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Record of revision

Revision	Revision date	1 1		Insertion date	Ву
A	15/8/07	Initial Release			
В	22/2/08	Language correction	0001		

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1. GENERAL DESCRIPTION

1.1. INTRODUCTION

This manual describes the physical, mechanical and electrical features and functions of the TL-6024 Flight Position Logger.

1.2. EQUIPMENT DESCRIPTION

TL-6024 Flight Position Logger records history of the flight including position of the plane, altitude, track time and ground speed. The information is received via GPS (Global Position Systems) that is fitted in the TL-6024. The user can download the data from the TL-6024 with his PC using a program that is supplied with the unit

TL-6024_GWG Flight Position Logger (as well as TL-6024) records history of the flight including position of the plane, altitude and ground speed. The information is received via GPS (Global Position Systems) that is fitted in the unit. However, this version is more sophisticated, as it enables wireless data transfer about the flight history via GPRS technology (General Packet Radio Service) straight to the user. This version is equipped with an Quad-band transceiver with worldwide use.

On top of that TL-6024_GWG safeguards the aircraft or its parts such as engine, storage compartment etc. In this way it works as security equipment similar to e.g. car alarms. It can also send a short message with information about battery voltage, temperature and position of the aircraft directly to the user's mobile phone. Alternatively, this information can be displayed on the user's PC via an internet browser.

The Flight Position Logger saves the data about the flight position in KML format that can be displayed in any viewer such as Google Earth.

The Flight Position Logger has memory to store approx. 250 hours of flight history with 1 sec. samples rate.

1.3. TECHNICAL SPECIFICATIONS

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

1.3.1 Physical characteristics

Width	57mm (2.244 inches)	
Height	38mm (1.496 inches)	
Depth 170mm (6.692 inches) including connectors with cover		
TL-6024 Weight	$0.20 \mathrm{kg} (0.44 \mathrm{lbs})$	
TL-6024 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	0.005 Ampere @ 14 VDC - Sleep mode
	0.150 Ampere @ 14 VDC - Normal operation
	1.58 Ampere @ 14 VDC - Transmition mode
Vibration	5 to 500 Hz

1.3.3 Long-term Memory

Memory Capacity	32MB
Stored Values	Latitude and Longitude, Ground Speed,
	Altitude, Trace Time, Signal Quality, Status
Data Saved Endurance	10 years
Memory life-time	100 000 storings
Samples Rate	1 sec

1.3.4 GPS receiver

Receiver	GPS L1 C/A-code, SPS
Number of channels	12

1.3.5 GSM/GPRS Transceiver

Frequency	Quad-band 850/900/1800/1900MHz (World wide use)
GSM Power Class 1	1W conducted power maximum (30dBm +/- 2 dB),
	measured at the antenna port
GSM Power Class 4	2W conducted power maximum (33 dBm +/- 2 dB),
	measured at the antenna port
Data Communication	TCP/IP protocol, TL elektronic encrypted protocol
EMC	FCC Parts 15 & 24, Class B, GSM 11.10, Section 12.2
	EN 55022 Class B, FCC Part 22 for GSM 850

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 flight equipment, therefore, the manufacturer will not be held responsible for any damage caused by its use.

The usage of this product is entirely up to the user's decision.

TL elektronic is not responsible for any possible consequences connected with the operation of this equipment in the aircraft, particularly if the equipment affected some other sensitive instruments in the aircraft, or if operation of the equipment infringed laws, regulations or generally accepted standards in some countries.

2. INSTALLATION

2.1 INTRODUCTION

Careful planning and consideration of the suggestions in this section are required to achieve the desired performance and reliability of the TL-6024.



⚠ To use all the features of the TL-6024 GWG it is necessary to insert an activated SIM Card for data service (GPRS) into the Flight Position Logger. It is not possible to transfer flight history data wireless without a valid SIM Card.

Please contact your mobile phone operator in regards to their pricelist, terms and conditions and possibility of receiving GPRS signal in the area, where your aircraft will be used.

2.2 INSTALLATION INTO AIRCRAFT

The Flight Position Logger can be installed anywhere on the aircraft provided that the operation specifications are followed.

Prior to the installation choose an appropriate place to install the GPS antenna.

GPRS antenna of the TL-6024 GWG version should be placed far enough from the VHF transceiver antenna so that the undesirable interference is avoided.

During the installation keep in mind that the antenna cable should not be longer than necessary in order to prevent decrement of the Flight Position Logger's sensitivity.

The antenna cable should be separate from the rest of the cables in order to prevent possible interference. If it is necessary to cut the antenna cable short, seek professional advice.



A Never fold or curl up the unused antenna cable in a coil. Cutting the antenna cable should be always done by a professional.



A It is advisable to place the equipment away from heating vents or other sources of heat.

2.3 CONNECTION TO AIRCRAFT POWER

TL-6024 GWG version must be permanently connected to battery in the sake of proper operation. You can connect the Flight Position Logger cable to either battery or terminal block (as close to the battery as possible). In composite aircraft the GND cable must be also installed as close to the battery as possible.



A Since the Flight Position Logger is being continuously charged by battery, it is necessary to install a wire fuse with the parameters specified on pg. 3-2.

2.4 GPS ANTENNA INSTALLATION

If possible install the GPS antenna on the outer top side of the aircraft, so it can receive signals from satellites without any trouble. Install the GPS antenna at least 50 cm far away from the transceiver and other antennas.

2.5 GPRS ANTENNA INSTALLATION

If possible install the GPRS antenna on the bottom side of the aircraft, so it is at least 80 cm far from the ground. In case there is a transponder antenna placed on the bottom side of the aircraft, install the GPRS antenna at least 50 cm far from this unit

2.6 ALARM LOOP CONNECTION AND DEACTIVATION KEY

In the version TL-6024_GWG the input from the connector P6001, pin no. 4 needs to be connected in the way that it creates a grounded loop. It is necessary to use switching contacts or loops through the connector in the way that in case of disconnecting the connector or opening the door the loop is disconnected

The TL-6024 GWG is supplied with a lock (key) switch that has to be connected directly to the pin no. 4, and its other terminal has to be connected to the ground.

The switch bridges the loop and, in this way, prevents the alarm activation and subsequently prevents sending information incl. calling the phone number that was set by user.

It is also possible to connect a flashing indicator, which signalizes whether the alarm is active or not, see the diagram.

2.7 MAIN SWITCH

In the TL-6024 the input from the connector P6001, pin no. 10 must be connected to the connector P6001, pin no. 8.

In the version TL-6024 GWG the input from the connector P6001, pin no. 10 must be connected to the Main Switch for proper operation.

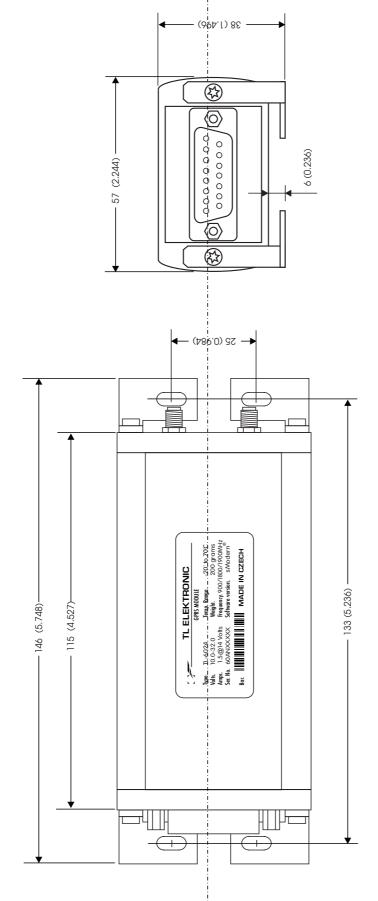
2.8 SIM CARD (only version TL-6024_GWG)

Insert the SIM card into the instrument at the side, where the Antenna connector is. To open SIM case press yellow button that is on the left.



⚠ The SIM card has to be activated for GPRS transmission (check with your local GSM provider) in order to have the Flight Position Logger working correctly.

Mounting Rack Dimension



NOTES:

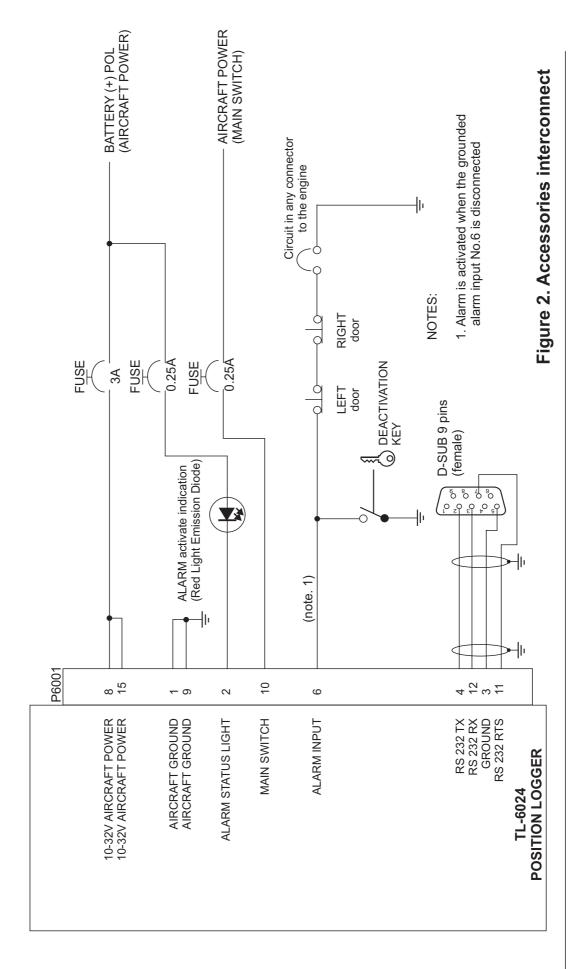
- 1. Dimension: mm (INCH)
 2. Unit weight: 0.2 kg (0.44 lbs)
 3. Mounting Rack & Hardware weight: 0.05 kg (0.11 lbs)

Figure 1. Rack Dimension

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3.1 PIN FUNCTION LIST

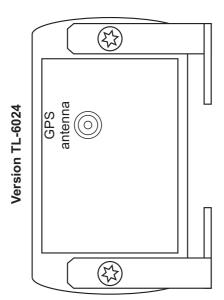
Pin	Pin Name	I/O
1	Aircraft ground	
2	Alarm and Status Light	Out
3	Ground for PC communication (RS-232)	
4	TXD to PC (RS-232) Out	Out
5	iFamily® communication ISCL	I/O
6	Alarm input	In
7	Do not connect!	
8	Aircraft power	In
9	Aircraft ground	
10	Main Switch	In
11	RTS from PC (RS-232)	In
12	RXD from PC (RS-232)	In
13	iFamily® communication ISDA	I/O
14	Do not connect!	
15	Aircraft power	In

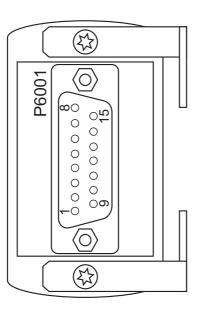


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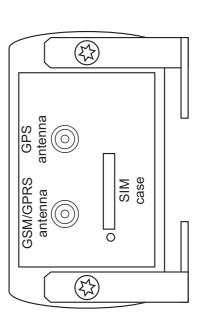
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View of connectors location





Version TL-6024_GWG



NOTES:

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

Figure 3. Connectors location

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4. DESCRIPTION

4.1 General Information

The Flight Position Logger can record basic flight information such as position of the plane, ground speed, altitude and track time and other information.

This information can be used for:

- checking students' navigation abilities while performing solo navigation flights
- posible disagreement, where the aircraft did or did not enter controlled airspace (CTR, TMA)
- in case of a complaint, for determination whether the aircraft was in the incriminated area
- flight billing at flight schools (it is possible to have an automated billing in the version $TL-6024\ GWG$)

On top of that TL-6024_GWG version can provide information about condition of the battery, temperature of the aircraft, threat of stealing the aircraft or its parts, and much more. The information can be transferred directly to the user's mobile phone. Alternatively, the information about aircraft can be displayed on the user's PC via an internet browser.

4.2 How the Flight Position Logger Works

When connecting the Flight Position Logger to a power supply or when switching on the Main Switch (in case of the TL-6024_GWG) the inner circuits and GPS receiver are activated. In case the ground speed limit (that can be set in the Setup Menu, see paragraph 5-2) is exceeded, the Flight Position Logger starts recording the position of the plane and also other values. The recording is processed once a second. If the flight lasts longer than 10sec., the record is considered as valid and the instrument continues in recording. As soon as the ground speed falls under the set limit and this lasts longer than 30sec. the flight is considered as finished and the record is finished at the point, when the ground speed fell under the set limit.

4.3 Data Collection from the Flight Position Logger TL-6024 and TL-6024_GWG

To retrieve the measured data from the TL-6024 connect the instrument to a PC and use the TL Control.exe software that is supplied with the instrument. Start the program, click on "Load" and choose a file, where the data will be stored on the disc. In case you choose a different file to the one you have used previously, all the flights will be downloaded again and saved in the new file.

Each flight is saved in the chosen file in TXT or KML format that can be displayed in a viewer such as Google Earth etc.

4.4 Data Collection from the Flight Position Logger TL-6024 GWG only

You can download the measured data from the TL-6024 GWG wireless via GPRS technology. There is also possibility to download the measured data by connecting the instrument to a PC; follow the steps described above.

Wireless transfer of the flight history is a highly sophisticated system and it is described below.

4.5 How the Wireless Transfer Works

As soon as the aircraft lands, the Flight Position Logger connects to the networks of provider via GPRS technology and TCP/IP protocol that is encrypted with the TL elektronic server. On grounds of this protocol the Flight Position Logger transfers basic flight information such as position and time of take off, position and time of landing, and length of the flight to the TL elektronic server. The information (incl. kml file showing the start and finish of the flight) is automatically processed and sent to the user's email address. The user receives this information generally within one minute. However, this depends on the supplier of GPRS service and GPRS signal quality at the landing site.

If the user requires information about the whole flight record, it is possible to download it with the help of the TL elektronic website. The client just needs to fill in his user name, password and then chose the flight(s) they need. There is also a possibility of an automatic data transfer, see section 5-2 "TRANSMIT MODE".



• On grounds of internal organisational regulations (QC-101), TL elektronic guarantees that no sensitive data is stored on the GPRS server of TL elektronic and the data is deleted immediately after sending it to the user.

4.6 Approximate Volume of the Transferred Data

Since the GPRS service (in regards to the transferred data volume) is being provided on a payment in some countries, there are approximate figures stated below:

Data transfer after landing (basic flight information such as position and time of take off, position and time of landing, flight time)	ca. 500 Byte
Data transfer of one flight that lasts approx. 1 hour (complete flight information with 1sec. sampling)	ca. 100 kByte

4.7 Flight Position Logger as Security Device

An unique feature of the Flight Position Logger is the security function that can secure the whole aircraft or some of its parts, such as storage compartment etc.

The Flight Position Logger is provided with a voice output that will call the phone number you have set and will inform you in several languages that somebody is trying to steal your aircraft or some of its parts. After that, the Flight Position Logger will send this information in an SMS message to your mobile phone or in an e-mail to your PC.



This function is controlled by the pin no. 6 (see section 2.5)



4.8 Information Provided by Flight Position Logger

It is also possible to use the Flight Position Logger for detecting the position of the aircraft, the information about its temperature, the condition of the battery and other information described in the section 5.7.

Information is transferred in intervals that are set in the unit, see section 5-2 "CONNECTION PERIODE".



5. CONFIGURATION

5.1 How to Configure Flight Position Logger

All settings are achived with the help of the TL-control.exe or via internet browser (only version GWG).

5.2 Main Set-up Functions' Description

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

0	PASSWORD	Enter your password.
1	CONNECTION PERIODE	Set the interval for connecting the TL-6024 to the server
		of the TL elektronic company.
2	TRANSMIT MODE	Select DISABLE = do not send the data after landing or
		select SHORT = send short message about the place and time
		of take off, excluding information about the whole flight course
		or select FULL = send the short message and the information
		about the whole flight course after landing
3	ALARM FUNCTION	Select ENABLE = in case of the disconnected Alarm loop,
		the TL-6024 will send an SMS message and call the set
		mobile phone number to inform on possible stealing of your
		aircraft. Or, select DISABLE = the loop will not be checked.
4	STATUS MESAGE	Select ENABLE = always before connecting the TL-6024 to
		the server of the TL elektronic company, the information on
		the position, battery condition etc. will be sent to the set
		mobile phone number. Or, select DISABLE = status message
		will not be sent. The interval for sending the STATUS
		MESSAGE is according to the "CONNECTION
		PERIODE" set by you. The information from the STATUS
		MESSAGE are available on the server of the TL elektronic
		company anytime the TL-6024 is connected.
5	AIRCRAFT TYPE	Enter type of aircraft.
6	AIRCRAFT ID	Enter aircraft identification number.
7	AUTOMATIC UPDATE	Select ENABLE = an automatic firmware update of the Flight
		Position Logger will be always performed DISABLE = an
	VOLD VODU ENUR (DED	automatic firmware update will be never performed
8	YOUR MOBILE NUMBER	Enter your mobile phone number.
9	SIM CARD PIN	Enter PIN code of your SIM card.
10	NO. OF SMS CENTER	Enter the number of the SMS center of your operator
11	VOLD EMAN	(get this information from the provider).
11	YOUR EMAIL	Enter the e-mail address to which the TL elektronic company
12	VOICE WARNING	can send you the data downloaded from your instrument.
12	VOICE WAKNING	Enable or disable the voice warning about operation and
		errors of the TL-6024 into your headphones
		(Only with use of our Intercom TL-2424 or Voice Module).



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 Set Parameters in Flight Position Logger

The whole configuration can be set on TL Control exe program that is supplied with the instrument. After starting TL Control.exe program, click on "Config" icon and then set all the parameters, see 5-2.

5.4 How to Perform Wirelless Setting of Parameters in Flight Position Logger (only version **TL-6024 GWG)**

First of all, it is necessary to register the Flight Position Logger in the GPRS server of the company TL elektronic.

Fill in the form on the website address:

http://www.tl-elektronic.com/goto.php?goto=gprs en login.php

Login: fp Password: **fp**

and follow the next instructions.

If you own more than one Flight Position Logger that information which is appropriate to individual units can be view simultaneously. To activate this in the registration form enter the assigned registration number of any Flight Position Logger and register the other Flight Position Logger in the section "Registration of other Flight Position Logger", which is to be found in the detailed information about the user.

5.5 How to Edit Detailed Information about User (only version TL-6024 GWG)

After registering, click on the icon next to the name of the aircraft's user. After that, a window shows where you have to fill in the e-mail address, to which the Flight Position Logger will send the error messages and other information. Here you can also add or delete the Flight Position Logger or edit some other information.

5.6 How to Set Interval of Flight Position Logger's Connection (only version TL-6024_GWG)

The interval for the frequency of connecting the Flight Position Logger with the server of the company TL elektronic can be set from 30 minutes up to 1 month.



A Remember that if you set a longer interval, the response to your request for downloading the data will depend on this interval. This interval does not affect, however, the immediate response in the case that somebody attempts to steal your aircraft or some of its parts. You should also remember that a short interval may cause faster discharge of your battery.

5.7 How to Set Parameters of Flight Position Logger (only version TL-6024 GWG)

After registering on our website in the section "Download", click on the icon next to the unit. After that, a window shows, where you can set some parameters of the unit.



A Remember that the performed changes will be accomplished after registering the Flight Position Logger in the server of the company TL elektronic. As soon as the Flight Position Logger loads the requests for changing the parameters in the unit, the changes or the settings will be accomplished in the unit. If the Flight position Logger is off (stand by mode), the changes will be accomplished after connection to the GPRS server of TL elektronic.

5.8 How to Set Detailed Information about Aircraft (only version TL-6024_GWG)

After registering on our website in the section "Download", click on the icon next to the identification mark of the aircraft. After that, a window shows where you have to fill in the e-mail address, to which the Flight Position Logger will send the information and the data from the instruments. It is also necessary to enter the phone number, which the Flight Position Logger will call and send SMS messages to - the information about temperature, voltage of the battery etc., or in case that somebody atempts to steal your aircraft or some of its parts.

The SMS message you will get is in the following form:

Aircraft:	OK-CZE
Position:	Airport, Prague
Temperature:	26°C
Battery:	12.6 Volts
Signal quality:	65%
Alarm status:	OK

5.9 How to Ask for Downloading Latest Version of Firmware to Unit

The Flight Position Logger detects automatically whether a new version of firmware is available. Update of the firmware is always processed automatically unless this action has been denied by the user, see section 5-2 "AUTOMATIC UPDATE".

6. OPERATIONAL MANUAL

6.1 After-installation Check

After the installation, check the correctness of all connected inputs and turn the Flight Position Logger on. After turning the unit on the Status signalization (output no. 2) will light up for 1 second, which indicates that the internal check has been performed and the unit is ready for operation.

Prior to the first take-off with newly installed Flight Position Logger; set the speed value, which activates recording into the Flight Position Logger's memory, at 5km/h (3kts) and then taxi on a runway for about one minute.

Then download the data from the Flight Position Logger on your PC via TL Control.exe program and check if the record matches the actual taxiway you have done with the plane.

6.2 Alarm, Status and Error Messages

After turning the instrument on, the instrument will check both the hardware and the software (e.g. the long-term memory, GPS receiver etc.). In case an error occurs, the error will be signalized by the Light signalization (output no. 2).

Blinking Frequency	Number	Error Description
	2sec interval	Alarm Armed
	2x	Insufficient Signal for GPS Receiver
	3x	Error in the Setting Memory
	4x	Error in the Operating Data Memory
	5x	Error in the Data Memory
	_	Data storing into Memory is Running
	Continuous	Bootloader Mode (the instrument is ready for
	blinking	downloading of the new firmaware)

6.3 Data Download in Basic Format

You can download data from the instrument via TL Control.exe in basic format and this can be then processed upon your requirements.

Sample of the TXT protocol is below

TL-6024 Log Created: 23.04.2006 07:43:30 (UTC)

TL-elektronic

TL-Control ver.1.6.8 TL-6024 ver.1.0.0

------ F L I G H T R E P O R T ------

Date and time of start flight: 23.04.2006 07:42:01 (UTC)

00:00:04

Flight identificator: 57
Number of lines: 5

Time	Possition		Gnd Speed	Altitude	Sat.	Status
UTC	Latitude	Longitude	[km/h]	[m]	Used	
07:42:01	5014.3543,N	01550.5726 , E	80	241	7	*T*
07:42:02	5014.3552,N	01550.5734 , E	85	248	7	
07:42:03	5014.3568,N	01550.5742,E	88	256	7	*B*
07:42:04	5014.3575,N	01550.5749 , E	85	248	7	*C*
07:42:05	5014.3584,N	01550.5754 , E	80	241	7	*L*

----- END OF REPORT -----

Symbols in the column "Status":

^{*}T* - Take off

^{*}L* - Landing

^{*}B* - Break

^{*}C* - Continuation in the flight after break

6.4 Data Download in KML Format

You can download data from the instrument via TL Control.exe in format, which is designed for a web browser such as Google Earth.

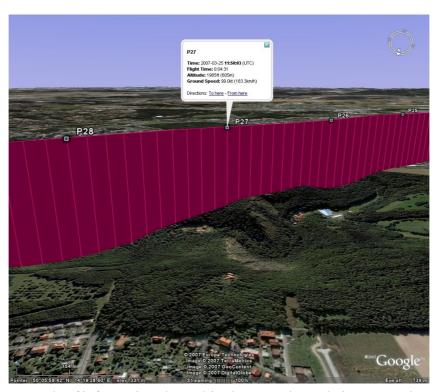
 $Sample \ of \ KML \ protocol \ in \ Google \ Earth \ web \ browser \ is \ below:$



Sample of track of the flight



Sample of the place of take-off



Sample of information about altitude, ground speed, time on track

6.5 Data Receive into Email (only version TL-6024 GWG)

Following the setting, see section 5.2 "Transmit Mode", you will receive a short email message after the flight. The message will inform you about the place and time of take-off and landing of the aircraft, alternatively about the whole flight course. The email always includes KMZ file, which can be viewed on a web browser e.g. Google Earth.

In case you have not activated data transfer after each flight, you can require record of the flight on our website at any time; go to "Download" or to this website address:

http://www.tl-elektronic.com/fp.htm

Sample of a short email message:

```
Dear User of TL elektronic equipment,
In the attachment we are sending you information on current position of your
aircraft, which you have activated through our web sites.
Aircraft: OK-JHC Flight ID: 48
----- T a k e - o f f ------
Date of take-off (UTC):
                                                  2007/04/05
Time of take-off (UTC):
                                                     8:04:31
GPS position of take-off: 49`44'26.44"N,14`38'29.12"E
Take-off airport:
----- L a n d i n g ------
Date of landing (UTC):
                                                  2007/04/05
Time of landing (UTC):
                           50`14'49.98"N,15`50'58.39"E
GPS position of landing:
Landing airport:
Total flight time:
                                                    0:53:29
Thank you for using wireless GPRS service by TL elektronic.
If you are not the intended recipient please delete this e-mail immediately.
Any unauthorized copying, disclosure or distribution of the material in this
e-mail is strictly forbidden.
Copyright 2007 - TL elektronic, generated on: 05.04.2007 09:02:08
```

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