Digital pH sensors

Equipment protection level
Ga
1 Safety instructions 3
  1.1 General notes ........................................................................................................... 3
  1.2 NEPSI conformity ..................................................................................................... 3
  1.3 Safety instructions ................................................................................................... 4

2 Device description 5
  2.1 Device description ................................................................................................... 5
  2.2 Description code ..................................................................................................... 5
  2.3 Marking .................................................................................................................. 6
  2.4 Flammable products ............................................................................................... 7
  2.5 Equipment protection level ..................................................................................... 8
  2.6 Protection type for gas hazardous areas ................................................................. 8
  2.7 Temperature classes .............................................................................................. 9
  2.8 Autoclavability ....................................................................................................... 9
  2.9 Electrical data ....................................................................................................... 10

3 Installation 11
  3.1 Installation ............................................................................................................. 11

4 Electrical connections 12
  4.1 General notes ....................................................................................................... 12
  4.2 Power supply ........................................................................................................ 12
  4.3 Inputs/outputs ...................................................................................................... 12
  4.4 Grounding and equipotential bonding ................................................................. 13

5 Operation 14
  5.1 Starting up for the first time .................................................................................. 14
  5.2 Operation ............................................................................................................. 14
  5.3 Electrostatic charge ............................................................................................. 14

6 Service 15
  6.1 Maintenance ....................................................................................................... 15
  6.2 Dismantling ....................................................................................................... 15
1.1 General notes

This additional Ex instruction applies to explosion-protected versions of the sensors with the marking Ex ia IIC T3-T6 Ga. It completes the standard documentation for non-explosion protected versions.

The information given in this instruction contains only the data relevant to explosion protection. The technical details given in the standard documentation for the non-explosion protected versions remain unchanged unless they will be excluded or replaced by this instruction.

1.2 NEPSI conformity

SMARTPAT PH8 series digital PH sensor has been certified by National Supervision and Inspection Center for Explosion Protection and Safety of Instrumentation (NEPSI). This product is in accordance with the following standards:

- GB 3836.1-2010 Explosive atmospheres-Part 1: Equipment-General requirements
- GB 3836.4-2010 Explosive atmospheres-Part 4: Equipment protection by intrinsic safety “i”
- GB 3836.20-2010 Explosive atmospheres-Part 20: Equipment with equipment protection ‘level (EPL) Ga

The certificate number is:

GYJ14.1048X

This certification together with its boundary conditions is required to be observed without fail.

INFORMATION!

The Ex marking is NOT acc. to the ATEX directive. Placing the product on the market of the EU for purpose of distribution and/or use in the EU is NOT permitted.
1.3 Safety instructions

If these instructions are not followed, there is a risk of explosion.

Assembly, installation, start-up and maintenance may only be performed by personnel trained in explosion protection!

For installation, use and maintenance of SMARTPAT sensors, observe the following standards:

- GB3836.13-1997 Electrical apparatus for explosive gas atmospheres Part 13: Repair and overhaul for apparatus used in explosive gas atmospheres
- GB3836.15-2000 Electrical apparatus for explosive gas atmospheres Part 15: Electrical installations in hazardous area (other than mines)
- GB3836.16-2006 Electrical apparatus for explosive gas atmospheres Part 16: Inspection and maintenance of electrical installation in hazardous areas (other than mines)
- GB50257.1996 Code for construction and acceptance of electric device for explosion atmospheres and fire hazard electrical equipment installation engineering

CAUTION!
Operating conditions and place of installation may require compliance with additional standards, directives or laws. The responsibility for compliance rests solely with the operator or his agent.
2.1 Device description

The pH sensor is designed to measure pH in liquids. It has a connection for a 4...20 mA current output with HART® communication. The connection is designed as a plug connector and at the same time supplies the sensor with power.

The PG connection is used as process connection.

![Diagram of pH sensor components]

1. Nickel-plated brass body with VP2 connector
2. PG 13.5 thread
3. Washer
4. O-ring
5. Glass shaft
6. Diaphragm
7. Membrane glass

2.2 Description code

The safety description code of the pH sensors is made up of the following elements (spaces in the code may be omitted):

<table>
<thead>
<tr>
<th>Feature a</th>
<th>Feature b</th>
<th>Type of diaphragm</th>
<th>Field of application</th>
</tr>
</thead>
<tbody>
<tr>
<td>a = 1: Open (hole)</td>
<td>b = 2: Industrial wastewater</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a = 3: PTFE</td>
<td>b = 5: Chemical</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a = 5: Ceramic</td>
<td>b = 7: Pharma</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Versions available are: SMARTPAT PH 8150, PH 8320 and PH 8570.
2 DEVICE DESCRIPTION

2.3 Marking

The marking of the devices in accordance with the description code is shown on the nameplates below. The main plate is on the main part of the device and there is an additional marking on the glass.

![Example nameplate NEPSI](image1)

**Figure 2-1: Example nameplate NEPSI**

1. Manufacturer
2. Type
3. TAG number, order code, serial number D xxxxxx = Year of manufacture
4. Ex data acc. to GYJ14.1048X
5. Date of manufacture
6. Observe the installation and operation instruction

![Marking on the glass shaft](image2)

**Figure 2-2: Marking on the glass shaft**

1. Manufacturer
2. Type
2.4 Flammable products

Atmospheric conditions

An explosive atmosphere is a mixture of air and flammable gases, vapours, mists or dusts under atmospheric conditions. It is defined by the following values:

\[ T_{\text{atm}} = -20\ldots+60^\circ \text{C} / -4\ldots+140^\circ \text{F} \] and \[ P_{\text{atm}} = 0.8\ldots1.1 \text{ bar} / 11.6\ldots15.9 \text{ psi} \]

Outside of these ranges, for most mixtures no key figures are available for the ignition behaviour.

**DANGER!**

*The operator is responsible to ensure that the sensor is operated safely in terms of temperature and pressure of the products used. In case of operation with flammable products the sensor must be included in the periodic pressure tests of the plant.*
2.5 Equipment protection level

The sensor is designed in EPL Ga for use in zone 0, zone 1 or zone 2.

**INFORMATION!**

Definition of zone 0:
An area in which an explosive atmosphere, as a result of the mixture of flammable substances in the form of gas, vapours or mist with air, is continuously or for long periods or frequently present.

For more information refer to chapter “Flammable products”.

2.6 Protection type for gas hazardous areas

In type of protection “Intrinsic Safety” the sensor meets the requirements of the applicable standards. The explosion protection is ensured by limitation of the current and voltage so that no ignitable energy can occur.

The marking of the sensor is:

![Ex ia IIC T3-T6 Ga](image)

Components of the Ex marking and their definition

<table>
<thead>
<tr>
<th>Ex ia</th>
<th>Intrinsically safe equipment, level of protection ia</th>
</tr>
</thead>
<tbody>
<tr>
<td>IIC</td>
<td>Gas group IIC approved, suitable for group IIA, IIB and IIC</td>
</tr>
<tr>
<td>T3-T6</td>
<td>Temperature class range T3...T6 approved, suitable for temperature class T1...T6</td>
</tr>
<tr>
<td>Ga</td>
<td>Equipment Protection Level (EPL) Ga, suitable for Zone 0, Zone 1 and Zone 2</td>
</tr>
</tbody>
</table>
2.7 Temperature classes

The permissible temperature range depending on the temperature class of the sensor is:

<table>
<thead>
<tr>
<th>Temperature class</th>
<th>Permissible ambient or product temperature in °C</th>
<th>Permissible ambient or product temperature in °F</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>-10...+85°C</td>
<td>14...+185°F</td>
</tr>
<tr>
<td>T2</td>
<td>-10...+85°C</td>
<td>14...+185°F</td>
</tr>
<tr>
<td>T3</td>
<td>-10...+85°C</td>
<td>14...+185°F</td>
</tr>
<tr>
<td>T4</td>
<td>-10...+55°C</td>
<td>14...+131°F</td>
</tr>
<tr>
<td>T5</td>
<td>-10...+55°C</td>
<td>14...+131°F</td>
</tr>
<tr>
<td>T6</td>
<td>-10...+55°C</td>
<td>14...+131°F</td>
</tr>
</tbody>
</table>

The permissible product temperature range can vary depending on the sensor used. Consult the standard documentation for this information.

2.8 Autoclavability

To kill off germs, the sensor may be stored in the autoclave at 140°C / 284°F for 20 minutes.

**INFORMATION!**

The sensor is not operated in the autoclave. For more information consult the standard documentation.
2 DEVICE DESCRIPTION

2.9 Electrical data

Connect the sensor only to intrinsically-safe certified circuits. Observe the following maximum values for the sensor when connecting:

- $U_i = 30 \text{ V}$
- $I_i = 120 \text{ mA}$
- $P_i = 1.0 \text{ W}$
- $L_i = 10 \mu \text{H}$
- $C_i = 5 \text{ nF}$

**CAUTION!**
Capacity and inductance of the connecting cable have to be considered.

**INFORMATION!**
For information about nominal data and the HART interface consult the standard documentation.

The internal electrode circuit is limited to the following maximum values:

- $U_o = 7.8 \text{ V}$
- $I_o = 10 \text{ mA}$
- $P_o = 20 \text{ mW}$
Installation

3.1 Installation

Mounting of the sensor

- Ensure that you use a gasket suitable for the dimensions of the process connection and the requirements of the measuring point.
- Align the gasket correctly.
- Carefully lower the sensor into the provided assembly and afterwards into the tank or the pipe.
- Observe all the relevant regulations.

DANGER!
The manufacturer is not liable for any damage or injuries resulting from improper use or use other than the intended purpose. This applies in particular to hazards due to insufficient corrosion resistance and suitability of the materials in contact with product.

DANGER!
Installation and setup must be carried out according to the applicable installation standards (e.g. EN 60079-14) by qualified personnel trained in explosion protection. Observe the information contained in the manuals and the supplementary instructions. The installation must always comply with the following requirements:

- No external forces are affecting the sensor.
- The device is accessible for any necessary visual inspections and can be viewed from all sides.
- The nameplate is clearly visible.
- All gaskets are suitable for the intended use.
**Electrical connections**

### 4 ELECTRICAL CONNECTIONS

#### 4.1 General notes

In order to avoid risks, always observe the following points when electrically connecting a sensor:

- Ensure that all connecting cables conform to the valid installation standards (e.g. IEC 60079-14) and withstand the maximum operating temperature.
- Securely lay the connecting cables and sufficiently protect them against damage.
- Securely connect all the cores not in use with the ground potential of the explosive area or carefully insulate them from each other and from ground (test voltage $\geq 500\text{V}_{\text{eff}}$).

**INFORMATION!**

When connecting the sensor cable, observe the standard documentation for the sensor, the chapter “Installation”. When using junction box SJB 200 W-Ex, the corresponding handbook must also be observed.

#### 4.2 Power supply

The sensor does not require a separate power supply. The required supply for the electronics is provided via the 4...20 mA current output.

#### 4.3 Inputs/outputs

The connector pin assignment of the sensor is described in the standard documentation. The signal circuits of the sensor may only be connected to certified intrinsically safe slave units or circuits. For more information refer to chapter “Electrical data”.
4.4 Grounding and equipotential bonding

To dissipate dangerous electrostatic charges the metal housing must be grounded. When installing in pipes or vessels that are grounded, the electrical connection to earth is carried out via the PG screw connection made of electrically conductive PEEK or metal (SMARTPAT PH 8570).

If installing in pipes or vessels that are not grounded, the shield of the sensor cable must be connected to the ground potential. The electrical connection to the metal housing and the ground is made by the sensor cable with the VP connector.

**WARNING!**
The cable shield must not be connected directly on both ends to the ground potential, since unacceptably high equalizing currents can cause an explosion.

When using junction box SJB 200 W-Ex, the shield of the sensor cable must be connected to the shield connector provided for all SMARTPAT PH Bxxx. This will ensure sufficient electrostatic grounding and at the same time prevent unacceptably high equalizing currents.

**INFORMATION!**
On junction box SJB 200 W-Ex, the shield connector is connected to the ground potential via a 1 megohms resistor and a capacitor in parallel. The connections for the intrinsically safe 4...20 mA sensor circuit are galvanically isolated from both the electrode circuit and the ground and can be considered ground-free (test voltage 500 V_{eff}). It is accepted that the electrode circuit can be directly connected to the ground potential.
5.1 Starting up for the first time

To avoid injury and material damage, only operate the sensor under the following conditions:

- The equipment has to be installed and connected in accordance with the manufacturer’s instructions.
- At the operator’s request, a check was conducted prior to start-up to ensure the correct installation and connection.
- The check prior to start-up was in compliance with the national regulations for checks before start-up.

**INFORMATION!**
Observe the information regarding calibration in the standard documentation.

5.2 Operation

To avoid injury and material damage, only operate the sensor under the following conditions:

- Temperatures, pressures and electrical limit values are in the manufacturer’s specified range.
- The equipment parts necessary for safety are effective in the long run, never disable them during operation!
- Include the sensor in the periodic pressure tests of the plant when operating with flammable products.

**CAUTION!**
When using the sensor, and in particular after connecting the connector, ensure that it is connected properly. Otherwise the degree of IP protection is not guaranteed.

5.3 Electrostatic charge

In order to avoid ignition hazards due to electrostatic charge, the sensors may not be used in areas where:

- processes that generate strong charges,
- mechanical friction and cutting processes,
- spraying of electrons (e.g. in the vicinity of electrostatic painting systems),
- dust carried by compressed air.
6.1 Maintenance

For systems in hazardous areas, regular checks are required in order to maintain the proper condition. The manufacturer recommends the following maintenance measures:

- Check the housing, the cable entry and the feed lines for corrosion and/or damage.
- Check the process connection and the piping connections for leakage.
- Check the entire sensor for dust deposits.

**CAUTION!**

Maintenance measures of a safety-relevant nature within the meaning of explosion protection may only be carried out by the manufacturer, his authorised representative or under the supervision of authorised inspectors.

6.2 Dismantling

In order to prevent injury or material damage when replacing the sensor, always observe the following points:

- Before dismantling the electrical connecting lines of the device, ensure that all the cables leading to the sensor are de-energised themselves and to the reference potential of the explosive area.
- All the relevant process pipes or containers must be depressurised before dismounting the sensor.
- If the process pipes or the container contain products that are harmful to the environment or to health, implement the appropriate safety measures before dismantling the sensor.
- Replace all the seals when reinstalling the device in the process pipe or container.
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