**TechnoKom**

DOCUMENT
VERSION
**1.1**

FUEL
LEVEL SENSOR
DC 7...60 V === 30 mA

**TKLS-L**
A-RS232

S/N 10003135 | 07/2015

**TechnoKom**

www.tkls.eu

# TKLS-L

## FUEL LEVEL SENSOR

F-RS485      A-RS232

# USER MANUAL

📖  ⚙  SMS

# Table of content

# Software Copyright Notice

Products of TechnoKom referred to in this Manual may incorporate software stored in semiconductor memory or other media, copyrights to which belong to TechnoKom or third parties. Laws of the Russian Federation and other countries secure certain exclusive rights of TechnoKom and third parties to the software, which is subjected to copyright, for example, exclusive rights for distribution or reproduction.

Therefore, any alteration, reverse engineering, distribution or reproduction of any software incorporated in TechnoKom products, is prohibited to the extent provided by law.
Furthermore, purchase of TechnoKom products does not imply direct, indirect or other granting of any licenses related to copyrights, patents and patent applications of TechnoKom or any third party, except for an ordinary, nonexclusive free license for use, which is granted in virtue of law upon each sale of the product.

The communication protocol between the AutoGRAPH Series on-board vehicle tracking controllers and the TKLS-L fuel level sensors (AutoGRAPH Hardware Interface Protocol) is considered to be confidential information and intellectual property of TechnoKom. The AutoGRAPH Hardware Interface Protocol (AGHIP) shall be transferred by TechnoKom to integrators and software manufacturers only upon signing a Confidentiality Undertaking.
Unauthorized distribution of the AutoGRAPH Hardware Interface Protocol is strictly prohibited.

# Safe Operation and Installation

This section contains important information for effective and safe operation of TKLS-L fuel level sensors. Please read the information below before using the sensor.

• Sensors with damaged insulation of conductive parts, testing probe and body must not be used.

• Operational conditions of the TKLS-L such as electrical and environmental characteristics and condition of measured liquid should fit the requirements contained in this User Manual. Otherwise, the manufacturer will not be responsible for sensor safety and functional efficiency.

• All connections should be made when the sensor and external devices to be connected to the sensor are disconnected from the power supply.

# Introduction

This User Manual applies to TKLS-L fuel level sensor (hereafter – TKLS-L, sensor) produced by TechnoKom Ltd. It contains installation and connection procedures of the TKLS-L, as well as its function and control.

This Manual is intended for specialists who are aware of the maintenance and installation principles typical for motor vehicles and are proficient in using the electronic and electrical equipment of various vehicles.

To ensure the best performance of the TKLS-L, it should be installed and set up only by qualified specialists.

The TKLS-L sensor can operate both as a part of a fuel monitoring system and as a part of a fleet management system. For proper operation of the TKLS-L sensor, the customer should be aware of the operating principles of these systems as a whole, as well as understanding the functions of its individual components

........................................................................................................................................................................

**IMPORTANT**

*All information on functions, functional capabilities and other specifications related to TKLS-L fuel level sensors, as well as all information contained in this User Manual is based on current data (at time of writing) and is deemed to be valid as of the date of publication.*
*TechnoKom reserves the right to modify the information or specifications without prior notice or commitment.*

........................................................................................................................................................................

## VERSION HISTORY

This table provides a summary of the document revision.

| Version | Description | Date |
|---------|-------------|------|
| 1.0 | Initial version of the document | 07/2016 |
| 1.1 | Added conditions of storage, transportation and utilization of TKLS-L sensors<br>Updated section "Power supply connection" | 11/2016 |

# Product Overview

The TKLS-L fuel level sensor is designed to measure fuel level in a vehicle fuel tank and transfer this information to external devices via one of the supported interfaces. The TKLS-L can be used as a replacement of the factory-fitted standard fuel level sensor or as an additional sensor for fuel level monitoring.

**Modifications of TKLS-L fuel level sensor**

| Modification | Description | Connection to external devices |
|---|---|---|
| **F-RS485** | The fuel level data is transferred via RS-485 bus (in LLS and Modbus protocols) and via frequency output as pulses proportional to measured fuel level, PWM signal or periodic sequence. | • Any device equipped with RS-485 and supporting data exchange in LLS or Modbus protocols, e.g. a level indicator or an onboard vehicle tracking device); <br><br> • Any device with digital active low input supporting pulse counting within the range of frequency signal provided by TKLS-L. |
| **A-RS232** | The fuel level data is transferred via RS-232 bus and via analogue output as voltage level proportional to measured fuel level. | • Any device equipped with RS-232 bus and supporting data exchange in LLS protocol; <br><br> • Any device with analogue input supporting measuring within the range of analogue signal provided by TKLS-L sensor. |

# Technical Specification

## Common

| Description | Value |
|---|---|
| **General** | |
| Automatic calibration | Yes[1] |
| Self-diagnostic | Yes |
| Error Report | Yes |
| Remote Firmware Update | Yes[2] |
| Remote configuration | Yes[2] |
| Logging | Yes |
| Digital Input, numbers | 1 |
| **Measuring Features** | |
| Operational Liquids | Gasoline, fuel oil |
| Level Measuring Accuracy, % | ≤1 |
| Resolution, bit | 12 |
| **Operational Conditions** | |
| Operational Voltage, V | +7…+60 |
| Power Consumption at 12 VDC, mA | < 30 |
| Operational Temperature, °C | -40…+85 |
| Protection Class | IP69K |
| Probe Length, mm | 750 / 1000 / 1500 / 2000 |
| Mounting | SAE 5-bolt pattern |
| Average Life Time, years | 5 |

## Output interface

**TKLS-L F-RS485**

| Description | Value |
|---|---|
| Output Interface | 1 x RS-485 (TIA/EIA-485-A), 1 x Frequency output |
| Protocols for RS-485 | AGHIP[3] / LLS / Modbus |
| **Frequency Output** | |
| Output Frequency Range, Hz | 100…3000 |
| Output Type | Open collector |
| Maximum Load Current, mA | 200 |

**TKLS-L A-RS232**

| Description | Value |
|---|---|
| Output Interface | 1 x RS-232 (TIA/EIA-232), 1 x Analogue output |
| Protocols for RS-232 | LLS |
| **Analogue Output** | |
| Output Voltage Range, V | 0…10 |
| Minimal Input Load of External Device, kOhm | 10 |

[1] Available only for TKLS-L of the modification F-RS485.

[2] Available only for TKLS-L of the modification F-RS485.

[3] The AGHIP protocol is the AutoGRAPH Hardware Interface Protocol used by AutoGRAPH onboard controllers to communicate with TKLS-L sensors and providing exchange of additional information, e.g. error reports, logs and etc. In order to establish the communication between the AutoGRAPH controller and the TKLS-L sensor in AGHIP protocol, it is sufficient to enable the protocol in the controller as it is enabled in the TKLS-L by default and does not require any sensor re-configuration. It means that if the device, which the TKLS-L is connected to, initiates the communication in the AGHIP protocol, the sensor will automatically recognize it even if other protocol is enabled in the sensor.

# Scope of Supply

| № | Description | Qty |
|---|-------------|-----|
| 1 | "TKLS-L" Fuel Level Sensor with Plastic Cover | 1 pc. |
| 2 | Mounting Kit[1] | 1 set |
| 3 | Signal Cable in Corrugated Pipe | 7,5 m. |
| 4 | Warranty Certificate | 1 pc. |
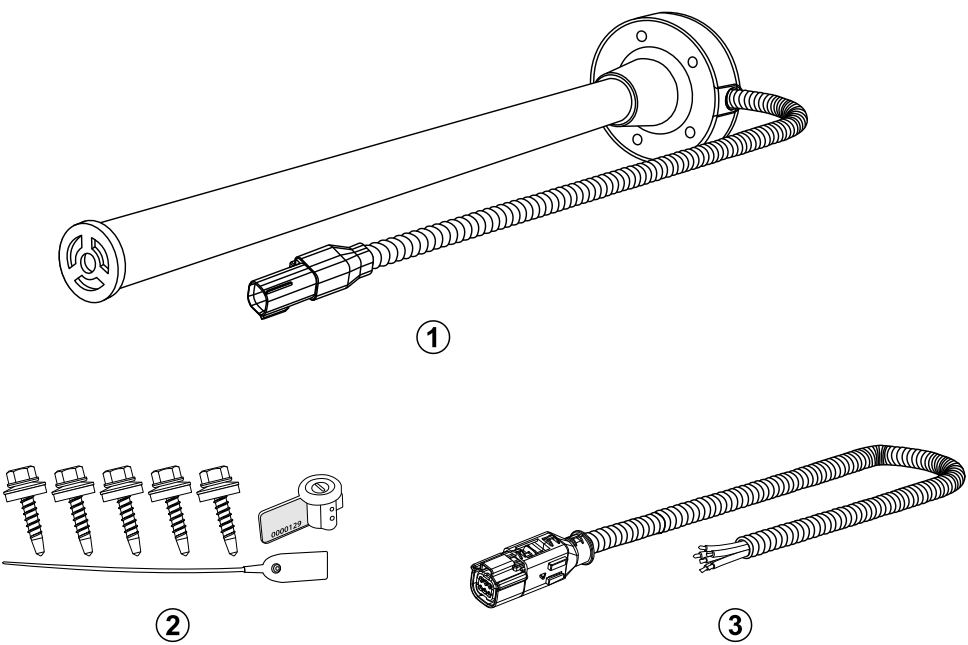


Fig.1. Scope of supply.

[1] The mounting kit includes following tools:

| | |
|---|---|
| Seal gasket | – 1 pc. |
| Self-tapping screws with mounted washer and sealing, M5 size | – 5 pc. |
| Rivet nut, knurled, M5 size | – 5 pc. |
| Machine screw, M5 size | – 5 pc. |
| Plastic seal | – 1 pc. |
| Meter seal (for connector) | – 1 pc. |
| End cap (spare) | – 1 pc. |
| Fuse with holder | – 1 pc. |

The figure given above shows just an example of the scope of supply which can differ from the real set delivered with the TKLS-L sensor.

# Components of Sensor
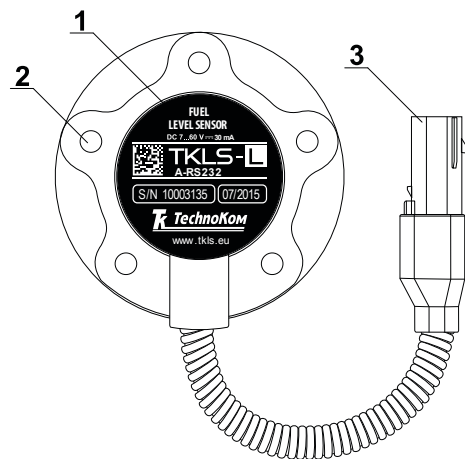


1.  **Product identification[1].**
2.  **Mounting hole (x5).**
3.  **Interface Connector 1 (male).**
4.  **Sensor cover.**
5.  **Seal gasket.**
6.  **Measuring probes.**
7.  **End cap[2].**
8.  **Sealing hole (x4).**
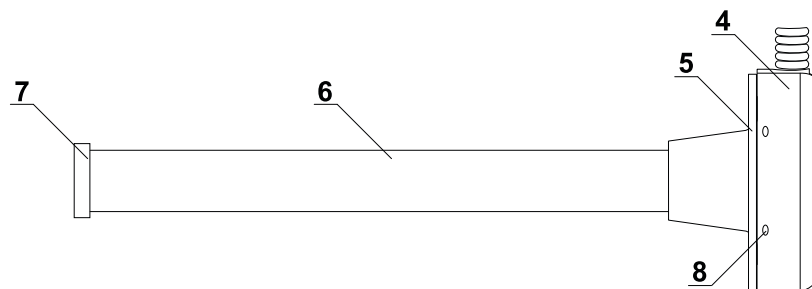
Fig.2. Components of the sensor.

[1] Device designation contains trademark and contact details of the manufacturer, device description, serial number and release date of the device.
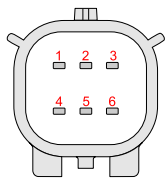[2] The sensor is supplied with a transport plug, which should be removed before sensor installation.

## Sensor designation

Given below is samples of identification labels for different modifications of TKLS-L sensor.

| Modification | Label |
|---|---|
| **F-RS485** |  |
| **A-RS232** |  |

# Interface Connectors



**Interface Connector 1 (male)**
*View from side of pins*
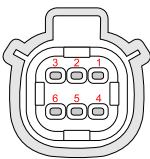


**Connector 2 (female)**
*The connector of the signal cable supplied
with the sensor. View from side of sockets*

Fig.3. Interface Connectors.

Both connectors are keyed to prevent wrong orientation.

## F-RS485

| № | | Wire Colour | Assignment |
|---|---|---|---|
| **1** | | Red | +Vin |
| **2** | | **Orange** | **RS-485 (A)** |
| **3** | | **Gray** | **Frequency output (open collector)** |
| **4** | | Black | -Vin |
| **5** | | **Brown** | **RS-485 (B)** |
| **6** | | White | Digital input (active low) |

## A-RS232

| № | | Wire Colour | Assignment |
|---|---|---|---|
| **1** | | Red | +Vin |
| **2** | | **Orange** | **RS-232 (TxD)** |
| **3** | | **Gray** | **Analogue output** |
| **4** | | Black | -Vin |
| **5** | | **Brown** | **RS-232 (RxD)** |
| **6** | | White | Digital input (active low) |

# Getting started

Before installation it is highly recommended to check the sensor for any mechanical damage.

## Select the sensor installation place

• The sensor location depends on the geometric form of the tank and should be chosen in such a way as to provide accurate readings regardless of fuel movement in the tank during vehicle motion.

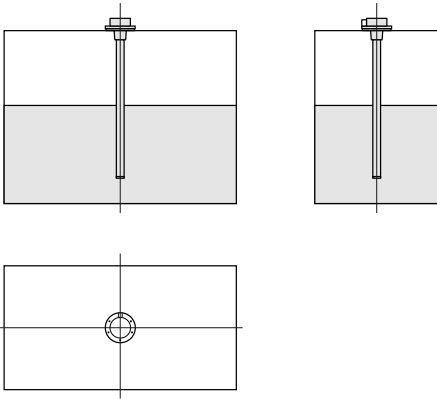• Normally, the sensor should be located at the centre of the top of the tank. See figures below:

Fig.4. Recommended variant of sensor installation.

• If it is impossible to install the sensor as shown above, it should be located as close as possible to the recommended area.

• If, due to the geometric features of the tank, one fuel level sensor does not provide the required accuracy of readings, it is recommended that several sensors are installed into the tank. A set of two sensors is commonly used in this way. In this case, the fuel level in the tank amounts to the average readings of the two sensors.
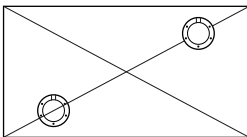
Fig.5. Recommended variant of two sensors installation.

## Prepare the fuel tank for the sensor installation

All preparation work must be performed in accordance with the safety requirements specified for the tank:

• Before installation on a petrol tank, it must be completely emptied of petrol and filled with water.

• Before drilling, ensure that there aren't any baffle plates inside in the tank in the proposed

sensor installation area within a radius of 20 mm. This can be checked by drilling a small hole (about 3 mm) in the installation area.

• Drill a central hole 35…37 mm diameter using a bimetal boring bit.
• Drill five holes for SAE-5 bolts.
• Install the seal gasket on the sensor, then mount the sensor into the tank.

## Cut the sensor length

• The sensor length can be cut to match the specific fuel tank. To do this, you should follow these steps:

• Measure the tank depth by inserting a ruler in the tank through the central hole that has been prepared for installing the sensor.

• Measure the tank depth on the effective length of the sensor L. It is recommended that the sensor is shorter than the tank depth by 10-30 mm to prevent false reading due to impurities (including water) in the bottom of the tank. The effective length of the sensor should be adjusted depending on the amount of the impurities.

• When cutting the sensor, be sure that the cut is straight and perpendicular to the roll axis of the sensor.
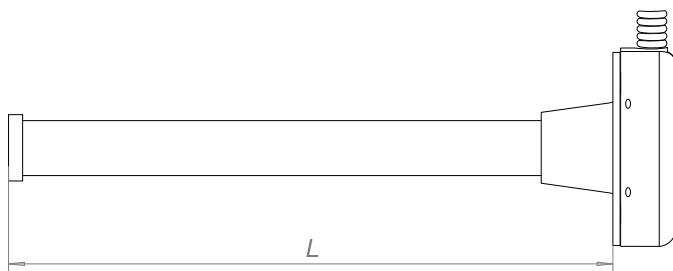


Fig.6.Length of measuring probes.

• After cutting, install the supplied end cap on the measuring probe (see figure below). Do not forget to remove the transport plug before the sensor installation.
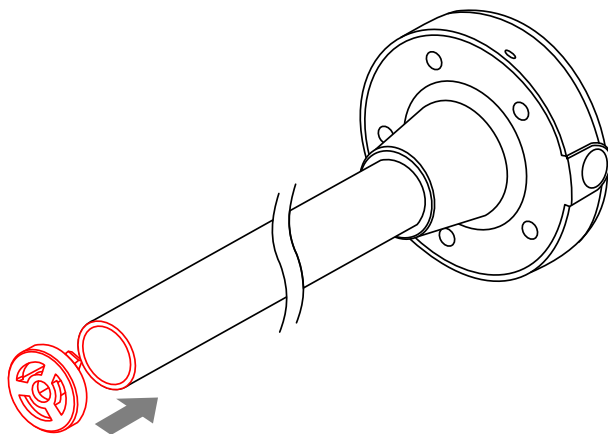


Fig.7.End cap installation.

**IMPORTANT**   *Empty/full tank and volume calibrations as well as the sensor operation without the end cap may cause incorrect fuel level measuring.*

**NOTE**   *The effective length of the sensor must be at least 150 mm after cutting.*

• After the end cap installation, it is highly recommended to set up the empty and full tanks calibration readings. The calibration can be performed using the TKLS-L configuration tool.

**IMPORTANT**   *TKLS-L fuel level sensor of the modification A-RS232 is allowed to be installed without empty/full tank calibration of analogue output if less than 30% of nominal length of the measuring probes is cut.*

## Calibrate the sensor readings for empty/full tank

The empty/full tank calibration is required to set a measuring range of the sensor.
It is highly recommended to start with an empty tank calibration and perform it before the sensor first use while the measuring probes have not been inserted in fuel yet. If the sensor is used earlier, it must be removed from fuel tank and the measuring tubes must be cleaned from fuel residues (e.g. let the fuel drain off the tubes for about 15-20 minutes after the sensor removing from fuel tank).

**To set an empty tank readings:**

• connect the TKLS-L sensor to the TKLS Configuration Tool following the instruction given in the help file for this software. The sensor readings of empty tank will be displayed on the Settings tab of the configuration tool;

• wait for about 1-2 minutes and apply empty tank readings pressing the button `<` in the "Empty tank" field. The sensor initial readings will be entered in the "Empty tank" field;

• after setting the empty tank readings, you need to perform the full tank calibration.

Fig.8. Empty tank calibration.

**To set a full tank readings:**

• connect the TKLS-L sensor to the TKLS Configuration Tool following the instruction given in the help file for this application.

• if the sensor is calibrated by inserting into a fuel storage, first turn the sensor upside down and pour about 10-20 ml of fuel into the measuring probes through the drain hole, e.g. by means of a syringe, or pour it into the measuring probes from above. Then install the sensor in the storage filled up with fuel;



• if the sensor is calibrated by pouring fuel into the measuring probes, first you need to turn the sensor upside down, block the drain hole, then fill up the measuring probes with fuel;

• the sensor readings will be displayed on the configuration tool:

• apply full tank readings pressing the button `<` in the "Full tank" field. The sensor initial readings will be entered in the "Full tank" field;

Fig.9. Full tank calibration.

**NOTE**

*It is not recommended to disconnect the TKLS-L sensor from the configuration tool during the calibration in order to prevent calibration data loss. If you need to save the calibration data, press the Save settings button on the configuration tool before disconnecting the sensor from PC.*

## Install the sensor

• Install the seal gasket on the sensor with the wide side of the seal's outer ring facing the sensor (see figure below). When installing the seal, also be sure that the mounting holes of the sensor matches the mounting holes of the seal.
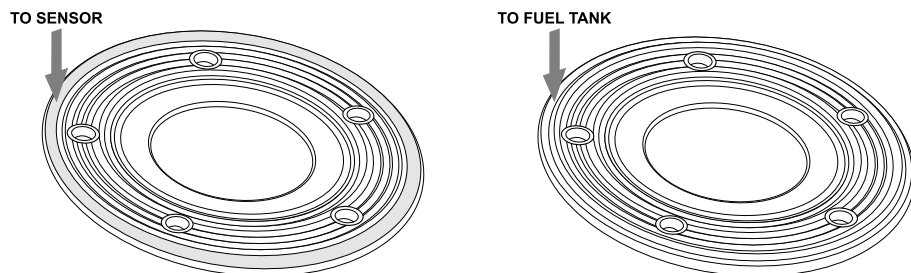
**TO SENSOR**  **TO FUEL TANK**

Fig. 10. Seal gasket installation.

• Install the sensor into the tank and tighten five fastening screws supplied with the sensor.

# Connection of the Sensor

This section covers connection procedures of the TKLS-L fuel level sensor:

• Power supply connection
• Connection of data buses (RS-485 or RS-232)
• Connection of frequency and analogue outputs

The sensor is supplied with a 7.5m signal cable in a corrugated pipe. The cable is equipped with a female connector (Connector 2) for connecting to the sensor (to Connector 1). Both connectors are keyed, which prevents incorrect orientation.

When making connections, pay careful attention to the safety rules stipulated by the regulations for motor vehicle repair procedures. All connections should be properly isolated and securely connected. If the wire is too short, it can be spliced with a wire of at least 0.5 mm$^2$ cross section (20 AWG or thicker).

**IMPORTANT** *All connections should be performed when the sensor and all external devices be connected to the sensor are disconnected from the power supply.*

# Power Supply Connection

When making the power connection, pay careful attention to the safety rules stipulated by the regulations for motor vehicle repair procedures.

The sensor is supplied with a fuse intended to provide short circuit protection of the sensor power supply circuit. The fuse holder is installed on a wire ring, which should be cut before operation.
The power supply input of the sensor is rated for a voltage of 7-60 V.

*General diagram of power supply connection to TKLS-L sensor:*

**To connect the power to the sensor you should follow these steps:**

•  Connect "+Vin" wire of the signal cable to "+Vin" line of vehicle power system and connect "-Vin" wire to "-Vin" line of the vehicle power system.

•  Connect the fuse supplied with the sensor to the "+Vin" line. The fuse should be placed as close as possible to the point where the TKLS-L is connected to vehicle power system.

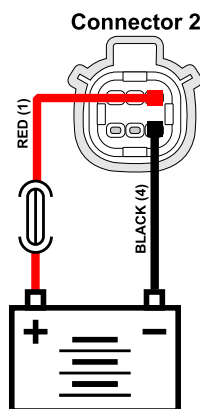•  Connect Connector 2 of the signal cable to the male Connector 1.



Fig.11.Power supply connection diagram.



*If a vehicle is equipped with battery disconnecting switch, "-Vin" line of TKLS-L sensor must be connected to on-board power system after the disconnecting switch (between the battery and the switch) in order to avoid the sensor failure. Given in Fig.12 are variants of correct and incorrect connection of the sensor power supply.*
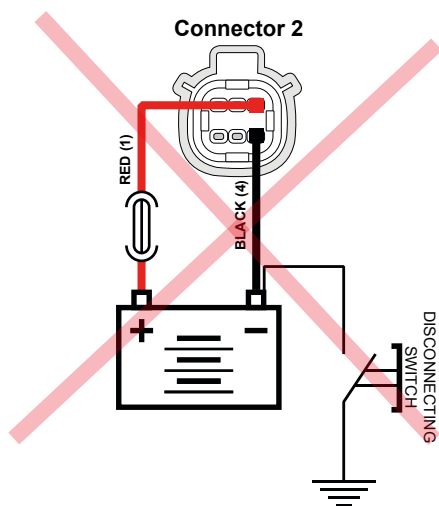
1 – Incorrect scheme.

2 – Correct scheme.

Fig.12. Power supply connection diagram.
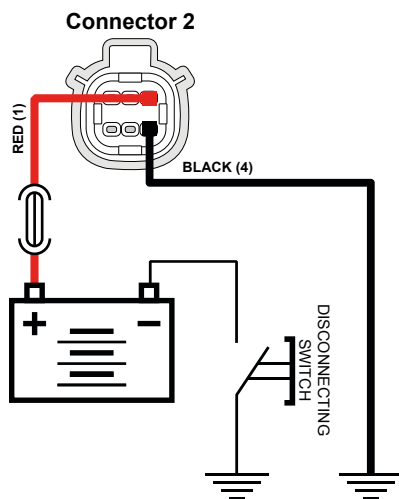
# Connection of data buses and outputs

Depending on the modification TKLS-L sensor can be equipped with RS-485 or RS-232 bus intended to transfer fuel level data to an external device with similar interface. Also TKLS-L sensor is equipped with additional output – analogue or frequency, which allows the sensor to transfer readings as an analogue or frequency signal.

Given below is an instruction on how to connect data buses and outputs of each modification of TKLS-L sensor.

## TKLS-L F-RS485 fuel level sensor

TKLS-L fuel level sensor of the F-RS485 modification is equipped with RS-485 bus and frequency output.

### RS-485 (TIA/EIA-485-A) Bus Connection

RS-485 bus allows the sensor to transfer collected data to an external unit equipped with RS-485 bus.

The TKLS-L supports the following data transmission protocols: AGHIP, LLS and Modbus which allows the sensor to connect to any external device supporting those protocols.



*The AGHIP format (AutoGRAPH Hardware Interface Protocol) is intended for communication with AutoGRAPH on-board controllers and provides transmissions of additional information.*

The TKLS-L sensor is able to transfer fuel level readings in liters, ADC stages or percent of full tank to external device via RS-485 in AGHIP or LLS protocol. To send fuel level readings in liters and %, the volume calibration table must be recorded in the TKLS-L. This option, as well as the protocol, can be configured in the TKLS Configuration tool.

**TKLS-L sensor can be connected to following devices via RS-485 bus:**

• AutoGRAPH on-board vehicle tracking device. Communication can be provided in AGHIP, LLS and Modbus protocols. When connecting to AutoGRAPH device equipped with two RS-485 buses, TKLS-L must be connected to RS-485-1;

• any third-party device equipped with RS-485 bus and supporting LLS or Modbus protocol.



*When connecting TKLS-L to RS-485 bus of an external device, be careful not to cross the "A" and "B" wires, otherwise correct operation of the sensor is not guaranteed. Also ensure that TKLS-L sensor and all external devices to be connected to the RS-485 bus are disconnected from the power supply.*

**Frequency Output Connection**

TKLS-L sensor of the F-RS485 modification is equipped with one frequency output, which is open-collector. The frequency of the output signal is proportional to the fuel level in the tank.

The output frequency range varies from 100 Hz to 3000 Hz.
Maximum load current should not exceed 200 mA.
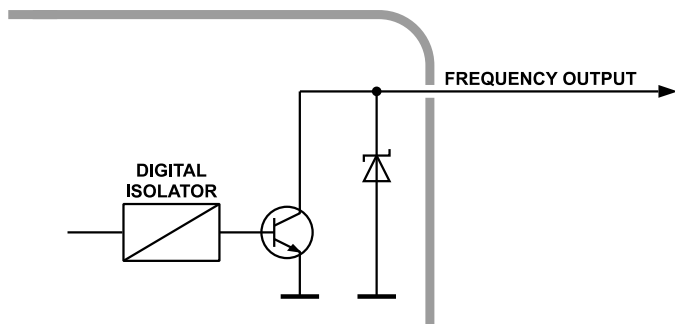
*Internal diagram of frequency output:*



Fig.13.Frequency output internal diagram.

**The frequency output is intended for connection:**

• to the digital input of the AutoGRAPH on-board vehicle tracking device, which can acquire reading in frequency form;

• to third-party device which supports frequency measuring within the range of TKLS-L sensor readings.

When connection to the AutoGRAPH controller, the sensor must be connected to one of the active low digital inputs of the controller (inputs 1-4).Before connecting to the TKLS-L, the input of the AutoGRAPH must be switched to Frequency Mode.

The configuration of third-party device must be performed according to the instructions given in the User Manual of that device.

# TKLS-L A-RS232 fuel level sensor

TKLS-L fuel level sensor of the A-RS232 modification is equipped with RS-232 bus and analogue output.

### RS-232 Bus Connection

RS-232 bus allows the sensor to transfer collected data to an external unit equipped with RS-232 an supporting LLS protocol.

The TKLS-L sensor is able to transfer fuel level readings in liters, ADC stages or percent of full tank to external device via RS-232 in LLS protocol. To send fuel level readings in liters and percent, the volume calibration table must be recorded in the TKLS-L. To set up the calibration table use the TKLS configuration tool.

### Analogue Output Connection

TKLS-L fuel level sensor of the A-RS232 modification is equipped with an analogue  output providing voltage level linearly proportional to fuel level in the tank. The analogue signal is independent from the power supply voltage of TKLS-L sensor.

The voltage range of analogue output is 0...10 V.
The input resistance of an external device which the analogue output of TKLS-L sensor is connected to must be at least 10 kOhm.

Given below are characteristics of the analogue signal provided by TKLS-L sensor:

| Voltage level of analogue signal depending the length of measuring probes | Tank filling | |
|---|---|---|
| | Empty | Full |
| Nominal length | 2.5 V | 9 V |
| 30% of the length cut-off | 0.85 V | 5.38 V |

Due to the linear dependence of analogue data from fuel level readings, the data given on the table can be used to calculate the range of analogue output readings for other length of the sensor measuring probes.
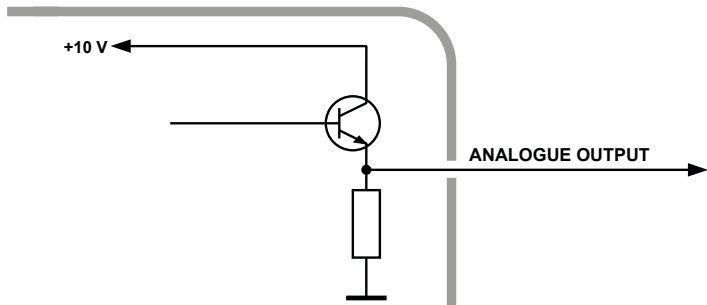
### *Internal Diagram of Analogue Output:*



Fig.14.Analogue output internal diagram.

**The analogue output is intended for connection:**
• to analogue input of AutoGRAPH on-board controller;
• to third-party device providing the measuring within the range of TKLS-L analogue signal.

When connecting analogue output of the sensor to AutoGRAPH controller, it must be connected to the analogue input 1 of the controller.

# Auto calibration

TKLS-L sensor of the modification F-RS485 support automatic volume calibration.

During the automatic calibration fuel is transferred from storage tank to fuel tank with the calibrated sensor. The transferred fuel volume is measured by a flowmeter which output is connected to digital input of the TKLS-L sensor. At each calibration step, when the required fuel volume has been transferred in the tank, the sensor waits until the fuel fluctuations in the tanks stop and takes measurements with the specified timeout. If difference between adjacent readings does not exceed the acceptable deviation, the last reading is added in the calibration table – in the form of ADC stages and frequency, along with actual fuel level in the tank, calculated using the flowmeter readings.

The TKLS-L sensor is connected to a PC via USB-RS485 Converter produced by TechnoKom. For more detailed information see section "Sensor configuration" of this User Manual.

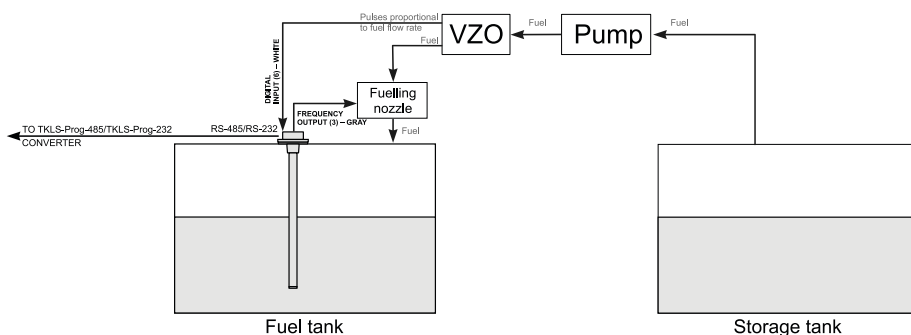**Structural diagram of auto calibration station:**



Fig.15. Auto calibration station.

**Described below is the instruction on the TKLS-L sensor auto calibration procedure:**

• Connect the sensor which is being calibrated to the TKLS-L configuration tool;

• Go to the "Settings" tab and set the sensor frequency output to the Auto calibration mode (Fig.16);



Fig.16. Frequency output configuration for auto calibration mode.

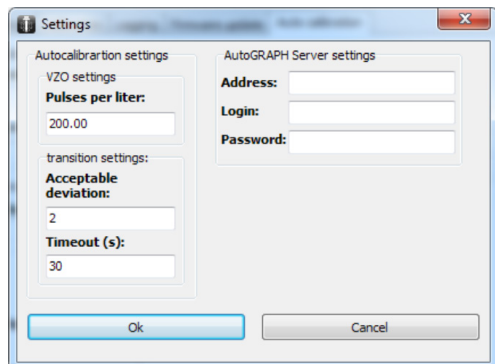• Then select Menu File – Settings... in the configuration tool;



Fig.17. Calibration settings.

• In the Settings menu (Fig.17), set up the flowmeter parameters – a number of pulses accounted for 1 litre of fuel. This characteristic is given in technical documentation on the flowmeter;

• Also set up acceptable deviation and timeout between sensor adjacent readings;

• Then apply settings by pressing OK button and go to the Auto calibration tab;

• Before starting the calibration, specify the fuel tank volume in the "Tank volume (l)" field (Fig.18). Also specify a number of calibration points in the "Number of points" field. Maximum value is 50;

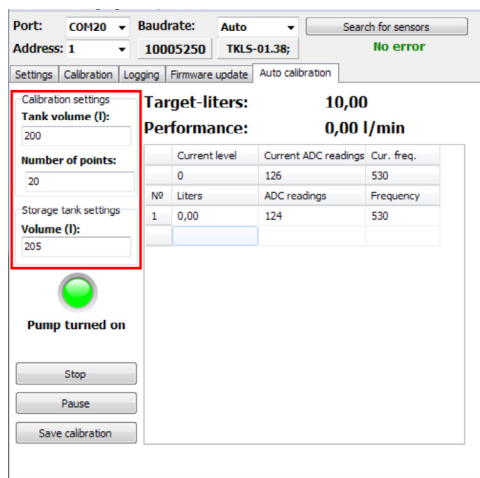• Then specify the storage tank volume in litres (Fig.18);



Fig.18. Settings on the Auto calibration tab.

• To start auto calibration, press the Start calibration tab. The pump will start fuel transition from the storage tank into the fuel tank. The current state of the pump is displayed on the Auto calibration tab – Pump is turned off, Pump is turned on. If the calibration has not started, check the frequency output mode and ensure that the Auto calibration mode is selected on the Settings tab (Fig.16);

• While calibration, calculated calibration points are added in the calibration table on the Auto calibration tab. Current readings of the TKLS-L sensor are displayed at the top of the table – current fuel level in liters, appropriate sensor readings in the form of ADC stages and frequency;

• The target-liters display fuel level achieving which starts next step of calibration;

• The performance displays fuel volume transferred by the pump per a minute;

• When the calibration is on, the status "Calibration" is displayed on the status bar (at the bottom of the window);

• To pause the calibration, press the Pause button. To cancel the calibration, press the Stop button (displayed instead of the Calibration button when the calibration is on);

• As all calibration points have been calculated, the calibration finishes (Fig.19). After that the calibration table can be saved in an external file by pressing the Save calibration button. The calibration table is saved in text file in the \Tare folder located in root directory of the configuration tool.



Fig.19.Calibration finished.

**NOTE**

*The calibration is totally managed by the TKLS-L sensor. It means that after starting the calibration the configuration tool can be closed and opened to read complete calibration data after finishing the calibration.*

# Error Codes

The TKLS-L sensor has an embedded self-diagnostic procedure that provides detection of errors during sensor operation.
The error code is transferred via RS-485/RS-232 bus in AGHIP and LLS protocols. The code is recorded in the controller as a temperature record.

## Error Code Description

| Error Code | Error / failure description |
|:---:|:---|
| -127 | short circuit |
| -126 | capacitance probe break |
| -125 | frequency out of calibration range |

Also diagnostic operation can be performed using the TKLS Configuration Tool. If an error is occurred, this will be shown in the program window.
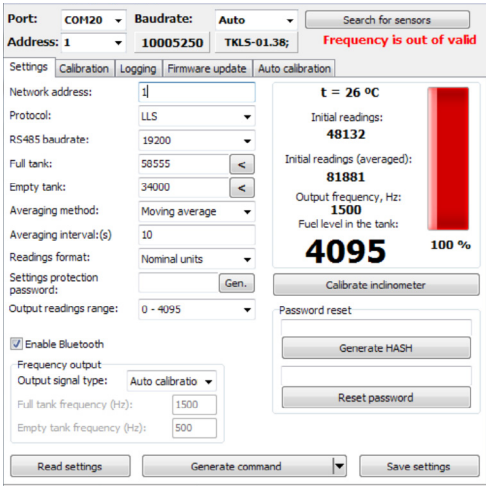


Fig.20. Sensor diagnostics.

# Sensor Configuration

The TKLS-L can be set up in the following ways:

• using the TKLS Configuration Tool – special program developed by TechnoKom specialists and intended for the sensor set up and its firmware update;
• remotely via RS-485 when the sensor is connected to AutoGRAPH controller (only for F-RS485 modification);

To set up the sensor using the TKLS Configuration Tool, it is necessary to connect the device to a PC or a laptop. For correct operation, the sensor drivers should be installed before connection. If the device drivers have not been installed, install them following the steps in the "Installing the Drivers" section.
To connect the sensor to a PC, use special converter (see fig.6).

**Depending the modification of your sensor, USB-RS485 or USB-RS232 converter is required:**
• To connect the TKLS-L sensors of the F-RS485 modification to a PC, the "TKLS-Prog-485" USB-RS485 converter is required.
• To connect the TKLS-L sensors of the A-RS232 modification to a PC, the "TKLS-Prog-232" USB-RS232 converter is required.

The converter is supplied with the adapter intended to connect the converter to TKLS-L sensor.
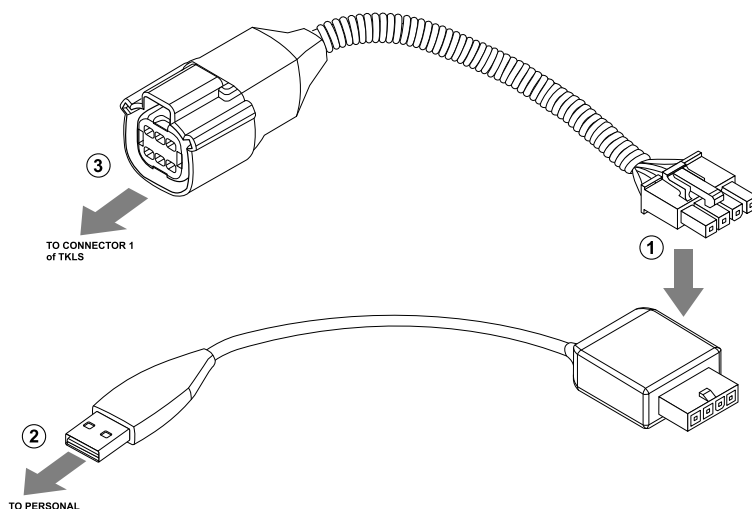


Fig.21. – Connection to a PC.

**To connect the sensor to a PC follow the steps:**

• turn off the sensor power supply;

• connect the 4-pin connector of the TKLS-Prog-485/TKLS-Prog-232 to the 4-pin connector of the adaptor (see fig.6, step 1);

• connect the USB cable to the PC (fig.6, step 2);

• connect the free end of the adaptor (Molex connector) to Connector 1 of the sensor (fig.6, step 3);
• if the sensor drivers have been installed previously, the connected device will be automatically recognized;
• open the TKLS Configuration tool and establish the connection to the sensor COM-port.

The TKLS Configuration tool provides configuration of the sensor via the RS-485/RS-232 bus.

Also the settings can be specified in the Configuration tool and sent to TKLS-L via data server.

Remote configuration is available only for TKLS-L sensors of the F-RS485 modification.

..............................................................................................................................................................

**NOTE**    *For more information on the TKLS Configuration tool see "TKLS Configuration tool" help file.*

..............................................................................................................................................................

# Driver Installation

This section covers an installation procedure of the TKLS-L driver. For proper operation the AGUSB Driver must be installed before the sensor connection to a PC. This driver can be downloaded for free from the official website of TechnoKom. The AGUSB Driver is compatible with MS Windows 7, 8, Server 2003, Server 2008 (x86 и x64).

**To install the driver:**

• Connect the sensor to a PC.

• The system will automatically search for a new equipment.

• If the Internet connection is available, the TKLS-L driver will be automatically downloaded from Windows Update server and installed. If the Internet connection is not available, continue with the procedure outlined below.

• Download the archived drivers folder from the official website of TechnoKom and extract files to a temporary directory on a hard driver.

• Launch the driver update wizard and select "Browse my computer for driver software" to search for the drivers manually.

• Install the driver. When the drivers is installed the system will automatically identify connected device. The sensor is ready to operate with configuration and troubleshooting applications.

# Modbus Register Mapping

The TKLS-L of the modification F-RS485 is capable of communication via the RS-485 serial bus in the Modbus/RTU protocol. The TKLS-L supports the Modbus function 03 – Read Holding Registers.

| Address (HEX) | Description |
|---|---|
| 0x00 | TKLS-L address |
| 0x01 | RS-485 baud rate (high bit) |
| 0x02 | RS-485 baud rate (low bit) |
| 0x03 | Full calibration (high bit) |
| 0x04 | Full calibration (low bit) |
| 0x05 | Zero calibration (high bit) |
| 0x06 | Zero calibration (low bit) |
| 0x07 | Averaging time / weighting coefficient (%) |
| 0x08 | Temperature |
| 0x09 | Raw fuel level data (high bit) |
| 0x0A | Raw fuel level data (low bit) |
| 0x0B | Fuel level |
| 0x0C | Serial number (high bit) |
| 0x0D | Serial number (low bit) |
| 0x0E | Averaging method |
| 0x0F | Output frequency when tank is full |
| 0x10 | Output frequency when tank is empty |
| 0x11 | Averaged raw fuel level data (high bit) |
| 0x12 | Averaged raw fuel level data (low bit) |
| 0x13 | Error code (high bit) |
| 0x14 | Error code (low bit) |
| 0x15 | Roll angle |
| 0x16 | Pitch angle |

# Storage

TKLS-L sensors must be stored in dry and ventilated warehouses without air conditioning facilities.
TKLS-L storage is allowed only in original packaging at temperature range from -50 to +50° C and relative humidity up to 98% at +35° C.
TKLS-L storage in the same room with substances that cause metal corrosion and / or contain aggressive impurities is not allowed.

# Transportation

TKLS-L in packaging may be transported by rail (in heated closed waggon), road, water, and air (in heated pressurized container) and without any limitation of distance, speed, altitude if total transportation duration does not exceed 3 months and the sensor protection from direct effect of solar-radiation, atmospheric precipitation, shocks, and falling is provided. The transportation should be carried out in accordance with rules and regulations specified for a certain mean of transport.

Transportation conditions should comply with requirements:

• it is not allowed to drop and cant the packages containing TKLS during loading and unloading;

• packages must be securely fixed against moving during the transportation;

• TKLS-L must be protected from moisture, dust, ingress of aggressive environment and corrosive substances;

• a facility to fasten the package containing TKLS-L sensors to transport body using an attachment fitting must be provided;

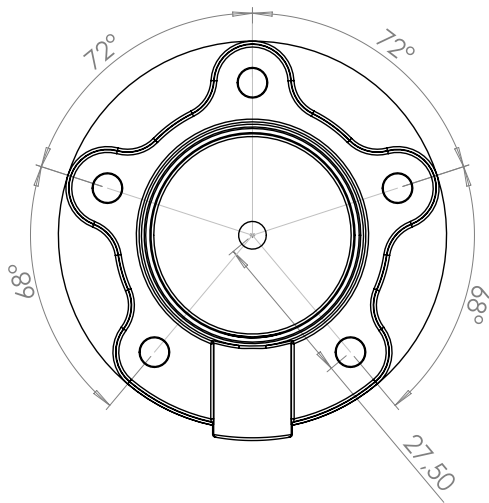• brick acceleration in any direction must not exceed 10g during the transportation.

The transportation packaging containing TKLS-L sensors must be sealed in reliable way excluding any possibility to access the packaged sensors without damage of the seal.

# Utilization

TKLS-L fuel level sensor does not contain harmful substances and ingredients that are dangerous to human health and environment during and after the end of life and recycling. Plastic materials and base metals are recyclable.

# Appendix

**APPENDIX 1: SAE-5 MOUNTING.**

**TK TechnoKom**

FUEL LEVEL SENSORS