

# APLISENS

MANUFACTURE OF PRESSURE TRANSMITTERS  
AND CONTROL INSTRUMENTS

## USER'S MANUAL





SMART LEVEL PROBES TYPE:  
**SGE-25.SMART; SGE-25S.SMART,  
SGE-25C.SMART, SGE-25S.SMART/TITAN**

HYDROSTATIC LEVEL PROBES  
**SGE-25; SGE-25/HASTELLOY;  
SGE-25S; SGE-25C; SGE-16**

Edition E5

WARSAW JANUARY 2020

## Symbols used

Symbol	Description
	Warning to proceed strictly in accordance with the information contained in the documentation in order to ensure the safety and full functionality of the device.
	Information particularly useful during installation and operation of the device.
	Information particularly useful during installation and operation of a type Ex device.
	Information on disposal of used equipment.

## **BASIC REQUIREMENTS AND SAFE USE**



- **The manufacturer will not be liable for damage resulting from incorrect installation, failure to maintain the device in a suitable technical condition, or use of the device other than for its intended purpose.**
- Installation should be carried out by qualified staff having the required authorizations to install electrical and pressure-measuring devices. The installer is responsible for performing the installation in accordance with these instructions and with the electromagnetic compatibility and safety regulations and standards applicable to the type of installation.
- The device should be configured appropriately for the purpose for which it is to be used. Incorrect configuration may cause erroneous functioning, leading to damage to the device or an accident.
- If a device is not functioning correctly, disconnect it and send it for repair to the manufacturer or to a firm authorized by the manufacturer.



- In order to minimize the risk of malfunction and associated risks to staff, the device is not to be installed or used in particularly unfavourable conditions, where the following dangers occur:
- possibility of mechanical impacts, excessive shocks and vibration;
  - excessive temperature fluctuation, exposure to direct sunlight;
  - condensation of water vapour, dust, icing.



Installation of intrinsic safety versions should be performed with particular care, in accordance with the regulations and standards applicable to that type of installation.

Changes to the products manufacturing documentation may forestall a paper user updating. Current User Manual is available on [www.aplisens.pl](http://www.aplisens.pl)

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# I. APPENDIX Ex.03 (SGE–25.SMART, SGE–25S.SMART, SGE–25C.SMART)



1453

SMART LEVEL PROBES

type: SGE–25.SMART, SGE–25S.SMART, SGE–25C.SMART

Ex VERSIONS

## 1. Introduction

- 1.1. This “**Appendix Ex.03**” applies only to smart level probes **SGE–25.SMART, SGE–25S.SMART, SGE–25C.SMART** in Ex versions, marked on the rating plate as shown in 2.2 and denoted Ex in the Product Certificate.
- 1.2. The appendix contains supplementary information relating to the Ex versions of the SGE–25.SMART, SGE–25S.SMART, SGE–25C.SMART probes. During installation and use of Ex probes reference should be made to **DTR.SG...05(ENG)** in conjunction with “**Appendix Ex.03**”.

## 2. Use of smart level probes in danger zones

- 2.1. The probes are produced in accordance with the requirements of the following standards: EN 60079-0:2012+A11:2013, EN 50303:2000, EN 60079-11:2012.
- 2.2. The probes may operate in areas where there is a risk of explosion, in accordance with the rating of the explosion protection design:



II 1G Ex ia IIC T4/T5/T6 Ga

II 1G Ex ia IIB T4/T5/T6 Ga

I M1 Ex ia I Ma

KDB 11 ATEX 140X

(for probe with teflon-shielded cable)

## 3. Identifying marks

Probes in Ex version have a rating plate containing the information specified in paragraph 4 of DTR.SG...05(ENG), and also at least the following:

- “CE” mark and number of notified unit: 1453 in the case of GIG KDB;
- “Ex” mark, designation of explosion protection design, certificate number;
- Values of parameters such as Ui, li, Ci;
- Year of manufacture;
- Inscription: “Version SA” - for probes with the protection against overvoltage (surge arrester).

## 4. User information

Together with the ordered probes, the user will receive:

- a. Product Certificate;
- b. Declaration of conformity;
- c. Copy of certificate (on request);
- d. User’s Manual named: DTR.SG...05(ENG) with Appendix Ex.03.

Items b), c), d) are available on [www.aplisens.pl](http://www.aplisens.pl)

## 5. Permitted input parameters of the smart level probes (based on data from the KDB 11 ATEX 140X certificate and certification documentation)



Probes should be powered via the associated power supply and measurement devices provided with the relevant intrinsic-safe certificates whose parameters of their outputs to the danger zone should not exceed the permitted power supply parameters.

Probes in “Version SA” should be powered with the devices with galvanically isolated power supply.

- Permitted input parameters for power supply with a linear output characteristic:  $U_i=30V$  DC;  $I_i=0.1A$
- Permitted input parameters for power supply with a rectangular output characteristic and trapezoidal output characteristic:  $U_i = 24V$  DC;  $I_i = 0.1A$ .

Pi for all type of power supply; see table below.

Pi[W]	Ta[°C]	Temperature class
0.75	50	T6
	70	T5
	80	T4, group I
1.2	40	T6
	65	T5
	80	T4, group I

Ta – ambient temperature (temperature of measuring medium).

Input inductance and capacity: Ci = 11nF\*; Li = 0.611mH

\*) One should take into account the capacity and inductance of the cable, which permanently connected cable are:  $C_K = 0.2\text{nF/m}$  and  $L_K = 1\mu\text{H/m}$ .

Input capacitance  $C_W$  and input inductance  $L_W$  of the probes taking into account the parameters of the permanently connected cable are accordingly:

$C_W = C_i + a \cdot C_K = 11\text{nF} + a \cdot 0.2\text{nF/m}$ ;  $L_W = L_i + a \cdot L_K = 0.611\text{mH} + a \cdot 1\mu\text{H/m}$

a - length of the mounted permanently cable in meters.

### 5.1. Special conditions for safe use:



Version of device with surge arrester, marked on the plate "Version SA", does not meet the 500V rms isolation test required by EN-60079-11. This must be taken into account when installing the equipment (see p.5).

## 6. Supply examples

6.1. Power supply with a linear output characteristic may be e.g. a typical barrier with parameters:

$U_o=28\text{V}$ ;  $i_o=0.093\text{A}$ ;  $R_w=300\Omega$

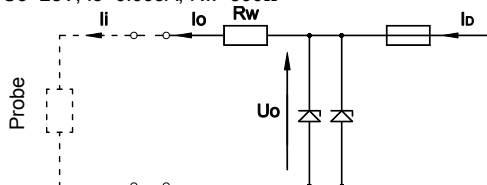


Fig. 1. Power supply from a source with linear output characteristic

Example of practical provision of power supply for case a) use the barrier with the parameters given above.

6.2. Example of power supply from a source with trapezoidal output characteristic (see Fig.2).

$U_o=24\text{V}$ ;  $i_o=0.05\text{A}$

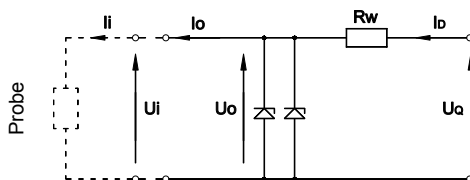


Fig. 2. Power supply from a source with trapezoidal output characteristic

$$\text{If } U_o < \frac{1}{2} U_a \text{ then } U_a = \frac{4P_o}{i_o}, \quad R_w = \frac{U_a}{i_o}, \quad P_o = \frac{U_o (U_a - U_o)}{R_w}$$

For power supply with rectangular output characteristic:

Supplementary attentions: The supply of power from a source with a rectangular output characteristic means that the voltage of the Ex power supply remains constant until current limitation activates.

The protection level of power supplies with a rectangular characteristic is normally "ib".

The probe powered from such a supply is also an Ex device with protection level "ib".

Example of practical provision of power supply with a rectangular characteristic:

use a stabilized power supply with  $U_o=24\text{V}$  with protection level „ib“ and current limited to  $25\text{mA} < i_o < 30\text{mA}$

### 6.3. The protection level

The probe is Ex device with protection level „ia“ when the powered circuit have protection level „ia“.

The probe is Ex device with protection level „ib“ when the powered circuit have protection level „ib“.

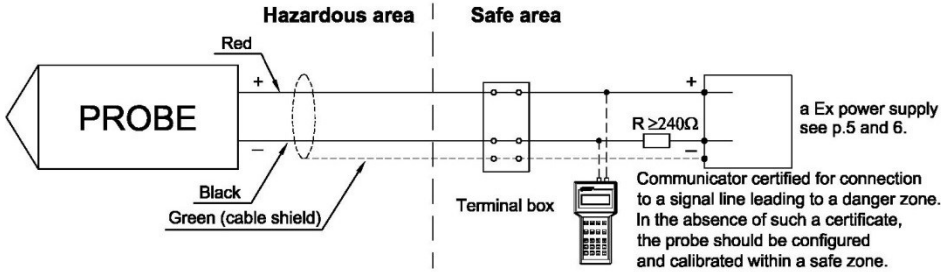


Fig.3. SGE-25.SMART, SGE-25S.SMART, SGE-25C.SMART probes in Ex version – connection method



**Devices in the measurement loop of the probe should be connected in accordance with intrinsic safety and explosion protection standards.**



**It is not permitted to repair or otherwise interfere with the probe's electrical circuits in any way. Damage and possible repair may be assessed only by the manufacturer or another authorized party.**

## II. APPENDIX Ex.04 (SGE–25, SGE–25S, SGE–25C)



HYDROSTATIC LEVEL PROBES  
type: SGE–25, SGE–25S, SGE–25C  
Ex VERSIONS

### 1. Introduction

- 1.1. This "Appendix Ex.04" applies only to hydrostatic level probes **SGE-25, SGE-25C** and **SGE-25S** in Ex versions, marked on the rating plate as shown in p.2.2 and denoted Ex in the Product Certificate.
- 1.2. The appendix contains supplementary information relating to the Ex versions of the **SGE–25, SGE–25C, SGE–25S** probes. During installation and use of Ex probes reference should be made to **DTR.SG...05(ENG)** in conjunction with "Appendix Ex.04".

### 2. Use of hydrostatic level probes in danger zones

- 2.1. The probes SGE–25, SGE–25S, SGE–25C are produced in accordance with the requirements of the following standards: EN 60079-0:2012+A11:2013, EN 60079-11:2012, EN 60079-26:2007, EN 50303:2000.
- 2.2. The probes may operate in areas where there is a risk of explosion, in accordance with the rating of the explosion protection design:



II 1G Ex ia IIC T4/T5/T6 Ga  
II 1G Ex ia IIB T4/T5/T6 Ga  
I M1 Ex ia I Ma  
KDB 09 ATEX 007X

(for probe with teflon-shielded cable)

### 3. Identifying marks

The above mentioned probes in Ex version must have a rating plate containing the information specified in paragraph 4 of DTR. SG...05(ENG), and also at least the following:

- "CE" mark and number of notified unit: 1453 in the case of GIG KDB;
- "Ex" mark, designation of explosion protection design, certificate number;
- Values of parameters such as Ui, li, Ci;
- Year of manufacture;
- Inscription: "Version SA" - for probes with the protection against overvoltage (surge arrester).

### 4. User information

Together with the probes ordered, the user will receive: User's Manual numbered DTR.SG...05(ENG) with Appendix Ex.04, and also the Product Certificate.

### 5. Permitted input parameters of the SGE–25, SGE–25S, SGE–25C probes (based on data from the KDB 09 ATEX 007X certificates and certification documentation)



Probes should be powered via the associated power supply and measurement devices provided with the relevant intrinsic-safe certificates whose parameters of their outputs to the danger zone should not exceed the permitted power supply parameters specified in points 5a and 5b.

Probes in "Version SA" should be powered with the devices with galvanically isolated power supply.

Minimum supply voltage for probe is 9 V DC.



The probe is an intrinsically safe (Ex) device with protection level „ia" when the powered circuit have protection level „ia".

- a) Permitted input parameters for power supply with a linear output characteristic  
Ui = 28V DC; li = 0.1A
- b) Permitted input parameters for power supply with a rectangular output characteristic and trapezoidal output characteristic  
Ui = 28V DC; li = 0.08A

Input inductance and capacity: Ci = 25nF; Li = 0.4mH

*\*) It should take into account the capacitance and inductance of the cable, which for permanently connected cable are: Ck= 0.2nF/m and Lk=1µH/m.*

Input capacitance Cw and input inductance Lw taking into account the parameters of the permanently attached cable: Cw = Ci + a · Ck = 11nF + a · 0.2nF/m; Lw = Li + a · Lk = 1000µH + a · 1µH/m

a - length of the permanently mounted cable in meters.

Pi for all type of power supply; see table Z1.

**Table Z1**

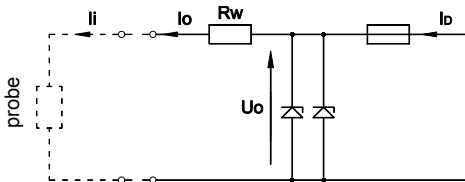
Pi [W]	Ta [°C]	Temperature class
0.7	50	T6
	80	T5, T4, group I
1.2	40	T6
	75	T5
	80	T4, group I

Ta – ambient temperature (temperature of measuring medium).

## 6. Supply examples

6.1. Power supply with a linear characteristic may be e.g. a typical barrier with parameters:

$$U_o=28V \quad I_o=0.093A \quad R_w=300\Omega$$



Example of practical provision of power supply: use the barrier with the parameters given above.

Fig. 1. Power supply from a source with linear output characteristic

6.2. Example of power supply from a source with trapezoidal output characteristic (see Fig.2).

$$U_o=24V; \quad I_o=0.05A$$

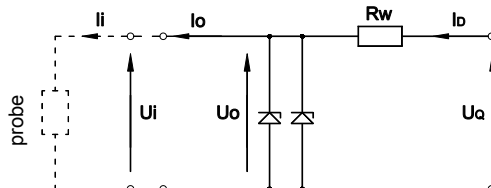


Fig. 2. Power supply from a source with trapezoidal output characteristic

$$\text{If } U_o < \frac{1}{2} U_a \quad \text{then} \quad U_o = \frac{4P_o}{I_o}, \quad R_w = \frac{U_a}{I_o}, \quad P_o = \frac{U_o(U_a - U_o)}{R_w}$$

For power supply with rectangular output characteristic:

The supply of power from a source with a rectangular output characteristic means that the voltage of the Ex power supply remains constant until current limitation activates.

The protection level of power supplies with a rectangular characteristic is normally "ib". The probe powered from such a supply is also an Ex device with protection level "ib".

Example of practical provision of power supply with a rectangular characteristic:

– use a stabilized power supply with  $U_o=24V$  with protection level „ib” and current limited to  $I_o=50mA$ .



## 6.3. Protection level

The probe is Ex device with protection level „ia” when the powered circuit have protection level „ia”.  
 The probe is Ex device with protection level „ib” when the powered circuit have protection level „ib”.

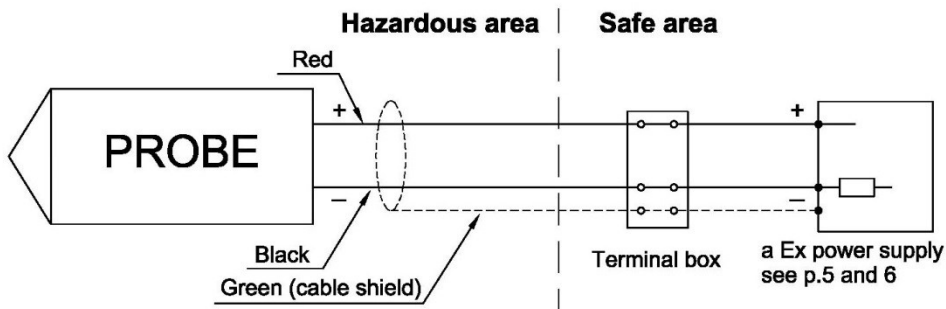


Fig.3. SGE-25, SGE-25S, SGE-25C probes in Ex version – connection method



**Devices in the measurement loop of the probe should be connected in accordance with intrinsic safety and explosion protection standards.**



**It is not permitted to repair or otherwise interfere with the probe's electrical circuits in any way. Damage and possible repair may be assessed only by the manufacturer or another authorized party.**

#### Special conditions for safe use:

- Probes with surge arrester, marked on the rating plate version “SA”, does not meet the 500V rms isolation test required by EN 60079-11. This must be taken into consideration during the installation of probe (see p.5).

## 1. INTRODUCTION

1.1. This manual is intended for users of **SGE-25.SMART**, **SGE-25S.SMART**, **SGE-25C.SMART**, **SGE-25S.SMART/TITAN**, **SGE-25**, **SGE-25/Hastelloy**, **SGE-25S**, **SGE-25C** and **SGE-16** hydrostatic level probes containing the data and guidelines necessary to understand the functioning of the probes and how to operate them. It includes essential recommendations concerning installation and use, as well as emergency procedures.

1.2. The **SGE-25**, **SGE-25S**, **SGE-25C** and **SGE-25SMART**, **SGE-25S.SMART**, **SGE-25C.SMART** are also made in Ex version.



Additional data on the probes in Ex version is contained in the appendix designated “**DTR.SG...05(ENG). Appendix.Ex.04**” or “**DTR.SG...05(ENG). Appendix.Ex.03**”.

During installation and use of the probes in Ex version, reference should be made to **DTR.SG...05(ENG)** in conjunction with **Appendix Ex**.

1.3. The level probes: **SGE-25**, **SGE-25/Hastelloy**, **SGE-25S**, **SGE-25C**, **SGE-25SMART**, **SGE-25S.SMART** and **SGE-25C.SMART** in realization for sea uses are complied with DNV-GL Rules for Classification of Ships, High Speed & Light Craft acc. to DNV Standard for Certification No. 2.4, April 2006, in following Location Classes: Temperature C, Humidity: B, Vibrations: B, EMC: B, Enclosure: D.



## 2. USER MATERIALS

The level probes are delivered in single and/or multiple packs.

Together with the probe are delivered:

- a. Product certificate, which is also as the warranty card;
- b. Declaration of conformity (on request);
- c. Copy of ATEX certificate (on request);
- d. User's Manual numbered „DTR.SG...05(ENG)”.

Items b), c), d) are available at: [www.aplisens.pl](http://www.aplisens.pl)

## 3. APPLICATIONS OF PROBES

The **SGE-25.SMART**, **SGE-25S.SMART**, **SGE-25C.SMART**, **SGE-25S.SMART/TITAN**, **SGE-25**, **SGE-25S**, **SGE-25** and **SGE-16** probes are designed to measure the depth of liquid in wells, tanks, watercourses, boreholes etc.

The **SGE-25S.SMART** and **SGE-25S** probes are particularly designed for the measurement of levels of liquid waste and of dense or viscous.

The **SGE-16** probes, due to their small diameter, are designed for the measurement of water levels in wells and boreholes, wherever it is necessary to insert probes into pipes of small diameter.

Probes fitted with cables with an additional Teflon shield may be used with food products and with reactive substances.

The **SGE-25/HASTELLOY** hydrostatic level probe is applicable to measure liquid levels in tanks where probe made in stainless steel can't be used – e.g. in seawater or chemical applications.

The **SGE-25**, **SGE-25/HASTELLOY**, **SGE-16**, **SGE-25C**, **SGE-25S** probes convert an input pressure (being a measure of the level of the medium) into a standard 4÷20 mA signal transmitted in a two-wire system, or in special versions into a 0÷10V signal transmitted in a three-wire system.

The **SGE-25.SMART**, **SGE-25S.SMART**, **SGE-25C.SMART**, **SGE-25S.SMART/TITAN** probes generate a 4÷20mA output signal and a digital HART signal in a two-wire system (current loop).

## 4. IDENTIFYING MARKS. ORDERING PROCEDURE

### 4.1. Identifying marks on a rating plate

Every probe carries a rating plate containing at least the following information: CE mark, numbers of notified institutions and designations of certificates obtained, name or logo of manufacturer, type, factory number, basic range, output signal, power supply voltage.

Probes for marine uses are equipped in additional rating plates with the DNV certificate number, and signs of environmental classes.

### 4.2. Ordering procedure

See the catalogue cards.

## 5. TECHNICAL DATA

### 5.1. Technical data. SGE-25.SMART, SGE-25S.SMART, SGE-25C.SMART, SGE-25S.SMART/TITAN probes

#### 5.1.1. SGE-25.SMART, SGE-25S.SMART, SGE-25C.SMART and SGE-25S.SMART/TITAN. Measurement Ranges

Type of probe	Basic range (FSO)	Minimum set range	Overpressure limit (without hysteresis)
SGE-25.SMART	0 ÷ 1,5 mH <sub>2</sub> O	0,15 mH <sub>2</sub> O	15 mH <sub>2</sub> O
SGE-25S.SMART	0 ÷ 10 mH <sub>2</sub> O	0,8 mH <sub>2</sub> O	100 mH <sub>2</sub> O
SGE-25.SMART	0÷100 mH <sub>2</sub> O	8 mH <sub>2</sub> O	700 mH <sub>2</sub> O
SGE-25C.SMART	0 ÷ 10 mH <sub>2</sub> O	0.8 mH <sub>2</sub> O	100 mH <sub>2</sub> O

#### SGE-25S.SMART/TITAN Measurement ranges:

Basic range	0 ÷ 10 mH <sub>2</sub> O
Minimum set range	0,8 mH <sub>2</sub> O

#### 5.1.2. SGE-25.SMART, SGE-25C.SMART. Metrological parameters

Accuracy	≤ ± 0.1 % for the basic range ≤ ± 0.3 % for range 0...10% FSO
Long term stability	≤ 0.1 % (FSO) for 2 years
Thermal error	< ± 0.08 % (FSO) / 10°C < ± 0.2 % for the whole thermal compensation range
Thermal compensation range	-25 ÷ 80°C
Error due to supply voltage changes	0.002% (FSO) / 1V

#### 5.1.3. SGE-25S.SMART, SGE-25S.SMART/TITAN Metrological parameters

Accuracy	≤ ± 0.16 % for the basic range ≤ ± 0.4 % for range 0...10% FSO
Thermal error	< ± 0.08 % (FSO) / 10°C < ± 0.2 % for the whole thermal compensation range
Additional absolute zero error related to changes in the medium temperature	up to 80 Pa/10°C
Thermal compensation range	-25 ÷ 80°C
Error due to supply voltage changes	0.002% (FSO) / 1V

#### 5.1.4. SGE-25.SMART, SGE-25S.SMART, SGE-25C.SMART and SGE-25S.SMART/TITAN. Electrical parameters

Type of probe	Power supply
SGE-25.SMART SGE-25S.SMART SGE-25C.SMART SGE-25S.SMART/TITAN	7.5 ÷ 55V DC
SGE-25.SMART / Ex SGE-25S.SMART / Ex SGE-25C.SMART / Ex	7.5 ÷ 30V DC



More information for Ex-version see "Appendix Ex.03".

E5  
Output signal

10  
4...20 mA + HART  
or inverse 20...4 mA two wire transmission

DTR.SG...05(ENG)

Load resistance

$$R[\Omega] \leq \frac{U_{\text{sup}} [V] - 7.5 V}{0,0225 A}$$

Communication is carried out via HART transmission protocol and signal of 4+20mA. For this purpose: KAP-03, KAP-03Ex communicator, HART/RS232 converter or HART/USB Converter (APLISENS) or another converter, PC computer and Raport 2 programme can be used (see p. 9).

Resistance required for communication 240...1100  $\Omega$ ,  
Minimum supply voltage for specified load resistance  $R_L[\Omega]$   $U_{\text{min}}[V] = R_L[\Omega] \times 0.0225 A + 7.5 V$   
Constant response time 22 ms (cannot be set by software)  
Additional electronic damping 0...30 s  
Voltage for insulation testing 500 V AC or 750 V DC  
– versions "normal" and "SA" 100 V DC  
Excess voltage protection see p. 10.2.2

### 5.1.5. SGE-25.SMART,SGE-25C.SMART, SGE-25S.SMART AND SGE-25S.SMART/TITAN. Permitted Environmental Conditions

Process temperature limit -30...40°C - standard  
0...80°C - for special versions



Maximum process temperatures for Ex version see "Appendix Ex.03" for SGE-25.SMART, SGE-25S.SMART and SGE-25C.SMART.



The medium must not be allowed to freeze in the immediate vicinity of the probe.

## 5.2. Technical Parameters of the SGE-25, SGE-25/Hastelloy

### 5.2.1. Technical Parameters of the SGE-25

Any measurement range 1...500 m H<sub>2</sub>O for normal version  
1...100 m H<sub>2</sub>O for Ex version  
Recommended standard ranges 4, 10, 20, 50, 100 m H<sub>2</sub>O

	Measurement Range		
	1 mH <sub>2</sub> O	4 mH <sub>2</sub> O	10 mH <sub>2</sub> O ÷ 500 mH <sub>2</sub> O
Overpressure Limit (repeatable–without hysteresis)	40 x range	25 x range	10 x range (max. 700 mH <sub>2</sub> O)
Accuracy % FSO acc. to IEC 60770	0.6 %	0.3 %	0.2 %
Accuracy % FSO acc. to BFSL	0.3 %	0.15 %	0.1 %
Thermal error	typical 0.3% / 10°C max 0.4% / 10°C		typical 0.2% / 10°C max 0.3% / 10°C

Hysteresis, repeatability 0.05%  
Long term stability 0.1% or 1 cm H<sub>2</sub>O for 1 year  
Thermal compensation range 0 ÷ 40°C – standard  
-10 ÷ 70°C – for special version  
Medium temperature range -25 ÷ 40°C – standard  
0 ÷ 75°C – ETFE and PTFE version



Maximum process temperatures for Ex version see "Appendix Ex.04" for SGE-25, SGE-25S, SGE-25C.



The medium must not be allowed to freeze in the immediate vicinity of the probe.

### 5.2.2. Technical Parameters of the SGE-25/Hastelloy

Any measurement range 2...20 m H<sub>2</sub>O  
 Recommended standard ranges 4, 10, 10, 20 m H<sub>2</sub>O

	Measurement Range	
	2 mH <sub>2</sub> O...4 mH <sub>2</sub> O	10 mH <sub>2</sub> O ÷ 20 mH <sub>2</sub> O
Overpressure Limit (repeatable–without hysteresis)	10 x range	10 x range
Accuracy % FSO	0.2 %	0.2 %
Thermal error	typical 0.3% / 10°C max 0.4% / 10°C	typical 0.2% / 10°C max 0.3% / 10°C

Hysteresis, repeatability 0.05%  
 Long term stability 0.1% or 1 cm H<sub>2</sub>O for 1 year  
 Thermal compensation range 0 ÷ 40°C – standard  
 Medium temperature range -25 ÷ 40°C – standard



The medium must not be allowed to freeze in the immediate vicinity of the probe.

### 5.3. Technical Parameters of the SGE-25S, SGE-25C

Any measurement range 2...20 mH<sub>2</sub>O for normal and Ex-version  
 Recommended standard ranges 2, 5, 4, 10 mH<sub>2</sub>O

	Measurement Range		
	2,5 mH <sub>2</sub> O	4 mH <sub>2</sub> O	10 mH <sub>2</sub> O ÷ 20 mH <sub>2</sub> O
Overpressure Limit (repeatable–without hysteresis)	20 x range	20 x range	10 x range
Accuracy % FSO acc. to IEC 60770	1,5%	1%	0.5%
Accuracy % FSO acc. to BFSL	0,75%	0,5%	0.25%
Thermal error of zero	typical 0.4% / 10°C max 0.6% / 10°C		typical 0.2% / 10°C max 0.3% / 10°C
Thermal error of span	typical 0.3% / 10°C max 0.4% / 10°C		typical 0.2% / 10°C max 0.3% / 10°C

Hysteresis, repeatability 0.05%  
 Thermal compensation range 0 ÷ 40°C – standard  
 -10 ÷ 70°C – for special version  
 Medium temperature range -25 ÷ 40°C – standard  
 0 ÷ 75°C – for version with ETFE and PTFE cable



Maximum process temperatures for Ex version see “Appendix Ex.04” for SGE–25, SGE–25S, SGE–25C.



Medium must not be allowed to freeze in the immediate vicinity of the probe.

### 5.4. Technical Parameters of the SGE-16

Measurement ranges 10; 20; 50; 100 mH<sub>2</sub>O  
 Accuracy 0.3%  
 Hysteresis, repeatability 0.05%  
 Overpressure limit (repeatable – without hysteresis) 10 x range  
 Thermal compensation range 0 ÷ 40°C  
 Process temperature limit 0 ÷ 40°C  
 0 ÷ 75°C – for version with ETFE and PTFE cable

## **5.5. SGE-25, SGE-25/Hastelloy, SGE-16, SGE-25S, SGE-25C.**

### **Electrical parameters**

Type of probe	Signal type	Power supply
SGE-25 SGE-25/Hastelloy SGE-25S SGE-25C	4 ÷ 20 mA	8 ÷ 36V DC
SGE-25 SGE-25S SGE-25C	4 ÷ 20 mA	10.5 ÷ 36V DC <i>for TR version</i>
SGE-25/Ex SGE-25S/Ex SGE-25C/Ex	4 ÷ 20 mA	9 ÷ 28V DC 12 ÷ 28V DC <i>for TR version</i>
SGE-25 SGE-25S SGE-25C	0 ÷ 10 V	13 ÷ 30V DC
SGE-25	0 ÷ 3.3 V	4.1 ÷ 14.1V DC
SGE-25	0 ÷ 5 V 0.5 ÷ 4.5 V	8 ÷ 14.1V DC
SGE-16	4 ÷ 20 mA	8 ÷ 36V DC
SGE-16	0 ÷ 3.3 V	3.6 ÷ 4.5 V DC

Output signal	4 ÷ 20mA, two wire transmission
Load resistance (for current output)	$R[\Omega] \leq \frac{U_{sup} [V] - 8^* V}{0,02 A}$
Load resistance (for voltage output)	$R[\Omega] \geq 20k\Omega$
Error due to supply voltage changes	0,005%/1V



**More information for Ex-version see "Appendix Ex.04" for SGE-25, SGE-25S, SGE-25C.**

\*) Insert the minimum supply voltage according to the table above.

## **5.6. Construction Materials: (for whole probes)**

Diaphragm	Stainless steel 1.4404/1.4435 (316L)-for SGE-16, SGE-25S, SGE-25S.SMART, SGE-25C Hastelloy C276 – for SGE-25, SGE-25.SMART, SGE-25/Hastelloy
Sensing module	Stainless steel 1.4404 (316L)
Casing for electronic parts	Steel pipe 1.4404 (316L) Hastelloy C276 for SGE-25/Hastelloy
Liquid filling the interior of the sensing module	Silicone oil
Cable shield	Polyurethane, ETFE and PTFE ETFE for SGE-25/Hastelloy
Additional cable shield	Teflon (fitted by arrangement)

## **5.7. Ingress protection rating**

SGE-25.SMART, SGE-25S.SMART, SGE-25, SGE-25/Hastelloy,  
SGE-25S, SGE-25C and SGE-16

IP68

## 6. TECHNICAL DESCRIPTION

### 6.1. Principles of Operation

The hydrostatic level probes work by converting changes in the resistance of a piezoresistive bridge, which are proportional to the pressure (of a hydrostatic column of liquid), into a standard current output signal. The active sensing device is a silicon diaphragm with in-diffused piezoresistors.

### 6.2. Construction

**6.2.1.** The probe is composed of the active sensing device with silicon and sealing diaphragm, and plate with the electronic components.

The **SGE-25S.SMART** and **SGE-25S** probes are additionally fitted with a diaphragm seal enabling measuring the depth of dense media and media with suspended matter and impurities, such as liquid waste (fig. 1, 3).

The output signal is passed through a special cable with a capillary used to connect the negative side of the measuring diaphragm to the atmosphere.

**6.2.2.** Special versions of the probes can be produced with cables shielded by an additional teflon layer.

The shield covers the parts of the cable while is immersed in the medium being measured, as well as a necessary additional segment.

The Teflon shield (in Ex version) is additionally equipped in stainless steel cord escorted electrostatic charges (see fig. 5).

**6.2.3.** The probes are fitted with elements ensuring excess voltage protection: „transil” diodes between the wires, and plasma surge arresters between the wires and the casing.

The plasma surge arresters are assembled in normal and "Version SA" only.

### 6.3. Electronic circuit of the probes

Electronic circuit can be produced in two versions:

**6.3.1.** The digital version (**SGE-25.SMART** and **SGE-25S.SMART** probes).

The electronic circuit changes the signal from the sensing module into digital signal and input to a microprocessor, which controls the probe's operation. Using data input during the production process, the processor processes the conversion curve, adjusts for thermal errors and carries out linearization.

After processing, the digital signal is again converted into an analogue 4÷20mA current signal, with a superimposed digital communication HART signal.

**6.3.2.** The analog version (**SGE-25**, **SG-25/Hastelloy**, **SGE-25S**, **SGE-25C** and **SGE-16** probes).

The electronic circuit changes the signal from the sensing module into an output signal 4...20 mA.

The electronic circuit is equipped in filter elements assured resistance on conducted and radiated disturbances and electric impulse.

## 7. PLACE OF INSTALLATION

**7.1.** The level probes installed in places where liquid levels are measured in wells, tanks, boreholes etc. The probe is immersed in the medium being measured. A special cable extends above the level of the medium; this can be connected directly to another device or to a terminal box.

### 7.2. High and Low Ambient Temperatures and Medium Temperatures

When measuring liquids whose solidification point is above the ambient temperature, the medium should not be allowed to freeze around the probe, this applies in particular to water in the case of open-air installations. For maximum medium temperatures see sect. 5.



Data for versions Ex in accordance with Appendix Ex.03, Appendix Ex.04.

## 8. INSTALLATION AND CONNECTION

### **8.1. Mechanical Installation**

The probe can be suspended from the power supply cable e.g. using the handle SG prod. Aplisens. If the probe will often be removed or, when during the pull, there is the possibility of hitching protruding elements it is recommended to suspend the probe on a steel cable using the supporting handle (not applicable to **SGE-16**). If the cable is to be exposed to current or turbulence, it should be installed in a protective tube, e.g. one made from PCV.



**Directly before location the probe in measured medium to take off from diaphragm seals SGE-25S, SGE-25S.SMART, SGE-25C the securing covers. Protect the level probe from impacts during installation.**



The probe with an additional Teflon shield suspends on a steel cable or on an internal cable (do not catch for teflon).  
The probe in Ex-version with a cord for earthing suspend on a steel cable using the lifting handle.

### **8.2. Electrical Connection**

The method of making electrical connections is shown in figure 2, 3A, 4A (for Ex version in figure 3 „Appendix Ex“). If the transmission line leads to remote premises via the open air, it is recommended that a terminal box be fitted, e.g. the Aplisens type PP, in order to connect the probe's cable to the remaining section of the transmission line. The box should have an IP65 ingress protection rating, and but should not be so airtight as to prevent the probe's active sensing device from "breathing" via a capillary embedded in the cable. The opening of the capillary should not be allowed to become dirty, and water should not be allowed to enter the capillary.

Where the transmission line is very long, it is recommended that the section leading from the end of the probe cable be made from twisted pair cable, and it is desirable that entry points to other devices be fitted with excess voltage protection, e. g. the Aplisens UZ-2 system.

The cable of the probe and the remaining section of the transmission line should be protected from mechanical damage.

From the probe power supply is led cable screen (green wire). The manufacturer recommends connecting the probe cable shield to the ground point measuring system; grounding of the cable shield is particularly appropriate in an environment of large EMC; e.g. the pumping station when the cable passes the test probes power cable supply pump. Cable shield in work station with battery may, but need not be grounded.

## 9. SETTINGS AND REGULATION

### **9.1. Settings of SGE-25, SG-25/Hastelloy, SGE-16, SG-25C, SGE-25S probes**

The **SGE-25, SG-25/Hastelloy, SGE-16, SGE-25C, SGE-25S** are factory set to the range stated in the order. The user does not have access to the "zero" and "range" potentiometers. Setting may be adjusted by the manufacturer only.

### **9.2. Settings of SGE-25.SMART, SGE-25S.SMART, SGE-25S.SMART/TITAN probes**

The **SGE-25.SMART** and **SGE-25S.SMART** probes are equipped with a smart electronic and HART communication system, thought which the user can make e.g. set „zero“ and measurement ranges.

### **9.3. SGE-25.SMART, SGE-25S.SMART, SGE-25S.SMART/TITAN. Measurement ranges. Definitions**

**9.3.1.** The maximum range of level, while the probe can measure is called „**basic range**“ (for specifications of "basic range" see 5.1.1).

The width of the basic range is the difference between the upper and lower limits of the basic range.

The internal characteristic conversion curve for the basic range is coded in the probe's memory.

This is the reference curve used when making any adjustments which affect the probe's output signal.

**9.3.2.** When the probe is in use the term "set range" is used.

The set range is the range whose lower end-point corresponds to an output current of 4mA and whose upper end-point corresponds to a current of 20mA (or 20mA and 4mA respectively when the conversion curve inverted). The set range may cover the whole of the basic range or only a part of it. The width of the set range is the difference between the upper and lower limits of the set range. The probe may be set to any range within the basic range of level values, subject the restrictions set out in the table in 5.1.1.



## **9.4. Configuration and Calibration**

**9.4.1.** The **SGE-25.SMART**, **SGE-25S.SMART**, **SGE-25C.SMART**, **SGE-25S.SMART/TITAN** probes have features which enable metrological and identification parameters to be set and altered. The configurable metrological parameters affecting the probe's output signal include the following:

- a) Unit in which the measured level is expressed on the display;
- b) Upper end-point of the set range;
- c) Lower end-point of the set range;
- d) Time instant;
- e) Type of characteristic curve: linear or radical.

Parameters of an informational nature which cannot be altered include the following:

- a) Upper limit of the basic range;
- b) Lower limit of the basic range;
- c) Minimum set range.

**9.4.2.** Other identification parameters, not effecting the output signal, include: device address, device code, factory identification code, factory device code, number of preambles (3÷20), UCS, TSD, program version, electronics version, flags, factory number, label tag, description tag, date tag, message, record number, sensing module number.

The process of setting the parameters listed in 9.4.1 and 9.4.2 is called "Configuration".

**9.4.3.** It is possible to adjust the probe's **zero point**, for example to compensate for deviation resulting from a change in position of installation.

The probes may also be **calibrated**, by taking readings with the input pressure controlled using a standard device. These process and zero-point adjustments are called "Calibration".

**9.4.4.** Configuration and Calibration of the probe are carried out using an Aplisens KAP-03 or KAP-03Ex communicator, certain HART communicators or a PC with HART/RS232 converter and Aplisens "Raport2" software.

Catalogue cards and user manuals for Aplisens communication tools (KAP communicator, HART/RS232 converter and "Raport 2" programme) can be found on the manufacturer website [www.aplisens.pl](http://www.aplisens.pl).

**During configuration it is important to protect the transducers using command HART [247]. During work probe should be safe prior to entries. This prevents accidental or intentional changes configurational data. The protection function is accessible in KAP-03 communicator, "Raport2" software, as well as, in applying DD or DMT programs libraries.**



## **10. INSPECTIONS, REPAIRS AND SPARE PARTS**

### **10.1. Regular inspections**

**10.1.1.** Regular inspections should be carried out in accordance with the regulations to which the user subject An inspection should be made of the external condition of the probe, during which:

- a) Check that there are no signs of mechanical damage in the form of impact marks or dents;
- b) Check the condition of the cable, which should not show signs of wearing, bending or fraying of the external coating; check the condition of the packing gland.

Every two years or in accordance with regulations applicable to the user, check the zero point (4mA).

**10.1.2.** Check the „zero point“ (**SGE-25**, **SG-25/Hastelloy**, **SGE-25S**, **SGE-25C** and **SGE-16**) bring the probe up above the surface of the liquid and read the output current. In case of excessive deviation of the zero reading, return the probe to the manufacturer for adjustment of the conversion curve or adjust the zero point of a device used in conjunction with the probe (e.g. monitor, regulator, and controller).

**10.1.3.** Check the „zero point“ **SGE-25.SMART**, **SGE-25S.SMART**, **SGE-25S.SMART/TITAN** see 10.1.2.

### **10.2. Additional Inspections**

If the probe is installed in a place where it might have been subject to mechanical damage, wearing cable covering, excess pressure, hydraulic impulses, sedimentation, crystallization or erosion of the diaphragm, or excess electrical voltage, inspections should be made as necessary.

Check the state of the diaphragm and cable, clean the diaphragm, and check the zero point.

### 10.2.1. Faults in the Transmission Line

If there is no current in the line or the value of the current is random, check the transmission line, the connections with the terminal adapters, connectors etc.

If the transmission line is in good order, check whether the probe is functioning correctly.

### 10.2.2. Protection from Excess Voltage

The probe may be in danger from excess voltage caused by connection faults or atmospheric electrical discharge.

Protection from excess voltage between the wires of the transmission line is provided by TVS diodes installed in all types of probe (see the table, column 2).

In order to protect against excess voltage between the transmission line and the casing or earth (not prevented by the diodes connected between the transmission wires), additional protection is provided in the form of plasma surge arresters (see the table, column 3).

Also external protective devices may be used, e.g. the UZ-2 Aplisens system, or others.

Internal protection of probes:

1	2	3
Type of probe	Protection between wires (TVS diodes) – permitted voltage	Protection between wires and earth and/or casing – type of protection, permitted voltage
SGE-25.SMART, SGE-25 series	68V DC	Plasma surge arresters - 230V DC (only in normal and "SA" versions)

The voltage in the protective elements must not exceed the maximum permitted values given in columns 2 and 3 of the table.



The insulation test voltages 500V AC or 750V DC refer to transmitters with plasma surge arresters.

In case of a large surge of excess voltage between the wires of the line, the safety diode may sustain damage due to a low-resistance short circuit (a diode damaged in this way still provides protection to the probe's circuits).

Symptoms of damage:

- When the probe is connected to the power supply, the value of the current exceeds 20 mA, and the voltage on the probe is of an order of several hundred mV (in extreme cases a particularly strong surge may cause circuits or wires inside the probe to burn out; the current is then 0 mA and there is full voltage in the output circuit);
- When the probe is not connected to a power supply, the resistance of the probe should be measured; this is approximately 10Ω and is equal to the value of the limiting resistors + resistance of the damaged diode.

Damage to the gas-filled spark gap (Plasma surge arresters) is much less likely than damage to the diode, and may lead to a short circuit or a lowering of the resistance of the spark gap.

### 10.2.3. Damage Caused by Overpressure

Another possible reason for malfunctioning of the probe is damage caused by overpressure, which may result from such factors as

- a) Freezing of the medium;
- b) Dynamic effects of a strong current of liquid on the diaphragm seal while the probe is being washed (applies mainly to the **SGE-25S**, **SGE-25S.SMART** model);
- c) Striking or scraping of the diaphragm with a hard object, such as a screwdriver.

If excess pressure on the probe has caused damage to the silicon or sealing diaphragm, the probe can no longer be used. Symptoms of such damage are generally such that the output current falls below 4 mA or rises above 20 mA, and the probe fails to react to input pressure.

### 10.2.4. Cleaning the Diaphragm Seal

Impurities which have accumulated on the diaphragm during operation should not be removed by mechanical means such as scraping, scrubbing etc., as this may cause damage. The only permitted method is to dissolve the impurities, possibly aiding their removal with a light brush.

Sedimentation on the diaphragm may affect the conversion curve.



**After removing sedimentation, parts which have come into contact with the solvent substance should be thoroughly rinsed, and the health and safety regulations relating to the chemical in question should be adhered to.**

**Do not use substances which might cause corrosion of the diaphragm seal.**

### **10.3. Spare Parts**

The following parts of the probe can be replaced when worn or damaged: cable, seals on the packing gland. The cable may be replaced by the manufacturer only.

## **11. PACKING, STORAGE AND TRANSPORT**

### **11.1. Packing, Transport**

The probes should be packed in such a way as to protect them from damage during transportation, in single or multiple packs. The cable should be rolled into a loop  $\geq 300$  mm in diameter, secured so as to prevent the coils from moving relative to each other and the whole from moving within the package. Avoid breakage to the cable at the point where it enters the packing gland. Land, sea or air transport may be used, provided that direct action of atmospheric effects is prevented.

### **11.2. Storage**

The probes should be stored in multiple packs under cover, in a place free of vapours and reactive substances, with temperature and humidity not exceed the limits for specific probes.

## **12. GUARANTEE**

Manufacturer warrants under the conditions specified in the Product Certificate which is also a guarantee card.

## **13. SCRAPPING, DISPOSAL**

Waste or damaged probes should be dismantled and disposed of in accordance with Directive (2012/19/UE) on waste electrical and electronic equipment (WEEE) or returned to the manufacturer.

## **14. ADDITIONAL INFORMATION**

Related standards:

EN 60529:1991/A2:2013

Ingress protection rating of casing. (IP code)

EN 61010-1:2010

Safety requirements for automated electrical measuring devices and laboratory devices. General requirements.

## **15. LEVEL PROBE WITH INTERNAL TEMPERATURE SENSOR PT100**

Electrical connections and wire colours in the probe power supply cable in the output signal 4 ... 20mA with resistive temperature sensors.

Level probe

- red: “+” probe power supply
- black: “-” probe power supply
- green: cable shield (if it is led out)

Resistance sensor

- |                                                                                                              |                                     |
|--------------------------------------------------------------------------------------------------------------|-------------------------------------|
| <ul style="list-style-type: none"> <li>– white</li> <li>– white</li> <li>– brown</li> <li>– brown</li> </ul> | sensor in the four-wire connection  |
| <ul style="list-style-type: none"> <li>– white</li> <li>– brown</li> <li>– brown</li> </ul>                  | sensor in the three-wire connection |

### 16. FIGURES

Special version of probe.  
Cable with additional  
teflon covering

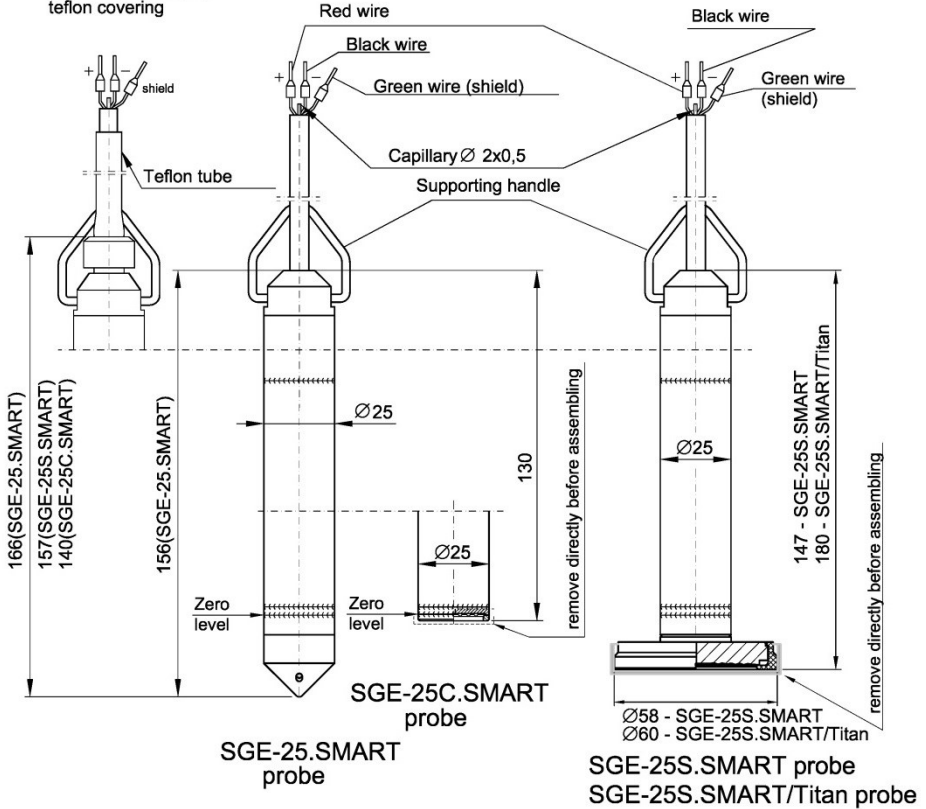


Figure 1. SGE-25.SMART and SGE-25S.SMART probes – dimensions

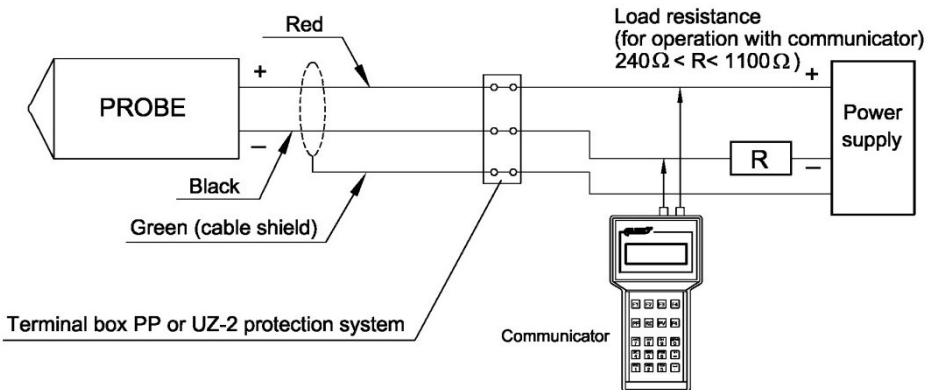
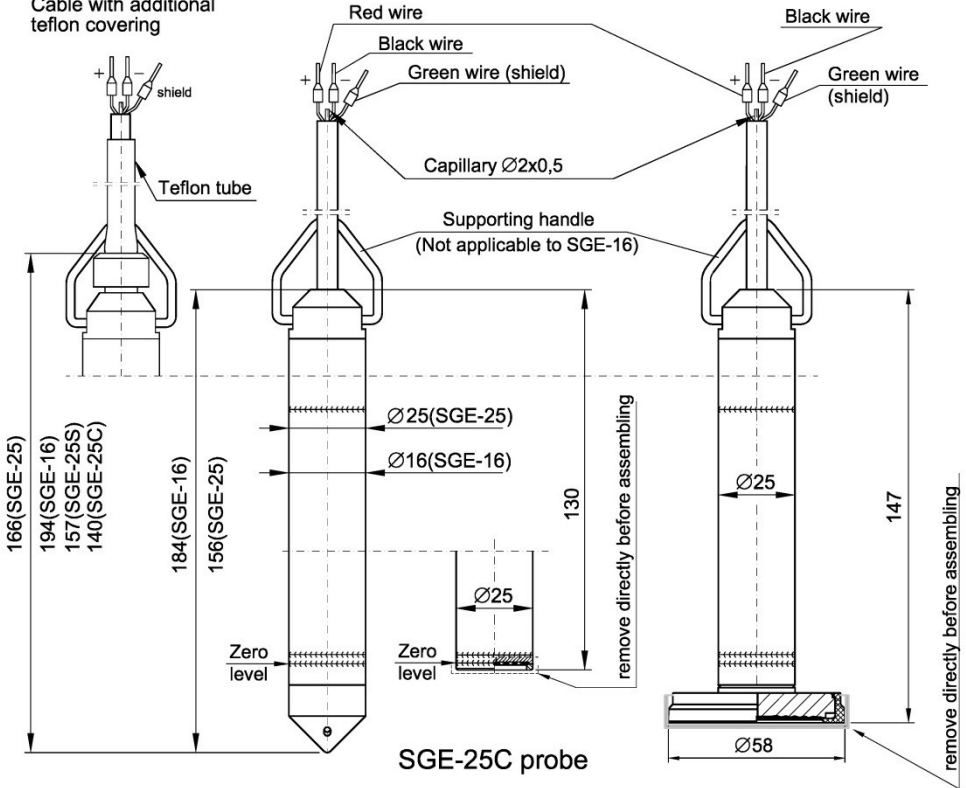


Figure 2. SGE-25.SMART and SGE-25S.SMART probes – connection method

Special version of probe.  
Cable with additional  
teflon covering



SGE25 and SGE-16 probe

SGE-25S probe

Figure 3. SGE-25, SGE-16, SGE-25C and SGE-25S probes – dimensions

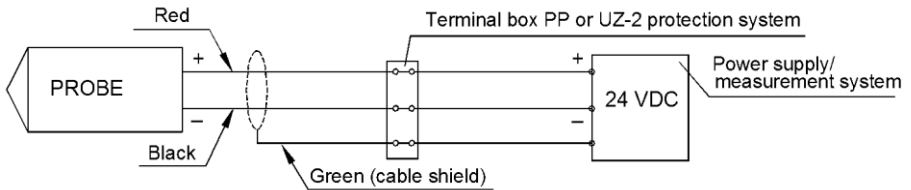
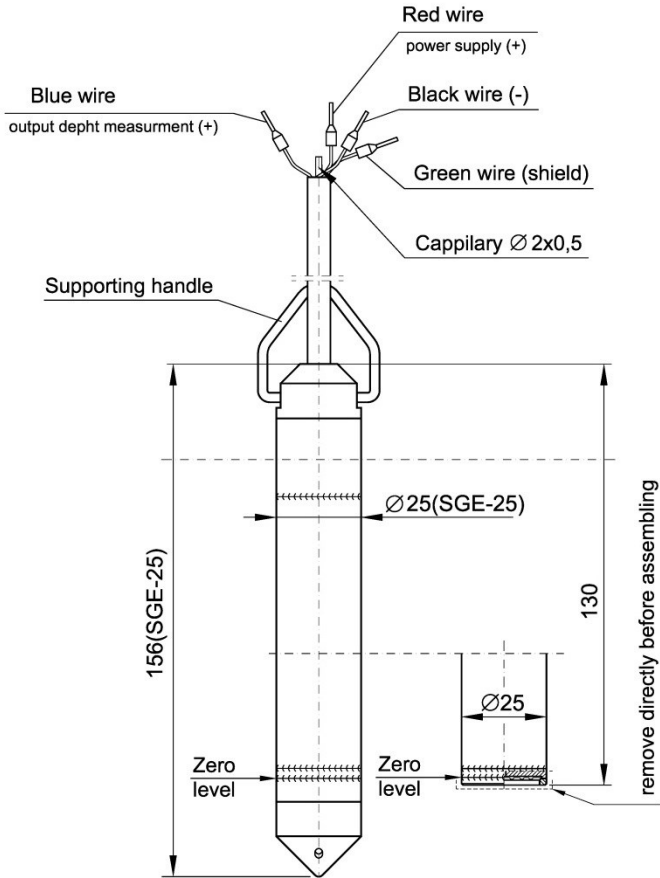


Figure 3A. Connection of SGE-25, SGE-25/Hastelloy, SGE-16, SGE-25S, SGE-25C in a two-wire system  
(4...20mA output signal)

Not applicable to Ex version (Ex version according to Appendix)



### SGE-25 probe with voltage output signal

Figure 4. SGE-25, SGE-16, SGE-25C probes in low voltage versions – dimensions

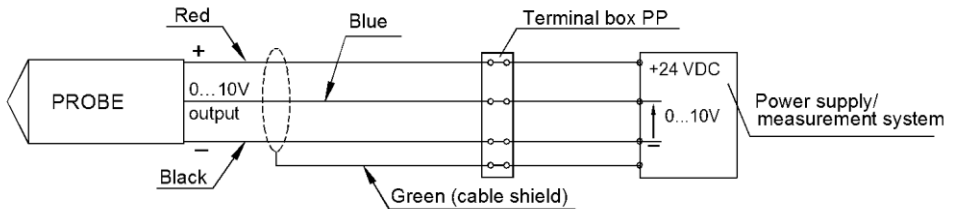
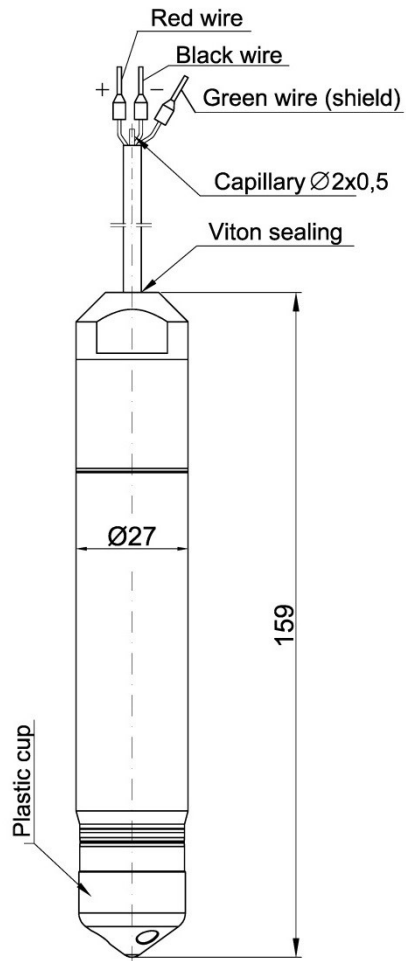


Figure 4A. Connection of SGE-25, SGE-25S and SGE-25C in a three-wire system (0...10V output signal)  
Not applicable to Ex version (Ex version according to Appendix)



**Figure 5. SGE-25/Hastelloy probe – dimensions**

The method of SGE-25/Hastelloy probes electrical connection is shown in figure 3A.

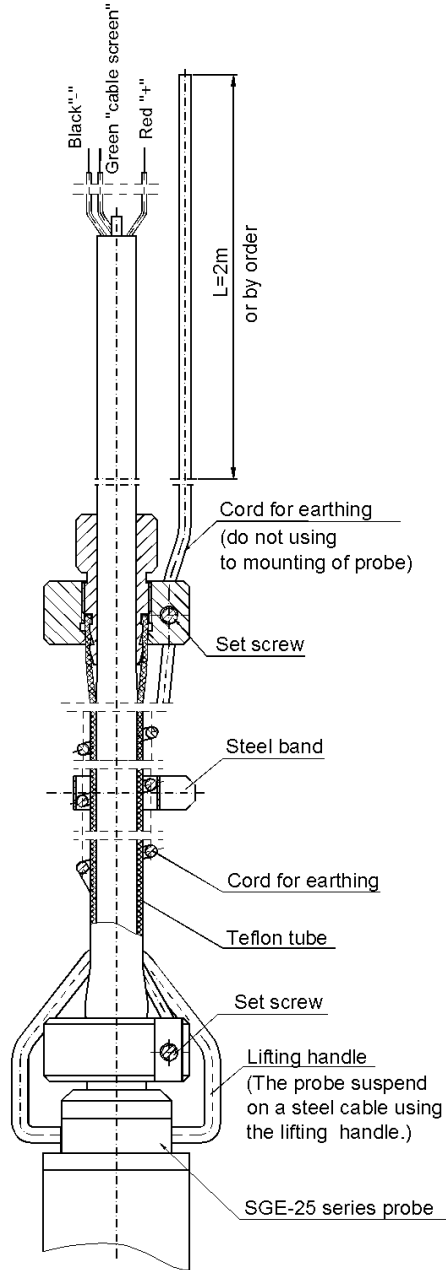


Figure 6. The probe in Ex-version with a cable with Teflon shield









