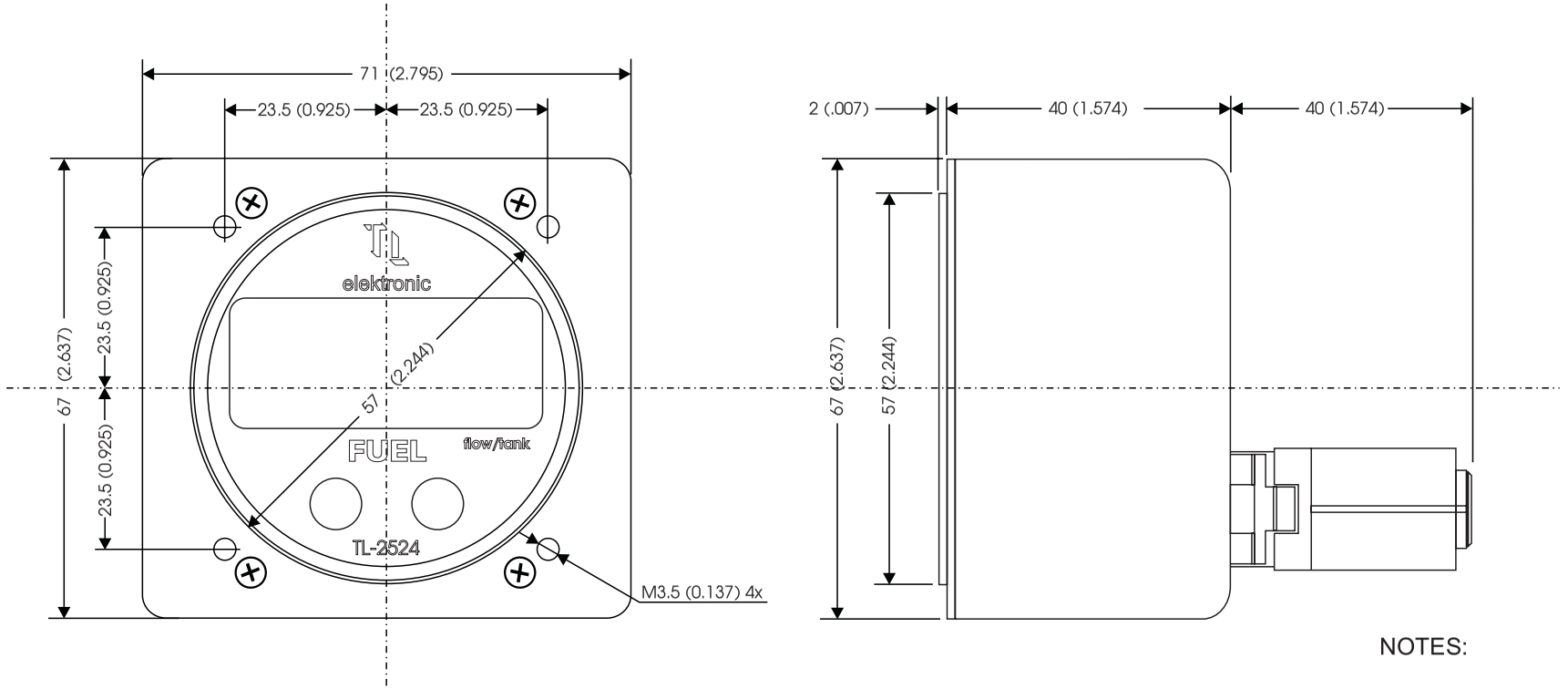
Make sure that the sensor connection complies with the configuration set in the instrument according to the main set-up. If not, ask an authorized distributor for the correct sensor setting. Connecting the sensors and other parts must be done properly in order to avoid any damage.

⚠ **Connect the cables into the connector and use the connector cover. Secure the incoming leads to prevent their effect on the connector in the vertical direction.**

2.4 FLOW SENSOR INSTALLATION

If the flow sensor is delivered with the instrument, follow the installation datasheet.

Mounting Rack Dimension



NOTES:

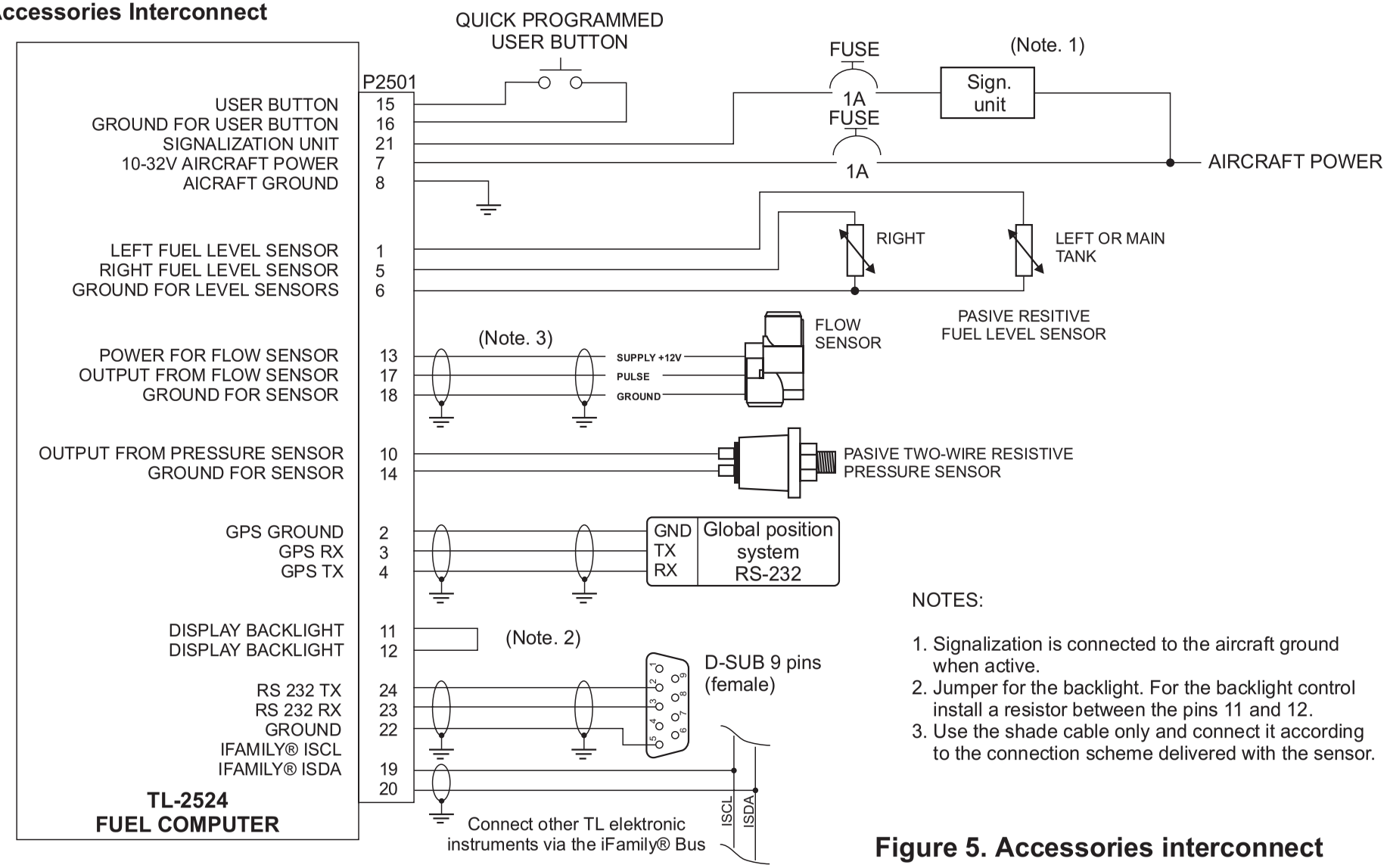
1. Dimension: mm (INCH)
2. Unit weight: 0.4 kg (0.88 lbs)
3. Mounting Rack & Hardware weight: 0.05 kg (0.11 lbs)

Figure 4. Rack Dimension

3.1 PIN FUNCTION LIST

Pin	Pin Name	I/O
1	Left or main tank- fuel level sensor input	In
2	Ground for GPS communication (RS-232)	- -
3	RXD from GPS (RS-232)	In
4	TXD to GPS (RS-232)	Out
5	Right tank - fuel level sensor input	In
6	Ground for left and right fuel level sensor	- -
7	Aircraft power	In
8	Aircraft ground	- -
9	Power +12 Volts output for active pressure sensor	Out
10	Input for pressure sensor	In
11	Input for backlight	In
12	Internal source for backlight	Out
13	Power +12 Volts output for flow sensor	Out
14	Ground for pressure sensor	- -
15	Input for User button	In
16	Ground for User button input	- -
17	Input for flow sensor	In
18	Ground for flow sensor	- -
19	iFamily® communication ISCL	I/O
20	iFamily® communication ISDA	I/O
21	Signalization unit	Out
22	Ground for PC communication (RS-232)	- -
23	RXD from PC (RS-232)	In
24	TXD to PC (RS-232)	Out

Accessories Interconnect

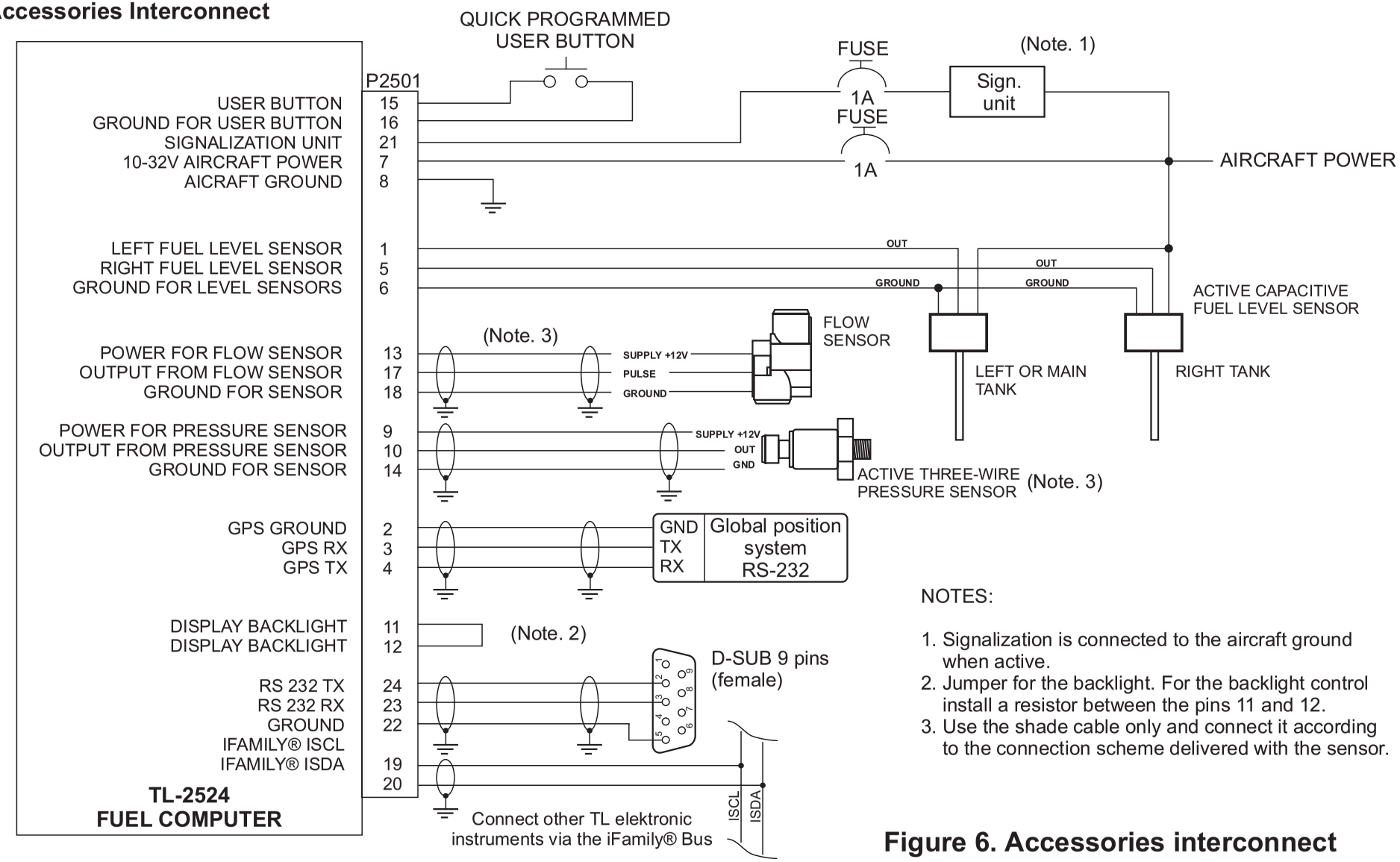


NOTES:

1. Signalization is connected to the aircraft ground when active.
2. Jumper for the backlight. For the backlight control install a resistor between the pins 11 and 12.
3. Use the shade cable only and connect it according to the connection scheme delivered with the sensor.

Figure 5. Accessories interconnect

Accessories Interconnect

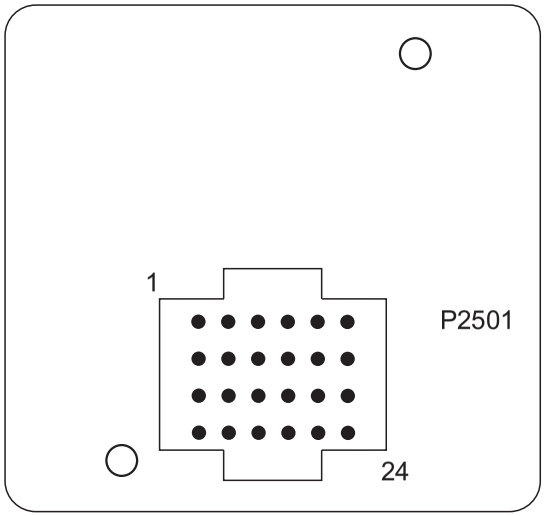


NOTES:

1. Signalization is connected to the aircraft ground when active.
2. Jumper for the backlight. For the backlight control install a resistor between the pins 11 and 12.
3. Use the shade cable only and connect it according to the connection scheme delivered with the sensor.

Figure 6. Accessories interconnect

Rear view of connector plate



NOTES:

1. Secure the incoming leads to prevent their effect on the connector in the vertical direction.

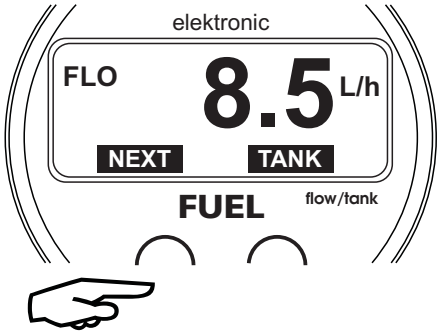
Figure 6. Connectors locate

4. NAV-MENU DESCRIPTION

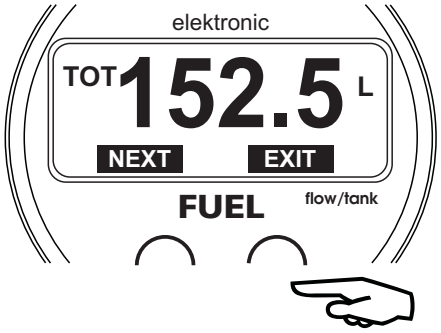
4.1 How to Control Instrument via NAV-MENU

There are black labels on the display. Each is affiliated to the left and the right button. Before pressing a button, read the information on the label. Its functions are different in every menu.

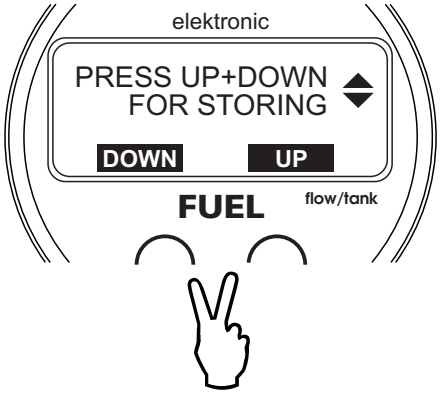
The left label is for the Left button.



The right label is for the Right button.



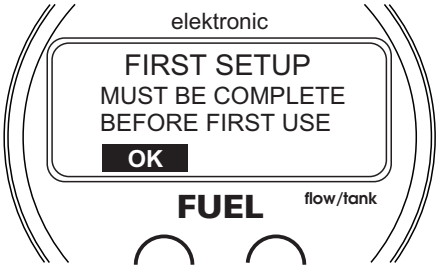
To store a value into the memory, press both buttons simultaneously. Release the buttons when the setting arrows vanish.



5 INSTRUMENT SETUP

5.1 First Instrument Turn-on

Before the Fuel Computer starts to indicate you must do the basic setting of language, contrast, units, etc. After the first turn-on of the instrument, the „FIRST SETUP“ message will show on the display. This set-up must be completed to continue.



5.2 Main Set-up Functions' Description

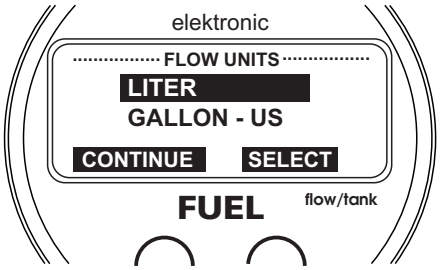
The table of the instrument configuration steps is shown below (Initial - firmware version 1.1).

0	LANGUAGE	Select your language for communication with the instrument.
1	DISPLAY CONTRAST	Select contrast of the display.
2	FLOW UNIT	Select your local unit for fuel flow.
3	PRESSURE UNIT	Select your local unit for fuel pressure.
4	DISTANCE UNIT	Select your local unit for distance.
5	K-FACTOR	Insert the value, which is delivered with the sensor.
6	TIME OF AVER. FLOW	Select the time of average instant fuel flow (5second advised).
7	PRESS SENS. TYPE	Select, which pressure sensor is used. Selecting **OTHER** = means non-calibrated (calibration is required)
8	SENSOR TYPE (only when „Other" pressure sensor is selected)	Select, which pressure sensor is used. **PASSIVE** = output from sensor as resistive, or **ACTIVE** = output as voltage.
9	PRESSURE CALIB. (only when „Other" pressure sensor is selected)	Go to the calibration of fuel pressure.
10	LEVEL SENS. TYPE	Select, which quantity sensor is used. **PASSIVE** = output from sensor as resistive, or **ACTIVE** = output as voltage.
11	PRESSURE CALIB.	Go to the calibration of fuel pressure.
12	CONTENT OF TANK	Set the Total content of the used tank.
13	QUANTITY CALIB. (only when active or passive quantity sensor are selected)	Go to the calibration of the tank.
14	TANK CALIB. STEP (only when active or passive quantity sensor are selected)	Select the number of steps for calibration of tank non-linearity.
15	TANK CALIBRATION (only when active or passive quantity sensor are selected)	Start of the tank calibration.
17	INEXHAUSTIBLE FUEL	Set the inexhaustible amount of fuel in your tank
16	LOW FUEL WARNING	Set the minimum level in the tank(s) for warning.
17	OTHER WARNING	Select other Warning and Alarm for fuel pressure, range, endurance etc.
18	VOICE WARNING	Enable or disable the voice warning into the headphones (only with use of our Intercom TL-2424 or Voice Module).
19	GPS MODE	Select **NMEA** or **ARNAV** protocol for the communication with your GPS (consult GPS manual for using the protocol).
20	USER BUTTON	Program your button for these functions: **SHOW QUANTITY** = quick show the quantity of the tank **SHOW INST.FLOW** = quick show instant fuel flow
21	DELETE	The Engine hours, Total used fuel etc. will be deleted.
22	INST. ON-LINE	Check the connected instruments from the TL elektronic iFamily® that are On-Line.

All information on this page is subject to change without prior notice. Download the latest version of the manual from www.tl-elektronic.com and compare it with your version of the firmware.

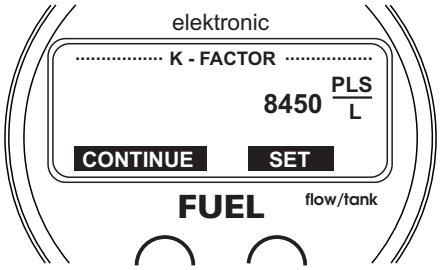
5.3 How to Select Units and Enable or Disable Any Function

For selecting the units, use the „Select“ button in the Set-up menu. The selected unit is shown inversely on the black background. When the unit has been selected, press the „Continue“ button for storing and step to the next configuration.



5.4 K_FACTOR Setting

Each flow transducer outputs a different number of electrical pulses for each liter (gallon) of the fuel that flows through it. This value is called the K_FACTOR. Before the first use of the Fuel Computer, insert the K_FACTOR value, which is delivered with the sensor. The installation and the type of engine (carburetor or injection) can affect the K_FACTOR.
Possible mistakes caused by faulty installing can be eliminated by modifying the K_FACTOR according to the value table below.



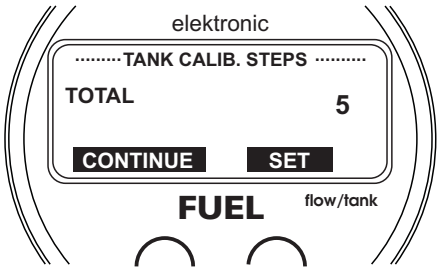
MODIFICATION OF K_FACTOR VALUE

K_FACTOR = LAST K_FACTOR+[((SHOWN VALUE-REAL VALUE)xLAST K_FACTOR)/REAL VALUE]

For example:
The value shown on the display: 2,1 liters
The real value of the fuel used: 2,0 liters
Calculation:
K_FACTOR = 8450+[((2,1 - 2,0) x 8450)/2,0]
The new value for calibration is 8873.

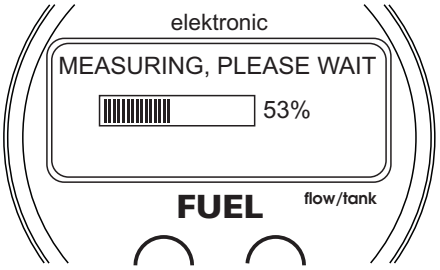
Insert the new calculated K-FACTOR into Fuel Computer.

5.5 Tank Non-linearity Correction and Sensor Calibration



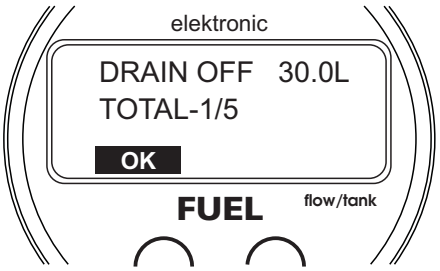
Before the calibration you must insert the number of the calibration steps you want to use for the tank calibration. If your tank is of a regular shape, the number of steps can be small. If your tank is of an irregular shape, set the highest possible number of steps. The higher number of steps will offer you a better non-linearity correction of your tank.

5.6 Calibration Measuring



Every measured value in each step is averaged for more precise calibration (in case of unstable fuel level). If the progress bar is being continuously reset, you must do the calibration in the place where the fuel level in the tank is in a stable position.

5.7 Calibration Steps

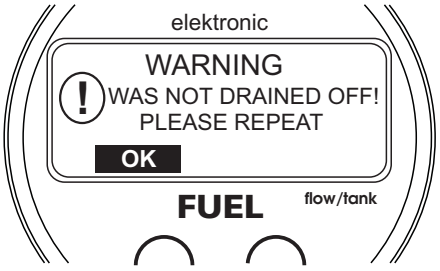


After each calibration step, the instrument informs you about the fuel amount that must be drained off the tank and also about the number of steps to be done. If you forget or are not sure how much fuel has been drained, quit this calibration process and turn the instrument off. After turning the instrument on, you can repeat the calibration. Make sure that there is no fuel in the tank after the calibration. In the opposite case, repeat the calibration (only a slight deviation, caused by the instrument's accuracy - 5% of total amount - or by your measuring, can be accepted).

⚠ **The calibration must be done accurately. An incorrect calibration could cause misleading information about the fuel quantity and, thus, endanger your life or the lives of your passengers.**

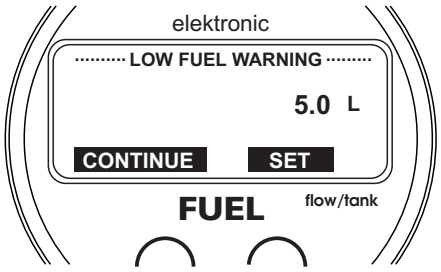
⚠ **TL electronic does not hold any responsibility for the calibration carried out by the user and for information about the fuel amount in the tank displayed on the instrument.**

5.8 Checking Input Resolution



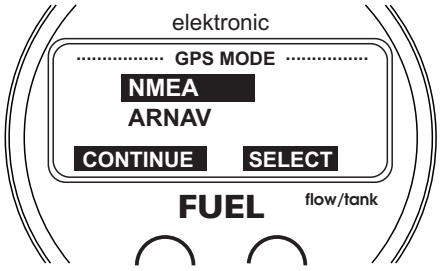
If the change of voltage or resistance at the level sensor output is lower than the minimum input resolution, the warning message will show on the display. In this case, you must quit the calibration process and check the parameters of your sensor and/or its proper function in the tank.

5.9 Low Fuel Warning



This alarm should be set as a reminder (e.g. 5 liters) that will inform you on reaching the minimum fuel amount. When the fuel amount gets lower than the preset limit, the message „FUEL“ will be blinking. Also the alarm signalization is activated. The alarm signalization can be deactivated by pressing the right or the left button. In case of the low fuel amount, the message „FUEL“ will show, see point 6.4.

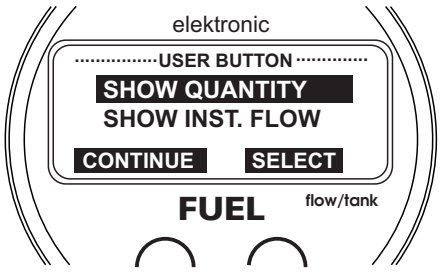
5.10 Data Format for GPS Communication



For receiving the data from the GPS, it is necessary to configure the Fuel Computer TL-2524. The data transmitted from the Fuel Computer to the GPS are used for calculating the fuel plan and the data received from the GPS are used for calculating the instant fuel consumption in liters/100km (gallons/100miles) and also for calculating the endurance in km or miles. If the TL-2524 is not receiving data from the GPS, the menu with this information will not show on the display. Check the following settings and check that the GPS receive wire is connected to the proper pin on the GPS.

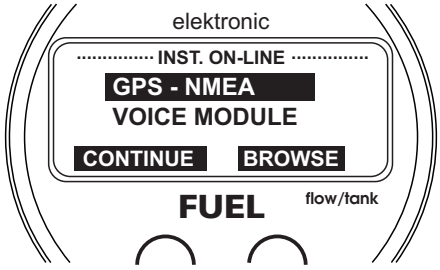
It is important to set the format of communication. Prefer the ARNAV format with the 9600Bd speed. If your GPS offers only the NMEA format, in most cases your instrument will get information only from the GPS.

5.11 User Button



When pressed, the external User button offers you the possibility of programming to quick show or quick switch to the selected menu. After releasing the button, you will get back the measured value indication. For example - if you have set „SHOW QUANTITY“, after pressing the button you can monitor the actual fuel consumption till releasing the button.

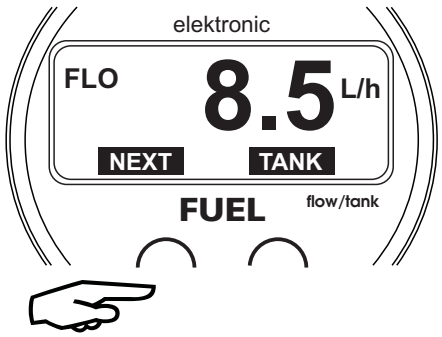
5.12 iFamily® and Other Connecting Devices



As the first of aircraft instruments, the TL-2524 offers you the possibility of connecting with other instruments from the TL elektronic family, in order to gain simultaneous recording of the measured values, mass PC download of all connected instruments etc. via one cable. If some other instruments or the GPS are connected to the reserved inputs, this menu shows each connected instrument. It also enables checking the connected instruments and devices.

6. OPERATIONAL MANUAL

6.1. Left Menu Description



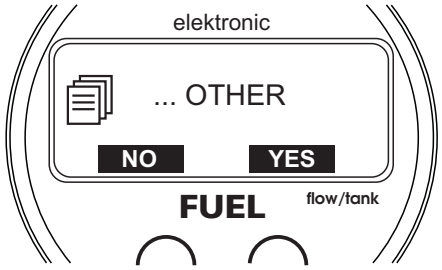
The left main menu shows the information about the instant and average fuel flow etc. according to the table below.

Left Menu (Initial firmware version 1.0)

First	Second	Description
FLO		Flow - instant fuel flow at liters/hour (gallons/hour)
FLO		Flow - instant fuel flow at liters/100km (gallons/100miles) (only when the GPS is connected and the instrument receives the correct
		format)
AVE		Average - average value of fuel flow
FP		Fuel Pressure - fuel pressure
EDR		Endurance - Time of endurance calculated from instant flow and quantity
	TOT	Total fuel used
	TIM	Total engine hours
	DELETE	Delete the flow average value
	EXIT	Exit from second menu

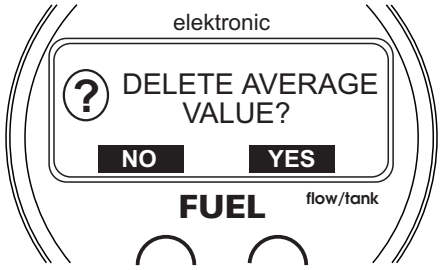
All information on this page is subject to change without prior notice. Download the latest version of the manual from www.tl-elektronic.com and compare with you version of firmware.

6.1.1 Second Menu



The "OTHER" dialog will show on the display after pressing the left button. If you press „YES“ in this dialog, the instrument will go to the second menu where you can get the information about total engine hours etc.

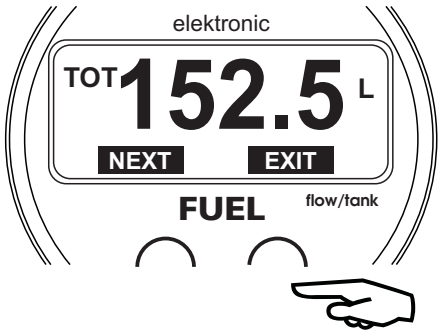
6.2 Deleting Average Value



The second menu includes a dialog for deleting the average or the maximum consumption. If you press „YES“ on this dialog, the average or the maximum values will be deleted. Please note that this datum is the long-term average consumption and is calculated from the moment of the last delete. If you have made any changes in the engine system (e.g. propeller setting etc.), it is necessary to delete this long-term average datum. In other case, the change in consumption will show after a longer period of time.

6.2 Right Menu Description

The right menu shows the information about the quantity of fuel in the tank according to the table below.



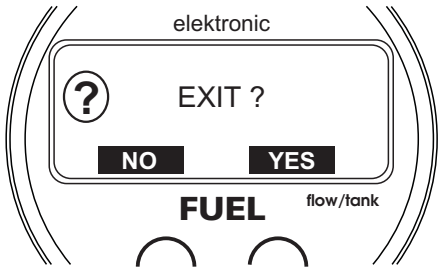
Right Menu (Initial firmware version 1.0)

First	Second	Description
TOTAL		Total quantity (of both tank)
LEFT		Average - average value of fuel flow (when two tanks are selected)
RIGHT		Fuel Pressure - fuel pressure (when two tanks are selected)
EXIT		Exit from the menu

All information on this page is subject to change without prior notice. Download the latest version of the manual from www.tl-elektronic.com and compare with you version of firmware.

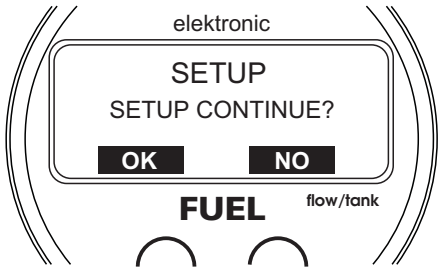
6.2.1 Exit from Right Menu

The "Exit" dialog will show on the display after pressing the left button for a few times. If you press „YES“ in this dialog, the instrument will go to the Left menu.



6.3 How to Change Configuration

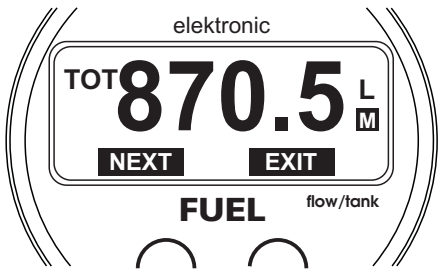
If you want to change e.g. units or contrast, press and hold both buttons and turn the instrument on. The "SETUP" message will show on the display. Press „OK“ and go to the Instrument Setup.



Note that any unauthorized change of values in the Setup can cause a defect of the instrument. An incorrect change of the calibration could endanger your life and the lives of your passengers.

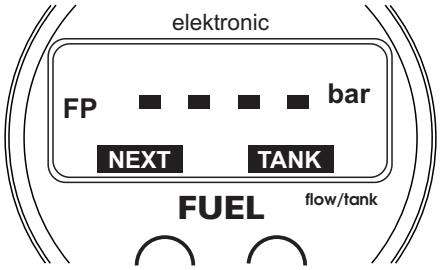
6.4 Memory Displaying

The inverted symbol [M] (on the black background) shown on the right indicates that the maximum values or the memory data are displayed.



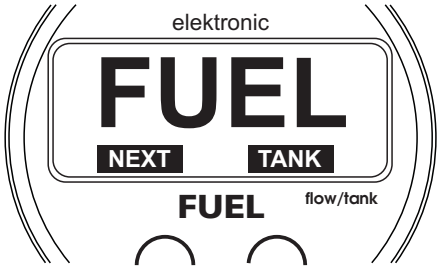
6.5 Disconnected Sensor

When any sensor is disconnected or is out of range, the [----] message will show on the display.



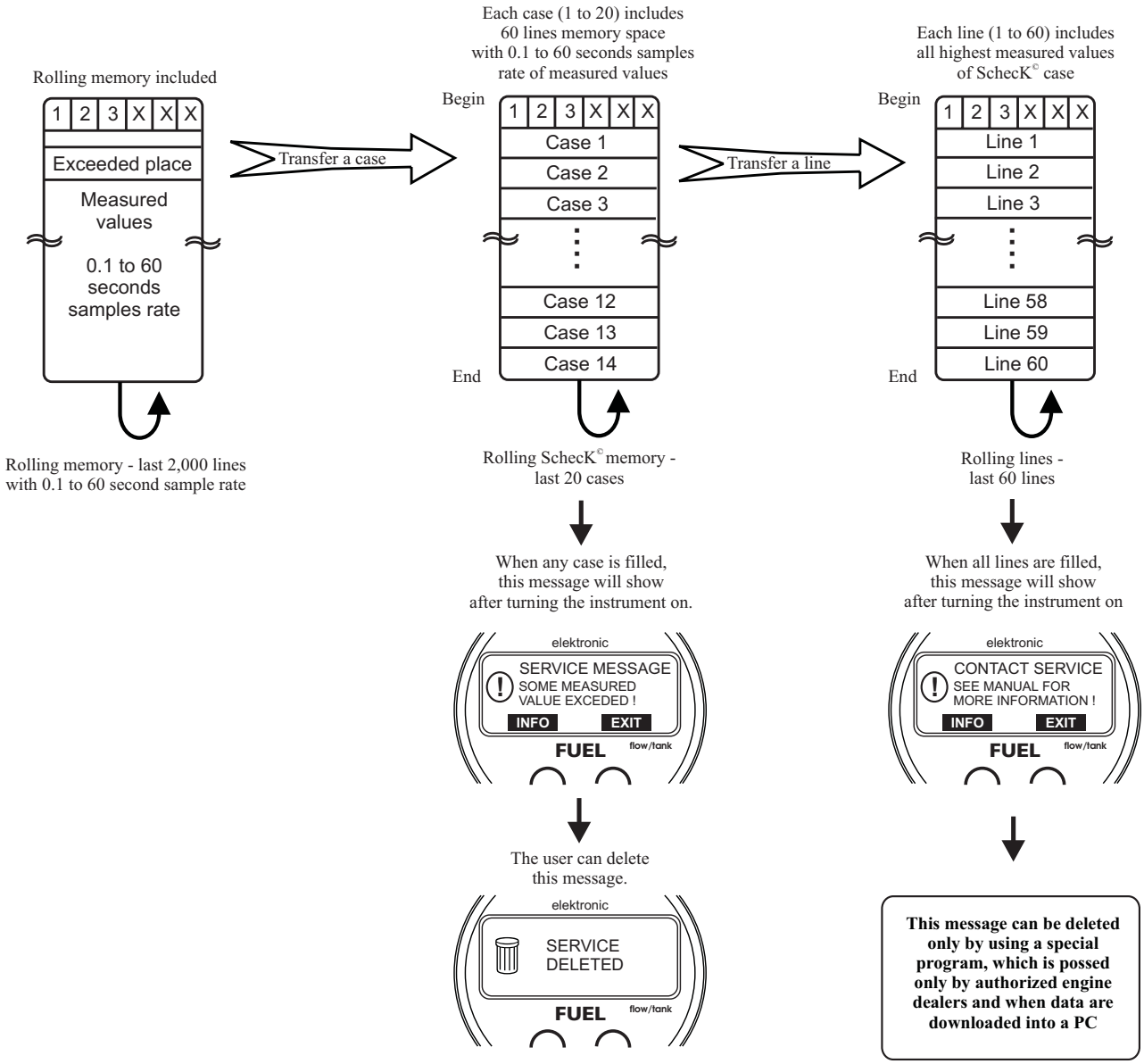
6.6 Low Fuel Warning

This alarm informs you about the low quantity in your tank. If the fuel amount is lower (the Alarm Limit is exceeded) the alarm signalization will start blinking. Pushing any button will stop the blinking and turn the alarm signalization off. Also for the period of time when the fuel amount is low, the "FUEL" message will be displayed. The minimum fuel amount can be set according to the point 5.9.

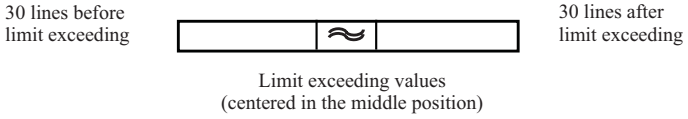


7.1 SchecK® memory description

The TL-2524 includes a 2,000 lines long-term memory and SchecK memory for storing of measured values in the 0.1 to 60 second sample rate. The measured data you can be downloaded via a standard PC serial cable RS-232 into a Laptop or Personal Computer.



Cases 1 to 20 include 60 lines of exceeded limit values and engine hours when the values were exceeded.



In this version it is possible to read last 20 exceeded records at total operational time.

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