

Operating Manual

HART Level Sensor

Type PT-HL



Intrinsically safe level probe with HART communication

For applications in hazardous environments

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MÜLLER
INDUSTRIE - ELEKTRONIK GMBH

TEL.: (+49) 05032-9672-111
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1. Important Details for Your Information

Read this operating manual before installing and starting the level probe. Keep the operating manual in a place that is accessible to all users at any time. The following installation and operating instructions have been compiled by us with great care but it is not feasible to take all possible applications into consideration. These installation and operation instructions should meet the needs of most pressure measurement applications. If questions remain regarding a specific application, you can obtain further information:

- Via our Internet address www.mueller-ie.com
- The designation of the product data sheet is PT-HL
- Technical support by telephone: (+49) 05032-9672-111

If the serial number on the product label gets illegible (e.g. by mechanical damage or repainting), the retraceability of the instrument is not possible any more.

The level probes, described in this operating instructions, are carefully designed and manufactured using state-of-the-art technology. Every component undergoes strict quality and environmental inspection before assembly

Use of PT-HL according to regulations:

Use the intrinsically safe level probe to transform the hydrostatic pressure into an electrical signal in hazardous areas.

Certificate ATEX:

Level probe for operation in hazardous areas in compliance with the respective certificate (see attached EC-type examination certificate BVS 12 ATEX E066 X).

ATEX Approval ratings:

for gases and mist: Mounting to Zone 0; installation in Zone 0, Zone 1 and Zone 2

Knowledge required

Install and start the level probe only if you are familiar with the relevant regulations and directives of your country and if you have the qualification required. You have to be acquainted with the rules and regulations on hazardous areas, measurement and control technology and electric circuits, since this level probe is defined as „electrical equipment“. Depending on the operating conditions of your application you have to have the corresponding knowledge, e.g. of corrosive media

2. A Quick Overview for You

If you want to get a quick overview, read **Chapters 3, 5, 7 and 10**. There you will get some short safety instructions and important information on your product and its starting.

Read these chapters in any case.

3. Signs, Symbols, Abbreviations



Warning

Potential danger of life or of severe injuries.



Warning

Potential danger of life or of severe injuries due to catapulting parts.



Warning

Instructions for hazardous areas:
Potential danger of life or of severe injuries.



Caution

Potential danger of burns
due to hot surfaces.



Notice, important information, malfunction.



The product complies with the applicable European directives.



ATEX
European guideline for explosion protection (Atmosphäre=AT, Explosion=EX). The product complies with the requirements of the European directive 2014/34/EU (ATEX) on explosion protection.

4. Function

2-wire Two connection lines are intended for the voltage supply.
The supply current is the measurement signal.

The hydrostatic pressure prevailing within the application is transformed into a standardised electrical signal through the deflection of the diaphragm, which acts on the sensor element with the power supply fed to the level probe. This electric signal changes in proportion to the hydrostatic pressure and can be evaluated correspondingly.

5. For your safety



- Select the appropriate level probe with regard to scale range, performance and specific measurement conditions prior to installing and starting the instrument.
- Observe the relevant national regulations and observe the applicable standards and directives for special applications. **If you do not observe the appropriate regulations, serious injuries and/or damage can occur!**
- Please make sure that the level probe is only used within the overload threshold limit all the time!
- Observe the ambient and working conditions outlined in section 11 „Technical data“.
- Ensure that the level probe is only operated in accordance with the provisions i.e. as described in the following instructions.
- Do not interfere with or change the level probe in any other way than described in these operating instructions.
- Remove the level probe from service and mark it to prevent it from being used again accidentally, if it becomes damaged or unsafe for operation
- **Take precautions with regard to remaining media in removed level probes. Remaining media in the pressure port may be hazardous or toxic!**
- Have repairs performed by the manufacturer only

Information about material consistency against corrosion and diffusion can be found in the materials data sheet according your application.

1. Stainless steel 1.4571
2. Hasteloy HC4 2.4610



Consider the details given in the EC-type examination certificate as well as the respective country specific regulations for installation and operation in hazardous areas. If you do not observe these stipulations, serious injuries and/or damage can occur.

6. Packaging

Has everything been supplied?



- Check the scope of supply:
- Completely assembled level probes
- EC-type examination certificate
- Inspect the level probe for possible damage during transportation. Should there be any obvious damage, inform the transport company and Müller Industrie Elektronik without delay.
- Keep the packaging, as it offers optimal protection during transportation (e.g. changing installation location, shipment for repair).
Ensure that the connection contacts will not be damaged.

7. Starting, Operation

Diaphragm test for your safety

It is necessary that before starting the level probe you test the diaphragm, as this is a **safety-relevant** component.






Warning

- Pay attention to any liquid leaking out, for this points to a diaphragm damage.
- Use the pressure transmitter only if the diaphragm is undamaged.
- Use the pressure transmitter only if it is in a faultless condition as far as the safety-relevant features are concerned.

Mechanical connection



Product plate (example)

MÜLLER		PT-HL
INDUSTRIE - ELEKTRONIK GMBH		
SN: 1405.09/09-20.0-011		GL TAA00002H1
Year: 2019		
Supply: 16...30 VDC (+red, -black)	Output: 4...20 mA HART	
Range: 0...2500 mbar	max. Range: 2500 mbar	
Temp.-Range: -10°C...+85°C	Cable: 12,50 m	
Material: Hastelloy (HC4)		
Space for Customer Data		
 II 1G Ex ia IIA T4 Ga BVS 12 ATEX E 066X	 0044	
D-31535 Neustadt	info@mueller-ie.com	Made in Germany



- An additional strain relief is not necessary because the cable has a max. tensile strength of 500 N.
- The protection cap (A) protects the secluded diaphragm (B) from damaging the level probe during transport and immersion. Remove the protection cap if used with viscous or contaminated media.



Warning

- Protect the diaphragm against any contact with abrasive substances and pressure peaks and do not touch it with tools. If you damage the diaphragm, no intrinsic safety can be guaranteed (ATEX)!
- Observe the technical data for the use of the pressure transmitter in connection with aggressive or corrosive media and for the avoidance of mechanical hazards.

Installation in / mounting to Zone 0

(In general Zone 0 is given when the pressure transmitter is surrounded by a mixture of explosive gases more than 1.000 hours per year = continuous hazard).



Warning

- Include the screen/sheath of the connection line used as a suspension rope in the equipotential bonding of the container.
- For separation of the zones the bulkhead cable gland in the wall must have the ingress protection according to IEC 60 529 namely for zone 0: IP 67.
- Integrate an overvoltage protection, if the mounting position is less than 1 m away from the transition into **Zone 0**.

Warning with regard to heat sources near the place of installation



Warning

- When fixing the place of installation take into consideration the influence of heat sources near the place of installation, eg heating coils on the tank bottom. The place of installation has to be chosen in a way which prevents external heat sources to exceed the allowed working temperature.
- When exceeding the maximum allowed working temperature the ATEX approval expires and damage of the device is possible (loss of warranty)

7. Starting, Operation (Continued)

Mounting, electrical connection



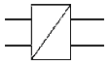
- Operate the level probe with a shielded cable and earth the shield at least on one side of the cable, if the cable is longer than 30m (2-wire), or if it is run outside of the building.
- There must be no difference in potential between medium/tank and the grounding of the junction box and the control cabinet when the shield of the cable is applied.
- Ingress protection per IEC 60529
- Please make sure that the ends of cables with flying leads do not allow any ingress of moisture.

Mounting, electrical connection



Warning

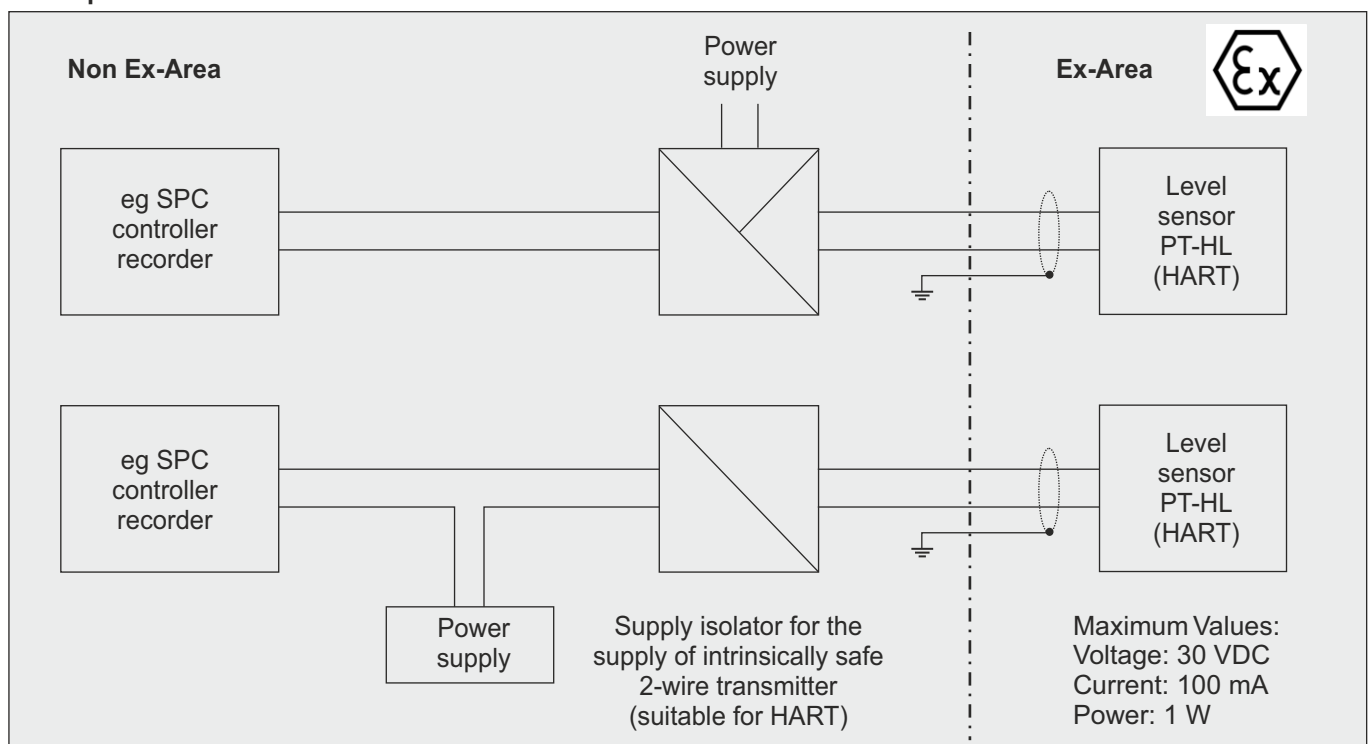
- Ground the cable screen at one end, preferably in the safe, thus non-Ex, area (EN 60079-14). For devices with flying leads, the screen is connected to the housing. The simultaneous connection of housing and cable screen to ground is only permitted if ground loop problems between the screen connection (e.g. at the power supply) and housing can be excluded (see EN 60079-14).
- If the housing of the transmitter is not grounded and is likely to be subjected to any electrostatic charging (EN 60079-14, 6.3 Paragraph 4) or if the level probe is to be operated in Zone 0, the cable screen should be connected to the equipotential bonding. See also BVS12 ATEX E 066 X
- Supply the level probe from an intrinsically safe current circuit (Ex ia).
- Consider both the internal capacitance and inductance.
- Cover flying leads with fine wires by an end splice (cable preparation).
- Consider that cables for use in zones 1 and 2 must be checked with a test voltage between conductor/earth, conductor/screen of more than 500V (AC).



With a line transformer, which has to be suitable for HART communication, you realise the mandatory galvanic isolation of the voltage and current supply between hazardous and non-hazardous areas and ensure the safety connection data.

Connection leads: red: + supply / + signal
black: - supply / - signal

Examples of connection



7. Starting, Operation (Continued)

HART Communication



- In the intrinsically safe circuit (to and within Ex-area) the device for the HART communication has to be intrinsically safe.
- For the HART communication is a load resistance of minimum 250 ohms necessary, when needed it has to be connected in addition.
- When the HART communication will be used in the non Ex-area the supply isolator has to be suitable for HART communication.

Functional test



The output signal must be proportional to the pressure. If not, this might point to a damage of the diaphragm. In that case refer to chapter 10 „Trouble shooting“.



Warning

- Observe the ambient and working conditions outlined in section 11 „Technical data“.
- Please make sure that the level probe is only used within the over load threshold limit at all times!



Caution

When touching the level probe, keep in mind that the surfaces of the instrument components might get hot during operation.

8. Maintenance, accessories



- PT-HL level probes require no maintenance.
- Have repairs performed by the manufacturer only.

Accessories: For details about the accessories, please refer to our standard price list, our catalogue or contact our sales department.

9. Trouble shooting



Warning

- Take precautions with regard to remaining media in removed level probes. Remaining media in the pressure port may be hazardous or toxic!
- Remove the level probe from service and mark it to prevent it from being used again accidentally, if it becomes damaged or unsafe for operation.
- Have repairs performed by the manufacturer only.



- Do not insert any pointed or hard objects into the pressure port for cleaning to prevent damage to the diaphragm.

Please verify in advance if pressure is being applied (valves/ ball valve etc. open) and if the right voltage supply and the right type of wiring (2-wire) has been chosen?

Failure	Possible cause	Procedure
Signal span dropping off Signal span too small	Diaphragm is damaged, eg through impact, abrasive/agressive media; corrosion of diaphragm/pressure connector; transmission fluid missing	Contact the manufacturer and replace the instrument
Signal span drops off	Moisture present (eg at the cable tail)	Install the cable correctly
Signal span erratic Signal span incorrect	Working temperature too high/low	Ensure permissible temperatures as per operating manual

Troubleshooting (Continued)

Failure	Possible cause	Procedure
Abnormal zero point signal	Medium or ambient temperature too high/low	Control internal instrument temp. within permissible range; observe allowable temperature error (see operating instructions)
	Diaphragm is damaged, eg through impact, abrasive / aggressive media corrosion of diaphragm or pressure connector	Replace instrument
	Working temperature too high / low	Ensure permissible temperatures as per the operating instructions
Zero point signal unstable Zero point signal too high/low	Moisture present (eg at the cable tail)	Install the cable correctly, filter element insertion
Hot instrument case surface	Permissible ambient or medium temperature exceeded	Ensure permissible ambient/medium temperature limits are observed (see op. instr.)
No output signal	No/wrong voltage supply or line transient	Correct the voltage supply according operation instructions

Make sure that after the assembly the unit is working properly. In case the error continues to exist send in the instrument for reparation (or replace the unit). If the problem persists, contact our sales department.

Providing service

Purge / clean dismantled instruments before returning them in order to protect our employees and the environment from any hazard caused by adherent remaining media. An examination of faulty devices is only possible when we have a detailed description of the error.

10. Storage, Disposal



Warning

When storing or disposing of the level probe, take precautions with regard to remaining media in removed level probes. We recommend cleaning the level probe properly and carefully. Remaining media in the pressure port may be hazardous or toxic!

Storage

c



Mount the protection cap when storing the pressure transmitter in order to prevent any damage to the diaphragm.

Disposal



Dispose of instrument components and packaging materials in accordance with the respective waste treatment and disposal regulations of the region or country to which the instrument is supplied.

11. Technical Data

Input ranges (in bar) Please Note: preferred ranges are marked with **

Pressure range	0,1	0,16	0,25	0,4**	0,6	1**	1,6	2,5**	4	6	10
Over pressure safety	1	1,5	2	2	4	5	10	10	17	35	35
Burst pressure	2	2	2,4	2,4	4,8	6	12	12	20,5	42	42

Power supply: $U_B = 16...30$ VDC (maximum current consumption: <25 mA)

Output signal: 4...20 mA, 2-wire, with superimposed communication signal (HART-protocol)

Load: $R = (U_B - 16 \text{ V}) / 0,02 \text{ A}$ - (length of cable in m x 0,14 ohms)

(HART communication: a communication resistance of 250 ohms has to be taken into account)

Accuracy: up to 0,25 bar: 0,25% of span, above 0,25 bar: 0,125% of span (according to BFSL)
up to 0,25 bar: 0,5% of span, above 0,25 bar: 0,25% of span*

*including non-linearity, hysteresis, zero point and full scale error

Non-linearity: 0,2% of span (according to BFSL)

Non-repeatability: 0,1% of span

1-year stability: 0,2% of span (at reference conditions)

Adjusted in vertical mounting position with lower pressure connection

Temperature ranges: operation range HART transmitter and FEP-cable: $-10...+85$ °C

More details about temperature ranges are included in the EC-type examination certificate

storage range: $-10...+60$ °C

Compensated temperature range: $0...+50$ °C

Temperature coefficient: mean TC of zero: 0,2% of span / 10 °K

mean TC of zero: 0,4% of span / 10 °K (ranges up to 0,25 bar)

mean TC of range: 0,2% of span / 10 °K

CE-conformity: pressure equipment directive: 2014/68/EU

EMC directive: 2014/30/EU

ATEX directive: 2014/34/EU

Ex-protection: according ATEX (category: II 1G)

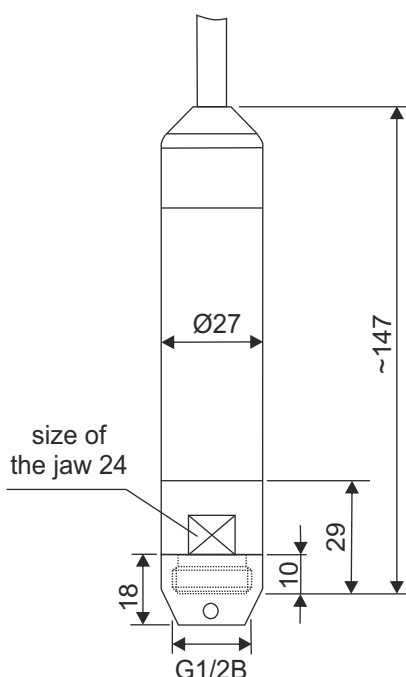
Ignition protection type: Ex ia IIA T4 EPL-Level: Ga

- For this take into account the data of the belonging to **EC-type examination certificate**.

Wiring protection: short-circuit protection: permanent

reverse polarity protection: no damage, but no function, too

Dimensions (in mm)



Mechanics

Materials: case, covering cap: CrNi-steel (1.4571)

- option: Hastelloy (HC4)

cable: FEP

internal transmission fluid: synthetic oil

Weight: approx. 200 g

- cable: approx. 80 g per m cable

Covering cap: for transport and storage

- if the sensor is used as an immersion probe:

can be removed when medium is dirty or viscous

11. EU Conformity Declaration

We MÜLLER INDUSTRIE-ELEKTRONIK GMBH

(supplier's name)

Justus-von-Liebig-Straße 24
31535 Neustadt
GERMANY

(address)

declare that the product

HART level sensor type PT-HL

(name, type or model, batch or serial number, possibly sources and number of items)

is (are) in conformity with the following European CE-directives:

2014/30/EU

by the application with the following standard(s)

DIN EN 61000-6-2, DIN EN 61000-6-4, DIN EN 61000-4-2 and DIN EN 55011

and is in conformity with the following EC Type Examination Certificate:

BVS 12 ATEX E 066 X

according the following European CE-directive:

2014/34/EU

by the application with the following standard(s)

EN 60079-0:2009, EN 60079-11:2007 and EN60079-26:2007

by the notified body number 0158

**DEKRA EXAM GmbH
BVS
44809 Bochum
GERMANY**

Neustadt, 16.11.2017

(Place and date of issue)



**Müller Industrie-Elektronik GmbH
Matthias Müller**

(name and signature or equivalent marking of authorized person)

12. EC Type Examination Certificate

(1) **EG-Baumusterprüfbescheinigung**

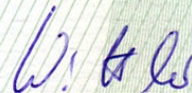
- (2) Geräte und Schutzsysteme zur bestimmungsgemäßen Verwendung in explosionsgefährdeten Bereichen - Richtlinie 94/9/EG
Ergänzung gemäß Anhang III Ziffer 6
- (3) Nr. der EG-Baumusterprüfbescheinigung: **BVS 12 ATEX E 066 X**
- (4) Gerät: **Tauchsonde Typ PT-HL**
- (5) Hersteller: **Müller Industrie-Elektronik GmbH**
- (6) Anschrift: **Justus-von-Liebig-Str. 24, 31535 Neustadt**
- (7) Die Bauart dieser Geräte sowie die verschiedenen zulässigen Ausführungen sind in der Anlage zu diesem Nachtrag festgelegt.
- (8) Die Zertifizierungsstelle der DEKRA EXAM GmbH, benannte Stelle Nr. 0158 gemäß Artikel 9 der Richtlinie 94/9/EG des Europäischen Parlaments und des Rates vom 23. März 1994, bescheinigt, dass diese Geräte die grundlegenden Sicherheits- und Gesundheitsanforderungen für die Konzeption und den Bau von Geräten und Schutzsystemen zur bestimmungsgemäßen Verwendung in explosionsgefährdeten Bereichen gemäß Anhang II der Richtlinie erfüllen. Die Ergebnisse der Prüfung sind in dem Prüfprotokoll BVS PP 09.2173 EG niedergelegt.
- (9) Die grundlegenden Sicherheits- und Gesundheitsanforderungen werden erfüllt durch Übereinstimmung mit
- EN 60079-0:2009 Allgemeine Anforderungen**
EN 60079-11:2007 Eigensicherheit 'i'
EN 60079-26:2007 Geräte mit Geräteschutzniveau (EPL) Ga
- (10) Falls das Zeichen "X" hinter der Bescheinigungsnummer steht, wird in der Anlage zu dieser Bescheinigung auf besondere Bedingungen für die sichere Anwendung des Gerätes hingewiesen.
- (11) Dieser Nachtrag zur EG-Baumusterprüfbescheinigung bezieht sich nur auf die Konzeption und die Baumusterprüfung der beschriebenen Geräte in Übereinstimmung mit der Richtlinie 94/9/EG. Für Herstellung und Inverkehrbringen der Geräte sind weitere Anforderungen der Richtlinie zu erfüllen, die nicht durch diese Bescheinigung abgedeckt sind.
- (12) Die Kennzeichnung des Gerätes muss die folgenden Angaben enthalten:

 **II 1G Ex ia IIA T4 Ga**

DEKRA EXAM GmbH
Bochum, den 16. August 2012



Zertifizierungsstelle



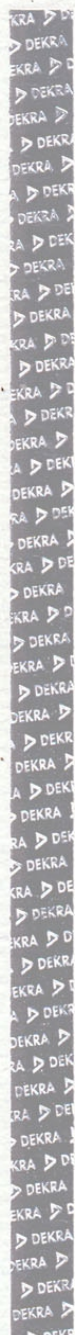
Fachbereich

Seite 1 von 2 zu BVS 12 ATEX E 066 X

Dieses Zertifikat darf nur vollständig und unverändert weiterverbreitet werden.

DEKRA EXAM GmbH, Dinnendahlstraße 9, 44809 Bochum, Telefon +49.234.3696-105, Telefax +49.234.3696-110, zs-exam@dekra.com

12. EC Type Examination Certificate



(13) Anlage zum

(14) **EG-Baumusterprüfbescheinigung**
BVS 12 ATEX E 066 X

(15) 15.1 Gegenstand und Typ

Tauchsonde Typ PT-HL

15.2 Beschreibung

Die Tauchsonde dient zum Messen von Füllständen.

Sie besteht aus einem rohrförmigen Gehäuse aus Stahl, das in Vergussmasse eingebettete Isolierstoffplatten mit elektronischen Bauteilen enthält. Der eigensichere Speise- und Signalstromkreis wird über eine flexible Leitung mit freien Leitungsenden aus dem Verguss und dem Gehäuse herausgeführt.

15.3 Kenngrößen

Maximale Eingangsspannung	U _i	DC	30	V
Maximale Eingangsstromstärke	I _i		100	mA
Maximale Eingangsleistung	P _i		1	W
Wirksame innere Kapazität	C _i		vernachlässigbar	
Wirksame innere Induktivität	L _i		vernachlässigbar	
Umgebungstemperaturbereich	T _a		-10 °C bis +85 °C	

(16) Prüfprotokoll

BVS PP 09.2173 EG, Stand 03.05.2012

(17) Besondere Bedingungen für die sichere Anwendung

Die Tauchsonde muss mit in den Potentialausgleich einbezogen werden.

Seite 2 von 2 zu BVS 12 ATEX E 066 X

Dieses Zertifikat darf nur vollständig und unverändert weiterverbreitet werden.

DEKRA EXAM GmbH, Dinnendahlstraße 9, 44809 Bochum, Telefon +49.234.3696-105, Telefax +49.234.3696-110, zs-exam@dekra.com

13. GL-Certificate (Excerpt)

DNV-GL

Certificate No:
TAA00002H1

TYPE APPROVAL CERTIFICATE

This is to certify:**That the Pressure Transmitter**with type designation(s)
PT-HL

Issued to

Müller Industrie-Elektronik GmbH
Neustadt am Rübenberge, Niedersachsen, Germanyis found to comply with
DNV GL rules for classification – Ships, offshore units, and high speed and light craft**Application :****Product(s) approved by this certificate is/are accepted for installation on all vessels classed by DNV GL.****Location classes:**

Temperature	D
Humidity	B
Vibration	B
EMC	B
Enclosure	C, D

Issued at **Hamburg** on **2019-12-16**This Certificate is valid until **2024-12-15**.
DNV GL local station: **Essen**Approval Engineer: **Dariusz Lesniewski**Digitally Signed By: Rinkel, Marco
for **DNV GL**

Location: Hamburg, on behalf of

Joannis Papanuskas
Head of Section

This Certificate is subject to terms and conditions overleaf. Any significant change in design or construction may render this Certificate invalid. The validity date relates to the Type Approval Certificate and not to the approval of equipment/systems installed.



Form code: TA 251

Revision: 2016-12

www.dnvgl.com

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