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### **8. Assembly Instructions**

THE MANUFACTURER RESERVES A RIGHT TO MAKE MODIFICATIONS (NOT DETRIMENTAL TO USAGE OR METROLOGICAL PARAMETERS OF THE DEVICE) WITHOUT UPDATING THE CONTENTS OF THIS TECHNO-FUNCTIONAL SPECIFICATION.

## 1. TECHNICAL SPECIFICATION

### 1.1. Function.

The CS-26 Fuel level probe is used to measure fuel level in the tanks of motor vehicles, working-machines and locomotives. The probes are officially certified by the Ministry of Transport.

Certificate number:

- E20 10R-03 2517

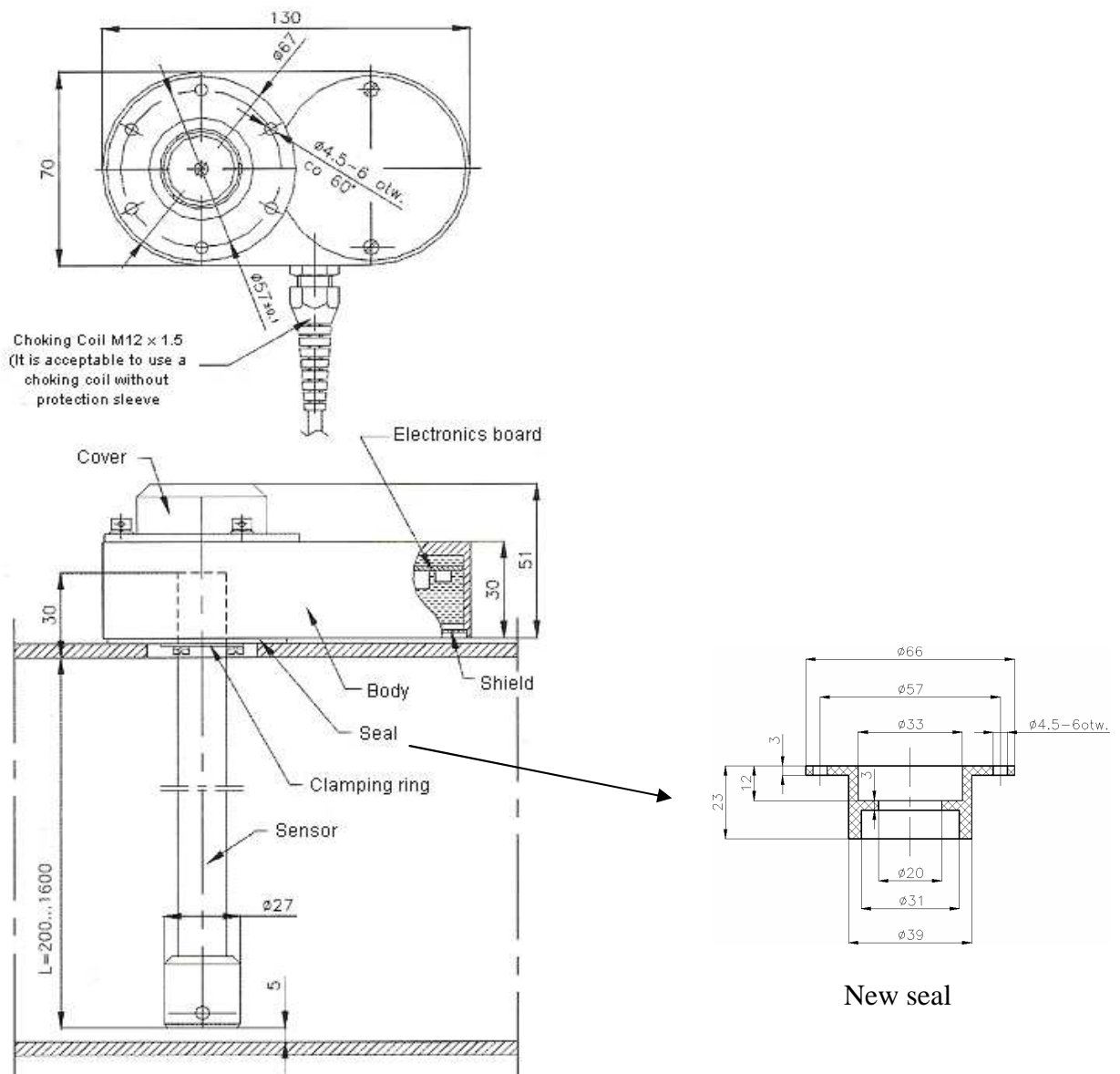


Fig. 1. CS-26 probe – overall dimensions.

## 1.2 Technical data.

<u>1.2.1 Measuring range:</u>	0 – 800 mm H <sub>2</sub> O (special 0...2000mm H <sub>2</sub> O)
pipe length:	800 mm (special 200...2000mm)).
maximum overload:	≤ 100kPa

### 1.2.2 Output data:

- output analog signal	: 0 – 10V, 0 – 5V, 0 – 4.5V, 0 – 2.5V
- output digital signal	: 100...3800 bit (acc. to protocols below)

#### a) 100...3800 bit with RS-485 interface (receiver sensitivity: +- 0.2V, emitter output: min +-1.5V)

Transmission parameters: 4800, N, 8, 1

Inquiry frame (12 bytes): <0XAA><0X55><CRC><0X07><0X84><0X18><VER>TYPE><DEVID>

CRC = <CRC\_LO><CRC\_HI>: 2 bytes of CRC control total, type CRC-16 (acc. to MODBUS-RTU protocol) for the last 8 bytes in frame

VER = <VER\_LO><VER\_HI>: 2 bytes of software version (e.g. 0xA8><0x0C>)

TYPE: frame type byte (<0x01> for standard type, other types acc. to appendix A)

DEVID = <DEVID\_LO><DEVID\_HI>: 2 bytes of probe address (range 1...65534, 65535 – the ‘broadcast’ address – probe responds at all times)

Response frame (20 bytes):

<0xAA><0x55><CRC><0x0F><0x18><0x84><VER><TYPE><DEVID><LEVF><UZAS><LEV><REZ>

CRC, VER, TYPE, DEVID the same as in inquiry frame

LEVF = <LEVF\_LO><LEVF\_HI>: 2 bytes of digitally filtered fuel level value(range 0x0064...0x0ED8: dec. 100...3800 b)

UZAS = <UZAS\_LO><UZAS\_HI>: 2 bytes of power voltage in mV (range 0x0258... 0x0E10: dec. 600...3600 b)

LEV = <LEV\_LO><LEV\_HI> : 2 bytes of temporary fuel level value (range 0x0064...0x0ED8: dec. 100...3800 b)

REZ = <REZ\_LO><REZ\_HI> 2 reserve bytes (e.g. <0x00><0x00>), e.g. fuel temperature: for 25°C - <0x19><0x00>

#### b) 100...3800 bit with RS-485 interface (receiver sensitivity: +- 0.2V, emitter output: min +-1.5V)

Transmission parameters: 57600, N, 8, 1

Inquiry frame (12 bytes): <0XAA><0X55><CRC><0X07><0X84><0X18><VER>TYPE><DEVID>

CRC = <CRC\_LO><CRC\_HI>: 2 bytes of CRC control total, type CRC-16 (acc. to MODBUS-RTU protocol) for the last 8 bytes in frame

VER = <VER\_LO><VER\_HI>: 2 bytes of software version (e.g. 0xA8><0x0C>)

TYPE: frame type byte (<0x01> for standard type, other types acc. to appendix A)

DEVID = <DEVID\_LO><DEVID\_HI>: 2 bytes of probe address (range 1...65534, 65535 – the ‘broadcast’ address – probe responds at all times)

Response frame (23 bytes):

<0xAA><0x55><CRC><0x0F><0x18><0x84><VER><TYPE><DEVID><LEVF><LEV><UZAS><REZ><TC><INF>

CRC, VER, TYPE, DEVID, LEVF, UZAS, LEV the same as in a)

REZ = <REZ\_LO><REZ\_HI> : 2 reserve bytes (e.g. <0xFF><0xFF>)

TC = <TC\_LO><TC\_HI> 2 bytes for temporal constant of digital filter (range T = 0...900s, standard T=3s)

INF: byte – information indicator (0x00...0xFF) – probe status applies to calibration or correction of probe parameters

#### c) 100...3800 bit with RS-232 interface (0...3.3V)

Transmission parameters: 300, N, 8, 1

Inquiry frame (6 bytes): <0x40><0x40><0x45><0x72><0x37><0x0D>

Response frame (11 bytes): 0x40><0x40><0x45><0x76><0x0F><0xFF><0x00><0x64><CRC><0x0D><0x0A (for 100 bit)

Response frame (11 bytes): 0x40><0x40><0x45><0x76><0x0F><0xFF><0x0E><0xD8><CRC><0x0D><0x0A> (for 3800 bit)

Response frame secured with CRC XOR type control total (for the first 8 bytes).

NOTE: For additional protocol details check appendixes A and B.

### 1.2.3. Temperature:

- working temperature range	-25 - 80°C (special -30 - 80°C)
- compensation temperature range	-25 - 50°C

### 1.2.4. Processing errors:

- basic error	≤ 0.16%
- power voltage fluctuation error	0.05%

- hysteresis, replicability 0.05%
- temperature fluctuation error 0.1% / 10°C
- additional error depending from impact of electromagnetic field  $\leq 1\%$

#### 1.2.5. Power:

12 – 36V for output = 0 – 10V and RS-485  
 8 – 36V for output = 0 – 4,5V and RS-485  
 3,3 +/- 0,1V for output = 0 – 2,5V and RS-485  
 3,3 +/- 0,1V ( $I \leq 10\text{mA}$ ) for RS-232 output (3,3V)  
 6.0 – 36V ( $I \leq 10\text{mA}$ ) for RS-485 output  
 6.0 – 36V ( $I \leq 10\text{mA}$ ) for RS-232 output (3,3V)

#### 1.2.6. Normal usage conditions:

- relative humidity 30 – 90%
- atmospheric pressure 80 – 120kPa
- maximum charring and vibration up to 2.5 m/s<sup>2</sup>
- dustiness any
- working position vertical
- active constituents concentration no aggressive constituents in atmosphere

#### 1.2.7. Limiting transport and storage:

- environment temperature 0... +70°C
- relative humidity up to 95% at 40°C
- strokes up to 10g, 10ms.

#### 1.2.8. Housing:

- type aluminum box
- dimensions according to Illustration 1
- housing protection degree IP 68

#### 1.2.9. Weight

- 1.8 kg (depending on pipe length)

#### 1.2.10. Ordering

CS-26/ RS / U / \_ / \_ / L= ... mm

Measuring range ↑  
 Output signal ↑  
 Pipe length (mm) ↑

- for digital output signal belong give kind of digital output (232 or 485)

#### Examples

1. CS-26/RS/U/0...800mmH<sub>2</sub>O/0...10V/L=830mm

Measuring range: 0...800mm, analog output signal 0...10V, pipe length 830mm

2. CS-26/RS-485/0...800mmH<sub>2</sub>O/100...3800bit/L=830mm

Measuring range : 0...800mm, digital output signal 100...3800bit, pipe length 830mm

3. CS-26/RS-232/0...800mmH<sub>2</sub>O/100...3800bit/L=830mm

Measuring range : 0...800mm, digital output signal 100...3800bit, pipe length 830mm

### 1.3. Usage conditions

Usage conditions are set by this TFS.

### 1.4. Structure and functioning

The CS-26 fuel level probe operates by measuring hydrostatic pressure, the value of which is proportional to the height of liquid column. The measuring element is a piezoresistive sensor, separated from the medium by a separating membrane. Pressure measuring is performed at the separating membrane of the submerged probe (5-10 mm above tank bottom) and related either to atmospheric pressure or pressure inside the tank with the use of a small hose placed inside the pipe. The electronic system is placed inside aluminum housing. The housing can be sealed.

The compensation elements of the sensor are placed in the electronic system, therefore both the sensor and the system are strictly assigned to each other. There is a number of the mating sensor written inside the housing.

## **2. ASSEMBLY AND OPERATION**

### 2.1. Assembly recommendations

The CS-26 probe should be used according to the conditions specified in 1.2.6. of this TFS.

Connection diagram has been presented on Illustration 2, 3 and 4 (depending on performance)

#### **Note:**

- 1. Connect probe sensor according to wire colors to the electronic system.**
- 2. Put the venting hose onto the nozzle.**
- 3. Be careful to follow the numbers while you complete the probe before assembly: the number of the sensor (stamped on the sensor's head) must correspond to the number of the sensor marked on the plate inside the housing.**
- 4. THE PROBE SHOULD BE MOUNTED IN THE CENTER OF THE TANK to ensure the utmost precision of level measuring process (inaccurate indications due to the vehicle's tilt are thus eliminated).**
- 5. The shield for the feeding and measuring cable of the probe's electronics system is not to be connected to anything. The voltage of the shield is 0V because it is internally connected to the negative pole of probe's electronics system power supply.**
- 6. In order to protect the interior of the fuel tank against impurities resulting from drilling probe assembly acc. to 2.1.1), it is recommended to clear the spot of working with a brush, a dust brush or cloth, and additionally to perform the following:**
  - for a steel tank: use a strong magnet in the vicinity of the drilling,**

- for an aluminum tank: apply compressed air through the fuel line – having closed and sealed the inlet, the return line and all other holes. When removing the chips while using this method, eye protection goggles must be worn at all times.
- for a plastic tank: use a battery-powered vacuum cleaner.

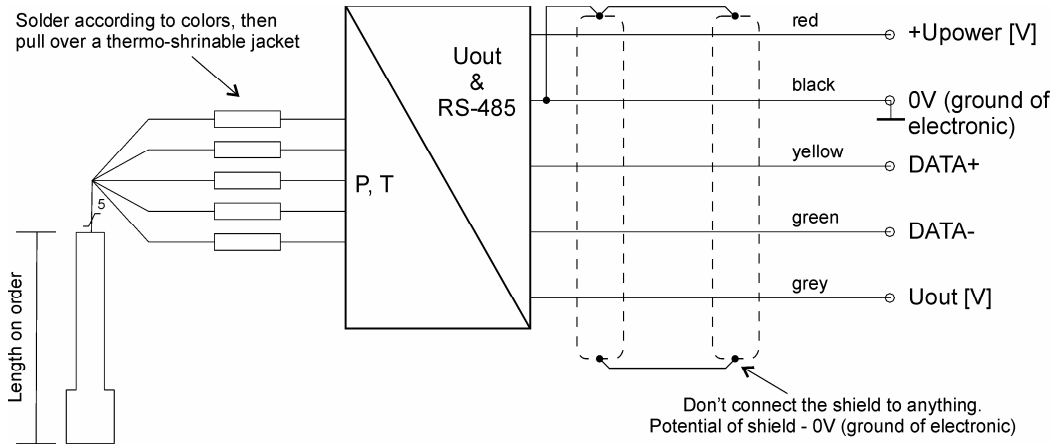


Fig. 2. Connecting CS-26/RS/U with analog output 0...10V and digital output in RS-485 in standard

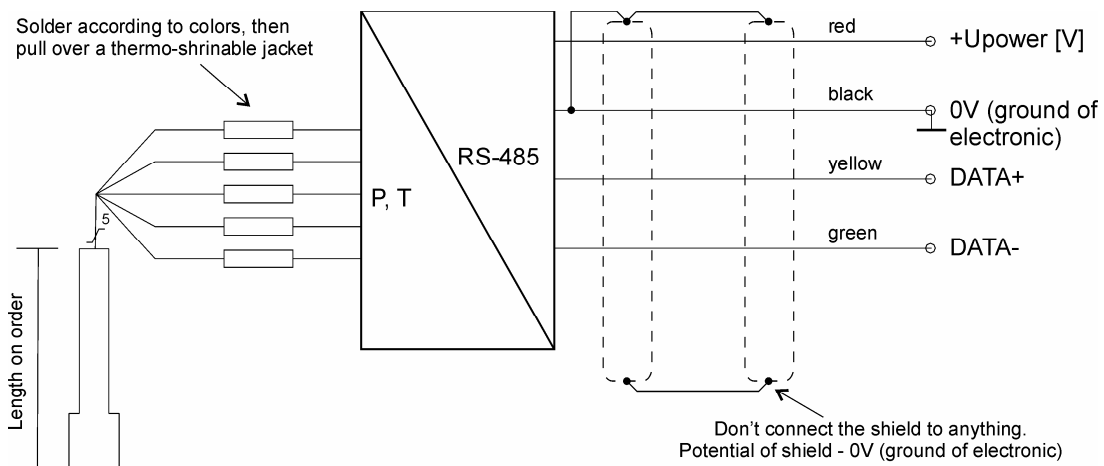


Fig. 3. Connecting CS-26/RS-485 probe with digital output in RS-485 standard

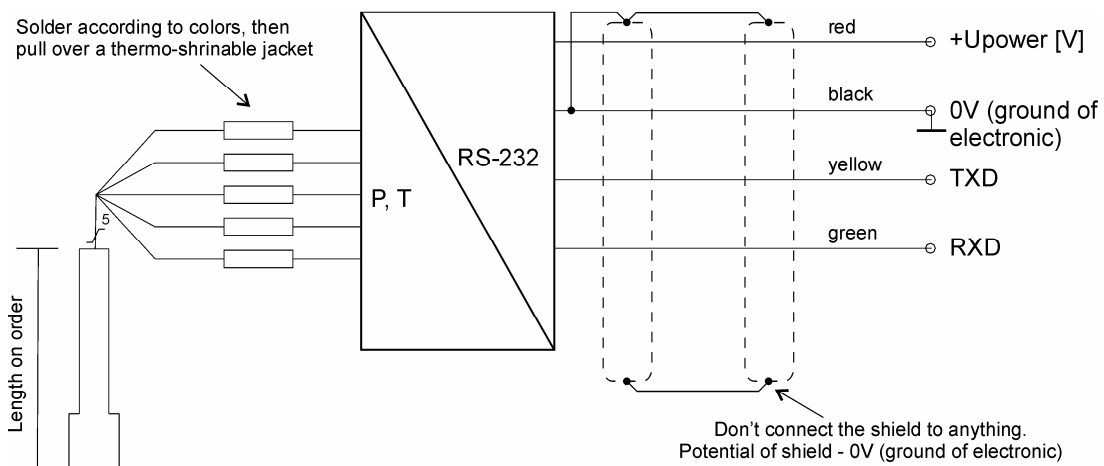


Fig. 4. Connecting CS-26/RS-232 probe with digital output in RS-232 standard

### 2.1.1. CS-26 probe assembly procedure steps

1. Glue the template onto the tank and make a  $\phi 39$  hole accordingly. In case of steel tanks, you should make 6  $\phi 3.2$  holes at a  $\phi 57$  spacing (according to template), next make M4 screw threads in the holes. If the tank is aluminum, you can screw the self-piercing screw (no.14), without drilling the lead hole.
2. Place sensor pipe (no.6) in probe housing (no.1), then put it into the tank together with gasket (no.9) in such a way, so that the sensor touches the bottom.
3. Mark the part on the sensor, which juts out over "P" surface.
4. Take the sensor out of the tank. Cut the pipe 5mm below the marking (be very careful not to damage wire insulation or venting hose). Use stainless steel pipe cutter for cutting.
5. After cutting the pipe to a desired size, put a rubber pass (no.12) on the cut pipe end to protect the wires and the venting hose from damage.
6. Put a clamping ring (no.3) and a sealing ring (no.10) on the pipe, then install the sensor in the body (no.1).
7. Set 1mm measure over "P" surface, according to the illustration below.
8. Fix the sensor in the body by equally screwing 3 M3 tap bolts (no.13) diagonally and tighten the M8 screw, located on the side wall of the body.
9. Cut the venting hose to a right size and put on the nozzle (no.4).
10. Cut sensor wires to a right length and solder with wires from the electronics, according to the colors, securing the soldered spots with a thermo-shrinkable jacket.
11. The probe is now ready. Put it into the tank and fix it with fixing screws (no.14).
12. Screw the cover (no.2). Pay special attention so that the clamping ring (no.11) is properly placed in the duct.

<p>While mounting the body (no.1) to the tank, you can also use oil-resistant silicone adhesive between the gasket (no.9) and the tank cover (no.8). Adhesive layer should be so thin that after tightening the adhesive is not pushed out of the gasket.</p>
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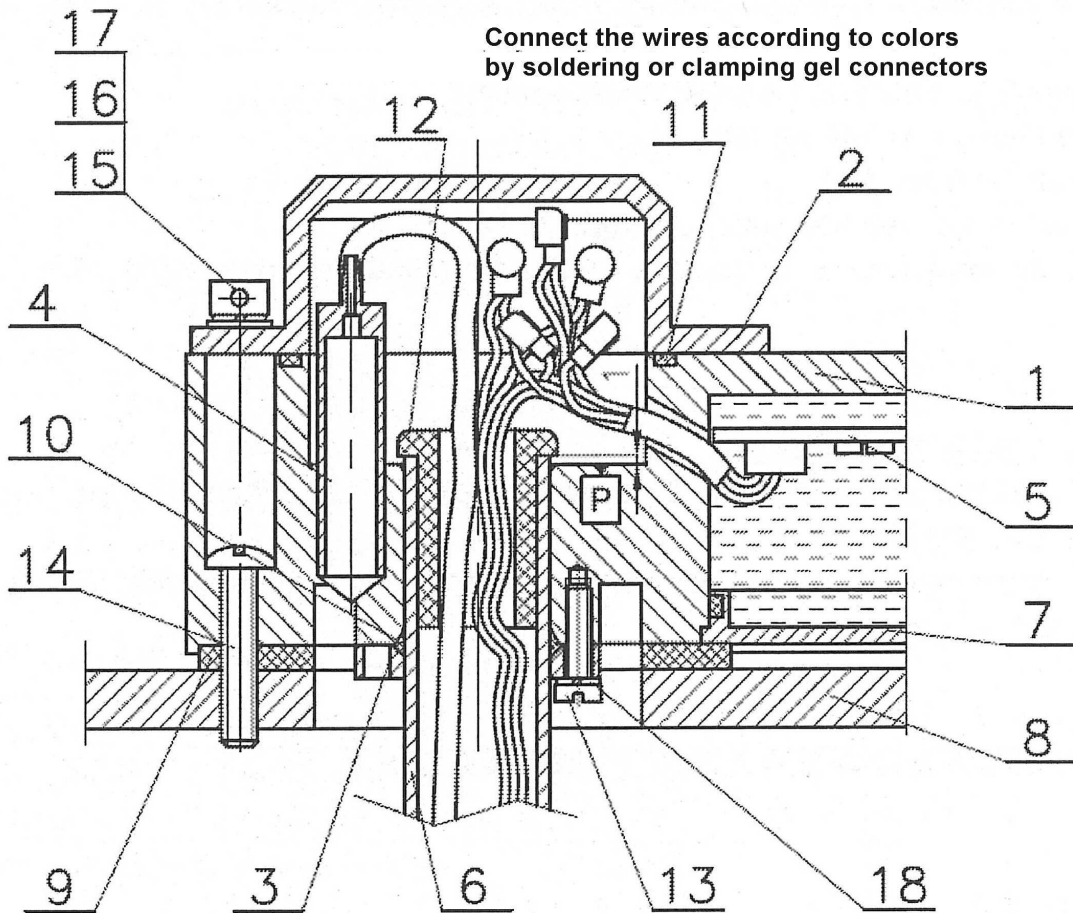


Fig. 5. Mounting the probe onto the tank.

1. Probe body
2. Cover
3. Pressure ring
4. Nozzle
5. Electronics board
6. Sensor pipe
7. Shield
8. Tank cover
9. Gasket
10. 16x2 sealing ring
11. 42x2 sealing ring
12. Rubber pass
13. M3x12 tap bolt
14. 4.2x32 plate screw or M4x18 screw
15. M4x12 screw
16. 4.3 washer
17. 4.1 elastic washer
18. 3.1 elastic washer



## 2.2. Repair and starting up.

Because of significant influence of quality and type of elements on overall quality of the device, we strongly recommend performing all guarantee and post-guarantee repairs by APLISENS service and manufacturer – Ostrów Wielkopolski department.

The address:

**Aplisens S.A. Oddział Ostrów Wielkopolski**

**ul. Krotoszyńska 35**

**63-400 Ostrów Wielkopolski**

The device does not require constant maintenance.

We recommend checking the device while performing inspection of the entire facility.

## 2.3 Safety conditions.

All actions (inspection, checking) must be performed after reading this TFS carefully.

Before you perform any connection, the power source must be totally disconnected.

## **3. STORAGE AND TRANSPORT**

### 3.1. Storage.

The probe must be stored in the manufacturing package in closed compartment, free of aggressive constituents that cause corrosion, at temperature of 0°C to 70°C with relative humidity not higher than 80%, with shock and vibration protection.

### 3.2 Transport.

Probe transport should be carried out with covered means of transport. The packages should be protected against displacing. Limiting transport conditions are presented in 1.2.7.

## **4. ILLUSTRATIONS**

Fig.1. CS-26 probe – overall dimensions.

Fig.2. Connecting CS-26/RS/U probe with analog output 0...10V and digital output in RS-485 standard

Fig.3. Connecting CS-26/RS-485 probe with digital output in RS-485

Fig.4. Connecting CS-25/RS-232 probe with digital output RS-232

Fig.5. Mounting the probe onto the tank.

Fig.6. Proper probe fitting

Fig.7. Improper probe fitting

Fig.8-11 Tools and accessories

## 5. APPENDIX A.

The following inquiry frames should be used to perform probe parameter setting (with RS-485), i.e. address selection, 'minimum' and 'maximum' calibration, 'minimum' and 'maximum' correction, correction of temporal constant of probe output signal filter and 'range' correction:

No.	Inquiry frame <0xAA><0x55><CRC><0x07><0x84><0x18><VER><TYPE><DEVID>	Info
1	AA 55 <b>1F AD</b> 07 84 18 <b>02 00 02</b> 01 00	address frame (address change 1 to 2)
2	AA 55 <b>45 D4</b> 07 84 18 A8 0C <b>06</b> 02 00	initial frame for calibration
3	AA 55 <b>E4 14</b> 07 84 18 A8 0C <b>04</b> 02 00	minimum calibration frame
4	AA 55 <b>B5 D4</b> 07 84 18 A8 0C <b>05</b> 02 00	maximum calibration frame
5	AA 55 <b>55 D5</b> 07 84 18 A8 0C <b>03</b> 02 00	minimum correction frame
6	AA 55 <b>24 17</b> 07 84 18 A8 0C <b>08</b> 02 00	maximum correction frame
7	AA 55 <b>32 9C</b> 07 84 18 <b>03 00 07</b> 02 00	filter correction frame
8	AA 55 <b>F4 15</b> 07 84 18 A8 0C <b>01</b> 02 00	standard frame
9	AA 55 <b>F4 C5</b> 07 84 18 A8 0C <b>01</b> FF FF	'broadcast' frame
10*	AA 55 <b>66 DC</b> 07 84 18 20 03 <b>0A</b> 02 00	default setting save frame (range 800mm – 0x0320 hex)
11*	AA 55 <b>C6 BF</b> 07 84 18 90 01 <b>0C</b> 02 00	range correction frame (e.g. for 400mm – 0x0190 hex)
12*	AA 55 <b>D4 17</b> 07 84 18 A8 0C <b>0B</b> 02 00	return to default setting frame
13*	AA 55 <b>75 D7</b> 07 84 18 A8 0C <b>09</b> 02 00	filter reading frame (i.e. temporal constant)
14*	AA 55 34 16 07 84 18 A8 0C 0D 02 00	calibration status frame

\* - do not apply to protocol acc. to 1.2.2b

Basic probe setting must be performed only with the use of 5 sequential frames numbered:  
1, 2, 3, 4, 7

In address frame, VER entry is used to set the current address (e.g. DEVID = 2), to specify type of operation, the address is changed, from standard 0x01 in TYPE entry, changed into 0x02. VER entry is also used for filter correction frame (temporal constant setting from 0s to 900s, standard 3s), to specify type of operation, filter correction is performed, from standard 0x01 in TYPE entry, changed into 0x07. In all other frames, the function is determined by contents of TYPE entry.

Standard frame (item 8) and 'broadcast' frame (item 9) are used for 'polling' the probe about current parameter setting, whereas 'broadcast' frame provides communication with probe, regardless of its internal address.

The 'minimum' calibration and the 'maximum' calibration correspond to 'set empty tank' (output signal 100 bit) and 'set full tank' (output signal 3800 bit) respectively, whereas the 'minimum' correction and 'maximum' correction stand for 'correct empty tank' and 'correct full tank' respectively.

Note 1: Calibration (or level correction) must be performed with proper fuel levels in tank

(e.g. 'maximum' calibration must be performed only with a full tank).

Calibration is a process of 'teaching' the probe to respond properly and timely to the level of fuel in the tank, while correction ('minimum' or 'maximum') is used only to improve the temporary nominal characteristics of the probe. It must be performed with an empty tank, e.g. in a situation when the output signal should amount to 100 bit but in fact it is 115 bit. The entire temporary characteristics of the probe sometimes shifts, e.g. along the OX axis – 'fuel level' and in this case it is not necessary to recalibrate the probe, but it would be sufficient just to perform the 'zero correction' with an empty tank. The output signal will then drop from

115 bit to exactly 100 bit. Consequently, the maximum signal will be corrected by 15 bit as well (from 3815 bit to 3800 bit).

**Note 2:** In order to perform calibration, first send initial frame to the probe, only then it is possible to input 'new minimum' and 'new maximum' level. To each proper Inquiry frame, the probe will respond with a corresponding response frame.

**Note 3:** Calibration status frame allows to obtain information about calibration status. The entry VERSION of the response frame shows whether calculation has commenced or is in progress (min. and max has been input) or has been completed – 0x00 0x00, 0x01 0x01, 0x02 0x01, 0x03 0x02 (the first byte indicates calibration progress, the second one shows the number of points of sensor characteristics).

Note 4: for protocol acc. to 1.2.2b on calibration or correction status, the last byte of the frame <INF>: 0x01 – address change, 0x09 – calibration start, 0x0D – MIN calibration (1<sup>st</sup> point), 0x0B – MAX calibration (1<sup>st</sup> point), 0x07 – calibration end, 0x06 – parameter correction.

## 6. APPENDIX B.

The following inquiry frames should be used to perform probe parameter setting (with RS-232), i.e. 'minimum' and 'maximum' calibration, 'minimum' and 'maximum' correction, correction of temporal constant of probe output signal filter and 'range' correction:

No.	Inquiry frame 0x40<0x40><FUNCTION><PAR lo><PAR hi><CRC_TOTAL>	Info
1	40 40 06 00 00 06	initial frame for calibration
2	40 40 04 00 00 04	minimum calibration frame
3	40 40 05 00 00 05	maximum calibration frame
4	40 40 03 00 00 03	minimum correction frame
5	40 40 08 00 00 08	maximum correction frame
6	40 40 07 03 00 04	filter correction frame
7	40 40 09 00 00 09	filter reading frame (i.e. temporal constant)
8	40 40 0A 20 03 29	default setting save frame (range 800mm – 0x0320 hex)
9	40 40 0B 00 00 0B	return to default setting frame
10	40 40 0C 90 01 9D	range correction frame (e.g. for 400mm – 0x0190 hex)
11	40 40 0E 00 00 0E	calibration status frame
12	40 40 45 72 37 0D	standard frame (note: byte 0x0D is not XOR control total for 5 first bytes) for level reading

Note: Frames from items 1-11 are secured with CRC – XOR control total for 5 first bytes. Basic probe setting must be performed only with the use of 4 sequential frames numbered: 1, 2, 3 and 6

Standard frame (item 12) is used for 'polling' the probe about the measured fuel level. The 'minimum' calibration and the 'maximum' calibration correspond to 'set empty tank' (output signal 100 bit) and 'set full tank' (output signal 3800 bit) respectively, whereas the 'minimum' correction and 'maximum' correction stand for 'correct empty tank' and 'correct full tank' respectively.

**Note 1:** Calibration (or level correction) must be performed with proper fuel levels in tank (e.g. 'maximum' calibration must be performed only with a full tank).

Calibration is a process of 'teaching' the probe to respond properly and timely to the level of fuel in the tank, while correction ('minimum' or 'maximum') is used only to improve the

temporary nominal characteristics of the probe. It must be performed with an empty tank, e.g. in a situation when the output signal should amount to 100 bit but in fact it is 115 bit. The entire temporary characteristics of the probe sometimes shifts, e.g. along the OX axis – ‘fuel level’ and in this case it is not necessary to recalibrate the probe, but it would be sufficient just to perform the ‘zero correction’ with an empty tank. The output signal will then drop from 115 bit to exactly 100 bit. Consequently, the maximum signal will be corrected by 15 bit as well (from 3815 bit to 3800 bit).

**Note 2: In order to perform calibration, first send initial frame to the probe, only then it is possible to input ‘new minimum’ and ‘new maximum’ level. To each proper inquiry frame, the probe will respond with a corresponding response frame.**

**Note 3: Calibration status frame allows to obtain information about calibration status. The entry VERSION of the response frame shows whether calculation has commenced or is in progress (min. and max has been input) or has been completed – 0x00 0x00, 0x01 0x01, 0x02 0x01, 0x03 0x02 (the first byte indicates calibration progress, the second one shows the number of points of sensor characteristics).**

EXAMPLE: inquiry frame and response frame:

Inquiry frame – filter reading, i.e. temporal constant T

<0x40><0x40><0x09><0x00><0x00><0x09>

Response frame:

<0x40><0x40><0x09><0x76><0x03><0x00><0x0E><0xD8><0xAA><0x0D><0x0A>

where entry no. 3 (from the left side) the probe returns instruction code 0x09, while entries 5 and 6 contain the value of temporal constant T = 3s (byte order: LO, HI). Entries 7 and 8 contain the value of fuel level (0x0ED8 – 3800 bit), where ‘normal’ byte order holds: HI, LO.

## 7. DIAGNOSTICS

### 7.1. Probe visual inspection.

A) Perform external visual inspection of the probe by:

- a) checking the securing seal,
- b) checking for any visible physical damage, i.e. cracks, housing indentation etc.,
- c) checking the probe’s power – signal wire (rubs, cuts etc.),
- d) checking the venting hose: the hose should be placed firmly on the venting nozzle, it should not have any cracks and there should be no fuel inside it,
- e) checking if the nozzle is clear,
- f) checking the soldered joints and clamping connectors of the sensor,
- g) checking the probe sensor wire insulation,
- h) checking the presence of the rubber pass in sensor pipe, that contains sensor wires.

B) Check the probe’s power voltage with a voltmeter

C) Check output signal (voltage or current) with a universal digital meter with accuracy class  $\leq 0.1\%$

### 7.2. Checking the probe’s measuring sensor.

A) Sensor disconnected from the electronic system.

Check the sensor with resistance method using an ohmmeter.

Perform resistance measuring between clamp – wires:

- a) brown – black, brown – white, black – blue, white – green; resistance R1 = 4...5 k $\Omega$
- b) brown – blue, brown – green; R2 = 8...10 k $\Omega$

B) Sensor connected to the electronic system.

Check the sensor with voltage method using a voltmeter.

Perform resistance measuring between clamp – wires:

- a) brown – blue, brown – green; voltage U1 = 3.0...4.5V
- b) brown – black, brown – white, black – blue, white – green; voltage U2 = 1.50...2.25V
- c) black – white; voltage U3 = 0 mV when tank is empty, U4 = 5...100V when tank is full

NOTE 1: With digital probe, voltage  $U3 \neq 0$  mV when tank is empty, when tank is full voltage  $U4 > U3$  (Example:  $U3 = -30$ mV,  $U4 = -10$ mV).

NOTE 2: Short-circuit in probe sensor wires will not cause any damage while probe is working (with normal power).

### 7.3 Checking the polarization of digital probe clamps.

The clamps RXD and TXD or DATA+ and DATA- disconnected from the sender-receiver, e.g. vehicle GPS/GSM recorder, RS-232 converter (0...3,3V)/RS-232C (-12...+12V) with CPU, ADAM-4561 (RS-485/USB) converter with CPU.

with RS-232 interface (maximum acceptable range: 0...3,3V)

Clamp voltage: TXD (yellow conductor) 3,0...3,3V, RXD (green conductor) 0V (regarding black wire).

with RS-485 interface (maximum acceptable range: -7...+12V)

Clamp voltage: DATA+ (yellow conductor) approx. 0,3V, DATA- (green conductor) approx. 0,1V (regarding black wire).

Clamps RXD and TXD or DATA+ and DATA- connected to the sender-receiver, e.g. vehicle GPS recorder, RS-232 converter (0...3,3V)/RS-232C (-12...+12V) with CPU, ADAM-4561 (RS-485/USB) converter with CPU.

with RS-232 interface (maximum acceptable range: 0...3,3V)

Clamp voltage: TXD (yellow conductor) 3,0...3,3V, RXD (green conductor) 3,0...3,3V V (regarding black wire).

with RS-485 interface (maximum acceptable range: -7...+12V)

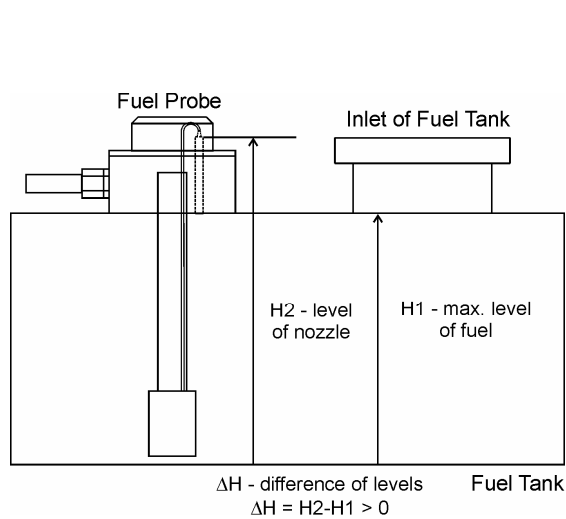
Clamp voltage: DATA+ (yellow conductor) approx. 3,0V, DATA- (green conductor) approx. 0,6V (regarding black wire) with a single probe on RS-485 data bus, A (yellow conductor) approx. 1,8V, B (green conductor) approx. 0,4V (regarding black wire) with four probes on RS-485 data bus.

Note: Probe clamp voltage are given as an example in receiving mode, i.e. while the probe 'awaits' a query frame from peripherals.

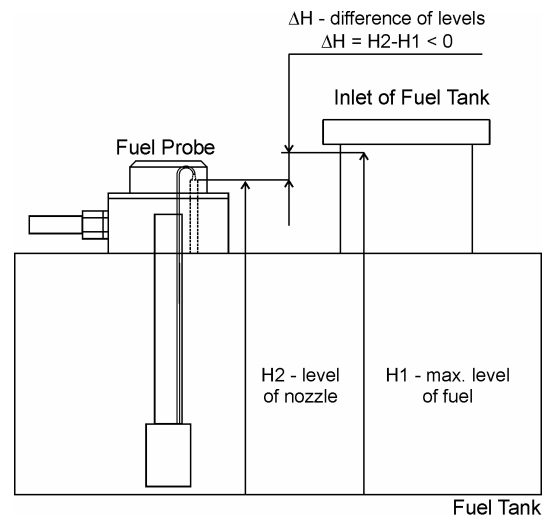
### 8. Assembly Instructions

- the probe must be fitted to the fuel tank in such a way, that level difference  $\Delta H \gg 0$ ; e.g.  $\Delta H = 35\text{mm}$  – i.e. the difference  $\Delta H$  is at least equal to nozzle height in the housing (Pic. 6). If level difference  $\Delta H < 0$  (pic. 7), then the fuel could block the reference hose and the probe's measuring properties could be disturbed.

Pic. 6 Proper probe fitting

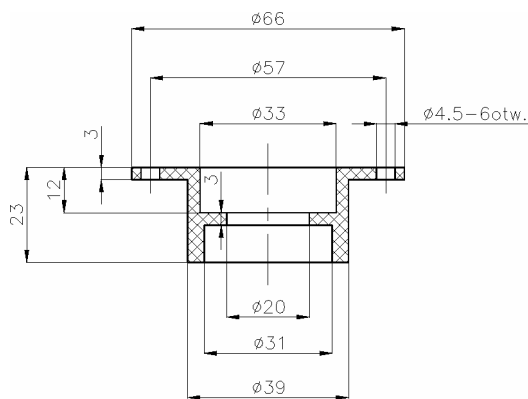


Pic. 7 Improper probe fitting



- for proper fitting probe in situation from picture 7 please use new seal on picture below

Pic. 8



- use proper tools to cut the probe's sensor tube, e.g. REMS-RAS-CU-INOX 3-42, 3 – 42mm manual pipe cutter, manufactured by REMS, as shown in Pic. 8

Pic. 9



- use only Scotchlok UY type gel couplings (included in probe fitting kit – Pic. 9) to connect wires extending from probe's sensor tube and wires in electronics housing (as shown in Pic. 4). The coupling is damp-proof, and it is not necessary to remove insulation from wires while connecting them, thanks to the use of 'sharp teeth' that cut it when the coupling is clamped. To clamp the coupling, use pliers or a special clammer, e.g. SAMAL (Warsaw) HT105 (Pic. 10).
- to secure outputs A (DATA+) and B (DATA-) of the wire from digital – analog probe, use heat-shrinkable tubes (Pic. 11), e.g. RT2.4-BK (2 pieces) and RT9.5-BL (1 piece) from probe fitting kit.

Pic.10



Pic.11



Pic. 12

