TL-2724
USER`S MANUAL

TL elektronic
Airport, Building 125, Hradec Kralove
503 41, Czech Republic

 Non TSO approved

Producer's address:
TL elektronic Inc.
Airport, Building 125,
503 41 Hradec Kralove, Czech Republic
Fax: +420 49 548 23 94 E-mail: info@tl-elektronic.com
Website Address: www.tl-elektronic.com

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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		
C	1/3/05	ACV version added	0003		
D	8/12/05	Main Setup updated	0004		

TABLE OF CONTENTS

1. GENERAL DESCRIPTION

1.1. INTRODUCTION

This manual describes the physical, mechanical and electrical features of the TL-2724 Volt-ampere Meter.

1.2. INSTRUMENT DESCRIPTION

The Volt-ampere Meter TL-2724 is complete management for the aircraft electrical power source.
The instrument incorporates the new generation of precise components for measuring voltage and current from more than one input. In this way, you can detect voltage and current e.g. in the main branch, in the branch of avionics and in the branch of electric/electronic units, such as electric pumps, undercarriage gear etc.
The TL-2724 also enables detecting and signalizing the differences in the particular branches.

The TL-2724 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 after the next turn-on of the instrument to inform the user on the exceeded voltage or currency.

The TL-2724 incorporates a 2,000 line long-term memory and SchecK® memory (see page 7-1) for storing the measured values at 0.1 to 60 second sample rate.

The User Button can be programmed in the main set-up for the quick display the minimum and maximum voltage or current. 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 (3.346 inches)
Depth	82mm (3.228 inches) including connectors with cover
Panel hole	57mm (2.244 inches) diameter
TL-2724 Weight	0.30 kg (0.66 lbs)
TL-2724 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**
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	**1 to 60 seconds user selectable**
Memory Capacity	**Scheck® method**
Stored Values	**Voltage, current, frequency**
Data Saved Endurance	**30 years**
Rolling Memory life-time	**50 000 hours @ 1 second storing rate**
Communication	**RS-232c**
Communication Speed	**38400 bps**

1.3.4 Instrument Measured Range / Resolution

Voltage	**0 to ±60 Volts / 0.1 Volt DC**
Voltage (version ACV)	**0 to 250 Volts / 1 Volt AC/DC**
Current	**±100mV / 0.1A (1Amps@1mV) DC**
Current (version ACV)	**±100mV / 0.1A (1Amps@1mV) AC/DC**
Frequency (version ACV)	**30 to 500 Hz**

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.
If the user utilizes a current shunt sensor not recommended by the producer, the producer will not be responsible for incorrect interpretation of the current data.

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-2724.

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 place away from heating vents or other sources of heat generation is optimal.

2.3 INSTALLATION INTO PANEL

⚠ **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 MEASURING IN PARTICULAR PLACES OF AIRCRAFT POWER SOURCE

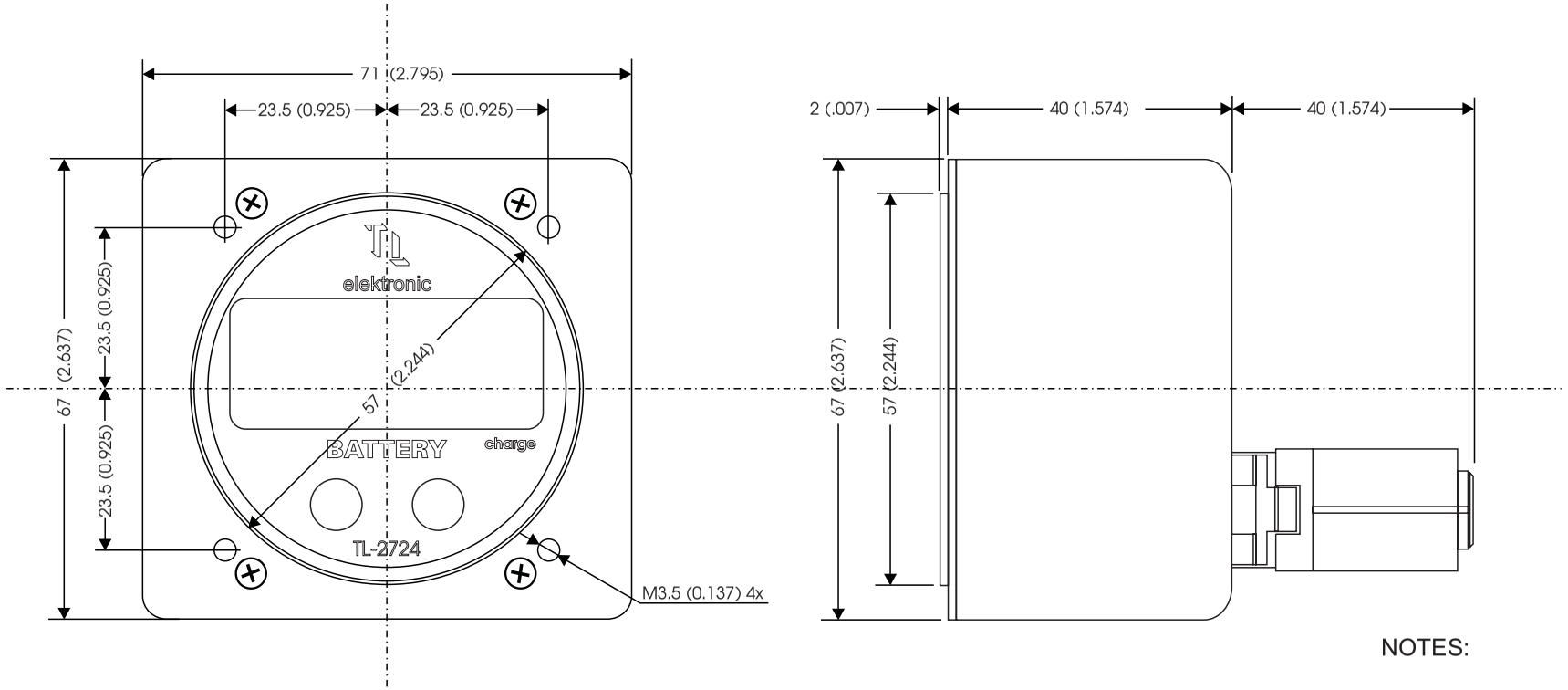
The measured voltage from the particular inputs must be connected to the instrument with a screened wire only, and both (power and ground) must be inside the screened wire.

⚠ **If some inputs are connected directly to the battery or another permanently fed power supply, install a fuse (0.5 Amps) on the positive wire, directly in front of the connector.**

2.5 INSTALLING CURRENT SHUNT SENSOR

For measuring current, the instrument requires a shunt that measures the flowing current.
Pay attention to the installation of the shunt and be particular about its proper placing: no metal parts connected with the aircraft ground should occur in the close proximity. The reason is to prevent a possible short circuit in the course of some aircraft destruction caused by a crash.

Mounting Rack Dimension



NOTES:

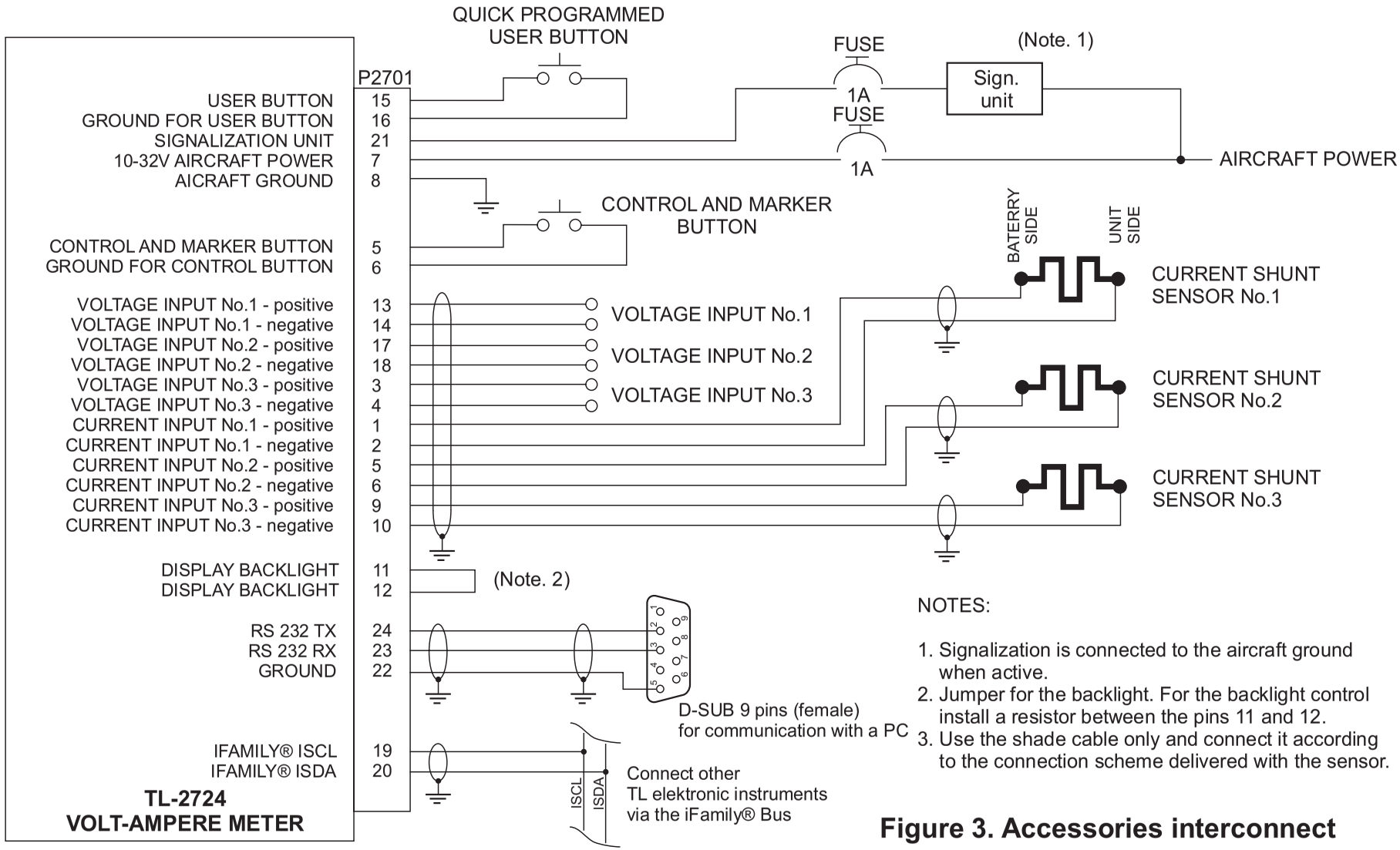
1. Dimension: mm (INCH)
2. Unit weight: 0.25 kg (0.55 lbs)
3. Mounting Rack & Hardware weight: 0.05 kg (0.11 lbs)

Figure 1. Rack Dimension

3.1 PIN FUNCTION LIST

Pin	Pin Name	I/O
1	Current No.1 - incoming side of the shunt - battery side	In
2	Current No.1 - outgoing side of the shunt - unit side	In
3	Voltage No.3 - positive terminal	In
4	Voltage No.3 - negative terminal	In
5	Current No.2 - incoming side of the shunt - battery side	In
6	Current No.2 - outgoing side of the shunt - unit side	In
7	Aircraft power	In
8	Aircraft ground	- -
9	Current No.3 - incoming side of the shunt - battery side	In
10	Current No.3 - outgoing side of the shunt - unit side	In
11	Input for backlight	In
12	Internal source for backlight	Out
13	Voltage No.1 - positive terminal	In
14	Voltage No.1 - negative terminal	In
15	Input for User button	In
16	Ground for User button input	- -
17	Voltage No.2 - positive terminal	In
18	Voltage No.2 - negative terminal	In
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

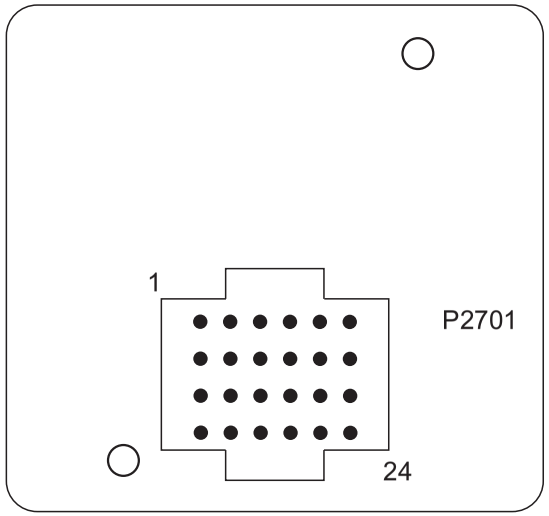


NOTES:

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 3. Accessories interconnect

Rear view of connector plate



NOTES:

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

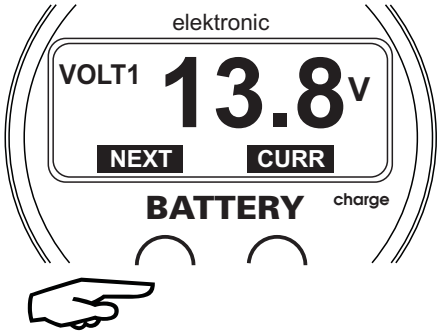
Figure 4. Connectors locate

4. NAV-MENU DESCRIPTION

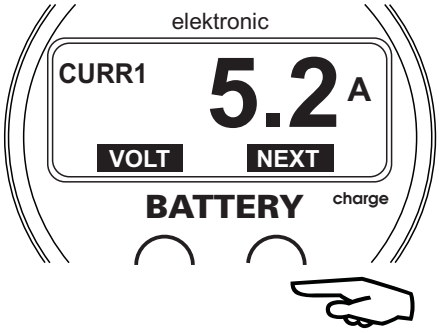
4.1 How to Control Instrument via NAV-MENU

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.

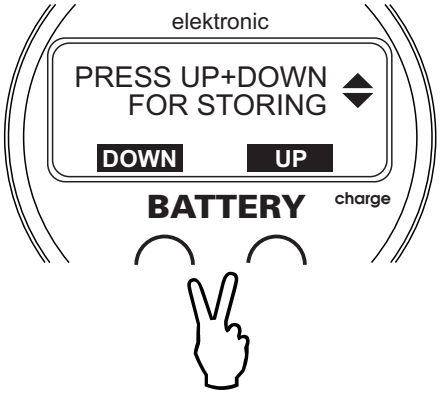
The left label is for the Left button.



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 Volt-ampere Meter 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

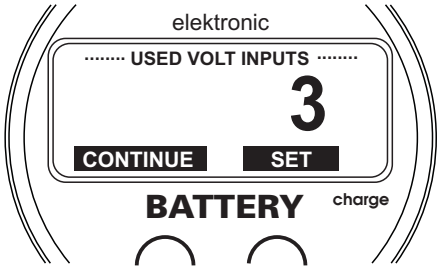
The table of the instrument configuration steps is shown below (Initial - firmware version 1.0).

0	LANGUAGE	Select your language for communication with the instrument.
1	DISPLAY CONTRAST	Select the contrast of the display.
2	PASSWORD	Select your password.
3	USED VOLT INPUTS	Set the number of voltage inputs you are going to measure.
4	USED CURR INPUTS	Set the number of current inputs you are going to measure.
5	MAIN CURR INPUT	Select the input (shunt sensor) that signalizes that the battery is not being charged.
6	CHARGING TYPE (only the ACV version)	Select the type of charging, **DC** = direct current, **AC** = alternating current.
7	MEASURING FREQ. (only the ACV version)	Enable or disable displaying frequency (for AC only).
8	ALARM SETUP	Set the alarm limits for the maximum and minimum voltage and current.
9	WARNING SETUP	Set the warning limits for the maximum and minimum voltage and current.
10	DIFFEFRENCE WARN.	Set the limit for the maximum differential voltage between the particular voltage inputs. If this limit is exceeded, the signalization will be activated.
11	USER BUTTON	Program your button to the function **SHOW MIN/MAX** = shows the minimum and maximum voltage or current.
12	VOICE WARNING	Enable or disable voice warning into your headphones (only with use of our Intercom TL-2424 or Voice Module).
13	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 with you version of firmware.

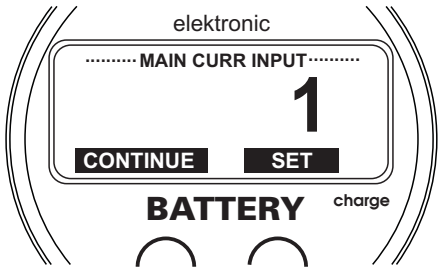
5.3 How to Select Used Inputs

In this menu, you can set the number of inputs used for measuring voltage. If you measure voltage only in one place, set 1 and use the input No.1 for measuring voltage.
If you want to measure voltage in two places, set 2 and use the inputs No.1 and No.2.
With this instrument, you can measure voltage at most in three places. Complete the same setting form measuring current.



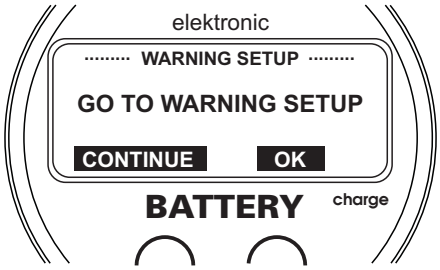
5.4 How to Select Charge Signalization

It is possible (like in a car) to signalize the charge-checking with a control lamp. For this purpose, it is possible to select a current input in this set-up that will be assigned for the charge signalization. If current flows through the shunt into an electric unit, the control lamp will light up and signalize that the battery is not being charged. However, if opposite current flows from the alternator through the shunt into the battery, the lamp control will switch off.



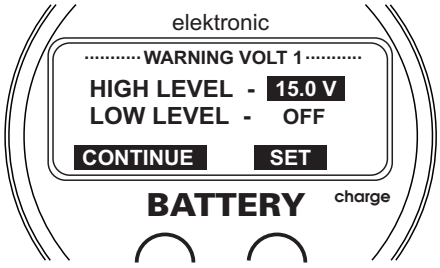
5.5 Warning and Alarm

The maximum and minimum limit values can be set at two levels in the Set-up menu. The „Warning“ message informs about the first level exceeding, the „Alarm“ message informs about exceeding the second limit and activates recording into the SchecK® drawer. You can download all exceeded values form the instrument and analyze them on your PC.



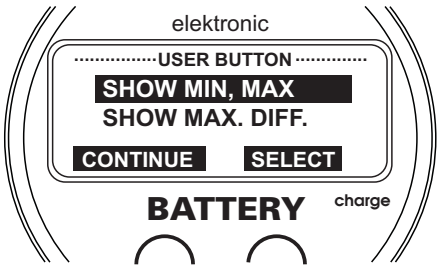
5.6 How to Select Warning and Alarm Limits

As soon as the set-up table shows, press the button „SET“; then you will be able to set the required limit on the inversely displayed position. In the voltage inputs, it is also possible to set the minimum as well as the maximum voltage for signalization. In the current inputs, it is also possible to set the maximum positive and the maximum negative current. If you set 0.0 Volt/Amps, „OFF“ will show on the display and the value will not be checked.



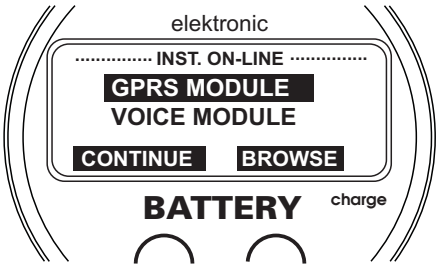
5.7 User Button

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 to the measured value indication. For example - if you have set SHOW MIN / MAX, after pressing the button you can monitor the memory of the minimum and maximum voltage and current.



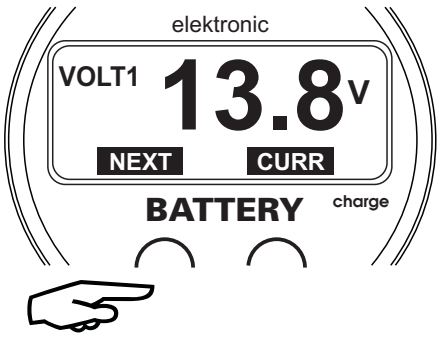
5.8 iFamily® and Other Connecting Devices

As the first of aircraft instruments, The TL-2724 enables you the connection with other instruments of the TL elektronic family in order to gain simultaneous recording of the measured values, the 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



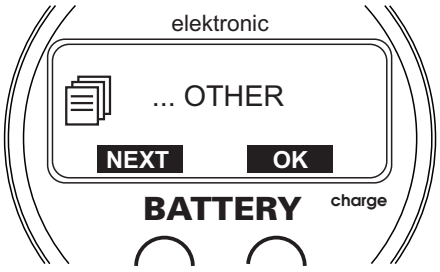
The left menu shows the information about voltage according to the table below.

Left Menu (Initial firmware version 1.0)

First	Second	Description
VOLT1		Voltage from input No.1
VOLT2		Voltage from input No.2 (if it has been set in the set-up)
VOLT3		Voltage from input No.3 (if it has been set in the set-up)
FREQ1		Frequency from input No.1 (only ACS and if it has been set in the set-up)
FREQ2		Frequency from input No.2 (only ACS and if it has been set in the set-up)
FREQ3		Frequency from input No.3 (only ACS and if it has been set in the set-up)
	SCAN ACT.	Enable Scan function
	MIN/MAX	Long-term memory of min. and max. voltage and current
	DELETE	Delete long-term memory

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.

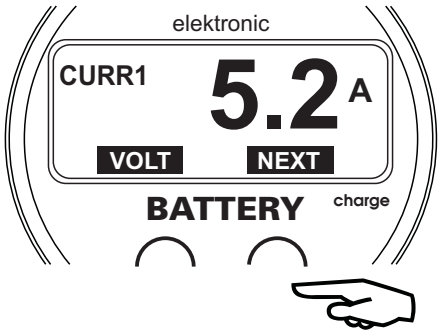
6.1.1 Second Menu



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 the maximum measured voltage, current, or you can activate the Scan function here.

6.2 Right Menu Description

The right menu shows the information about current according to the table below.



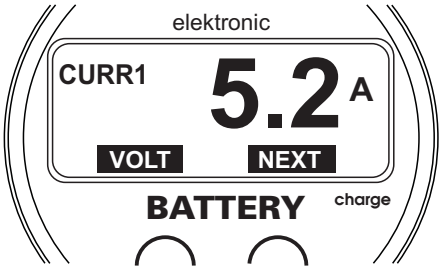
Right menu (Initial firmware version 1.0)

First	Second	Description
CURR1		Current from shunt sensor - input No.1
CURR2		Current from shunt sensor - input No.2 (if it has been set in the set-up)
CURR3		Current from shunt sensor - input No.3 (if it has been set in the set-up)

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.

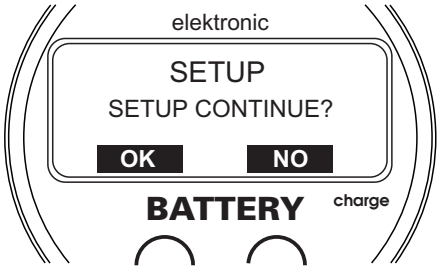
6.2.1 Exit from Right Menu

You will get back to the left menu after pressing the button „VOLT“.



6.3 How to Change Configuration

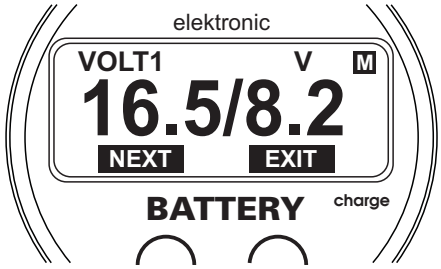
If you want to change e.g. units or contrast, press and hold both buttons and turn the instrument on. The „Setup“ message will show on the display. Press „OK“ and go to the Instrument Setup.



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

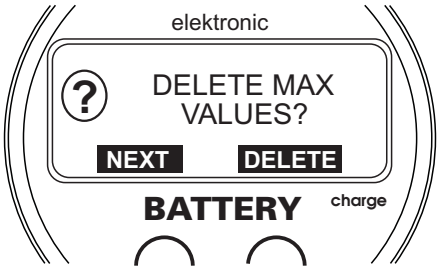
6.4 Long-term Memory of Maximum Measured Values

The inverted symbol [M] (on the black background) shown on the right indicates that the maximum or minimum voltage and current from the long-term memory are displayed. Going through the maximum and minimum values in the particular inputs is possible after pressing the button „NEXT“.



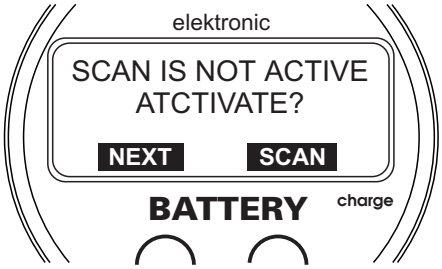
6.5 Delete Long-term Memory

The long-term memory of the maximum and minimum measured voltage and current can be deleted in this menu.



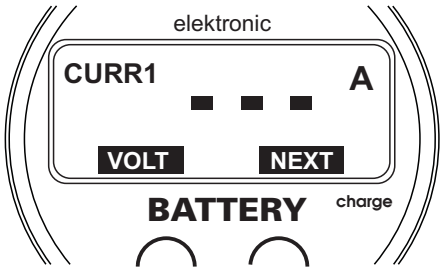
6.6 Scan Function

If you enable the Scan function, the measured inputs will alternate on the display.
You can disable the Scan function any time with the button „NO SCAN“. You can enable the function in the second menu.



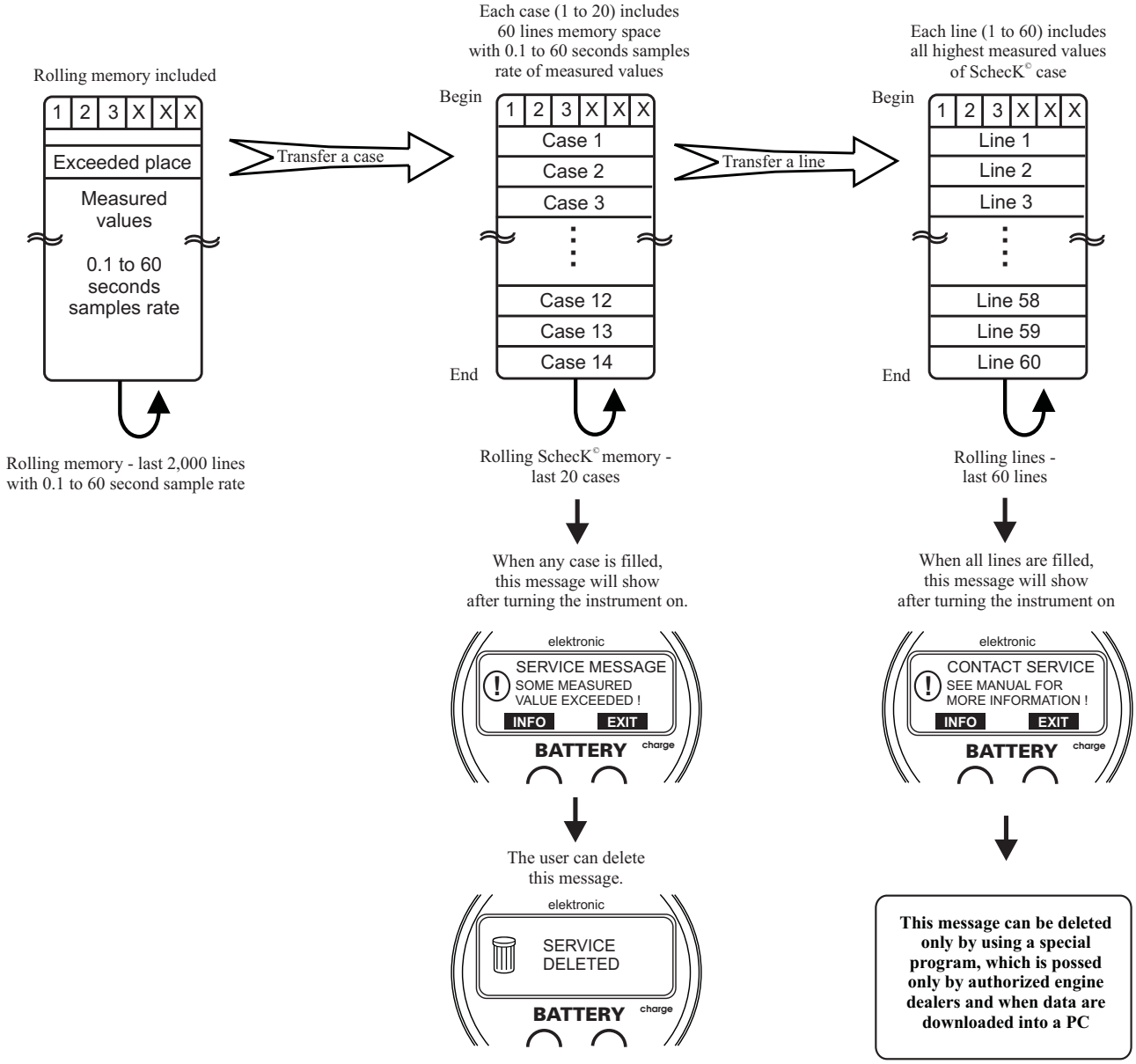
6.7 Measuring Value out of Range

When the measured voltage or current is out of range, the [----] message will show on the display.
Also when the current shunt sensor is disabled, this message will show, too.

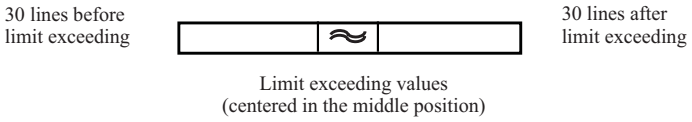


7.1 SchecK® memory description

The TL-2724 includes a 2,000 lines long-term memory and SchecK memory for storing measured values in the 0.1 to 60 second sample rate. You can download the measured data via standard PC serial cable RS-232 into Laptop or Personal Computer.



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



In this version it is possible to read last 20 records of the exceeded values.

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