

LiGO

DATA SHEET FUEL LEVEL SENSOR

DOCUMENT
VERSION

2.0.1



Highlight Feature:

99.5%

High accuracy up to 99.5%



1500V

Galvanic separation



+85
-40

Good operating temperature from -40 - 85 °C



IP67

Measures against dust and water IP67



Certification Quatest 1

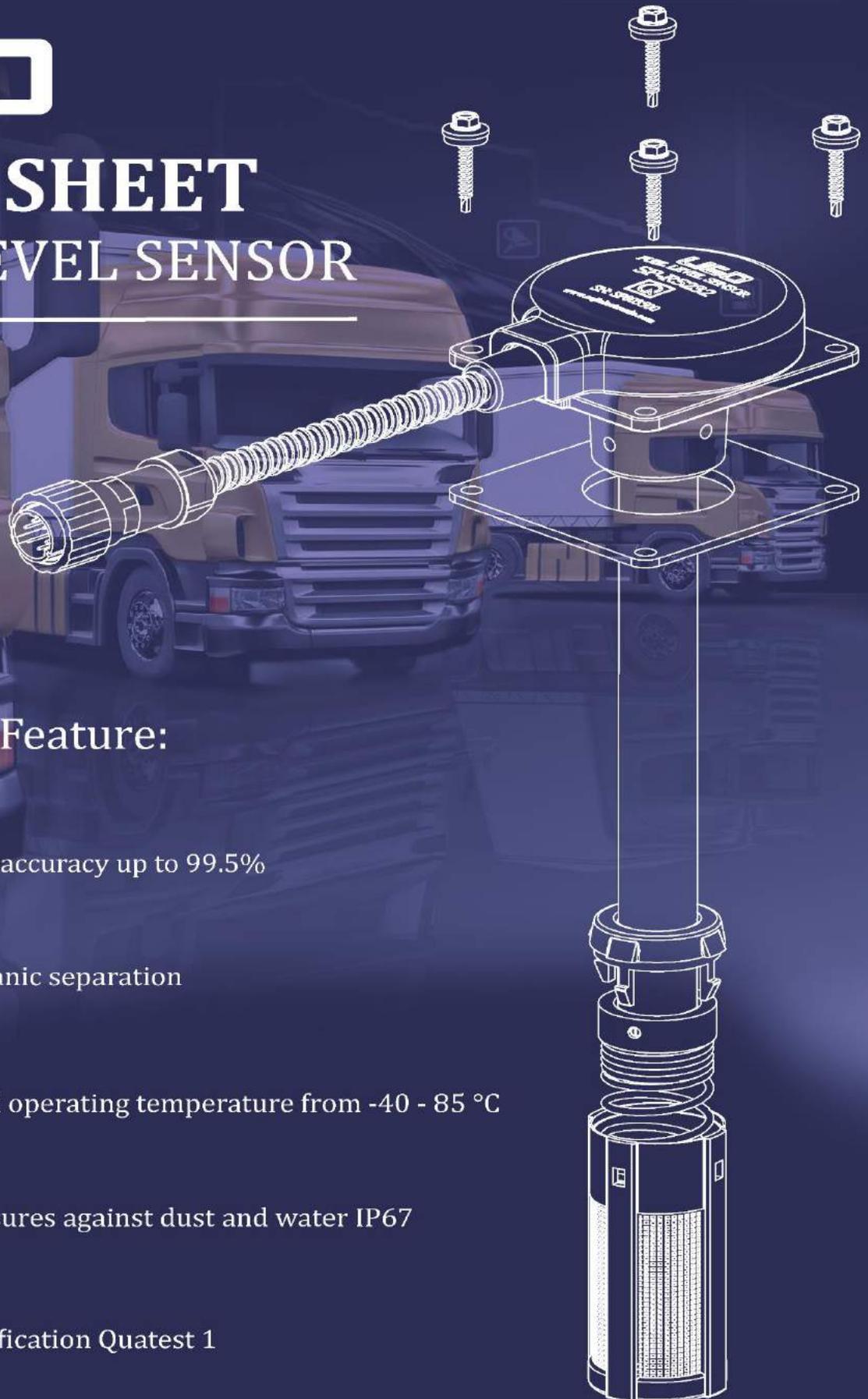




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I. GENERAL INTRODUCTION

LIGO Fuel level sensor is produced and developed by SOJI Electronics Limited Company. The device is designed to measure the level of liquid fuel and other non-conductive liquids in vehicle's tanks and stationary fuel storage, applicable in different fields. The measured values will be transmitted to an external device as an output signal such as: Analog, Frequency, RS232, RS485... in order to connect to an external device.

Under particular conditions, the device can reach a high accuracy up to 99.5%. At present, on the market there are several lines of sensor used to measure fuel level, possessing different technologies such as: magnetically operated switches (reed switches), ultrasound wave (ultrasonic sensor), capacitive sensing (capacitive sensor). Among these ones, capacitive sensing technology is considered to have highest accuracy and best device lifespan.

II. KEY FEATURES

1. High accuracy up to 99,5%.
2. Wide operating voltage range (only applicable to LIGO-SP-PRO with the voltage from 7.5 to 75V).
3. Inside isolation voltage up to 2500V (only applicable to LIGO-SP-PRO).
4. Can be optionally cut off or prolonged up to 6000mm.
5. Automatically recognizes new length after being cut.
6. Wide operating temperature range from -40°C to +85°C.
7. A filter protects the probe from dregs and water.
8. IP67 waterproof standard.
9. Interference filter and thermal error compensation system.
10. Installation and configuration software... on PC though a Connection Device.
11. Quick installation, security seal.

III. GENERAL APPLICATIONS

Trucks, container cars, excavators, trains...

Boats, barges.

Electric generators.

Industrial oil storage tanks and stationary storage tanks.

Factories, industrial zones.

Fuel storage tanks in agricultural machines and maritime transportation...



IV. TECHNICAL SPECIFICATIONS

Technical specifications of the LIGO-SP product

PARAMETER	AF	RS232	RS485
Standard length (L),mm	700, 1000, 1500...up to 6000 mm	700, 1000, 1500...up to 6000 mm	700, 1000, 1500...up to 6000 mm
Measuring error, %	± 0.5 %	± 0.5 %	± 0.5 %
Output signal	Analog (1-10V), Frequency (500- 2000Hz).	RS232	RS485
Baud rate, bit/sec	9600	2400, 4800, 9600, 19200, 38400, 57600, 115200.	2400, 4800, 9600, 19200, 38400, 57600, 115200.
Power supply (DC input voltage, V)	9-37	9-37	9-37
Maximum power consumption, mA	20	20	20
Waterproof standard (Ingress protection rating, IP)	IP67	IP67	IP67
Operating temperature, °C	-40...+85	-40...+85	-40...+85
Maximum allowed humidity level,%	100	100	100
Resolution, bit	12	12	12
Digital reading range corresponding to the minimum level measurement value	Analog (1...9V); Frequency (500...1500 Hz)	0	0
Digital reading range corresponding to the maximum level measurement value	Analog (2...10V); Frequency (1000...2000 Hz)	4095	4095
Average sampling period, s	0...120	0...120	0...120
Message interval, s	Continuous	1...60	1...60
Absolute error in temperature measurement within the entire temperature measuring range, °C	±2	±2	±2
Average service life, years (minimum)	8	8	8



Technical specifications of the LIGO-SP PRO product

- LIGO-SP PRO product is designed to applied to devices having wide input voltage (7.5-50V), the voltage of the internal sensing printed circuit board isolated from outside is 2500V. The internal temperature sensor has a very low error rate at <math><0.6^{\circ}\text{C}</math>. The product is designed to operate in extreme environment.

PARAMETER	AF	RS232	RS485
Standard length (L),mm	700, 1000, 1500...up to 6000 mm	700, 1000, 1500...up to 6000 mm	700, 1000, 1500...up to 6000 mm
Measuring error, %	$\pm 0.5 \%$	$\pm 0.5 \%$	$\pm 0.5 \%$
Output signal	Analog (1-10V), Frequency (5s00- 2000Hz).	RS232	RS485
Baud rate, bit/sec	9600	2400, 4800, 9600, 19200, 38400, 57600, 115200.	2400, 4800, 9600, 19200, 38400, 57600, 115200.
Power supply (DC input voltage, V) 2500V internal isolated	7.5-75	7.5-75	7.5-75
Maximum power consumption, mA	20	20	20
Waterproof standard (Ingress protection rating, IP)	IP67	IP67	IP67
Operating temperature, $^{\circ}\text{C}$	-40...+85	-40...+85	-40...+85
Maximum allowed humidity level,%	100	100	100
Resolution, bit	12	12	12
Digital reading range corresponding to the minimum level measurement value	Analog (1...9V); Frequency (500...1500 Hz)	0	0
Digital reading range corresponding to the maximum level measurement value	Analog (2...10V); Frequency (1000...2000 Hz)	4095	4095
Average sampling time, s	0...255	0...255	0...255
Message interval, s	continuous	1...60	1...60
Absolute error in temperature measurement within the entire temperature measuring range, $^{\circ}\text{C}$	± 0.6	± 0.6	± 0.6
Average service life, years	10	10	10



TECHNICAL CHARACTERISTICS

1. Voltage output signal depending on the probe length

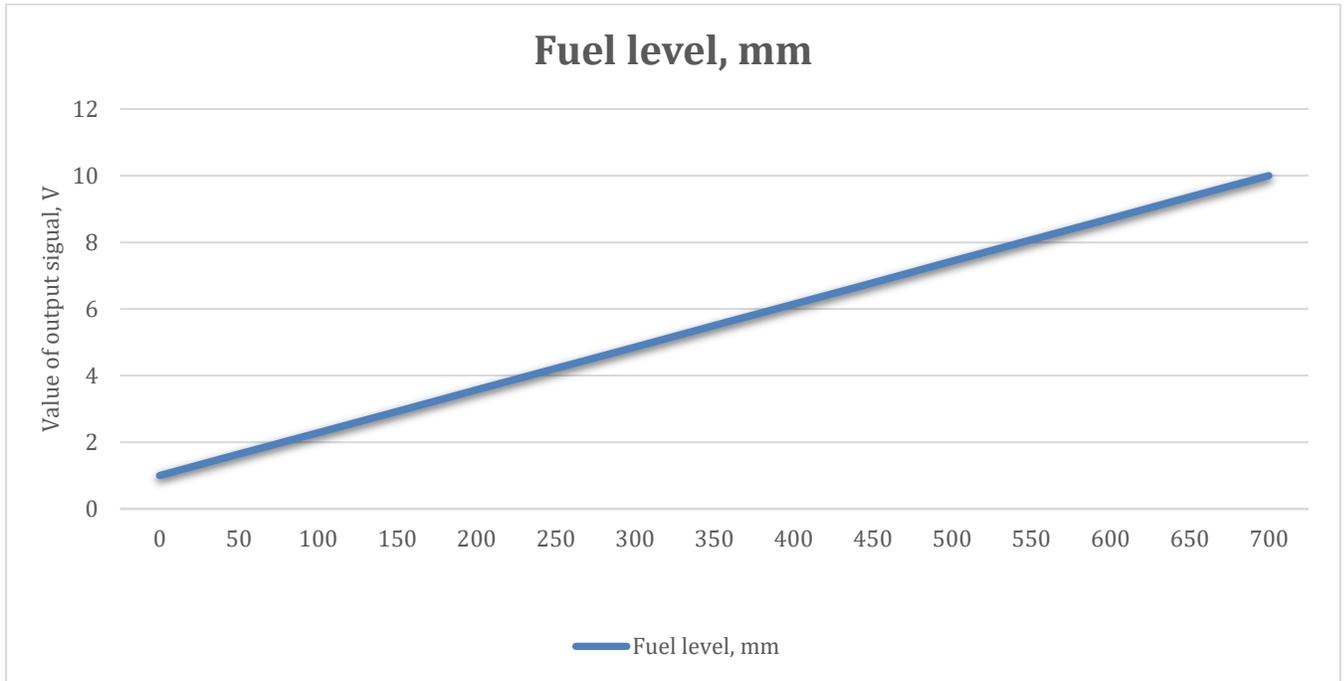


Figure 1. Dependence of the voltage output signal on the fuel level. Operating voltage range from 0-10V.

2. Frequency output signal depending on the probe length

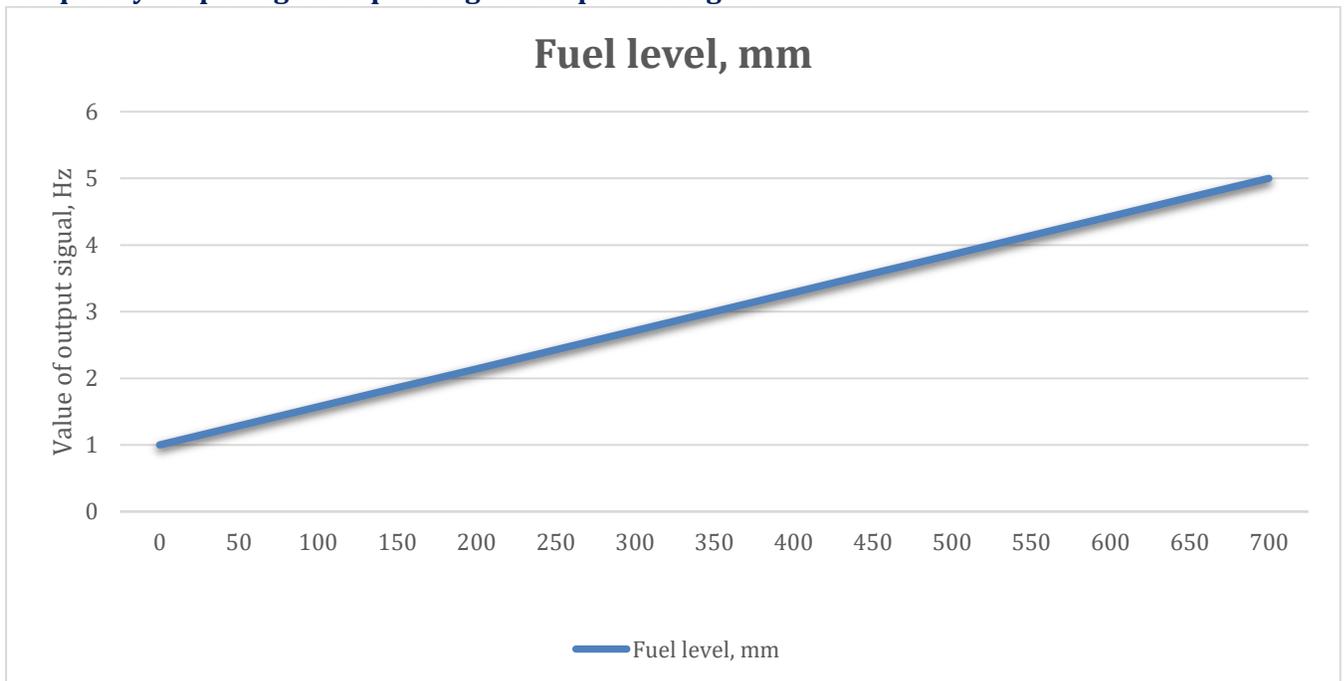


Figure 2. Dependence of the frequency output signal on the probe length. Operating frequency range from 500-2000Hz.



3. RS232/RS485 output signal depending on the probe length

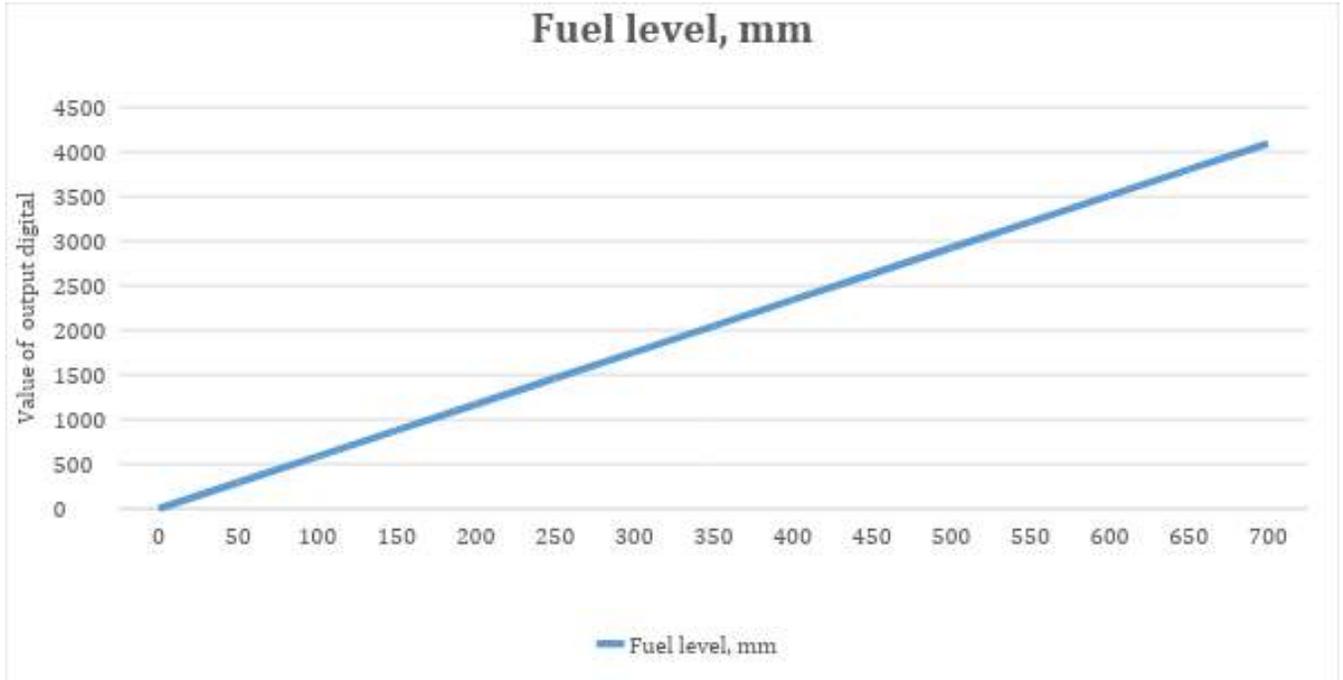


Figure 3. Dependence of the RS232/RS485 output signal on the probe length. Measurement range from (0-4095)

V. OVERALL DIMENSIONS AND DETAILED DESCRIPTION

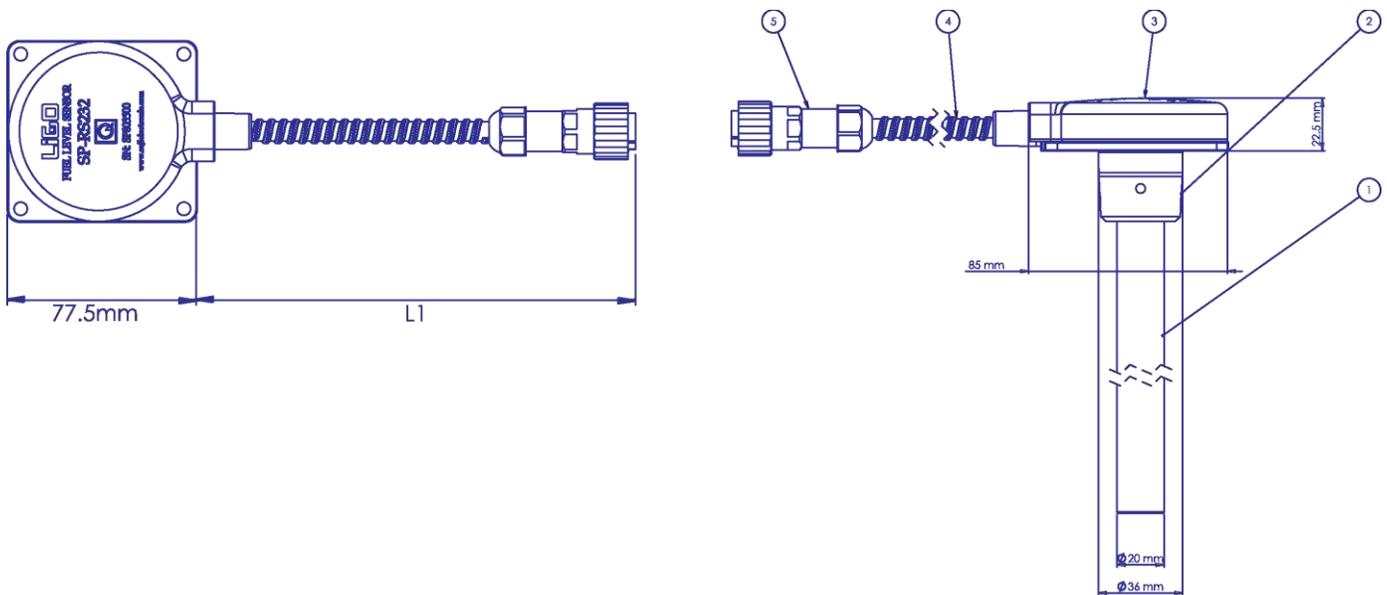


Figure 4. LIGO fuel level sensor's overall dimensions.

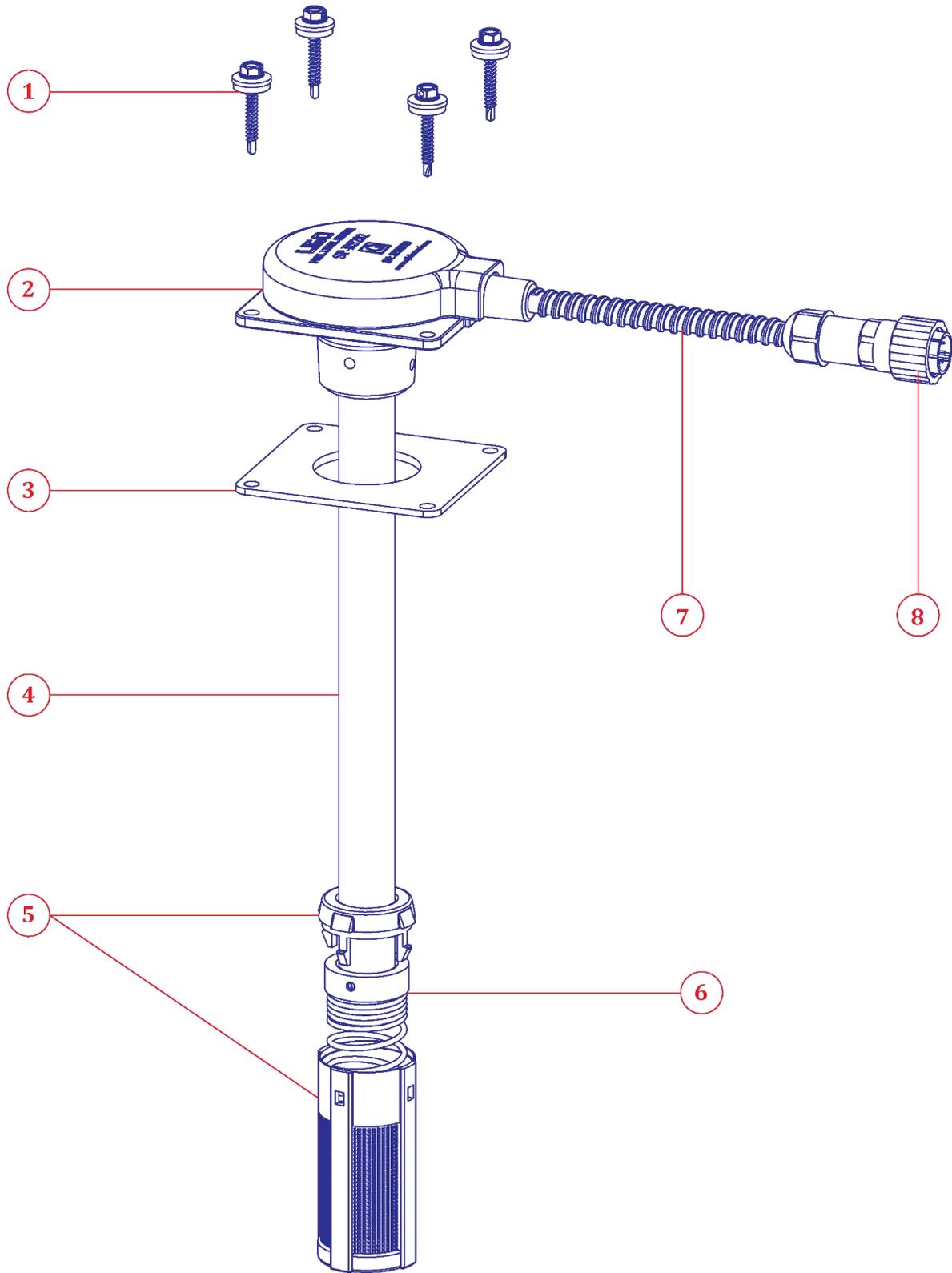


Figure 5: Description of sensor's parts



Description:

No	Content
1	Self-drilling M4.8x32mm x 4pcs, M5x20 revitnut x4pcs
2	Sensor's head containing sensing circuit board
3	Gasoline resistant rubber gasket
4	Sensing probe (Aluminum 6061 and stainless steel option)
5	Oil filter
6	Anti-vibration spring
7	PE flexible conduit
8	Connector IP67

VI. CONNECTOR

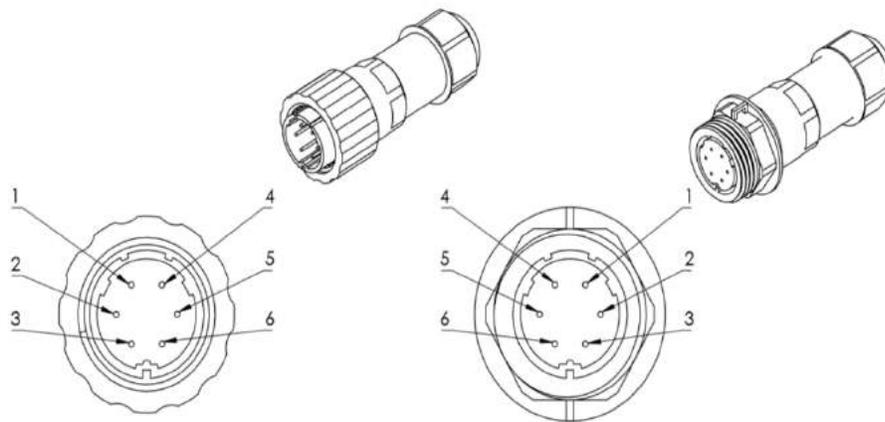


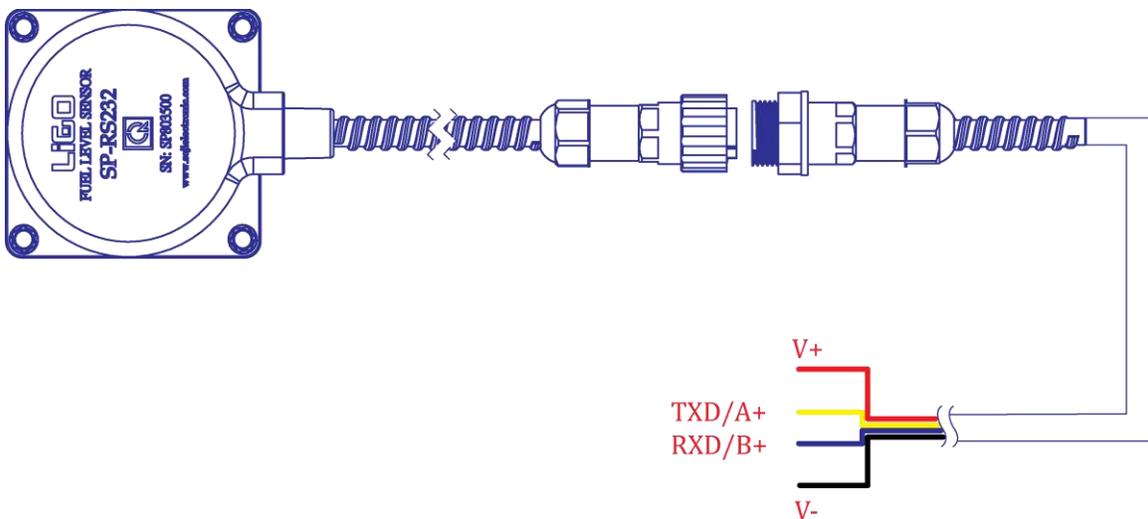
Figure 6. The detail of connector pins



PIN	DESCRIPTION
1	GND
2	9-37 VDC
3	NC (Not connected)
4	Analog or Frequency
5	TXD/A+
6	RXD/ B+

1. Connecting LIGO-SP and LIGO-SP PRO to an external device

+ RS232/ RS485

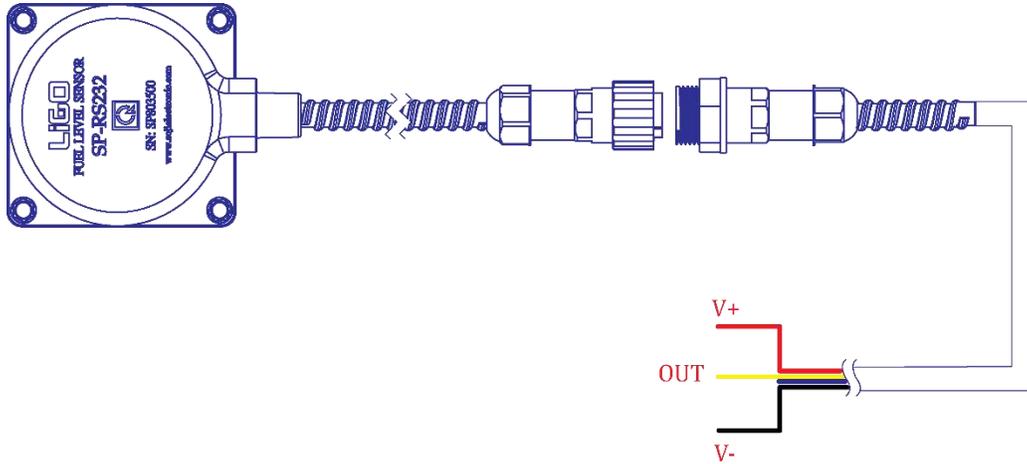


WIRE COLOUR	DESCRIPTION
Black	GND (Ground) (V-)
Yellow	RXD/A+
Blue	TXD/B+
Red	9-37 VDC or 7.5-75V for SP PRO series

Figure 7. Wiring diagram of RS232 and RS485 output signals.



+ AF (Analog & Frequency)



WIRE COLOUR		DESCRIPTION
	Black	GND (Ground) (V-)
	Yellow	Out (Analog/Frequency)
	Red	9-37 VDC or 7.5-75V for SP PRO series

Figure 8. Wiring diagram of Analog and Frequency output signals.

LIGO fuel sensor is protected against reverse-polarity and overvoltage. This feature helps to protect circuit boards against incorrect connections and it can withstand a continuous over-voltage condition (up to 50V in LIGO-SP product and 100V in LIGO-SP-PRO product) and short-circuit. Please avoid connecting sensor to a power supply which is unstable, usually fluctuates, or has a voltage higher than the recommended voltage range above.



Using a fuse coupled with one pole (-) or (+) is recommended for over-voltage protection purpose in case the car equipment is too old or the power cannot be guaranteed. It is advisable to use fuses which have the rated current less than 2A.



2. Connecting to PC to configure the device

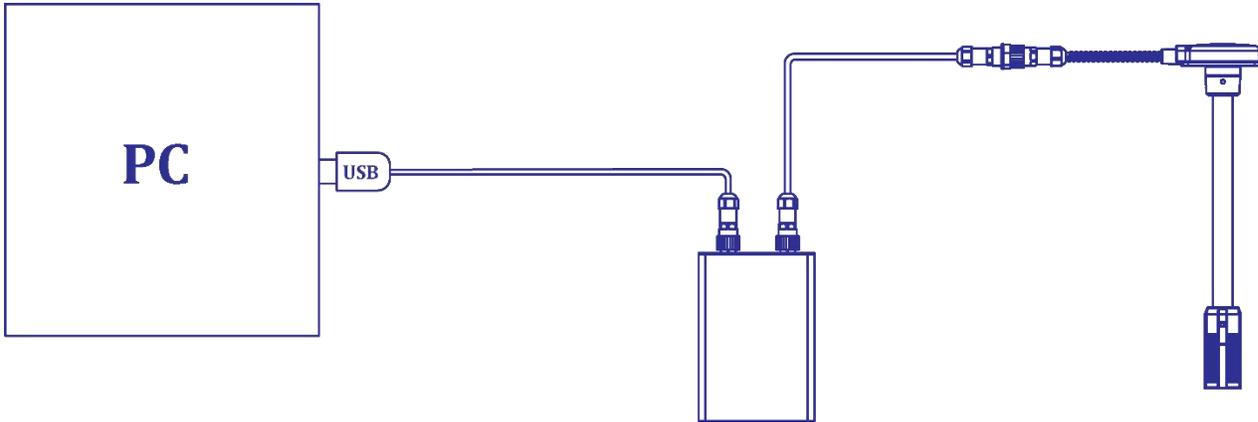


Figure 9. Connection diagram of sensor to PC via a configuration tool.

3. Configuration software interface

Setting up and managing the appropriate configurations for the sensor is indispensable to properly, stably and accurately operate the device sensor LiGO-AF, as well as usually keep informed about the device’s operating situation, failure (caused by the sensor itself or external factors), and lifespan.

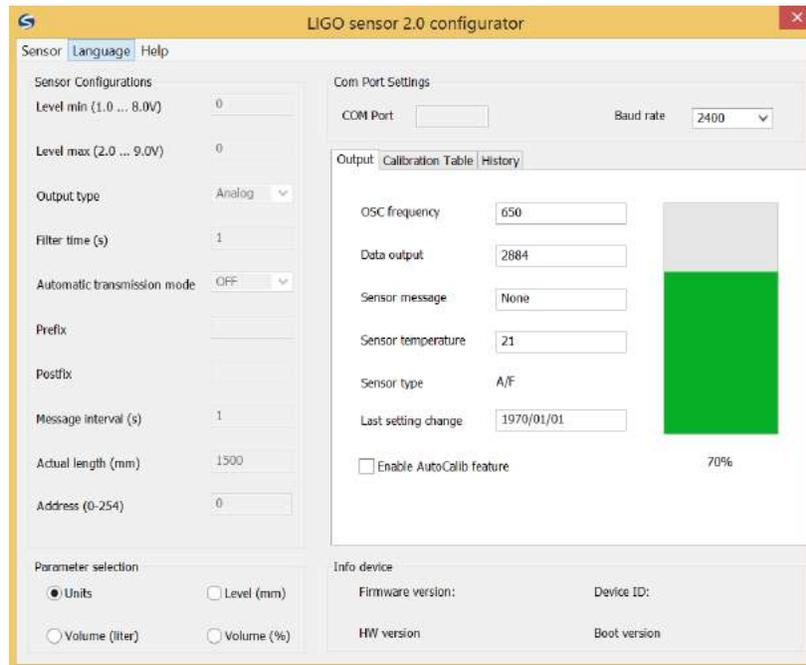


Figure 10. Device’s management, setting up and configuration software interface



Main parameters:

1. Sensor:

Restore password: Restore user password, user will receive an encrypted string which will be sent to SOJI for password decryption

Change password: Change user password

Load config: Load configurations from sensor to PC. Note: user must load configurations from sensor before changing configurations on PC

Save config: Save configurations from PC to sensor

Update firmware: Upgrade new firmware for sensor (visit www.sojieletronics.com for the latest firmware version)

Set full: Set Full for maximum fuel level calibration

Set Empty: Set Empty for minimum fuel level calibration

Exit: Quit configuration interface

2. **Language:** Choose English or Vietnamese interface

3. **Level Min:** Configure LIGO SP-AF output voltage or frequency range according to the voltage or frequency range of the tracking device input

4. **Level Max:** Configure LIGO SP-AF output voltage or frequency range according to the voltage or frequency range of the tracking device input

5. **Output type:** Select analog or frequency output (used only for LIGO SP-AF)

6. **Filter time:** set output signal processing time. Default time 60 seconds.

7. **Automatic transmission mode:** Automatic transmission mode applied only to RS232/RS485 defines sensor output message type:

- Off – no automatic message transmission, sensor is waiting for tracking device request;
- HEX - automatic message transmission in binary format (used by default);
- ASCII - automatic message transmission in text format;
- ASCII EXT – automatic message transmission in extended text format. Additional Prefix and Postfix configurable parameters are available for this mode to insert required header or ending of the message.

8. **Message interval:** Time period that the sensor automatically sends output message to the tracking device. Parameter value range is from 1...60 seconds with 1 second step. Default value is 1 second.



9. **Actual length:** The actual length of sensor probe
10. **Address (0-254):** Set the network address for the sensor. When several sensors are connected to one external device, they should have a unique network address.
11. **Parameter selection:** Select output value type for sensor data
 One of the following output value types available for LIGO-RS232 and LIGO-RS485
 - Fuel level in standard (normalized) units (0...1000);
 - Fuel level in millimeters (mm), 0.1 mm step;
 - Fuel volume in liters (L), 0.1 L step;
 - Fuel volume in percentage (%), 0.4% step.
12. **COM Port:** COM port number will be displayed on PC as well as baud rate for RS232 and RS485.
13. **Baud rate:** Select the rate for data exchange with external device. Default value – 9600 bit/s.
14. **Output:**
 - OSC frequency:** Initial measuring generator frequency (Hz)
 - Data output:** Data output (0-4095)
 - Sensor message:** Sensor working message

Sensor message	Transcript of the malfunction code	Possible solution
255 or 254	Calibration error	Check if the measuring probe actual size value is inserted correctly and (or) re-calibrate the sensor
253	Short circuit in measuring probe tubes	Wash the measuring probe tubes with clean fuel, clean fuel tank of mud and water.



252	Calibration error	Check if the measuring probe actual size value is inserted correctly and (or) re-calibrate the sensor
251	Hardware failure	Contact supplier
250	Calibration error	Check if the measuring probe actual size value is inserted correctly and (or) re-calibrate the sensor

Sensor temperature: temperature inside sensor circuit board

Sensor type: Sensor models RS232, RS485, AF

15. **Calibration Table:** Calibration table

16. **History:** Configuration history

17. **Enable AutoClib feature:** Automatically calibrate after cutting. User does not need to reconfigure after cutting.

18. **Infor device:**

Firmware version: Sensor's firmware version

Device ID: Sensing chip's ID

HW version: Sensor's hardware version

Boot version: Sensor's bootloader version

4. Connecting multiple sensors together (Only applicable to RS232 and RS485)

In some situations, there are oil tanks with particular dimensions, communicating oil tanks, too long or too large oil tanks... multiple oil tanks need to be managed on only 1 device or Dataloger cannot use only 1 sensor to measure the accurate fuel level inside oil tanks, and therefore requires the connection between 2 or multiple sensors together by the data processor DATA-SUM.

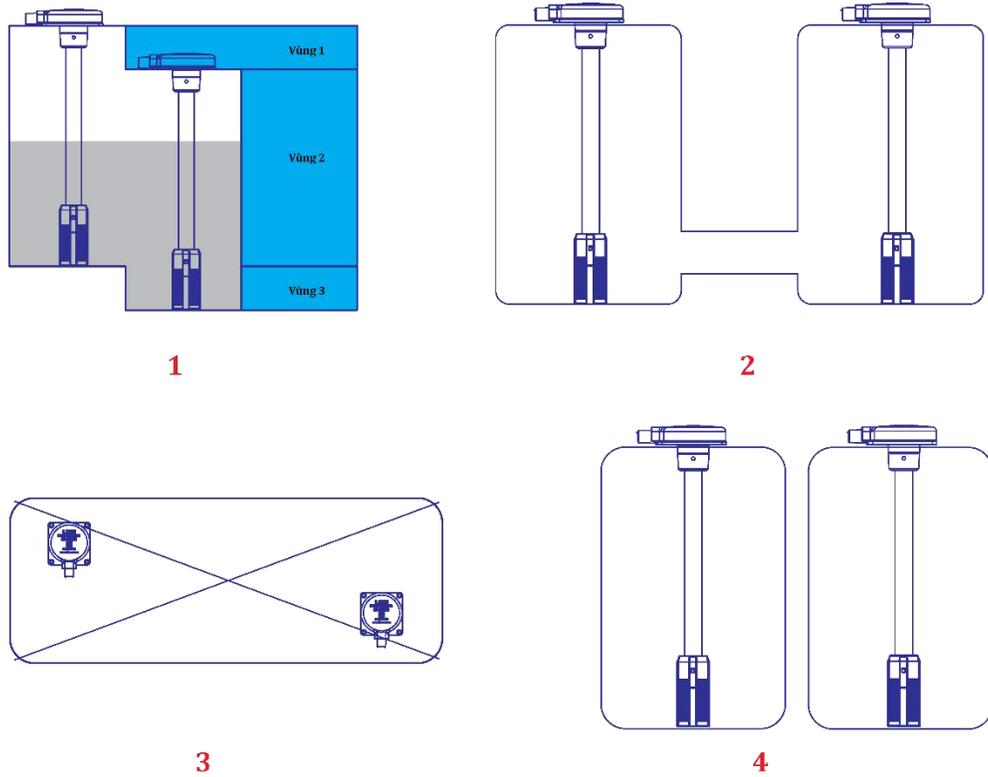


Figure 11. Oil tank with particular dimensions connecting multiple sensors together

Connection diagram of the processor SUM-DATA for multiple sensors:

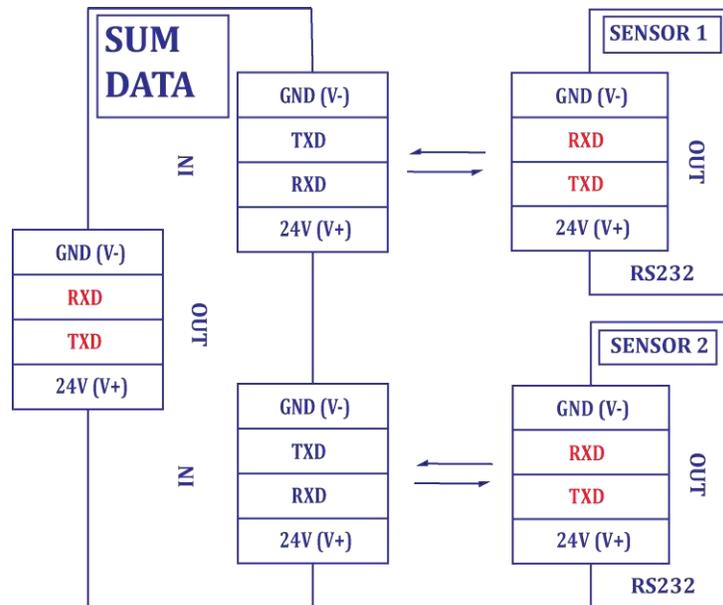


Figure 12: Connecting 2 sensors by 01 processor SUM-DATA

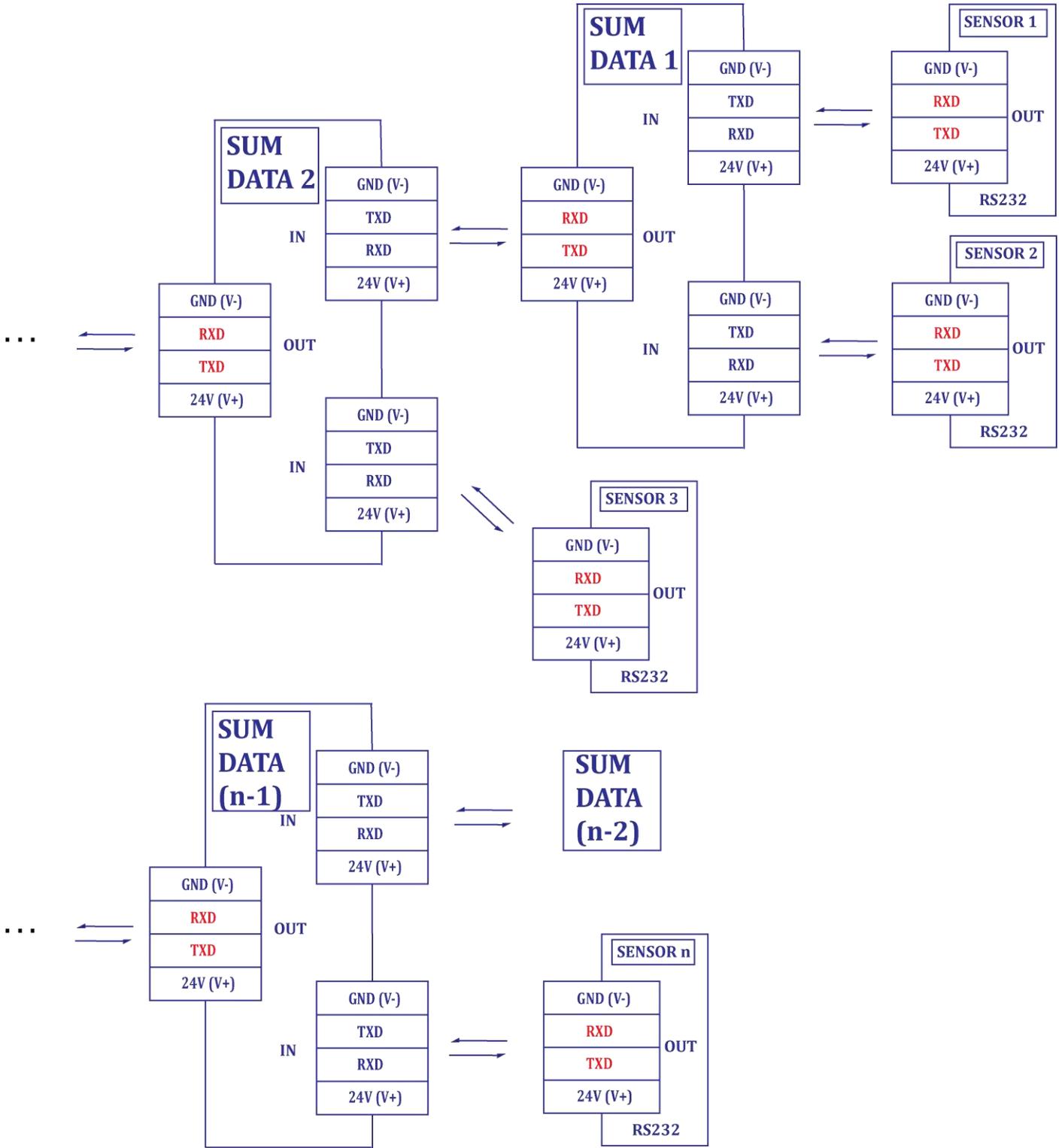


Figure 13: Connecting multiple sensors together by multiple processors SUM-DATA



VII. PRODUCT AND ACCESSORIES

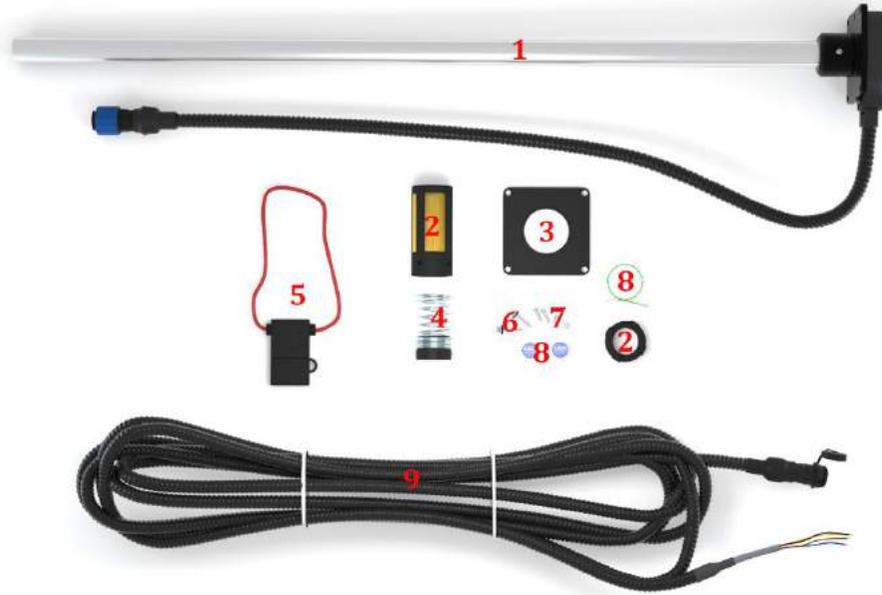


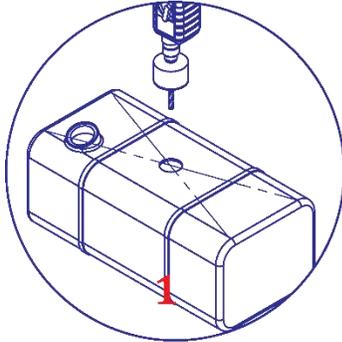
Figure 14: Sensor and all the accessories

No.	Description	Q'ty (pcs)
1	LIGO Fuel Level Sensor. Standard lengths: 700, 1000, 1500mm (for other customized lengths, please contact the manufacturer)	01
2	Oil filter	01
3	Gasoline resistant rubber gasket	01
4	Anti-vibration spring when moving	01
5	2A Fuse protection	01
6	Self-drilling screw M4.8x32mm	04
7	Rivet and screw M5x20mm	04
8	Sealing cord	02
9	7m PVC coated signal wire	01
10	Quick installation manual	01

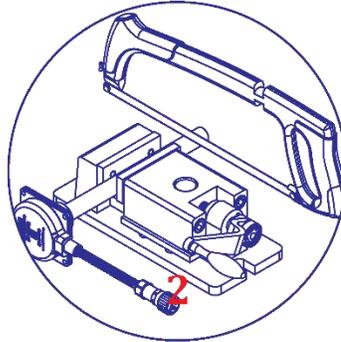


VIII. INSTALLATION

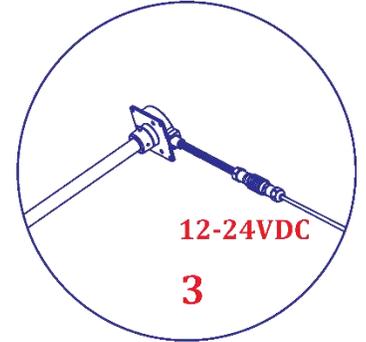
Quick installation through 5 steps:



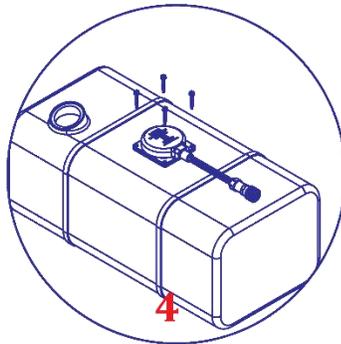
Pierce oil tank



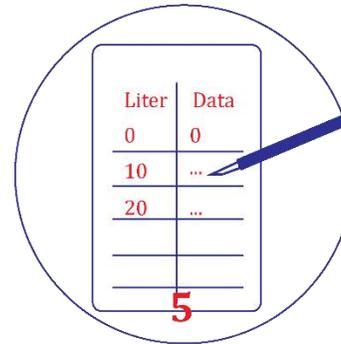
Based on oil tank's height, cut a suitable level indicator



Configure new length



Install the level indicator in the oil tank



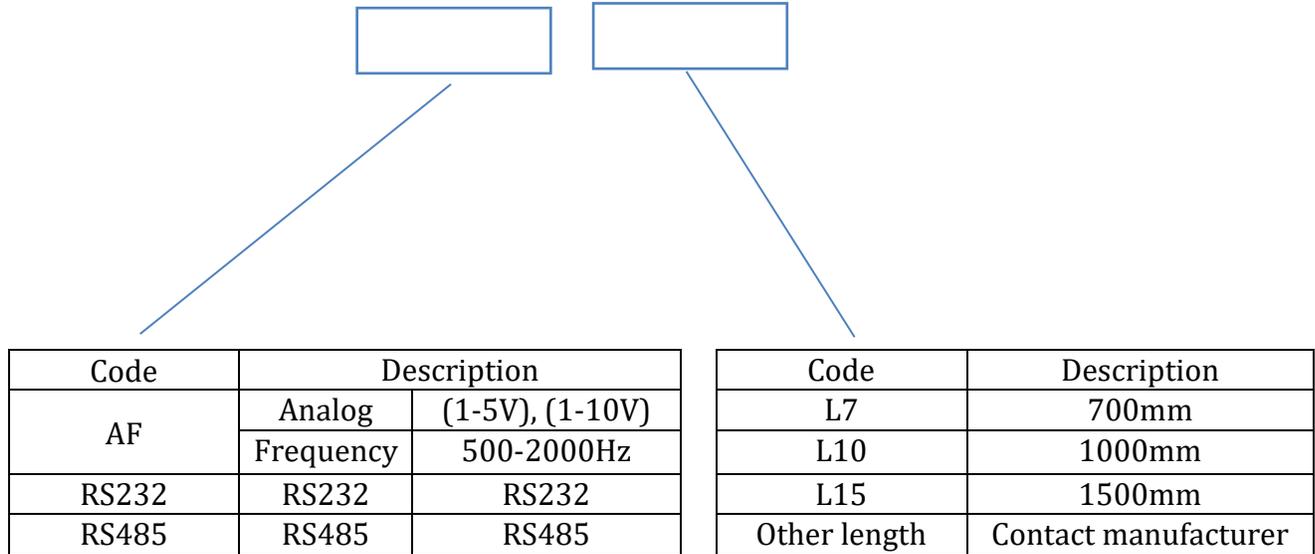
Re-adjust the sensor according to the volume of the oil tank

Figure 15. 5-step sensor installation.

For further information about the sensor's installation procedure and configurator software, please visit our website www.sojielectronics.com or contact us for more details.

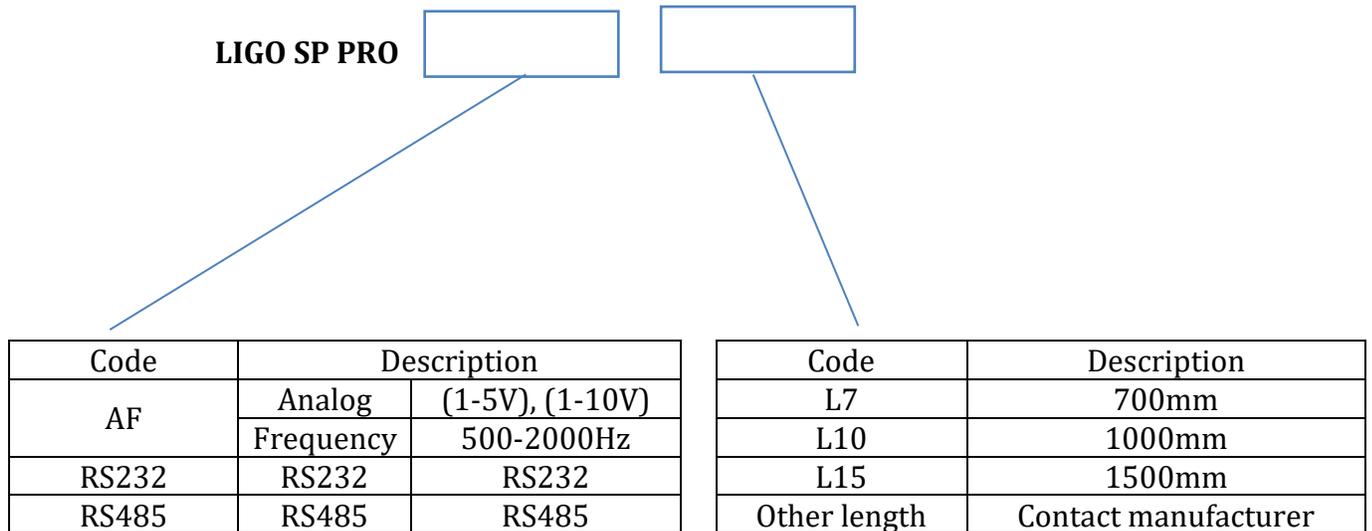


IX. LIGO-SP ORDER CODE



For example: **700mm length, output signal AF** sensor has the order code: LIGO-SP-AFL7

X. LIGO-SP-PRO ORDER CODE



For example: **700mm length, output signal AF** sensor has the order code: LIGO-SP-PRO-AFL7



XI. CONTACT US

The purpose of this datasheet is to provide comprehensive information on the structure, operation principle and operating rules for the LiGO-series fuel level sensor. Please feel free to send your comments regarding any errors or omissions you might find, or any suggestions you might have for the general improvement of this document. Data specifications can be changed without any notification. For the latest information and updates, please visit us at: www.sojielectronics.com

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REVISION HISTORY

Date	Version	Description
10.01.2018	2.0.1	First release