



# TL-4324 USER`S MANUAL



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#### **Record of revision**

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## 1. GENERAL DESCRIPTION

### 1.1. INTRODUCTION

This manual describes the physical, mechanical and electrical features and functions of the TL-4324 Accelerometer.

### 1.2. INSTRUMENT DESCRIPTION

The TL-4324 is complete weight acceleration management. The instrument incorporates a high-precision sensor for measuring acceleration in the vertical axis and also incorporates a sensor for measuring the indicated airspeed, which enables the activation of memory recording.

The TL-4324 enables to utilize an undercarriage sensor that can also activate memory recording.

The Control and Marker Button serves for storing marks in the memory records. Pressing the button enters marks into the memory records and enables the user the manual control of the memory records.

The TL-4324 incorporates a 20,000 line long-term memory and ScheckK® memory (see page 7-1) for storing the measured values at 0.1 to 60 second sample rate.

The TL-4324 incorporates a matrix of the successive extremes, which presents the aircraft's long-term operation and is used for the aircraft operational load analysis based on your order:

- Version SPC is one-parameter matrix
- Version SPD is two-parameter matrix with center value of amplitude
- Version SPP is two matrixes with two-parameter storing of increase and decrease amplitude
- Version SPT is one matrix with two-parameter storing of increase and decrease amplitude

The TL-4324 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 acceleration.

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

<b>Width</b>	71mm (2.795 inches)
<b>Height</b>	67mm (2.637 inches)
<b>Depth</b>	92mm (3.622 inches) including connectors with cover
<b>TL-4324 Weight</b>	0.30 kg (0.66 lbs)
<b>TL-4324 Harness</b>	0.05 kg (0.11 lbs)

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### 1.3.2 General Specifications

<b>Operating Temperature Range</b>	<b>-20°C to +70°C</b>
<b>Humidity</b>	<b>95% non-condensing</b>
<b>Altitude Range</b>	<b>4600 meters max.</b>
<b>Power Range</b>	<b>10.0 to 32.0 Volts</b>
<b>Max. Signalization</b>	<b>30 Volts, 1 Ampere</b>
<b>Power Consumption</b>	<b>0.15 Ampere @ 14 VDC without gear sensor</b>
<b>Vibration</b>	<b>5 to 500 Hz</b>

### 1.3.3 Long-term Memory and Communication

<b>Storing Rate</b>	<b>0.1 to 60 seconds user selectable</b>
<b>Memory Capacity</b>	<b>Scheck® method</b>
<b>Stored Values</b>	<b>Acceleration, (Air speed - version SAS only)</b>
<b>Data Saved Endurance</b>	<b>10 years</b>
<b>Rolling Memory life-time</b>	<b>50 000 hours @ 0.1 second storing rate</b>
<b>Matrix memory Life-time</b>	<b>1 million hours @ 0.1 second storing rate</b>
<b>Communication</b>	<b>RS-232c</b>
<b>Communication Speed</b>	<b>38400 bps</b>

### 1.3.4 Landing Gear Switch

<b>Input Parameter</b>	<b>Positive pulse 8 to 32 Volts</b>
<b>Type of Switch</b>	<b>Inductive sensor of PNP type or standard gear switch connected between pins 9 and 5</b>

### 1.3.5 Instrument Measured Range / Resolution

<b>Acceleration</b>	<b>+15.0g to -15.0g / 0.1g</b>
<b>Air speed (only SAS version)</b>	<b>20 to 350 km/h / 5 km (10.8 knots to 189 knots / 2.7 knots) Absolute maximum speed 500 km/h (270 knots)</b>

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## 1.4. LIMITED CONDITIONS

### 1.5. LIMITED WARRANTY

The TL elektronik company warrants this product to be free from defects in materials and manufacture for three years from the date of purchase. TL elektronik 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 elektronik 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 elektronik warranty service station. A copy of the original sales receipt is required as the proof of purchase for warranty repairs. TL elektronik 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.**

**All maximum or minimum acceleration limits set either by the manufacturer or by the user cannot be used for flight operations on or beyond the boarder of the aircraft operational acceleration.**

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## 2. INSTALLATION

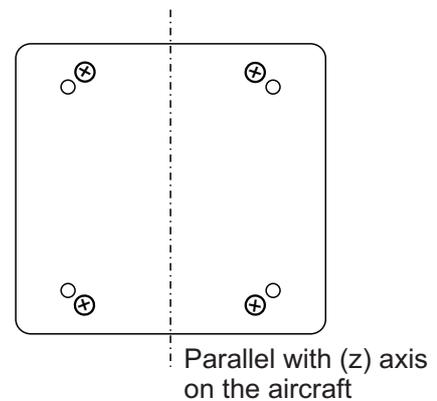
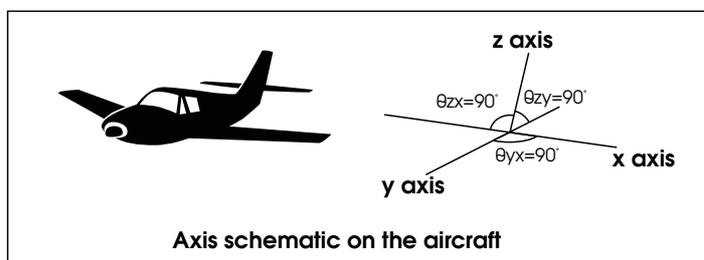
### 2.1 INTRODUCTION

Careful planning and consideration of the suggestions in this section are required to achieve the desired performance and reliability from the TL-4324.

### 2.2 INSTALLATION IN AIRCRAFT

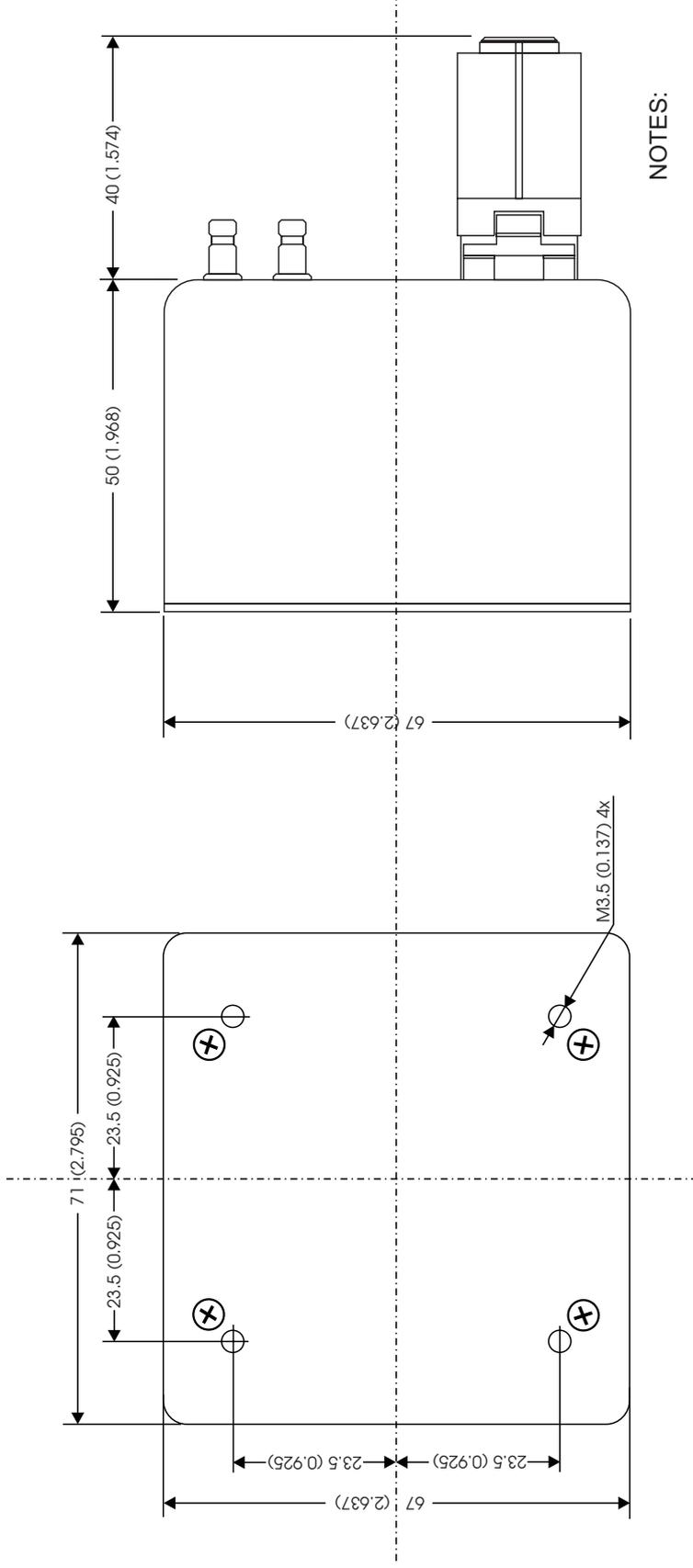
It is possible to install the Fatiguemeter in a centropfan in the aircraft supposing the operation specifications are followed. A location away from heating vents or other sources of heat generation is optimal.

- ⚠** 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.
- ⚠** Connect the static and dynamic pressure hoses into the fitting. Secure the incoming leads to prevent their effect on the hoses in the vertical and horizontal direction.
- ⚠** The instrument must be installed parallel with the aircraft axis and in a place with no vibration.



- ⚠** Check after the installation that the instrument shows the reading **+1.0g** in the downloaded rolling memory when the aircraft is standing on the straight tract

## Mounting Rack Dimension



### NOTES:

1. Dimension: mm (INCH)
2. Unit weight: 0.3 kg (0.66 lbs)
3. Mounting Rack & Hardware weight: 0.05 kg (0.11 lbs)

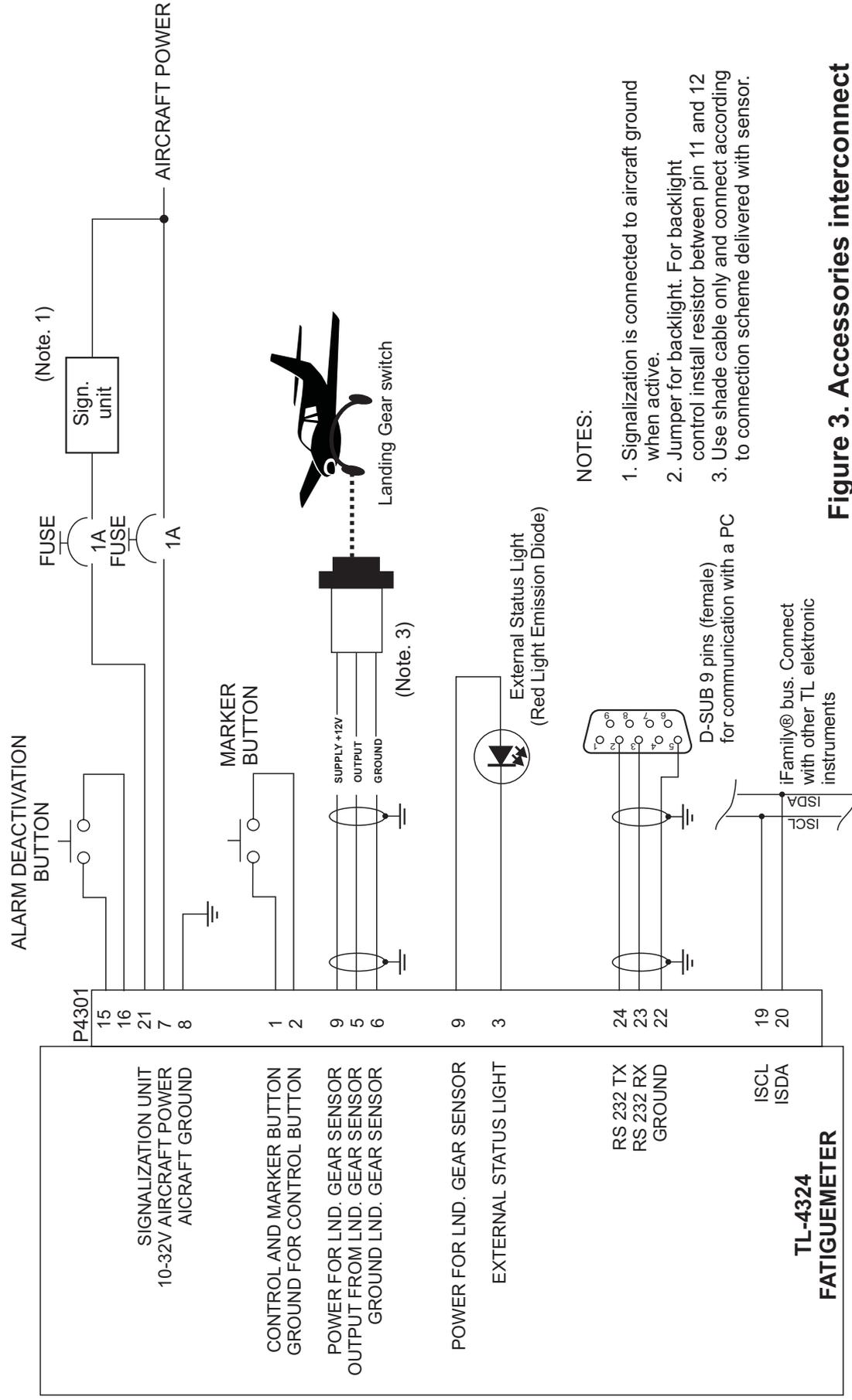
**Figure 2. Rack Dimension**

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### 3.1 PIN FUNCTION LIST

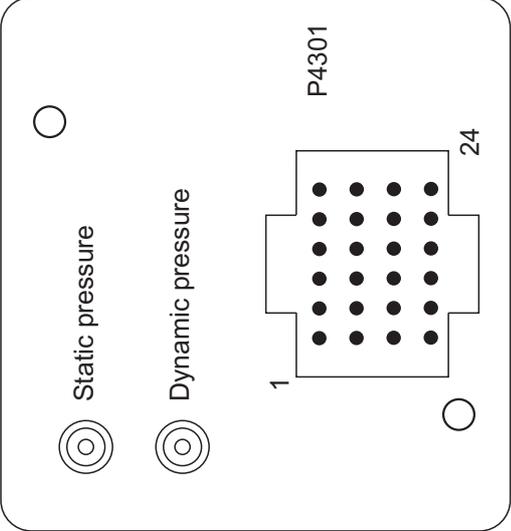
Pin	Pin Name	I/O
1	Marker button	In
2	Ground for Marker button	--
3	External status light	In
4	Ground for external status light	--
5	Output from landing gear switch (pick-up sensor)	In
6	Ground for landing gear switch (pick-up sensor)	--
7	Aircraft power	In
8	Aircraft ground	--
9	Power +12 Volts for landing gear switch (pick-up sensor)	Out
10	Do not connect!	--
11	Do not connect!	--
12	Do not connect!	--
13	Do not connect!	--
14	Do not connect!	--
15	Alarm deactivation button	--
16	Ground for alarm deactivation button	--
17	Do not connect!	--
18	Do not connect!	--
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



**Figure 3. Accessories interconnect**

**Rear view of connector plate and pressure fitting**



**NOTES:**

- 1. Secure the incoming leads to prevent their effect on the connector in the vertical direction.
- 2. Secure all leads of the static or the complete (pitot) pressure. Any leakage or untightness could cause incorrect indications of other instruments.

**Figure 5. Connectors locate**

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## 4. DESCRIPTION

### 4.1 Measured Quantities' Reliability

The Fatiguemeter TL-4324 is designed and tested for long-term autonomous monitoring of an aircraft's operation, i.e. the operational load spectrum. The Fatiguemeter TL-4324 measures the „g“ acceleration with help of the electro-mechanical component manufactured by the technology IMEMS® with 42 sensors in the chip.

** To ensure the control of the Fatiguemeter, you should install a control lamp, connected to the output No. 3, into the panel. The control lamp will inform you on the instrument's appropriate functioning. With use of this control lamp, it is also possible to monitor when the instrument starts and stops recording into the memory for distinguishing the flight and ground operation.**

### 4.2 Description of Particular Types of Memory

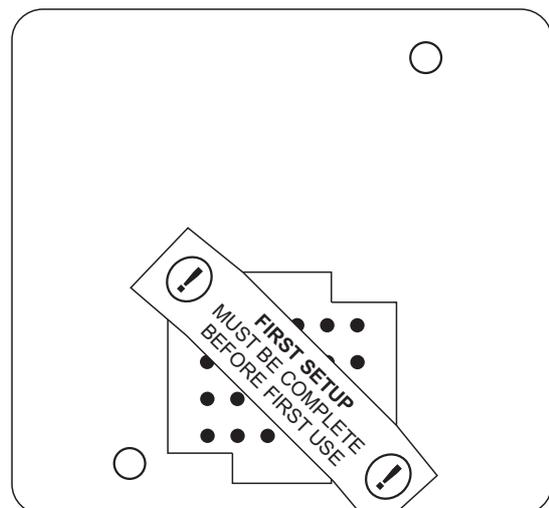
The Fatiguemeter TL-4324 incorporates several types of memory, which enable detailed monitoring of the aircraft's operation and, thus, enable the analysis in case of exceeding the operational acceleration.

Rolling memory	Recording 30 minutes of the running log with 0,1 second sample rate
Case memory	3-minute record of the acceleration history in case of exceeding the set limits
Lines memory	60 lines for recording the maximum values in case of exceeding the set limits of the positive or negative acceleration
Matrix memory	Special matrix memory with 7000 cells for the long-term record of the aircraft's operational load by the method of the successive extremes, see the versions SPC, SPD, SPP, SPT.

## 5. INSTRUMENT SETUP

### 5.1 First Instrument Turn-on

All settings are done with help of the program TL-control.exe or the website. However, if you want to use the latter, there must be installed the GPRS Communication module TL-5024 in the aircraft.



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## 5.2 Main Set-up Functions' Description

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

0	PASSWORD	Enter your password.
1	WARNING MAX	Set the warning limit for the maximum acceleration.
2	WARNING MIN	Set the warning limit for the minimum acceleration.
3	ALARM MAX	Set the alarm limit for the maximum acceleration.
4	ALARM MIN	Set the alarm limit for the minimum acceleration.
5	AIR SPEED UNIT	Select your local unit for air speed.
6	REC. ACTIVATE	Select the mode for the activation of memory recording. <b>AUTO</b> = after power supply, <b>LAND</b> = landing switch, <b>SPEED</b> = over air speed .
7	REC. ACT. SPEED	Set the air speed that activates memory recording. Note that the instrument hysteresis is +/- 3 km/h. That means that when 100 km/h has been set, the instrument starts recording at 103 km/h and stops at 97 km/h.
8	REC. TIMER	Enable or disable the timer that will show whenever recording into the memory is required.
9	ALARM MODE	Select the mode for the external signalization. <b>OFF</b> = signalization disabled. <b>EXCEEDED</b> = signalization when the acceleration is exceeded + 1 second.
10	LIGHT MODE	Select the mode for the light signalization. <b>OFF</b> = signalization disabled, <b>WHEN RECORDING</b> = light only when recording acceleration into the memory, <b>WHEN ALARM</b> = light only when acceleration is exceeded.
11	VOICE WARNING	Enable or disable voice warning into your headphones. (Only with use of our Intercom TL-2424 or Voice Module)
12	DELETE MEMORY	Delete the long-term minimum and maximum acceleration.



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

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### 5.3 How to Select Warning and Alarm Limits of Acceleration

The maximum and minimum limit values can be set at two levels via PC in the TL Control program. 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 from the instrument and analyze them on your PC.

Before setting the maximum and minimum limits, check the limits of these values in the aircraft operation manual. Set the limits stated in the aircraft operation manual into the Alarm menu. The Warning limits should be lower, so that the aircraft is operated safely.

 **The Warning limits activate signalization informing you that the set acceleration limits have been exceeded. The Alarm limits activate signalization and, in addition, the memory recording of the exceeded value, and also informs the pilot before the next flight that the set aircraft manufacturer's safety limits have been exceeded.**

 **If the memory recording is de-activated, only the Warning limit signalization is active and no data are recorded into the SchecK® memory.**

### 5.4 How to Control Recording into Memory

The memory recording can be activated or deactivated. The reason for such control is to separate the ground and the in-flight acceleration measurement. The user can decide upon the automatic, landing gear or other sensor (recording is done only during the flight) record activation.

### 5.5 Speed for Activation of Recording into Memory

Set the air speed value via PC in the TL Control program, at which you want the memory recording to be activated. This air speed activation is shown only if you have selected „SPEED“ in the REC. ACTIVATION menu.

 **Note that the instrument hysteresis is +/- 3 km/h. That means that if the air speed of 100 km/h is set, the instrument starts recording at 103 km/h and stops at 97 km/h.**

### 5.6 Recording with Timer

If you, for any reason, require the deactivation of recording after a certain period of time, tick „TIMER ENABLE“ in the program and set the time required. After the time lapse from the moment of recording activation, recording is deactivated.

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## 5.7 External Signalization Unit

The input no. 21 can be used for connecting a signalization unit that will inform you on exceeding the set limit value. You can decide on either an acoustic or visual (light) warning. Select „OFF“ if you do not want to be informed on limit exceeding.

** In case you have set the Alarm mode as a Button, while activating the alarm, the signalisation will remain active untill the Alarm deactivation button is pressed.**

## 5.8 Light Signalization

The input no. 3 can be used for connecting the signalization light (Led Emission Diode) that will inform you on exceeding the set limit value, or it can also inform you on other processes, e.g. activation/deactivation of the memory recording.

## 5.9 How to Set Analysis Filter

In the TL Control program, enter the value of the Analysis filter x 0.1 for neglecting the „g“ cycles lower than the set filter value. If you set the value 0.1g, it is the same as if the filter was off.

** For neglecting the undesirable „g“ cycles, e.g. due to vibrations in the construction or the vibrations in the engine, it is recommended to set the filter for at least 0.3g.**

## 5.10 Delete Scheck Memory of Acceleration

The Rolling, Case, Lines or Fatigue memory can be deleted by ticking the particular field and pressing the button „Delete“.

## 5.11 iFamily® and Other Connecting Devices

As the first of aircraft instruments, The TL-4324 enables you the connection with other instruments of the TL elektronik 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, the connected instruments will show in the left column of the TL Control program. It also enables checking the connected instruments and devices.

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## 6. OPERATIONAL MANUAL

### 6.1 After-installation Check

After the installation, check the correctness of all connected inputs and turn the instrument on. After turning the instrument on, both the signalization unit (input no. 21) and the light signalization (input no. 3) will light up for 1 second, which indicates that the internal check has been performed and the instrument is ready for measuring.

Before operating the instrument, place the aircraft into the flight position and activate the recording for a short period of time. After that, download the data via the TL Control program and check in the Rolling memory that the measured acceleration equals 1.0g.

### 6.2 Error Messages

After turning the instrument on, the instrument will check both the hardware and the software (e.g. the acceleration sensor or the memory for storing the measured values). In case an error occurs, the error will be signalized by the Light signalization (output no. 3)

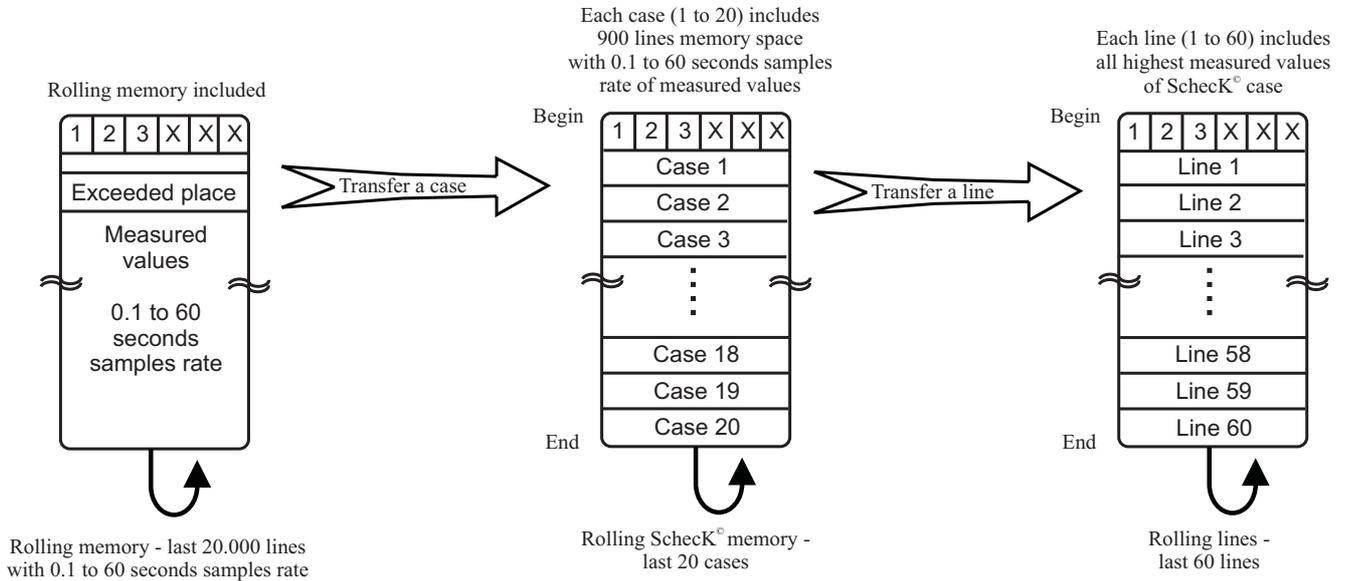
Blinking Frequency	Number	Error Description
.. .. .	2x	Integrity error of the internal configuration memory
... .. .	3x	Integrity error of the external configuration memory
.... .. .	4x	Integrity error of the SchecK® memory
..... .. .	5x	Error of the acceleration sensor
..... .. .	6x	Error of the external memory
..... .. .	7x	Error of the matrix memory
..... .. .	8x	Integrity error of the Matrix memory
..... .. .	Continuous blinking	Bootloader mode, the instrument is ready for downloading of the new firmware

### 6.3 Marker External Button

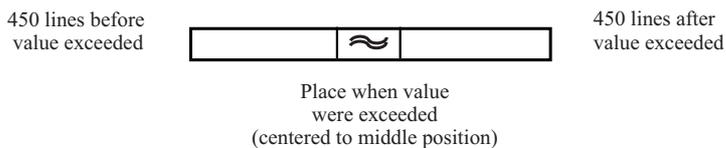
If the user needs to mark a certain part of the flight, then e.g. the number „1“ would indicate the beginning of recording. This value will always rise up by 1 if recording is activated and the Control/Marker Button is pressed again.

## 7.1 SchecK® memory description

The TL-4324 includes a 20,000 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 900 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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