

VPS

Pressure Sensor



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1 Overview

The VPS pressure sensor is a sensor for continuous and high-resolution monitoring of tank pressures in fuel and LPG tanks. Two types of pressure sensors are available, which differentiate themselves in the type of the application and pressure range:

- **VPS-V pressure sensor** serves for monitoring the vapour pressure in Otto fuel depot tanks.
- **VPS-L pressure sensor** serves for monitoring the vapour pressure and in combination with VISY-Stick LPG and VISY-Density module for determining the product mass in LPG tanks.

In the following chapters you will be guided by means of a detailed description through the installation and commissioning of the pressure sensors VPS-V and VPS-L.



After installation, or replacement of the pressure sensor, a configuration of the evaluation unit is required.

For VPS-V pressure sensor, the operating software of the SECON device must be configured with a PC/laptop, see:



Technical Documentation SECON-Vap Administrator, art. no. 350134

For VPS-L pressure sensors, the VISY-Command evaluation unit must be configured with a PC/laptop. For this, the VISY-Setup software is used, see:



Technical Documentation VISY-Setup V4, art. no. 207158

2 Safety Instructions

The VPS pressure sensor serves for measuring and monitoring the tank pressures in storage tanks. The measuring medium must be used exclusively for this purpose. The manufacturer accepts no liability for any form of damage resulting from improper use. Pressure sensor VPS has been developed manufactured and tested in accordance with the latest good engineering practices and generally accepted safety standards. Nevertheless, hazards may arise from their use. For this reason, the following safety instructions must be observed:

- Opening or removing the cover from pressure sensor VPS could result in a risk of electric shock.
- Do not change or modify the system or add any equipment without the prior consent of the manufacturer.
- Only use original spare parts. These comply with the technical requirements specified by the manufacturer.
- The installation, operation and maintenance of pressure sensor VPS must be carried out only by expert personnel. Specialised knowledge must be acquired by regular training.
- Operators, installers and service technicians must observe all applicable safety regulations. This also applies to any local safety and accident prevention regulations which are not stated in this manual.
- Pressure sensor VPS may be powered only via the permissible power supply.

The safety instructions in this manual are marked as follows:



If you do not comply with the safety instructions, there is a risk of accident, or the sensor may be damaged.



Useful tips and information in this manual that should be observed appear in italics and are identified by this symbol.

3 Design and Function

The VPS pressure sensors are capacitive-ceramic sensor for measuring the absolute or differential pressure.

VPS-V pressure sensor measures the difference between the vapour pressure in fuel tanks and the external atmospheric pressure.

VPS-L pressure sensor measures the vapour pressure in LPG tanks. In combination with VISY-Stick LPG and VISY-Density Module the product mass is determined.

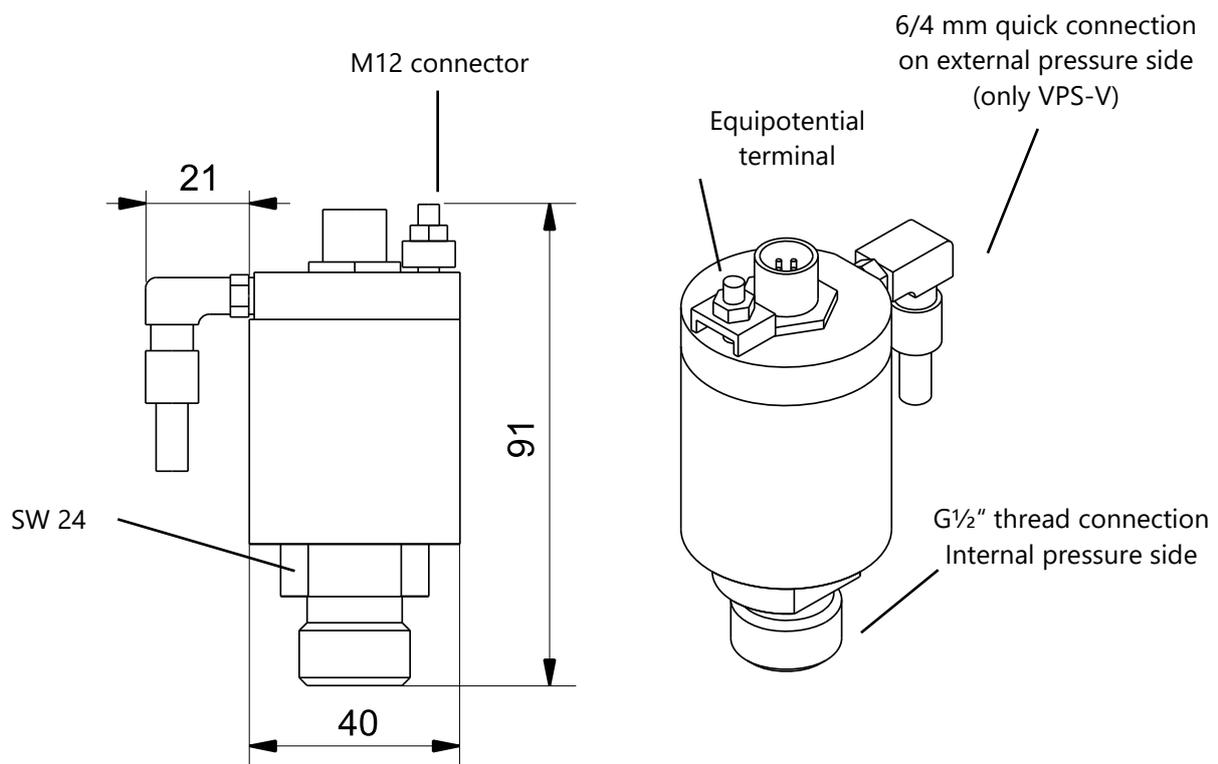


Figure 1: Dimensions of VPS-V pressure sensor

4 VPS-V Pressure Sensor

4.1 Description

VPS-V pressure sensor serves for monitoring the vapour pressure in Otto fuel depot tanks equipped with the "**VAPORIX**" vapour recovery monitoring system. The pressure is measured relative to the ambient pressure. If operating errors occur, these are signalled to the operating personnel.

- Regular overpressure or underpressure in the tank indicates, for example, that the vapour recovery has been set too high or too low.
- Balanced internal and external pressure (no pressure difference) indicates, for example, leakages in the tank or the piping system.

The SECON-X system is used for evaluating and displaying pressure values, which in the smallest version consists of SECON device with SECON-Vap+ software. The SECON-Vap+ software continuously stores, visualizes and evaluates the measured values of the pressure sensor. In case of a fault, alarms are signalled and, in accordance with legal specifications, a switch-off of the fuelling points is triggered. The measured values of the VPS-V are transmitted to the evaluation unit via cable.

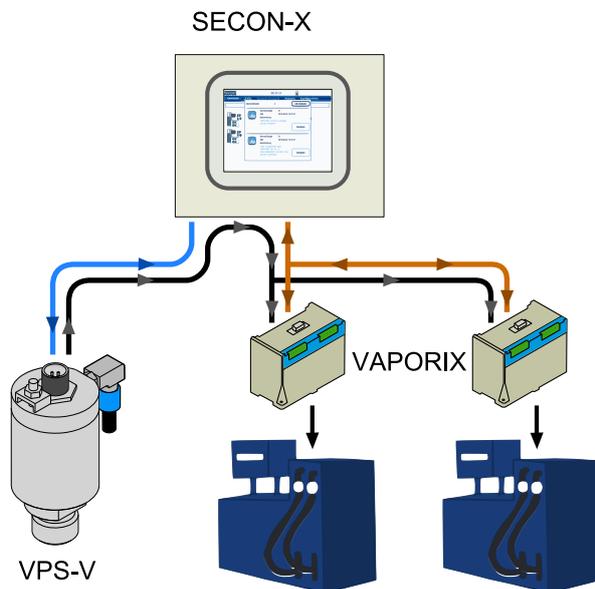


Figure 2: VPS-V pressure sensor as part of the vapour recovery monitoring system

4.2 Requirements for Operation

- Free connection to the gas space of the tanks via G $\frac{1}{2}$ " thread
- Available evaluation unit (SECON device)
- If required, extension cable (specifications see chapter 9.3)



The VPS pressure sensors must only be connected to measuring transducers that have been certified by a recognized inspection authority.

4.3 Scope of Delivery

- VPS-V pressure sensor
- FAFNIR connection cable with M12 coupling plug
- Cable connector
- Technical Documentation

4.4 Installation



When installing and servicing the VPS pressure sensor, the requirements of the Explosion Protection Regulations, the Industrial Health and Safety Regulations and the Equipment Safety Regulations as well as generally accepted rules of engineering and these operating instructions must be observed.



All applicable local safety and accident prevention regulations not included in these operating instructions must also be observed.



When working with the VPS pressure sensor, the national safety and accident prevention regulations and safety instructions in this manual must be observed.

Please also observe the installation notes, see



Technical Documentation VPI, art. no. 350068

4.4.1 Mounting

Vent masts of the tanks are suitable as installation points. The pressure sensor is screwed into vent mast below the P/V valve or throttle opening via a G $\frac{1}{2}$ " thread. The connection must be made gas-tight with the use of a sealing ring.

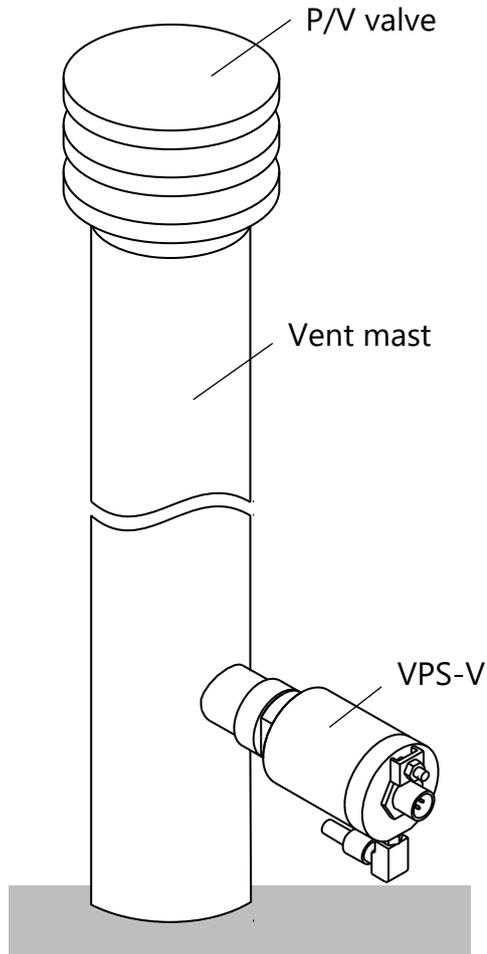


Figure 3: Mounting on the vent mast

4.4.2 Electrical Connection

For the VPS-V wiring and installation are the following components required:

- VPS-V pressure sensor
- FAFNIR connection cable with M12 coupling plug
- Cable connector
- VPI measuring transducer
- Auxiliary power supply

For wiring the VPS-V pressure sensor, proceed as follows:

- (1) Connect the M12 coupling plug of the FAFNIR connection cable with the pressure sensor. Extending the cable is possible if the specifications of the FAFNIR connection cable listed in chapter "Technical data" are met.
- (2) Connect the free wires at the other end of the FAFNIR connection cable with the screw terminals of the connecting strip of the VPI measuring transducer, which simultaneously defines the channels.
- (3) The equipotential terminal on the pressure sensor is provided for potential equalization. The potential equalization (min. 4 mm² cable) must be carried out by the installer in accordance with the nationally applicable installation regulations.



Please comply with general installation regulations concerning equipotential bonding.



For more information about the electrical connection see:
Technical Documentation VPI, art. no. 350068

The data output of the VPI measuring transducer is compatible with standard RS-485. Since the RS-485 interface is galvanically isolated via optocouplers, a power supply of 5 V must be made available by the evaluation unit.

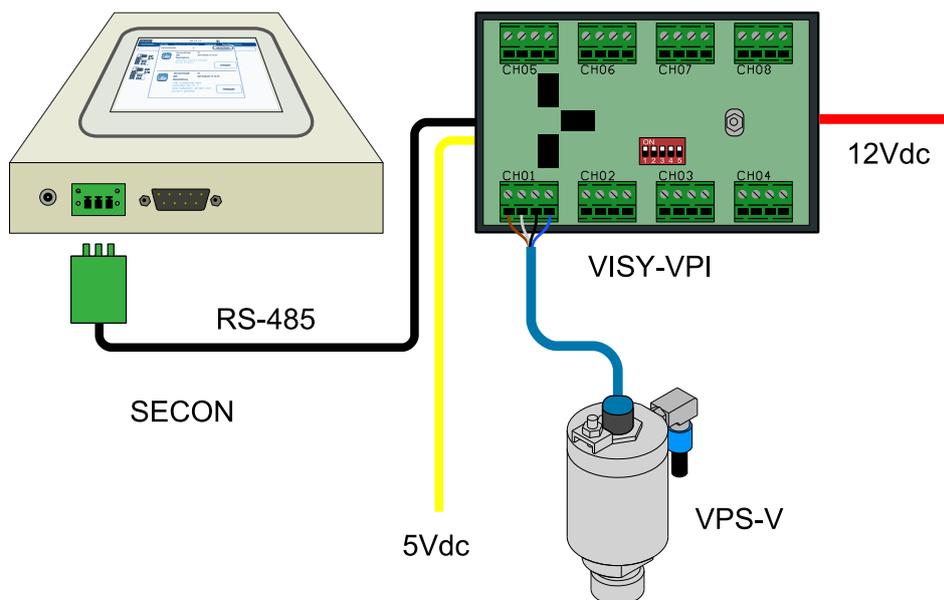


Figure 4: Wiring of the VPS-V pressure sensor to the SECON

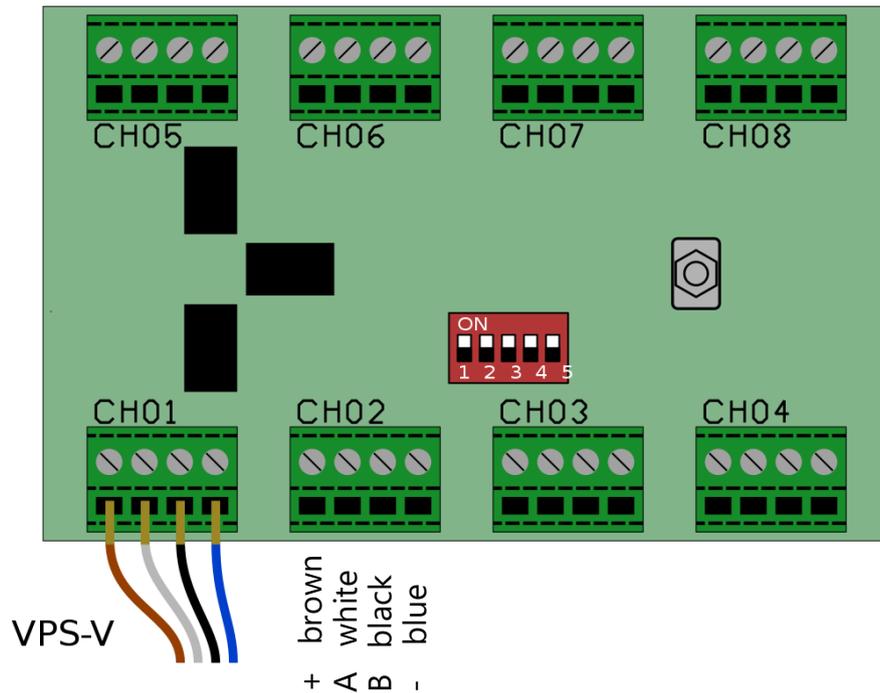


Figure 5: Connectors of VPI measuring transducer

5 VPS-L Pressure Sensor

5.1 Description

The VPS-L pressure sensor serves to determine the product mass (mass of the liquid phase and vapour phase) of liquefied petroleum gas in LPG tanks equipped with the VISY-Stick LPG and the VISY-Density module.

With the VPS-L pressure sensor, the vapour pressure in LPG tanks is measured, which only depends on the temperature and gas composition. Filling height and product density of the liquid phase are measured by VISY-Stick LPG and VISY-Density module to determine the product mass and volume of the liquid phase.

The product mass of the vapour phase is determined from the volume of gas (total volume minus liquid volume) and the vapour pressure. The entire product mass is calculated from the mass of the liquid phase plus the mass of the vapour phase.



The safety valve of the storage tank opens if the pressure exceeds the maximum of 16 bar.

The VPS-L pressure sensor is connected directly to the VISY-Command evaluation unit.

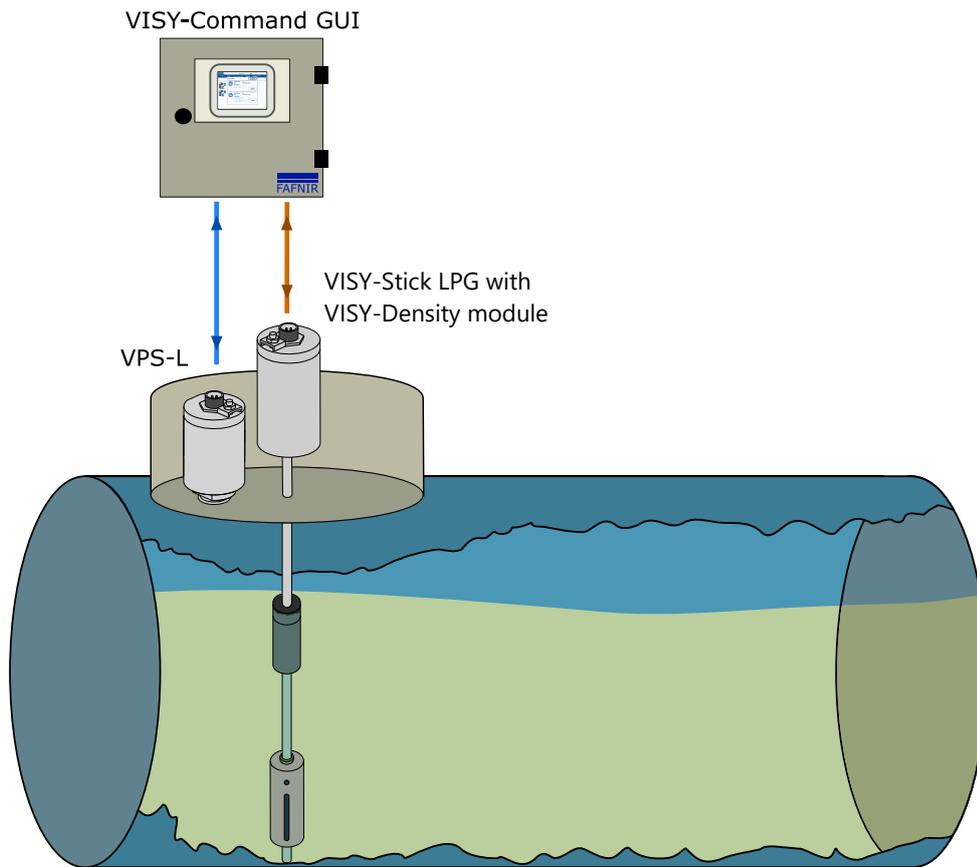


Figure 6: VPS-L pressure sensor for monitoring the vapour pressure in LPG tanks

5.2 Requirements for Operation

- Free connection to the gas space of the tanks via G $\frac{1}{2}$ " thread
- Available evaluation unit (VISY-Command)
- If required, extension cable (specifications see chapter 9.3)
- VISY-Stick LPG with VISY-Density module



The VPS pressure sensors must only be connected to measuring transducers that have been certified by a recognized inspection authority.

5.3 Scope of Delivery

- VPS-L pressure sensor
- FAFNIR connection cable with M12 coupling plug
- Cable connector
- Technical Documentation

5.4 Installation

-  *When installing and servicing the VPS pressure sensor, the requirements of the Explosion Protection Regulations, the Industrial Health and Safety Regulations and the Equipment Safety Regulations as well as generally accepted rules of engineering and this manual must be observed.*
-  *All applicable local safety and accident prevention regulations not included in this manual must also be observed.*
-  *When working with the VPS pressure sensor, the national safety and accident prevention regulations and safety instructions in this manual must be observed.*

5.4.1 Mounting

A free process connection in the tank lid is suitable as installation point for monitoring the gas pressure. The pressure sensor is screwed in via a G $\frac{1}{2}$ " thread. The connection must be made gas-tight with the use of a sealing ring. Since the housing of VPS-L pressure sensor is designed water-tight, the pressure sensor is not affected by water entering the manhole.

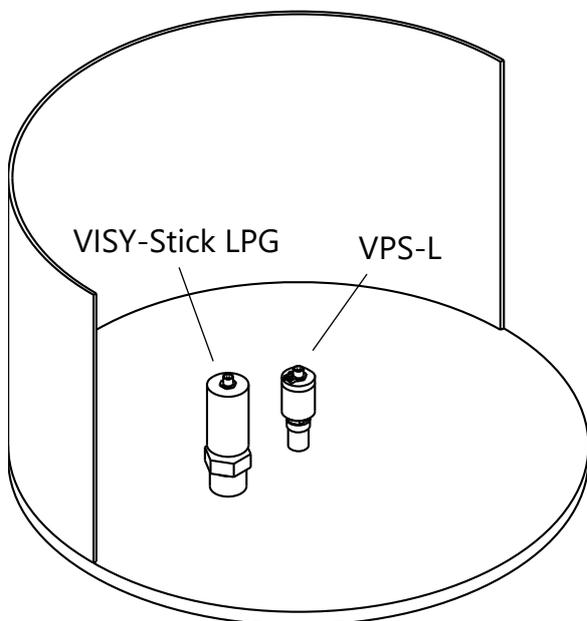


Figure 7: Mounting on the tank lid

5.4.2 Electrical Connection

For the wiring of VPS-L pressure sensor, proceed as follows:

- (1) Connect the M12 coupling plug of the FAFNIR connection cable with the pressure sensor. Extending the cable is possible if the specifications of the FAFNIR connection cable listed in chapter "Technical data" are met.
- (2) Open the casing cover of the VISY-Command
- (3) Insert the free wires of FAFNIR connection cable in a free cable gland of the VISY-Command.
- (4) Connect the free wires (brown, white, black, blue) at the other end of the FAFNIR connection cable with the screw terminals (+ A B -) of the connecting strip of measuring transducer VP in accordance to the connection diagram (see figure).

 *The VPS-L pressure sensor must be connected to the same probe terminal like the associated VISY-Stick (Advanced) level sensor to be able to be assigned to this level sensor and to be able to calculate the correct mass. The VISY-Stick and the VPS can either be connected to one cable in the manhole or to one probe terminal inside the VISY-Command.*

 *At each probe terminal, it is possible to connect up to three different types of FAFNIR probes (e. g. one VISY-Stick, one VPS, and one VISY-Stick Sump Manhole, see the following figure)*

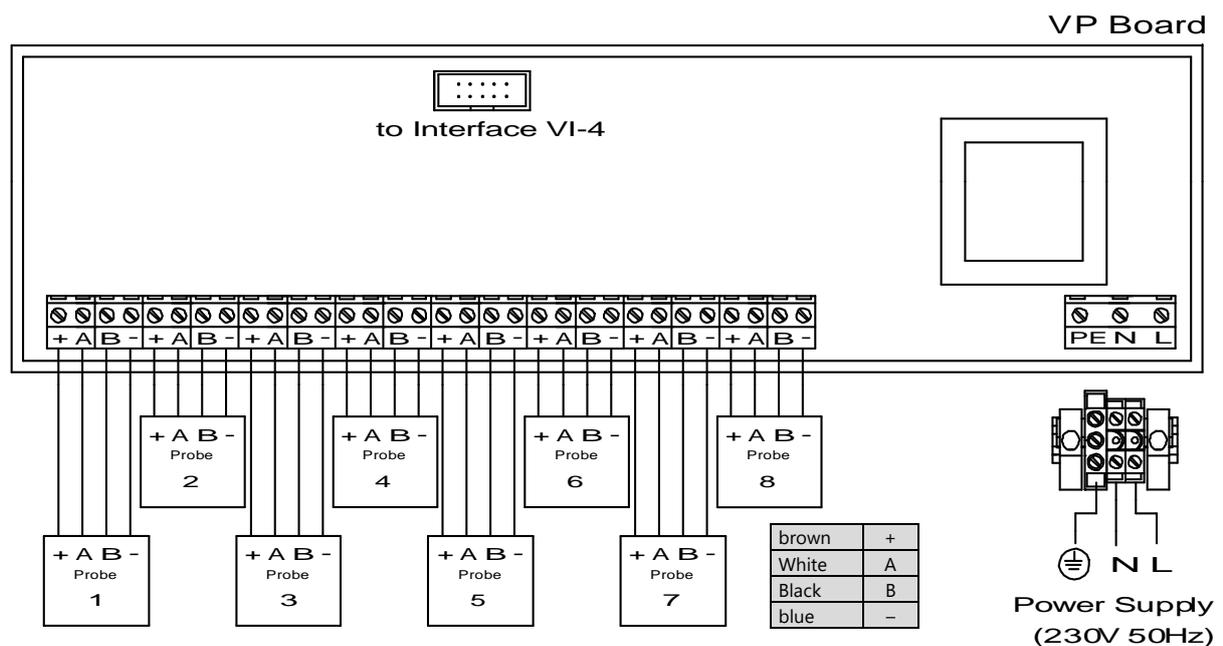


Figure 8: Connection of VPS-L pressure sensor to the VP board in VISY-Command

- (5) The equipotential terminal on the pressure sensor is provided for potential equalization. The potential equalization (min. 4 mm² cable) must be carried out by the installer in accordance with the nationally applicable installation regulations.



Please comply with general installation regulations concerning equipotential bonding.

6 Maintenance

6.1 Service

The VPS Pressure Sensor is maintenance-free if operated according to the manufacturer's specifications.

6.2 Return of Goods

Before returning FAFNIR products, approval by the FAFNIR customer service is required. Please speak to your customer support or customer service, who will inform you about the details of the return.



The return of FAFNIR products is only possible after approval by FAFNIR customer service.

7 Technical Data



Details of the technical data can be found in the approvals and instructions.

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**EU-Konformitätserklärung
EU Declaration of Conformity
Déclaration UE de Conformité**

**FAFNIR GmbH
Bahrenfelder Straße 19
22765 Hamburg / Germany**

erklärt als Hersteller in alleiniger Verantwortung, dass das Produkt
declares as manufacturer under sole responsibility that the product
déclare sous sa seule responsabilité en qualité de fabricant que le produit

**Drucksensor
Pressure Sensor
Capteur de pression
VPS-...**

den Vorschriften der europäischen Richtlinien
complies with the regulations of the European directives
est conforme aux réglementations des directives européennes suivantes

2011/65/EU	Beschränkung der Verwendung bestimmter gefährlicher Stoffe in Elektro- und Elektronikgeräten	RoHS
2011/65/EU	Restriction of the use of certain hazardous substances in electrical and electronic equipment	RoHS
2011/65/UE	Limitation de l'utilisation de certaines substances dangereuses dans les équipements électriques et électroniques	RoHS
2014/30/EU	Elektromagnetische Verträglichkeit	EMV
2014/30/EU	Electromagnetic compatibility	EMC
2014/30/UE	Compatibilité électromagnétique	CEM
2014/34/EU	Geräte und Schutzsysteme zur bestimmungsgemäßen Verwendung in explosionsgefährdeten Bereichen	ATEX
2014/34/EU	Equipment and protective systems intended for use in potentially explosive atmospheres	ATEX
2014/34/UE	Appareils et systèmes de protection destinés à être utilisés en atmosphères explosibles	ATEX

durch die Anwendung folgender harmonisierter Normen entspricht
by applying the harmonised standards
par l'application des normes

RoHS / RoHS / RoHS	EN 50581:2012
EMV / EMC / CEM	EN 61326-1:2013
ATEX / ATEX / ATEX	EN 60079-0:2009
	EN 60079-11:2012
	EN 60079-26:2007

Das Produkt ist bestimmt als Elektro- und Elektronikgerät der RoHS-
The product is determined as electrical and electronic equipment of RoHS
Le produit est déterminés comme des équipements électriques et électroniques de RoHS

Kategorie / Category / Catégorie	Überwachungs- und Kontrollinstrumenten in der Industrie / Industrial Monitoring and Control Instruments / Instruments de contrôle et de surveillance industriels
---	---

Das Produkt entspricht den EMV-Anforderungen
The product complies with the EMC requirements
Le produit est conforme aux exigences CEM

Störaussendung / Emission / Émission	Klasse B / Class B / Classe B
Störfestigkeit / Immunity / D'immunité	Industrielle elektromagnetische Umgebung / Industrial electromagnetic environment / Environnement électromagnétique industriel

Die notifizierte Stelle TÜV NORD CERT GmbH, 0044 hat eine EG-Baumusterprüfung durchgeführt und folgende Bescheinigung ausgestellt
The notified body TÜV NORD CERT GmbH, 0044 performed a EC-type examination and issued the certificate
L'organisme notifié TÜV NORD CERT GmbH, 0044 a effectué examen CE de type et a établi l'attestation

VPS-... TÜV 12 ATEX 111601

Hamburg, 20.04.2016
Ort, Datum / Place, Date / Lieu, Date

Geschäftsführer / Managing Director / Gérant: René Albrecht

Translation

(1) **EC-Type Examination Certificate**

(2) Equipment and protective systems intended for use in potentially explosive atmospheres, **Directive 94/9/EC**



(3) **Certificate Number** TÜV 12 ATEX 111601

(4) for the equipment: Pressure Sensor VPS-...

(5) of the manufacturer: FAFNIR GmbH

(6) Address: Bahrenfelder Straße 19
22765 Hamburg
Germany

Order number: 8000414822

Date of issue: 2013-02-05

- (7) This equipment or protective system and any acceptable variation thereto are specified in the schedule to this certificate and the documents therein referred to.
- (8) The TÜV NORD CERT GmbH, notified body No. 0044 in accordance with Article 9 of the Council Directive of the EC of March 23, 1994 (94/9/EC), certifies that this equipment or protective system has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres given in Annex II to the Directive. The examination and test results are recorded in the confidential report No. 12 203 111601.
- (9) Compliance with the Essential Health and Safety Requirements has been assured by compliance with:

EN 60079-0:2009

EN 60079-11:2012

EN 60079-26:2007

- (10) If the sign "X" is placed after the certificate number, it indicates that the equipment or protective system is subject to special conditions for safe use specified in the schedule to this certificate.
- (11) This EC-type examination certificate relates only to the design, examination and tests of the specified equipment in accordance to the Directive 94/9/EC. Further requirements of the Directive apply to the manufacturing process and supply of this equipment. These are not covered by this certificate.
- (12) The marking of the equipment or protective system must include the following:

Ex II 1 G Ex ia IIC T6 Ga resp. II 1/2 G Ex ia IIC T6 Ga/Gb resp. II 2 G Ex ia IIC T6 Gb

TÜV NORD CERT GmbH, Langemarckstraße 20, 45141 Essen, notified by the central office of the countries for safety engineering (ZLS), Ident. Nr. 0044, legal successor of the TÜV NORD CERT GmbH & Co. KG Ident. Nr. 0032

The head of the notified body



Schwedt

Hanover office, Am TÜV 1, 30519 Hannover, Fon +49 (0)511 986 1455, Fax +49 (0)511 986 1590

(13) **SCHEDULE**

(14) **EC-Type Examination Certificate No. TÜV 12 ATEX 111601**

(15) Description of equipment

The Pressure Sensor VPS-... is used for the detection of inner tank pressures in explosive hazardous areas.

The permissible ambient temperature ranges as well as the medium temperature ranges in dependence of the temperature class have to be taken from the following tables:

Use as Category 1 (EPL Ga) and Category 1/2 (EPL Ga/Gb) apparatus

Temperature class	Ambient and medium temperature range
T6	-20 °C to +45 °C
T1 to T5	-20 °C to +60 °C

The process pressure of the media has to be from 0.8 bar to 1.1 bar when potentially explosive mist air mixtures exist. If no potential explosive mixtures exist, the device may also be operated outside of this stated range according to the specification of the manufacturer.

Use as Category 2 (EPL Gb) apparatus

Temperature class	Ambient and medium temperature range
T6	-20 °C to +45 °C
T5	-20 °C to +60 °C
T1 to T4	-20 °C to +70 °C

Electrical data

Signal- and power circuit
(terminals +, -, A, B)

in type of protection "Intrinsic Safety" Ex ia IIC

only for the connection to a certified intrinsically safe circuit

Maximum values: $U_i = 15 \text{ V}$
 $I_i = 100 \text{ mA}$
 $P_i = 100 \text{ mW}$
 $L_i = 50 \text{ } \mu\text{H}$
 $C_i = 10 \text{ nF}$

(16) Test documents are listed in the test report No. 12 203 111601.

(17) Special conditions for safe use

none

(18) Essential Health and Safety Requirements

no additional ones

Instructions

Edition: 12.2012

Pressure Sensor VPS-...

TÜV 12 ATEX 111601

I Range of application

The pressure sensor VPS- ... is used to measure tank internal pressures, absolute or differential pressure.

II Standards

The intrinsically safe apparatus is designed in accordance with the following European standards

EN 60079-0:2009	Equipment - General requirements
EN 60079-11:2012	Equipment protection by intrinsic safety "i"
EN 60079-26:2007	Equipment with equipment protection level (EPL) Ga

III Instructions for safe ...

III.a ... use

The pressure sensor is designed as intrinsically safe apparatus and is approved for use in potentially explosive areas. The pressure sensor may be used for all gas groups (IIA, IIB and IIC).

The approval applies to the device versions

VPS-L	for absolute pressure measurement (0 bar ... 25 bar)
VPS-V	for differential pressure measurement (± 30 mbar)

III.b ... assembly or disassembly

To operate the pressure sensor disassembly is not provided. Disassembly may damage the pressure sensor and expire its approval.

III.c ... installation

All wiring operations must solely be carried out with the power disconnected. Special rules and regulations, including EN 60079-14 respectively local installation regulations, must be observed.

The pressure sensor can be screwed directly into the tank. The sensor is supplied with a G 1/2 inch thread.

General information (see also EN 60079-26, clause 4.6):

Attention must be paid, if the sensor is built into the boundary wall between Zone 0 and Zone 1, that a protection class of at least IP67 is achieved after installation.

When wiring the sensor to the evaluation unit (preferably blue coloured cable), the approved inductance and capacitance of the associated equipment must not be exceeded.

The electrical connection is made using the M12 plug. The cable coding is:

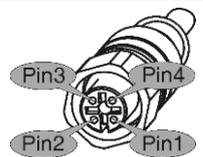
Pin		VPS-L	VPS-V	
1	+	brown		
2	A	white		
4	B	black		
3	-	blue		

Table 1: Pin assignment of the pressure sensor

For integration of the pressure sensor in the potential equalization, a PA terminal at the sensor housing is present.

III.d ... adjustment

To operate the device security settings are not necessary.

III.e ... putting into service

Before putting into service, all equipment must be checked to ensure it is properly connected and installed. The power supply, as well of connected equipment, must be checked.

III.f ... maintenance, overhaul and repair

Generally the device is maintenance-free. In case of a defect it must be send back to FAFNIR or one of his representations.

When performing an isolation test with 500 V under well-controlled conditions, it is not necessary to disconnect the pressure sensor, since there is conformity in accordance with EN 60079-11, clause 6.3.13.

IV Equipment marking

- | | | |
|---|---------------------|---|
| 1 | Manufacturer: | FAFNIR GmbH, Hamburg |
| 2 | Type designation: | VPS-... |
| 3 | Serial number: | Ser. N°: ... |
| 4 | Certificate Number: | TÜV 12 ATEX 111601 |
| 5 | Ex marking: |  II 1 G Ex ia IIC T6 Ga
II 1/2 G Ex ia IIC T6 Ga/Gb
II 2 G Ex ia IIC T6 Gb |
| 6 | CE marking: |  0044 |
| 7 | Technical data: | See instruction manual for technical data |

V Technical data

The following safety-related values are defined with:

Input voltage:	$U_i \leq 15 \text{ V}$
Input current:	$I_i \leq 100 \text{ mA}$
Input power:	$P_i \leq 100 \text{ mW}$

The externally effective capacitance and inductance are:

Internal capacitance:	$C_i < 10 \text{ nF}$
Internal inductance:	$L_i < 50 \text{ }\mu\text{H}$

When used in potentially explosive atmospheres, the maximum temperatures depending on the temperature classes and categories can be found in the table 2.

Temperature class	Range of ambient and media temperature T_a
Category 1 resp. equipment protection level Ga (pressure sensor completely installed in Zone 0)	
T6	-20 °C ... +45 °C
T5, T4, T3, T2, T1	-20 °C ... +60 °C
Category 1/2 resp. equipment protection level Ga/Gb (pressure sensor installed into the boundary wall)	
T6	-20 °C ... +45 °C
T5, T4, T3, T2, T1	-20 °C ... +60 °C
Category 2 resp. equipment protection level Gb (pressure sensor completely installed in Zone 1)	
T6	-20 °C ... +45 °C
T5	-20 °C ... +60 °C
T4, T3, T2, T1	-20 °C ... +70 °C

Table 2: Service temperatures

For use in Category 1 and Category 1/2 applies:

The process pressure for the media must be between 0.8 bar and 1.1 bar where explosive vapour-air mixtures are present. If no explosive mixtures are present, the equipment may also be operated outside this area according to the manufacturer's specification.

General information (see also EN 60079-0, clause 1):

Zone 0 exists only under atmospheric conditions:

Temperature range:	-20 °C ... +60 °C
Pressure range:	0.8 bar ... 1.1 bar
Oxidants:	Air (oxygen content approx. 21 %)

VI Specific conditions

None.



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