1. Všeobecné ustanovenie

Tento protokol je podkladom na vydanie rozhodnutia o schválení typu meradla podľa § 11 ods.1 zákona 142/2000 Z. z. o metrológii a o zmene niektorých zákonov v znení zákona č. 431/2004 Z. z. (ďalej len "zákon o metrológii") na typ meradla:

prevodník tlaku typového radu CERABAR M vo vyhotovení
PMC 51, PMP 51, PMP 55

1.1 Rozsah posudzovania

Meradlo svojím charakterom zodpovedá:

určenému meradlu podľa následovných položiek prílohy č. 1 k vyhláške ÚNMS SR č. 210/2000 Z. z. o meradlách a metrologickej kontrole v znení neskorších predpisov (ďalej len vyhláška 210/2000 Z. z.):

- podľa položky 1.3.16 c) „Prepočítavače množstva kvapalín vrátane pripojených prevodníkov: - prevodníky tlaku",
- podľa položky 1.3.21 „Prepočítavače pretečeného množstva plynu vrátane pripojených prevodníkov podliehajúcich pravidelnej skúške na mieste inštalácie jedenkrát za rok podľa prílohy č. 35",
- podľa položky 2.3.2 „Prevodníky tlaku používané v kafilerických zariadeniach",
- podľa položky 3.1.5 e) „Merače tepla a ich členy – prevodníky tlaku".

Meradlo bolo posudzované z hľadiska požiadaviek na daný druh meradla ustanovených predpisom:

príloha č. 33 ,Prevodníky tlaku, k vyhláške č. 210/2000 Z.z. v znení neskorších predpisov (ďalej uvádzaná len ako príloha č.33), STN EN 60770-1 Meracie prevodníky pre riadiace systémy priemyselných procesov – časť 1: Metódy hodnotenia spôsobilosti. december 2001

1.2 Údaje o technickej dokumentácii použitej pri posudzovaní:

Technical information Cerabar M PMC51, PMP51/55 Process pressure measurement Pressure transmitters with ceramic and metal sensors; modular design and easy operation; with Analog or HART Electronics, No. 71103453,
Operating instructions Cerabar M PMC51, PMP51/55, No. 71123275,
Brief Operating Instructions Cerabar M PMC51, PMP51/55, No. 71123261.
Provozní návod Cerabar M PMC51, PMP51/55, č. 71104504
Struční provozní návod Cerabar M PMC51, PMP51/55, č. KA1030P/32/CS/10.09/03.

Uvedená dokumentácia je uložená v laboratóriu tlaku Centra hmotnosti a tlaku 220 SMU Bratislava

1.3 Údaje o dokladoch použitých pri posudzovaní:

k posudzovaniu neboli predložené žiadne doklady o skúškach vykonaných v zahraničí.

1.4 Údaje o vzorkách určeného meradla:

Na posúdenie určeného meradla boli predložené následovné vzorky:

Prevodník tlaku Cerabar M PMC51 v.č. E300E501128
rozsah (0 až 100) mbar abs.
Prevodník tlaku Cerabar M PMC51 v.č. E300E401128
rozsah (0 až 1000) kPa abs.
Prevodník tlaku Cerabar M Cerabar M PMP51 v.č. E301B401129
Rozsah (0 až 40) MPa.

Vzorky boli dodané dňa 29.3.2011 a prevzala ich pracovníčka centra hmotnosti a tlaku p. Gizela Čambalová

2. Popis meradla:

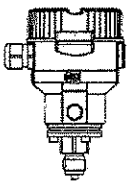
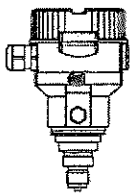
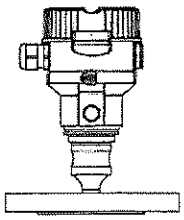
Názov meradla: Prevodníky tlaku radu Cerabar M
Vyhotovenie: PMC 51, PMP 51, PMP 55

Technický popis meradla
Prevodníky tlaku radu Cerabar M v prevedení PMC 51 sú prevodníky tlaku so snímačom tlaku pracujúcim na základe kapacitného snímania priehybu keramickej meracej membrány, ktorý prevádza meranú hodnotu tlaku na elektrický výstupný prúdový signál (4 až 20) mA.
Prevodníky tlaku Cerabar M v prevedení PMP 51, 55 sú prevodníky tlaku so snímačom tlaku pracujúcom na princípe piezoelektrického snímania priehybu kovovej membrány, ktorý sa prevádza na elektrický výstupný prúdový signál (4 až 20) mA.
Elektronická časť prevodníka tlaku je zabudovaná do telesa prevodníka. Na telese je umiestnený nástavec pre prívod meraného tlaku.

Prevodníky tlaku sa skladajú nasledovných častí:
- puzdro,
- elektronika so snímačom tlaku,
- pripojovacie miesta (tlakové a elektrické konektory)

2.1 Základné technické a metrologické charakteristiky

2.1.1 Rozsah aplikácií a design

Cerabar M	**PMC51**	**PMP51**	**PMP55**
	 Kapacitný merací princíp s keramickou bunkou (Ceraphire®)	 Piezo-odporová meracia bunka s kovovou membránou.	 Oddeľovač tlaku.
Oblasť použitia	– relatívny tlak, absolútny tlak – meranie hladiny		
Procesné pripojenie	– závitové – EN prírubové	– závitové – EN prírubové	Široký rozsah prírub.

Slovenský metrologický ústav – Bratislava

	DN25 – DN80 – ANSI príruby 1" – 4" – JIS príruby 50 A – 100 A	DN25 – DN80 – ANSI príruby 1" – 4" – JIS príruby 50 A – 100 A – Príprava na montáž na oddelovač tlaku	
Merací rozsah	Od -100/0 až 100 mbar do -1/0 až 40 bar	Od -400/0 až 400 mbar do -1/0 až 400 bar	
OPL	Maximálne 60 bar	Maximálne 600 bar	
Teplotný rozsah – procesný	-20°C do +100°C	-40°C do +125°C	-70°C do 400°C
Teplotný rozsah – okolitý	– bez LCD displeja: -40°C do +85°C – s LCD displejom: -20°C do +70°C (rozšírený teplotný rozsah -40°C do +85°C s obmedzeniami optických vlastností LCD displeja ako rýchlosť odozvy zobrazovania alebo kontrast displeja) – oddelená verzia: -20°C do +60°C		
Najväčšia dovolená chyba	– do ±0,15 % nastaveného rozsahu – PLATINUM verzia: do ±0,075 % nastaveného rozsahu		do ±0,15 % nastaveného rozsahu
Napájacie napätie	– 11,5V do 45V DC (verzia s konektorom do 35V DC) – Pre iskrovo bezpečné verzie: 11,5V do 30V DC		
Výstup	4 až 20 mA, 4 až 20 mA s HART protokolom,		
Možnosti	– PMP51, PMP55: materiály podľa NACE – PMC51, PMP51, PMP55: inšpekčný certifikát 2.2 alebo 3,1 alebo iné certifikáty – Špecifické verzie Firmware – Nastavenie prístroja vo výrobnom závode – Oddelená verzia – Široký rozsah príslušenstva		

OPL – Over Pressure Limit – hranica preťaženia, závisí od najslabšieho článku, pri tlaku závisí od vybraných komponentov

2.1.2 Merací rozsah – PMC51 s keramickou bunkou - relatívny tlak

Nominálna hodnota	**Hranica rozsahu**		**Najmenší nastav. rozsah** [4]	**MWP** [1]	**OPL** [2]	**Odolnosť voči vákuu**
	Spodná bar	**Horná** bar	bar	bar	bar	bar $_{abs}$
100 mbar	-0,1	+0,1	0,01	2,7	4	0,7
250 mbar	-0,25	+0,25	0,01	3,3	5	0,5
400 mbar	-0,4	+0,4	0,02	5,3	8	0
1 bar	-1	+1	0,05	6,7	10	0
2 bar	-1	+2	0,1	12	18	0

4 bar	-1	+4	0,2	16,7	25	0
10 bar	-1	+10	0,5	26,7	40	0
40 bar	-1	+40	2	40	60	0

2.1.3 Merací rozsah – PMC51 s keramickou, proces oddeľujúcou bunkou - absolútny tlak

Nominálna hodnota	**Hranica rozsahu**		**Najmenší nastav. rozsah** [4]	**MWP** [1]	**OPL** [2]	**Odolnosť voči vákuu**
	Spodná bar $_{abs}$	**Horná** bar $_{abs}$	bar	bar $_{abs}$	bar $_{abs}$	bar $_{abs}$
100 mbar	0	+0,1	0,01	2,7	4	0
250 mbar	0	+0,25	0,01	3,3	5	0
400 mbar	0	+0,4	0,02	5,3	8	0
1 bar	0	+1	0,05	6,7	10	0
2 bar	0	+2	0,1	12	18	0
4 bar	0	+4	0,2	16,7	25	0
10 bar	0	+10	0,5	26,7	40	0
40 bar	0	+40	2	40	60	0

1 – MWP (Maximum Working Pressure) Maximálny pracovný tlak
2 – OPL (Over Pressure Limit) limitná hodnota tlaku pre danú bunku
4 – Zúženie rozsahu > 20:1 môže byť nastavené v elektronike prístroja alebo na vyžiadanie vo výrobnom závode

2.1.4 Merací rozsah – PMP51 a PMP55 s kovovou, proces oddeľujúcou bunkou - relatívny tlak

Nominálna hodnota	**Hranica rozsahu**		**Najmenší nastaviteľný rozsah** [5]	**MWP** [1]	**OPL** [2]	**Odolnosť voči vákuu** [3]
	Spodná bar	**Horná** bar	bar	bar	bar	bar $_{abs}$
400 mbar	-0,4	+0,4	0,02	4	6	0,01 / 0,04
1 bar	-1	+1	0,05	6,7	10	
2 bar	-1	+2	0,1	13,3	20	
4 bar	-1	+4	0,2	18,7	28	
10 bar	-1	+10	0,5	26,7	40	
40 bar	-1	+40	2	100	160	
100 bar	-1	+100	5	100	400	
400 bar	-1	+400	20	400	600	

2.1.5 Merací rozsah – PMP51 a PMP55 s kovovou, proces oddeľujúcou bunkou - absolútny tlak

Nominálna hodnota	**Hranica rozsahu**		**Najmenší nastaviteľný rozsah** [5]	**MWP** [1]	**OPL** [2]	**Odolnosť voči vákuu** [3]
	Spodná bar abs	**Horná** bar abs	bar abs	bar abs	bar abs	bar abs
400 mbar	0	+0,4	0,02	4	6	0,01 / 0,04
1 bar	0	+1	0,05	6,7	10	
2 bar	0	+2	0,1	13,3	20	
4 bar	0	+4	0,2	18,7	28	
10 bar	0	+10	0,5	26,7	40	
40 bar	0	+40	2	100	160	
100 bar	0	+100	5	100	400	
400 bar	0	+400	20	400	600	

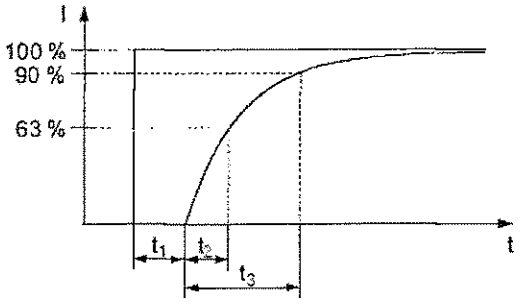
1 – MWP (Maximum Working Pressure) Maximálny pracovný tlak
2 – OPL (Over Pressure Limit) limitná hodnota tlaku pre danú bunku
3 – Odolnosť voči vákuu sa vzťahuje na meraciu bunku pri referenčných podmienkach. Tlakový a teplotný limit pre silikónový alebo inertný plniaci olej musí byť zohľadnený pri diafragmovej verzii PMP55
5 – Zúženie rozsahu > 20:1 môže byť nastavené v elektronike prístroja alebo na vyžiadanie vo výrobnom závode

2.1.6 Rozsah výstupného prúdu

4...20 mA, 4...20 mA HART: 3,8 ... 20,5 mA

2.1.7 Dynamika prúdového výstupu

Mŕtvy čas, časová konštanta (T63):



Zobrazenie mŕtveho času **a** časovej konštanty

Slovenský metrologický ústav -3- Bratislava

2.1.7.1 Dynamika prúdového výstupu 4 – 20 mA (Analógová verzia)

Typ	**Mŕtvy čas t_1**	**Časová konštanta (T63), t_2**	**Časová konštanta (T90), t_3**
PMC51	60ms	40ms	50ms
PMP51	40ms	40ms	50ms
PMP55	PMP51 + vplyv diafragmy		

2.1.7.2 Dynamika prúdového výstupu 4 – 20 mA HART

Typ	**Mŕtvy čas t_1**	**Časová konštanta (T63), t_2**
PMC51	90ms	120ms
PMP51	60ms	70ms
PMP55	PMP51 + vplyv diafragmy	

2.1.7.3 Dynamika digitálneho výstupu HART

Typ	**Mŕtvy čas t_1**	**Časová konštanta (T63), t_2**
PMC51	340ms	120ms
PMP51	310ms	70ms
PMP55	PMP51 + vplyv diafragmy	

2.1.8 Referenčné pracovné podmienky:

- Podľa IEC 60770
- Okolitá teplota T_A = konštantná, v rozsahu od +21°C do +33°C
- Vlhkosť φ = konštantná, v rozsahu od 5% do 80%
- Okolitý tlak p_A = konštantný, v rozsahu od 860 mbar do 1060 mbar
- Pozícia meracej bunky konštantná, v rozsahu +/- 1° horizontálne
- Nastavenie LOW SENSOR TRIM a HIGH SENSOR TRIM pre spodný rozsah a horný rozsah
- Rozsah nastavený od nuly
- Materiál keramickej meracej bunky PMC5: Al_2O_3
- Materiál kovovej meracej bunky PMP51 a PMP 55: AISI 316L
- Plniaci olej pre PMP51 a PMP55: silikónový olej
- Napájacie napätie: 24 V DC +/- 3 V DC
- Záťaž s HART: 250 ohm

2.1.9 Dlhodobá stabilita

PMC51	**Dlhodobá stabilita URL / 1 rok**	**Dlhodobá stabilita URL / 5 rokov**	**Dlhodobá stabilita URL / 10 rokov**
< 1 bar	± 0,2%	± 0,4%	± 0,5%
> 1 bar	± 0,1%	± 0,25%	± 0,4%

PMP51	**Dlhodobá stabilita URL / 1 rok**	**Dlhodobá stabilita URL / 5 rokov**	**Dlhodobá stabilita URL / 10 rokov**
< 1 bar	± 0,2%	± 0,4%	± 0,5%
1 bar do 10 bar	± 0,1%	± 0,175%	± 0,4%
40 bar	± 0,1%	± 0,2%	± 0,4%
100 bar	± 0,1%	± 0,25%	± 0,2%
400 bar	± 0,1%	± 0,25%	± 1%

URL (Upper Range Limit) Horná hranica rozsahu

3. Posúdenie výkresovej a technickej dokumentácie:

Predložená technická dokumentácia je dostatočná pre schválenie typu a zhoduje sa s predloženou vzorkou.

4. Podmienky vykonania skúšok technických charakteristík a metrologických charakteristík

Skúšky boli vykonaných v laboratóriach SMÚ podľa prílohy č.33 a STN EN 60770 Meracie prevodníky pre riadiace systémy priemyselných procesov – časť 1: Metódy hodnotenia vlastností. 2001 s nasledovným skúšobným zariadením:

- etalónový piestový tlakomer PTO 60, v.č. 001 s meracím rozsahom (2 až 60) MPa, s kombinovanou štandardnou neistotou $u_c = 5.10^{-5}$
- etalónový tlakomer RPM4 A100k, v.č. 376 s meracím rozsahom (60 až 110) kPa, s kombinovanou štandardnou neistotou $u_c = 5.10^{-5}$
- etalónový piestový tlakomer PTV 10, v.č. 045 s meracím rozsahom (0,1 až 10) MPa, s kombinovanou štandardnou neistotou $u_c = 5.10^{-5}$tand
- klimatická komora Vötsch VC 4018, výr.č. 58566061880010
- vibračné zariadenie typ TIRA *Vib* TV5200, výrobné číslo 275/06

Podklady z vykonaných skúšok sú uložené v laboratóriu tlaku SMÚ.

Merania boli vykonané podľa pracovného postupu SMÚ „Pracovný postup na kalibráciu a overenie prevodníkov tlaku" č. 21/220/02 verzia 2 z 27.8.2004. Merania boli vykonané v laboratóriu tlaku, miestnosti č. H–207 a H-215.

Výsledky meraní sú uložené v Centre hmotnosti a tlaku.

5. Údaje o hodnotených technických charakteristikách a metrologických charakteristikách:

Výsledky vykonaných skúšok sú uvedené v následovných protokoloch SMU o meraní:

- č. 122/220/17/11 zo dňa 10.05.2011
- č. 123/220/17/11 zo dňa 04.05.2011

- č. 124/220/17/11 zo dňa 10.05.2011

Protokoly obsahujú všetky skúšky požadované prílohou č. 33. Výsledkom skúšok je zistenie, že predložené vzorky prevodníkov tlaku vyhoveli vo všetkých predpísaných kritériách.

6. Záver

Z výsledkov skúšok, meraní, zistení a vyhodnotení uvedených v tomto protokole vyplýva, že uvedený typ meradla vyhovuje svojimi technickými charakteristikami, metrologickými charakteristikami a konštrukčným vyhotovením požiadavkám vzťahujúcim sa na daný druh meradla ustanovenými v prílohe č. 33 " Prevodníky tlaku " k vyhláške ÚNMS SR č. 210/2000 Z. z. o meradlách a metrologickej kontrole v znení neskorších predpisov a v STN EN 60770 Meracie prevodníky pre riadiace systémy priemyselných procesov – časť 1: Metódy hodnotenia spôsobilosti. december 2001

7. Údaje na meradle

V zmysle prílohy č.33 budú na prístroji tieto značky a nápisy :
- meno alebo označenie výrobcu
- typ prevodníka
- výrobné číslo
- merací rozsah
- trieda presnosti
- výstupný signál
- napájanie
- značka schválenia typu

Dovozca je povinný dodať návod na obsluhu v slovenskom jazyku
Všetky údaje na meradle musia byť v štátnom jazyku slovenskom. Povoľuje sa používať medzinárodne uznávané označenia a skratky.

8. Overenie

1. Prvotné a následné overenie

Skúšky pre prvotné a následné overenie sú rovnaké. Vykonávajú sa podľa prílohy č. 33 k vyhláške 210/2000 Z. z.

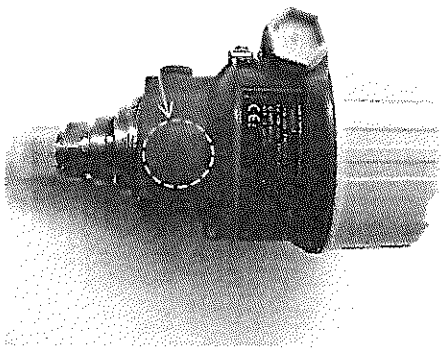
2. Čas platnosti overenia

Čas platnosti overenia prevodníkov tlaku typového radu Cerabar M vo vyhotovení PMC 51, PMP 51, PMP 55 je podľa jednotlivých položiek prílohy č. 1 k vyhláške ÚNMS SR č. 210/2000 Z.z. o meradlách a metrologickej kontrole v znení neskorších predpisov následovný:
- podľa položky 1.3.16 je čas platnosti overenia 2 roky,
- podľa položky 1.3.21 je čas platnosti overenia 5 rokov,
- podľa položky 2.3.2 je čas platnosti overenia 1 rok,
- podľa položky 3.1.5 je čas platnosti overenia 2 roky.

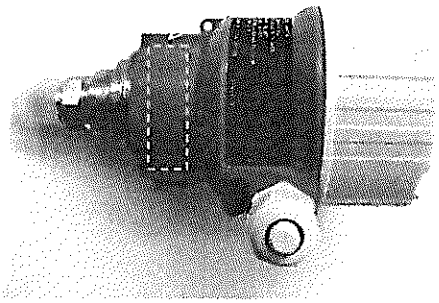
1. Umiestnenie overovacej a zabezpečovacej značky

Prístroje, ktoré vyhoveli skúškam podľa prílohy č. 33 k vyhláške 210/2000 Z.z. sa vybavia národnou overovacou značkou a zabezpečovacou značkou (nálepky) podľa nižšie uvedeného obr. 1.

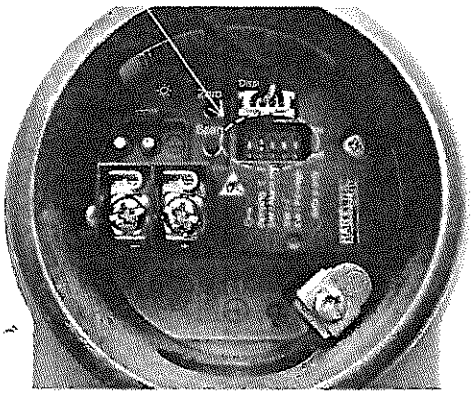
národná overovacia značka



značka schváleného typu



zabezpečovacia značka



Po vykonaní overenia, za účelom uzamknutia metrologických parametrov, prepnúť zámok do polohy „ON" a tento stav zabezpečiť prelepením zabezpečovacou značkou.

obr. 1

Posúdenie vykonal: Ing. Adam Kopkáš

Technical Information
Proline Prowirl F 200

Vortex flowmeter

The flowmeter with wet steam detection, available as compact or remote device version

Application

- Preferred measuring principle for wet/saturated/ superheated steam, gases & liquids (also cryogenic)
- Suitable for a wide range of applications; optimized for steam applications

Device properties
- Wet steam detection and measurement for DN 25 to 100 (1 to 4")
- Inlet run compensation
- Face-to-face length according to industry standard
- Display module with data transfer function
- Robust dual-compartment housing
- Plant safety: worldwide approvals (SIL, Haz. area)

Your benefits

- Integrated temperature measurement for mass/energy flow of saturated steam
- Highest process safety – dualsens version enables redundant measurement
- High availability – proven robustness, resistance to vibrations, temperature shocks & water hammer
- No maintenance – lifetime calibration
- Convenient device wiring – separate connection compartment
- Safe operation – no need to open the device due to display with touch control, background lighting
- Integrated verification – Heartbeat Technology™

Endress+Hauser
People for Process Automation

Table of contents

Document information

Symbols used

Electrical symbols

Symbol	Meaning	Symbol	Meaning
⎓	Direct current	~	Alternating current
⎓~	Direct current and alternating current	⏚	**Ground connection** A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.
⊜	**Protective ground connection** A terminal which must be connected to ground prior to establishing any other connections.	⏚	**Equipotential connection** A connection that has to be connected to the plant grounding system: This may be a potential equalization line or a star grounding system depending on national or company codes of practice.

Symbols for certain types of information

Symbol	Meaning
✓	**Permitted** Procedures, processes or actions that are permitted.
✓✓	**Preferred** Procedures, processes or actions that are preferred.
✗	**Forbidden** Procedures, processes or actions that are forbidden.
ℹ	**Tip** Indicates additional information.
📖	Reference to documentation
📄	Reference to page
🖼	Reference to graphic
👁	Visual inspection

Symbols in graphics

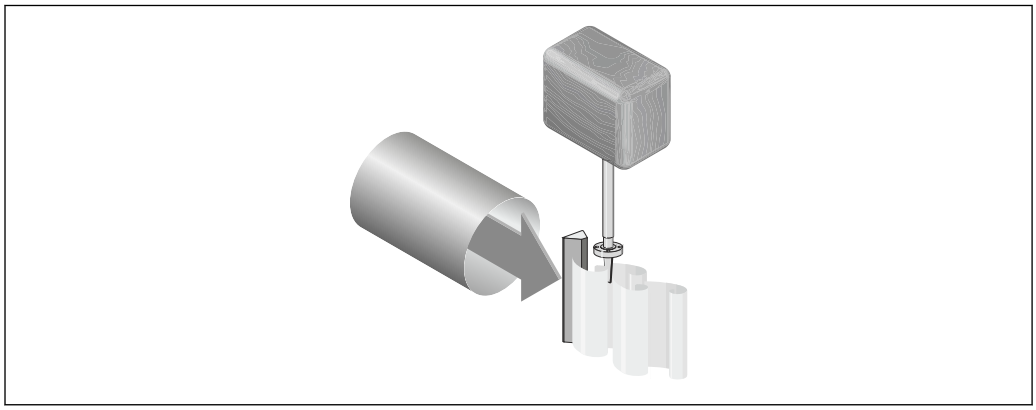
Symbol	Meaning	Symbol	Meaning
1, 2, 3,...	Item numbers	1., 2., 3., ...	Series of steps
A, B, C, ...	Views	A-A, B-B, C-C, ...	Sections
-	Hazardous area	▪	Safe area (non-hazardous area)
≋➡	Flow direction		

Function and system design

Measuring principle

Vortex meters work on the principle of the *Karman vortex street*. When fluid flows past a bluff body, vortices are alternately formed on both sides with opposite directions of rotation. These vortices each generate a local low pressure. The pressure fluctuations are recorded by the sensor and converted to

electrical pulses. The vortices develop very regularly within the permitted application limits of the device. Therefore, the frequency of vortex shedding is proportional to the volume flow.



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The calibration factor (K-factor) is used as the proportional constant:

$$\text{K-Factor} = \frac{\text{Pulses}}{\text{Unit Volume [m}^3\text{]}}$$

A0003939-EN

Within the application limits of the device, the K-factor only depends on the geometry of the device. It is for Re > 20 000:
- Independent of the flow velocity and the fluid properties viscosity and density
- Independent of the type of substance under measurement: steam, gas or liquid

The primary measuring signal is linear to the flow. After production, the K-factor is determined in the factory by means of calibration. It is not subject to long-time drift or zero-point drift.

The device does not contain any moving parts and does not require any maintenance.

The capacitance sensor

The sensor of a vortex flowmeter has a major influence on the performance, robustness and reliability of the entire measuring system.

The robust DSC sensor is:
- burst-tested
- tested against vibrations
- tested against thermal shock (thermal shocks of 150 K/s)

The Prowirl uses the tried-and-tested capacitance measuring technology of Endress+Hauser applied in over 300 000 measuring points worldwide.

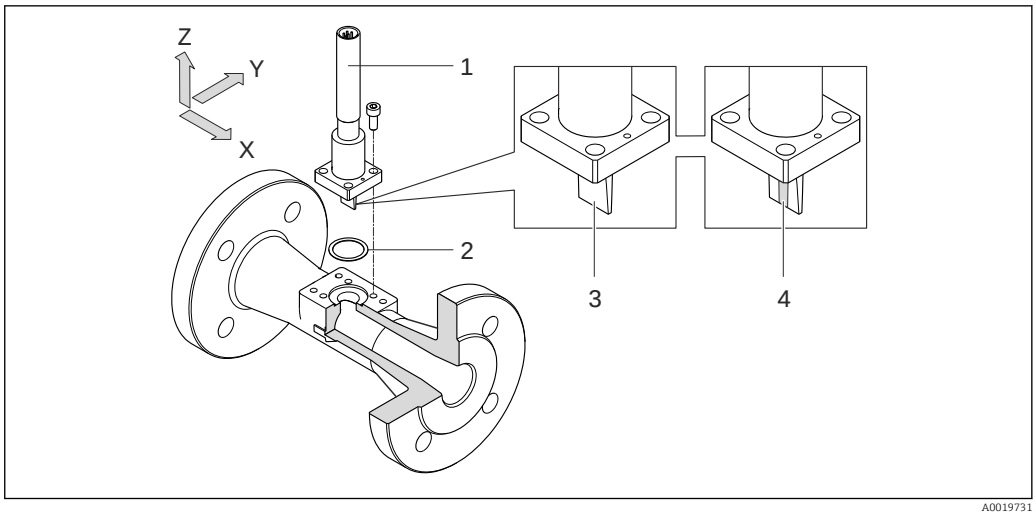
The DSC (differential switched capacitance) sensor patented by Endress+Hauser has complete mechanical balancing. It only reacts to the measured variable (vortex) and does not react to vibrations. Even in the event of pipe vibrations, the smallest of flows can be reliably measured at low density thanks to the unimpaired sensitivity of the sensor. Thus, the wide turndown is also maintained even in the event of harsh operating conditions. Vibrations up to 1 g at least, at frequencies up to 500 Hz in every axis (X, Y, Z), do not affect the flow measurement. Thanks to its design, the capacitance sensor is also particularly mechanically resistant to temperature shocks and pressure shocks in steam pipelines.

Temperature measurement

Under the order code for *"Sensor version"*, the *"Mass flow"* option is available. With this option the measuring device can also measure the temperature of the medium.

The temperature is measured via Pt 1000 temperature sensors. These sensors are located in the paddle of the DSC sensor and are therefore in the direct vicinity of the fluid.

Order code for *"Sensor version"*:
- Option 1 *"Volume flow, basis"*
- Option 2 *"Volume flow, high-temperature/low temperature"*
- Option 3 *"Mass flow (integrated temperature measurement)"*



1 Sample graphic

1 Sensor
2 Seal
3 Order code for "Sensor version", option 1 "Volume flow, basis" and option 2 "Volume flow, high-temperature/ low-temperature"
4 Order code for "Sensor version", option 3 "Mass flow (integrated temperature measurement)"

Lifelong calibration

Experience has shown that recalibrated Prowirl devices demonstrate a very high degree of stability compared to their original calibration: The recalibration values were all within the original measuring accuracy specifications of the devices.

Various tests and simulation procedures have shown that once the radii of the edges on the bluff body are less than 1 mm (0.04 in), the resulting effect does not have a negative impact on accuracy.

If the radii of the edges on the bluff body do not exceed 1 mm (0.04 in), the following general statements apply (in the case of non-abrasive and non-corrosive media, such as in most water and steam applications):
- The measuring device does not display an offset in the calibration and the accuracy is still guaranteed.
- All the edges on the bluff body have a radius that is typically smaller in size. As the measuring devices are naturally also calibrated with these radii, the measuring device remains within the specified accuracy rating provided that the additional radius that is produced as a result of wear and tear does not exceed 1 mm (0.04 in).

Consequently it can be said that the Prowirl product line offers lifelong calibration if the measuring device is used in non-abrasive and non-corrosive media.

Inlet run correction

Inlet run correction makes it possible to shorten the necessary inlet run before the measuring device to a minimum length of 10 × DN. If the inlet run available is too short, the measuring device can correct the measured error depending on the preceding disruption in the flow profile. This results in an additional measured error of ±0.5 %o.r. [1)]

The **Inlet Run Correction** function can be used for the following pressure ratings and nominal diameters:
DN 15 to 150 (1 to 6")
– EN (DIN)
– ASME B16.5, Sch. 40/80

1) = of reading

Inlet run correction is possible for the following flow obstructions:
- Single elbow (90° elbow)
- Double elbow (2 × 90° elbows, opposite)
- Double elbow 3D (2 × 90° elbows, opposite, not on one plane)
- Reduction by one nominal diameter size

Inlet and outlet runs to be considered → 40

For detailed information about inlet run correction, see the Special Documentation for the device → 96

Wet steam detection

The Prowirl 200 is optionally available with a "**Wet Steam Detection**" application package.

The **Wet Steam Detection** application package is only available for:
- Prowirl F 200
- Nominal diameters: DN 25 to 100 (1 to 4")
- Order code for *"Sensor version"*, option 3 *"Mass flow (integrated temperature measurement)"*

The **Wet Steam Detection** application package has an additional function that makes it possible to monitor the steam quality.

The application package offers:
- Diagnostics information that issues a warning when the steam quality drops below the limit value for steam quality in the range between 80 to 100 % .
- Correction of the volume flow [2], mass flow and energy flow.
- An additional indicator to monitor the operation of steam traps.

For detailed information about wet steam detection, see the Special Documentation for the device → 96

Wet steam measurement

The Prowirl 200 is optionally available with a "**Wet Steam Measurement**" application package.

The **Wet Steam Measurement** application package is only available for:
- Prowirl F 200
- Nominal diameters: DN 25 to 100 (1 to 4")
- Order code for *"Sensor version"*, option 3 *"Mass flow (integrated temperature measurement)"*

The **Wet Steam Measurement** application package complements the **Wet Steam Detection** application package in steam applications by providing quantitative steam quality measurement.

The application package offers:
- Steam quality as a direct measured value (on the display/current output/HART/PROFIBUS PA)
- Diagnostics information that issues a warning when the steam quality drops below the limit value for steam quality in the range between 80 to 100 % .
- Calculation of the following additional process variables:
  - Total mass flow [3] (on the display/current output/HART/PROFIBUS PA)
  - Condensate mass flow (on the display/current output/HART/PROFIBUS PA)
  - Correction of the volume flow [4], mass flow and energy flow in the steam application.

The **Wet Steam Measurement** application package is available as of the following firmware versions:
- HART: 01.02.zz
- PROFIBUS DP: 01.01.zz

For detailed information about wet steam measurement, see the Special Documentation for the device → 96

Diagnostic functions

In addition, the device offers extensive diagnostic options, such as tracking fluid and ambient temperatures, extreme flows etc.

2) Correction of the volume flow = correction of the primary volume flow towards condensate in a steam application (not to be confused with corrected volume flow); corrected volume flow = volume flow in relation to reference conditions
3) Total mass flow = steam mass flow + condensate mass flow
4) Correction of the volume flow = correction of the primary volume flow towards condensate in a steam application (not to be confused with corrected volume flow); corrected volume flow = volume flow in relation to reference conditions

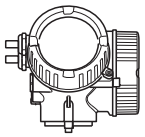
The following minimum and maximum values are tracked in the measuring device and saved for diagnostic purposes:
- Frequency
- Temperature
- Velocity
- Pressure

Measuring system

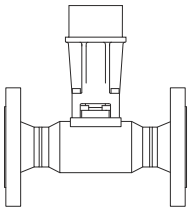
The device consists of a transmitter and a sensor.

Two device versions are available:
- Compact version – transmitter and sensor form a mechanical unit.
- Remote version - transmitter and sensor are mounted in separate locations.

Transmitter

Prowirl 200  A0013471	Device versions and materials: ▪ Compact or remote version, aluminum coated: Aluminum, AlSi10Mg, coated ▪ Compact or remote version, stainless: For maximum corrosion resistance: stainless steel CF-3M (316L, 1.4404) Configuration: ▪ Via four-line local display with key operation or via four-line, illuminated local display with touch control and guided menus ("Make-it-run" wizards) for applications ▪ Via operating tools (e.g. FieldCare)

Sensor

Prowirl F  A0009921	Flanged version: ▪ Nominal diameter range: DN 15 to 300 (½ to 12") ▪ Materials: – Measuring tubes: stainless steel, 1.4408 (CF3M) – Process connections DN 15 to 150 (½ to 6"): stainless steel, 1.4404 (F316, F316L) – Fully cast construction for DN 200 to 300 (8 to 12"): stainless cast steel, 1.4408 (CF3M) – Version for "harsh process, wetted parts": cast alloy CX2MW similar to Alloy C22/2.4602

Input

Measured variable

Direct measured variables

Order code for *"Sensor version"*:
- Option 1 *"Volume flow, basis"* and
- Option 2 *"Volume flow, high-temperature/low temperature"*:
  Volume flow

Order code for *"Sensor version"*:
Option 3 *"Mass flow (integrated temperature measurement)"*:
– Volume flow
– Temperature

Calculated measured variables

Order code for *"Sensor version"*:
- Option 1 *"Volume flow, basis"* and
- Option 2 *"Volume flow, high-temperature/low temperature"*:
  – In the case of constant process conditions: Mass flow [5] or Corrected volume flow
  – The totalized values for Volume flow, Mass flow [5], or Corrected volume flow

5) A fixed density must be entered for calculating the mass flow (**Setup** menu → **Advanced setup** submenu → **External compensation** submenu → **Fixed density** parameter).

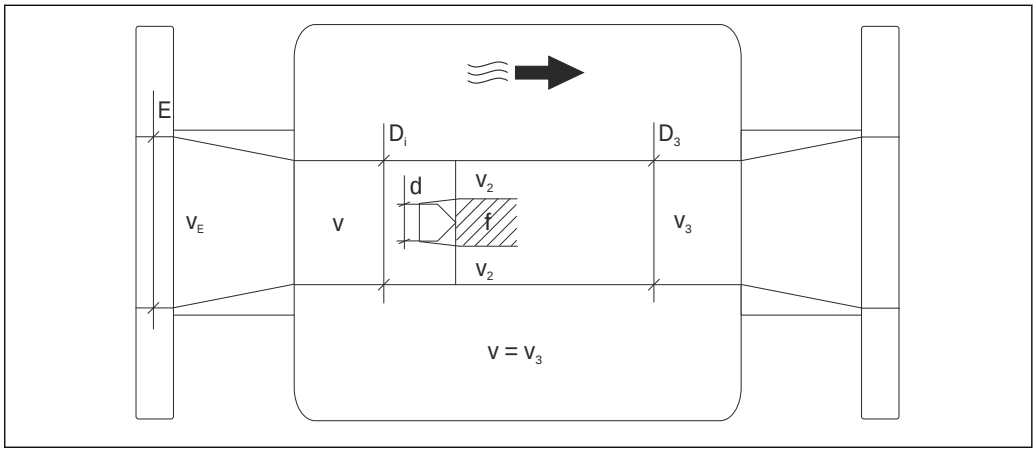
Order code for *"Sensor version"*:
- Option 3 *"Mass flow (integrated temperature measurement)"*:
  - Corrected volume flow
  - Mass flow
  - Calculated saturated steam pressure
  - Energy flow
  - Heat flow difference
- Only in combination with order code for *"Output; input"*, bus version *HART* and *PROFIBUS PA*:
  - Specific volume
  - Degrees of superheat

Order code for *"Sensor version"*, option *"Mass flow (integrated temperature measurement)"* combined with order code *"Application package"*, EU *"Wet steam measurement"*:
- Steam quality
- Total mass flow
- Condensate mass flow

Measuring range

The measuring range depends on the fluid and nominal diameter.

Flow velocity



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E *DN diameter*
v_E *Velocity in process pipe*
v *Bluff body approaching flow velocity (Re is based on this)*
v2 *Maximum velocity (applies only to oxygen) $v_2 = v_{max}$*
v_3 *Velocity when leaving the measuring device*
D_i *Internal diameter $D_i = D_3$*
D3 *Internal diameter $D_3 = D_i$*
d *Width of bluff body*
f *Vortex shedding frequency*

The Applicator can be used for calculation purposes. → 94

Maximum volume flow	Strouhal number	Reynolds number
$Q_{max(G)} = v_{max} \cdot \frac{\pi}{4} D_i^2$ A0027504	$Sr = \frac{f \cdot d}{v}$ A0027505	$Re = \frac{\rho \cdot v \cdot D_i}{\mu}$ A0027506

Lower range value

Depends on the density of the medium and the Reynolds number (Re_{min} = 5 000, Re_{linear} = 20 000). The Reynolds number is dimensionless and indicates the ratio of the inertia force of a fluid to its viscous force. It is used to characterize the flow. The Reynolds number is calculated as follows:

$$Re = \frac{4 \cdot Q\ [m^3/s] \cdot \rho\ [kg/m^3]}{\pi \cdot di\ [m] \cdot \mu\ [Pa \cdot s]} \qquad Re = \frac{4 \cdot Q\ [ft^3/s] \cdot \rho\ [lb/ft^3]}{\pi \cdot di\ [ft] \cdot \mu\ [0.001\ cP]}$$

A0003794

Re = Reynolds number; Q = flow; di = internal diameter; μ = dynamic viscosity, ρ = density

$$\textbf{DN 15...300} \rightarrow v_{min.} = \frac{6}{\sqrt{\rho\ [kg/m^3]}}\ [m/s]$$

$$\textbf{DN ½...12"} \rightarrow v_{min.} = \frac{4.92}{\sqrt{\rho\ [lb/ft^3]}}\ [ft/s]$$

A0003239

Upper range value

Liquids:
The upper range value must be calculated as follows:
v_{max} = 9 m/s (30 ft/s) and v_{max} = 350/√ρ m/s (130/√ρ ft/s)

► Use the lower value.

Gas/steam:

Nominal diameter	v_{max}
Standard device: DN 15 (½")	46 m/s (151 ft/s) and 350/√ρ m/s (130/√ρ ft/s) (Use the lower value.)
Standard device: DN 25 (1"), DN 40 (1½")	75 m/s (246 ft/s) and 350/√ρ m/s (130/√ρ ft/s) (Use the lower value.)
Standard device: DN 50 to 300 (2 to 12")	120 m/s (394 ft/s) and 350/√ρ m/s (130/√ρ ft/s) (Use the lower value.) Calibrated range: up to 75 m/s (246 ft/s)

For information on the Applicator → 94

Operable flow range

Up to 45: 1 (ratio between lower and upper range value)

Input signal

Current input

Current input	4-20 mA (passive)
Resolution	1 µA
Voltage drop	Typically: 2.2 to 3 V for 3.6 to 22 mA
Maximum voltage	≤35 V
Possible input variables	▪ Pressure ▪ Temperature ▪ Density

External measured values

To increase the accuracy of certain measured variables or to calculate the corrected volume flow, the automation system can continuously write different measured values to the measuring device:
- Operating pressure to increase accuracy (Endress+Hauser recommends the use of a pressure measuring device for absolute pressure, e.g. Cerabar M or Cerabar S)
- Medium temperature to increase accuracy (e.g. iTEMP)
- Reference density for calculating the corrected volume flow

- Various pressure transmitters can be ordered from Endress+Hauser: see "Accessories" section → 95
- Please comply with the special mounting instructions when using pressure transmitters → 43

It is recommended to read in external measured values to calculate the following measured variables:
- Energy flow
- Mass flow
- Corrected volume flow

Current input

The measured values are written from the automation system to the measuring device via the current input → 10.

HART protocol

The measured values are written from the automation system to the measuring device via the HART protocol. The pressure transmitter must support the following protocol-specific functions:
- HART protocol
- Burst mode

Fieldbuses

The measured values can be written from the automation system to the measuring via:
- FOUNDATION Fieldbus
- PROFIBUS PA

Output

Output signal

Current output

Current output 1	4-20 mA HART (passive)
Current output 2	4-20 mA (passive)
Resolution	< 1 µA
Damping	Adjustable: 0.0 to 999.9 s
Assignable measured variables	▪ Volume flow ▪ Corrected volume flow ▪ Mass flow ▪ Flow velocity ▪ Temperature ▪ Calculated saturated steam pressure ▪ Total mass flow ▪ Energy flow ▪ Heat flow difference

Pulse/frequency/switch output

Function	Can be set to pulse, frequency or switch output
Version	Passive, open collector

Maximum input values	▪ DC 35 V ▪ 50 mA For information on the Ex connection values → 15
Voltage drop	▪ For ≤ 2 mA: 2 V ▪ For 10 mA: 8 V
Residual current	≤ 0.05 mA
Pulse output	
Pulse width	Adjustable: 5 to 2 000 ms
Maximum pulse rate	100 Impulse/s
Pulse value	Adjustable
Assignable measured variables	▪ Total volume flow ▪ Total corrected volume flow ▪ Total mass flow ▪ Total energy flow ▪ Total heat flow difference
Frequency output	
Output frequency	Adjustable: 0 to 1 000 Hz
Damping	Adjustable: 0 to 999 s
Pulse/pause ratio	1:1
Assignable measured variables	▪ Volume flow ▪ Corrected volume flow ▪ Mass flow ▪ Flow velocity ▪ Temperature ▪ Calculated saturated steam pressure ▪ Steam quality ▪ Total mass flow ▪ Energy flow ▪ Heat flow difference
Switch output	
Switching behavior	Binary, conductive or non-conductive
Switching delay	Adjustable: 0 to 100 s
Number of switching cycles	Unlimited
Assignable functions	▪ Off ▪ On ▪ Diagnostic behavior ▪ Limit value – Volume flow – Corrected volume flow – Mass flow – Flow velocity – Temperature – Calculated saturated steam pressure – Steam quality – Total mass flow – Energy flow – Heat flow difference – Reynolds number – Totalizer 1-3 ▪ Status ▪ Status of low flow cut off

FOUNDATION Fieldbus

Signal encoding	Manchester Bus Powered (MBP)
Data transfer	31.25 KBit/s, Voltage mode

PROFIBUS PA

Signal encoding	Manchester Bus Powered (MBP)
Data transfer	31.25 KBit/s, Voltage mode

Signal on alarm

Depending on the interface, failure information is displayed as follows:

Current output

HART

Device diagnostics	Device condition can be read out via HART Command 48

Pulse/frequency/switch output

Pulse output	
Failure mode	No pulses
Frequency output	
Failure mode	Choose from: ▪ Actual value ▪ 0 Hz ▪ Defined value: 0 to 1250 Hz
Switch output	
Failure mode	Choose from: ▪ Current status ▪ Open ▪ Closed

FOUNDATION Fieldbus

Status and alarm messages	Diagnostics in accordance with FF-891
Error current FDE (Fault Disconnection Electronic)	0 mA

PROFIBUS PA

Status and alarm messages	Diagnostics in accordance with PROFIBUS PA Profile 3.02
Error current FDE (Fault Disconnection Electronic)	0 mA

Local display

Plain text display	With information on cause and remedial measures
Backlight	Additionally for device version with SD03 local display: red lighting indicates a device error.

Status signal as per NAMUR recommendation NE 107

Operating tool

- Via digital communication:
  - HART protocol
  - FOUNDATION Fieldbus
  - PROFIBUS PA
- Via service interface

Plain text display	With information on cause and remedial measures

Additional information on remote operation → 84

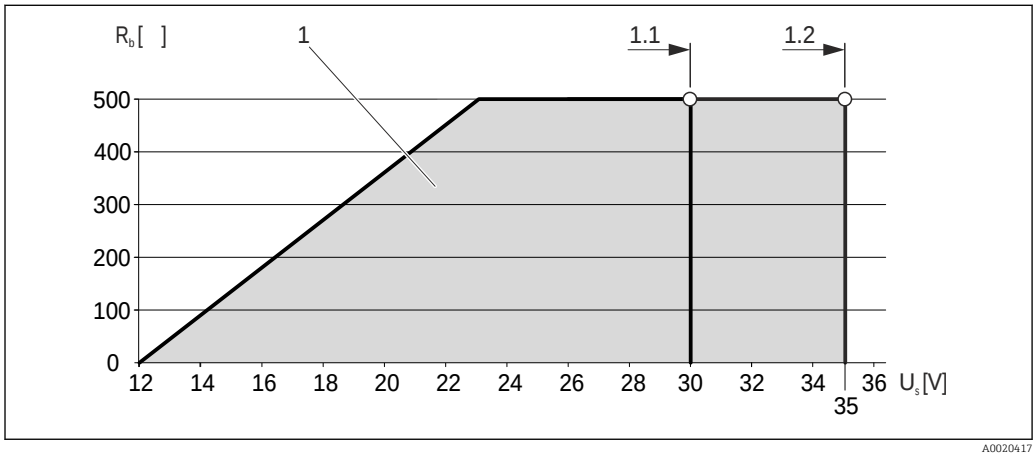
Load

Load for current output: 0 to 500 Ω, depending on the external supply voltage of the power supply unit

Calculation of the maximum load

Depending on the supply voltage of the power supply unit (U_S), the maximum load (R_B) including line resistance must be observed to ensure adequate terminal voltage at the device. In doing so, observe the minimum terminal voltage

- $R_B \leq (U_S - U_{term.\ min})$: 0.022 A
- $R_B \leq 500\ \Omega$



2 Load for a compact version without local operation

1 Operating range
1.1 For order code for "Output", option A "4-20 mA HART"/option B "4-20 mA HART, pulse/frequency/switch output" with Ex i and option C "4-20 mA HART + 4-20 mA analog"
1.2 For order code for "Output", option A "4-20 mA HART"/option B "4-20 mA HART, pulse/frequency/switch output" with non-Ex and Ex d

Sample calculation

Supply voltage of the supply unit:
- U_S = 19 V
- $U_{term.\ min}$ = 12 V (measuring device) + 1 V (local operation without lighting) = 13 V

Maximum load: $R_B \leq$ (19 V - 13 V): 0.022 A = 273 Ω

The minimum terminal voltage ($U_{term.\ min}$) increases if local operation is used (Verweisziel existiert nicht, aber @y.link.required='true').

Ex connection data

Safety-related values

Type of protection Ex d

Order code for "Output"	Output type	Safety-related values
Option **A**	4-20mA HART	U_{nom} = DC 35 V U_{max} = 250 V
Option **B**	4-20mA HART	U_{nom} = DC 35 V U_{max} = 250 V
	Pulse/frequency/switch output	U_{nom} = DC 35 V U_{max} = 250 V P_{max} = 1 W [1)]
Option **C**	4-20mA HART	U_{nom} = DC 30 V U_{max} = 250 V
	4-20mA analog	
Option **D**	4-20mA HART	U_{nom} = DC 35 V U_{max} = 250 V
	Pulse/frequency/switch output	U_{nom} = DC 35 V U_{max} = 250 V P_{max} = 1 W [1)]
	4 to 20 mA current input	U_{nom} = DC 35 V U_{max} = 250 V
Option **E**	FOUNDATION Fieldbus	U_{nom} = DC 32 V U_{max} = 250 V P_{max} = 0.88 W
	Pulse/frequency/switch output	U_{nom} = DC 35 V U_{max} = 250 V P_{max} = 1 W [1)]
Option **G**	PROFIBUS PA	U_{nom} = DC 32 V U_{max} = 250 V P_{max} = 0.88 W
	Pulse/frequency/switch output	U_{nom} = DC 35 V U_{max} = 250 V P_{max} = 1 W [1)]

1) Internal circuit limited by R_i = 760.5 Ω

Ex nA type of protection

Order code for "Output"	Output type	Safety-related values
Option **A**	4-20mA HART	U_{nom} = DC 35 V U_{max} = 250 V
Option **B**	4-20mA HART	U_{nom} = DC 35 V U_{max} = 250 V
	Pulse/frequency/switch output	U_{nom} = DC 35 V U_{max} = 250 V P_{max} = 1 W [1)]
Option **C**	4-20mA HART	U_{nom} = DC 30 V U_{max} = 250 V
	4-20mA analog	
Option **D**	4-20mA HART	U_{nom} = DC 35 V U_{max} = 250 V

Order code for "Output"	Output type	Safety-related values
	Pulse/frequency/switch output	U_{nom} = DC 35 V U_{max} = 250 V P_{max} = 1 W [1]
	4 to 20 mA current input	U_{nom} = DC 35 V U_{max} = 250 V
Option **E**	FOUNDATION Fieldbus	U_{nom} = DC 32 V U_{max} = 250 V P_{max} = 0.88 W
	Pulse/frequency/switch output	U_{nom} = DC 35 V U_{max} = 250 V P_{max} = 1 W [1]
Option **G**	PROFIBUS PA	U_{nom} = DC 32 V U_{max} = 250 V P_{max} = 0.88 W
	Pulse/frequency/switch output	U_{nom} = DC 35 V U_{max} = 250 V P_{max} = 1 W [1]

1) Internal circuit limited by R_i = 760.5 Ω

Type of protection XP

Order code for "Output"	Output type	Safety-related values
Option **A**	4-20mA HART	U_{nom} = DC 35 V U_{max} = 250 V
Option **B**	4-20mA HART	U_{nom} = DC 35 V U_{max} = 250 V
	Pulse/frequency/switch output	U_{nom} = DC 35 V U_{max} = 250 V P_{max} = 1 W [1]
Option **C**	4-20mA HART	U_{nom} = DC 30 V U_{max} = 250 V
	4-20mA analog	
Option **D**	4-20mA HART	U_{nom} = DC 35 V U_{max} = 250 V
	Pulse/frequency/switch output	U_{nom} = DC 35 V U_{max} = 250 V P_{max} = 1 W [1]
	4 to 20 mA current input	U_{nom} = DC 35 V U_{max} = 250 V
Option **E**	FOUNDATION Fieldbus	U_{nom} = DC 32 V U_{max} = 250 V P_{max} = 0.88 W
	Pulse/frequency/switch output	U_{nom} = DC 35 V U_{max} = 250 V P_{max} = 1 W [1]
Option **G**	PROFIBUS PA	U_{nom} = DC 32 V U_{max} = 250 V P_{max} = 0.88 W
	Pulse/frequency/switch output	U_{nom} = DC 35 V U_{max} = 250 V P_{max} = 1 W [1]

1) Internal circuit limited by R_i = 760.5 Ω

Intrinsically safe values

Type of protection Ex ia

Order code for "Output"	Output type	Intrinsically safe values	
Option **A**	4-20mA HART	U_i = DC 30 V I_i = 300 mA P_i = 1 W L_i = 0 µH C_i = 5 nF	
Option **B**	4-20mA HART	U_i = DC 30 V I_i = 300 mA P_i = 1 W L_i = 0 µH C_i = 5 nF	
	Pulse/frequency/switch output	U_i = DC 30 V I_i = 300 mA P_i = 1 W L_i = 0 µH C_i = 6 nF	
Option **C**	4-20mA HART	U_i = DC 30 V I_i = 300 mA P_i = 1 W L_i = 0 µH C_i = 30 nF	
	4-20mA analog		
Option **D**	4-20mA HART	U_i = DC 30 V I_i = 300 mA P_i = 1 W L_i = 0 µH C_i = 5 nF	
	Pulse/frequency/switch output	U_i = DC 30 V I_i = 300 mA P_i = 1 W L_i = 0 µH C_i = 6 nF	
	4 to 20 mA current input	U_i = DC 30 V I_i = 300 mA P_i = 1 W L_i = 0 µH C_i = 5 nF	
Option **E**	FOUNDATION Fieldbus	STANDARD U_i = 30 V l_i = 300 mA P_i = 1.2 W L_i = 10 µH C_i = 5 nF	FISCO U_i = 17.5 V l_i = 550 mA P_i = 5.5 W L_i = 10 µH C_i = 5 nF
	Pulse/frequency/switch output	U_i = 30 V l_i = 300 mA P_i = 1 W L_i = 0 µH C_i = 6 nF	
Option **G**	PROFIBUS PA	STANDARD U_i = 30 V l_i = 300 mA P_i = 1.2 W L_i = 10 µH C_i = 5 nF	FISCO U_i = 17.5 V l_i = 550 mA P_i = 5.5 W L_i = 10 µH C_i = 5 nF
	Pulse/frequency/switch output	U_i = 30 V l_i = 300 mA P_i = 1 W L_i = 0 µH C_i = 6 nF	

Type of protection Ex ic

Order code for "Output"	Output type	Intrinsically safe values	
Option **A**	4-20mA HART	U_i = DC 35 V I_i = n.a. P_i = 1 W L_i = 0 µH C_i = 5 nF	
Option **B**	4-20mA HART	U_i = DC 35 V I_i = n.a. P_i = 1 W L_i = 0 µH C_i = 5 nF	
	Pulse/frequency/switch output	U_i = DC 35 V I_i = n.a. P_i = 1 W L_i = 0 µH C_i = 6 nF	
Option **C**	4-20mA HART	U_i = DC 30 V I_i = n.a. P_i = 1 W L_i = 0 µH C_i = 30 nF	
	4-20mA analog		
Option **D**	4-20mA HART	U_i = DC 35 V I_i = n.a. P_i = 1 W L_i = 0 µH C_i = 5 nF	
	Pulse/frequency/switch output	U_i = DC 35 V I_i = n.a. P_i = 1 W L_i = 0 µH C_i = 6 nF	
	4 to 20 mA current input	U_i = DC 35 V I_i = n.a. P_i = 1 W L_i = 0 µH C_i = 5 nF	
Option **E**	FOUNDATION Fieldbus	STANDARD U_i = 32 V l_i = 300 mA P_i = n.a. L_i = 10 µH C_i = 5 nF	FISCO U_i = 17.5 V l_i = n.a. P_i = n.a. L_i = 10 µH C_i = 5 nF
	Pulse/frequency/switch output	U_i = 35 V l_i = 300 mA P_i = 1 W L_i = 0 µH C_i = 6 nF	
Option **G**	PROFIBUS PA	STANDARD U_i = 32 V l_i = 300 mA P_i = n.a. L_i = 10 µH C_i = 5 nF	FISCO U_i = 17.5 V l_i = n.a. P_i = n.a. L_i = 10 µH C_i = 5 nF
	Pulse/frequency/switch output	U_i = 35 V l_i = 300 mA P_i = 1 W L_i = 0 µH C_i = 6 nF	

Type of protection IS

Order code for "Output"	Output type	Intrinsically safe values	
Option **A**	4-20mA HART	U_i = DC 30 V I_i = 300 mA P_i = 1 W L_i = 0 µH C_i = 5 nF	
Option **B**	4-20mA HART	U_i = DC 30 V I_i = 300 mA P_i = 1 W L_i = 0 µH C_i = 5 nF	
	Pulse/frequency/switch output	U_i = DC 30 V I_i = 300 mA P_i = 1 W L_i = 0 µH C_i = 6 nF	
Option **C**	4-20mA HART	U_i = DC 30 V I_i = 300 mA P_i = 1 W L_i = 0 µH C_i = 30 nF	
	4-20mA analog		
Option **D**	4-20mA HART	U_i = DC 30 V I_i = 300 mA P_i = 1 W L_i = 0 µH C_i = 5 nF	
	Pulse/frequency/switch output	U_i = DC 30 V I_i = 300 mA P_i = 1 W L_i = 0 µH C_i = 6 nF	
	4 to 20 mA current input	U_i = DC 30 V I_i = 300 mA P_i = 1 W L_i = 0 µH C_i = 5 nF	
Option **E**	FOUNDATION Fieldbus	STANDARD U_i = 30 V l_i = 300 mA P_i = 1.2 W L_i = 10 µH C_i = 5 nF	FISCO U_i = 17.5 V l_i = 550 mA P_i = 5.5 W L_i = 10 µH C_i = 5 nF
	Pulse/frequency/switch output	U_i = 30 V l_i = 300 mA P_i = 1 W L_i = 0 µH C_i = 6 nF	
Option **G**	PROFIBUS PA	STANDARD U_i = 30 V l_i = 300 mA P_i = 1.2 W L_i = 10 µH C_i = 5 nF	FISCO U_i = 17.5 V l_i = 550 mA P_i = 5.5 W L_i = 10 µH C_i = 5 nF
	Pulse/frequency/switch output	U_i = 30 V l_i = 300 mA P_i = 1 W L_i = 0 µH C_i = 6 nF	

Low flow cut off The switch points for low flow cut off are user-selectable.

Galvanic isolation

All outputs are galvanically isolated from one another.

Protocol-specific data

HART

Manufacturer ID	0x11
Device type ID	0x38
HART protocol revision	7
Device description files (DTM, DD)	Information and files under: www.endress.com
HART load	▪ Min. 250 Ω ▪ Max. 500 Ω

Dynamic variables	Read out the dynamic variables: HART command 3 The measured variables can be freely assigned to the dynamic variables. **Measured variables for PV (primary dynamic variable)** ▪ Volume flow ▪ Corrected volume flow ▪ Mass flow ▪ Flow velocity ▪ Temperature ▪ Calculated saturated steam pressure ▪ Steam quality ▪ Total mass flow ▪ Energy flow ▪ Heat flow difference **Measured variables for SV, TV, QV (secondary, tertiary and quaternary dynamic variable)** ▪ Volume flow ▪ Corrected volume flow ▪ Mass flow ▪ Flow velocity ▪ Temperature ▪ Calculated saturated steam pressure ▪ Steam quality ▪ Total mass flow ▪ Energy flow ▪ Heat flow difference ▪ Condensate mass flow ▪ Reynolds number ▪ Totalizer 1 ▪ Totalizer 2 ▪ Totalizer 3 ▪ HART input ▪ Density ▪ Pressure ▪ Specific volume ▪ Degree of overheating
Device variables	Read out the device variables: HART command 9 The device variables are permanently assigned. A maximum of 8 device variables can be transmitted: ▪ 0 = volume flow ▪ 1 = corrected volume flow ▪ 2 = Mass flow ▪ 3 = flow velocity ▪ 4 = temperature ▪ 5 = calculated saturated steam pressure ▪ 6 = steam quality ▪ 7 = total mass flow ▪ 8 = energy flow ▪ 9 = heat flow difference ▪ 10 = condensate mass flow ▪ 11 = Reynolds number ▪ 12 = totalizer 1 ▪ 13 = totalizer 2 ▪ 14 = totalizer 3 ▪ 15 = HART input ▪ 16 = density ▪ 17 = pressure ▪ 18 = specific volume ▪ 19 = degree of overheating

FOUNDATION Fieldbus

Manufacturer ID	0x452B48
Ident number	0x1038
Device revision	1

DD revision	Information and files under: ▪ www.endress.com ▪ www.fieldbus.org
CFF revision	
Device Tester Version (ITK version)	6.1.1
ITK Test Campaign Number	IT094200
Link Master capability (LAS)	Yes
Choice of "Link Master" and "Basic Device"	Yes Factory setting: Basic Device
Node address	Factory setting: 247 (0xF7)
Supported functions	The following methods are supported: ▪ Restart ▪ ENP Restart ▪ Diagnostic
Virtual Communication Relationships (VCRs)	
Number of VCRs	44
Number of link objects in VFD	50
Permanent entries	1
Client VCRs	0
Server VCRs	10
Source VCRs	43
Sink VCRs	0
Subscriber VCRs	43
Publisher VCRs	43
Device Link Capabilities	
Slot time	4
Min. delay between PDU	8
Max. response delay	Min. 5

Transducer Blocks

Block	Contents	Output values
Setup Transducer Block (TRDSUP)	All parameters for standard commissioning.	No output values
Advanced Setup Transducer Block (TRDASUP)	All parameters for more accurate measurement configuration.	No output values
Display Transducer Block (TRDDISP)	Parameters for configuring the local display.	No output values
HistoROM Transducer Block (TRDHROM)	Parameters for using the HistoROM function.	No output values

Block	Contents	Output values
Diagnostic Transducer Block (TRDDIAG)	Diagnostics information.	Process variables (AI Channel) ▪ Temperature (7) ▪ Volume flow (9) ▪ Mass flow (11) ▪ Corrected volume flow (13) ▪ Flow velocity (37) ▪ Energy flow (38) ▪ Calculated saturated steam pressure (45) ▪ Total mass flow (46) ▪ Condensate mass flow (47) ▪ Steam quality (48) ▪ Heat flow difference (49) ▪ Reynolds number (50)
Expert Configuration Transducer Block (TRDEXP)	Parameters that require the user to have in-depth knowledge of the operation of the device in order to configure the parameters appropriately.	No output values
Expert Information Transducer Block (TRDEXPIN)	Parameters that provide information about the state of the device.	No output values
Service Sensor Transducer Block (TRDSRVS)	Parameters that can only be accessed by Endress +Hauser Service.	No output values
Service Information Transducer Block (TRDSRVIF)	Parameters that provide Endress+Hauser Service with information about the state of the device.	No output values
Total Inventory Counter Transducer Block (TRDTIC)	Parameters for configuring all the totalizers and the inventory counter.	Process variables (AI Channel) ▪ Totalizer 1 (16) ▪ Totalizer 2 (17) ▪ Totalizer 3 (18)
Heartbeat Technology Transducer Block (TRDHBT)	Parameters for the configuration and comprehensive information about the results of the verification.	No output values
Heartbeat Results 1 Transducer Block (TRDHBTR1)	Information about the results of the verification.	No output values
Heartbeat Results 2 Transducer Block (TRDHBTR2)	Information about the results of the verification.	No output values
Heartbeat Results 3 Transducer Block (TRDHBTR3)	Information about the results of the verification.	No output values
Heartbeat Results 4 Transducer Block (TRDHBTR4)	Information about the results of the verification.	No output values

Function blocks

Block	Number of blocks	Contents	Process variables (Channel)
Resource Block (RB)	1	This Block (extended functionality) contains all the data that uniquely identify the device; it is the equivalent of an electronic nameplate for the device.	–
Analog Input Block (AI)	4	This Block (extended functionality) receives the measurement data provided by the Sensor Block (can be selected via a channel number) and makes the data available for other blocks at the output. **Execution time:** 13 ms	▪ Temperature (7) ▪ Mass flow (11) ▪ Volume flow (9) ▪ Corrected volume flow (13) ▪ Flow velocity (37) ▪ Energy flow (38) ▪ Calculated saturated steam pressure (45) ▪ Total mass flow (46) ▪ Condensate mass flow (47) ▪ Steam quality (48) ▪ Heat flow difference (49) ▪ Reynolds number (50)
Discrete Input Block (DI)	2	This Block (standard functionality) receives a discrete value (e.g. indicator that measuring range has been exceeded) and makes the value available for other blocks at the output. **Execution time:** 12 ms	▪ Switch output state (101) ▪ Low flow cut off (103) ▪ Status verification (105)
PID Block (PID)	1	This Block (standard functionality) acts as a proportional-integral-differential controller and can be used universally for control in the field. It enables cascading and feedforward control. **Execution time:** 13 ms	–
Multiple Analog Output Block (MAO)	1	This Block (standard functionality) receives several analog values and makes them available for other blocks at the output. **Execution time:** 11 ms	Channel_0 (121) ▪ Value 1: External compensation variable, pressure ▪ Value 2: External compensation variable, relative pressure ▪ Value 3: External compensation variable, density ▪ Value 4: External compensation variable, temperature ▪ Value 5: External compensation variable, second temperature heat difference ▪ Value 6 to 8: Not assigned The compensation variables must be transmitted to the device in the SI basic unit.

Block	Number of blocks	Contents	Process variables (Channel)
Multiple Digital Output Block (MDO)	1	This Block (standard functionality) receives several discrete values and makes them available for other blocks at the output. **Execution time:** 14 ms	Channel_DO (122) ▪ Value 1: Reset totalizer 1 ▪ Value 2: Reset totalizer 2 ▪ Value 3: Reset totalizer 3 ▪ Value 4: Flow override ▪ Value 5: Start heartbeat verification ▪ Value 6: Status switch output ▪ Value 7: Not assigned ▪ Value 8: Not assigned
Integrator Block (IT)	1	This Block (standard functionality) integrates a measured variable over time or totalizes the pulses from a Pulse Input Block. The Block can be used as a totalizer that totalizes until a reset, or as a batch totalizer whereby the integrated value is compared against a target value generated before or during the control routine and generates a binary signal when the target value is reached. **Execution time:** 16 ms	–

PROFIBUS PA

Manufacturer ID	0x11
Ident number	0x1564
Profile version	3.02
Device description files (GSD, DTM, DD)	Information and files under: ▪ www.endress.com ▪ www.profibus.org
Output values (from measuring device to automation system)	**Analog input 1 to 4** ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Temperature ▪ Calculated saturated steam pressure ▪ Steam quality ▪ Total mass flow ▪ Energy flow ▪ Heat flow difference ▪ Reynolds number ▪ Density ▪ Pressure ▪ Specific volume ▪ Degree of overheating **Digital input 1 to 2** ▪ Empty pipe detection ▪ Low flow cut off ▪ Status switch output ▪ Status verification **Totalizer 1 to 3** ▪ Mass flow ▪ Volume flow ▪ Corrected volume flow ▪ Total mass flow ▪ Condensate mass flow ▪ Energy flow ▪ Heat flow difference

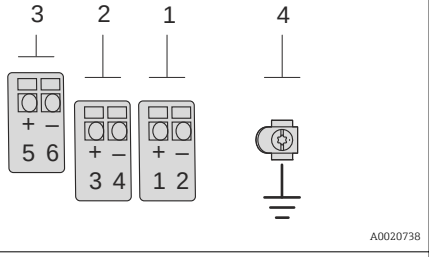
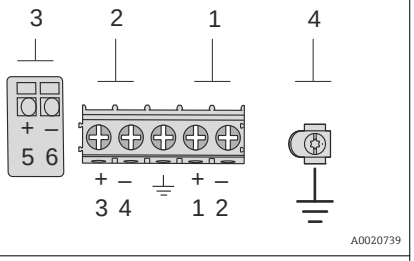
Input values (from automation system to measuring device)	**Analog output** ▪ External density ▪ External temperature **Digital output 1 to 2 (fixed assignment)** ▪ Digital output 1: switch positive zero return on/off ▪ Digital output 2: start verification **Totalizer 1 to 3** ▪ Totalize ▪ Reset and hold ▪ Preset and hold ▪ Operating mode configuration: – Net flow total – Forward flow total – Reverse flow total
Supported functions	▪ Identification & Maintenance Simplest device identification on the part of the control system and nameplate ▪ PROFIBUS upload/download Reading and writing parameters is up to ten times faster with PROFIBUS upload/download ▪ Condensed status Simplest and self-explanatory diagnostic information by categorizing diagnostic messages that occur
Configuration of the device address	▪ DIP switches on the I/O electronics module ▪ Local display ▪ via operating tools (e.g. FieldCare)

Power supply

Terminal assignment

Transmitter

Connection versions

	
Maximum number of terminals *Terminals 1 to 6:* *Without integrated overvoltage protection*	*Maximum number of terminals for order code for "Accessory mounted", option NA "Overvoltage protection"* ▪ *Terminals 1 to 4:* *With integrated overvoltage protection* ▪ *Terminals 5 to 6:* *Without integrated overvoltage protection*
1 *Output 1 (passive): supply voltage and signal transmission* *2* *Output 2 (passive): supply voltage and signal transmission* *3* *Input (passive): supply voltage and signal transmission* *4* *Ground terminal for cable shield*	

Order code for "Output"	Terminal numbers					
	Output 1		Output 2		Input	
	1 (+)	2 (-)	3 (+)	4 (-)	5 (+)	6 (-)
Option **A**	4-20 mA HART (passive)		-		-	
Option **B** [1]	4-20 mA HART (passive)		Pulse/frequency/switch output (passive)		-	
Option **C** [1]	4-20 mA HART (passive)		4-20 mA analog (passive)		-	
Option **D** [1] [2]	4-20 mA HART (passive)		Pulse/frequency/switch output (passive)		4-20 mA current input (passive)	
Option **E** [1] [3]	FOUNDATION Fieldbus		Pulse/frequency/switch output (passive)		-	
Option **G** [1] [4]	PROFIBUS PA		Pulse/frequency/switch output (passive)		-	

1) Output 1 must always be used; output 2 is optional.
2) The integrated overvoltage protection is not used with option D: Terminals 5 and 6 (current input) are not protected against overvoltage.
3) FOUNDATION Fieldbus with integrated reverse polarity protection.
4) PROFIBUS PA with integrated reverse polarity protection.

Remote version

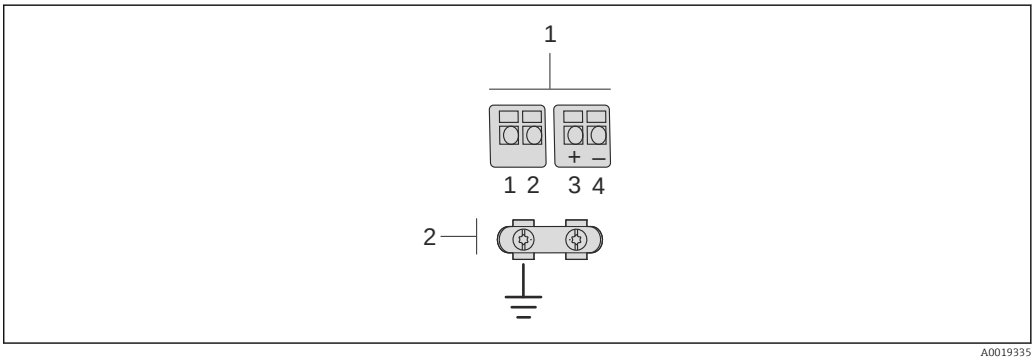
In the case of the remote version, the sensor and transmitter are mounted separately from one another and connected by a connecting cable. The sensor is connected via the connection housing while the transmitter is connected via the connection compartment of the wall holder unit.

The way the transmitter wall holder is connected depends on the measuring device approval and the version of the connecting cable used.

Connection is only possible via terminals:
- For approvals Ex n, Ex tb and cCSAus Div. 1
- If a reinforced connecting cable is used

The connection is via an M12 connector:
- For all other approvals
- If the standard connecting cable is used

Connection to the connection housing of the sensor is always via the terminals (tightening torque for terminals: 1.2 to 1.7 Nm).



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3 Terminals for connection compartment in the transmitter wall holder and the sensor connection housing

1 Terminals for connecting cable
2 Grounding via the cable strain relief

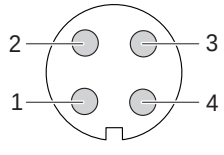
Terminal number	Assignment	Cable color Connecting cable
1	Supply voltage	Brown
2	Grounding	White

Terminal number	Assignment	Cable color Connecting cable
3	RS485 (+)	Yellow
4	RS485 (–)	Green

Pin assignment, device plug

PROFIBUS PA

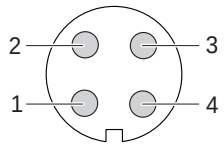
Device plug for signal transmission (device side)



Pin		Assignment	Coding	Plug/socket
1	+	PROFIBUS PA +	A	Plug
2		Grounding		
3	-	PROFIBUS PA –		
4		Not assigned		

FOUNDATION Fieldbus

Device plug for signal transmission (device side)



Pin		Assignment	Coding	Plug/socket
1	+	Signal +	A	Plug
2	-	Signal –		
3		Not assigned		
4		Grounding		

Supply voltage

Transmitter

An external power supply is required for each output.

Supply voltage for a compact version without a local display [1)]

Order code for "Output"	Minimum terminal voltage [2)]	Maximum terminal voltage
Option **A**: 4-20 mA HART	≥ DC 12 V	DC 35 V
Option **B**: 4-20 mA HART, pulse/ frequency/switch output	≥ DC 12 V	DC 35 V
Option **C**: 4-20 mA HART + 4-20 mA analog	≥ DC 12 V	DC 30 V
Option **D**: 4-20 mA HART, pulse/ frequency/switch output, 4-20 mA current input [3)]	≥ DC 12 V	DC 35 V
Option **E**: FOUNDATION Fieldbus, pulse/ frequency/switch output	≥ DC 9 V	DC 32 V
Option **G**: PROFIBUS PA, pulse/frequency/ switch output	≥ DC 9 V	DC 32 V

1) In event of external supply voltage of the power supply unit with load, the PROFIBUS DP/PA coupler or FOUNDATION Fieldbus power conditioner
2) The minimum terminal voltage increases if local operation is used: see the following table
3) Voltage drop 2.2 to 3 V for 3.59 to 22 mA

Increase in minimum terminal voltage

Local operation	Increase in minimum terminal voltage
Order code for *"Display; Operation"*, option **C**: Local operation SD02	+ DC 1 V
Order code for *"Display; Operation"*, option **E**: Local operation SD03 with lighting (backlighting **not used**)	+ DC 1 V
Order code for *"Display; Operation"*, option **E**: Local operation SD03 with lighting (backlighting **used**)	+ DC 3 V

For information about the load see → 14

Various power supply units can be ordered from Endress+Hauser: see "Accessories" section → 95

For information on the Ex connection values → 15

Power consumption

Transmitter

Order code for "Output"	Maximum power consumption
Option **A**: 4-20 mA HART	770 mW
Option **B**: 4-20 mA HART, pulse/ frequency/switch output	▪ Operation with output 1: 770 mW ▪ Operation with output 1 and 2: 2 770 mW
Option **C**: 4-20 mA HART + 4-20 mA analog	▪ Operation with output 1: 660 mW ▪ Operation with output 1 and 2: 1 320 mW
Option **D**: 4-20 mA HART, pulse/ frequency/switch output, 4-20 mA current input	▪ Operation with output 1: 770 mW ▪ Operation with output 1 and 2: 2770 mW ▪ Operation with output 1 and input: 840 mW ▪ Operation with output 1, 2 and input: 2840 mW
Option **E**: FOUNDATION Fieldbus, pulse/ frequency/switch output	▪ Operation with output 1: 512 mW ▪ Operation with output 1 and 2: 2 512 mW
Option **G**: PROFIBUS PA, pulse/frequency/ switch output	▪ Operation with output 1: 512 mW ▪ Operation with output 1 and 2: 2 512 mW

For information on the Ex connection values → 15

Current consumption

Current output

For every 4-20 mA or 4-20 mA HART current output: 3.6 to 22.5 mA

If the option **Defined value** is selected in the **Failure mode** parameter : 3.59 to 22.5 mA

Current input

3.59 to 22.5 mA

Internal current limiting: max. 26 mA

PROFIBUS PA

15 mA

FOUNDATION Fieldbus

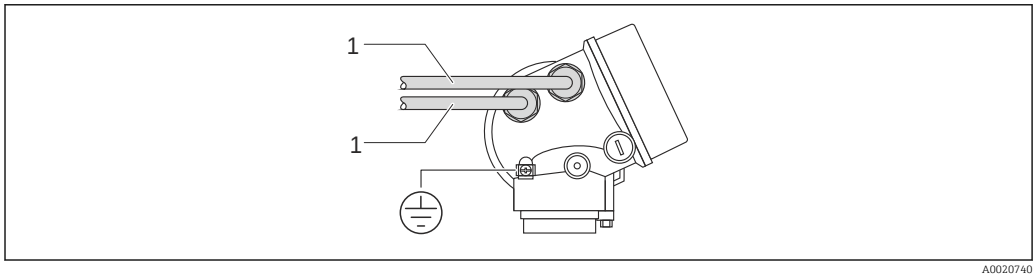
15 mA

Power supply failure

- Totalizers stop at the last value measured.
- Configuration is retained in the device memory (HistoROM).
- Error messages (incl. total operated hours) are stored.

Electrical connection

Connecting the transmitter



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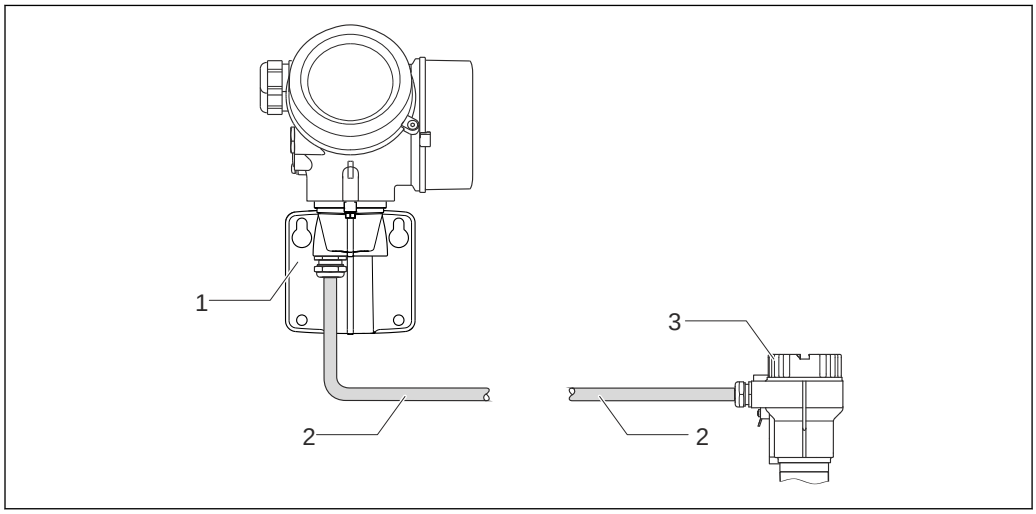
1 Cable entries for inputs/outputs

Remote version connection

Connecting cable



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4 Connecting cable connection

1 Wall holder with connection compartment (transmitter)
2 Connecting cable
3 Sensor connection housing

The way the transmitter wall holder is connected depends on the measuring device approval and the version of the connecting cable used.

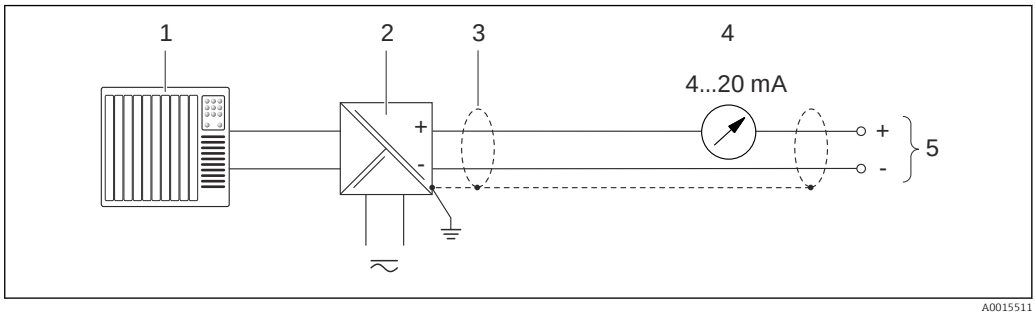
Connection is only possible via terminals:
- For approvals Ex n, Ex tb and cCSAus Div. 1
- If a reinforced connecting cable is used

The connection is via an M12 connector:
- For all other approvals
- If the standard connecting cable is used

Connection to the connection housing of the sensor is always via the terminals (tightening torque for terminals: 1.2 to 1.7 Nm).

Connection examples

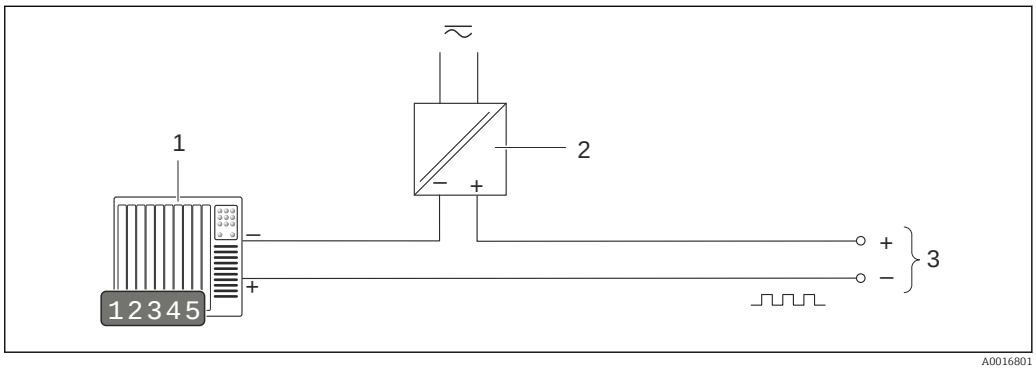
Current output 4-20 mA HART



5 Connection example for 4-20 mA HART current output (passive)

1 Automation system with current input (e.g. PLC)
2 Active barrier for power supply with integrated resistor for HART communication (≥ 250 Ω)(e.g. RN221N)
Connection for HART operating devices → 84
Observe the maximum load → 14
3 Cable shield, observe cable specifications
4 Analog display unit: observe maximum load → 14
5 Transmitter

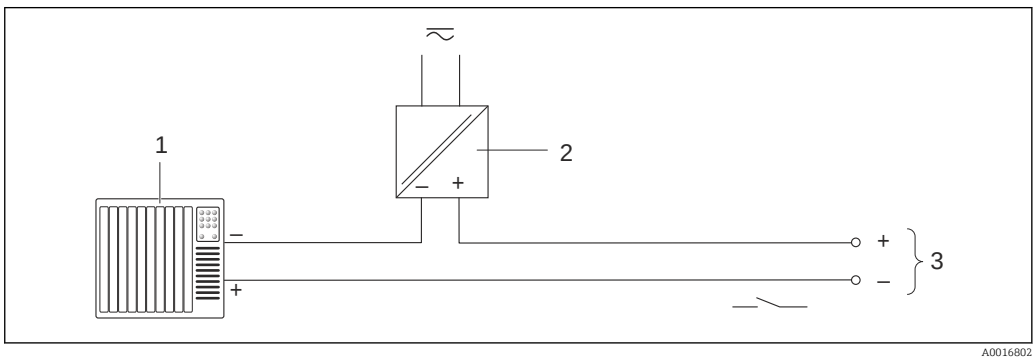
Pulse/frequency output



6 Connection example for pulse/frequency output (passive)

1 Automation system with pulse/frequency input (e.g. PLC)
2 Power supply
3 Transmitter: observe input values → 11

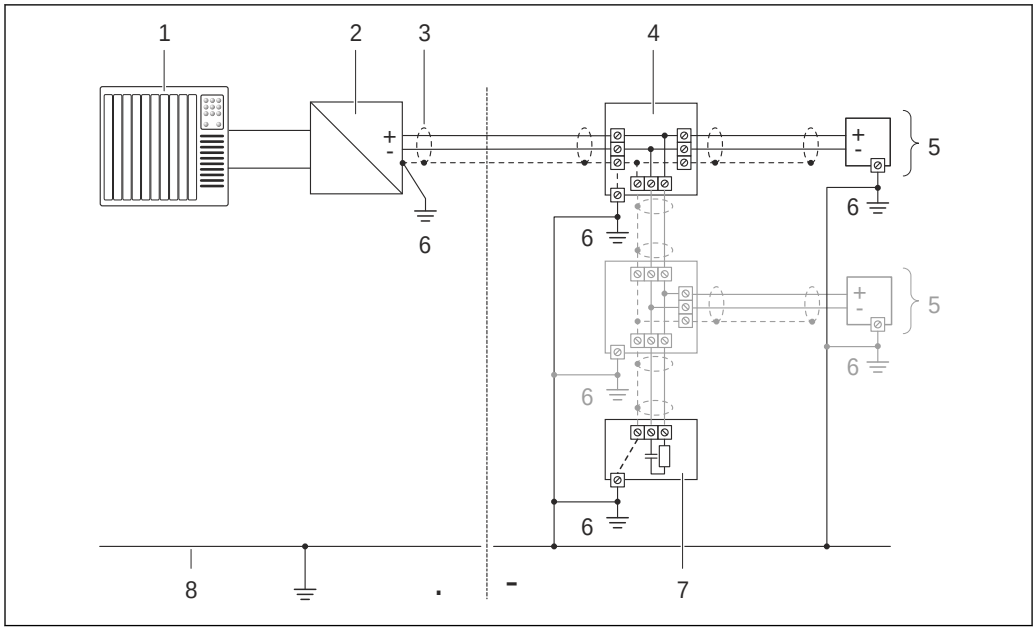
Switch output



7 Connection example for switch output (passive)

1 Automation system with switch input (e.g. PLC)
2 Power supply
3 Transmitter: observe input values

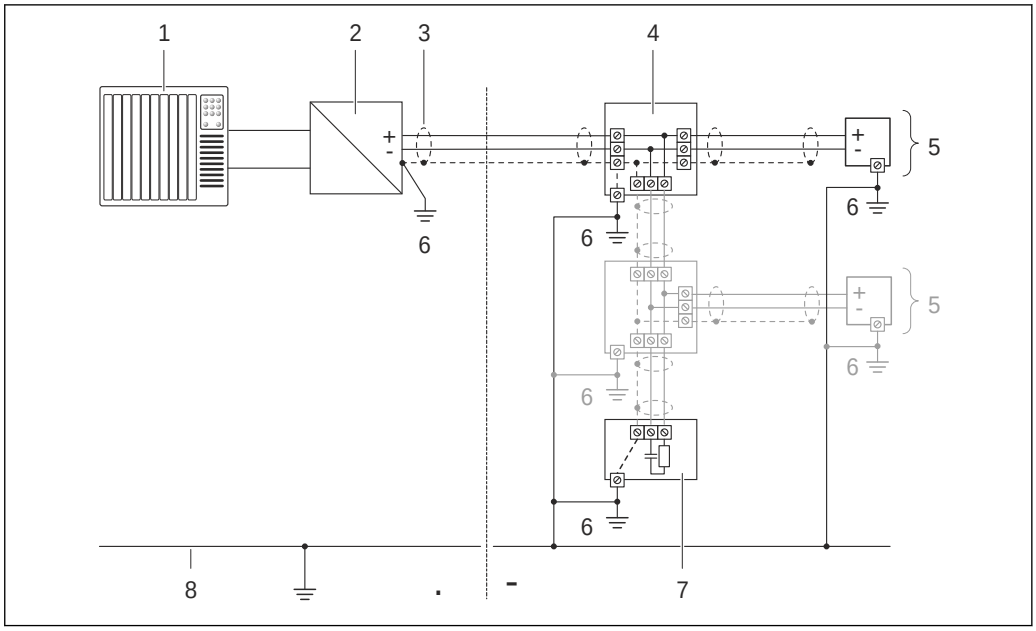
PROFIBUS-PA



8 Connection example for PROFIBUS-PA

1 Control system (e.g. PLC)
2 Segment coupler PROFIBUS DP/PA
3 Cable shield
4 T-box
5 Measuring device
6 Local grounding
7 Bus terminator
8 Potential matching line

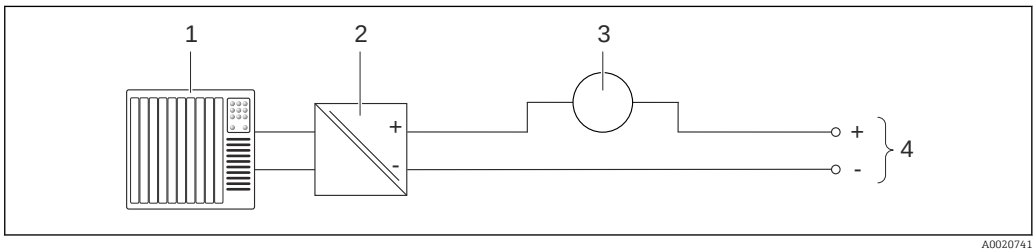
FOUNDATION Fieldbus



9 Connection example for FOUNDATION Fieldbus

1 Control system (e.g. PLC)
2 Power Conditioner (FOUNDATION Fieldbus)
3 Cable shield
4 T-box
5 Measuring device
6 Local grounding
7 Bus terminator
8 Potential matching line

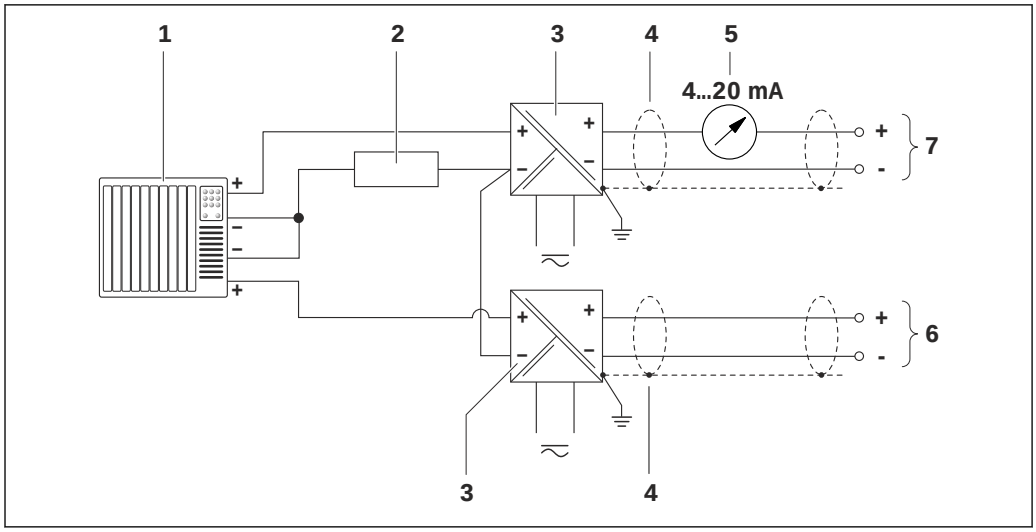
Current input



10 Connection example for 4-20 mA current input

1 Control system (e.g. PLC)
2 Power supply
3 External measuring device (for reading in pressure or temperature, for instance)
4 Transmitter: Observe input values → 10

HART input



11 Connection example for HART input with a common negative

1 Automation system with HART output (e.g. PLC)
2 Resistor for HART communication (≥ 250 Ω): observe maximum load → 14
3 Active barrier for power supply (e.g. RN221N)
4 Cable shield, observe cable specifications
5 Analog display unit: observe maximum load → 14
6 Pressure transmitter (e.g. Cerabar M, Cerabar S): see requirements
7 Transmitter

Potential equalization

Requirements

Please consider the following to ensure correct measurement:
- Same electrical potential for the fluid and sensor
- Remote version: same electrical potential for the sensor and transmitter
- Company-internal grounding concepts
- Pipe material and grounding

For devices intended for use in hazardous locations, please observe the guidelines in the Ex documentation (XA).

Terminals

- For device version without integrated overvoltage protection: plug-in spring terminals for wire cross-sections 0.5 to 2.5 mm² (20 to 14 AWG)
- For device version with integrated overvoltage protection: screw terminals for wire cross-sections 0.2 to 2.5 mm² (24 to 14 AWG)

Cable entries

- Cable gland (not for Ex d): M20 × 1.5 with cable Φ 6 to 12 mm (0.24 to 0.47 in)
- Thread for cable entry:
  - For non-Ex and Ex: NPT ½"
  - For non-Ex and Ex (not for CSA Ex d/XP): G ½"
  - For Ex d: M20 × 1.5

Cable specification

Permitted temperature range

- −40 °C (−40 °F) to +80 °C (+176 °F)
- Minimum requirement: cable temperature range ≥ ambient temperature +20 K

Signal cable

Current output

- For 4-20 mA: standard installation cable is sufficient.
- For 4-20 mA HART: Shielded cable recommended. Observe grounding concept of the plant.

Pulse/frequency/switch output

Standard installation cable is sufficient.

Current input

Standard installation cable is sufficient.

FOUNDATION Fieldbus

Twisted, shielded two-wire cable.

For further information on planning and installing FOUNDATION Fieldbus networks see:
- Operating Instructions for "FOUNDATION Fieldbus Overview" (BA00013S)
- FOUNDATION Fieldbus Guideline
- IEC 61158-2 (MBP)

PROFIBUS PA

Twisted, shielded two-wire cable. Cable type A is recommended.

For further information on planning and installing PROFIBUS PA networks see:
- Operating Instructions "PROFIBUS DP/PA: Guidelines for planning and commissioning" (BA00034S)
- PNO Directive 2.092 "PROFIBUS PA User and Installation Guideline"
- IEC 61158-2 (MBP)

Connecting cable for remote version

Connecting cable (standard)

Standard cable	2 × 2 × 0.34 mm² (22 AWG) PVC cable with common shield (2 pairs, pair-stranded)
Flame resistance	According to DIN EN 60332-1-2
Oil-resistance	According to DIN EN 60811-2-1
Shielding	Galvanized copper-braid, opt. density approx. 85%
Cable length	5 m (16 ft), 10 m (32 ft), 20 m (65 ft), 30 m (98 ft)
Operating temperature	When mounted in a fixed position: −50 to +105 °C (−58 to +221 °F); when cable can move freely: −25 to +105 °C (−13 to +221 °F)

Connecting cable (reinforced)

Cable, reinforced	2 × 2 × 0.34 mm² (22 AWG) PVC cable with common shield (2 pairs, pair-stranded) and additional steel-wire braided sheath
Flame resistance	According to DIN EN 60332-1-2
Oil-resistance	According to DIN EN 60811-2-1
Shielding	Galvanized copper-braid, opt. density approx. 85%
Strain relief and reinforcement	Steel-wire braid, galvanized
Cable length	5 m (16 ft), 10 m (32 ft), 20 m (65 ft), 30 m (98 ft)
Operating temperature	When mounted in a fixed position: −50 to +105 °C (−58 to +221 °F); when cable can move freely: −25 to +105 °C (−13 to +221 °F)

Overvoltage protection

The device can be ordered with integrated overvoltage protection for diverse approvals:
Order code for "Accessory mounted", option NA "Overvoltage protection"

Input voltage range	Values correspond to supply voltage specifications [1)]
Resistance per channel	2 · 0.5 Ω max
DC sparkover voltage	400 to 700 V
Trip surge voltage	< 800 V
Capacitance at 1 MHz	< 1.5 pF

Nominal discharge current (8/20 µs)	10 kA
Temperature range	–40 to +85 °C (–40 to +185 °F)

1) The voltage is reduced by the amount of the internal resistance $I_{min} \cdot R_i$

Depending on the temperature class, restrictions apply to the ambient temperature for device versions with overvoltage protection → 45

Performance characteristics

Reference operating conditions

- Error limits following ISO/DIN 11631
- +20 to +30 °C (+68 to +86 °F)
- 2 to 4 bar (29 to 58 psi)
- Calibration system traceable to national standards
- Calibration with the process connection corresponding to the particular standard

To obtain measured errors, use the *Applicator* sizing tool → 94

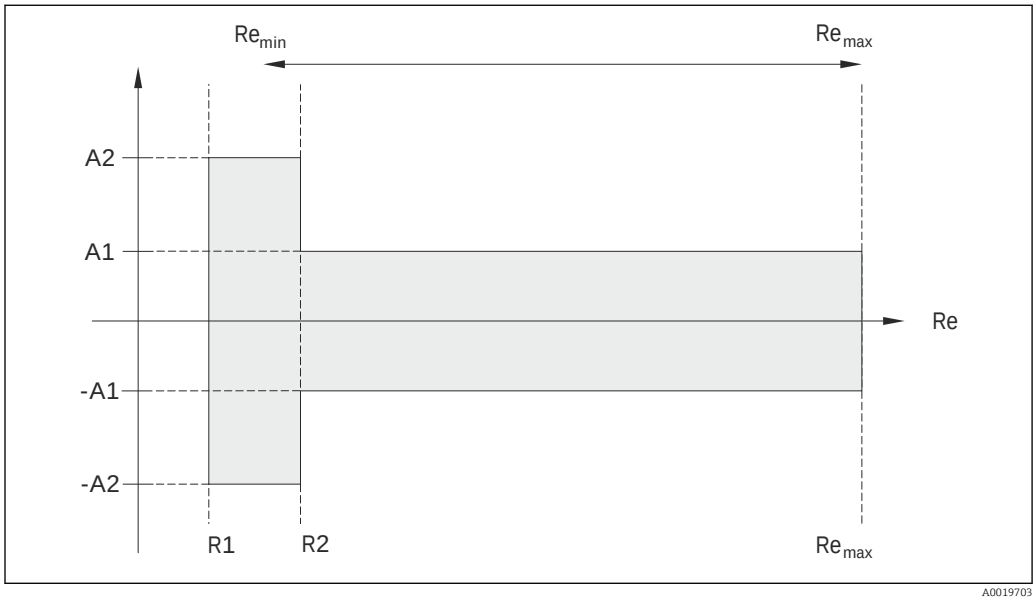
Maximum measured error

Base accuracy

o.r. = of reading, Re = Reynolds number

Volume flow

The measured error for the volume flow is as follows depending on the Reynolds number and the compressibility of the medium under measurement:



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Deviation of volume flow value (absolute) from the reading			
Medium type		**Incompressible**	**Compressible** [1]
Re range	**Measured value deviation**	**Standard**	**Standard**
R1 to R2	A2	< 10 %	< 10 %
R2 to Re_{max}	A1	< 0.75 %	< 1.0 %

1) Accuracy specifications valid up to 75 m/s (246 ft/s)

Reynolds numbers	Incompressible	Compressible
	Standard	Standard
R1	5 000	
R2	20 000	

Temperature
- Saturated steam and liquids at room temperature if T > 100 °C (212 °F) applies: < 1 °C (1.8 °F)
- Gas: < 1 % o.r. [K]
- Volume flow: > 70 m/s (230 ft/s): 2% o.r.

Rise time 50 % (stirred under water, following IEC 60751): 8 s

Mass flow (saturated steam)
- Flow velocities 20 to 50 m/s (66 to 164 ft/s), T > 150 °C (302 °F) or (423 K)
  - Re > 20 000: < 1.7 % o.r.
  - Re between 5 000 to 20 000: < 10 % o.r.
- Flow velocities 10 to 70 m/s (33 to 210 ft/s), T > 140 °C (284 °F) or (413 K)
  - Re > 20 000: < 2 % o.r.
  - Re between 5 000 to 20 000: < 10 % o.r.
- Flow velocities < 10 m/s (33 ft/s): Re > 5000: 5%

The use of a Cerabar S is required for the measured errors listed in the following section. The measured error used to calculate the error in the measured pressure is 0.15%.

Mass flow of superheated steam and gas (single gas, gas mixture, air: NEL40; natural gas: ISO 12213-2 contains AGA8-DC92, AGA NX-19, ISO 12213-3 contains SGERG-88 and AGA8 Gross Method 1)
- Re > 20 000 and process pressure < 40 bar abs. (580 psi abs.): 1.7 % o.r.
- Re between 5 000 to 20 000 and process pressure < 40 bar abs. (580 psi abs.): 10 % o.r.
- Re > 20 000 and process pressure < 120 bar abs. (1 740 psi abs.): 2.6 % o.r.
- Re between 5 000 to 20 000 and process pressure < 120 bar abs. (1 740 psi abs.): 10 % o.r.

abs. = absolute

Mass flow (water)
- Re 20 000: < 0.85 % o.r.
- Re between 5 000 to 20 000: < 10 % o.r.

Mass flow (user-defined liquids)

To specify the system accuracy, Endress+Hauser requires information about the type of liquid and its operating temperature or information in table form about the dependency between the liquid density and the temperature.

Example
- Acetone is to be measured at fluid temperatures from +70 to +90 °C (+158 to +194 °F).
- For this purpose, the **Reference temperature** parameter (7703) (here 80 °C (176 °F)), **Reference density** parameter (7700) (here 720.00 kg/m^3) and **Linear expansion coefficient** parameter (7621) (here 18.0298 × 10^{-4} 1/°C) must be entered in the transmitter.
- The overall system uncertainty, which is less than 0.9 % for the example above, is comprised of the following measurement uncertainties: uncertainty of volume flow measurement, uncertainty of temperature measurement, uncertainty of the density-temperature correlation used (incl. the resulting uncertainty of density).

Mass flow (other media)
Depends on the selected fluid and the pressure value, which is specified in the parameters. Individual error analysis must be performed.

Diameter mismatch correction

Prowirl 200 can correct shifts in the calibration factor which are caused, for example, by diameter mismatch between the device flange (e.g. ASME B16.5/Sch. 80, DN 50 (2")) and the mating pipe (e.g. ASME B16.5/Sch. 40, DN 50 (2")). Only apply diameter mismatch correction within the following limit values (listed below) for which test measurements have also been performed.

Flange connection:
- DN 15 (½"): ±20 % of the internal diameter
- DN 25 (1"): ±15 % of the internal diameter
- DN 40 (1½"): ±12 % of the internal diameter
- DN ≥ 50 (2"): ±10 % of the internal diameter

If the standard internal diameter of the ordered process connection differs from the internal diameter of the mating pipe, an additional measuring uncertainty of approx. 2 % o.r. must be expected.

Example
Influence of the diameter mismatch without using the correction function:
- Mating pipe DN 100 (4"), schedule 80
- Device flange DN 100 (4"), schedule 40
- This installation position results in a diameter mismatch of 5 mm (0.2 in). If the correction function is not used, an additional measuring uncertainty of approx. 2 % o.r. must be expected.

For detailed information about diameter mismatch correction, refer to the Operating Instructions

Accuracy of outputs

The outputs have the following base accuracy specifications.

Current output

Accuracy	±10 µA

Pulse/frequency output

o.r. = of reading

Accuracy	Max. ±100 ppm o.r.

Repeatability

o.r. = of reading

±0.2 % o.r.

Response time

If all the configurable functions for filter times (flow damping, display damping, current output time constant, frequency output time constant, status output time constant) are set to 0, in the event of vortex frequencies of 10 Hz and higher a response time of max(T_v,100 ms) can be expected.

In the event of measuring frequencies < 10 Hz, the response time is > 100 ms and can be up to 10 s. T_v is the average vortex period duration of the flowing fluid.

Influence of ambient temperature

Current output

o.r. = of reading

Additional error, based on span of 16 mA:

Temperature coefficient at zero point (4 mA)	0.02 %/10 K
Temperature coefficient with span (20 mA)	0.05 %/10 K

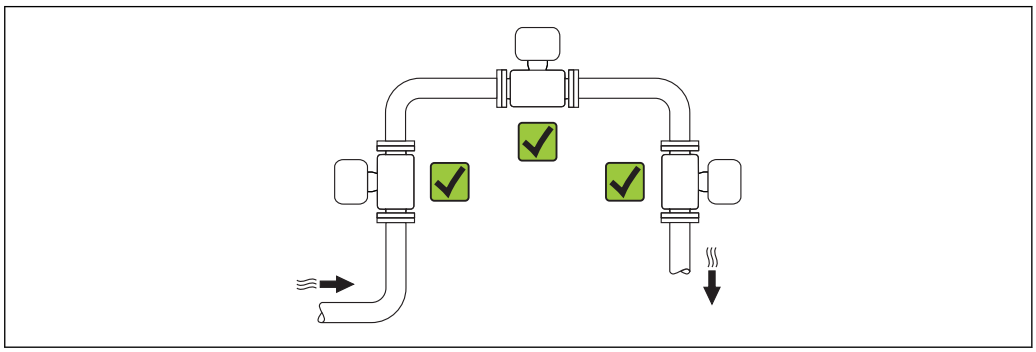
Pulse/frequency output

o.r. = of reading

Temperature coefficient	Max. ±100 ppm o.r.

Installation

Mounting location

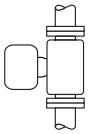
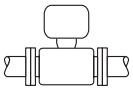
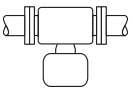


A0015543

Orientation

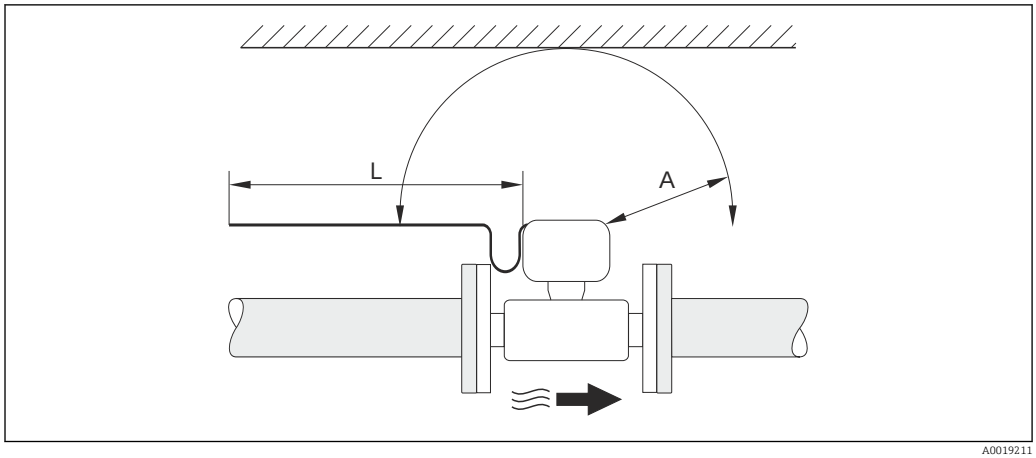
The direction of the arrow on the sensor nameplate helps you to install the sensor according to the flow direction (direction of medium flow through the piping).

Vortex meters require a fully developed flow profile as a prerequisite for correct volume flow measurement. Therefore, please note the following:

Orientation			Compact version	Remote version
A	Vertical orientation	 A0015545	✔✔ 1)	✔✔
B	Horizontal orientation, transmitter head up	 A0015589	✔✔ 2) 3)	✔✔
C	Horizontal orientation, transmitter head down	 A0015590	✔✔ 4) 5)	✔✔
D	Horizontal orientation, transmitter head at side	 A0015592	✔✔ 4)	✔✔

1) In the case of liquids, there should be upward flow in vertical pipes to avoid partial pipe filling (Fig. A). Disruption in flow measurement! In the case of vertical orientation and downward flowing liquid, the pipe always needs to be completely filled to ensure correct liquid flow measurement.
2) Danger of electronics overheating! If the fluid temperature is ≥ 200 °C (392 °F) orientation B is not permitted for the wafer version (Prowirl D) with nominal diameters DN 100 (4") and DN 150 (6").
3) In the case of hot media (e.g. steam or fluid temperature (TM) ≥ 200 °C (392 °F): orientation C or D
4) In the case of very cold media (e.g. liquid nitrogen): orientation B or D
5) For "wet steam detection/measurement" option: orientation C

Minimum spacing and cable length



A0019211

A Minimum spacing in all directions
L Required cable length

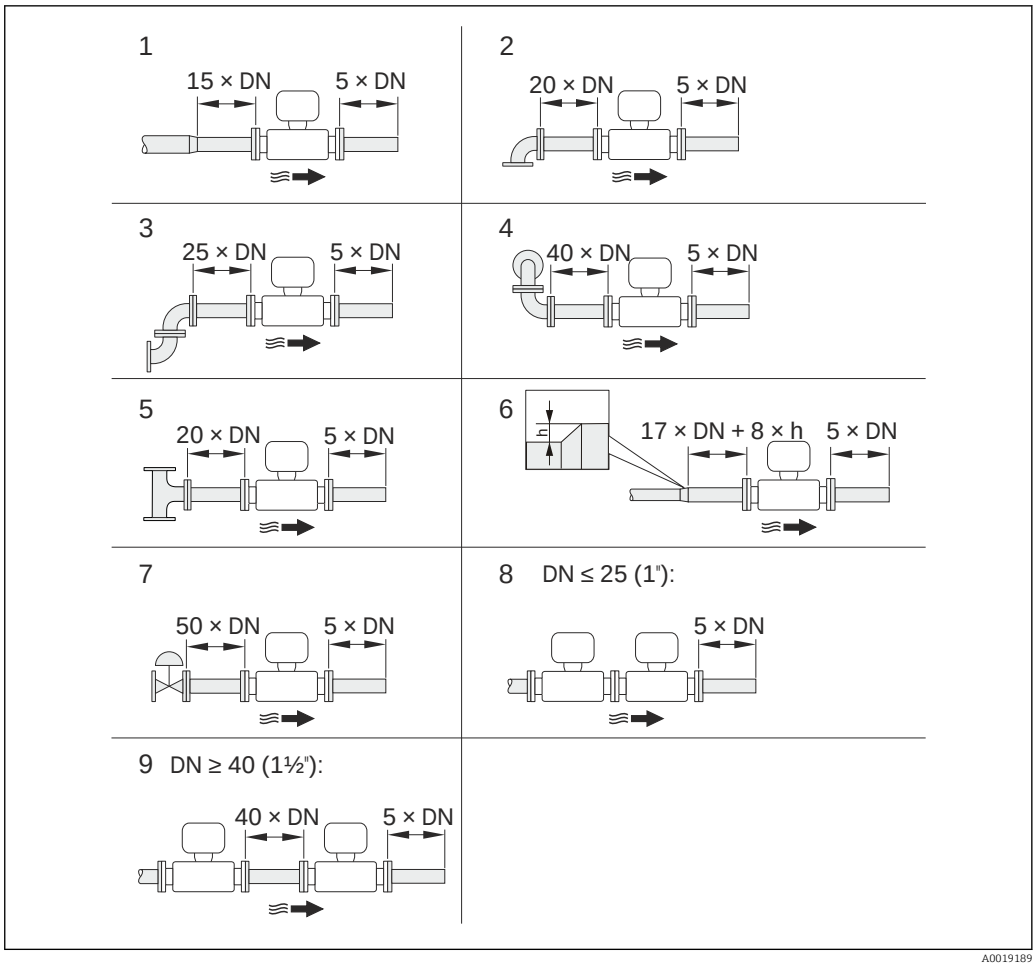
The following dimensions must be observed to guarantee problem-free access to the device for service purposes:
- A =100 mm (3.94 in)
- L = L + 150 mm (5.91 in)

Rotating the electronics housing and the display

The electronics housing can be rotated continuously by 360 °° on the housing support. The display unit can be rotated in 45 ° stages. This means you can read the display comfortably from all directions.

Inlet and outlet runs

To attain the specified level of accuracy of the measuring device, the inlet and outlet runs mentioned below must be maintained at the very minimum.



12 *Minimum inlet and outlet runs with various flow obstructions*

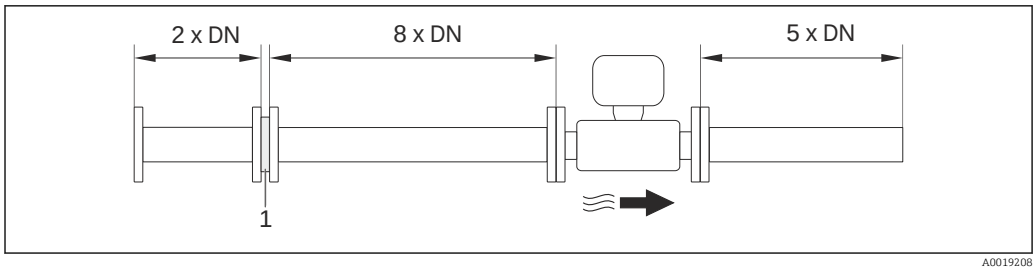
h Difference in expansion
1 Reduction by one nominal diameter size
2 Single elbow (90° elbow)
3 Double elbow (2 × 90° elbows, opposite)
4 Double elbow 3D (2 × 90° elbows, opposite, not on one plane)
5 T-piece
6 Expansion
7 Control valve
8 Two measuring devices in a row where DN ≤ 25 (1"): directly flange on flange
9 Two measuring devices in a row where DN ≥ 40 (1½"): for spacing, see graphic

- If there are several flow disturbances present, the longest specified inlet run must be maintained.
- If the required inlet runs cannot be observed, it is possible to install a specially designed flow conditioner → 43.

The **inlet run correction** function:
- Makes it possible to shorten the inlet run to a minimum length of 10 × DN in the event of flow obstructions 1 to 4. An additional measuring uncertainty of ±0.5% o.r. occurs here.
- Cannot be combined with the **wet steam detection/measurement** → 91 application package. If wet steam detection/measurement is used, the corresponding inlet runs must be taken into consideration. It is not possible to use a flow conditioner for wet steam.

Flow conditioner

If the required inlet runs cannot be observed, it is possible to install a specially designed flow conditioner which can be ordered from Endress+Hauser. The flow conditioner is fitted between two pipe flanges and centered by the mounting bolts. Generally this reduces the inlet run needed to 10 × DN with full accuracy.



1 Flow conditioner

The pressure loss for flow conditioners is calculated as follows: Δp [mbar] = 0.0085 · ρ [kg/m³] · v² [m/s]

Example for steam	Example for H_2O condensate (80 °C)
p = 10 bar abs.	ρ = 965 kg/m³
t = 240 °C → ρ = 4.39 kg/m³	v = 2.5 m/s
v = 40 m/s	$\Delta p = 0.0085 \cdot 965 \cdot 2.5^2$ = 51.3 mbar
$\Delta p = 0.0085 \cdot 4.394.39 \cdot 40^2$ = 59.7 mbar	

ρ : density of the process medium

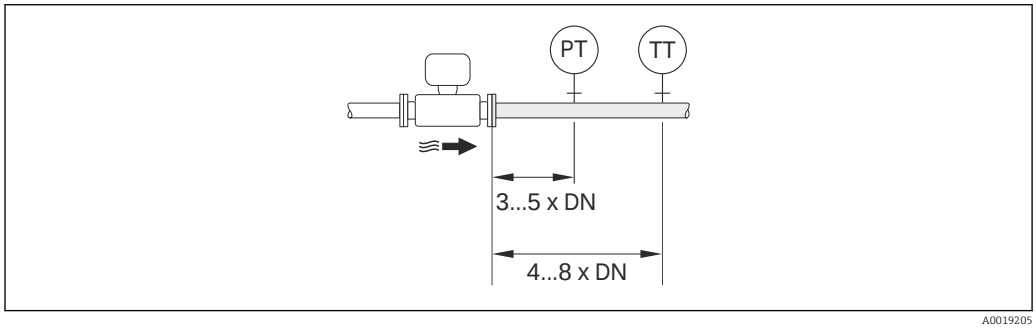
v: average flow velocity

abs. = absolute

For information on the flow conditioner

Outlet runs when installing external devices

If installing an external device, observe the specified distance.



PT Pressure transmitter
TT Temperature transmitter

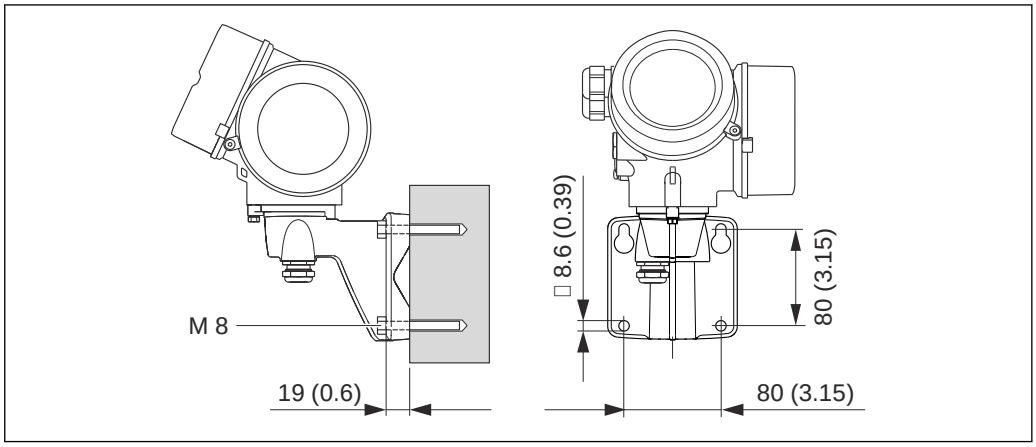
Length of connecting cable

To ensure correct measuring results when using the remote version,
- observe the maximum permitted cable length: L_{max} = 30 m (90 ft).
- The value for the cable length must be calculated if the cable cross-section differs from the specification.

For detailed information about calculating the length of the connecting cable, refer to the Operating Instructions for the device on the CD-ROM provided

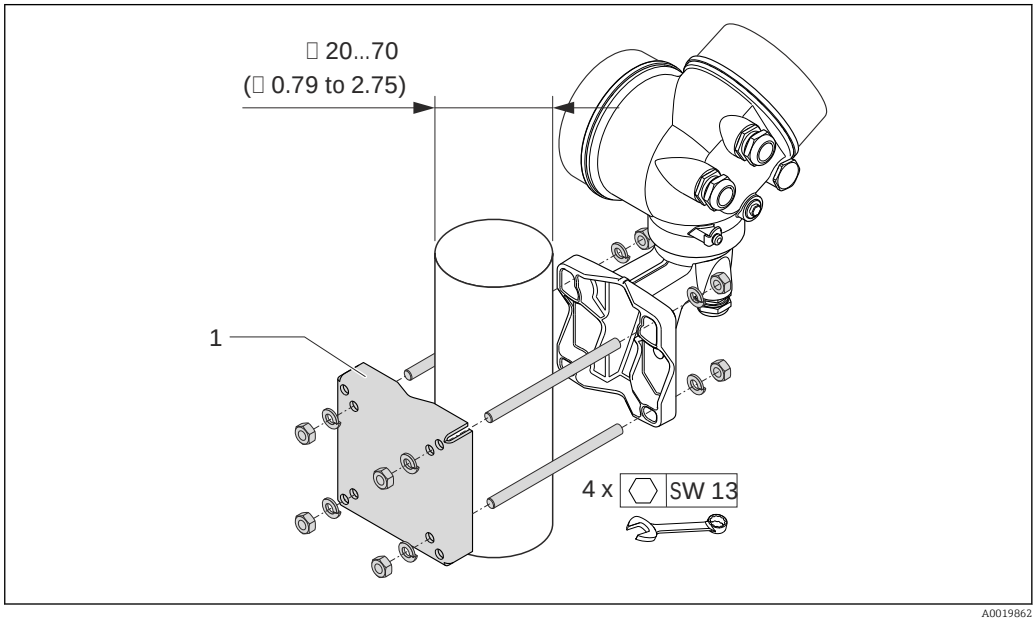
Installing the wall-mount housing

Wall mounting



13 Engineering unit mm (in)

Post mounting



14 Engineering unit mm (in)

1 Post retainer kit for post mounting

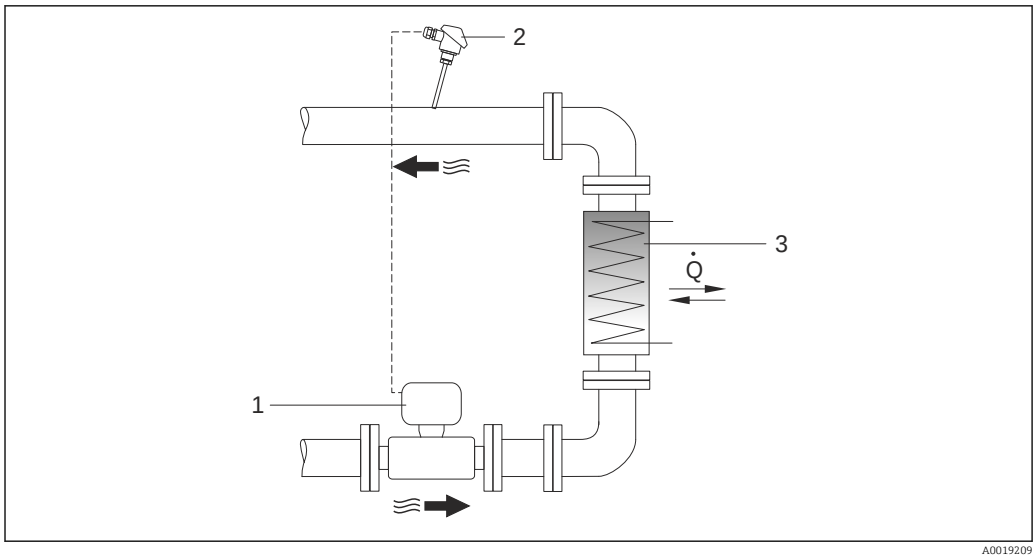
Special mounting instructions

Installation for delta heat measurements

Order code for *"Sensor version"*, option 3 *"Mass flow (integrated temperature measurement)"*

The second temperature measurement is taken using a separate temperature sensor. The measuring device reads in this value via a communication interface.

- In the case of saturated steam delta heat measurements, the Prowirl 200 must be installed on the steam side.
- In the case of water delta heat measurements, the Prowirl 200 can be installed on the cold or warm side.



15 Layout for delta heat measurement of saturated steam and water

1 Prowirl
2 Temperature sensor
3 Heat exchanger
Q Heat flow

Weather protection cover

Observe the following minimum head clearance: 222 mm (8.74 in)

For information on the weather protection cover, see → 92

Environment

Ambient temperature range

Compact version

Measuring device	Non-Ex:	−40 to +80 °C (−40 to +176 °F) [1]
	Ex i:	−40 to +70 °C (−40 to +158 °F) [1]
	EEx d/XP version:	−40 to +60 °C (−40 to +140 °F) [1]
	ATEX II1/2G Ex d, Ex ia:	−40 to +60 °C (−40 to +140 °F) [1]
Local display		−20 to +70 °C (−4 to +158 °F) [1]

1) Additionally available as order code for "Test, certificate", option JN "Transmitter ambient temperature −50 °C (−58 °F)".

Remote version

Transmitter	Non-Ex:	−40 to +80 °C (−40 to +176 °F) [1]
	Ex i:	−40 to +80 °C (−40 to +176 °F) [1]
	Ex d:	−40 to +60 °C (−40 to +140 °F) [1]
	ATEX II1/2G Ex d, Ex ia:	−40 to +60 °C (−40 to +140 °F) [1]
Sensor	Non-Ex:	−40 to +85 °C (−40 to +185 °F) [1]
	Ex i:	−40 to +85 °C (−40 to +185 °F) [1]
	Ex d:	−40 to +85 °C (−40 to +185 °F) [1]

	ATEX II1/2G Ex d, Ex ia:	−40 to +85 °C (−40 to +185 °F) [1]
Local display		−20 to +70 °C (−4 to +158 °F) [1]

1) Additionally available as order code for "Test, certificate", option JN "Transmitter ambient temperature −50 °C (−58 °F)".

- If operating outdoors:
  Avoid direct sunlight, particularly in warm climatic regions.

Weather protection covers can be ordered from Endress+Hauser: see "Accessories" section → 92

Temperature tables

T_m = fluid temperature, T_a = ambient temperature

The following interdependencies between the permitted ambient and fluid temperatures apply when operating the device in hazardous areas:

Compact version

Order code for *"Sensor version"*, option 1 *"Volume flow, basis"*; option 3 *"Mass flow (integrated temperature measurement)"*

Order code for *"Sensor version"*, option 2 *"Volume flow, high-temperature/low-temperature"*

The following temperature tables apply to the low-temperature version → 45.

Order code for "Output", option A "4-20mA HART"
Order code for *"Approval"*, all options
- Ex d, Ex ia, Ex ic, Ex nA, Ex tb
- $_{C}CSA_{US}$ IS, $_{C}CSA_{US}$ XP, $_{C}CSA_{US}$ NI

SI units

Version with max. T_m = 280 °C						
T_a [1] [°C]	**T6 [85 °C]**	**T5 [100 °C]**	**T4 [135 °C]**	**T3 [200 °C]**	**T2 [300 °C]**	**T1 [450 °C]**
40	80	95	130	195	280	–
60	–	95	130	195	280	–
65	–	–	130	195	280	–
70	–	–	130	–	–	–

1) The following applies for installations with overvoltage protection in conjunction with temperature class T5, T6 and approval options BA, BB, BD, BH, BJ, B2, IA, IB, ID, IH, IJ, I4, C2: $T_a = T_a$ - 2 °C

US units

Version with max. T_m = 536 °F						
T_a [1] [°F]	**T6 [185 °F]**	**T5 [212 °F]**	**T4 [275 °F]**	**T3 [392 °F]**	**T2 [572 °F]**	**T1 [842 °F]**
104	176	203	266	383	536	–
140	–	203	266	383	536	–
149	–	–	266	383	536	–
158	–	–	266	–	–	–

1) The following applies to installations with overvoltage protection in conjunction with temperature class T5, T6 and approval options BA, BB, BD, BH, BJ, B2, IA, IB, ID, IH, IJ, I4, C2: $T_a = T_a$ - 35.6 °F

Order code for "Output", option B "4-20mA HART, pulse/frequency/switch output"
Order code for *"Approval"*, options BA, BB, BD, BH, BJ, B2, IA, IB, ID, IH, IJ, I4, C2
- Ex ia, Ex ic, Ex tb
- $_{C}CSA_{US}$ IS

SI units

Version with max. T_m = 280 °C						
T_a [1] [°C]	T6 [85 °C]	T5 [100 °C]	T4 [135 °C]	T3 [200 °C]	T2 [300 °C]	T1 [450 °C]
35 [2]	80	95	130	195	280	–
50 [3]	–	95	130	195	280	–
60	–	–	130	195	280	–
65	–	–	130	195	280 [4]	–
70	–	–	130	195 [5]	280 [5]	–

1) The following applies for installations with overvoltage protection in conjunction with temperature class T5, T6 and approval options BA, BB, BD, BH, BJ, B2, IA, IB, ID, IH, IJ, I4, C2: $T_a = T_a$ - 2 °C
2) T_a = 40 °C for pulse/frequency/switch output P_i = 0.85 W
3) T_a = 55 °C for pulse/frequency/switch output P_i = 0.85 W
4) T_a = 65 °C for pulse/frequency/switch output P_i = 0.7 W
5) T_a = 70 °C for pulse/frequency/switch output P_i = 0.7 W

US units

Version with max. T_m = 536 °F						
T_a [1] [°F]	T6 [185 °F]	T5 [212 °F]	T4 [275 °F]	T3 [392 °F]	T2 [572 °F]	T1 [842 °F]
95 [2]	176	203	266	383	536	–
122 [3]	–	203	266	383	536	–
140	–	–	266	383	536	–
149	–	–	266	383	536 [4]	–
158	–	–	266	383 [5]	536 [5]	–

1) The following applies to installations with overvoltage protection in conjunction with temperature class T5, T6 and approval options BA, BB, BD, BH, BJ, B2, IA, IB, ID, IH, IJ, I4, C2: $T_a = T_a$ - 35.6 °F
2) T_a = 104 °F for pulse/frequency/switch output P_i = 0.85 W
3) T_a = 131 °F for pulse/frequency/switch output P_i = 0.85 W
4) T_a = 149 °F for pulse/frequency/switch output P_i = 0.7 W
5) T_a = 158 °F for pulse/frequency/switch output P_i = 0.7 W

Order code for *"Approval"*, options BC, BG, BK, B3, IC, IG, IK, I5, C3
- Ex d, Ex nA, Ex tb
- $_{C}CSA_{US}$ XP

SI units

Version with max. T_m = 280 °C						
T_a [°C]	T6 [85 °C]	T5 [100 °C]	T4 [135 °C]	T3 [200 °C]	T2 [300 °C]	T1 [450 °C]
40	80	95	130	195	280	–
55	–	95	130	195	280	–

Version with max. T_m = 280 °C						
T_a [°C]	T6 [85 °C]	T5 [100 °C]	T4 [135 °C]	T3 [200 °C]	T2 [300 °C]	T1 [450 °C]
65	–	–	130	195	280 [1]	–
70	–	–	130	195 [2]	280 [2]	–

1) T_a = 65 °C for pulse/frequency/switch output P_i = 0.7 W
2) T_a = 70 °C for pulse/frequency/switch output P_i = 0.7 W

US units

Version with max. T_m = 536 °F						
T_a [°F]	T6 [185 °F]	T5 [212 °F]	T4 [275 °F]	T3 [392 °F]	T2 [572 °F]	T1 [842 °F]
104	176	203	266	383	536	–
131	–	203	266	383	536	–
149	–	–	266	383	536 [1]	–
158	–	–	266	383 [2]	536 [2]	–

1) T_a = 149 °F for pulse/frequency/switch output P_i = 0.7 W
2) T_a = 158 °F for pulse/frequency/switch output P_i = 0.7 W

Order code for "Output", option C "4-20mA HART, 4-20mA analog"
Order code for *"Approval"*, all options
- Ex d, Ex ia, Ex ic, Ex nA, Ex tb
- $_{C}CSA_{US}$ IS, $_{C}CSA_{US}$ XP, $_{C}CSA_{US}$ NI

SI units

Version with max. T_m = 280 °C						
T_a [1] [°C]	T6 [85 °C]	T5 [100 °C]	T4 [135 °C]	T3 [200 °C]	T2 [300 °C]	T1 [450 °C]
40	80	95	130	195	280	–
55	–	95	130	195	280	–
60	–	–	130	195	280	–
65	–	–	130	195	280 [2]	–
70	–	–	130	–	–	–

1) The following applies for installations with overvoltage protection in conjunction with temperature class T5, T6 and approval options BA, BB, BD, BH, BJ, B2, IA, IB, ID, IH, IJ, I4, C2: $T_a = T_a$ - 2 °C
2) T_a = 65 °C for pulse/frequency/switch output P_i = 0 W

US units

Version with max. T_m = 536 °F						
T_a [1] [°F]	T6 [185 °F]	T5 [212 °F]	T4 [275 °F]	T3 [392 °F]	T2 [572 °F]	T1 [842 °F]
104	176	203	266	383	536	–
131	–	203	266	383	536	–
140	–	–	266	383	536	–

Version with max. T_m = 536 °F						
T_a [1] [°F]	T6 [185 °F]	T5 [212 °F]	T4 [275 °F]	T3 [392 °F]	T2 [572 °F]	T1 [842 °F]
149	–	–	266	383	536 [2]	–
158	–	–	266	–	–	–

1) The following applies to installations with overvoltage protection in conjunction with temperature class T5, T6 and approval options BA, BB, BD, BH, BJ, B2, IA, IB, ID, IH, IJ, I4, C2: $T_a = T_a$ - 35.6 °F
2) T_a = 149 °F for pulse/frequency/switch output P_i = 0 W

Order code for "Output", option D "4-20 mA HART, PFS output; 4-20 mA input"
Order code for *"Approval"*, all options
- Ex d, Ex ia, Ex ic, Ex nA, Ex tb
- $_C$CSA$_{US}$ IS, $_C$CSA$_{US}$ XP, $_C$CSA$_{US}$ NI

SI units

Version with max. T_m = 280 °C						
T_a [1] [°C]	T6 [85 °C]	T5 [100 °C]	T4 [135 °C]	T3 [200 °C]	T2 [300 °C]	T1 [450 °C]
35	80	95	130	195	280	–
50	–	95	130	195	280	–
55	–	–	–	195	280	–
60	–	–	–	195	–	–

1) The following applies for installations with overvoltage protection in conjunction with temperature class T5, T6 and approval options BA, BB, BD, BH, BJ, B2, IA, IB, ID, IH, IJ, I4, C2: $T_a = T_a$ - 2 °C

US units

Version with max. T_m = 536 °F						
T_a [1] [°F]	T6 [185 °F]	T5 [212 °F]	T4 [275 °F]	T3 [392 °F]	T2 [572 °F]	T1 [842 °F]
95	176	203	266	383	536	–
122	–	203	266	383	536	–
131	–	–	–	383	536	–
140	–	–	–	383	–	–

1) The following applies to installations with overvoltage protection in conjunction with temperature class T5, T6 and approval options BA, BB, BD, BH, BJ, B2, IA, IB, ID, IH, IJ, I4, C2: $T_a = T_a$ - 35.6 °F

Order code for "Output", option E "FOUNDATION Fieldbus, pulse/frequency/switch output" and option G "PROFIBUS PA, pulse/frequency/switch output"
Order code for *"Approval"*, all options
- Ex d, Ex ia, Ex ic, Ex nA, Ex tb
- $_C$CSA$_{US}$ IS, $_C$CSA$_{US}$ XP, $_C$CSA$_{US}$ NI

SI units

Version with max. T_m = 280 °C						
T_a [1] [°C]	T6 [85 °C]	T5 [100 °C]	T4 [135 °C]	T3 [200 °C]	T2 [300 °C]	T1 [450 °C]
40	80	95	130	195	280	–
50 [2]	–	95	130	195	280	–
60	–	–	130	195	280	–

Version with max. T_m = 280 °C						
T_a [1] [°C]	T6 [85 °C]	T5 [100 °C]	T4 [135 °C]	T3 [200 °C]	T2 [300 °C]	T1 [450 °C]
65	–	–	130	195	280 [3]	–
70	–	–	130	195 [4]	280 [4]	–

1) The following applies for installations with overvoltage protection in conjunction with temperature class T5, T6 and approval options BA, BB, BD, BH, BJ, B2, IA, IB, ID, IH, IJ, I4, C2: $T_a = T_a$ - 2 °C
2) T_a = 60 °C for pulse/frequency/switch output P_i = 0 W
3) T_a = 65 °C for pulse/frequency/switch output P_i = 0 W
4) T_a = 70 °C for pulse/frequency/switch output P_i = 0 W

US units

Version with max. T_m = 536 °F						
T_a [1] [°F]	T6 [185 °F]	T5 [212 °F]	T4 [275 °F]	T3 [392 °F]	T2 [572 °F]	T1 [842 °F]
104	176	203	266	383	536	–
122 [2]	–	203	266	383	536	–
140	–	–	266	383	536	–
149	–	–	266	383	536 [3]	–
158	–	–	266	383 [4]	536 [4]	–

1) The following applies to installations with overvoltage protection in conjunction with temperature class T5, T6 and approval options BA, BB, BD, BH, BJ, B2, IA, IB, ID, IH, IJ, I4, C2: $T_a = T_a$ - 35.6 °F
2) T_a = 140 °F for pulse/frequency/switch output P_i = 0 W
3) T_a = 149 °F for pulse/frequency/switch output P_i = 0 W
4) T_a = 158 °F for pulse/frequency/switch output P_i = 0 W

High-temperature version

Order code for *"Sensor version"*, option 2 *"Volume flow, high-temperature/low-temperature"*

The following temperature tables apply to the high-temperature version → 49.

Order code for "Output", option A "4-20mA HART"
Order code for *"Approval"*, all options
- Ex d, Ex ia, Ex ic, Ex nA, Ex tb
- $_{C}CSA_{US}$ IS, $_{C}CSA_{US}$ XP, $_{C}CSA_{US}$ NI

SI units

Version with max. T_m = 440 °C						
T_a [1] [°C]	T6 [85 °C]	T5 [100 °C]	T4 [135 °C]	T3 [200 °C]	T2 [300 °C]	T1 [450 °C]
40	80	95	130	195	290	440
60	–	95	130	195	290	440
70	–	–	130	195	290	440

1) The following applies for installations with overvoltage protection in conjunction with temperature class T5, T6 and approval options BA, BB, BD, BH, BJ, B2, IA, IB, ID, IH, IJ, I4, C2: $T_a = T_a$ - 2 °C

US units

Version with max. T_m = 824 °F						
T_a [1] [°F]	T6 [185 °F]	T5 [212 °F]	T4 [275 °F]	T3 [392 °F]	T2 [572 °F]	T1 [842 °F]
104	176	203	266	383	554	824
140	–	203	266	383	554	824
158	–	–	266	383	554	824

1) The following applies to installations with overvoltage protection in conjunction with temperature class T5, T6 and approval options BA, BB, BD, BH, BJ, B2, IA, IB, ID, IH, IJ, I4, C2: $T_a = T_a$ - 35.6 °F

Order code for "Output", option B "4-20mA HART, pulse/frequency/switch output"
Order code for *"Approval"*, options BA, BB, BD, BH, BJ, B2, IA, IB, ID, IH, IJ, I4, C2
- Ex ia, Ex ic, Ex tb
- $_{C}CSA_{US}$ IS

SI units

Version with max. T_m = 440 °C						
T_a [1] [°C]	T6 [85 °C]	T5 [100 °C]	T4 [135 °C]	T3 [200 °C]	T2 [300 °C]	T1 [450 °C]
35 [2]	80	95	130	195	290	440
50 [3]	–	95	130	195	290	440
65	–	–	130	195	290	440
70	–	–	130	195 [4]	290	440 [4]

1) The following applies for installations with overvoltage protection in conjunction with temperature class T5, T6 and approval options BA, BB, BD, BH, BJ, B2, IA, IB, ID, IH, IJ, I4, C2: $T_a = T_a$ - 2 °C
2) T_a = 40 °C for pulse/frequency/switch output P_i = 0.85 W
3) T_a = 55 °C for pulse/frequency/switch output P_i = 0.85 W
4) T_a = 70 °C for pulse/frequency/switch output P_i = 0.85 W

US units

Version with max. T_m = 824 °F						
T_a [1] [°F]	T6 [185 °F]	T5 [212 °F]	T4 [275 °F]	T3 [392 °F]	T2 [572 °F]	T1 [842 °F]
95 [2]	176	203	266	383	554	824
122 [3]	–	203	266	383	554	824
149	–	–	266	383	554	824
158	–	–	266	383 [4]	554	824 [4]

1) The following applies to installations with overvoltage protection in conjunction with temperature class T5, T6 and approval options BA, BB, BD, BH, BJ, B2, IA, IB, ID, IH, IJ, I4, C2: $T_a = T_a$ - 35.6 °F
2) T_a = 104 °F for pulse/frequency/switch output P_i = 0.85 W
3) T_a = 131 °F for pulse/frequency/switch output P_i = 0.85 W
4) T_a = 158 °F for pulse/frequency/switch output P_i = 0.85 W

Order code for *"Approval"*, options BC, BG, BK, B3, IC, IG, IK, I5, C3
- Ex d, Ex nA, Ex tb
- $_{C}CSA_{US}$ XP

SI units

Version with max. T_m = 440 °C						
T_a [°C]	T6 [85 °C]	T5 [100 °C]	T4 [135 °C]	T3 [200 °C]	T2 [300 °C]	T1 [450 °C]
40	80	95	130	195	290	440
55	–	95	130	195	290	440
65	–	–	130	195	290	440
70	–	–	130	195 [1)]	290 [1)]	440 [1)]

1) T_a = 70 °C for pulse/frequency/switch output P_i = 0.85 W

US units

Version with max. T_m = 824 °F						
T_a [°F]	T6 [185 °F]	T5 [212 °F]	T4 [275 °F]	T3 [392 °F]	T2 [572 °F]	T1 [842 °F]
104	176	203	266	383	554	824
131	–	203	266	383	554	824
149	–	–	266	383	554	824
158	–	–	266	383 [1)]	554 [1)]	824 [1)]

1) T_a = 158 °F for pulse/frequency/switch output P_i = 0.85 W

Order code for "Output", option C "4-20mA HART, 4-20mA analog"
Order code for *"Approval"*, all options
- Ex d, Ex ia, Ex ic, Ex nA, Ex tb
- $_{C}CSA_{US}$ IS, $_{C}CSA_{US}$ XP, $_{C}CSA_{US}$ NI

SI units

Version with max. T_m = 440 °C						
T_a [1)] [°C]	T6 [85 °C]	T5 [100 °C]	T4 [135 °C]	T3 [200 °C]	T2 [300 °C]	T1 [450 °C]
40	80	95	130	195	290	440
55	–	95	130	195	290	440
65	–	–	130	195	290	440
70	–	–	130	195 [2)]	290 [2)]	440 [2)]

1) The following applies for installations with overvoltage protection in conjunction with temperature class T5, T6 and approval options BA, BB, BD, BH, BJ, B2, IA, IB, ID, IH, IJ, I4, C2: $T_a = T_a$ - 2 °C
2) T_a = 70 °C for pulse/frequency/switch output P_i = 0 W

US units

Version with max. T_m = 824 °F						
T_a [1)] [°F]	T6 [185 °F]	T5 [212 °F]	T4 [275 °F]	T3 [392 °F]	T2 [572 °F]	T1 [842 °F]
104	176	203	266	383	554	824
131	–	203	266	383	554	824

Version with max. T_m = 824 °F						
T_a [1] [°F]	T6 [185 °F]	T5 [212 °F]	T4 [275 °F]	T3 [392 °F]	T2 [572 °F]	T1 [842 °F]
149	–	–	266	383	554	824
158	–	–	266	383 [2]	554 [2]	824 [2]

1) The following applies to installations with overvoltage protection in conjunction with temperature class T5, T6 and approval options BA, BB, BD, BH, BJ, B2, IA, IB, ID, IH, IJ, I4, C2: $T_a = T_a$ - 35.6 °F
2) T_a = 158 °F for pulse/frequency/switch output P_i = 0 W

Order code for "Output", option D "4-20 mA HART, PFS output; 4-20 mA input"
Order code for *"Approval"*, all options
- Ex d, Ex ia, Ex ic, Ex nA, Ex tb
- $_C$CSA$_{US}$ IS, $_C$CSA$_{US}$ XP, $_C$CSA$_{US}$ NI

SI units

Version with max. T_m = 440 °C						
T_a [1] [°C]	T6 [85 °C]	T5 [100 °C]	T4 [135 °C]	T3 [200 °C]	T2 [300 °C]	T1 [450 °C]
35	80	95	130	195	290	440
50	–	95	130	195	290	440
55	–	–	–	195	290	440
60	–	–	–	195	290	440
65	–	–	–	–	290	–

1) The following applies for installations with overvoltage protection in conjunction with temperature class T5, T6 and approval options BA, BB, BD, BH, BJ, B2, IA, IB, ID, IH, IJ, I4, C2: $T_a = T_a$ - 2 °C

US units

Version with max. T_m = 824 °F						
T_a [1] [°F]	T6 [185 °F]	T5 [212 °F]	T4 [275 °F]	T3 [392 °F]	T2 [572 °F]	T1 [842 °F]
95	176	203	266	383	554	824
122	–	203	266	383	554	824
131	–	–	–	383	554	824
140	–	–	–	383	554	824
149	–	–	–	–	554	–

1) The following applies to installations with overvoltage protection in conjunction with temperature class T5, T6 and approval options BA, BB, BD, BH, BJ, B2, IA, IB, ID, IH, IJ, I4, C2: $T_a = T_a$ - 35.6 °F

Order code for "Output", option E "FOUNDATION Fieldbus, pulse/frequency/switch output" and option G "PROFIBUS PA, pulse/frequency/switch output"
Order code for *"Approval"*, all options
- Ex d, Ex ia, Ex ic, Ex nA, Ex tb
- $_C$CSA$_{US}$ IS, $_C$CSA$_{US}$ XP, $_C$CSA$_{US}$ NI

SI units

Version with max. T_m = 440 °C						
T_a [1] [°C]	T6 [85 °C]	T5 [100 °C]	T4 [135 °C]	T3 [200 °C]	T2 [300 °C]	T1 [450 °C]
40	80	95	130	195	290	440
50 [2]	–	95	130	195	290	440
65	–	–	130	195	290	440
70	–	–	130	195 [3]	290 [3]	440 [3]

1) The following applies for installations with overvoltage protection in conjunction with temperature class T5, T6 and approval options BA, BB, BD, BH, BJ, B2, IA, IB, ID, IH, IJ, I4, C2: $T_a = T_a$ - 2 °C
2) T_a = 60 °C for pulse/frequency/switch output P_i = 0 W
3) T_a = 70 °C for pulse/frequency/switch output P_i = 0 W

US units

Version with max. T_m = 824 °F						
T_a [1] [°F]	T6 [185 °F]	T5 [212 °F]	T4 [275 °F]	T3 [392 °F]	T2 [572 °F]	T1 [842 °F]
104	176	203	266	383	554	824
122 [2]	–	203	266	383	554	824
149	–	–	266	383	554	824
158	–	–	266	383 [3]	554 [3]	824 [3]

1) The following applies to installations with overvoltage protection in conjunction with temperature class T5, T6 and approval options BA, BB, BD, BH, BJ, B2, IA, IB, ID, IH, IJ, I4, C2: $T_a = T_a$ - 35.6 °F
2) T_a = 140 °F for pulse/frequency/switch output P_i = 0 W
3) T_a = 158 °F for pulse/frequency/switch output P_i = 0 W

Remote version

Transmitter

Order code for *"Housing"*, option J *"GT20 two-chamber, remote G314, aluminum coated"*; option K *"GT20 two-chamber, remote G315, 316L"*

SI units

Order code for "Output", option	Order code for "Approval", option	T6 [85 °C]	T5 [100 °C]	T4 [135 °C]
A	All	40	60	75
B	BA, BB, BD, BH, BJ, B2, IA, IB, ID, IH, IJ, I4, C2	35 [1]	50 [2]	70 [3]
	BC, BG, BK, B3, IC, IG, IK, I5, C3	40	55	70 [3]
C	All	40	55	70 [4]
D	All	35 [5]	50 [5]	65
E G	All	40	55	70 [4]

1) T_a = 40 °C for pulse/frequency/switch output P_i = 0.85 W
2) T_a = 60 °C for pulse/frequency/switch output P_i = 0.85 W
3) T_a = 75 °C for pulse/frequency/switch output P_i = 0.85 W
4) T_a = 75 °C for pulse/frequency/switch output P_i = 0 W
5) The following applies to installations with overvoltage protection in conjunction with temperature class T5, T6 and approval options BA, BB, BD, BH, BJ, B2, IA, IB, ID, IH, IJ, I4, C2: $T_a = T_a$ - 2 °C

US units

Order code for "Output", option	Order code for "Approval", option	T6 [185 °F]	T5 [212 °F]	T4 [275 °F]
A	All	104	140	167
B	BA, BB, BD, BH, BJ, B2, IA, IB, ID, IH, IJ, I4, C2	95 [1]	122 [2]	158 [3]
	BC, BG, BK, B3, IC, IG, IK, I5, C3	104	131	158 [3]
C	All	104	131	158 [4]
D	All	95 [5]	122 [5]	149
E G	All	104	131	158 [4]

1) T_a = 104 °F for pulse/frequency/switch output P_i = 0.85 W
2) T_a = 140 °F for pulse/frequency/switch output P_i = 0.85 W
3) T_a = 167 °F for pulse/frequency/switch output P_i = 0.85 W
4) T_a = 167 °F for pulse/frequency/switch output P_i = 0 W
5) The following applies to installations with overvoltage protection in conjunction with temperature class T5, T6 and approval options BA, BB, BD, BH, BJ, B2, IA, IB, ID, IH, IJ, I4, C2: $T_a = T_a$ - 35.6 °F

Sensor

Order code for *"Sensor version"*, option 1 *"Volume flow, basis"*; option 3 *"Mass flow (integrated temperature measurement)"*

Order code for *"Sensor version"*, option 2 *"Volume flow, high-temperature/low-temperature"*

The following temperature tables apply to the low-temperature version → 54.

SI units

Version with max. T_m = 280 °C						
T_a [°C]	T6 [85 °C]	T5 [100 °C]	T4 [135 °C]	T3 [200 °C]	T2 [300 °C]	T1 [450 °C]
55	80	95	130	195	280	–
70	–	95	130	195	280	–
85	–	–	130	195	280	–

US units

Version with max. T_m = 536 °F						
T_a [°F]	T6 [185 °F]	T5 [212 °F]	T4 [275 °F]	T3 [392 °F]	T2 [572 °F]	T1 [842 °F]
104	176	203	266	383	536	–
122	–	203	266	383	536	–
149	–	–	266	383	536	–

High-temperature version

Order code for *"Sensor version"*, option 2 *"Volume flow, high-temperature/low-temperature"*

The following temperature tables apply to the high-temperature version → 55.

SI units

Version with max. T_m = 440 °C						
T_a [°C]	T6 [85 °C]	T5 [100 °C]	T4 [135 °C]	T3 [200 °C]	T2 [300 °C]	T1 [450 °C]
55	80	95	130	195	290	440
70	–	95	130	195	290	440
85	–	–	130	195	290	440

US units

Version with max. T_m = 824 °F						
T_a [°F]	T6 [185 °F]	T5 [212 °F]	T4 [275 °F]	T3 [392 °F]	T2 [572 °F]	T1 [842 °F]
131	176	203	266	383	554	824
158	–	203	266	383	554	824
185	–	–	266	383	554	824

Storage temperature

All components apart from the display modules:
−50 to +80 °C (−58 to +176 °F)

Remote display and operating module DKX001

−50 to +80 °C (−58 to +176 °F)

Climate class

DIN EN 60068-2-38 (test Z/AD)

Degree of protection

Transmitter
- As standard: IP66/67, type 4X enclosure
- When housing is open: IP20, type 1 enclosure
- Display module: IP20, type 1 enclosure

Sensor
IP66/67, type 4X enclosure

Device plugs
IP67, only in screwed situation

Vibration resistance

- For compact/remote version made of coated aluminum and remote version made of stainless steel:
  Acceleration up to 2 g (if gain set to factory setting), 10 to 500 Hz, following IEC 60068-2-6
- For the compact version made of stainless steel:
  Acceleration up to 1 g (if gain set to factory setting), 10 to 500 Hz, following IEC 60068-2-6

Electromagnetic compatibility (EMC)

As per IEC/EN 61326 and NAMUR Recommendation 21 (NE 21)

For details, refer to the Declaration of Conformity.

Process

Medium temperature range

DSC sensor [6]

Order code for "Sensor version":
- *Option 1 "Volume flow, basis"*:
  −40 to +260 °C (−40 to +500 °F), stainless steel
- *Option* 2 "Volume flow, high-temperature/low-temperature":
  −200 to +400 °C (−328 to +752 °F), stainless steel
- *Option 3 "Mass flow (integrated temperature measurement)"*:
  −200 to +400 °C (−328 to +752 °F), stainless steel

Order code for "Sensor option":
- *Option CD "Harsh environment* [7]*, DSC sensor components Alloy C22"*:
  −200 to +400 °C (−328 to +752 °F), DSC sensor Alloy C22
- *Option CE "Harsh process* [8]*, wetted parts Alloy C22, (including option CD)"*:
  −40 to +260 °C (−40 to +500 °F), sensor and DSC sensor Alloy C22

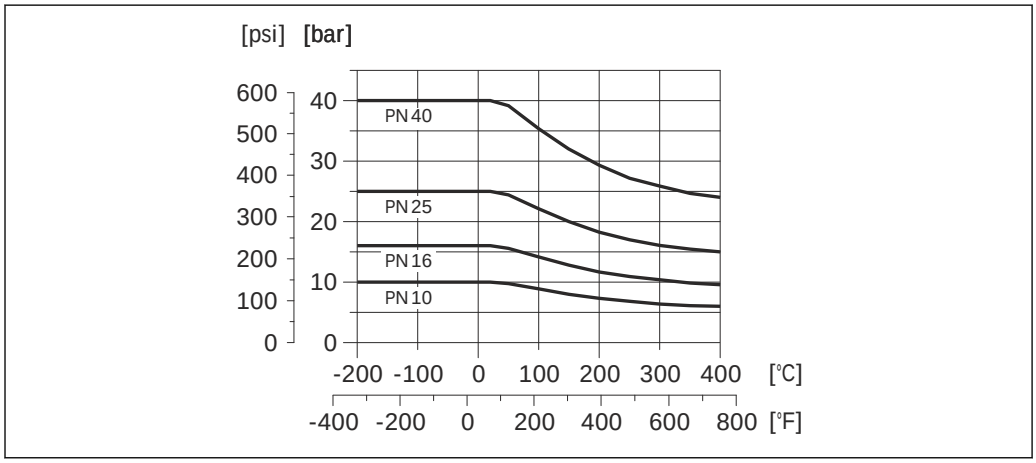
Seals
- −200 to +400 °C (−328 to +752 °F) for graphite (standard)
- −15 to +175 °C (+5 to +347 °F) for Viton
- −20 to +275 °C (−4 to +527 °F) for Kalrez
- −200 to +260 °C (−328 to +500 °F) for Gylon

Pressure-temperature ratings

The following pressure-temperature ratings refer to the entire device and not just the process connection.

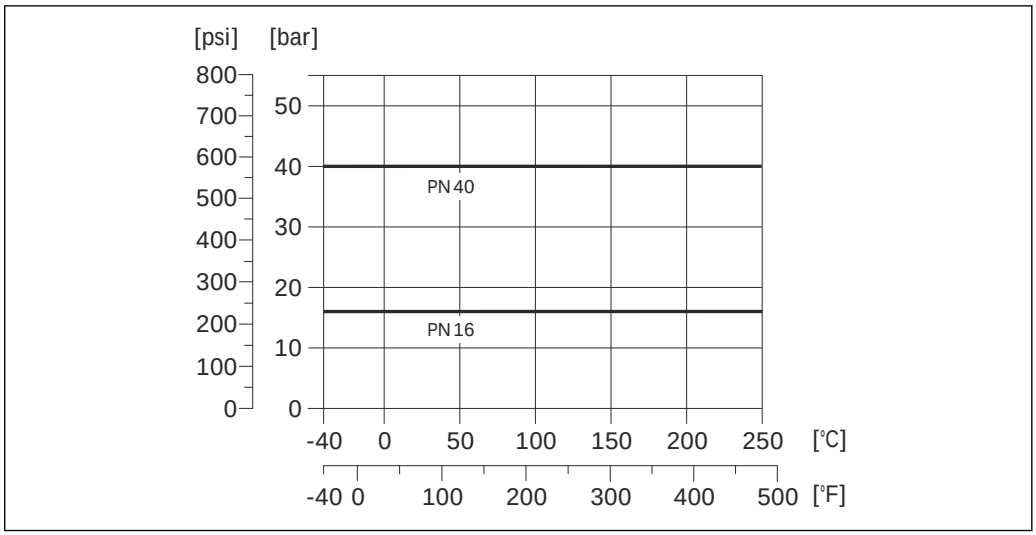
The pressure-temperature rating for the specific measuring device is programmed into the software. If values exceed the curve range a warning is displayed. Depending on the system configuration and sensor version, the pressure and temperature are determined by entering, reading in or calculating values.

Process connection: flange to EN 1092-1 (DIN 2501)



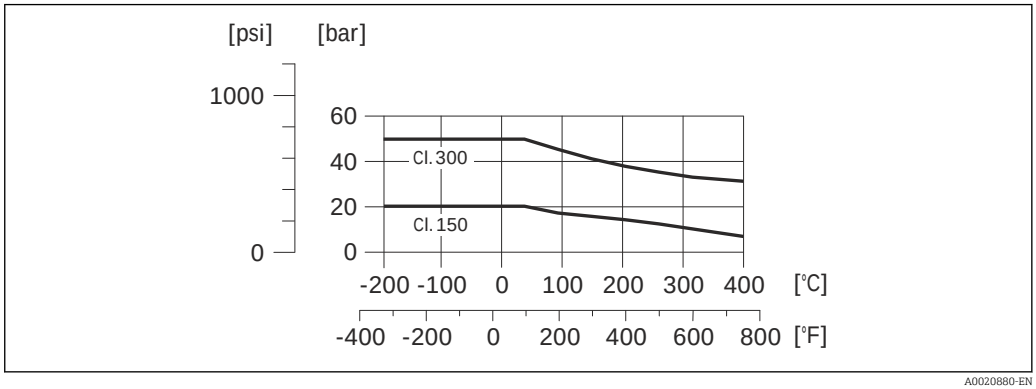
16 Process connection material: stainless steel, multiple certifications, 1.4404 (F316, F316L)

6) Capacitance sensor
7) Aggressive atmosphere (salts or chloride in the air)
8) Aggressive medium (risk of corrosion due to chloride, for example)

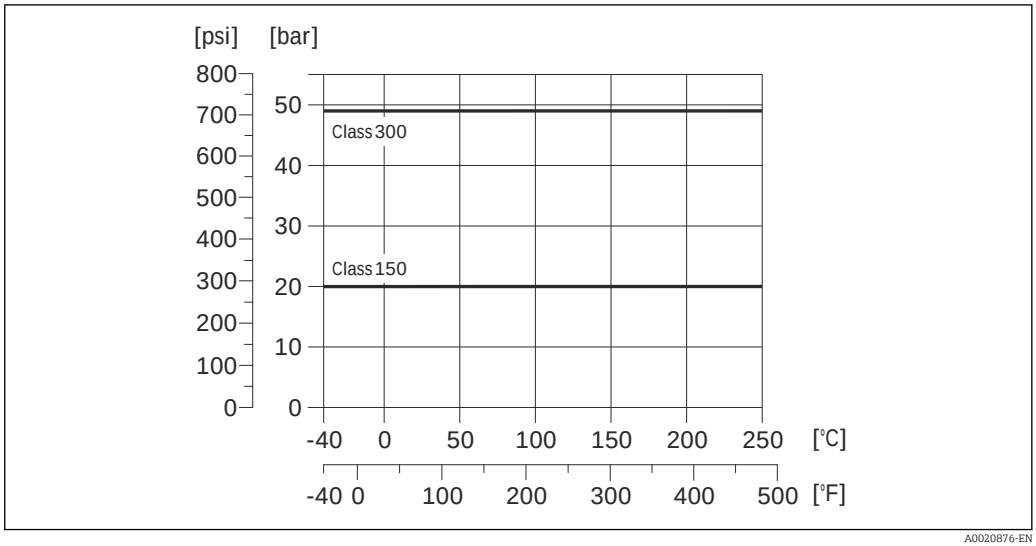


17 *Process connection material: cast alloy CX2MW similar to Alloy C22/2.4602*

Process connection: flange to ASME B16.5

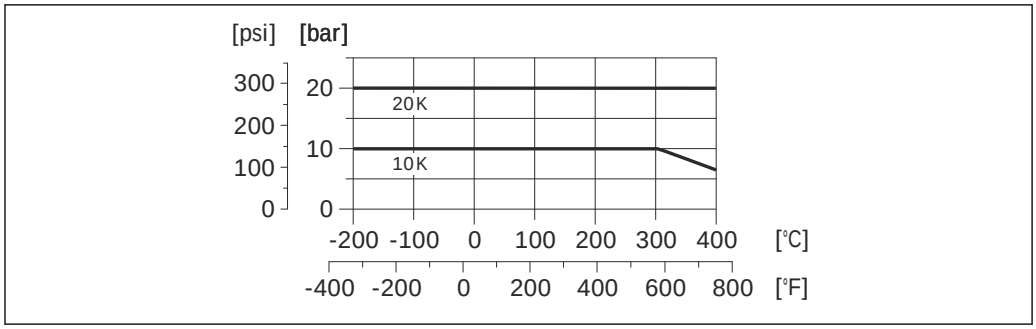


18 *Process connection material: stainless steel, multiple certifications, 1.4404 (F316, F316L)*

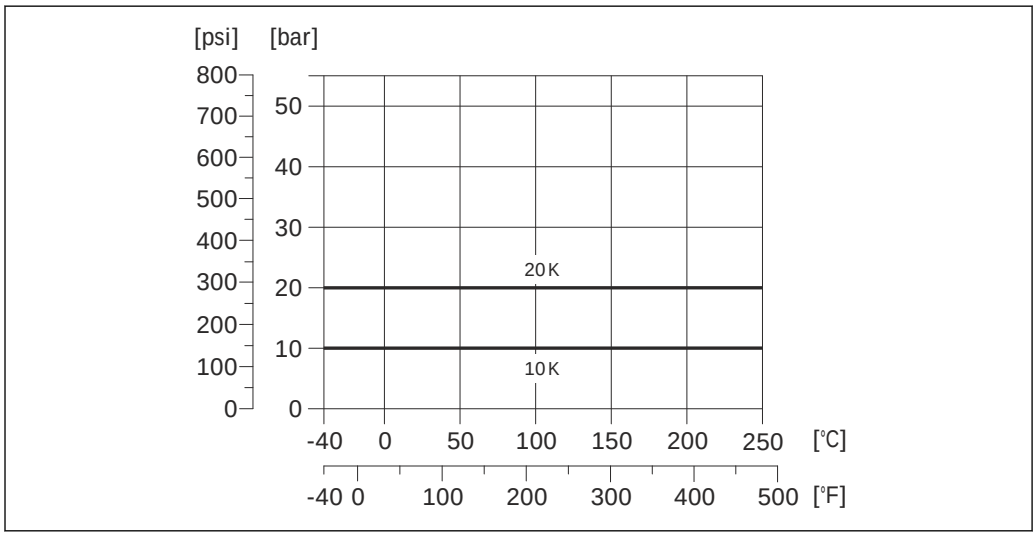


19 *Process connection material: cast alloy CX2MW similar to Alloy C22/2.4602*

Process connection: flange to JIS B2220



20 Process connection material: stainless steel, multiple certifications, 1.4404 (F316, F316L)



21 Process connection material: cast alloy CX2MW similar to Alloy C22/2.4602

Secondary containment pressure rating

The following overpressure resistance values apply to the sensor shaft in the event of a membrane rupture:

Sensor version	Overpressure, sensor shaft in [bar a]
Volume flow, basis	200
Volume flow, high-temperature/low-temperature	200
Mass flow (integrated temperature measurement)	200

Pressure loss

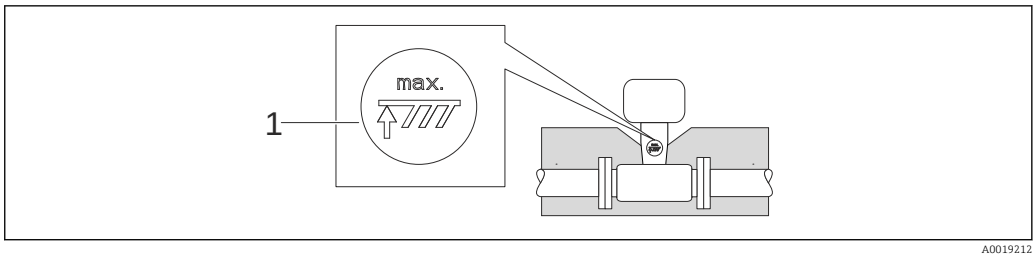
For a precise calculation, use the Applicator→ 94.

Thermal insulation

For optimum temperature measurement and mass calculation, heat transfer at the sensor must be avoided for some fluids. This can be ensured by installing thermal insulation. A wide range of materials can be used for the required insulation.

This applies for:
- Compact version
- Remote sensor version

The maximum insulation height permitted is illustrated in the diagram:



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1 Maximum insulation height

- When insulating, ensure that a sufficiently large area of the housing support remains exposed.

The uncovered part serves as a radiator and protects the electronics from overheating and excessive cooling.

Vibrations

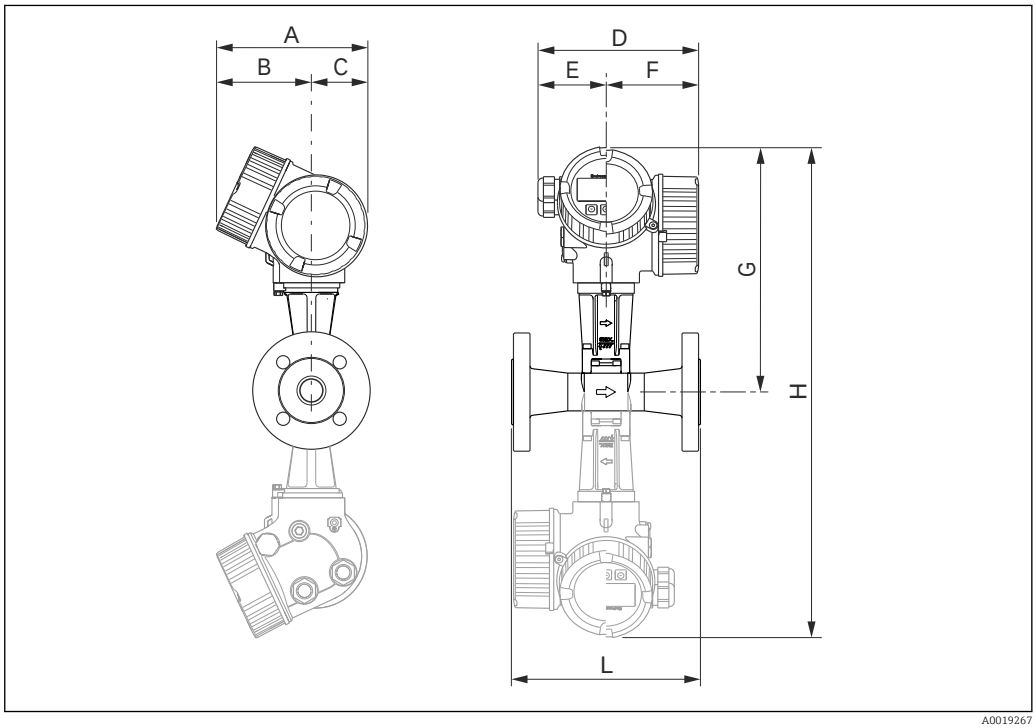
The correct operation of the measuring system is not affected by plant vibrations up to 1 g, 10 to 500 Hz. Therefore no special measures are needed to secure the sensors.

Mechanical construction

Dimensions in SI units

Compact version

Order code for "Housing", option B "GT18 two-chamber, 316L"; option C "GT20 two-chamber, aluminum, coated"



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22 Gray broken line: Dualsens version

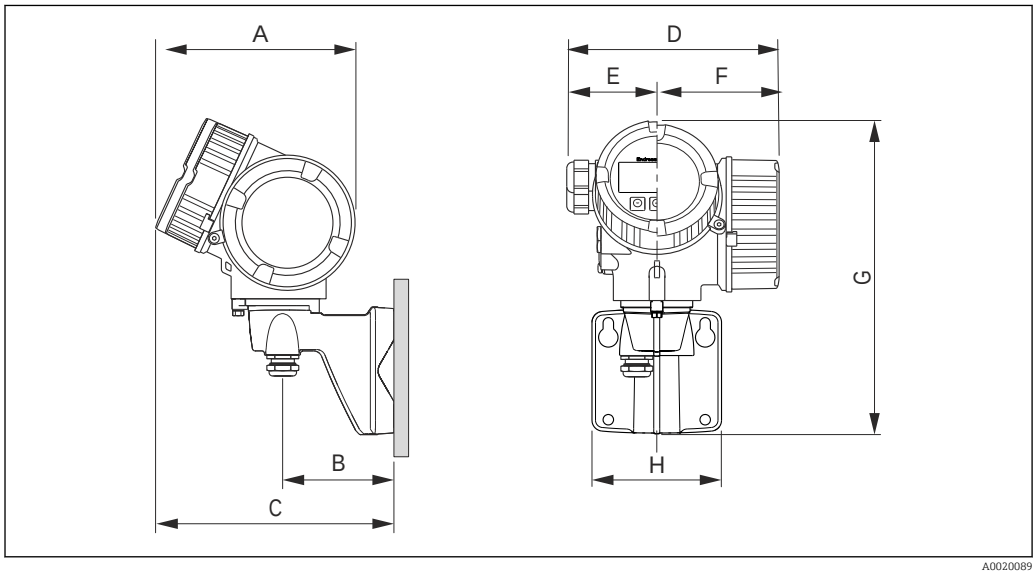
DN [mm]	A [mm]	B [1] [mm]	C [mm]	D [2] [mm]	E [mm]	F [2] [mm]	G [3] [4] [mm]	H [5] [6] [mm]	L [mm]
15	162	102	60	165	75	90	254.0	[7]	[8]
25	162	102	60	165	75	90	260.4	[7]	[8]
40	162	102	60	165	75	90	268.5	537.0	[8]

DN [mm]	A [mm]	B [1] [mm]	C [mm]	D [2] [mm]	E [mm]	F [2] [mm]	G [3] [4] [mm]	H [5] [6] [mm]	L [mm]
50	162	102	60	165	75	90	275.3	550.6	8)
80	162	102	60	165	75	90	288.2	576.4	8)
100	162	102	60	165	75	90	300.1	600.2	8)
150	162	102	60	165	75	90	324.8	649.6	8)
200	162	102	60	165	75	90	353.4	706.8	8)
250	162	102	60	165	75	90	379.3	758.6	8)
300	162	102	60	165	75	90	404.4	808.8	8)

1) For version without local display: values - 7 mm
2) For version with overvoltage protection: values + 8 mm
3) For version without local display: values - 10 mm
4) For high-temperature/low-temperature version: values + 29 mm
5) For version without local display: values - 20 mm
6) For high-temperature/low-temperature version: values + 58 mm
7) Not available as a Dualsens version
8) dependent on respective process connection

Transmitter remote version

Order code for "Housing", option J "GT20, remote, aluminum coated"; option K "GT18 remote, 316L"



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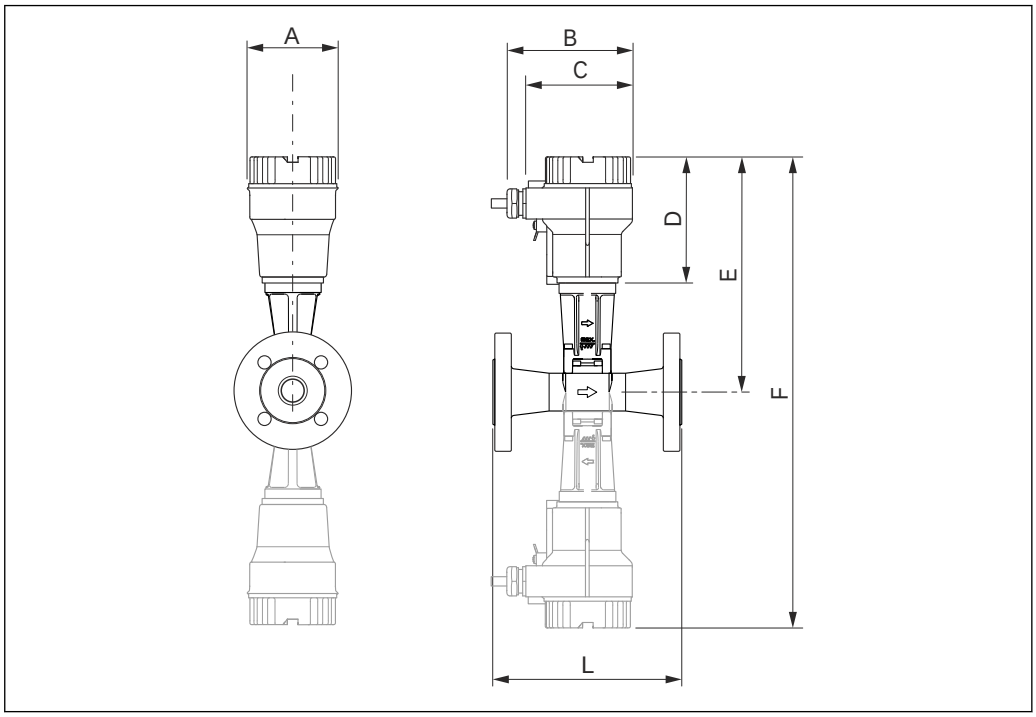
A [1] [mm]	B [mm]	C [1] [mm]	D [2] [mm]	E [mm]	F [2] [mm]	G [3] [mm]	H [mm]
162	90	191	165	75	90	254	107

1) For device version without local display: value − 7 mm
2) For device version with overvoltage protection (OVP): value + 8 mm
3) For device version without local operation: value − 10 mm

Sensor remote version

Order code for "Housing", option J "GT20, remote, aluminum, coated"; option K "GT18, remote, 316L"



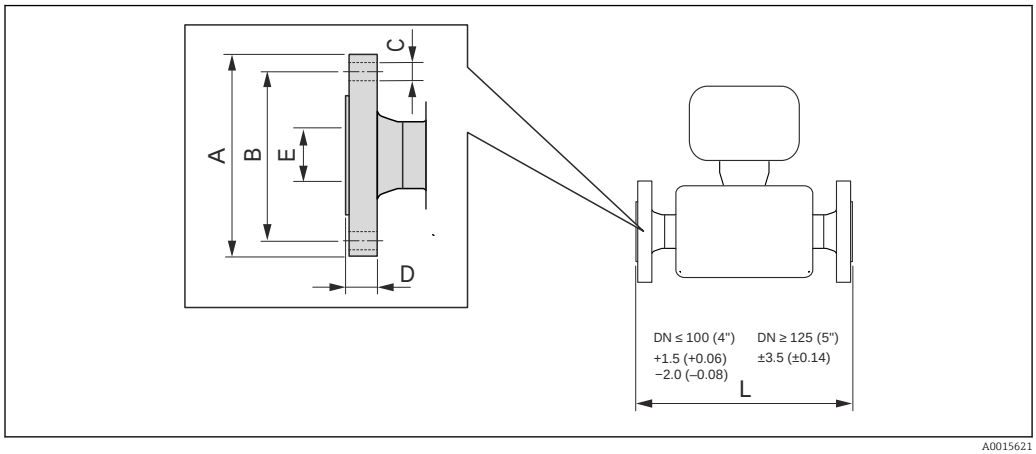
23 Gray broken line: Dualsens version

DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [1] [mm]	F [2] [mm]	L [mm]
15	94.3	134.3	107.3	115.8	224.3	[3]	[4]
25	94.3	134.3	107.3	115.8	230.7	[3]	[4]
40	94.3	134.3	107.3	115.8	238.8	477.6	[4]
50	94.3	134.3	107.3	115.8	245.6	491.2	[4]
80	94.3	134.3	107.3	115.8	258.5	517.0	[4]
100	94.3	134.3	107.3	115.8	270.4	540.8	[4]
150	94.3	134.3	107.3	115.8	295.1	590.2	[4]
200	94.3	134.3	107.3	115.8	323.7	647.4	[4]
250	94.3	134.3	107.3	115.8	349.6	699.2	[4]
300	94.3	134.3	107.3	115.8	374.7	749.4	[4]

1) For high-temperature/low-temperature version: values + 29 mm
2) For high-temperature/low-temperature version: values + 58 mm
3) Not available as a Dualsens version
4) dependent on respective process connection

Flange connections

Fixed flange



24 *Engineering unit mm (in)*

Fixed flange according to EN 1092-1 (DIN 2501): PN 10 1.4408 Order code for "Process connection", option DDS						
DN [mm]	**A [mm]**	**B [mm]**	**Ø C [mm]**	**D [mm]**	**E [mm]**	**L [1] [mm]**
200	340	295	8 × 22	42	207.3	300
250	395	350	12 × 22	48	260.4	380
300	445	400	12 × 22	51	309.7	450
Raised face according to EN 1092-1 Form B1 (DIN 2526 Form C): Ra 6.3 to 12.5 µm						

1) Available in compliance with ISO 13359 on request: for DN 200 to 300 (350 mm for DN 200, 450 mm for DN 250, 500 mm for DN 300).

Fixed flange according to EN 1092-1 (DIN 2501): PN 16 1.4404/CX2MW [1] or 1.4408 [2] Order code for "Process connection", option D1S						
DN [mm]	**A [mm]**	**B [mm]**	**Ø C [mm]**	**D [mm]**	**E [mm]**	**L [3] [4] [mm]**
100	220	180	8 × 18	20	107.1	250
150	285	240	8 × 22	22	159.3	300
200	340	295	12 × 22	42	207.3	300
250	405	355	12 × 26	48	260.4	380
300	460	410	12 × 26	51	309.7	450
Raised face according to EN 1092-1 Form B1 (DIN 2526 Form C): Ra 6.3 to 12.5 µm						

1) DN 15 to 150
2) DN 200 to 300
3) In compliance with ISO 13359 for DN 15 to 150.
4) Available in compliance with ISO 13359 on request: for DN 200 to 300 (350 mm for DN 200, 450 mm for DN 250, 500 mm for DN 300).

Fixed flange according to EN 1092-1 (DIN 2501): PN 16 with groove 1.4404/CX2MW Order code for "Process connection", option D5S						
DN [mm]	A [mm]	B [mm]	Ø C [mm]	D [mm]	E [mm]	L [1] [mm]
100	220	180	8 × 18	20	107.1	250
150	285	240	8 × 22	22	159.3	300
Raised face according to EN 1091-1 Form D (DIN 2512 Form N): Ra 6.3 to 12.5 µm						

1) In compliance with ISO 13359 for DN 15 to 150.

Fixed flange according to EN 1092-1 (DIN 2501): PN 25 1.4408 Order code for "Process connection", option DES						
DN [mm]	A [mm]	B [mm]	Ø C [mm]	D [mm]	E [mm]	L [1] [mm]
200	360	310.0	12 × 26	42	206.5	300
250	425	370	12 × 30	48	258.8	380
300	485	430	16 × 30	51	307.9	450
Raised face according to EN 1092-1 Form B1 (DIN 2526 Form C): Ra 6.3 to 12.5 µm						

1) Available in compliance with ISO 13359 on request: for DN 200 to 300 (for DN 200: 350 mm; for DN 250: 450 mm; for DN 300: 500 mm).

Fixed flange according to EN 1092-1 (DIN 2501): PN 40 1.4404/CX2MW [1] or 1.4408 [2] Order code for "Process connection", option D2S						
DN [mm]	A [mm]	B [mm]	Ø C [mm]	D [mm]	E [mm]	L [3] [4] [mm]
15 [5]	95	65	4 × 14	16	17.3	200
25 [5]	115	85	4 × 14	18	28.5	200
40	150	110	4 × 18	18	43.1	200
50	165	125	4 × 18	20	54.4	200
80	200	160	8 × 18	24	82.5	200
100	235	190	8 × 22	24	107.1	250
150	300	250	8 × 26	28	159.3	300
200	375	320.0	12 × 30	42	206.5	300
250	450	385	12 × 33	48	258.8	380
300	515	450	16 × 33	51	307.9	450
Raised face according to EN 1092-1 Form B1 (DIN 2526 Form C): Ra 6.3 to 12.5 µm						

1) DN 15 to 150
2) DN 200 to 300
3) In compliance with ISO 13359 for DN 15 to 150.
4) Available in compliance with ISO 13359 on request: for DN 200 to 300 (350 mm for DN 200, 450 mm for DN 250, 500 mm for DN 300).
5) Not available as a Dualsens version

Fixed flange according to EN 1092-1 (DIN 2501): PN 40 with groove 1.4404/CX2MW Order code for "Process connection", option D6S						
DN [mm]	A [mm]	B [mm]	Ø C [mm]	D [mm]	E [mm]	L [1) 2)] [mm]
15 [3)]	95	65	4 × 14	16	17.3	200
25 [3)]	115	85	4 × 14	18	28.5	200
40	150	110	4 × 18	18	43.1	200
50	165	125	4 × 18	20	54.4	200
80	200	160	8 × 18	24	82.5	200
100	235	190	8 × 22	24	107.1	250
150	300	250	8 × 26	28	159.3	300
Raised face according to EN 1091-1 Form D (DIN 2512 Form N): Ra 6.3 to 12.5 µm						

1) In compliance with ISO 13359 for DN 15 to 150.
2) Available in compliance with ISO 13359 on request: for DN 200 to 300 (350 mm for DN 200, 450 mm for DN 250, 500 mm for DN 300).
3) Not available as a Dualsens version

Fixed flange according to ASME B16.5: Class 150, Schedule 40 1.4404/CX2MW [1)] or 1.4408 [2)] Order code for "Process connection", option AAS						
DN [mm]	A [mm]	B [mm]	Ø C [mm]	D [mm]	E [mm]	L [mm]
15 [3)]	88.9	60.5	4 × 15.7	11.2	15.7	200
25 [3)]	107.9	79.2	4 × 15.7	15.7	26.7	200
40	127.0	98.6	4 × 15.7	17.5	40.9	200
50	152.4	120.7	4 × 19.1	19.1	52.6	200
80	190.5	152.4	4 × 19.1	23.9	78.0	200
100	228.6	190.5	8 × 19.1	24.5	102.4	250
150	279.4	241.3	8 × 22.4	25.4	154.2	300
200	342.9	298.5	8 × 22.4	42.0	202.7	300
250	406.4	362.0	12 × 25.4	48.0	254.5	380
300	482.6	431.8	12 × 25.4	60.0	304.8	450
Surface roughness: Ra 3.2 to 6.3 µm						

1) DN 15 to 150
2) DN 200 to 300
3) Not available as a Dualsens version

Fixed flange according to ASME B16.5: Class 150, Schedule 80 1.4404/CX2MW Order code for "Process connection", option AFS						
DN [mm]	A [mm]	B [mm]	Ø C [mm]	D [mm]	E [mm]	L [mm]
15 [1)]	88.9	60.5	4 × 15.7	11.2	13.9	200
25	107.9	79.2	4 × 15.7	15.7	24.3	200
40	127.0	98.6	4 × 15.7	17.5	38.1	200
50	152.4	120.7	4 × 19.1	19.1	49.2	200
80	190.5	152.4	4 × 19.1	23.9	73.7	200

Fixed flange according to ASME B16.5: Class 150, Schedule 80 1.4404/CX2MW Order code for "Process connection", option AFS						
DN [mm]	**A [mm]**	**B [mm]**	**Ø C [mm]**	**D [mm]**	**E [mm]**	**L [mm]**
100	228.6	190.5	8 × 19.1	24.5	97.0	250
150	279.4	241.3	8 × 22.4	25.4	146.3	300
Surface roughness: Ra 3.2 to 6.3 µm						

1) Not available as a Dualsens version

Fixed flange according to ASME B16.5: Class 300, Schedule 40 1.4404/CX2MW [1] or 1.4408 [2] Order code for "Process connection", option ABS						
DN [mm]	**A [mm]**	**B [mm]**	**Ø C [mm]**	**D [mm]**	**E [mm]**	**L [mm]**
15 [3]	95.0	66.5	4 × 15.7	14.2	15.7	200
25 [3]	123.8	88.9	4 × 19.1	19.1	26.7	200
40	155.6	114.3	4 × 22.4	20.6	40.9	200
50	165.0	127.0	8 × 19.1	22.4	52.6	200
80	210.0	168.1	8 × 22.4	28.4	78.0	200
100	254.0	200.2	8 × 22.4	31.8	102.4	250
150	317.5	269.7	12 × 22.4	36.6	152.2	300
200	381.0	330.2	12 × 25.4	42.0	202.7	300
250	444.5	387.4	16 × 28.4	48.0	254.5	380
300	520.7	450.9	16 × 31.8	50.8	304.8	450
Surface roughness: Ra 3.2 to 6.3 µm						

1) DN 15 to 150
2) DN 200 to 300
3) Not available as a Dualsens version

Fixed flange according to ASME B16.5: Class 300, Schedule 80 1.4404/CX2MW Order code for "Process connection", option AGS						
DN [mm]	**A [mm]**	**B [mm]**	**Ø C [mm]**	**D [mm]**	**E [mm]**	**L [mm]**
15 [1]	95.0	66.5	4 × 15.7	14.2	13.9	200
25 [1]	123.8	88.9	4 × 19.1	19.1	24.3	200
40	155.6	114.3	4 × 22.4	20.6	38.1	200
50	165.0	127.0	8 × 19.1	22.4	49.2	200
80	210.0	168.1	8 × 22.4	28.4	73.7	200
100	254.0	200.2	8 × 22.4	31.8	97.0	250
150	317.5	269.7	12 × 22.4	36.6	146.3	300
Surface roughness: Ra 3.2 to 6.3 µm						

1) Not available as a Dualsens version

Fixed flange according to JIS B2220: 10K, Schedule 40 1.4404/CX2MW [1] or 1.4408 [2] Order code for "Process connection", option NDS						
DN [mm]	**A [mm]**	**B [mm]**	**Ø C [mm]**	**D [mm]**	**E [mm]**	**L [mm]**
50	155	120	4 × 19	16	52.7	200
80	185	150	8 × 19	18	78.1	200
100	210	195	8 × 19	18	102.3	250
150	280	240	8 × 23	22	151.0	300
200	330	290	12 × 23	42	202.7	300
250	400	355	12 × 25	48	254.5	380
300	445	400	16 × 25	51	304.8	450
Surface roughness: Ra 3.2 to 6.3 µm						

1) DN 15 to 150
2) DN 200 to 300

Fixed flange according to JIS B2220: 10K, Schedule 80 1.4404/CX2MW Order code for "Process connection", option NFS						
DN [mm]	**A [mm]**	**B [mm]**	**Ø C [mm]**	**D [mm]**	**E [mm]**	**L [mm]**
50	155	120	4 × 19	16	49.2	200
80	185	150	8 × 19	18	73.7	200
100	210	195	8 × 19	18	97.0	250
150	280	240	8 × 23	22	146.3	300
Surface roughness: Ra 3.2 to 6.3 µm						

Fixed flange according to JIS B2220: 20K, Schedule 40 1.4404/CX2MW [1] or 1.4408 [2] Order code for "Process connection", option NES						
DN [mm]	**A [mm]**	**B [mm]**	**Ø C [mm]**	**D [mm]**	**E [mm]**	**L [mm]**
15 [3]	95	70	4 × 15	14	16.1	200
25 [3]	125	90	4 × 19	16	27.2	200
40	140	105	4 × 19	18	41.2	200
50	155	120	8 × 19	18	52.7	200
80	200	160	8 × 23	22	78.1	200
100	225	185	8 × 23	24	102.3	250
150	305	260	12 × 25	28	151.0	300
200	350	305	12 × 25	42	202.7	300
250	430	380	12 × 27	48	254.5	380
300	480	430	16 × 27	51	304.8	450
Surface roughness: Ra 3.2 to 6.3 µm						

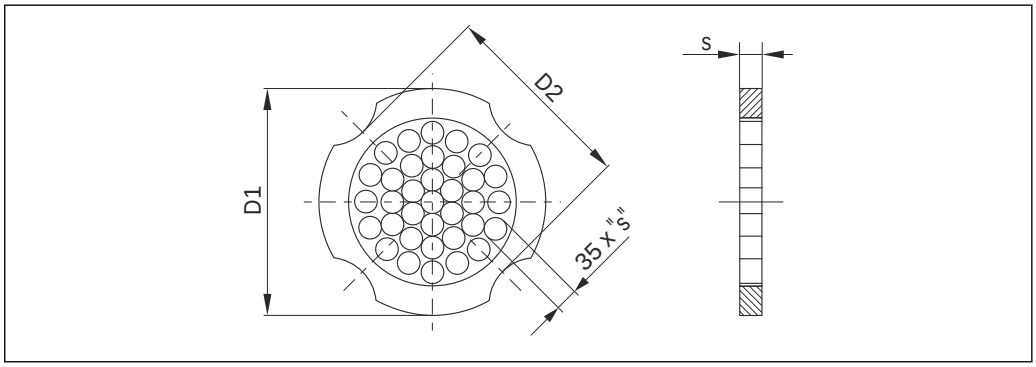
1) DN 15 to 150
2) DN 200 to 300
3) Not available as a Dualsens version

Fixed flange according to JIS B2220: 20K, Schedule 80 1.4404/CX2MW Order code for "Process connection", option NGS						
DN [mm]	**A [mm]**	**B [mm]**	**ø C [mm]**	**D [mm]**	**E [mm]**	**L [mm]**
15 [1]	95	70	4 × 15	14	13.9	200
25 [1]	125	90	4 × 19	16	24.3	200
40	140	105	4 × 19	18	38.1	200
50	155	120	8 × 19	18	49.2	200
80	200	160	8 × 23	22	73.7	200
100	225	185	8 × 23	24	97.0	250
150	305	260	12 × 25	28	146.8	300
Surface roughness: Ra 3.2 to 6.3 µm						

1) Not available as a Dualsens version

Accessories

Flow conditioner



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As per EN 1092-1 (DIN 2501): PN 10 1.4404 (316, 316L) Order code for "Accessory enclosed", option PF			
DN [mm]	**Centering diameter [mm]**	**D1 [1] / D2 [2]**	**s [mm]**
15	54.3	D2	2.0
25	74.3	D1	3.5
40	95.3	D1	5.3
50	110.0	D2	6.8
80	145.3	D2	10.1
100	165.3	D2	13.3
150	221.0	D2	20.0
200	274.0	D1	26.3
250	330.0	D2	33.0
300	380.0	D2	39.6

1) The flow conditioner is fitted at the outer diameter between the bolts.
2) The flow conditioner is fitted at the indentations between the bolts.

As per EN 1092-1 (DIN 2501): PN 16 1.4404 (316, 316L) Order code for "Accessory enclosed", option PF			
DN [mm]	**Centering diameter [mm]**	**D1 [1] / D2 [2]**	**s [mm]**
15	54.3	D2	2.0
25	74.3	D1	3.5
40	95.3	D1	5.3
50	110.0	D2	6.8
80	145.3	D2	10.1
100	165.3	D2	13.3
150	221.0	D2	20.0
200	274.0	D2	26.3
250	330.0	D2	33.0
300	380.0	D2	39.6

1) The flow conditioner is fitted at the outer diameter between the bolts.
2) The flow conditioner is fitted at the indentations between the bolts.

As per EN 1092-1 (DIN 2501): PN 25 1.4404 (316, 316L) Order code for "Accessory enclosed", option PF			
DN [mm]	**Centering diameter [mm]**	**D1 [1] / D2 [2]**	**s [mm]**
15	54.3	D2	2.0
25	74.3	D1	3.5
40	95.3	D1	5.3
50	110.0	D2	6.8
80	145.3	D2	10.1
100	171.3	D1	13.3
150	227.0	D2	20.0
200	280.0	D1	26.3
250	340.0	D1	33.0
300	404.0	D1	39.6

1) The flow conditioner is fitted at the outer diameter between the bolts.
2) The flow conditioner is fitted at the indentations between the bolts.

As per EN 1092-1 (DIN 2501): PN 40 1.4404 (316, 316L) Order code for "Accessory enclosed", option PF			
DN [mm]	**Centering diameter [mm]**	**D1 [1] / D2 [2]**	**s [mm]**
15	54.3	D2	2.0
25	74.3	D1	3.5
40	95.3	D1	5.3
50	110.0	D2	6.8
80	145.3	D2	10.1
100	171.3	D1	13.3

As per EN 1092-1 (DIN 2501): PN 40 1.4404 (316, 316L) Order code for "Accessory enclosed", option PF			
DN [mm]	Centering diameter [mm]	D1 [1] / D2 [2]	s [mm]
150	227.0	D2	20.0
200	294.0	D2	26.3
250	355.0	D2	33.0
300	420.0	D1	39.6

1) The flow conditioner is fitted at the outer diameter between the bolts.
2) The flow conditioner is fitted at the indentations between the bolts.

As per ASME B16.5: Class 150 1.4404 (316, 316L) Order code for "Accessory enclosed", option PF			
DN [mm]	Centering diameter [mm]	D1 [1] / D2 [2]	s [mm]
15	50.1	D1	2.0
25	69.2	D2	3.5
40	88.2	D2	5.3
50	106.6	D2	6.8
80	138.4	D1	10.1
100	176.5	D2	13.3
150	223.5	D1	20.0
200	274.0	D2	26.3
250	340.0	D1	33.0
300	404.0	D1	39.6

1) The flow conditioner is fitted at the outer diameter between the bolts.
2) The flow conditioner is fitted at the indentations between the bolts.

As per ASME B16.5: Class 300 1.4404 (316, 316L) Order code for "Accessory enclosed", option PF			
DN [mm]	Centering diameter [mm]	D1 [1] / D2 [2]	s [mm]
15	56.5	D1	2.0
25	74.3	D1	3.5
40	97.7	D2	5.3
50	113.0	D1	6.8
80	151.3	D1	10.1
100	182.6	D1	13.3
150	252.0	D1	20.0
200	309.0	D1	26.3
250	363.0	D1	33.0
300	402.0	D1	39.6

1) The flow conditioner is fitted at the outer diameter between the bolts.
2) The flow conditioner is fitted at the indentations between the bolts.

As per JIS B2220: 10K 1.4404 (316, 316L) Order code for "Accessory enclosed", option PF			
DN [mm]	**Centering diameter [mm]**	**D1 [1] / D2 [2]**	**s [mm]**
15	60.3	D2	2.0
25	76.3	D2	3.5
40	91.3	D2	5.3
50	106.6	D2	6.8
80	136.3	D2	10.1
100	161.3	D2	13.3
150	221.0	D2	20.0
200	271.0	D2	26.3
250	330.0	D2	33.0
300	380.0	D2	39.6

1) The flow conditioner is fitted at the outer diameter between the bolts.
2) The flow conditioner is fitted at the indentations between the bolts.

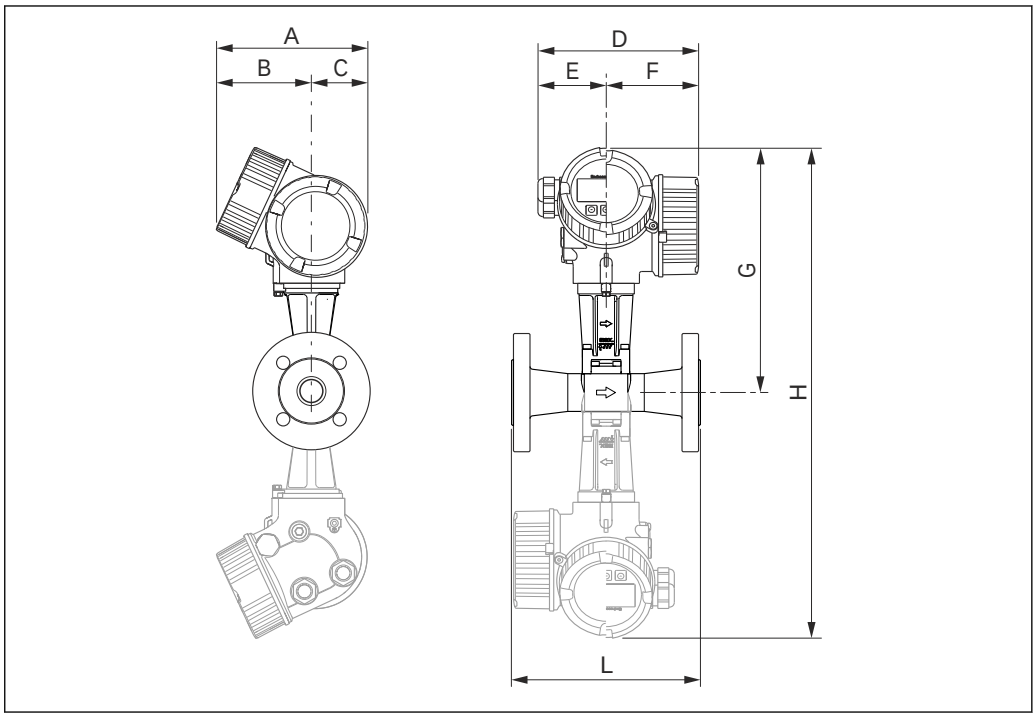
As per JIS B2220: 20K 1.4404 (316, 316L) Order code for "Accessory enclosed", option PF			
DN [mm]	**Centering diameter [mm]**	**D1 [1] / D2 [2]**	**s [mm]**
15	60.3	D2	2.0
25	76.3	D2	3.5
40	91.3	D2	5.3
50	106.6	D2	6.8
80	142.3	D1	10.1
100	167.3	D1	13.3
150	240.0	D1	20.0
200	284.0	D1	26.3
250	355.0	D2	33.0
300	404.0	D1	39.6

1) The flow conditioner is fitted at the outer diameter between the bolts.
2) The flow conditioner is fitted at the indentations between the bolts.

Dimensions in US units

Compact version

Order code for "Housing", option B "GT18 two-chamber, 316L"; option C "GT20 two-chamber, aluminum, coated"



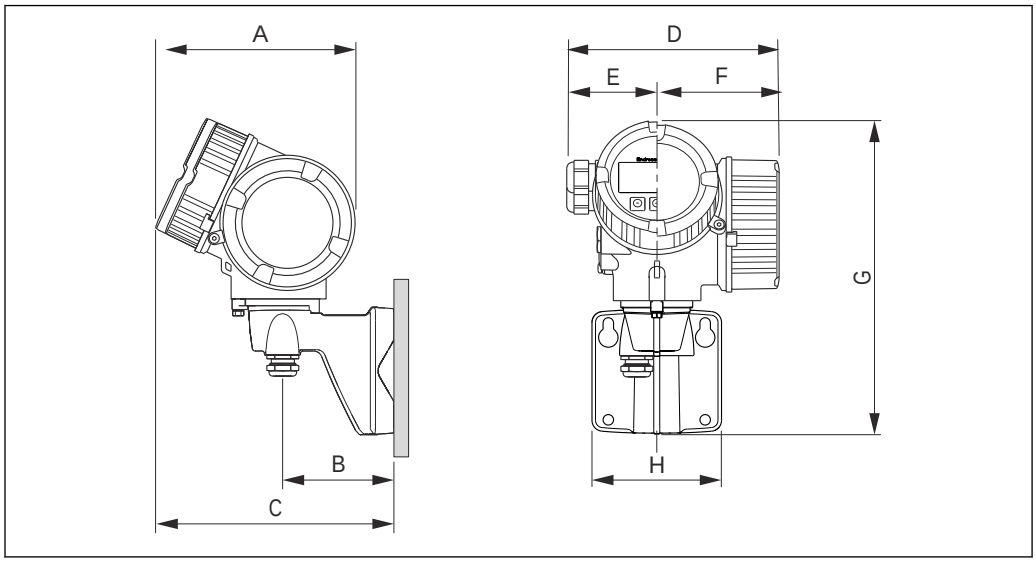
25 *Gray broken line: Dualsens version*

DN [in]	A [in]	B [1] [in]	C [in]	D [2] [in]	E [in]	F [2] [in]	G [3] [4] [in]	H [5] [6] [in]	L [in]
½	6.38	4.02	2.36	6.50	2.95	3.54	10.00	[7]	[8]
1	6.38	4.02	2.36	6.50	2.95	3.54	10.25	[7]	[8]
1½	6.38	4.02	2.36	6.50	2.95	3.54	10.57	21.14	[8]
2	6.38	4.02	2.36	6.50	2.95	3.54	10.84	21.68	[8]
3	6.38	4.02	2.36	6.50	2.95	3.54	11.35	22.69	[8]
4	6.38	4.02	2.36	6.50	2.95	3.54	11.81	23.63	[8]
6	6.38	4.02	2.36	6.50	2.95	3.54	12.79	25.57	[8]
8	6.38	4.02	2.36	6.50	2.95	3.54	13.91	27.63	[8]
10	6.38	4.02	2.36	6.50	2.95	3.54	14.93	29.67	[8]
12	6.38	4.02	2.36	6.50	2.95	3.54	15.92	31.84	[8]

1) For version without local display: values - 0.28 in
2) For version with overvoltage protection: values + 0.31 in
3) For version without local display: values - 0.39 in
4) For high-temperature/low-temperature version: values + 1.14 in
5) For version without local display: values - 0.78 in
6) For high-temperature/low-temperature version: values + 2.28 in
7) Not available as a Dualsens version
8) dependent on respective process connection

Transmitter remote version

Order code for "Housing", option J "GT20, remote, aluminum coated"; option K "GT18 remote, 316L"



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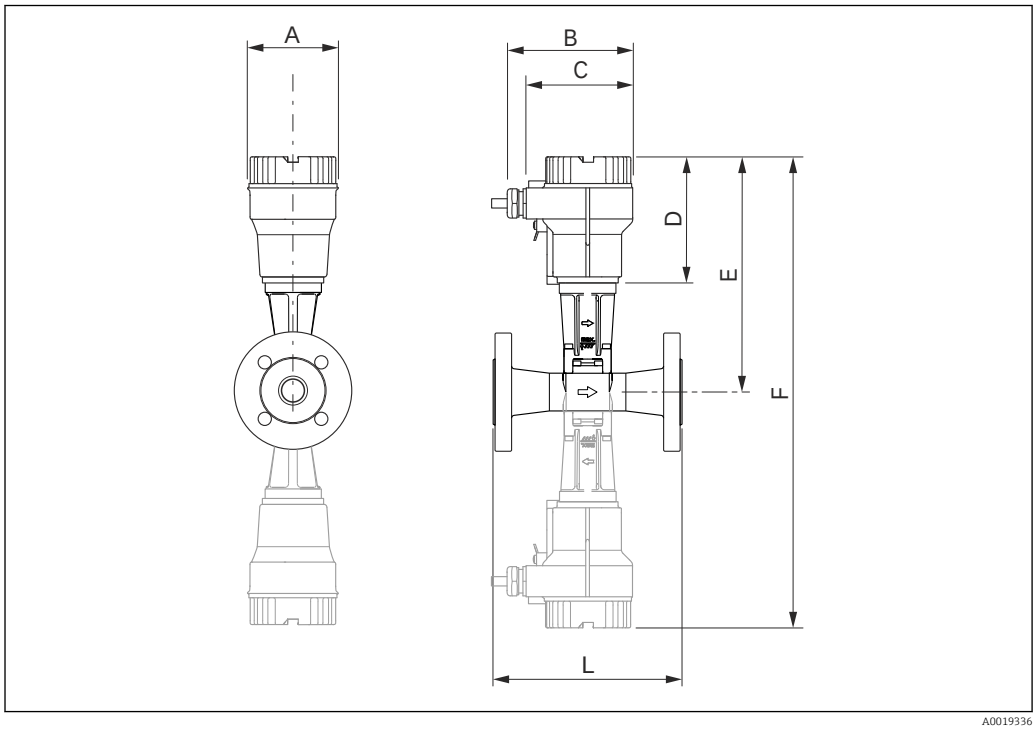
A [1] [in]	B [in]	C [in]	D [2] [in]	E [in]	F [in]	G [3] [in]	H [in]
6.38	3.54	7.52	6.5	2.75	3.54	10.0	4.21

1) For device version without local display: value − 0.28 in
2) For device version with overvoltage protection (OVP): value + 0.31 in
3) For device version without local operation: value − 0.39 in

Sensor remote version

Order code for "Housing", option J "GT20, remote, aluminum, coated"; option K "GT18, remote, 316L"



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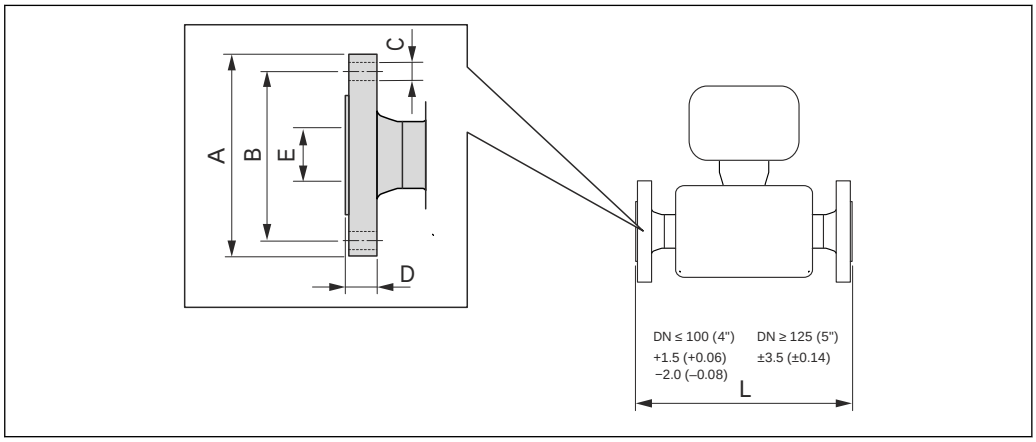
26 Gray broken line: Dualsens version

DN [in]	A [in]	B [in]	C [in]	D [in]	E [1] [in]	F [2] [in]	L [in]
½	3.71	5.29	4.22	4.56	8.83	[3]	[4]
1	3.71	5.29	4.22	4.56	9.08	[3]	[4]
1½	3.71	5.29	4.22	4.56	9.40	18.80	[4]
2	3.71	5.29	4.22	4.56	9.67	19.34	[4]
3	3.71	5.29	4.22	4.56	10.18	20.35	[4]
4	3.71	5.29	4.22	4.56	10.65	21.29	[4]
6	3.71	5.29	4.22	4.56	11.62	23.24	[4]
8	3.71	5.29	4.22	4.56	12.74	25.49	[4]
10	3.71	5.29	4.22	4.56	13.76	27.53	[4]
12	3.71	5.29	4.22	4.56	14.75	29.50	[4]

1) For high-temperature/low-temperature version: values + 1.14 in
2) For high-temperature/low-temperature version: values + 2.28 in
3) Not available as a Dualsens version
4) dependent on respective process connection

Flange connections

Fixed flange



27 *Engineering unit mm (in)*

Fixed flange according to ASME B16.5: Class 150, Schedule 40 F316, F316L/CX2MW [1] or CF3M [2] Order code for "Process connection", option AAS						
DN [in]	A [in]	B [in]	ø C [in]	D [in]	E [in]	L [in]
½ [3]	3.50	2.38	4 × 0.62	0.44	0.62	7.88
1 [3]	4.25	3.12	4 × 0.62	0.62	1.05	7.88
1½	5.00	3.88	4 × 0.62	0.69	1.61	7.88
2	6.00	4.75	4 × 0.75	0.75	2.07	7.88
3	7.51	6.00	4 × 0.75	0.94	3.07	7.88
4	9.01	7.50	8 × 0.75	0.97	4.03	9.85
6	11.01	9.50	8 × 0.88	1.00	6.08	11.82
8	13.51	11.80	8 × 0.88	1.65	7.99	11.82

Fixed flange according to ASME B16.5: Class 150, Schedule 40 F316, F316L/CX2MW [1] or CF3M [2] Order code for "Process connection", option AAS						
DN [in]	A [in]	B [in]	Ø C [in]	D [in]	E [in]	L [in]
10	16.01	14.30	12 × 1	1.89	10.03	14.79
12	19.01	17.00	12 × 1	2.36	12.01	17.73
Surface roughness: Ra 125 to 250µin						

1) DN ½ to 6"
2) DN 8 to 12"
3) Not available as a Dualsens version

Fixed flange according to ASME B16.5: Class 150, Schedule 80 F316, F316L/CX2MW Order code for "Process connection", option AFS						
DN [in]	A [in]	B [in]	Ø C [in]	D [in]	E [in]	L [in]
½ [1]	3.50	2.38	4 × 0.62	0.44	0.55	7.88
1 [1]	4.25	3.12	4 × 0.62	0.62	0.96	7.88
1½	5.00	3.88	4 × 0.62	0.69	1.50	7.88
2	6.00	4.75	4 × 0.75	0.75	1.94	7.88
3	7.51	6	4 × 0.75	0.94	2.90	7.88
4	9.01	7.5	8 × 0.75	0.97	3.82	9.85
6	11.01	9.5	8 × 0.88	1.00	5.76	11.82
Surface roughness: Ra 125 to 250µin						

1) Not available as a Dualsens version

Fixed flange according to ASME B16.5: Class 300, Schedule 40 F316, F316L/CX2MW [1] or CF3M [2] Order code for "Process connection", option ABS						
DN [in]	A [in]	B [in]	Ø C [in]	D [in]	E [in]	L [in]
½ [3]	3.74	2.62	4 × 0.62	0.56	0.62	7.88
1 [3]	4.88	3.5	4 × 0.75	0.75	1.05	7.88
1½	6.13	4.5	4 × 0.88	0.81	1.61	7.88
2	6.50	5	8 × 0.75	0.88	2.07	7.88
3	8.27	6.62	8 × 0.88	1.12	3.07	7.88
4	10.01	7.88	8 × 0.88	1.25	4.03	9.85
6	12.51	10.6	12 × 0.88	1.44	6.08	11.82
8	15.01	13	12 × 1	1.65	7.99	11.82
10	17.51	15.3	16 × 1.12	1.89	10.03	14.79
12	20.52	17.8	16 × 1.25	2	12.01	17.73
Surface roughness: Ra 125 to 250µin						

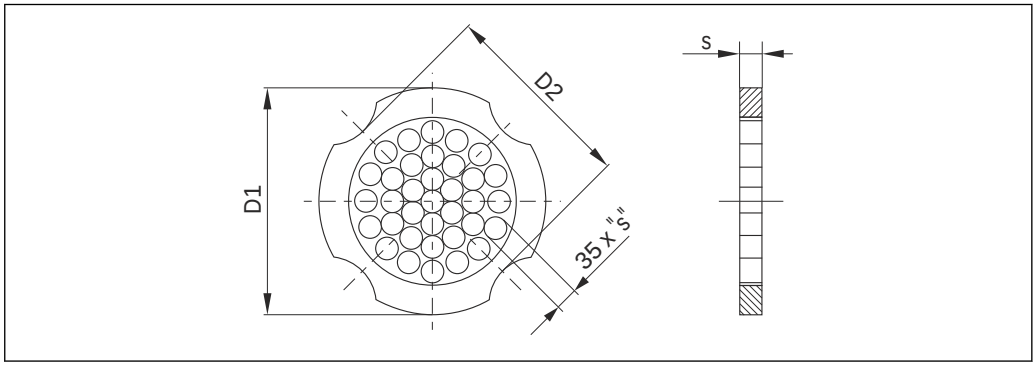
1) DN ½ to 6"
2) DN 8 to 12"
3) Not available as a Dualsens version

Fixed flange according to ASME B16.5: Class 300, Schedule 80 F316, F316L/CX2MW Order code for "Process connection", option AGS						
DN [in]	A [in]	B [in]	ø C [in]	D [in]	E [in]	L [in]
½ 1)	3.74	2.62	4 × 0.62	0.56	0.55	7.88
1 1)	4.88	3.5	4 × 0.75	0.75	0.96	7.88
1½	6.13	4.5	4 × 0.88	0.81	1.50	7.88
2	6.50	5	8 × 0.75	0.88	1.94	7.88
3	8.27	6.62	8 × 0.88	1.12	2.90	7.88
4	10.01	7.88	8 × 0.88	1.25	3.82	9.85
6	12.51	10.6	12 × 0.88	1.44	5.76	11.82
Surface roughness: Ra 125 to 250µin						

1) Not available as a Dualsens version

Accessories

Flow conditioner



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As per ASME B16.5: Class 150 1.4404 (316, 316L) Order code for "Accessory enclosed", option PF			
DN [in]	Centering diameter [in]	D1 1) / D2 2)	s [in]
½	1.97	D1	0.08
1	2.72	D2	0.14
1½	3.47	D2	0.21
2	4.09	D2	0.27
3	5.45	D1	0.40
4	6.95	D2	0.52
6	8.81	D1	0.79
8	10.80	D2	1.04
10	13.40	D1	1.30
12	15.90	D1	1.56

1) The flow conditioner is fitted at the outer diameter between the bolts.
2) The flow conditioner is fitted at the indentations between the bolts.

As per ASME B16.5: Class 300 1.4404 (316, 316L) Order code for "Accessory enclosed", option PF			
DN [in]	**Centering diameter [in]**	**D1 [1] / D2 [2]**	**s [in]**
½	2.22	D1	0.08
1	2.93	D1	0.14
1½	3.85	D2	0.21
2	4.45	D1	0.27
3	5.96	D1	0.40
4	7.19	D1	0.52
6	9.92	D1	0.79
8	12.20	D1	1.04
10	14.30	D1	1.30
12	15.80	D1	1.56

1) The flow conditioner is fitted at the outer diameter between the bolts.
2) The flow conditioner is fitted at the indentations between the bolts.

Weight

Compact version

Weight data:
- Including the transmitter:
  - Order code for *"Housing"*, option C: 1.8 kg (4.0 lb)
  - Order code for *"Housing"*, option B: 4.5 kg (9.9 lb)
- Excluding packaging material

Weight in SI units

All values (weight) refer to devices with EN (DIN), PN 40 flanges. Weight information in [kg].

DN [mm]	Weight [kg]	
	Order code for "Housing", option C Aluminum, AlSi10Mg, coated [1]	Order code for "Housing", option B Stainless steel, 1.4404 (316L) [1]
15	5.1	7.8
25	7.1	9.8
40	9.1	11.8
50	11.1	13.8
80	16.1	18.8
100	21.1	23.8
150	37.1	39.8
200	72.1	74.8
250	111.1	113.8
300	158.1	160.8

1) For high-temperature/low-temperature version: values + 0.2 kg

Weight in US units

All values (weight) refer to devices with ASME B16.5, Class 300/Sch. 40 flanges. Weight information in [lbs].

DN [in]	Weight [lbs]	
	Order code for "Housing", option C Aluminum, AlSi10Mg, coated [1]	Order code for "Housing", option B Stainless steel, 1.4404 (316L) [1]
½	11.3	17.3
1	15.7	21.7
1½	22.4	28.3
2	26.8	32.7
3	42.2	48.1
4	66.5	72.4
6	110.5	116.5
8	167.9	173.8
10	240.6	246.6
12	357.5	363.4

1) For high-temperature/low-temperature version: values + 0.4 lbs

Transmitter remote version

Wall-mount housing

Depends on the material of the wall-mount housing:
- Aluminum, AlSi10Mg, coated: 2.4 kg (5.2 lb)
- Stainless steel, 1.4404 (316L): 6.0 kg (13.2 lb)

Sensor remote version

Weight data:
- Including the connection housing:
  - Aluminum, AlSi10Mg, coated: 0.8 kg (1.8 lb)
  - Stainless cast steel, 1.4408 (CF3M): 2.0 kg (4.4 lb)
- Excluding the connecting cable
- Excluding packaging material

Weight in SI units

All values (weight) refer to devices with EN (DIN), PN 40 flanges. Weight information in [kg].

DN [mm]	Weight [kg]	
	Connection housing Aluminum, AlSi10Mg, coated [1]	Connection housing Stainless cast steel, 1.4408 (CF3M) [1]
15	4.1	5.3
25	6.1	7.3
40	8.1	9.3
50	10.1	11.3
80	15.1	16.3
100	20.1	21.3
150	36.1	37.3
200	71.1	72.3

DN [mm]	Weight [kg]	
	Connection housing Aluminum, AlSi10Mg, coated [1]	Connection housing Stainless cast steel, 1.4408 (CF3M) [1]
250	110.1	111.3
300	157.1	158.3

1) For high-temperature/low-temperature version: values + 0.2 kg

Weight in US units

All values (weight) refer to devices with ASME B16.5, Class 300/Sch. 40 flanges. Weight information in [lbs].

DN [in]	Weight [lbs]	
	Connection housing Aluminum, AlSi10Mg, coated [1]	Connection housing Stainless cast steel, 1.4408 (CF3M) [1]
½	8.9	11.7
1	13.4	16.1
1½	20.0	22.7
2	24.4	27.2
3	39.8	42.6
4	64.1	66.8
6	108.2	110.9
8	165.5	168.3
10	238.2	241.0
12	355.1	357.8

1) For high-temperature/low-temperature version: values + 0.4 lbs

Accessories

Flow conditioner

Weight in SI units

DN [1] [mm]	Pressure rating	Weight [kg]
15	PN 10 to 40	0.04
25	PN 10 to 40	0.1
40	PN 10 to 40	0.3
50	PN 10 to 40	0.5
80	PN 10 to 40	1.4
100	PN 10 to 40	2.4
150	PN 10/16 PN 25/40	6.3 7.8
200	PN 10 PN 16/25 PN 40	11.5 12.3 15.9

DN [1] [mm]	Pressure rating	Weight [kg]
250	PN 10 to 25 PN 40	25.7 27.5
300	PN 10 to 25 PN 40	36.4 44.7

1) EN (DIN)

DN [1] [mm]	Pressure rating	Weight [kg]
15	Class 150 Class 300	0.03 0.04
25	Class 150 Class 300	0.1
40	Class 150 Class 300	0.3
50	Class 150 Class 300	0.5
80	Class 150 Class 300	1.2 1.4
100	Class 150 Class 300	2.7
150	Class 150 Class 300	6.3 7.8
200	Class 150 Class 300	12.3 15.8
250	Class 150 Class 300	25.7 27.5
300	Class 150 Class 300	36.4 44.6

1) ASME

DN [1] [mm]	Pressure rating	Weight [kg]
15	20K	0.06
25	20K	0.1
40	20K	0.3
50	10K 20K	0.5
80	10K 20K	1.1
100	10K 20K	1.80
150	10K 20K	4.5 5.5
200	10K 20K	9.2

DN [1] [mm]	Pressure rating	Weight [kg]
250	10K 20K	15.8 19.1
300	10K 20K	26.5

1) JIS

Weight in US units

DN [1] [in]	Pressure rating	Weight [lbs]
½	Class 150 Class 300	0.07 0.09
1	Class 150 Class 300	0.3
1½	Class 150 Class 300	0.7
2	Class 150 Class 300	1.1
3	Class 150 Class 300	2.6 3.1
4	Class 150 Class 300	6.0
6	Class 150 Class 300	14.0 16.0
8	Class 150 Class 300	27.0 35.0
10	Class 150 Class 300	57.0 61.0
12	Class 150 Class 300	80.0 98.0

1) ASME

Materials

Transmitter housing

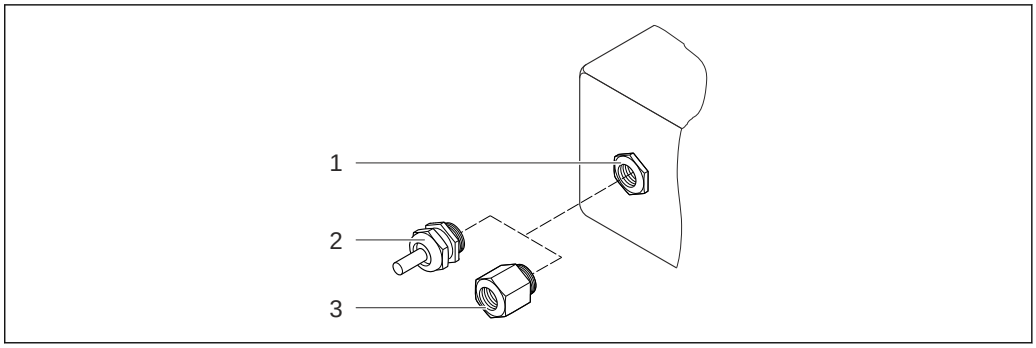
Compact version

- Order code for "Housing", option **B** "Compact, stainless":
  Stainless steel CF-3M (316L, 1.4404)
- Order code for "Housing", option **C** "Compact, aluminum coated":
  Aluminum, AlSi10Mg, coated
- Window material: glass

Remote version

- Order code for "Housing", option **J** "Remote, aluminum coated":
  Aluminum, AlSi10Mg, coated
- Order code for "Housing", option **K** "Remote, stainless":
  For maximum corrosion resistance: stainless steel 1.4404 (316L)
- Window material: glass

Cable entries/cable glands



28 *Possible cable entries/cable glands*

1 *Cable entry in transmitter housing, wall-mount housing or connection housing with internal thread M20 x 1.5*
2 *Cable gland M20 x 1.5*
3 *Adapter for cable entry with internal thread G ½" or NPT ½"*

Order code for "Housing", option B "Compact, stainless", option K "Remote, stainless"

Cable entry/cable gland	Type of protection	Material
Cable gland M20 × 1.5	▪ Non-Ex ▪ Ex ia ▪ Ex ic ▪ Ex nA ▪ Ex tb	Stainless steel ,1.4404
Adapter for cable entry with internal thread G ½"	For non-Ex and Ex (except for CSA Ex d/XP)	Stainless steel, 1.4404 (316L)
Adapter for cable entry with internal thread NPT ½"	For non-Ex and Ex	

Order code for "Housing": option C "Compact, aluminum coated", option J "Remote, aluminum coated"

Cable entry/cable gland	Type of protection	Material
Cable gland M20 × 1.5	▪ Non-Ex ▪ Ex ia ▪ Ex ic	Plastic
	Adapter for cable entry with internal thread G ½"	Nickel-plated brass
Adapter for cable entry with internal thread NPT ½"	For non-Ex and Ex (except for CSA Ex d/XP)	Nickel-plated brass
Thread NPT ½" via adapter	For non-Ex and Ex	

Connecting cable for remote version

- Standard cable: PVC cable with copper shield
- Reinforced cable: PVC cable with copper shield and additional steel wire braided jacket

Sensor connection housing

- Coated aluminum AlSi10Mg
- Stainless cast steel, 1.4408 (CF3M), in compliance with NACE MR0175-2003 and MR0103-2003

Measuring tubes

Pressure ratings up to PN 40, Class 150/300, and JIS 10K/20K:
- Stainless cast steel, 1.4408 (CF3M), in compliance with AD2000 (for AD2000 the temperature range is limited to −10 to +400 °C (+14 to +752 °F)) and in compliance with NACE MR0175-2003 and MR0103-2003
- Order code for *"Sensor option"*, option CE *"Harsh process* [9]*, wetted parts, Alloy C22, (including option CD)"*:
  Cast alloy CX2MW similar to Alloy C22/2.4602, in compliance with NACE MR0175-2003 and MR0103-2003

DSC sensor

Pressure ratings up to PN 40, Class 150/300, and JIS 10K/20K:

Parts in contact with medium (marked as "wet" on the DSC sensor flange):
- Stainless steel, 1.4435 (316, 316L), in compliance with NACE MR0175-2003 and MR0103-2003
- Order code for *"Sensor option"*, option CE *"Harsh process* [9]*, wetted parts, Alloy C22, (including option CD)"*:
  UNS N06022 similar to Alloy C22/2.4602, in compliance with NACE MR0175-2003 and MR0103-2003

Parts not in contact with medium:
- Stainless steel 1.4301 (304)
- Order code for *"Sensor option"*, option CD *"Harsh environment* [10]*, DSC sensor sensor components Alloy C22"*:
  Alloy C22 sensor: UNS N06022 similar to Alloy C22/2.4602, in compliance with NACE MR0175-2003 and MR0103-2003

Process connections

Pressure ratings up to PN 40, Class 150/300, and JIS 10K/20K:

Welding neck flanges DN 15 to 150 (½ to 6"), in compliance with NACE MR0175-2003 and MR0103-2003

The following materials are available depending on the pressure rating:
- Stainless steel, multiple certifications, 1.4404 (F316, F316L)
- Cast alloy CX2MW similar to Alloy C22/2.4602

DN 200 to 300 (8 to 12"):
Stainless cast steel, 1.4408 (CF3M)

List of all available process connections → 83

Seals

- Graphite (standard)
  Sigraflex Hochdruck™ with smooth sheet metal insert made of stainless steel, 316/316L (BAM-certified for oxygen applications, "high quality in terms of TA Luft" (German Clean Air Act))
- FPM (Viton)
- Kalrez 6375
- Gylon 3504 (BAM-certified for oxygen applications, "high quality in terms of TA Luft (German Clean Air Act"))

Housing support

Stainless steel, 1.4408 (CF3M)

Accessories

Weather protection cover

Stainless steel 1.4404 (316L)

9) Aggressive medium (risk of corrosion due to chloride, for example)
10) Aggressive atmosphere (salts or chloride in the air)

Flow conditioner

Stainless steel, multiple certifications, 1.4404 (316, 316L), in compliance with NACE MR0175-2003 and MR0103-2003

Process connections

- EN 1092-1 (DIN 2501)
- ASME B16.5
- JIS B2220

For information on the different materials used in the process connections → 82

Operability

Operating concept

Operator-oriented menu structure for user-specific tasks
- Commissioning
- Operation
- Diagnostics
- Expert level

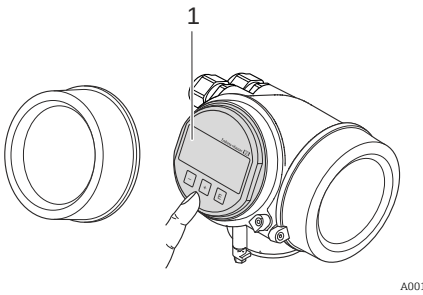
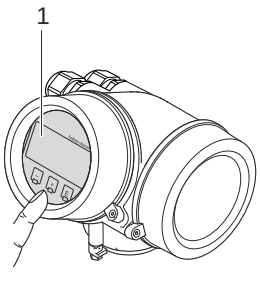
Quick and safe commissioning
- Guided menus ("Make-it-run" wizards) for applications
- Menu guidance with brief explanations of the individual parameter functions

Reliable operation
- Operation in the following languages:
  - Via local display:
    English, German, French, Spanish, Italian, Dutch, Portuguese, Polish, Russian, Swedish, Turkish, Chinese, Japanese, Korean, Bahasa (Indonesian), Vietnamese, Czech
  - Via "FieldCare" operating tool:
    English, German, French, Spanish, Italian, Chinese, Japanese
- Uniform operating philosophy applied to device and operating tools
- If replacing the electronic module, transfer the device configuration via the integrated memory (integrated HistoROM) which contains the process and measuring device data and the event logbook. No need to reconfigure.

Efficient diagnostics increase measurement availability
- Troubleshooting measures can be called up via the device and in the operating tools
- Diverse simulation options, logbook for events that occur and optional line recorder functions

Local operation

Via display module

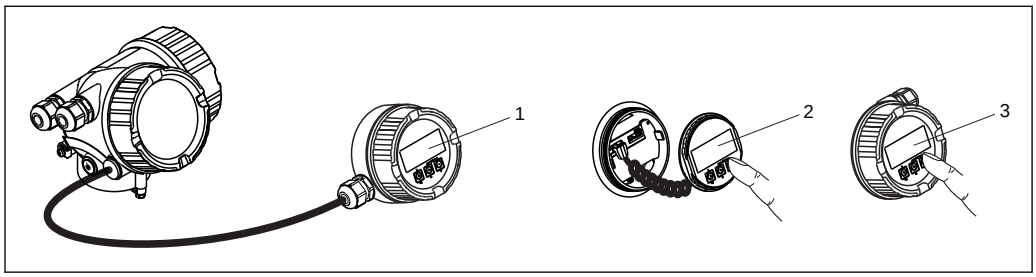
Order code for "Display; Operation", option **C** "SD02"	Order code for "Display; Operation", option **E** "SD03"
	
1 Operation with pushbuttons	*1 Operation with touch control*

Display elements
- 4-line display
- With order code for "Display; operation", option **E**:
  White background lighting; switches to red in event of device errors
- Format for displaying measured variables and status variables can be individually configured
- Permitted ambient temperature for the display: –20 to +60 °C (–4 to +140 °F)
  The readability of the display may be impaired at temperatures outside the temperature range.

Operating elements
- With order code for "Display; operation", option **C**:
  Local operation with 3 push buttons: ⊕, ⊖, ⓔ
- With order code for "Display; operation", option **E**:
  External operation via touch control; 3 optical keys: ⊕, ⊖, ⓔ
- Operating elements also accessible in various hazardous areas

Additional functionality
- Data backup function
  The device configuration can be saved in the display module.
- Data comparison function
  The device configuration saved in the display module can be compared to the current device configuration.
- Data transfer function
  The transmitter configuration can be transmitted to another device using the display module.

Via remote display and operating module FHX50



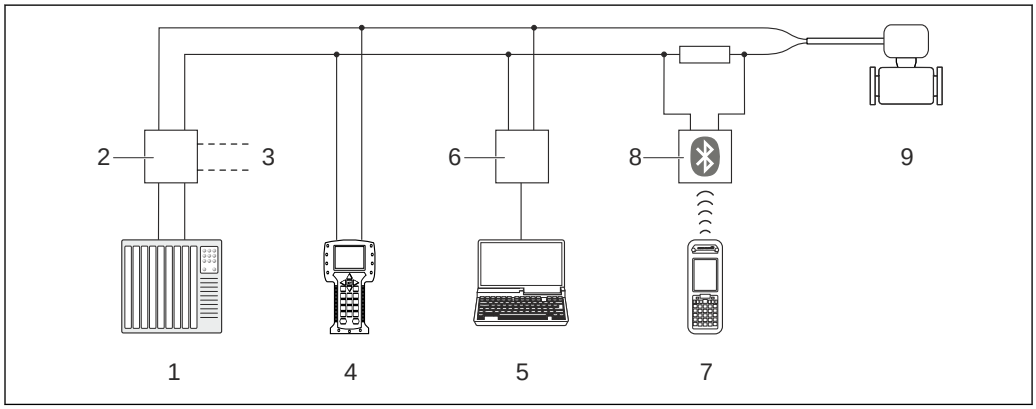
29 Operating options via FHX50

1 Housing of remote display and operating module FHX50
2 SD02 display and operating module, push buttons: cover must be opened for operation
3 SD03 display and operating module, optical buttons: operation possible through cover glass

Remote operation

Via HART protocol

This communication interface is available in device versions with a HART output.

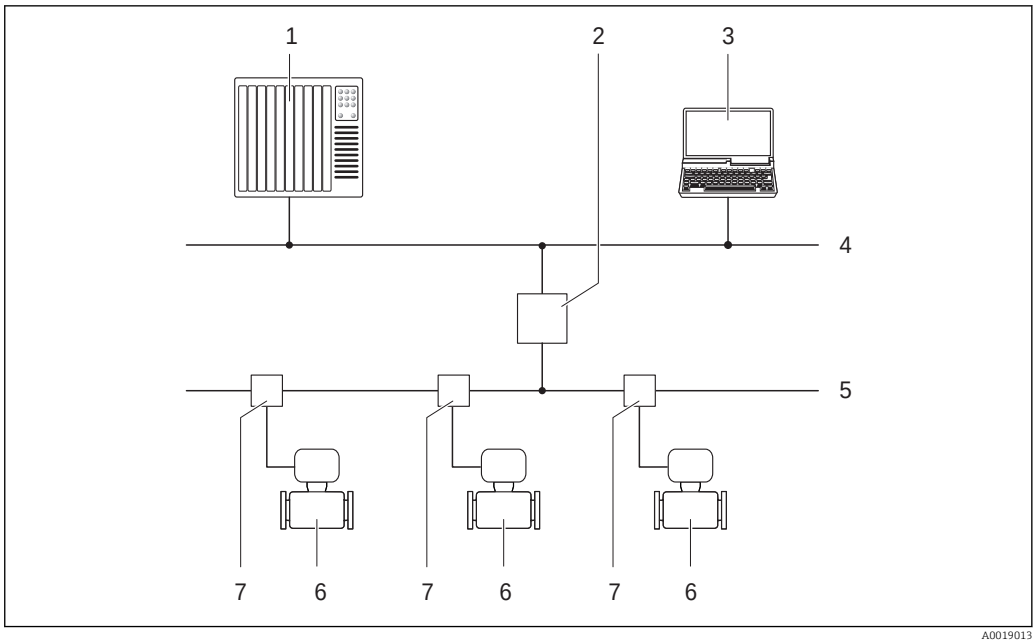


30 Options for remote operation via HART protocol

1 Control system (e.g. PLC)
2 Transmitter power supply unit, e.g. RN221N (with communication resistor)
3 Connection for Commubox FXA195 and Field Communicator 475
4 Field Communicator 475
5 Computer with operating tool (e.g. FieldCare, AMS Device Manager, SIMATIC PDM)
6 Commubox FXA195 (USB)
7 Field Xpert SFX350 or SFX370
8 VIATOR Bluetooth modem with connecting cable
9 Transmitter

Via PROFIBUS PA network

This communication interface is available in device versions with PROFIBUS PA.

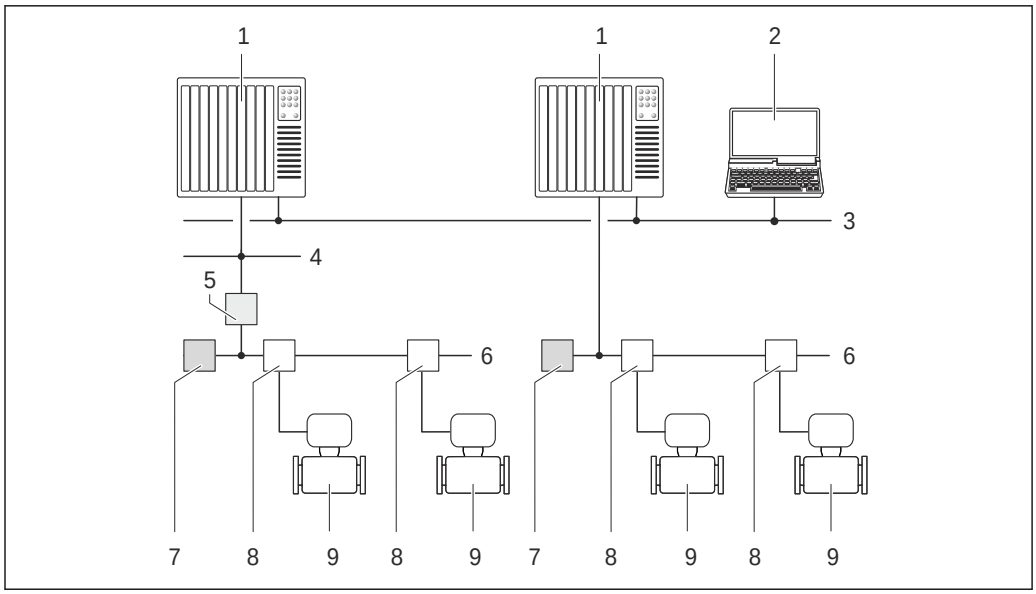


31 Options for remote operation via PROFIBUS PA network

1 Automation system
2 Segment coupler PROFIBUS DP/PA
3 Computer with PROFIBUS network card
4 PROFIBUS DP network
5 PROFIBUS PA network
6 Measuring device
7 T-box

Via FOUNDATION Fieldbus network

This communication interface is available in device versions with FOUNDATION Fieldbus.

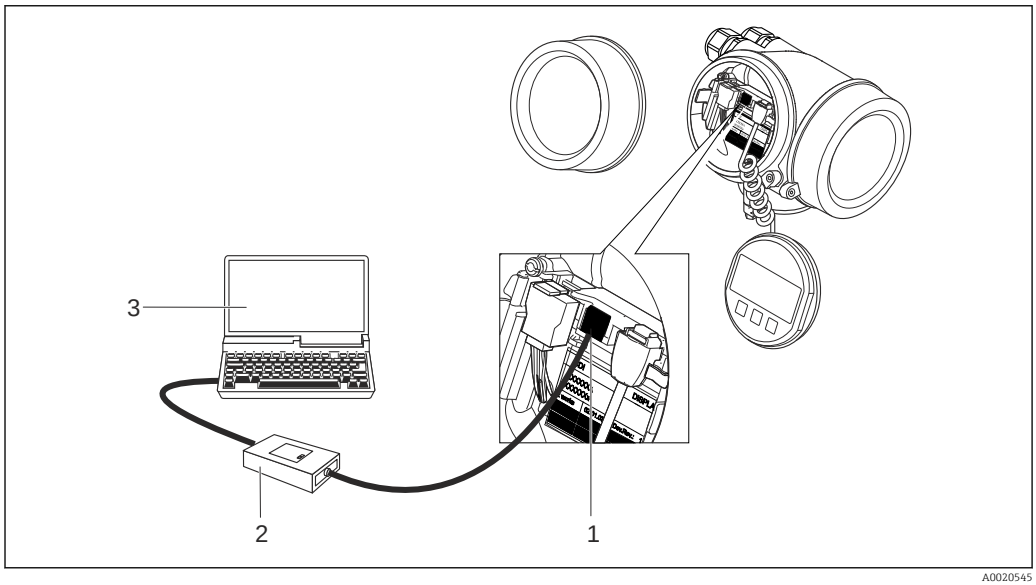


32 *Options for remote operation via FOUNDATION Fieldbus network*

1 Automation system
2 Computer with FOUNDATION Fieldbus network card
3 Industry network
4 High Speed Ethernet FF-HSE network
5 Segment coupler FF-HSE/FF-H1
6 FOUNDATION Fieldbus FF-H1 network
7 Power supply FF-H1 network
8 T-box
9 Measuring device

Service interface

Via service interface (CDI)



1 Service interface (CDI = Endress+Hauser Common Data Interface) of the measuring device
2 Commubox FXA291
3 Computer with "FieldCare" operating tool with COM DTM "CDI Communication FXA291"

Certificates and approvals

CE mark

The measuring system is in conformity with the statutory requirements of the applicable EC Directives. These are listed in the corresponding EC Declaration of Conformity along with the standards applied.

Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.

C-Tick symbol

The measuring system meets the EMC requirements of the "Australian Communications and Media Authority (ACMA)".

Ex approval

The measuring device is certified for use in hazardous areas and the relevant safety instructions are provided in the separate "Safety Instructions" (XA) document. Reference is made to this document on the nameplate.

The separate Ex documentation (XA) containing all the relevant explosion protection data is available from your Endress+Hauser sales center.

ATEX, IECEx

Currently, the following versions for use in hazardous areas are available:

Ex d

Category	Type of protection
II2G/Zone 1	Ex d[ia] IIC T6...T1
II1/2G/Zone 0/1	Ex d[ia] IIC T6...T1

Ex ia

Category	Type of protection
II2G/Zone 1	Ex ia IIC T6...T1
II1G/Zone 0	Ex ia IIC T6...T1
II1/2G/Zone 0/1	Ex ia IIC T6...T1

Ex ic

Category	Type of protection
II3G/Zone 2	Ex ic IIC T6...T1
II1/3G/Zone 0/2	Ex ic[ia] IIC T6...T1

Ex nA

Category	Type of protection
II3G/Zone 2	Ex nA IIC T6...T1

Ex tb

Category	Type of protection
II2D/Zone 21	Ex tb IIIC Txxx

cCSAus

Currently, the following versions for use in hazardous areas are available:

XP

Category	Type of protection
Class I, II, III Division 1 Groups A-G	XP (Ex d Flameproof version)

IS

Category	Type of protection
Class I, II, III Division 1 Groups A-G	IS (Ex i Intrinsically safe version)

NI

Category	Type of protection
Class I Division 2 Groups ABCD	NI (Non-incentive version), NIFW-Parameter*

*= Entity- und NIFW-Parameter gemäß Control Drawings

NEPSI

Currently, the following versions for use in hazardous areas are available:

Ex d

Category	Type of protection
Zone 1	Ex d[ia] IIC T1 ~ T6 Ex d[ia Ga] IIC T1 ~ T6
Zone 0/1	Ex d[ia] IIC T1 ~ T6 DIP A21 Ex d[ia Ga] IIC T1 ~ T6 DIP A21

Ex ia

Category	Type of protection
Zone 1	Ex ia IIC T1 ~ T6
Zone 0/1	Ex ia IIC T1 ~ T6 DIP A21

Ex ic

Category	Type of protection
II3G/Zone 2	Ex ic IIC T1 ~ T6
II1/3G/Zone 0/2	Ex ic[ia Ga] IIC T1 ~ T6

Ex nA

Category	Type of protection
Zone 2	Ex nA IIC T1 ~ T6 Ex nA[ia Ga] IIC T1 ~ T6

INMETRO

Currently, the following versions for use in hazardous areas are available:

Ex d

Category	Type of protection
–	Ex d[ia] IIC T6...T1

Ex ia

Category	Type of protection
–	Ex ia IIC T6...T1

Ex nA

Category	Type of protection
–	Ex nA IIC T6...T1 Ex nA|ia Ga| IIC T6...T1

Functional safety

The measuring device can be used for flow monitoring systems (min., max., range) up to SIL 2 (single-channel architecture) and SIL 3 (multichannel architecture with homogeneous redundancy) and is independently evaluated and certified by the TÜV in accordance with IEC 61508.

The following types of monitoring in safety equipment are possible:
Volume flow

Functional Safety Manual with information on the SIL device → 96

HART certification

HART interface

The measuring device is certified and registered by the FieldComm Group. The measuring system meets all the requirements of the following specifications:
- Certified according to HART 7
- The device can also be operated with certified devices of other manufacturers (interoperability)

FOUNDATION Fieldbus certification

FOUNDATION Fieldbus interface

The measuring device is certified and registered by the FieldComm Group. The measuring system meets all the requirements of the following specifications:
- Certified in accordance with FOUNDATION Fieldbus H1
- Interoperability Test Kit (ITK), revision version 6.1.1 (certificate available on request)
- Physical Layer Conformance Test
- The device can also be operated with certified devices of other manufacturers (interoperability)

Certification PROFIBUS

PROFIBUS interface

The measuring device is certified and registered by the PROFIBUS User Organization (PNO). The measuring system meets all the requirements of the following specifications:
- Certified in accordance with PROFIBUS PA Profile 3.02
- The device can also be operated with certified devices of other manufacturers (interoperability)

Pressure Equipment Directive

- With the PED/G1/x (x = category) marking on the sensor nameplate, Endress+Hauser confirms compliance with the "Essential Safety Requirements" specified in Annex I of the Pressure Equipment Directive 97/23/EC.
- Devices bearing this marking (PED) are suitable for the following types of medium:
  Media in Group 1 and 2 with a vapor pressure greater than, or smaller and equal to0.5 bar (7.3 psi)
- Devices not bearing this marking (PED) are designed and manufactured according to good engineering practice. They meet the requirements of Art.3 Section 3 of the Pressure Equipment Directive 97/23/EC. The range of application is indicated in tables 6 to 9 in Annex II of the Pressure Equipment Directive.

Experience

The Prowirl 200 measuring system is the official successor to Prowirl 72 and Prowirl 73.

Other standards and guidelines

- EN 60529
  Degrees of protection provided by enclosures (IP code)
- DIN ISO 13359
  Measurement of conductive liquid flow in closed conduits - Flanged-type electromagnetic flowmeters - Overall length
- EN 61010-1
  Safety requirements for electrical equipment for measurement, control and laboratory use - general requirements

- IEC/EN 61326
  Emission in accordance with Class A requirements. Electromagnetic compatibility (EMC requirements).
- NAMUR NE 21
  Electromagnetic compatibility (EMC) of industrial process and laboratory control equipment
- NAMUR NE 32
  Data retention in the event of a power failure in field and control instruments with microprocessors
- NAMUR NE 43
  Standardization of the signal level for the breakdown information of digital transmitters with analog output signal.
- NAMUR NE 53
  Software of field devices and signal-processing devices with digital electronics
- NAMUR NE 105
  Specifications for integrating fieldbus devices in engineering tools for field devices
- NAMUR NE 107
  Self-monitoring and diagnosis of field devices
- NAMUR NE 131
  Requirements for field devices for standard applications
- ASME BPVC Section VIII, Division 1
  Rules for Construction of Pressure Vessels

Ordering information

Detailed ordering information is available from the following sources:
- In the Product Configurator on the Endress+Hauser website: www.endress.com → Select your country → Products → Select measuring technology, software or components → Select the product (picklists: measurement method, product family etc.) → Device support (right-hand column): Configure the selected product → The Product Configurator for the selected product opens.
- From your Endress+Hauser Sales Center: www.addresses.endress.com

Product Configurator - the tool for individual product configuration
- Up-to-the-minute configuration data
- Depending on the device: Direct input of measuring point-specific information such as measuring range or operating language
- Automatic verification of exclusion criteria
- Automatic creation of the order code and its breakdown in PDF or Excel output format
- Ability to order directly in the Endress+Hauser Online Shop

Application packages

Many different application packages are available to enhance the functionality of the device. Such packages might be needed to address safety aspects or specific application requirements.

The application packages can be ordered with the device or subsequently from Endress+Hauser. Detailed information on the order code in question is available from your local Endress+Hauser sales center or on the product page of the Endress+Hauser website: www.endress.com.

Detailed information on the application packages:
- Special Documentation for the device → 96
- Special Documentation for the device

Diagnostics functions

Package	Description
HistoROM extended function	Comprises extended functions concerning the event log and the activation of the measured value memory. Event log: Memory volume is extended from 20 message entries (basic version) to up to 100 entries. Data logging (line recorder): ▪ Memory capacity for up to 1000 measured values is activated. ▪ 250 measured values can be output via each of the 4 memory channels. The recording interval can be defined and configured by the user. ▪ Data logging is visualized via the local display or FieldCare.

Heartbeat Technology

Package	Description
Heartbeat Verification	**Heartbeat Verification** Meets the requirement for traceable verification to DIN ISO 9001:2008 Chapter 7.6 a) "Control of monitoring and measuring equipment". ▪ Functional testing in the installed state without interrupting the process. ▪ Traceable verification results on request, including a report. ▪ Simple testing process via local operation or other operating interfaces. ▪ Clear measuring point assessment (pass/fail) with high test coverage within the framework of manufacturer specifications. ▪ Extension of calibration intervals according to operator's risk assessment.

Air and industrial gases

Package	Description
Air and industrial gases	This application package enables users to calculate the density and energy of air and industrial gases. The calculations are based on time-tested standard calculation methods. It is possible to automatically compensate for the effect of pressure and temperature via an external or constant value. With this application package it is possible to output the energy flow, standard volume flow and mass flow of the following fluids: ▪ Air ▪ Single gas ▪ Gas mixture ▪ User-specific gas

Natural gas

Package	Description
Natural gas	This application package enables users to calculate the chemical properties (gross calorific value, net calorific value) of natural gases. The calculations are based on time-tested standard calculation methods. It is possible to automatically compensate for the effect of pressure and temperature via an external or constant value. With this application package it is possible to output the energy flow, standard volume flow and mass flow based on the following standard methods: Energy can be calculated based on the following standards: ▪ AGA5 ▪ ISO 6976 ▪ GPA 2172 Density can be calculated based on the following standards: ▪ ISO 12213-2 (AGA8-DC92) ▪ ISO 12213-3 ▪ AGA NX19 ▪ AGA8 Gross 1 ▪ SGERG 88

Wet steam detection

Package	Description
Wet steam detection	Wet steam detection provides a qualitative parameter for monitoring the steam application. It is an additional indicator for checking steam quality. A warning is displayed as soon as the steam quality drops below x = 0.80 (80%). ▪ Additional quality parameter for ensuring a safe and efficient steam process ▪ Additional indicator to monitor the operation of steam traps

Wet steam measurement

Package	Description
Wet steam measurement	Innovative measurement of the steam quality and degree of overheating. The wet steam detection application package extends wet steam measurement to include the continuous display of the steam quality. The steam quality is used to calculate the correct volume flow and mass flow and can be assigned to outputs. The condensate amount can be displayed. By evaluating the data, deviations in the process can be quickly detected. ▪ As the warning values can be freely defined, users have optimum control of the steam process. ▪ Additional quality parameter for ensuring a safe and efficient steam process. ▪ Additional indicator to monitor the operation of steam traps. ▪ Combined with active pressure compensation, the device guarantees correct steam measurement. ▪ Automatic calculation of the steam state and correct measurement of the steam amount. ▪ Automatic navigation through the steam areas (wet steam, saturated steam and superheated steam).

Accessories

Various accessories, which can be ordered with the device or subsequently from Endress+Hauser, are available for the device. Detailed information on the order code in question is available from your local Endress+Hauser sales center or on the product page of the Endress+Hauser website: www.endress.com.

Device-specific accessories

For the transmitter

Accessories	Description
Prowirl 200 transmitter	Transmitter for replacement or storage. Use the order code to define the following specifications: ▪ Approvals ▪ Output ▪ Display / operation ▪ Housing ▪ Software For details, see Installation Instructions EA01056D

Remote display FHX50	FHX50 housing for accommodating a display module → 🖹 84. ▪ FHX50 housing suitable for: – SD02 display module (push buttons) – SD03 display module (touch control) ▪ Housing material: – Plastic PBT – Stainless steel CF-3M (316L, 1.4404) ▪ Length of connecting cable: up to max. 60 m (196 ft) (cable lengths available for order: 5 m (16 ft), 10 m (32 ft), 20 m (65 ft), 30 m (98 ft)) The measuring device can be ordered with the FHX50 housing and a display module. The following options must be selected in the separate order codes: ▪ Order code for measuring device, feature 030: Option L or M "Prepared for FHX50 display" ▪ Order code for FHX50 housing, feature 050 (device version): Option A "Prepared for FHX50 display" ▪ Order code for FHX50 housing, depends on the desired display module in feature 020 (display, operation): – Option C: for an SD02 display module (push buttons) – Option E: for an SD03 display module (touch control) The FHX50 housing can also be ordered as a retrofit kit. The measuring device display module is used in the FHX50 housing. The following options must be selected in the order code for the FHX50 housing: ▪ Feature 050 (measuring device version): option B "Not prepared for FHX50 display" ▪ Feature 020 (display, operation): option A "None, existing displayed used" For details, see Special Documentation SD01007F (Order number: FHX50)
Overvoltage protection for 2-wire devices	Ideally, the overvoltage protection module should be ordered directly with the device. See product structure, characteristic 610 "Accessory mounted", option NA "Overvoltage protection". Separate order necessary only if retrofitting. ▪ OVP10: For 1-channel devices (characteristic 020, option A): ▪ OVP20: For 2-channel devices (characteristic 020, options B, C, E or G) For details, see Special Documentation SD01090F.
Weather protection cover	Is used to protect the measuring device from the effects of the weather: e.g. rainwater, excess heating from direct sunlight or extreme cold in winter. For details, see Special Documentation SD00333F
Connecting cable for remote version	▪ Connecting cable available in various lengths: – 5 m (16 ft) – 10 m (32 ft) – 20 m (65 ft) – 30 m (98 ft) ▪ Reinforced cables available on request. Standard length: 5 m (16 ft) Is always supplied if no other cable length has been ordered.
Post mounting kit	Post mounting kit for transmitter. The post mounting kit can only be ordered together with a transmitter. (Order number: DK8WM-B)

For the sensor

Accessories	Description
Flow conditioner	Is used to shorten the necessary inlet run. (Order number: DK7ST)

Communication-specific accessories

Accessories	Description
Commubox FXA195 HART	For intrinsically safe HART communication with FieldCare via the USB interface. For details, see "Technical Information" TI00404F
Commubox FXA291	Connects Endress+Hauser field devices with a CDI interface (= Endress+Hauser Common Data Interface) and the USB port of a computer or laptop. For details, see the "Technical Information" document TI405C/07
HART Loop Converter HMX50	Is used to evaluate and convert dynamic HART process variables to analog current signals or limit values. For details, see "Technical Information" TI00429F and Operating Instructions BA00371F
Wireless HART adapter SWA70	Is used for the wireless connection of field devices. The WirelessHART adapter can be easily integrated into field devices and existing infrastructures, offers data protection and transmission safety and can be operated in parallel with other wireless networks with minimum cabling complexity. For details, see Operating Instructions BA00061S
Fieldgate FXA320	Gateway for the remote monitoring of connected 4-20 mA measuring devices via a Web browser. For details, see "Technical Information" TI00025S and Operating Instructions BA00053S
Fieldgate FXA520	Gateway for the remote diagnostics and remote configuration of connected HART measuring devices via a Web browser. For details, see "Technical Information" TI00025S and Operating Instructions BA00051S
Field Xpert SFX350	Field Xpert SFX350 is a mobile computer for commissioning and maintenance. It enables efficient device configuration and diagnostics for HART and FOUNDATION Fieldbus devices in the **non-Ex area**. For details, see Operating Instructions BA01202S
Field Xpert SFX370	Field Xpert SFX370 is a mobile computer for commissioning and maintenance. It enables efficient device configuration and diagnostics for HART and FOUNDATION Fieldbus devices in the **non-Ex area** and the **Ex area**. For details, see Operating Instructions BA01202S

Service-specific accessories

Accessories	Description
Applicator	Software for selecting and sizing Endress+Hauser measuring devices: ▪ Calculation of all the necessary data for identifying the optimum flowmeter: e.g. nominal diameter, pressure loss, accuracy or process connections. ▪ Graphic illustration of the calculation results Administration, documentation and access to all project-related data and parameters throughout the entire life cycle of a project. Applicator is available: ▪ Via the Internet: https://wapps.endress.com/applicator ▪ On CD-ROM for local PC installation.
W@M	Life cycle management for your plant W@M supports you with a wide range of software applications over the entire process: from planning and procurement, to the installation, commissioning and operation of the measuring devices. All the relevant device information, such as the device status, spare parts and device-specific documentation, is available for every device over the entire life cycle. The application already contains the data of your Endress+Hauser device. Endress +Hauser also takes care of maintaining and updating the data records. W@M is available: ▪ Via the Internet: www.endress.com/lifecyclemanagement ▪ On CD-ROM for local PC installation.

FieldCare	FDT-based plant asset management tool from Endress+Hauser. It can configure all smart field units in your system and helps you manage them. By using the status information, it is also a simple but effective way of checking their status and condition. For details, see Operating Instructions BA00027S and BA00059S
DeviceCare	Tool for connecting and configuring Endress+Hauser field devices. For details, see Innovation brochure IN01047S

System components

Accessories	Description
Memograph M graphic display recorder	The Memograph M graphic display recorder provides information on all relevant measured variables. Measured values are recorded correctly, limit values are monitored and measuring points analyzed. The data are stored in the 256 MB internal memory and also on a SD card or USB stick. For details, see "Technical Information" TI00133R and Operating Instructions BA00247R
RN221N	Active barrier with power supply for safe separation of 4-20 mA standard signal circuits. Offers bidirectional HART transmission. For details, see "Technical Information" TI00073R and Operating Instructions BA00202R
RNS221	Supply unit for powering two 2-wire measuring devices solely in the non-Ex area. Bidirectional communication is possible via the HART communication jacks. For details, see "Technical Information" TI00081R and Brief Operating Instructions KA00110R
Cerabar M	The pressure transmitter for measuring the absolute and gauge pressure of gases, steam and liquids. It can be used to read in the operating pressure value. For details, see "Technical Information" TI00426P, TI00436P and Operating Instructions BA00200P, BA00382P
Cerabar S	The pressure transmitter for measuring the absolute and gauge pressure of gases, steam and liquids. It can be used to read in the operating pressure value. For details, see "Technical Information" TI00383P and Operating Instructions BA00271P

Supplementary documentation

For an overview of the scope of the associated Technical Documentation, refer to the following:
- The *W@M Device Viewer* : Enter the serial number from the nameplate (www.endress.com/deviceviewer)
- The *Endress+Hauser Operations App*: Enter the serial number from the nameplate or scan the 2-D matrix code (QR code) on the nameplate.

Standard documentation

Brief Operating Instructions

Measuring device	Documentation code
Prowirl F 200	KA01136D

Operating Instructions

Measuring device	Documentation code		
	HART	FOUNDATION Fieldbus	PROFIBUS PA
Prowirl F 200	BA01154D	BA01217D	BA01222D

Description of device parameters

Measuring device	Documentation code		
	HART	FOUNDATION Fieldbus	PROFIBUS PA
Prowirl 200	GP01019D	GP01024D	GP01023D

Supplementary device-dependent documentation

Safety Instructions

Contents	Documentation code
ATEX/IECEx Ex d, Ex tb	XA01148D
ATEX/IECEx Ex ia, Ex tb	XA01151D
ATEX/IECEx Ex ic, Ex nA	XA01152D
$_{C}CSA_{US}$ XP	XA01153D
$_{C}CSA_{US}$ IS	XA01154D
NEPSI Ex d	XA01238D
NEPSI Ex i	XA01239D
NEPSI Ex ic, Ex nA	XA01240D
INMETRO Ex d	XA01250D
INMETRO Ex i	XA01042D
INMETRO Ex nA	XA01043D

Special Documentation

Contents	Documentation code
Information on the Pressure Equipment Directive	SD01163D
Functional Safety Manual	SD01162D
Heartbeat Technology	SD01204D
Natural gas	SD01194D
Air + Industrial Gases (Single Gas + Gas Mixtures)	SD01195D
Wet steam detection	SD01193D
Wet steam measurement	SD01315D
Inlet run correction	SD01226D

Installation Instructions

Contents	Documentation code
Installation Instructions for spare part sets	Specified for each individual accessory → 92

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People for Process Automation

Slovenský metrologický ústav
Karloveská 63, 842 55 Bratislava 4

CERTIFIKÁT TYPU MERADLA

č. 148/1/142/16 zo dňa 10.septembra 2016,

Slovenský metrologický ústav v súlade s ustanovením § 30 písm. b) a § 32 ods. 2 písm. e) zákona č. 142/2000 Z. z. o metrológii a o zmene a doplnení niektorých zákonov v znení neskorších predpisov (ďalej len "zákon") na základe žiadosti číslo 361445 vydáva podľa § 37 (§ 11) ods. 1 zákona toto rozhodnutie, ktorým

schvaľuje typ meradla

Názov meradla:	Vírový prietokomer
Typ meradla:	**Prowirl F 200**
Žiadateľ:	TRANSCOM TECHNIK, spol. s r. o., Bratislava IČO: 31 386 547
Výrobca:	Endress + Hauser Flowtec AG, Francúzsko

a podľa § 10 ods. 1 zákona potvrdzuje, že uvedený typ meradla vyhovuje svojimi technickými charakteristikami, metrologickými charakteristikami a konštrukčným vyhotovením požiadavkám na daný druh určeného meradla ustanovenými v prílohe č. 53 "Prietokomery ako členy meračov tepla" k vyhláške ÚNMS SR č. 210/2000 Z. z. o meradlách a metrologickej kontrole v znení neskorších predpisov (ďalej len „vyhláška 210/2000 Z. z.").

Základné technické charakteristiky a metrologické charakteristiky meradla a výsledky technických skúšok a zistení o splnení požiadaviek na daný druh meradla sú uvedené v protokole č. 035/300/142/16 zo dňa 05. 08. 2016 vydanom Slovenským metrologickým ústavom.

Uvedenému typu meradla sa prideľuje značka schváleného typu:

TSK 142/16 - 148

Dovozca je povinný podľa § 14 ods. 2 zákona umiestniť na meradle značku schváleného typu a podľa § 16 ods. 2 zákona zabezpečiť prvotné overenie meradla pred jeho uvedením na trh.

Platnosť do: 9.septembra 2026

Poučenie: Proti tomuto rozhodnutiu možno podať do 15 dní odo dňa jeho doručenia odvolanie na Úrad pre normalizáciu, metrológiu a skúšobníctvo Slovenskej republiky, Štefanovičova 3, P.O.BOX 76, 810 05 Bratislava prostredníctvom Slovenského metrologického ústavu.

Ing. Eva Šimková
určená vykonávaním funkcie generálneho riaditeľa

Popis meradla:

Prietokomer Prowirl F 200 slúži vo funkcii meradla určeného na meranie pretečeného množstva teplonosného média - sýtej a prehriatej pary potrubnými rozvodmi. Skladá sa zo snímača prietoku a elektronického prevodníku. Vyrába sa v kompaktnom, alebo v oddelenom vyhotovení. Pre zabezpečenie správnej funkčnosti a presnosti inštalovaného meradla v celom meracom rozsahu musí byť vstupná a výstupná trať rovná bez vnútorných prekážok a nepravidelností pri súčasnom dodržaní centrického uchytenia.

Základné technické charakteristiky:

Menovitá svetlosť DN	15, 25, 40, 50, 80, 100, 150, 200, 250 a 300
Hodnoty PN	PN 10, 16, 25, 40
Krytie	IP 66/67 v štandardnom prevedení
Teplota okolia: prevádzková	(–40 až + 80) °C pre kompaktnú verziu v základnom prevedení, pre ďalšie prevedenia podľa špecifikácie výrobcu (–20 až + 70) °C pre zobrazovaciu jednotku
skladovacia	(–50 až 80)°C; zobrazovacia jednotka (–40 až 80)°C
Rozsah teploty média	(–200 až + 450) °C podľa špecifikácie výrobcu
Napájanie	podľa prevedenia (12 až 35) V dc; (12 až 32) V dc;(12 až 30) V dc
Výstupy	4-20 mA; 4-20 mA HART; pulzný/frekvenčný/spínací
Digitálna komunikácia	HART, Profibus PA, Foundation Fieldbus

Základné metrologické charakteristiky:

Merané médium	sýta a prehriata para
Rozsah Reynoldsovho čísla	od 5 000
Maximálny prietok pre vodnú paru (Q_{max}))*	Prietok odpovedajúci menšej z hodnôt rýchlostí média v prietokomeri 46m/s alebo 350 $\sqrt{\rho}$ m/s ; pre DN 15
	Prietok odpovedajúci menšej z hodnôt rýchlostí média v prietokomeri 75 m/s alebo 350 $\sqrt{\rho}$ m/s pre DN 25 až DN 40
	Prietok odpovedajúci menšej z hodnôt rýchlostí média v prietokomeri 120 m/s alebo 350 $\sqrt{\rho}$ m/s pre DN 50 až DN 300
Minimálny prietok pre vodnú paru (Q_{min}))*	Prietok odpovedajúci rýchlosti média v prietokomeri 6 $\sqrt{\rho}$ m/s alebo Reynoldsovému číslu minimálne 20000
Maximálny prípustný tlak	10 (Mpa) podľa špecifikácie výrobcu
Najväčšia dovolená chyba	v intervale $Q_{min} \leq Q \leq Q_{max}$ ±5 % z meranej hodnoty
Metrologické triedy	A,B,C

)* ρ je hustota média v kg / m3

Metrologické charakteristiky vírového prietokomera vyhovujú požiadavkám prílohy č. 53 k vyhláške ÚNMS SR č. 75/2001 Z. z., druhej časti, oddielu III, bodu 2.

Overenie meradla:

Spôsob overenia prietokomera Prowirl F 200 sa vykonáva podľa požiadaviek Prílohy č. 53 k vyhláške ÚNMS SR č. 75/2001 Z. z. pod názvom „Prietokomery ako členy meračov tepla“ v znení bodu 6 oddielu III druhej časti pre prietokomerné členy meračov tepla.

Čas platnosti overenia v súlade s prílohou č. 1 vyhlášky č. 210 /2000 Z. z. o meradlách a metrologickej kontrole v znení neskorších predpisov, položky č. 3.1.5 Merače tepla a ich členy – b) prietokomery je stanovený na **4 roky**.

Umiestnenie overovacej, zabezpečovacích značiek a značiek montážnika:

Meradlo, ktoré vyhovelo všetkým predpísaným skúškam sa zabezpečí overovacou značkou a zabezpečovacími značkami podľa podmienok uvedených v bode č.7 protokolu č. 035/300/142/16.

Tento certifikát môže byť rozmnožovaný len celý a nezmenený.
Rozmnožovať jeho časti možno len s písomným súhlasom Slovenského metrologického ústavu.

Slovenský metrologický ústav
Karloveská 63, 842 55 Bratislava

PROTOKOL
O POSÚDENÍ TYPU MERADLA

Číslo protokolu: 035/300/142/16

Názov meradla: Vírový prietokomer

Typ meradla: Prowirl F 200

Značka schváleného typu: TSK 142/16 – 148

Výrobca: Obchodné meno: Endress+Hauser Flowtec AG
Adresa: 35, rue de Í Europe
68700 Cernay
Francúzsko

Žiadateľ:
Obchodné meno: TRANSCOM TECHNIK, spol. s r.o.
Adresa: Bojnická 18
831 04 Bratislava

IČO: 31386547

Evidenčné číslo žiadosti: 361445

Počet strán: 13

Počet príloh: 0

Dátum vydania:
05. 09. 2016

Vypracoval:

Protokol schválil:

Tento protokol môže byť rozmnožovaný len celý a nezmenený.
Rozmnožovať jeho časti možno len s písomným súhlasom Slovenského metrologického ústavu.

1. Všeobecné ustanovenie

Tento protokol je podkladom na vydanie rozhodnutia o schválení typu meradla: Vírový prietokomer typ „Prowirl F 200“, podľa § 37 zákona č. 142/2000 Z. z. Slovenským metrologickým ústavom.

1.1 Rozsah posudzovania

Meradlo svojim charakterom zodpovedá: položke 3.1.5b prílohy č. 1 k vyhláške ÚNMS SR č. 210/2000 Z. z. o meradlách a metrologickej kontrole v znení neskorších predpisov. Názov uvedenej položky je „Merače tepla a ich členy – časť Prietokomery“ . Meradlo je používané v oblasti merania prietoku teplonosného média - sýtej a prehriatej pary.

Meradlo bolo posudzované z hľadiska požiadaviek na daný druh meradla ustanovených predpisom:
Príloha č. 53: Prietokomery ako členy meračov tepla, k vyhláške ÚNMS SR č. 210/2000 Z. z. o meradlách a metrologickej kontrole v znení neskorších predpisov, prvá časť, body 1, 2d, 3c, druhá časť, oddiel III, body 2,3,4,a 5

1.2 Údaje o technickej dokumentácii použitej pri posudzovaní:

Pri posudzovaní meradla v rámci schválenia typu meradla boli preštudované a odborne posúdené nasledujúce dokumenty výrobcu:

- Proline Prowirl F 200, Vortex flowmeter, technické údaje, TI01084D/06/EN/05.15, 71299457, Endress+Hauser, (anglický jazyk), elektronická forma, 98strán
- Proline Prowirl F 200, Vortex flowmeter, stručný návod na obsluhu, KA01136D/06/EN/05.15, 71299438, Endress+Hauser, (anglický jazyk), elektronická forma, 64strán
- Proline Prowirl F 200, HART, Vortex flowmeter, návod na obsluhu, BA01154D/06/EN/04.15, 71299401 , Endress+Hauser, (anglický jazyk), elektronická forma, 196strán
- Proline Prowirl F 200, FOUNDATION Fieldbus, Vortex flowmeter, návod na obsluhu,, BA01217D/06/EN/02.15, 71299411, Endress+Hauser, (anglický jazyk), elektronická forma, 212strán
- Proline Prowirl F 200, PROFIBUS PA, Vortex flowmeter, BA01222D/06/EN/03.15, 71299421, návod na obsluhu,, Endress+Hauser, (anglický jazyk), elektronická forma, 218strán

Technická dokumentácia predložená na konanie o schválení typu meradla je archivovaná v laboratóriu prietoku a pretečeného objemu plynov Slovenského metrologického ústavu Bratislava.

1.3 Údaje o dokladoch použitých pri posudzovaní:

Tento protokol môže byť rozmnožovaný len celý a nezmenený.
Rozmnožovať jeho časti možno len s písomným súhlasom Slovenského metrologického ústavu.

Pri posudzovaní meradla v rámci schválenia typu meradla boli pri posudzovaní splnenia technických a metrologických požiadaviek použité nasledujúce dokumenty:

- Certifikát o schválení typu měřidla č. 0111-CS-C033-15 pre vírový prietokomer Prowirl F200 so značkou schválenia typu TCM 142/15-5343, ČMI Brno, 17.12.2015, 5strán
- Certifikát schválenia typu meradla - Prowirl 200 Vortex Flowmeter, Ruská federálna agentúra pre technické nariadenia a metrológiu, X/2014, (anglický jazyk), elektronická forma, 21strán
- Zkušebný protokol externího průtokoměru (ověřování metodou 10 průtoků) pre vírový průtokoměr E+H Prowirl 200, DN25, DN40, zkušebna ČMI Brno 03.08.2015, 4strany
- Zkušebný protokol externího průtokoměru (ověřování metodou 10 průtoků) pre vírový průtokoměr E+H Prowirl 200, DN80,DN150, zkušebna ČMI Brno ČMI Brno 04.08.2015, 3strany
- Zkušebný protokol externího průtokoměru (ověřování metodou 10 průtoků) pre vírový průtokoměr E+H Prowirl 200 DN150, zkušebna Žabovřesky, ČMI Brno 17.12.2015, 1strana
- Zkušebný protokol vodoměru (ověřování metodou 3 průtoků) s meračom E+ H Prowirl 200, pre vírový průtokoměr E+H Prowirl 200 DN150, zkušebna ČKD Blansko Holding, a.s., 22.01.2016, 6 strán
- Protokoly zo skúšok vplyvu elektromagnetického poľa, vnútorného tlaku , porúch prúdenia skúšok tlakovej straty a počiatočnej chyby v skúšobniach . ČMI Brno, VII/2115, (český jazyk), elektronická forma, 39 strán
- Protokol č. 15-6583 akreditovaného skúšobného laboratória Paconsult GmbH z vibračných, klimatických a teplotných skúšok a testov izolačného odporu, vykonaných v súvislosti s typovým schválením Prowirl 200, VI, 2015 , (anglický jazyk), elektronická forma, 22 strán
- Protokol č. 07472.062.15 V1.1 zo skúšok elektromagnetickej kompatibility pre Prowirl F 200, vykonaných v akreditovanom laboratóriu MeßTechnikNord GmbH, Wedel, , (anglický jazyk), elektronická forma, 39 strán
- Osvedčenia pre použitie vírových prietokomerov Proline Prowirl C/D/F/R/O 200 v potencionálne výbušnej atmosfére (anglický jazyk), elektronická forma, 19 strán

Doklady použité pri posudzovaní sú uložené v laboratóriu prietoku a pretečeného objemu plynov Slovenského metrologického ústavu Bratislava.

1.4 Údaje o vzorkách určeného meradla:

V rámci konania o schválení typu meradla bola na základe § 37 zákona č. 142/2000 Z. z. v znení neskorších predpisov posúdená dokumetácia predložená žiadateľom o schválenie typu meradla . Pri typovom schválení sa vychádzalo z dokumentu „ Certifikát o schválení typu měřidla č.0111-CS-C033-15, technickej dokumentácie uvedenej v bode 1.2 a súvisiacich skúšobných protokolov, realizovaných v skúšobniach ČMI Brno a ČKD Blansko Holding, a.s..

2 Popis meradla:

Tento protokol môže byť rozmnožovaný len celý a nezmenený.
Rozmnožovať jeho časti možno len s písomným súhlasom Slovenského metrologického ústavu.

Názov meradla: Vírový prietokomer
Typ meradla: Prowirl F 200

Vírový prietokomer Prowirl F 200 svojím konštrukčným a funkčným riešením slúži vo funkcii pracovného meradla určeného na meranie prietoku a pretečeného množstva teplonosného média - sýtej a prehriatej pary potrubnými rozvodmi.
Vírové prietokomery Prowirl F 200 sa skladajú zo snímača prietoku a elektronického prevodníku. Sú vyrobené v kompaktnom, alebo v oddelenom vyhotovení. V oddelenom prevedení je maximálna dĺžka kábla 30 m.

Vírový prietokomer typu Prowirl F200 je v prípade merania tepla odovzdaného vodnou parou pripojený spolu so snímačmi tlaku a teploty k elektronickej vyhodnocovacej jednotke. Snímače teploty, tlaku a elektronická vyhodnocovacia jednotka musia byť kompatibilné, schváleného typu a platne overené.

Meradlo sa montuje v zostave s nábehovým a výbehovým potrubím o špecifikovaných rozmeroch a vlastnostiach. Pre zabezpečenie správnej funkčnosti a presnosti meradla v celom meracom rozsahu musí byť vstupná a výstupná trať rovná bez vnútorných prekážok a nepravidelností pri súčasnom dodržaní centrického uchytenia. Podrobné požiadavky na minimálnu dĺžku vstupnej a výstupnej trate v závislosti od osadenia meradla sú uvedené v technickej dokumentácii "Proline Prowirl F 200, Vortex flowmeter, Brief Operating Instructions, KA01136D/06/EN/05.15, 71299438".

2.1. Snímač prietoku

Pozostáva z kovovej trubice kruhového prierezu, odporového telieska a diferenčného kapacitného senzoru pri snímanie frekvencie vírov. Snímače sú dodávané v prírubovom vyhotovení.
Snímač prietoku pracuje na princípe periodického odtrhávania vírov na prekážke vloženej do prúdu tekutiny (tzv.Kármanova vírivá cesta). Do potrubia je vložené rušivé teliesko s danými geometrickými rozmermi na ktorom vznikajú víry prúdiaceho média. Víry sa odtrhávajú na obidvoch stranách rušivého telieska s frekvenciou, závislou od rýchlosti prúdenia média v uzavretom potrubí. Pozostáva z kovovej trubice kruhového prierezu, odporového telieska pre odtrhávanie vírov a diferenčného kapacitného senzoru pri snímanie frekvencie vírov. Snímače sú dodávané v prírubovom vyhotovení.

Frekvencia vzniku vírov je v širokom rozsahu Reynoldsovho čísla závislá od strednej rýchlosti prúdiacej tekutiny pred rušivým telesom a od šírky telesa. Je vyjadrená podľa nasledujúceho vzťahu.

$$f = Sr \cdot \frac{\overline{w}}{b} \qquad (1)$$

Tento protokol môže byť rozmnožovaný len celý a nezmenený.
Rozmnožovať jeho časti možno len s písomným súhlasom Slovenského metrologického ústavu.

kde:
f - frekvencia odtrhávania vírov (Hz)
Sr - Strouhalovo číslo, ktoré vyjadruje zmenu rýchlostného poľa od času (-)
w - stredná rýchlosť prúdenia tekutiny (m/s)
b - šírka (priemer) odporového telieska (m)

Objemový prietok sa vypočíta zo vzťahu:

$$q_v = \frac{f \cdot \pi \cdot D^2 \cdot b}{4 \cdot Sr} \cdot 3600 = \frac{f}{K} \cdot 3600 \quad (2)$$

kde:
q_v objemový prietok (m^3/h)
D je vnútorný priemer potrubia (m)
K je faktor meradla ($1/m^3$)

Na stabilitu tvorby vírov a na hodnotu Strouhalovho čísla má vplyv tvar telesa, najmä pomer výšky a hĺbky telesa. Podmienkou vzniku Kármanových vírov je veľkosť hodnoty Reynoldsovho čísla.

$$R_D = \frac{wD\rho}{\mu_{cp}} \quad (3)$$

kde:
μ_{cp} je dynamická viskozita tekutiny (Pa·s)
ρ je hustota tekutiny (kg/m^3)

2.2. Prevodník

Prevodník zapracováva signál zo snímača a vyhodnocuje okamžitý objemový prietok.
Prevodník umožňuje nasledovné funkcie:

- zobrazenie aktuálnych údajov a nastavenie pomocou mechanických tlačidiel alebo dotykových tlačidiel u verzie prevodníku s displejom
- čítanie a zápis všetkých konfiguračných údajov do pamäte EEPROM, zabezpečenej proti strate dát pri výpadku napájania
- nastavenie limitných hodnôt a jednotiek prietoku
- prúdový a impulzný výstup, digitálnu komunikáciu

Podrobný popis prevodníku typu Prowirl 200 je uvedený v príslušnej technickej dokumentácii TI01084D (viď. bod.1.2).

Tento protokol môže byť rozmnožovaný len celý a nezmenený.
Rozmnožovať jeho časti možno len s písomným súhlasom Slovenského metrologického ústavu.

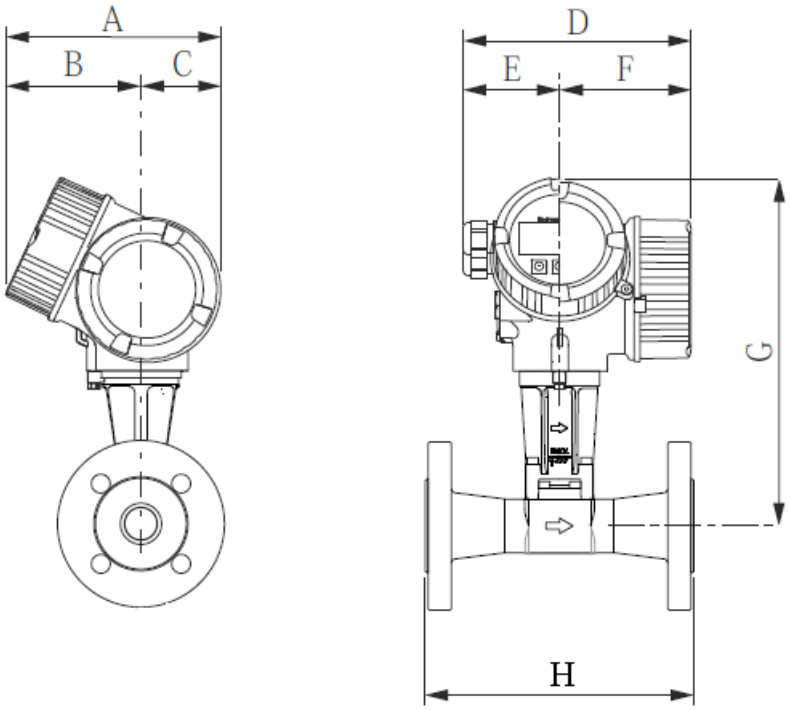
3. Základné technické a metrologické charakteristiky

Menovitá svetlosť snímačov (DN)	Prowirl F 200	15, 25, 40, 50, 80, 100, 150, 200, 250 a 300
Hodnoty PN		PN 10, 16, 25, 40
Rozsah Reynoldsovho čísla		od 5000
Maximálny prietok pre vodnú paru (Q_{max}))*		Prietok odpovedajúci menšej z hodnôt rýchlostí média v prietokomeri 46m/s alebo 350 $\sqrt{\rho}$ m/s pre DN 15
		Prietok odpovedajúci menšej z hodnôt rýchlostí média v prietokomeri 75 m/s alebo 350 $\sqrt{\rho}$ m/s pre DN 25 až DN 40
		Prietok odpovedajúci menšej z hodnôt rýchlostí média v prietokomeri 120 m/s alebo 350 $\sqrt{\rho}$ m/s pre DN 50 až DN 300
Minimálny prietok pre vodnú paru (Q_{min}))*		Prietok odpovedajúci rýchlosti média v prietokomeri 6 $\sqrt{\rho}$ m/s alebo Reynoldsovému číslu minimálne 20000
Najväčšia dovolená chyba (MPE) - prietokomerná časť merača tepla		v intervale $Q_{min} \leq Q \leq Q_{max}$ ±5% z meranej hodnoty
Maximálny prípustný tlak (MAP)		10 (Mpa) podľa špecifikácie výrobcu
Rozsah teploty média		(–200 až + 450)°C podľa špecifikácie výrobcu
Vlhkosť		Kondenzujúca (vonkajšie prostredie)
Trieda citlivosti profilu prúdenia		U20 a D5
Teplota okolia: prevádzková		(-40 až + 80)°C pre kompaktnú verziu v základnom prevedení, respektíve pre rôzne prevedenia podľa špecifikácie výrobcu
		(-20 až + 70)°C pre zobrazovaciu jednotku
skladovacia		(-50 až 80)°C; zobrazovacia jednotka (-40 až 80)° C
Pracovná poloha (viď. bod 3.1)		horizontálna s vhodnou orientáciou elektroniky
Zahrievacia doba		30 min
Trieda mechanického protredia		M1 (stacionárne prevedenie)
Napájanie		podľa prevedenia (12 až 35) V dc; (12 až 32) V dc; (12 až 30) V dc
Trieda elektromagnetického prostredia		E2
Výstupy Digitálna komunikácia		4-20 mA; 4-20mA HART; pulzný/frekvenčný/spínací HART, Profibus PA, Foundation Fieldbus
Displej		4-riadkový podsvietený displej s dotykovým ovládaním
Verzia firmware		01.01.zz, Profibus PA, DevRev02 01.01.zz, HART, DevRev03 01.01.zz, FF, DevRev01

)* *ρ je hustota média v kg / m3*

Tento protokol môže byť rozmnožovaný len celý a nezmenený.
Rozmnožovať jeho časti možno len s písomným súhlasom Slovenského metrologického ústavu.

obr.1: vzhľad vírového prietokomeru v kompaktnom prevedení



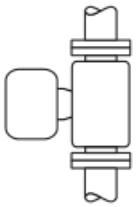
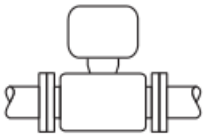
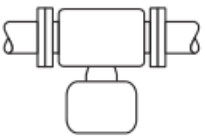
DN [mm]	A [mm]	B [1)] [mm]	C [mm]	D [2)] [mm]	E [mm]	F [2)] [mm]	G [3) 4)] [mm]	H [mm]
15	162	102	60	165	75	90	254.0	5)
25	162	102	60	165	75	90	260.4	5)
40	162	102	60	165	75	90	268.5	5)
50	162	102	60	165	75	90	275.3	5)
80	162	102	60	165	75	90	288.2	5)
100	162	102	60	165	75	90	300.1	5)
150	162	102	60	165	75	90	324.8	5)
200	162	102	60	165	75	90	353.4	5)

1) Pre verziu bez lokálneho displeja = tab. hodnota – 7 mm
2) Pre verziu s prepäťovou ochranou = tab. hodnota + 8 mm
3) Pre verziu bez lokálneho displeja = tab. hodnoty - 10 mm
4) Pre vysokoteplotné/nízkoteplotné prevedenie = tab. hodnoty + 29 mm
5) V závislosti od spôsobu pripojenia

Tento protokol môže byť rozmnožovaný len celý a nezmenený.
Rozmnožovať jeho časti možno len s písomným súhlasom Slovenského metrologického ústavu.

3.1 Poloha inštalácie

obr.2: orientácia elektroniky u kompaktnej verzie

A	**Vertikálna orientácia** Pre meranie kvapalín s tokom prúdenia smerom nahor vo zvislom potrubí, tak aby sa zabránilo čiastočnému zaplneniu meracieho priestoru.	 A0015545
B	**Horizontálna orientácia** **orientácia elektroniky smerom nahor** nevhodná orientácia pre meranie pary z dôvodu rizika prehriatia elektroniky	 A0015589
C	**Horizontálna orientácia** orientácia elektroniky smerom nadol	 A0015590
D	**Horizontálna orientácia** bočná orientácia elektroniky	 A0015592
V prípade horúceho média (pary) s teplotou ≥ 200 °C (392 °F) odporúčaná orientácia C alebo D		

3.2 Typické rozsahy prietoku nasýtenej pary

Tento protokol môže byť rozmnožovaný len celý a nezmenený.
Rozmnožovať jeho časti možno len s písomným súhlasom Slovenského metrologického ústavu.

Prevádzkový tlak	Limity prietoku	Prevádzkový prietok pre nasýtenú paru (kg/h)				
		DN15	DN25	DN40	DN50	DN80
1 bar G	q_{min}	10,195	17,823	27,945	43,769	98,213
	q_{max}	27,971	142,248	349,691	933,000	2093,58
2 bar G	q_{min}	10,555	18,452	31,705	52,870	118,636
	q_{max}	40,814	207,559	510,246	1361,38	3054,82
4 bar G	q_{min}	11,051	19,319	40,275	67,160	150,702
	q_{max}	65,859	334,923	823,345	2196,76	4929,32
10 bar G	q_{min}	11,922	23,795	58,496	97,545	218,881
	q_{max}	138,929	706,521	1736,85	4634,07	10398,4
20 bar G	q_{min}	12,759	32,522	79,950	133,321	299,159
	q_{max}	259,527	1319,82	3244,52	7777,04	17450,9
35 bar G	q_{min}	13,923	42,55	104,602	174,429	391,403
	q_{max}	444,248	2259,21	5553,85	10175	22831,8

Prevádzkový tlak	Limity prietoku	Prevádzkový prietok pre nasýtenú paru (kg/h)				
		DN100	DN150	DN200	DN250	DN300
1 bar G	q_{min}	170,129	387,010	742,919	1171,14	1679,82
	q_{max}	3626,58	8249,79	15836,6	24964,9	35808,4
2 bar G	q_{min}	205,506	467,488	897,407	1414,68	2029,14
	q_{max}	5291,68	12037,6	23107,7	36427,2	52249,2
4 bar G	q_{min}	261,052	593,843	1139,96	1797,04	2577,58
	q_{max}	8538,77	19424,1	37287,2	58779,7	84310,5
10 bar G	q_{min}	379,155	862,505	1655,7	2610,05	3743,72
	q_{max}	18012,6	40975,2	78657,5	123996	177854
20 bar G	q_{min}	518,216	1178,84	2262,95	3567,33	5116,76
	q_{max}	30229,3	68765,8	132005	208094	298479
35 bar G	q_{min}	678,004	1542,33	2960,71	4667,29	6694,51
	q_{max}	39550,2	89969,3	172708	272258	390513

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Rozmnožovať jeho časti možno len s písomným súhlasom Slovenského metrologického ústavu.

3.3 Rozsah skúšobného prietoku pre overenie vodou

Menovitá svetlosť (mm)	Q_{min} (m^3/h) *)	Q_n (m^3/h) *)
15	0,79	4,9
25	1,38	11,3
40	2,20	36,0
50	2,80	56,7
80	4,20	90,7
100	5,60	134,0
150	11.5	302,0
200	22,10	537,0
250	35,00	839,0
300	50,00	1208,0

*) pri prevádzkovej teplote 20°C

Metrologické charakteristiky vírového prietokomera vyhovujú požiadavkám prílohy č. 53 k vyhláške ÚNMS SR č. 75/2001 Z. z., druhej časti, oddielu III, bodu 2.
Všetky ostatné dôležité informácie pre prietokomer Prowirl F 200 sú uvedené v technickej dokumentácii meradla – viď.bod 1.2.

4. Podmienky vykonania skúšok technických charakteristík a metrologických charakteristík

Rozhodnutie o schválení typu meradla sa vydáva na základe uznania výsledkov skúšok, vykonaných v rámci schválenia typu predmetného meradla v ČR.

Na základe uvedenej skutočnosti a na základe technickej dokumentácie a odborného posúdenia dokumentov uvedených v bode 1.2 a 1.3 bolo zistené, že vírový prietokomer Prowirl F200 spĺňa metrologické a technické charakteristiky, ktoré sú uvedené v bode 3 tohto protokolu o posúdení typu meradla a je schopný plniť funkciu, pre ktorú je určený.

Údaje o hodnotených technických a metrologických charakteristikách:

V rámci schvaľovania typu meradla boli posudzované nasledovné technické a metrologické charakteristiky meradla:

Hodnotená technická a metrologická charakteristika, príloha 53 k vyhláške ÚNMS SR č. 75/2001 Z. z.	**Výsledky skúšok**	**Vyhodnotenie**
Bod 3.1, druhej časti oddielu III v znení bodu 3.1 **Konštrukcia – všeobecné ustanovenia**	Vyhodnotené na základe dokumentácie výrobcu	vyhovel požiadavkám
Bod 3.2., druhej časti oddielu III v znení bodu 3.2 **Materiály**	Vyhodnotené na základe dokumentácie výrobcu	vyhovel požiadavkám
Bod 3.3, druhej časti oddielu III **Tesnosť – odolnosť proti tlaku a odolnosť proti teplote**	Vyhodnotené na základe dokumentácie výrobcu a predložených výsledkov skúšok	vyhovel požiadavkám
Bod 3.4, druhej časti oddielu III **Vysielač údaja prietokomera**	Vyhodnotené na základe dokumentácie výrobcu a výsledkov skúšok	vyhovel požiadavkám

Tento protokol môže byť rozmnožovaný len celý a nezmenený.
Rozmnožovať jeho časti možno len s písomným súhlasom Slovenského metrologického ústavu.

Hodnotená technická a metrologická charakteristika, príloha 53 k vyhláške ÚNMS SR č. 75/2001 Z. z.	**Výsledky skúšok**	**Vyhodnotenie**
Bod 3.5.1, druhej časti oddielu III **Rovné úseky potrubí**	vyhodnotené na základe dokumentácie výrobcu a predložených výsledkov skúšok	vyhovuje požiadavkám prvej skupiny pri zadefinovanom usporiadaní podľa dok.“KA01136D/06/EN/05.15“
Bod 3.5.2, druhej časti oddielu III **Zhoda vnútorných priemerov pripojovacieho potrubia a prietokomera**	vyhodnotené na základe dokumentácie výrobcu	v zmysle dokumentácie “BA01154D/06/EN/04.15“ vyhovuje požiadavkám
Bod 3.5, druhej časti oddielu III **Odolnosť proti inštalačným podmienkam**	vyhodnotené na základe dokumentácie výrobcu a výsledkov skúšok	vyhovel požiadavkám
Bod 3.8, druhej časti oddielu III **Kolísanie napájania**	vyhodnotené na základe dokumentácie výrobcu a výsledkov skúšok	vyhovel požiadavkám
Bod 3.9, druhej časti oddielu III **Počítadlo**	vyhodnotené na základe dokumentácie výrobcu	vyhovel požiadavkám
Bod 3.6, druhej časti oddielu III **Strata tlaku**	vyhodnotené na základe dokumentácie výrobcu a výsledkov skúšok	vyhovel požiadavkám
Bod 3.10, druhej časti oddielu III **Prídavné zariadenie, resp. počítadlo na skúšku prietokomera**	vyhodnotené na základe dokumentácie výrobcu	vyhovel požiadavkám
Bod 3.11, druhej časti oddielu III **Najmenšia odčítacia schopnosť zariadenia**	vyhodnotené na základe dokumentácie výrobcu a posúdenia vzorky	vyhovel požiadavkám
Bod 3.12, druhej časti oddielu III **Počítadlo času**	vyhodnotené na základe dokumentácie výrobcu	vyhovel požiadavkám
Bod 2.1, druhej časti oddielu III **Najväčšie dovolené chyby prietokomerov**	Vyhodnotené na základe dokumentácie výrobcu a skúšok meradla	vyhovel požiadavkám
Bod 2.2., druhej časti oddielu III **Metrologické triedy**	Vyhodnotené na základe dokumentácie výrobcu a skúšok meradla	metrologické triedy A, B, C

5. Záver

Na základe odborného posúdenia schválenia typu meradla č.0111-CS-C033-15, dokumentácie uvedenej v bodoch 1.2 a 1.3 tohto protokolu bolo zistené, že uvedený typ meradla spĺňa metrologické a technické charakteristiky, ktoré sú uvedené v Prílohe č. 53 k vyhláške ÚNMS SR č.210/200 Z.z. v znení neskorších predpisov pod názvom „Prietokomery ako členy meračov tepla“.

6. Údaje na meradle

Na štítku prietokomera musia byť uvedené nasledujúce údaje:

- značka výrobcu
- typ snímača
- výrobné číslo a rok výroby

Tento protokol môže byť rozmnožovaný len celý a nezmenený.
Rozmnožovať jeho časti možno len s písomným súhlasom Slovenského metrologického ústavu.

- značka schváleného typu
- jednotka merania
- rozsah prietoku
- maximálny prípustný tlak
- rozsah teploty média
- trieda citlivosti na profil prúdenia
- teplota okolitého prostredia
- typ a úroveň výstupných signálov
- šípkou vyznačený smer prietoku

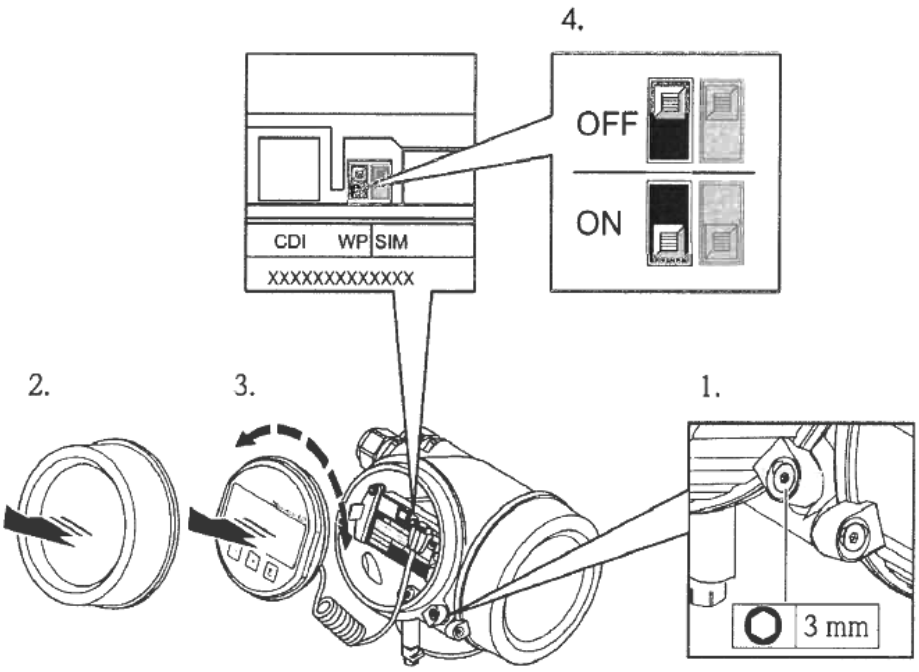
7. Overenie

7.1 Spôsob overenia prietokomera Vortex sa vykonáva podľa požiadaviek Prílohy č. 53 k vyhláške ÚNMS SR č. 75/2001 Z. z. pod názvom „Prietokomery ako členy meračov tepla“ v znení bodu 6 oddielu III druhej časti pre prietokomerné členy meračov tepla.

V súlade s bodom 6.4 Prílohy č. 53 k vyhláške ÚNMS SR č. 75/2001 Z. z., druhej časti oddielu III je najväčšia dovolená chyba pri skúške médiom voda ± 3% a pri skúške médiom para ± 5%. Pri skúške sa použije príslušný výstup podľa použitia v praxi. Overený výstup sa označí metrologickou značkou na svorkovnici.

Po vykonaní skúšok s kladným výsledkom sa vykoná prestavenie do režimu neumožňujúceho prepísanie metrologických parametrov pomocou prepnutia príslušného hardwarového prepínača do polohy ON (viď. obr.3).

obr.3: Zabezpečenie pomocou hardwarového prepínača



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Rozmnožovať jeho časti možno len s písomným súhlasom Slovenského metrologického ústavu.

7.2 Meradlo, ktoré vyhovelo všetkým predpísaným skúškam sa označí overovacou značkou na nasledujúcom mieste:

- hlavný štítok meradla – 1 overovacia značka (samolepka).

Zabezpečovacími značkami sa opatria nasledujúce miesta:

- spojenie snímača s prevodníkom 1 × zabezpečovacia značka ,
- neodnímateľnosť predného krytu prevodníka 1 × zabezpečovacia značka ,

Značkami montážnika sa zabezpečí:

- neodnímateľnosť bočného krytu prevodníka 1 ×
- kryt svorkovnice u oddeleného prevedenia 1 ×
- pripojenie vstupného potrubia 1 ×
- pripojenie výstupného potrubia 1 ×

7.3 Čas platnosti overenia v súlade s vyhláškou ÚNMS SR č. 69/2002 Z. z., ktorou sa mení a dopĺňa Príloha č. 1 vyhlášky č. 210 /2000 Z. z. o meradlách a metrologickej kontrole v znení neskorších predpisov , položky č. 3.1.5 Merače tepla a ich členy – b) prietokomery je stanovený na 4 roky.

Tento protokol môže byť rozmnožovaný len celý a nezmenený.
Rozmnožovať jeho časti možno len s písomným súhlasom Slovenského metrologického ústavu.

Technical Information
Omnigrad M TR13, TC13

Modular thermometer

TR13 with resistance insert (RTD)
TC13 with thermocouple insert (TC)

Application

- Universal range of application
- Measuring range:
  - Resistance insert (RTD): −200 to 600 °C (−328 to 1 112 °F)
  - Thermocouple (TC): −40 to 1 100 °C (−40 to 2 012 °F)
- Pressure range up to 100 bar (1 450 psi)
- Degree of protection: up to IP 68

Head transmitter

All Endress+Hauser transmitters are available with enhanced accuracy and reliability compared to directly wired sensors. Easy customizing by choosing one of the following outputs and communication protocols:

- Analog output 4 to 20 mA
- HART®
- PROFIBUS® PA
- FOUNDATION Fieldbus™

Your benefits

- High degree of flexibility thanks to modular design with standard terminal heads as per DIN EN 50446 and customer-specific immersion lengths
- High degree of insert compatibility and design as per DIN 43772
- Extension neck to protect the head transmitter from overheating
- Fast response time with reduced/tapered tip form
- Types of protection for use in hazardous locations:
  - Intrinsic Safety (Ex ia)
  - Non-sparking (Ex nA)

Endress+Hauser
People for Process Automation

Function and system design

Measuring principle

Resistance thermometer (RTD)

These resistance thermometers use a Pt100 temperature sensor according to IEC 60751. The temperature sensor is a temperature-sensitive platinum resistor with a resistance of 100 Ω at 0 °C (32 °F) and a temperature coefficient $\alpha = 0.003851\ °C^{-1}$.

There are generally two different kinds of platinum resistance thermometers:

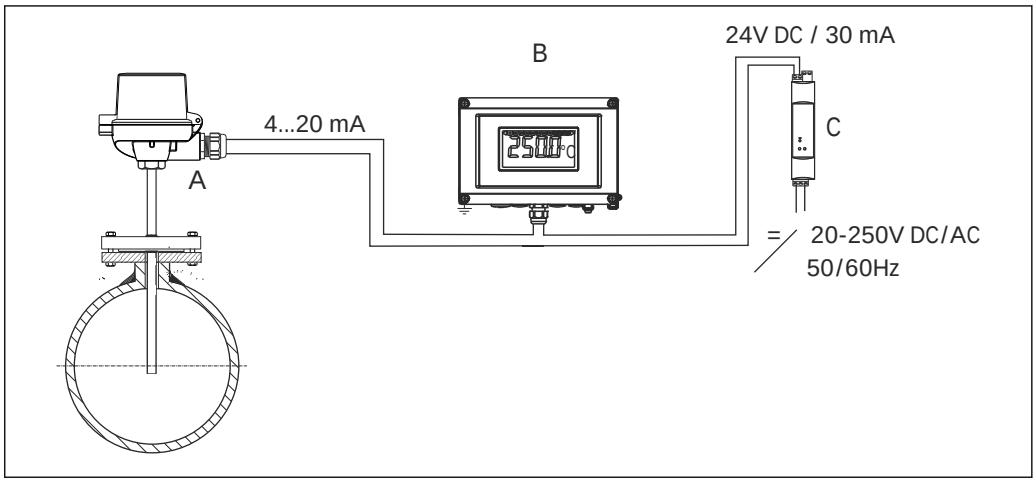
- **Wire wound (WW):** Here, a double coil of fine, high-purity platinum wire is located in a ceramic support. This is then sealed top and bottom with a ceramic protective layer. Such resistance thermometers not only facilitate very reproducible measurements but also offer good long-term stability of the resistance/temperature characteristic within temperature ranges up to 600 °C (1 112 °F). This type of sensor is relatively large in size and it is comparatively sensitive to vibrations.
- **Thin film platinum resistance thermometers (TF):** A very thin, ultrapure platinum layer, approx. 1 µm thick, is vaporized in a vacuum on a ceramic substrate and then structured photolithographically. The platinum conductor paths formed in this way create the measuring resistance. Additional covering and passivation layers are applied and reliably protect the thin platinum layer from contamination and oxidation, even at high temperatures.

The primary advantages of thin film temperature sensors over wire wound versions are their smaller sizes and better vibration resistance. A relatively low principle-based deviation of the resistance/temperature characteristic from the standard characteristic of IEC 60751 can frequently be observed among TF sensors at high temperatures. As a result, the tight limit values of tolerance category A as per IEC 60751 can only be observed with TF sensors at temperatures up to approx. 300 °C (572 °F). For this reason, thin-film sensors are generally only used for temperature measurements in ranges below 400 °C (932 °F).

Thermocouples (TC)

Thermocouples are comparatively simple, robust temperature sensors which use the Seebeck effect for temperature measurement: if two electrical conductors made of different materials are connected at a point, a weak electrical voltage can be measured between the two open conductor ends if the conductors are subjected to a thermal gradient. This voltage is called thermoelectric voltage or electromotive force (emf.). Its magnitude depends on the type of conducting materials and the temperature difference between the "measuring point" (the junction of the two conductors) and the "cold junction" (the open conductor ends). Accordingly, thermocouples primarily only measure differences in temperature. The absolute temperature at the measuring point can be determined from these if the associated temperature at the cold junction is known or is measured separately and compensated for. The material combinations and associated thermoelectric voltage/temperature characteristics of the most common types of thermocouple are standardized in the IEC 60584 and ASTM E230/ANSI MC96.1 standards.

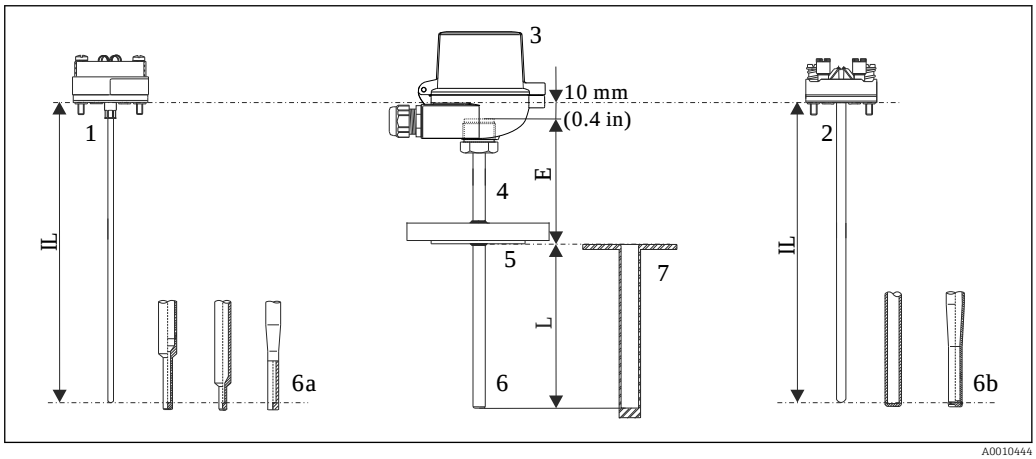
Measuring system



1 Application example

A Mounted thermometer with head transmitter installed.
B RIA16 field display unit - The display unit records the analog measuring signal from the head transmitter and shows this on the display. The LC display shows the current measured value in digital form and as a bar graph indicating a limit value violation. The display unit is looped into the 4 to 20 mA circuit and gets the required energy from there. More information on this can be found in the Technical Information (see "Documentation").
C Active barrier RN221N - The RN221N (24 V DC, 30 mA) active barrier has a galvanically isolated output for supplying voltage to loop-powered transmitters. The universal power supply works with an input supply voltage of 20 to 250 V DC/AC, 50/60 Hz, which means that it can be used in all international power grids. More information on this can be found in the Technical Information (see "Documentation").

Design



2 Thermometer design

1 Insert with head transmitter mounted (example with Φ3 mm (0.12 in))
2 Insert with terminal block mounted (example with Φ6 mm (0.24 in))
3 Terminal head
4 Thermowell
5 Process conneciton: flange
6 Various tip shapes - detailed information see chapter "Tip shape":
6a Reduced or tapered for inserts with Φ3 mm (0.12 in)
6b Straight or tapered for inserts with Φ6 mm (0.24 in)
7 Jacket (protective sheath)
E Extension neck length
L Immersion length
IL Insertion length

Thermometers from the Omnigrad M TR13 and TC13 series have a modular design. The terminal head is used as a connection module for the mechanical and electrical connection of the insert. The position of the actual thermometer sensor in the insert ensures that it is mechanically protected. The insert can be exchanged and calibrated without interrupting the process. Either ceramic terminal blocks or transmitters can be fitted to the internal base washer.

Measurement range

- RTD: −200 to 600 °C (−328 to 1 112 °F)
- TC: −40 to 1 100 °C (−40 to 2 012 °F)

Performance characteristics

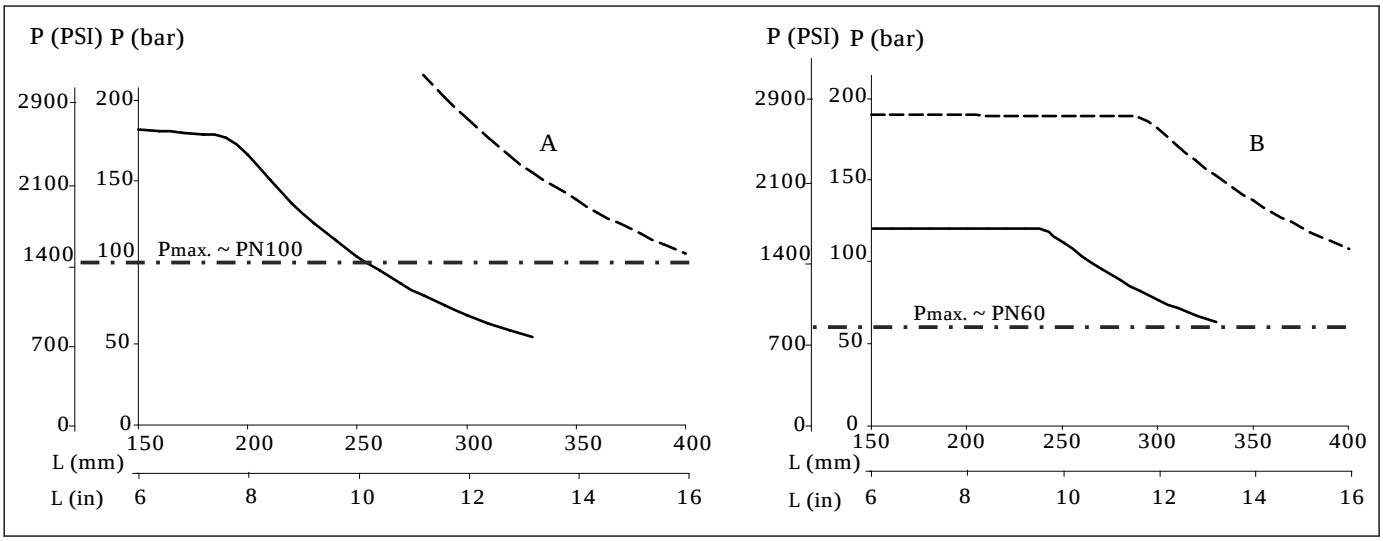
Operating conditions

Ambient temperature

Terminal head	Temperature in °C (°F)
Without mounted head transmitter	Depends on the terminal head used and the cable gland or fieldbus connector, see 'Terminal heads' section
With mounted head transmitter	−40 to 85 °C (−40 to 185 °F)
With mounted head transmitter and display	−20 to 70 °C (−4 to 158 °F)

Process pressure

The pressure values to which the actual thermowell can be subjected at the various temperatures and maximum permitted flow velocity are illustrated by the figure below. Occasionally, the pressure loading capacity of the process connection can be considerably lower. The maximum allowable process pressure for a specific thermometer is derived from the lower pressure value of the thermowell and process connection.



3 Maximum permitted process pressure for tube diameter

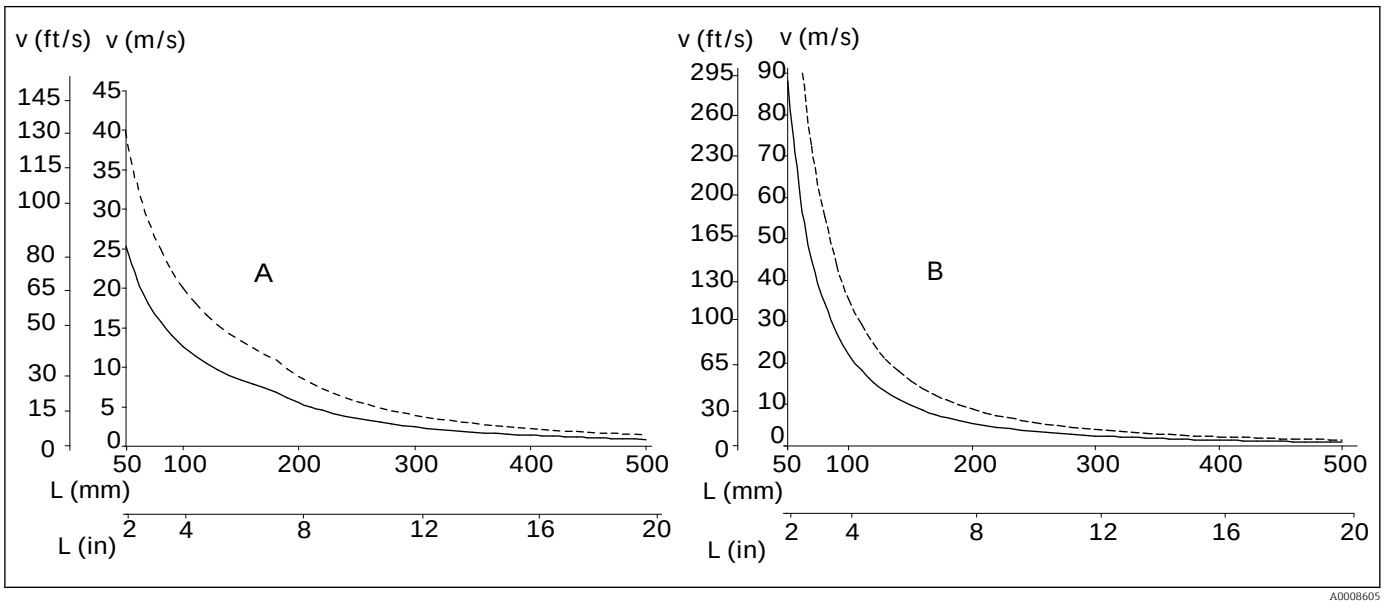
A Medium water T = 50 °C (122 °F)
B Medium superheated steam at T = 400 °C (752 °F)
L Immersion length
P Process pressure
___ Thermowell diameter 9 x 1 mm (0.35 in)
- - - Thermowell diameter 12 x 2.5 mm (0.47 in)

Note the limitation of the maximum process pressure to the flange pressure ratings indicated in the following table.

Process connection	Standard	Max. process pressure
Flange	EN1092-1 or ISO 7005-1	Depending on the flange pressure rating PNxx: 20, 40, 50 or 100 bar at 20 °C (68 °F)
	ASME B16.5	Depending on the flange pressure rating 150 or 300 psi at 20 °C (68 °F)
	JIS B 2220	Depending on the flange pressure rating 20K, 25K or 40K
	DIN2526/7	Depending on the flange pressure rating PN40 at 20 °C (68 °F)

Maximum flow velocity

The highest flow velocity tolerated by the thermowell diminishes with increasing immersion length exposed to the stream of the fluid. Detailed information may be taken from the figures below.



A0008605

4 *Flow velocity depending on the immersion length*

A Medium water at T = 50 °C (122 °F)
B Medium superheated steam at T = 400 °C (752 °F)
L Immersion length
v Flow velocity
___ Thermowell diameter 9 x 1 mm (0.35 in)
- - - Thermowell diameter 12 x 2.5 mm (0.47 in)

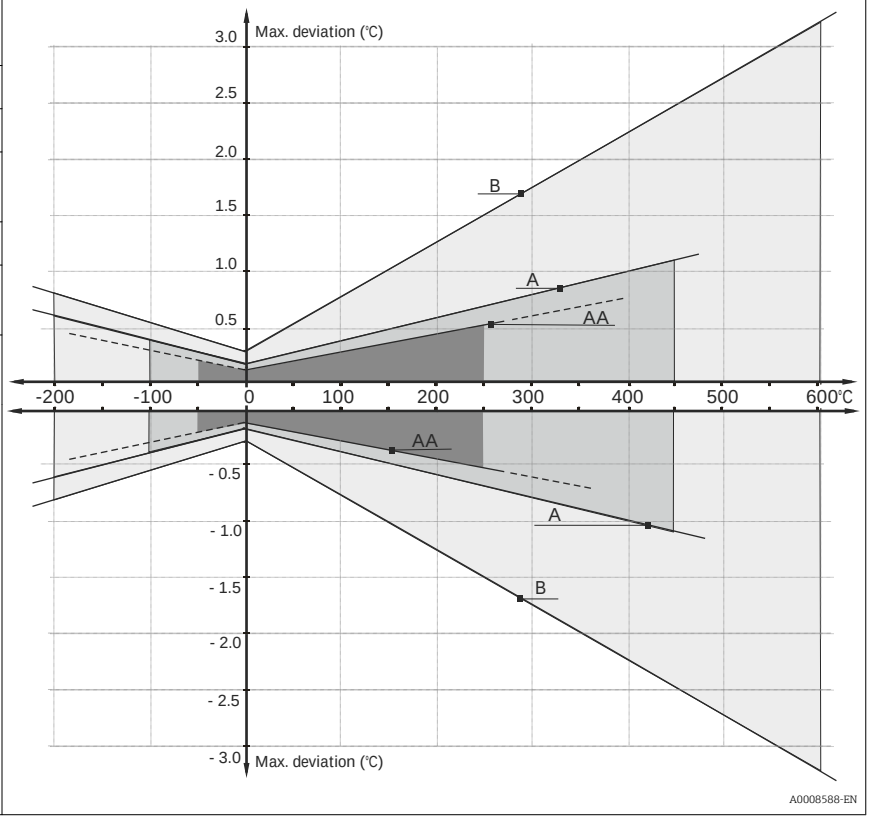
Shock and vibration resistance

- RTD: 3G / 10 to 500 Hz according to IEC 60751
- TC: 4G / 2 to 150 Hz according to IEC 60068-2-6

Accuracy RTD resistance thermometer as per IEC 60751

Class	Max. tolerances (°C)	
Cl. AA, former 1/3 Cl. B	± (0.1 + 0.0017 · |t| [1])	
Cl. A	± (0.15 + 0.002 · |t| [1])	
Cl. B	± (0.3 + 0.005 · |t| [1])	
Temperature ranges for compliance with the tolerance classes		
Wire wound sensor (WW):	Cl. A	Cl. AA
	−100 to +450 °C	−50 to +250 °C
Thin-film version (TF):	Cl. A	Cl. AA
▪ Standard	−30 to +300 °C	0 to +150 °C
▪ iTHERM® StrongSens	−30 to +300 °C	0 to +200 °C

Characteristics



1) |t| = absolute value °C

In order to obtain the maximum tolerances in °F, the results in °C must be multiplied by a factor of 1.8.

Permissible deviation limits of thermoelectric voltages from the standard characteristic for thermocouples as per IEC 60584 or ASTM E230/ANSI MC96.1:

Standard	Type	Standard tolerance		Special tolerance	
IEC 60584		Class	Deviation	Class	Deviation
	J (Fe-CuNi)	2	±2.5 °C (−40 to 333 °C) ±0.0075 |t| [1] (333 to 750 °C)	1	±1.5 °C (−40 to 375 °C) ±0.004 |t| [1] (375 to 750 °C)
	K (NiCr-NiAl)	2	±2.5 °C (−40 to 333 °C) ±0.0075 |t| [1] (333 to 1200 °C)	1	±1.5 °C (−40 to 375 °C) ±0.004 |t| [1] (375 to 1000 °C)

1) |t| = absolute value °C

Standard	Type	Standard tolerance	Special tolerance
ASTM E230/ANSI MC96.1		Deviation, the larger respective value applies	
	J (Fe-CuNi)	±2.2 K or ±0.0075 |t| [1] (0 to 760 °C)	±1.1 K or ±0.004 |t| [1] (0 to 760 °C)
	K (NiCr-NiAl)	±2.2 K or ±0.02 |t| [1] (−200 to 0 °C) ±2.2 K or ±0.0075 |t| [1] (0 to 1260 °C)	±1.1 K or ±0.004 |t| [1] (0 to 1260 °C)

1) |t| = absolute value °C

Response time

Calculated at an ambient temperature of approx. 23 °C by immersing in running water (0.4 m/s flow rate, 10 K excess temperature):

Complete assembly:

Thermometer type	Diameter	$t_{(x)}$	Reduced tip	Tapered tip	Straight tip
Resistance thermometer (measuring probe Pt100, TF/WW)	9 mm (0.35 in)	t_{50}	7.5 s	11 s	18 s
		t_{90}	21 s	37 s	55 s
	11 mm (0.43 in)	t_{50}	7.5 s	not available	18 s
		t_{90}	21 s	not available	55 s
	12 mm (0.47 in)	t_{50}	not available	11 s	38 s
		t_{90}	not available	37 s	125 s

Thermometer type	Diameter	$t_{(x)}$	Grounded			Ungrounded		
			Reduced tip	Tapered tip	Straight tip	Reduced tip	Tapered tip	Straight tip
Thermocouple	9 mm (0.35 in)	t_{50}	5.5 s	9 s	15 s	6 s	9.5 s	16 s
		t_{90}	13 s	31 s	46 s	14 s	33 s	49 s
	11 mm (0.43 in)	t_{50}	5.5 s	not available	15 s	6 s	not available	16 s
		t_{90}	13 s	not available	46 s	14 s	not available	49 s
	12 mm (0.47 in)	t_{50}	not available	8.5 s	32 s	not available	9 s	34 s
		t_{90}	not available	20 s	106 s	not available	22 s	110 s

Response times for insert without transmitter.

Tested in accordance with IEC 60751 in flowing water (0.4 m/s at 30 °C):

Insert:

Sensor type	Diameter ID	Response time	Thin film (TF)
iTHERM® StrongSens	6 mm (0.24 in)	t_{50}	<3.5 s
		t_{90}	<10 s
TF Sensor	3 mm (0.12 in)	t_{50}	2.5 s
		t_{90}	5.5 s
	6 mm (0.24 in)	t_{50}	5 s
		t_{90}	13 s
WW Sensor	3 mm (0.12 in)	t_{50}	2 s
		t_{90}	6 s
	6 mm (0.24 in)	t_{50}	4 s
		t_{90}	12 s
Thermocouple (TPC100) grounded	3 mm (0.12 in)	t_{50}	0.8 s
		t_{90}	2 s
	6 mm (0.24 in)	t_{50}	2 s
		t_{90}	5 s
Thermocouple (TPC100) ungrounded	3 mm (0.12 in)	t_{50}	1 s
		t_{90}	2.5 s
	6 mm (0.24 in)	t_{50}	2.5 s
		t_{90}	7 s

Response time for the sensor assembly without transmitter.

Insulation resistance

- RTD:
  Insulation resistance according to IEC 60751 > 100 MΩ at 25 °C between terminals and sheath material measured with a minimum test voltage of 100 V DC
- TC:
  Insulation resistance according to IEC 1515 between terminals and sheath material with a test voltage of 500 V DC:
  – > 1 GΩ at 20 °C
  – > 5 MΩ at 500 °C

Dielectric strength

Tested at a room temperature for 5 s:

- Φ6: ≥1 000 V DC between terminals and insert sheath
- Φ3: ≥250 V DC between terminals and insert sheath

Self heating

RTD elements are passive resistances that are measured using an external current. This measurement current causes a self-heating effect in the RTD element itself which in turn creates an additional measurement error. In addition to the measurement current, the size of the measurement error is also affected by the temperature conductivity and flow velocity of the process. This self-heating error is negligible when an Endress+Hauser iTEMP® temperature transmitter (very small measurement current) is connected.

Calibration

Endress+Hauser provides comparison temperature calibration from
−80 to +1 400 °C (−110 to +2 552 °F) based on the International Temperature Scale (ITS90).

Calibrations are traceable to national and international standards. The calibration certificate is referenced to the serial number of the thermometer. Only the insert is calibrated.

Insert: Ø6 mm (0.24 in) and 3 mm (0.12 in)	Minimum insertion length of insert in mm (in)	
Temperature range	without head transmitter	with head transmitter
−80 to −40 °C (−110 to −40 °F)	200 (7.87)	
−40 to 0 °C (−40 to 32 °F)	160 (6.3)	
0 to 250 °C (32 to 480 °F)	120 (4.72)	150 (5.91)
250 to 550 °C (480 to 1 020 °F)	300 (11.81)	
550 to 1 400 °C (1 020 to 2 552 °F)	450 (17.72)	

Material

Extension neck, thermowell and insert

The temperatures for continuous operation specified in the following table are only intended as reference values for use of the various materials in air and without any significant compressive load. The maximum operation temperatures are reduced considerably in some cases where abnormal conditions such as high mechanical load occur or in aggressive media.

Material name	Short form	Recommended max. temperature for continuous use in air	Properties
Wetted parts			
AISI 316L/ 1.4404 1.4435	X2CrNiMo17-12-2 X2CrNiMo18-14-3	650 °C (1 202 °F) [1]	▪ Austenitic, stainless steel ▪ High corrosion resistance in general ▪ Particularly high corrosion resistance in chlorine-based and acidic, non-oxidizing atmospheres through the addition of molybdenum (e.g. phosphoric and sulfuric acids, acetic and tartaric acids with a low concentration) ▪ Increased resistance to intergranular corrosion and pitting ▪ Compared to 1.4404, 1.4435 has even higher corrosion resistance and a lower delta ferrite content
AISI 316Ti/ 1.4571	X6CrNiMoTi17-12-2	700 °C (1 292 °F) [1]	▪ Properties comparable to AISI316L ▪ Addition of titanium means increased resistance to intergranular corrosion even after welding ▪ Broad range of uses in the chemical, petrochemical and oil industries as well as in coal chemistry ▪ Can only be polished to a limited extent, titanium streaks can form
Inconel600/ 2.4816	NiCr15Fe	1 100 °C (2 012 °F)	▪ A nickel/chromium alloy with very good resistance to aggressive, oxidizing and reducing atmospheres, even at high temperatures ▪ Resistance to corrosion caused by chlorine gases and chlorinated media as well as many oxidizing mineral and organic acids, sea water etc. ▪ Corrosion from ultrapure water ▪ Not to be used in sulfur-containing atmospheres

Material name	Short form	Recommended max. temperature for continuous use in air	Properties
Hastelloy C276/2.4819	NiMo16Cr15W	1 100 °C (2 012 °F)	▪ A nickel-based alloy with good resistance to oxidizing and reducing atmospheres, even at high temperatures ▪ Particularly resistant to chlorine gas and chloride as well as to many oxidizing mineral and organic acids
Jacket			
PTFE (Teflon)	Polytetrafluorethylen	200 °C (392 °F)	▪ Resistant to almost all chemicals ▪ High temperature stability
PVDF	Polyvinylidene fluoride	80 °C (176 °F)	▪ High stability ▪ A high creepage stability under continuous demand ▪ Good cold properties
Tantalum	-	250 °C (482 °F)	▪ With the exception of hydrofluoric acid, fluorine and fluorides, tantalum exhibits excellent resistance to most mineral acids and saline solutions ▪ Prone to oxidation and embrittlement at higher temperatures in air

1) Can be used to a limited extent up to 800 °C (1472 °F) for low compressive loads and in non-corrosive media. Please contact your Endress+Hauser sales team for further information.

Components

Family of temperature transmitters

Thermometers fitted with iTEMP® transmitters are an installation-ready complete solution to improve temperature measurement by significantly increasing accuracy and reliability, when compared to direct wired sensors, as well as reducing both wiring and maintenance costs.

PC programmable head transmitters
They offer a high degree of flexibility, thereby supporting universal application with low inventory storage. The iTEMP® transmitters can be configured quickly and easily at a PC. Endress+Hauser offers free configuration software which can be downloaded from the Endress+Hauser Website. More information can be found in the Technical Information.

HART® programmable head transmitters
The transmitter is a 2-wire device with one or two measuring inputs and one analog output. The device not only transfers converted signals from resistance thermometers and thermocouples, it also transfers resistance and voltage signals using HART® communication. It can be installed as an intrinsically safe apparatus in Zone 1 hazardous areas and is used for instrumentation in the terminal head (flat face) as per DIN EN 50446. Swift and easy operation, visualization and maintenance by PC using operating software, Simatic PDM or AMS. For more information, see the Technical Information.

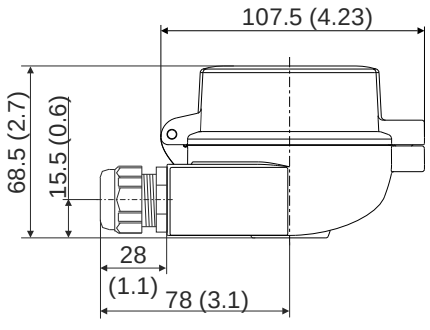
PROFIBUS® PA head transmitters
Universally programmable head transmitter with PROFIBUS® PA communication. Conversion of various input signals into digital output signals. High accuracy over the complete ambient temperature range. Swift and easy operation, visualization and maintenance using a PC directly from the control panel, e. g. using operating software, Simatic PDM or AMS. For more information, see the Technical Information.

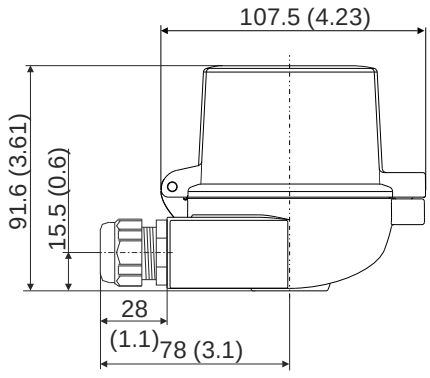
FOUNDATION Fieldbus™ head transmitters
Universally programmable head transmitter with FOUNDATION Fieldbus™ communication. Conversion of various input signals into digital output signals. High accuracy over the complete ambient temperature range. Swift and easy operation, visualization and maintenance using a PC directly from the control panel, e.g. using operating software such as ControlCare from Endress +Hauser or NI Configurator from National Instruments. For more information, see the Technical Information.

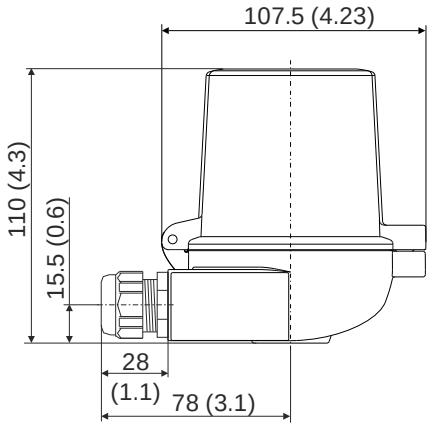
Advantages of the iTEMP® transmitters:
- Dual or single sensor input (optionally for HART® transmitter)
- Unsurpassed reliability, accuracy and long-term stability in critical processes
- Mathematical functions
- Monitoring of the thermometer drift, sensor backup functionality, sensor diagnostic functions
- Sensor-transmitter matching based on Callendar/Van Dusen coefficients

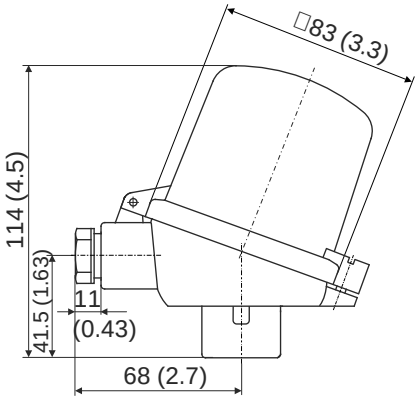
Terminal heads

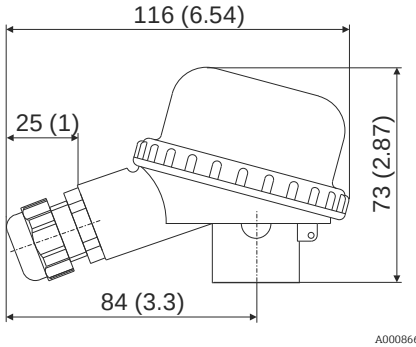
All terminal heads have an internal shape and size in accordance with DIN EN 50446 flat face and a thermometer connection of M24x1.5, G1/2" or 1/2" NPT thread. All dimensions in mm (in). The cable glands in the diagrams correspond to M20x1.5 connections. Specifications without head transmitter installed. For ambient temperatures with head transmitter installed, see "Operating conditions" section.

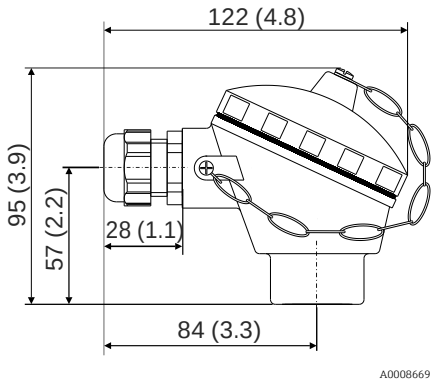
TA30A	Specification
	▪ Available with one or two cable entries ▪ Protection class: IP66/68 (NEMA Type 4x encl.) ▪ Temperature: −50 to +150 °C (−58 to +302 °F) without cable gland ▪ Material: aluminum, polyester powder coated Seals: silicone ▪ Threaded cable entry: G ½", ½" NPT and M20x1.5; ▪ Protection armature connection: M24x1.5 ▪ Head color: blue, RAL 5012 ▪ Cap color: gray, RAL 7035 ▪ Weight: 330 g (11.64 oz) ▪ Ground terminal, internal and external ▪ With 3-A® symbol

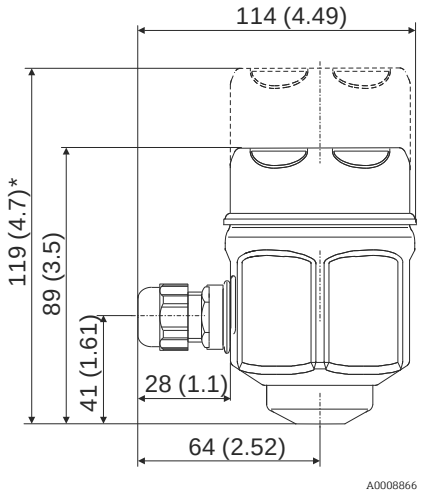
TA30A with display window	Specification
	▪ Available with one or two cable entries ▪ Protection class: IP66/68 (NEMA Type 4x encl.) ▪ Temperature: −50 to +150 °C (−58 to +302 °F) without cable gland ▪ Material: aluminum, polyester powder coated Seals: silicone ▪ Threaded cable entry: G ½", ½" NPT and M20x1.5 ▪ Protection armature connection: M24x1.5 ▪ Head color: blue, RAL 5012 Cap color: gray, RAL 7035 ▪ Weight: 420 g (14.81 oz) ▪ With TID10 display ▪ Ground terminal, internal and external ▪ With 3-A® symbol

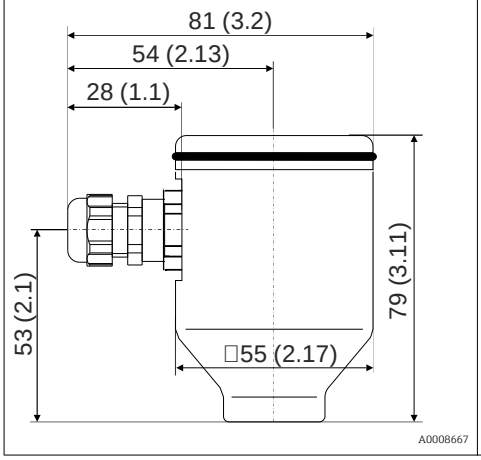
TA30D	Specification
	▪ Available with one or two cable entries ▪ Protection class: IP66/68 (NEMA Type 4x encl.) ▪ Temperature: −50 to +150 °C (−58 to +302 °F) without cable gland ▪ Material: aluminum, polyester powder coated Seals: silicone ▪ Threaded cable entry: G ½", ½" NPT and M20x1.5 ▪ Protection armature connection: M24x1.5 ▪ Two head transmitters can be mounted. In the standard version, one transmitter is mounted in the terminal head cover and an additional terminal block is installed directly on the insert. ▪ Head color: blue, RAL 5012 ▪ Cap color: gray, RAL 7035 ▪ Weight: 390 g (13.75 oz) ▪ Ground terminal, internal and external ▪ With 3-A® symbol

TA30P	Specification
	▪ Protection class: IP65 ▪ Max. temperature: −40 to +120 °C (−40 to +248 °F) ▪ Material: polyamide (PA), antistatic Seals: silicone ▪ Threaded cable entry: M20x1.5 ▪ Protection armature connection: M24x1.5 ▪ Head and cap color: black ▪ Weight: 135 g (4.8 oz) ▪ Types of protection for use in hazardous locations: Intrinsic Safety (G Ex ia) ▪ Ground terminal: only internal via auxiliary clamp

TA20B	Specification
	▪ Protection class: IP65 ▪ Max. temperature: 80 °C (176 °F) ▪ Material: polyamide (PA) ▪ Cable entry: M20x1.5 ▪ Head and cap color: black ▪ Weight: 80 g (2.82 oz) ▪ 3-A® marked

TA21E	Specification
	▪ Protection class: IP65 ▪ Max. temperature: 130 °C (266 °F) silicone, 100 °C (212 °F) rubber seal without cable gland (observe max. permitted temperature of the cable gland!) ▪ Material: aluminum alloy with polyester or epoxy coating, rubber or silicone seal under the cover ▪ Cable entry: M20x1.5 or plug M12x1 PA ▪ Protection armature connection: M24x1.5, G 1/2" or NPT 1/2" ▪ Head color: blue, RAL 5012 ▪ Cap color: gray, RAL 7035 ▪ Weight: 300 g (10.58 oz) ▪ 3-A® marked

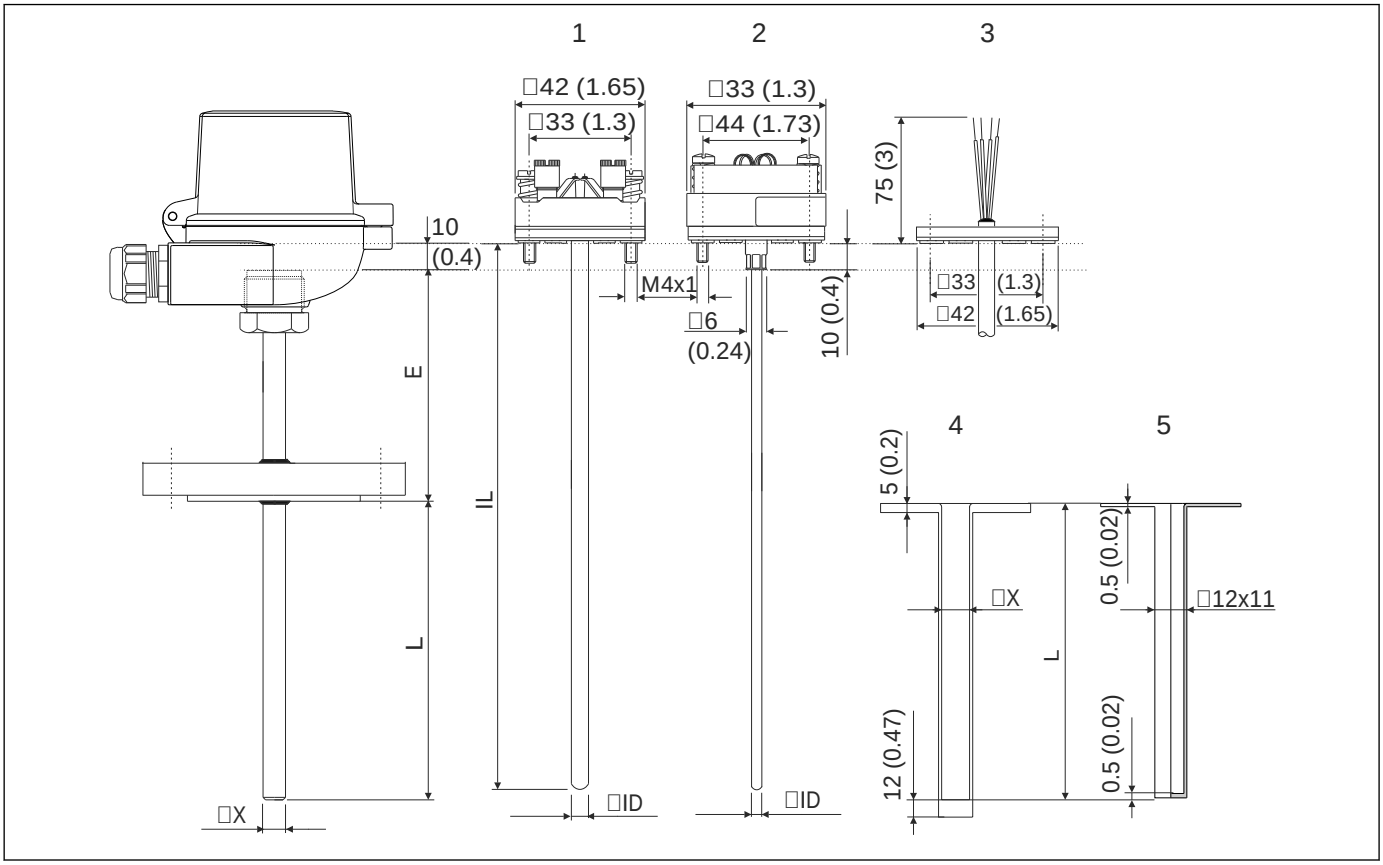
TA20J	Specification
 * dimensions with optional display	▪ Protection class: IP66/IP67 ▪ Max. temperature: 70 °C (158 °F) ▪ Material: 316L (1.4404) stainless steel, rubber seal under the cover (hygienic design) ▪ 4 digits 7-segments LC display (loop powered with optional4 to 20 mA transmitter) ▪ Cable entry: 1/2" NPT, M20x1.5 o plug M12x1 PA ▪ Protection armature connection: M24x1.5 or 1/2" NPT ▪ Head and cap color: stainless steel, polished ▪ Weight: 650 g (22.93 oz) with display ▪ Humidity: 25 to 95 %, no condensation ▪ 3-A® marked The programming is executed through 3 keys at the bottom of the display.

TA20R	Specification
	▪ Protection class: IP66/67 ▪ Max. temperature: 100 °C (212 °F) ▪ Material: SS 316L (1.4404) stainless steel ▪ Cable entry: 1/2" NPT, M20x1.5 or plug M12x1 PA ▪ Head and cap color: stainless steel ▪ Weight: 550 g (19.4 oz) ▪ LABS-free ▪ 3-A® marked

Maximum ambient temperatures for cable glands and fieldbus connectors	
Type	**Temperature range**
Cable gland ½" NPT, M20x1.5 (non Ex)	−40 to +100 °C (−40 to +212 °F)
Cable gland M20x1.5 (for dust ignition-proof area)	−20 to +95 °C (−4 to +203 °F)
Fieldbus connector (M12x1 PA, 7/8" FF)	−40 to +105 °C (−40 to +221 °F)

Design

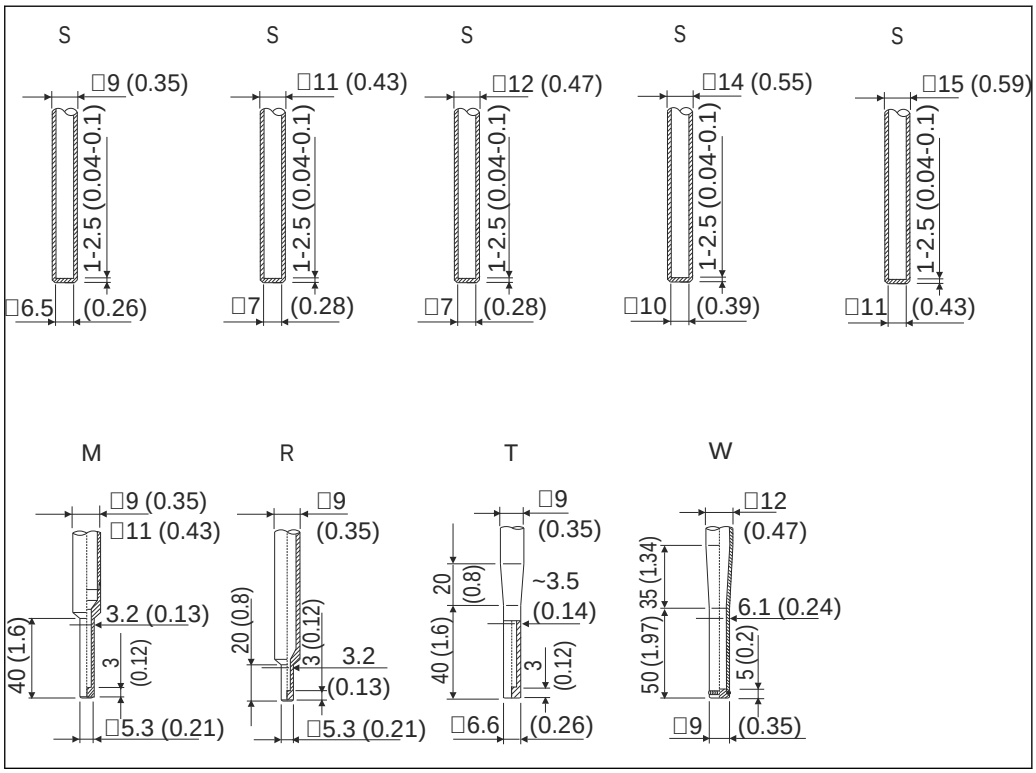
All dimensions in mm (in).



5 Dimensions of the Omnigrad M TR13 and TC13

1 Insert with terminal block mounted
2 Insert with head transmitter mounted
3 Insert with flying leads
4 Jacket (PTFE/PVDF)
5 Jacket (Tantalum)
E Extension neck length
ΦID Insert diameter
IL Total length of insert
L Immersion length
ΦX Thermowell diameter

Tip shape



6 *Available thermowell tips (reduced, straight or tapered). Maximum surface roughness Ra ≤ 1.6 µm (62.9 µin)*

Pos. No.	Tip shape, L = immersion length	Insert diameter
M	Reduced, L ≥70 mm (2.76 in)	3 mm (0.12 in)
R	Reduced, L ≥50 mm (1.97 in) [1]	3 mm (0.12 in)
S	Straight	6 mm (0.24 in)
T	Tapered, L ≥70 mm (2.75 in) [1]	3 mm (0.12 in)
W	Tapered DIN43772-3G, L ≥90 mm (3.54 in) [1]	6 mm (0.24 in)

1) not with material Hastelloy® C276/2.4819 and Inconel600

Jacket

For thermowells with straight tip shape and protection tube diameter 11 mm (PTFE/Tantalum) and 12 mm (PVDF) (0.43 and 0.47 in), a jacket in PTFE (Teflon®), PVDF or Tantalum is available. The external diameter of the thermowell stem will be 15 mm (PTFE) and 16 mm (PVDF) (0.6 and 0.63 in), for Tantalum 12 mm (0.47 in). The immersion length L will be slightly higher also because of the different thermal expansion of the thermowell and jacket. The upper part of the jacket is fitted with a disc of the same material that is inserted between the flange and counterflange.

Insert Depending on the application different inserts are available for the assembly:

RTD													
Selection in order code	A	B	C	F	G	2	3	6	7	S	T	U	V
Sensor design; wiring type	1x Pt100 WW; 3-wire	2x Pt100 WW; 3-wire	1x Pt100 WW; 4-wire	2x Pt100 WW; 3-wire	1x Pt100 WW; 4-wire	1x Pt100 TF; 3-wire	1x Pt100 TF; 4-wire	1x Pt100 TF; 3-wire	1x Pt100 TF; 4-wire	1x Pt100 TF; 3-wire	1x Pt100 TF; 4-wire	1x Pt100 TF; 3-wire	1x Pt100 TF; 4-wire
Vibration resistance for the tip of the insert	Vibration resistance up to 3g					Increased vibration resistance up to 4g				iTHERM® StrongSens® vibration resistance > 60g			
Measuring range; accuracy class with temperature range	−200 to 600 °C; cl. A, −200 to 600 °C			−200 to 600 °C; cl. AA, 0 to 250 °C		−50 to 400 °C; cl. A, −50 to 250 °C		−50 to 400 °C; cl. AA, 0 to 150 °C		−50 to 500 °C; cl. A, −30 to 300 °C		−50 to 500 °C; cl. AA, 0 to 200 °C	
Insert type	TPR100									iTHERM® TS111			
Diameter	Φ3 mm (0.12 in) or Φ6 mm (0.24 in), depending on the selected tip shape									Φ6 mm (0.24 in)			

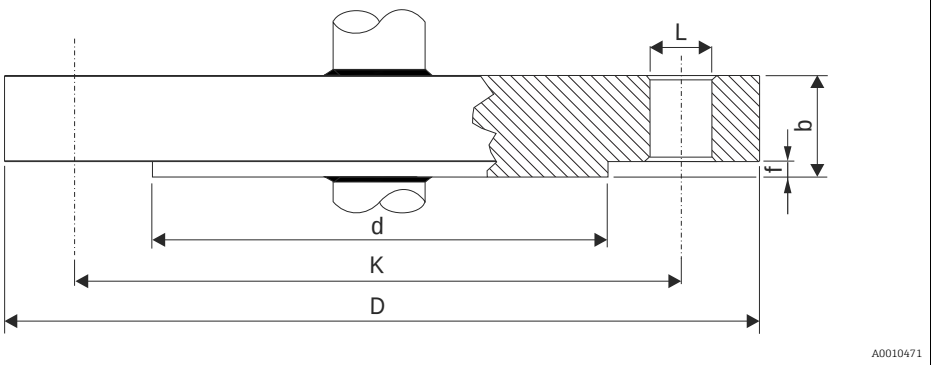
TC				
Selection in order code	A	B	E	F
Sensor design; material	1x K; INCONEL600	2x K; INCONEL600	1x J; 316L	2x J; 316L
Measuring range according to:				
DIN EN 60584	−40 to 1 200 °C		−40 to 750 °C	
ANSI MC 96.1	0 to 1 250 °C		0 to 750 °C	
TC Standard, accuracy	IEC 60584-2; class 1 ASTM E230-03; special			
Insert type	TPC100			
Diameter	Φ3 mm (0.12 in) or Φ6 mm (0.24 in), depending on the selected tip shape			

Weight From 1.5 to 3.5 kg (3.3 to 7.7 lbs) for standard options.

Process connection

The following figure shows the basic dimensions of the available flanges.

Flange



For detailed information on the flange dimensions refer to the following flange standards:

- ANSI/ASME B16.5
- ISO 7005-1
- EN 1092-1
- JIS B 2220 : 2004

The flange material must be the same as of the stem of the thermowell. For this reason, connections are available both in 316L/1.4404 and in 316Ti/1.4571. Models in Hastelloy® have flanges in basic material 316L/1.4404 and a disc in Hastelloy® on the surface in contact with the process media. For the specification PVDF/PTFE/Tantalum thermowell an additional jacket with a disc on the upper end will be used. The standard surface finish of the coupling side of flanges ranges from 3.2 to 6.4 µm (Ra). Other types of flanges can be supplied on request.

Spare parts

- The thermowell TW13 is available as spare part (→ 🖹 25)
- The Jacket (TA730) is available as spare part (→ 🖹 25)
- The gasket set M24x1.5, aramid+NBR (material no. 60001329) is available as spare part
- The RTD insert is available as spare part TPR100 (→ 🖹 25)
- The iTHERM® StrongSens is available as spare part TS111 (→ 🖹 25)
- The TC insert is available as spare part TPC100 (→ 🖹 25)

The inserts are made from mineral insulated cable (MgO) with a sheath in AISI316L/1.4404 (RTD) or Inconel600 (TC).

If spare parts are required, refer to the following equation:

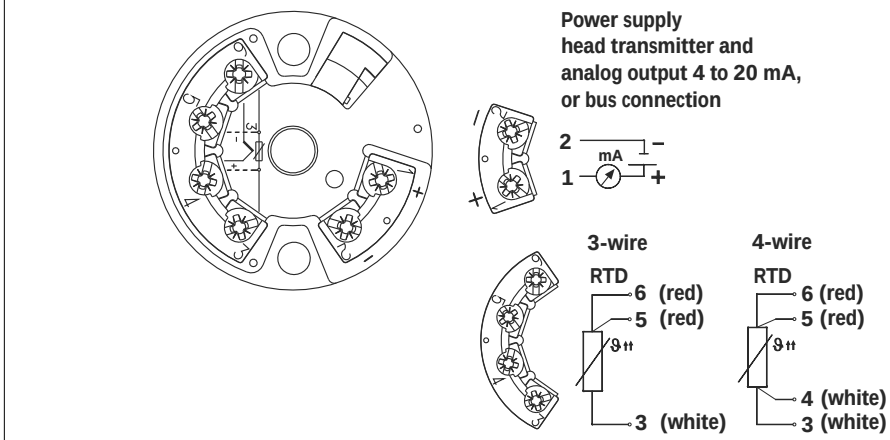
Insertion length IL = E + L + 10 mm (0.4 in)

Wiring

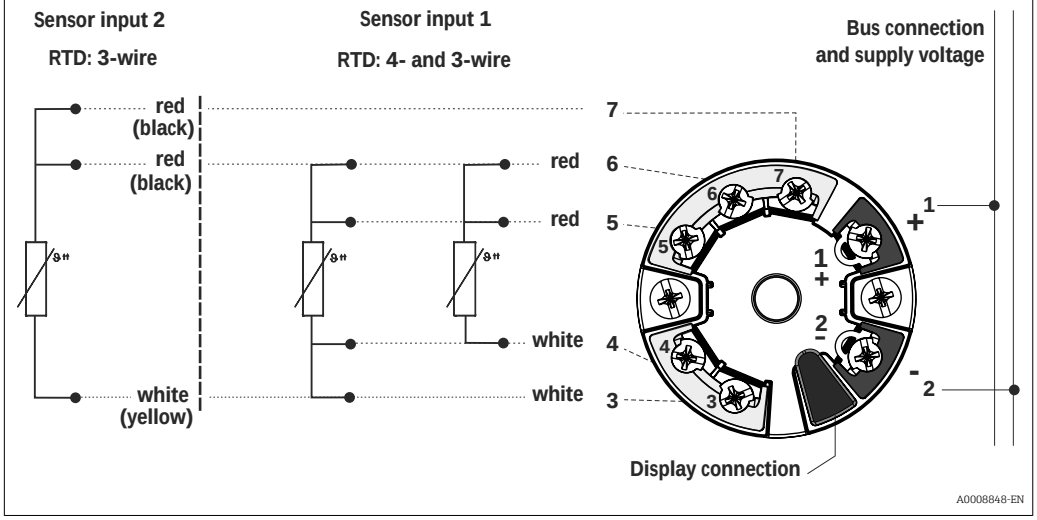
Wiring diagrams for RTD

Type of sensor connection

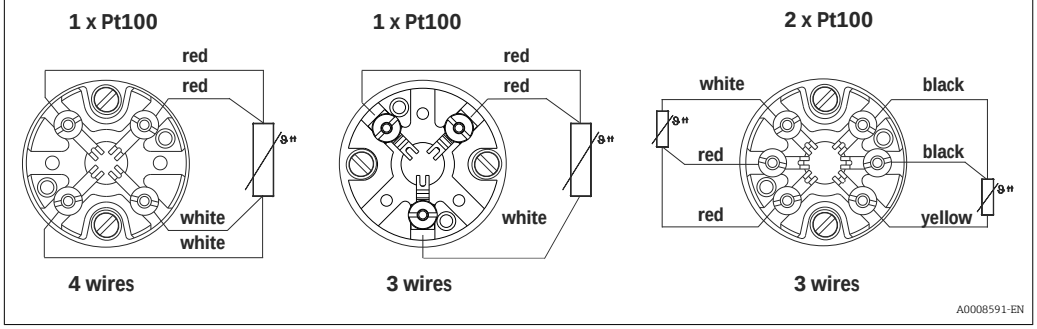
Head mounted transmitter TMT18x (single input)



Head mounted transmitter TMT8x (dual input)



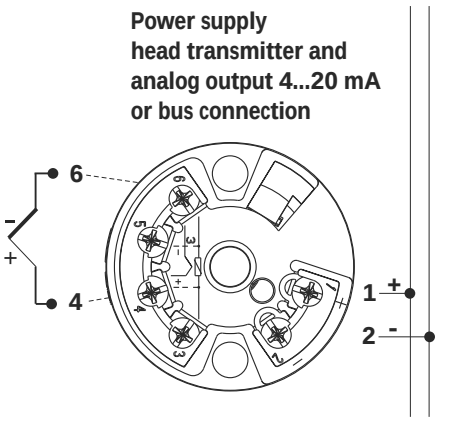
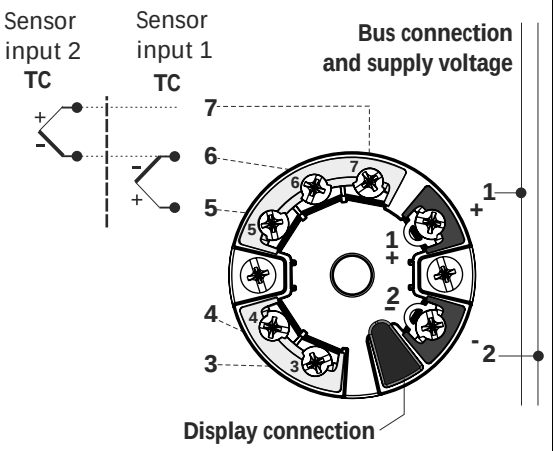
Terminal block mounted

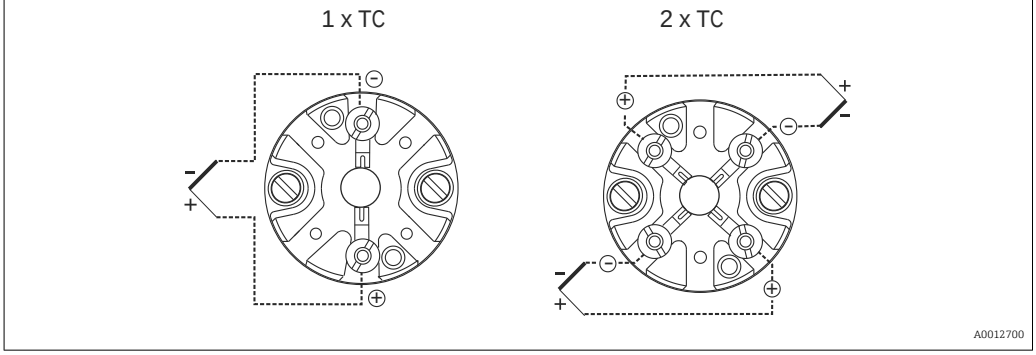


Wiring diagrams for TC

Thermocouple wire colors

As per IEC 60584	As per ASTM E230
▪ Type J: black (+), white (-) ▪ Type K: green (+), white (-)	▪ Type J: white (+), red (-) ▪ Type K: yellow (+), red (-)

Head mounted transmitter TMT18x (single input)	Head mounted transmitter TMT8x (dual input)
	

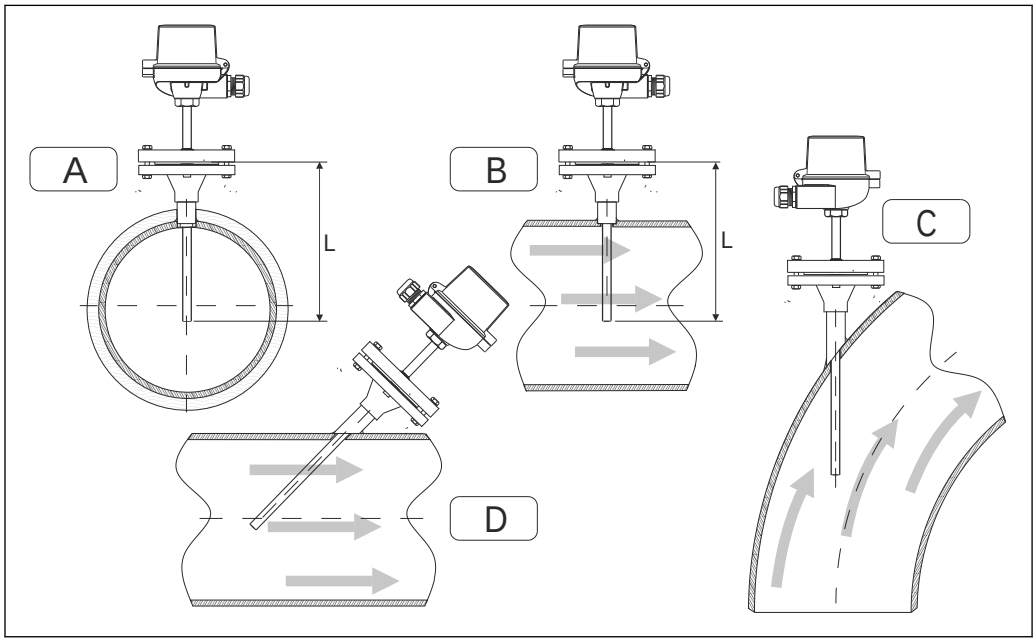
Terminal block mounted


Installation conditions

Orientation

No restrictions.

Installation instructions



7 *Installation examples*

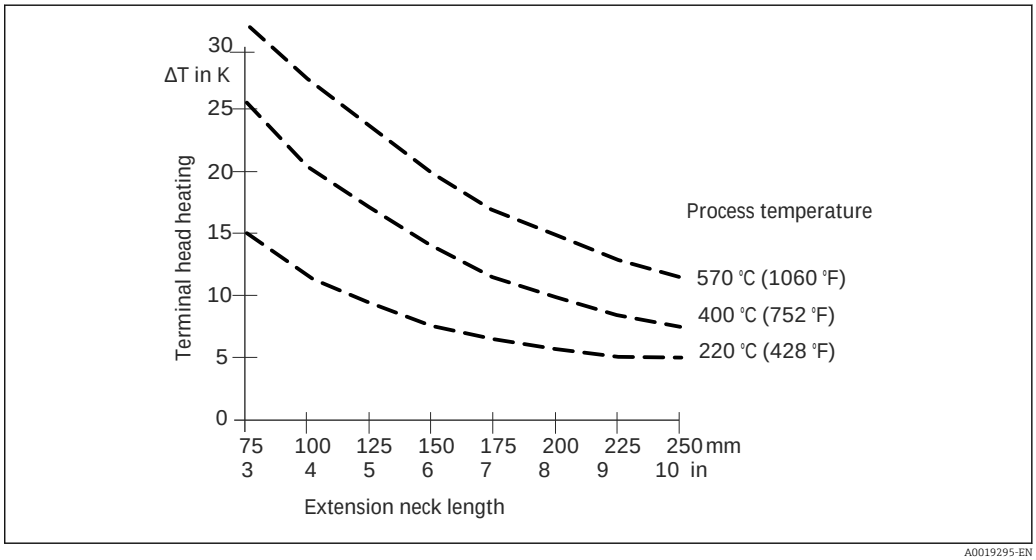
A-B In pipes with a small cross section the thermowell tip should reach or extend slightly past the center line of the pipe (=L).
C-D Angled installation.

The immersion length of the thermometer influences the accuracy. If the immersion length is too small then errors in the measurement are caused by heat conduction via the process connection and the container wall. If installing into a pipe then the immersion length should be at least half of the pipe diameter. A further solution could be an angled (tilted) installation (see C and D). When determining the immersion length all thermometer parameters and the process to be measured must be taken into account (e.g. flow velocity, process pressure).

- Installation possibilities: Pipes, tanks or other plant components
- Recommended minimum immersion length: 80 to 100 mm (3.15 to 3.94 in)
  The immersion length should correspond to at least 8 times of the thermowell diameter. Example: Thermowell diameter 12 mm (0.47 in) x 8 = 96 mm (3.8 in). A standard immersion length of 120 mm (4.72 in) is recommended.
- ATEX certification: Always take note of the installation regulations!

Extension neck length

The extension neck is the part between the process connection and the terminal head. As illustrated in the following diagram, the extension neck length influences the temperature in the terminal head. This temperature must remain within the limit values defined in the "Operating conditions" section.



8 Heating of the terminal head consequent to the process temperature. Temperature in terminal head = ambient temperature 20 °C (68 °F) + ΔT

Certificates and approvals

CE Mark	The device meets the legal requirements of the EC directives if applicable. Endress+Hauser confirms that the device has been successfully tested by applying the CE mark.
Hazardous area approvals	For further details on the available Ex versions (ATEX, CSA, FM etc.), please contact your nearest Endress+Hauser sales organization. All relevant data for hazardous areas can be found in separate Ex documentation.
Other standards and guidelines	▪ EN 60079: ATEX certification for hazardous areas ▪ IEC 60529: Degree of protection of housing (IP code) ▪ IEC 61010-1: Protection Measures for Electrical Equipment for Measurement, Control, Regulation and Laboratory Procedures. ▪ IEC 60751: Industrial platinum resistance thermometers ▪ IEC 60584 and ASTM E230/ANSI MC96.1: Thermocouples ▪ DIN 43772: Thermowells ▪ DIN EN 50446: Terminal heads ▪ IEC 61326-1: Electromagnetic compatibility (EMC requirements)
PED approval	The thermometer complies with paragraph 3.3 of the Pressure Equipment Directive 97/23/CE and is not marked separately.
Material certification	The material certificate 3.1 (according to EN 10204) can be requested separately. The "short form" certificate includes a simplified declaration with no enclosures of documents related to the materials used in the construction of the single sensor and guarantees the traceability of the materials through the identification number of the thermometer. The data related to the origin of the materials can subsequently be requested if necessary.
Test on thermowell	Thermowell pressure tests are carried out in accordance with the specifications in DIN 43772. With regard to thermowells with tapered or reduced tips that do not comply with this standard, these are tested using the pressure of corresponding straight thermowells. Sensors for use in hazardous areas are also always subjected to a comparative pressure during the tests. Tests according to other specifications can be carried out on request. The liquid penetration test verifies that there are no cracks in the welded seams of the thermowell.
Test report and calibration	The "Factory calibration" is carried out according to an internal procedure in a laboratory of Endress +Hauser accredited by the European Accreditation Organization (EA) according to ISO/IEC 17025. A calibration which is performed according to EA guidelines (SIT/Accredia or DKD/DAkks calibration) may be requested separately. The calibration is performed on the replaceable insert of the thermometer. In the case of thermometers without a replaceable insert, the entire thermometer - from the process connection to the tip of the thermometer - is calibrated.

Ordering information

Detailed ordering information is available from the following sources:
- In the Product Configurator on the Endress+Hauser website: www.endress.com → Select country → Instruments → Select device → Product page function: Configure this product
- From your Endress+Hauser Sales Center: www.endress.com/worldwide

Product Configurator - the tool for individual product configuration
- Up-to-the-minute configuration data
- Depending on the device: Direct input of measuring point-specific information such as measuring range or operating language
- Automatic verification of exclusion criteria
- Automatic creation of the order code and its breakdown in PDF or Excel output format
- Ability to order directly in the Endress+Hauser Online Shop

Accessories

Various accessories, which can be ordered with the device or subsequently from Endress+Hauser, are available for the device. Detailed information on the order code in question is available from your local Endress+Hauser sales center or on the product page of the Endress+Hauser website: www.endress.com.

Communication-specific accessories

Configuration kit TXU10	Configuration kit for PC-programmable transmitter with setup software and interface cable for PC with USB port Order code: TXU10-xx
Commubox FXA195 HART	For intrinsically safe HART communication with FieldCare via the USB interface. For details, see "Technical Information" TI00404F
Commubox FXA291	Connects Endress+Hauser field devices with a CDI interface (= Endress+Hauser Common Data Interface) and the USB port of a computer or laptop. For details, see "Technical Information" TI00405C
HART Loop Converter HMX50	Is used to evaluate and convert dynamic HART process variables to analog current signals or limit values. For details, see "Technical Information" TI00429F and Operating Instructions BA00371F
Wireless HART adapter SWA70	Is used for the wireless connection of field devices. The WirelessHART adapter can be easily integrated into field devices and existing infrastructures, offers data protection and transmission safety and can be operated in parallel with other wireless networks with minimum cabling complexity. For details, see Operating Instructions BA061S
Fieldgate FXA320	Gateway for the remote monitoring of connected 4-20 mA measuring devices via a Web browser. For details, see "Technical Information" TI00025S and Operating Instructions BA00053S
Fieldgate FXA520	Gateway for the remote diagnostics and remote configuration of connected HART measuring devices via a Web browser. For details, see "Technical Information" TI00025S and Operating Instructions BA00051S
Field Xpert SFX100	Compact, flexible and robust industry handheld terminal for remote configuration and for obtaining measured values via the HART current output (4-20 mA). For details, see Operating Instructions BA00060S

Service-specific accessories

Accessories	Description
Applicator	Software for selecting and sizing Endress+Hauser measuring devices: ▪ Calculation of all the necessary data for identifying the optimum measuring device: e.g. pressure loss, accuracy or process connections. ▪ Graphic illustration of the calculation results Administration, documentation and access to all project-related data and parameters over the entire life cycle of a project. Applicator is available: ▪ Via the Internet: https://wapps.endress.com/applicator ▪ On CD-ROM for local PC installation.

Konfigurator+temperature	Software for selecting and configuring the product depending on the measuring task, supported by graphics. Includes a comprehensive knowledge database and calculation tools: ▪ For temperature competence ▪ Quick and easy design and sizing of temperature measuring points ▪ Ideal measuring point design and sizing to suit the processes and needs of a wide range of industries The Konfigurator is available: On request from your Endress+Hauser sales office on a CD-ROM for local PC installation.

W@M	Life cycle management for your plant W@M supports you with a wide range of software applications over the entire process: from planning and procurement, to the installation, commissioning and operation of the measuring devices. All the relevant device information, such as the device status, spare parts and device-specific documentation, is available for every device over the entire life cycle. The application already contains the data of your Endress+Hauser device. Endress +Hauser also takes care of maintaining and updating the data records. W@M is available: ▪ Via the Internet: www.endress.com/lifecyclemanagement ▪ On CD-ROM for local PC installation.

FieldCare	FDT-based plant asset management tool from Endress+Hauser. It can configure all smart field units in your system and helps you manage them. By using the status information, it is also a simple but effective way of checking their status and condition. For details, see Operating Instructions BA00027S and BA00059S

System components

Accessories	Description
Field display unit RIA16	The display unit records the analog measuring signal from the head transmitter and shows this on the display. The LC display shows the current measured value in digital form and as a bar graph indicating a limit value violation. The display unit is looped into the 4 to 20 mA circuit and gets the required energy from there. For details, see the "Technical Information" document TI00144R/09/en
RN221N	Active barrier with power supply for safe separation of 4-20 mA standard signal circuits. Offers bidirectional HART transmission. For details, see "Technical Information" TI00073R and Operating Instructions BA00202R
RNS221	Supply unit for powering two 2-wire measuring devices solely in the non-Ex area. Bidirectional communication is possible via the HART communication jacks. For details, see "Technical Information" TI00081R and Brief Operating Instructions KA00110R

Documentation

Technical Information
- iTEMP® Temperature head transmitter
  - TMT180, PC-programmable, single-channel, Pt100 (TI088R/09/en)
  - PCP TMT181, PC-programmable, single-channel, RTD, TC, Ω, mV (TI00070R/09/en)
  - HART® TMT182, single-channel, RTD, TC, Ω, mV (TI078R/09/en)
  - HART® TMT82, two-channel, RTD, TC, Ω, mV (TI01010T/09/en)
  - PROFIBUS® PA TMT84, two-channel, RTD, TC, Ω, mV (TI00138R/09/en)
  - FOUNDATION Fieldbus™ TMT85, two-channel, RTD, TC, Ω, mV (TI00134R/09/en)
- Inserts:
  - Resistance thermometer insert Omniset TPR100 (TI268t/02/en)
  - Thermocouple insert Omniset TPC100 (TI278t/02/en)
  - iTHERM® TS111 Insert for installation in thermometers (TI01014T/09/en)
- Thermowell and thermowell oversheats:
  - Thermowell for temperature sensors Omnigrad M TW13 (TI00264T/02/en)
  - Thermowell oversheats Omnigrad TA730 (TI233t/02/en)
- Application example:
  - RN221N Active barrier, for supplying loop-powered transmitters (TI073R/09/en)
  - RIA16 Field display unit, loop-powered (TI00144R/09/en)

Supplementary ATEX documentation:
- RTD/TC Thermometer Omnigrad TRxx, TCxx, TxCxxx, ATEX II 1GD or II 1/2GD Ex ia IIC T6 to T1 (XA00072R/09/a3)
- Omnigrad TRxx, Omniset TPR100, TET10x, TPC100, TEC10x ATEX II 3GD EEx nA (XA00044r/09/a3)
- Inserts Omniset TPR100, TPC100, ATEX/IECEx Ex ia (XA00100T/09/a3)

www.addresses.endress.com

Endress+Hauser

People for Process Automation

Slovenský metrologický ústav
Karloveská 63, 842 55 Bratislava 4

CERTIFIKÁT TYPU MERADLA

č. 023/321/12 zo dňa 27. novembra 2012

Slovenský metrologický ústav v súlade s ustanovením § 30 písm. b) a § 32 ods. 2 písm. e) zákona č. 142/2000 Z. z. o metrológii a o zmene a doplnení niektorých zákonov v znení neskorších predpisov (ďalej len "zákon") na základe žiadosti číslo 361293 vydáva podľa § 11 ods. 1 zákona toto rozhodnutie, ktorým

schvaľuje typ meradla

Názov meradla:	Odporové snímače teploty Pt100
Typ meradla:	T10xx
Žiadateľ:	JSP Slovakia s.r.o., Bratislava IČO: 35 760 745
Výrobca:	JSP, s.r.o., Česká republika

a podľa § 10 ods. 1 zákona potvrdzuje, že uvedený typ meradla vyhovuje svojimi technickými charakteristikami, metrologickými charakteristikami a konštrukčným vyhotovením požiadavkám na daný druh určeného meradla ustanovenými v prílohe č. 37 "Snímače teploty a prevodníky teploty" k vyhláške ÚNMS SR č. 210/2000 Z. z. o meradlách a metrologickej kontrole v znení neskorších predpisov (ďalej len "vyhláška 210/2000 Z. z.").

Základné technické charakteristiky a metrologické charakteristiky meradla a výsledky technických skúšok a zistení o splnení požiadaviek na daný druh meradla sú uvedené v protokole č. 652/270/32/12 zo dňa 23. 11. 2012 vydanom Slovenským metrologickým ústavom.

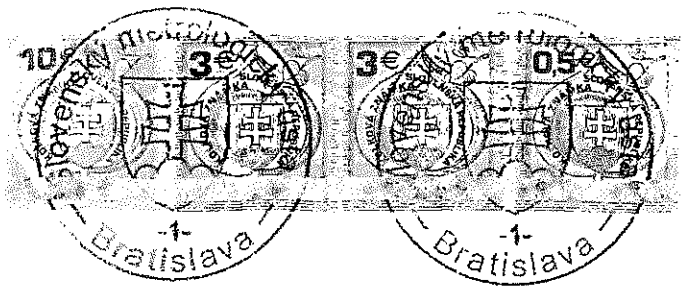
Uvedenému typu meradla sa prideľuje značka schváleného typu:

TSK 321/12 - 023

Dovozca je povinný podľa § 14 ods. 2 zákona umiestniť na meradle značku schváleného typu a podľa § 16 ods. 2 zákona zabezpečiť prvotné overenie meradla pred jeho uvedením na trh.

Platnosť do: 26. novembra 2022

Poučenie: Proti tomuto rozhodnutiu možno podať do 15 dní odo dňa jeho doručenia odvolanie na Úrad pre normalizáciu, metrológiu a skúšobníctvo Slovenskej republiky, Štefanovičova 3, P.O.BOX 76, 810 05 Bratislava prostredníctvom Slovenského metrologického ústavu.



RNDr. Jozef Kadlečík
zastupujúci generálny riaditeľ

Popis meradla: Odporové snímače teploty typu T10xx sa skladajú z hliníkovej hlavice, meracej vložky so snímačom Pt100 a puzdra alebo ochrannej trubice. V nerezovej stonke meracej vložky s priemerom 6 mm alebo 8 mm sú umiestnené jeden alebo dva platinové meracie odpory, ktoré sú 2-, 3-, alebo štvorvodičovým vnútorným zapojení pripojené ku keramickej svorkovnici.

Označenie	Vyhotovenie	Teplotný rozsah °C	Menovitá dĺžka L (mm)	Priemer puzdra Ø (mm) (vyhotovenie s puzdrom)
T 1001	s puzdrom	-50 až +600	100 až 630	11
T 1002	do puzdra	-50 až +600	100 až 630	-
T 1003	s puzdrom	-50 až +600	100 až 630	9
T 1004	s puzdrom/s upevňovacou prírubou	-50 až +600	100 až 5 300	11 až 20
T 1005	s puzdrom	-50 až +120	100 až 530	9
T 1006	tyčové	-50 až +600	250 až 2000	-
T 1007	bez puzdra	-50 až +600	110 až 2000	-
T 1020	bez puzdra	-50 až +600	100 až 630	-
T 1023	do puzdra	-50 až +600	140 až 260	-
T 1025	s puzdrom	-40 až +180	100 až 250	8
T 1070	s puzdrom/do puzdra/bez puzdra/tyčové	-50 až +600	100 až 10 000	9 až 24

Ku všetkým uvedeným typom odporových snímačov teploty môžu byť pripojené prevodníky teploty. Na prevodníky teploty sa toto schválenie typu nevzťahuje.

Odporové snímače teploty zodpovedajú určenému meradlu podľa položiek 1.3.13 a), b); 3.1.2 b) a 3.1.5 c) prílohy č. 1 vyhlášky 210/2000 Z. z. a sú v podľa tohto certifikátu o schválení typu určené len na použitie okrem oblasti definovanej v Nariadení vlády SR č. 294/2005 Z. z. o meradlách v znení Nariadenia vlády SR č. 445/2010 Z. z.

Základné technické charakteristiky a metrologické charakteristiky:

Typ meracieho odporu:	1 x Pt100 alebo 2 x Pt100
Základný odpor:	100 Ω podľa STN EN 60 751:2009
Maximálny merací prúd:	5 mA (pre vyhotovenie T1004 max. 3 mA)
Trieda presnosti:	**A** alebo **B** podľa STN EN 60 751:2009 a prílohy č. 37 k vyhláške 210/2000 Z. z.
Vnútorné zapojenie.	2-, 3- alebo štvorvodičové

Overenie meradla:

Overenie sa vykonáva v súlade s prílohou č. 37 "Snímače teploty a prevodníky teploty" k vyhláške 210/2000 Z. z., ak sú tieto meradlá určené na používanie ako určené meradlá okrem oblasti definovanej v Nariadení vlády SR č. 294/2005 Z. z. o meradlách v znení nariadenia vlády č. 445/2010 Z. z.. Skúška závislosti odporu na teplote sa vykoná minimálne v troch bodoch, zodpovedajúcich dolnej, hornej a strednej časti rozsahu konkrétneho meradla.

Čas platnosti overenia je podľa prílohy č. 1 k vyhláške 210/2000 Z. z. položky:

1.3.13 Meracie zostavy (pre stacionárne merania): a) na kvapaliny okrem vody 2 roky
b) ma skvapalnené plyny 1 rok

3.1.2b Meradlá používané na stanovenie spalného tepla pri bilančných meraniach/elektrické snímače teploty 2 roky

3.1.5c Merače tepla a ich členy (teplonosné médium para)/odporové snímače teploty 4 roky

Umiestnenie overovacej značky a montážnych značiek:

Umiestnenie overovacej značky a montážnych značiek sa vykoná podľa bodu 8 protokolu č. 652/270/32/12.

Slovenský metrologický ústav

Tento certifikát môže byť rozmnožovaný len celý a nezmenený.
Rozmnožovať jeho časti možno len s písomným súhlasom Slovenského metrologického ústavu.

Slovenský metrologický ústav
Karloveská 63, 842 55 Bratislava 4
Oddelenie termometrie, dĺžky, času a elektriny

PROTOKOL
O POSÚDENÍ TYPU MERADLA

č.: 652/270/32/12

Názov meradla:	Odporové snímače teploty Pt 100
Typ meradla:	T10xx
Značka schváleného typu:	TSK 321/12-023
Výrobca:	JSP, s.r.o. Raisova 547 506 01 Jičín, ČR
Žiadateľ:	JSP Slovakia s.r.o. Karloveská 63 841 04 Bratislava
Evidenčné číslo žiadosti:	361 293
Počet strán:	8
Počet príloh:	1

Dátum vydania:	**Pečiatka:**	**Protokol schválil:**
23. 11. 2012	Slovenský metrologický ústav	Ing. Štefan Gašparík vedúci oddelenia

Tento protokol môže byť rozmnožovaný len celý a nezmenený.
Rozmnožovať jeho časti možno len so súhlasom Slovenského metrologického ústavu.

1. Všeobecné ustanovenie

Tento protokol je podkladom na predĺženie rozhodnutia o schválení typu meradla podľa § 11 (resp. § 37) ods. 6 zákona 142/2000 Z.z. o metrológii a o zmene niektorých zákonov v znení zákona č. 431/2004 Z.z. (ďalej len „zákon o metrológii") na typ meradla:

Odporový snímač teploty Pt100 typ T10xx

1.1 Rozsah posudzovania

Meradlo svojím charakterom zodpovedá:

určenému meradlu podľa položiek č. 1.3.13 a), b), 3.1.2.b) a 3.1.5 c) Prílohy č. 1 Vyhlášky ÚNMS SR č. 210/2000 Z. z. o meradlách a metrologickej kontrole v znení neskorších predpisov a sú v podľa tohto protokolu o posúdení typu meradla stanovené na používanie ako určené meradlá okrem oblasti definovanej Nariadením vlády SR o meradlách č. 294/2005 Z. z..

Odporové snímače teploty Pt100 typ T10xx sa používajú vo funkcii:

1.3.13 Meracie zostavy (pre stacionárne merania)
a) na kvapaliny okrem vody
b) na skvapalnené plyny

3.1.2 Meradlá používané na stanovenie spalného tepla pri bilančných meraniach
b) elektrické snímače teplôt

3.1.5 Merače tepla a ich členy - len pre teplonosné médium vodná para
c) odporové snímače teploty

Meradlo bolo posudzované z hľadiska požiadaviek na daný druh meradla ustanovených Prílohou č. 37 k Vyhláške č. 9/2001 Z. z. „Snímače teploty a prevodníky teploty"

1.2 Údaje o technickej dokumentácii použitej pri posudzovaní

Pri posudzovaní meradla v rámci schválenia typu meradla boli odborne posúdené nasledovné dokumenty výrobcu označené ako prílohy:

- Snímače teploty pro nízke a střední teploty, JSP, s.r.o., 2012, český jazyk
- T10 - Odporové snímače teploty - Informační list č. 2001/06, český jazyk
- Tyčové snímače teploty pro střední a vysoké teploty, český jazyk
- Odporové a termoelektrické snímače teploty, český jazyk
- Odporové snímače teploty T1004 s přírubovou jímkou, český jazyk
- Snímače teploty pro nízke a střední teploty, český jazyk
- Modulární odporové a termoelektrické snímače teploty, český jazyk

Uvedená dokumentácia je uložená na Oddelení termometrie, dĺžky, času a elektriny Slovenského metrologického ústavu.

1.3 Údaje o dokladoch použitých pri posudzovaní

Pri posudzovaní meradla v rámci schválenia typu meradla boli použité dokumenty:

- Certifikát o schválení typu měřidla č. 011-CS-C009-12, miesto a dátum vydania: Český metrologický institut Brno, 28. 2. 2012, český jazyk
- Certifikát o schválení typu měřidla č. 011-CS-C016-02, miesto a dátum vydania: Český metrologický institut Brno, 15.02.2002, český jazyk
- Protokol o technické zkoušce č. TCM 321/01 - 3604, miesto a dátum vydania: Český metrologický institut Brno, 29.01.2002, český jazyk
- Pracovní protokol (protokoly o meraní) - ev.č. 11 0-300 a ev. č. 13 0-100, český jazyk
- Kalibrační list č. T696/2002 zo dňa 30.9.2002, VUCHZ Brno, český jazyk
- Kalibrační list č. T711/2002 zo dňa 2.10.2002, VUCHZ Brno, český jazyk
- Kalibrační list č. T712/2002 zo dňa 2.10.2002, VUCHZ Brno, český jazyk
- Kalibrační list č. T713/2002 zo dňa 2.10.2002, VUCHZ Brno, český jazyk
- Kalibrační list č. T716/2002 zo dňa 2.10.2002, VUCHZ Brno, český jazyk

Doklady použité pri posudzovaní sú uložené na Oddelení termometrie, dĺžky, času a elektriny Slovenského metrologického ústavu.

1.4 Údaje o vzorkách určeného meradla

Na základe vyhlásenia žiadateľa, že tieto meradlá nezmenili svoje technické a metrologické parametra voči pôvodnému schváleniu typu z roku 2002 (posledná revízia – zo dňa 9. 6. 2008 - Revízia č.2), pre účely posúdenia boli využité výsledky skúšania vzoriek uvedených v Protokole o posúdení typu meradla č. 180/270/321/08 zo dňa 9. 6. 2008:

- odporový snímač teploty evid.číslo 11, 000134462300117, 00388406, JSP 116061, 005, 1100Demo, 1xPt100/B/4, označenie SMU: 054/02/1
- odporový snímač teploty evid.číslo 13, 000134462300117, 00388406, JSP 116061, 008, 1100Demo, 1xPt100/B/4, označenie SMU: 054/02/2
- odporový snímač teploty č. 0001, 000153062300142, 00399072, JSP 117739, 1xPt100/A/4, označenie SMU: 054/02/7
- odporový snímač teploty č.0002, 000153062300142, 00399072, JSP 117739, 1xPt100/A/4, označenie SMU: 054/02/8
- odporový snímač teploty č.0002, 000191022300237, 00385021, JSP 121116, 1xPt100/B/4, (-50 až +600) °C, dĺžka: 420 mm, priemer: 8 mm, označenie SMU: 085/02/3
- odporový snímač teploty č.0001, 000189302300235, 00385021, JSP 121026, 1xPt100/B/4, (-50 až +600) °C, dĺžka: 420 mm, priemer: 8 mm, označenie SMU: 085/02/4
- odporový snímač teploty č.0004, 000189302300235, 00385021, JSP 121026,

- 1xPt100/B/4, (-50 až +600) °C, dĺžka: 420 mm, priemer: 8 mm, označenie SMU: 085/02/2
- odporový snímač teploty č.0002, 000189302300235, 00385021, JSP 121026, 1xPt100/B/4, (-50 až +600) °C, dĺžka: 420 mm, priemer: 8 mm, označenie SMU: 085/02/5
- odporový snímač teploty č.0004, 000183882300229, 00383130, JSP 120547, 1xPt100/B/4, (-50 až +600) °C, dĺžka: 420 mm, priemer: 6 mm, označenie SMU: 085/02/1
- odporový snímač teploty T1004-3, 072 999J99N9H6S1 P9 ED, 2xPt100/A/3, teplotný rozsah: (-50 až 450) °C
- odporový snímač teploty evid.č. 17, 000139232300123, 00383128, JSP 116492, 003, 1xPt100/B/4, označenie SMU: 054/02/5
- odporový snímač teploty evid.č. 24, 000139232300123, 00383128, JSP 116492, 0006, 1xPt100/B/4, označenie SMU: 054/02/3

Miesto uloženia vzoriek: vzorky č. 24, č.17 a č. 085/02/1 sú uložené na Oddelení termometrie, dĺžky, času a elektriny Slovenského metrologického ústavu.

Nové vzorky meradiel nebolí vyžiadané.

2. Popis meradla

2.1 Technický popis meradla

Odporové snímače teploty typu T10xx sa skladajú z hliníkovej hlavice, meracej vložky so snímačom Pt 100 a puzdra alebo ochrannej trubice. V nerezovej stonke meracej vložky s priemerom 6 alebo 8 mm sú umiestnené jeden alebo dva platinové meracie odpory, ktoré sú dvoj-, troj-, alebo štvorvodičovým vnútorným zapojením pripojené ku keramickej svorkovnici. Hlavica snímača teploty chráni keramickú svorkovnicu meracej vložky, na ktorú je pripojená snímacia časť odporového snímača teploty. Pri meraní sa využíva definovaná zmena odporu v závislosti na zmene teploty.

Snímače typu T10xx môžu byť vyhotovené do puzdra s puzdrom, tyčové, alebo pre priamu montáž do potrubia.

Snímače typu T1002 sa montujú do puzdier WT70C, WT70T a WT70 podľa technickej dokumentácie výrobcu.

Vyhotovenia odporových snímačov teploty sa používajú ako členy meračov tepla pre teplonosné médium vodná para. Ďalej sa môžu použiť ako súčasti určených meradiel pre fakturačné meranie podľa prílohy č. 1 k vyhláške ÚNMS SR č. 210/2000 Z.z. o meradlách a metrologickej kontrole v znení neskorších predpisov.

Prídavné zariadenia:

Ku všetkým uvedeným typom odporových snímačov teploty môžu byť pripojené prevodníky teploty.

Na prevodníky teploty sa toto schválenie typu nevzťahuje.

Tabuľka č.1

Označenie	Vyhotovenie	Teplotný rozsah °C	Menovitá dĺžka L mm	Priemer puzdra (vyhotovenie s puzdrom) mm
T1001	s puzdrom	-50 až +600	100 až 630	11
T1002	do puzdra	-50 až +600	100 až 630	-
T1003	s puzdrom	-50 až +600	100 až 630	9
T1004	s puzdrom, s upevňovacou prírubou	-50 až +600	100 až 5300	11 až 20
T1005	s puzdrom	-50 až +120	100 až 530	9
T1006	tyčové	-50 až +600	250 až 2000	-
T1007	priama montáž	-50 až +600	110 až 2000	-
T1020	priama montáž	-50 až +600	100 až 630	-
T1023	do puzdra	-50 až +600	140 až 260	-
T1025	s puzdrom	-40 až +180	100 až 250	8
T1070	s puzdrom, do puzdra, bez puzdra, tyčové	-50 až 600	100 až 10 000	9 až 24

2.1 Základné technické a metrologické charakteristiky

Typ meracieho odporu: 1 x Pt100, alebo 2 x Pt100
Základný odpor: 100 Ω podľa STN EN 60 751:2009
Maximálny merací prúd: 5 mA,
pre vyhotovenie T1004: max 3 mA
Teplotný rozsah: (-50 až +600) °C
Trieda presnosti: A alebo B podľa STN EN 60751:2009 a
Prílohy č. 37 k vyhláške ÚNMS SR č. 9/2001 Z. z.
Vnútorné zapojenie: 2-, 3- alebo štvorvodičové
Priemer meracej vložky: 6 mm alebo 8 mm
Dĺžka meracej vložky: (140 až 1025) mm

Merací odpor pri každom vyhotovení môže byť:

- 1 x Pt100, trieda presnosti A alebo B podľa STN EN 60751:2008 a podľa Prílohy č. 37 k Vyhláške ÚNMS SR č.9/2001 Z. z., 4-vodičové, 3-vodičové alebo 2-vodičové vnútorné zapojenie,
- 2 x Pt 100, trieda presnosti A alebo B podľa STN EN 60751:2008 a podľa Prílohy č. 37 k Vyhláške ÚNMS SR č.9/2001 Z. z., 3-vodičové alebo 2- vodičové vnútorné zapojenie.

3. Posúdenie výkresovej a technickej dokumentácie

Na základe posúdenia výkresovej a technickej dokumentácie možno konštatovať, že predložené vzorky meradiel boli vyrobené podľa nich.

4. Podmienky vykonania skúšok technických charakteristík a metrologických charakteristík

Skúšky odporových snímačov teploty boli vykonané v SMU Bratislava.

Predložené vzorky meradiel sa skúšali porovnávacou metódou v kvapalinových termostatoch a v kalibračnej peci porovnávacou metódou podľa pracovného postupu pp é4/270/00 na skúšobnom zariadení laboratória termometrie SMU Bratislava.

Skúšky sa vykonali v súlade s požiadavkami pre schválenie typu meradla, ktoré sú uvedené v Prílohe č. 37 k Vyhláške č. 9/2001 Z. z. .

5. Údaje o hodnotených technických charakteristikách a metrologických charakteristikách

V rámci schvaľovania typu meradla boli posudzované nasledovné technické a metrologické charakteristiky meradla podľa Prílohy č. 37 k Vyhláške č. 9/2001 Z. z. .

Tabuľka č.2

Hodnotené technické a metrologické charakteristiky, príloha č. 37 k vyhláške č. 9/2001 Z.z.	**Výsledky skúšok**	**Vyhodnotenie**
Bod 2, Druhá časť, Oddiel I **Metrologické a technické požiadavky Trieda presnosti, najväčšie dovolené chyby**	Vyhodnotené na základe dokumentácie výrobcu, vizuálnou kontrolou meradla a na základe skúšok pri schvaľovaní typu	vyhovel požiadavkám
Bod 3., Druhá časť Oddiel I **Označenie snímačov teploty**	Vyhodnotené na základe dokumentácie výrobcu a vizuálnou kontrolou snímačov	vyhovel požiadavkám
Bod 4, Druhá časť, Oddiel I **Technické skúšky pri schvaľovaní typu**	Vyhodnotené na základe dokumentácie výrobcu, na základe skúšok pri schvaľovaní typu v súlade s prílohou k vyhláške	vyhovel požiadavkám

6. Záver

Z výsledkov skúšok, meraní, zistení a vyhodnotení vyplýva, že uvedený typ meradla vyhovuje svojimi technickými charakteristikami, metrologickými charakteristikami a konštrukčným vyhotovením požiadavkám vzťahujúcim sa na daný druh meradla ustanovenými v Prílohe č. 37 k Vyhláške č. 9/2001 Z.z. pod názvom "Snímače teploty a prevodníky teploty".

7. Údaje na meradle

V zmysle požiadaviek, ktoré sú uvedené v Prílohe č. 37 k Vyhláške ÚNMS SR č. 9/2001 Z. z. budú na štítku každého snímača teploty uvedené nasledovné údaje:

a) označenie výrobcu
b) označenie typu
c) značka schválenia typu
d) výrobné číslo
e) druh snímača (Pt 100)
f) zapojenie (napr. 4-vodičové)
g) trieda presnosti
h) teplotný rozsah

Štítok na snímači teploty musí byť z trvanlivého materiálu, údaje na ňom musia byť nezmazateľné.

8. Overenie

Overenie odporových snímačov teploty T10xx sa vykoná v súlade s Prílohou č. 37 k Vyhláške ÚNMS SR č. 9/2001 Z. z. ak sú tieto meradlá v rozsahu tohto protokolu o posúdení typu meradla stanovené na používanie ako určené meradlá okrem oblasti definovanej Nariadením vlády SR o meradlách č. 294/2005 Z. z..

Skúška závislosti odporu na teplote sa vykoná minimálne v troch bodoch zodpovedajúcich dolnej, hornej a strednej časti rozsahu konkrétneho meradla.

Čas platnosti overenia podľa Prílohy č. 1 Vyhlášky ÚNMS SR č. 210/2000 Z.z. o meradlách a metrologickej kontrole v znení neskorších predpisov.

1.3.13 Meracie zostavy (pre stacionárne merania)	
a) na kvapaliny okrem vody	**2 roky**
b) na skvapalnené plyny	**1 rok**

3.1.2 Meradlá používané na stanovenie spalného tepla pri bilančných meraniach	
b) elektrické snímače teplôt	**2 roky**

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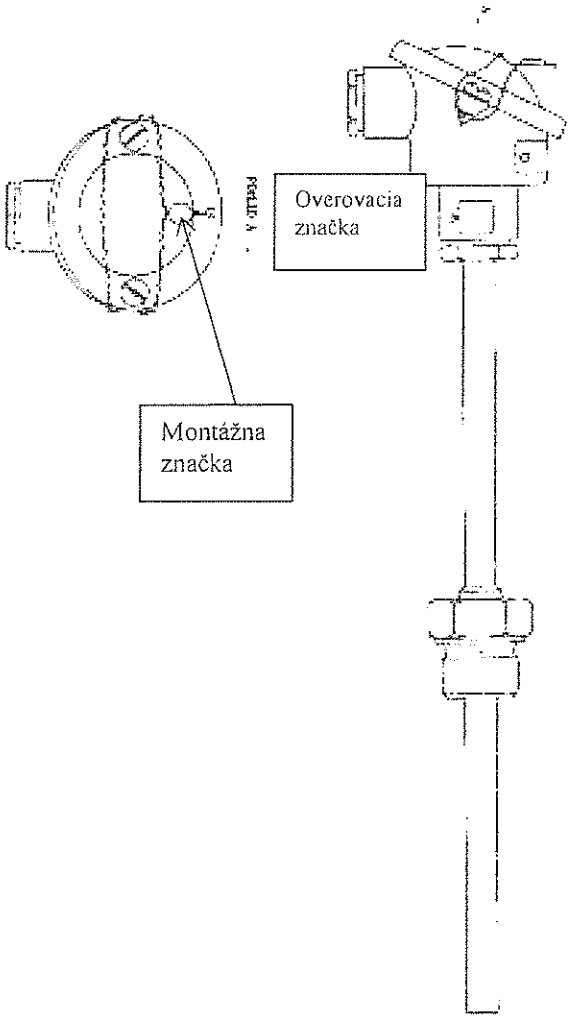
3.1.5 Merače tepla a ich členy (pre teplonosné médium para)
c) odporové snímače teploty **4 roky**

Umiestnenie overovacích značiek

Odporové snímače teploty, ktoré vyhoveli pri overení, sa opatria:
1 x overovacou značkou na boku keramickej svorkovnice meracej vložky
1 x overovacou značkou na hlavici puzdra snímača teploty

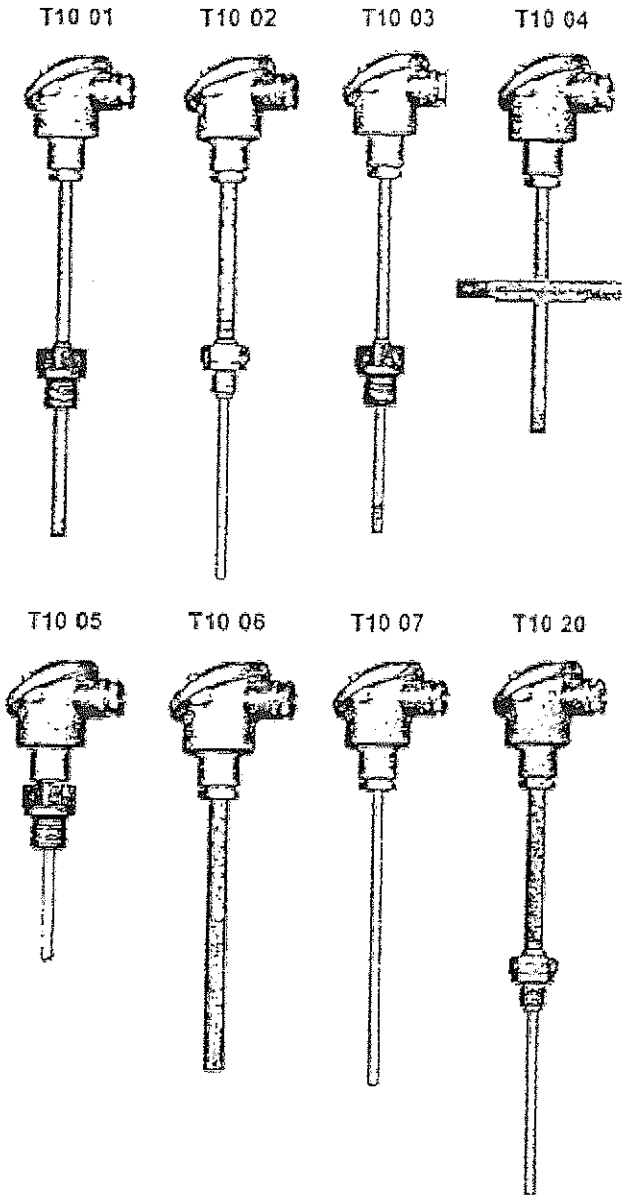
Kryt hlavice po namontovaní na mieste bude zaistený montážnou plombou:



Posúdenie vykonala: Ing. Renáta Knorová

Slovenský metrologický ústav
-2-
Bratislava

Obrázok č. 1 - Odporové snímače teploty T10xx



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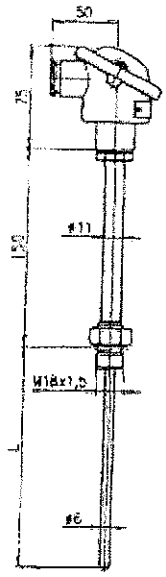
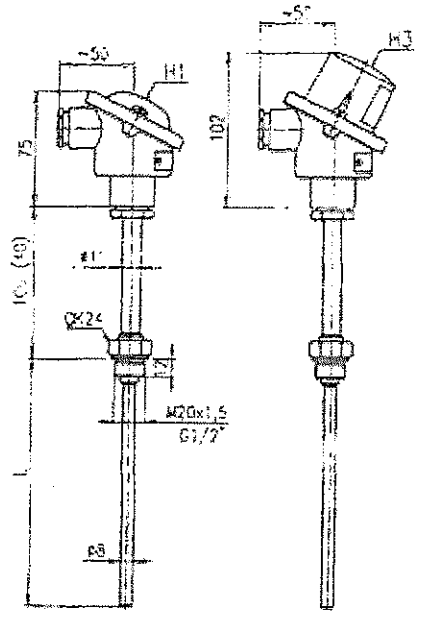
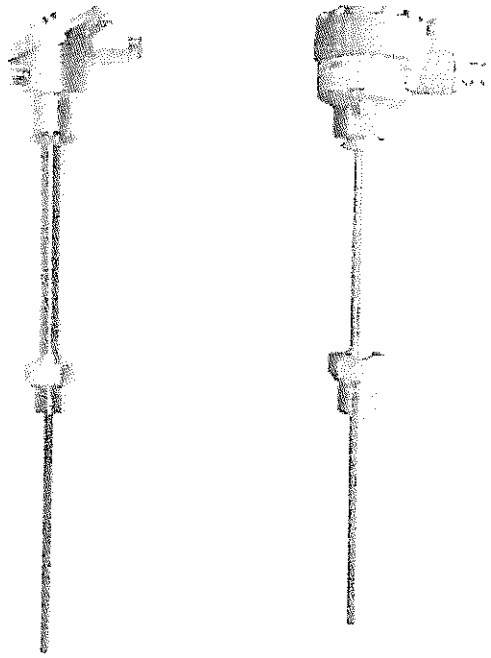
Obrázok č. 2 - Odporový snímač teploty T1023



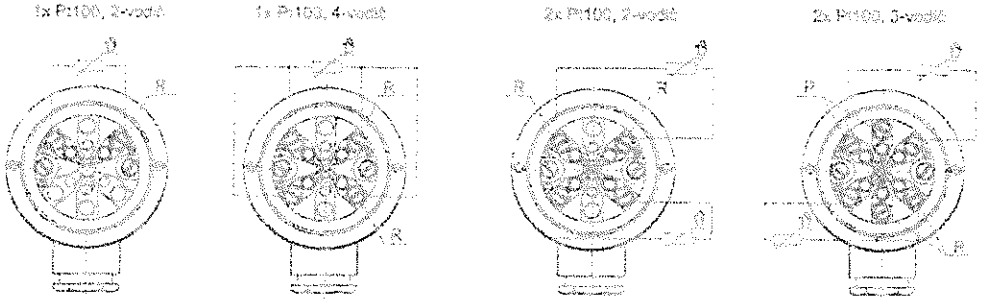
Obrázok č. 3 - Odporový snímač teploty T1025



Obrázok č. 4 - Odporový snímač teploty T 1070



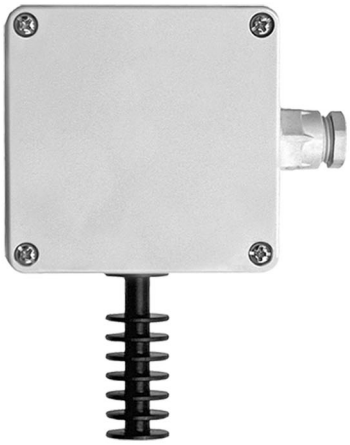
Obrázok č. 5 – Elektrické pripojenie



Slovenský metrologický ústav
-2-
Bratislava

Technical Information
Omnigrad T TST434

Resistance thermometer for indoor or outdoor ambient temperature measurement



Reliable measurement and high accuracy - Best protection of the measuring electronics from extreme ambient conditions. Applicable for wall mounting.

Applications

- Indoor or outdoor ambient temperature measurement
- Maximum measuring range:
  −50 to +100 °C (−58 to +212 °F)
- Degree of protection: IP66/68 (NEMA Type 4x encl.)

Head transmitter

All Endress+Hauser transmitters are available with enhanced accuracy and reliability compared to directly wired sensors. Easy customizing by choosing one of the following outputs and communication protocols:

- Analog output 4 to 20 mA
- HART®
- PROFIBUS® PA
- FOUNDATION Fieldbus™

Your benefits

- Robust terminal heads according to DIN EN 50446 or stable plastic housings offer optimal protection from extreme ambient conditions
- Reliable, long term stable and accurate indoor or outdoor ambient temperature measurement
- Simple and fast wall mounting

Endress+Hauser
People for Process Automation

Function and system design

Measuring principle

Resistance thermometer (RTD)

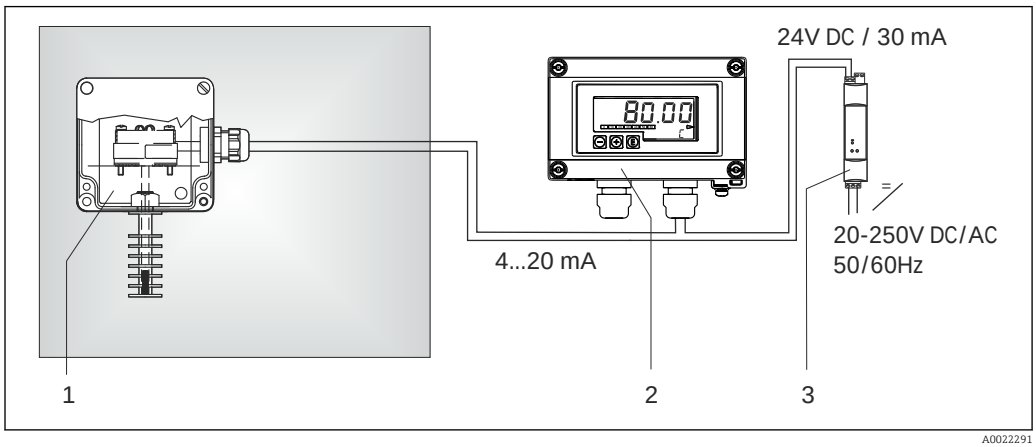
These resistance thermometers use a Pt100 temperature sensor according to IEC 60751. The temperature sensor is a temperature-sensitive platinum resistor with a resistance of 100 Ω at 0 °C (32 °F) and a temperature coefficient α = 0.003851 $°C^{-1}$.

There are generally two different kinds of platinum resistance thermometers:

- **Wire wound (WW):** Here, a double coil of fine, high-purity platinum wire is located in a ceramic support. This is then sealed top and bottom with a ceramic protective layer. Such resistance thermometers not only facilitate very reproducible measurements but also offer good long-term stability of the resistance/temperature characteristic within temperature ranges up to 600 °C (1 112 °F). This type of sensor is relatively large in size and it is comparatively sensitive to vibrations.
- **Thin film platinum resistance thermometers (TF):** A very thin, ultrapure platinum layer, approx. 1 µm thick, is vaporized in a vacuum on a ceramic substrate and then structured photolithographically. The platinum conductor paths formed in this way create the measuring resistance. Additional covering and passivation layers are applied and reliably protect the thin platinum layer from contamination and oxidation, even at high temperatures.

The primary advantages of thin film temperature sensors over wire wound versions are their smaller sizes and better vibration resistance. A relatively low principle-based deviation of the resistance/temperature characteristic from the standard characteristic of IEC 60751 can frequently be observed among TF sensors at high temperatures. As a result, the tight limit values of tolerance category A as per IEC 60751 can only be observed with TF sensors at temperatures up to approx. 300 °C (572 °F). For this reason, thin-film sensors are generally only used for temperature measurements in ranges below 400 °C (752 °F).

Measuring system



1 Application example, indoor ambient temperature monitoring with 4 to 20 mA analog output signal

1 Wall mounted thermometer with head transmitter installed.

2 RIA15 process display - The display unit records the analog measuring signal from the head transmitter and shows this on the display. The LC display shows the current measured value in digital form and as a bar graph indicating a limit value violation. The process display unit is integrated in the 4 to 20 mA or HART® loop and is powered directly from the current loop. Optionally up to four of a sensor's HART® process variables can be displayed. More information on this can be found in the Technical Information, see "Documentation".

3 Active barrier RN221N - The RN221N (24 V DC, 30 mA) active barrier has a galvanically isolated output for supplying voltage to loop-powered transmitters. The universal power supply works with an input supply voltage of 20 to 250 V DC/AC, 50/60 Hz, which means that it can be used in all international power grids. More information on this can be found in the Technical Information, see "Documentation".

Input

Measured variable

Temperature (temperature-linear transmission behavior)

Measuring range

Maximum −50 to +100 °C (−58 to +212 °F) according to IEC 60751, depending on configuration

Output

Output signal

Generally, the measured value can be transmitted in one of two ways:

- Directly-wired sensors - sensor measured values forwarded without a transmitter.
- Via all common protocols by selecting an appropriate Endress+Hauser iTEMP® temperature transmitter. All the transmitters listed below are mounted directly in the terminal head and wired with the sensory mechanism.

Family of temperature transmitters

Thermometers fitted with iTEMP® transmitters are an installation-ready complete solution to improve temperature measurement by significantly increasing accuracy and reliability, when compared to direct wired sensors, as well as reducing both wiring and maintenance costs.

PC programmable head transmitters
They offer a high degree of flexibility, thereby supporting universal application with low inventory storage. The iTEMP® transmitters can be configured quickly and easily at a PC. Endress+Hauser offers free configuration software which can be downloaded from the Endress+Hauser Website. More information can be found in the Technical Information.

HART® programmable head transmitters
The transmitter is a 2-wire device with one or two measuring inputs and one analog output. The device not only transfers converted signals from resistance thermometers and thermocouples, it also transfers resistance and voltage signals using HART® communication. It can be installed as an intrinsically safe apparatus in Zone 1 hazardous areas and is used for instrumentation in the terminal head (flat face) as per DIN EN 50446. Swift and easy operation, visualization and maintenance by PC using operating software, Simatic PDM or AMS. For more information, see the Technical Information.

PROFIBUS® PA head transmitters
Universally programmable head transmitter with PROFIBUS® PA communication. Conversion of various input signals into digital output signals. High accuracy over the complete ambient temperature range. Swift and easy operation, visualization and maintenance using a PC directly from the control panel, e. g. using operating software, Simatic PDM or AMS. For more information, see the Technical Information.

FOUNDATION Fieldbus™ head transmitters
Universally programmable head transmitter with FOUNDATION Fieldbus™ communication. Conversion of various input signals into digital output signals. High accuracy over the complete ambient temperature range. Swift and easy operation, visualization and maintenance using a PC directly from the control panel, e.g. using operating software such as ControlCare from Endress +Hauser or NI Configurator from National Instruments. For more information, see the Technical Information.

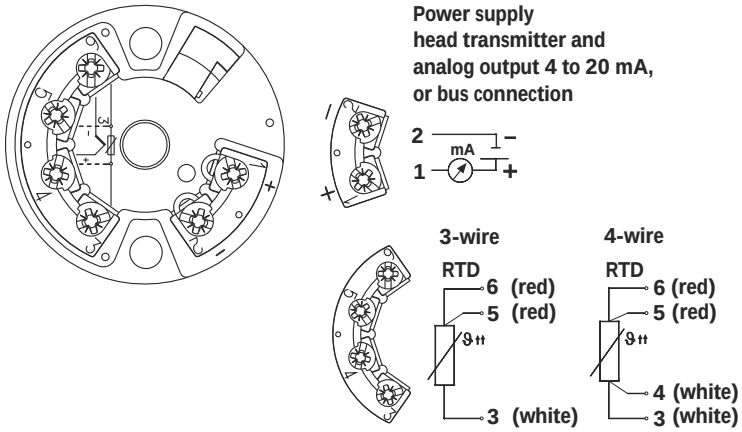
Advantages of the iTEMP® transmitters:
- Dual or single sensor input (optionally for certain transmitters)
- Unsurpassed reliability, accuracy and long-term stability in critical processes
- Mathematical functions
- Monitoring of the thermometer drift, sensor backup functionality, sensor diagnostic functions
- Sensor-transmitter matching for dual sensor input transmitters, based on Callendar/Van Dusen coefficients

Wiring

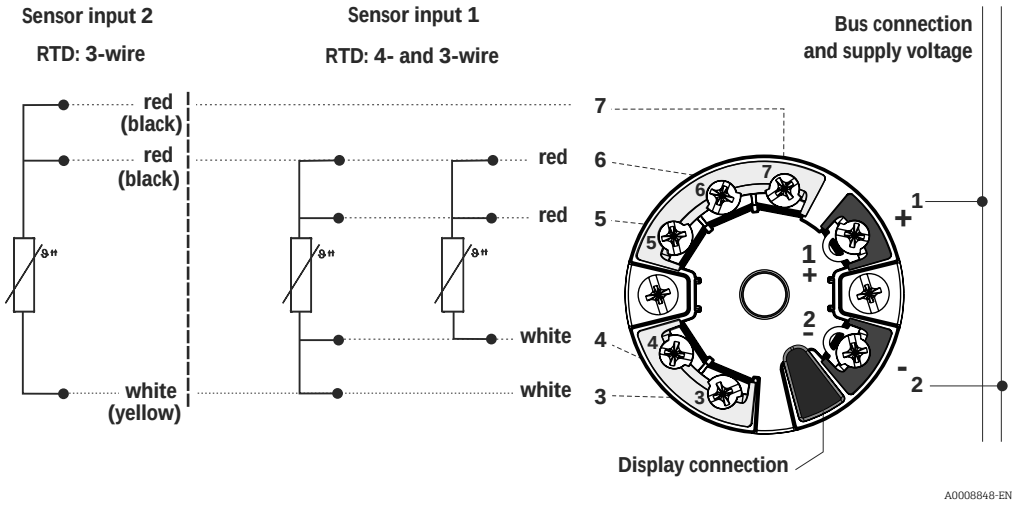
Wiring diagrams for RTD

Type of sensor connection

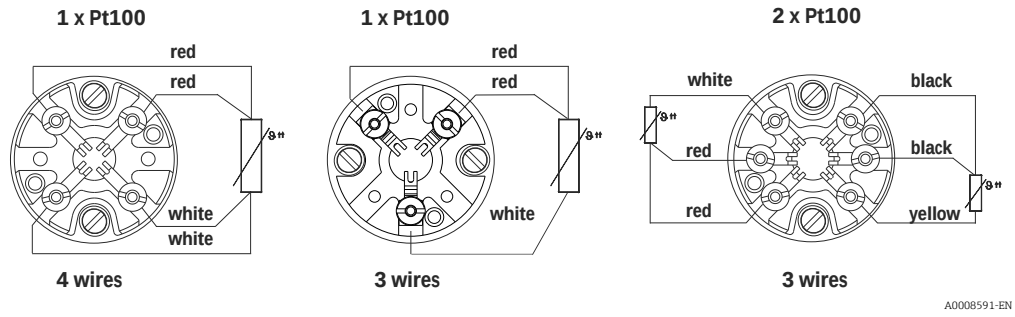
Head mounted transmitter TMT18x (single input)



Head mounted transmitter TMT8x (dual input)



Terminal block mounted



Performance characteristics

Reference conditions

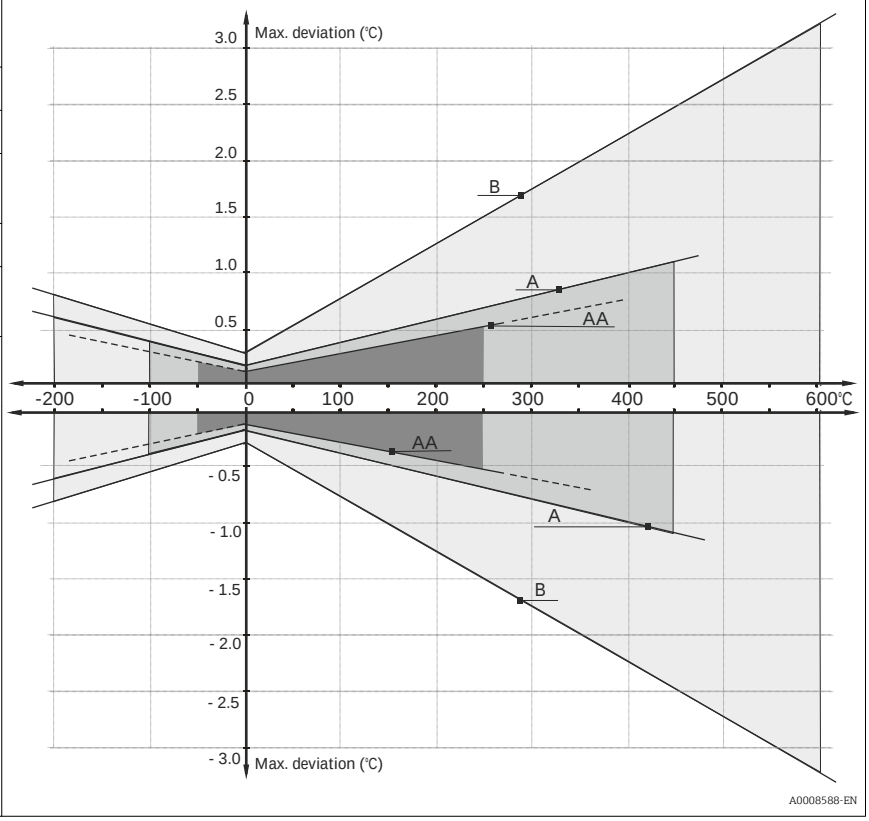
These data are relevant for determining the accuracy of the temperature transmitters used. More information on this can be found in the Technical Information of the iTEMP® temperature transmitters. (→ 🖹 11)

Accuracy

RTD resistance thermometer as per IEC 60751

Class	Max. tolerances (°C)	
Cl. AA, former 1/3 Cl. B	± (0.1 + 0.0017 · |t| [1])	
Cl. A	± (0.15 + 0.002 · |t| [1])	
Cl. B	± (0.3 + 0.005 · |t| [1])	
Temperature ranges for compliance with the tolerance classes		
Wire wound sensor (WW):	Cl. A	Cl. AA
	−100 to +450 °C	−50 to +250 °C
Thin-film version (TF):	Cl. A	Cl. AA
▪ Standard	−30 to +300 °C	0 to +150 °C
▪ iTHERM® StrongSens	−30 to +300 °C	0 to +200 °C

Characteristics



1) |t| = absolute value °C

In order to obtain the maximum tolerances in °F, the results in °C must be multiplied by a factor of 1.8.

Insulation resistance

Insulation resistance ≥ 100 MΩ at ambient temperature.

Insulation resistance between the terminals and the outer jacket is measured with a minimum voltage of 100 V DC.

Self heating

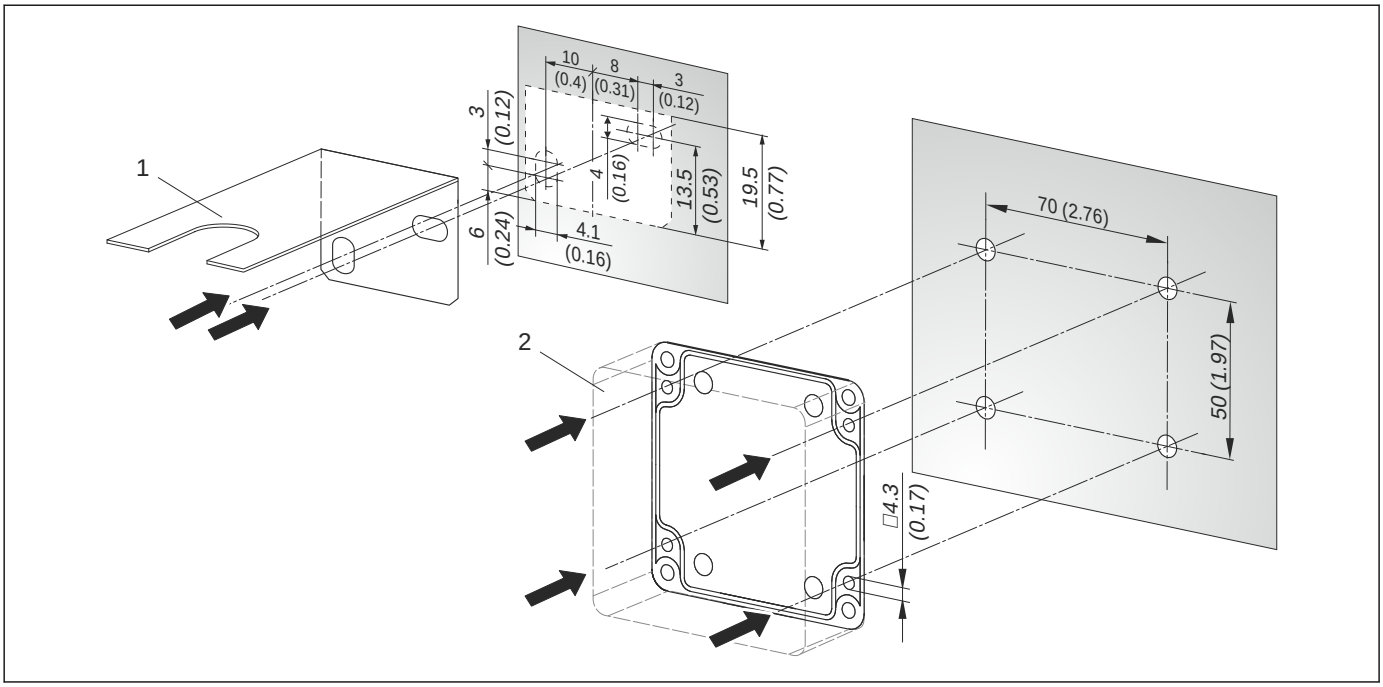
RTD elements are passive resistances that are measured using an external current. This measurement current causes a self-heating effect in the RTD element itself which in turn creates an additional measurement error. In addition to the measurement current, the size of the measurement error is also affected by the temperature conductivity and flow velocity of the process. This self-heating error is negligible when an Endress+Hauser iTEMP® temperature transmitter (very small measurement current) is connected.

Installation

Orientation

No restrictions.

Installation instructions



2 Drilling templates for wall mounting. Dimensions in mm (in)

1 Mounting bracket for mounting with terminal head
2 Plastic housing

Environment

Ambient temperature range

Housing	Temperature in °C (°F)
Terminal head without mounted head transmitter	Depends on the use of the cable glands, ▪ Without: −50 to +150 °C (−58 to +302 °F) ▪ With: −50 to +100 °C (−58 to +212 °F)
Terminal head with mounted head transmitter	−40 to +85 °C (−40 to +185 °F)
Plastic housing	−50 to +80 °C (−58 to +176 °F)

Storage temperature

For information, see ambient temperature.

Degree of protection

Terminal head	Degree of protection: IP66/68 (NEMA Type 4x encl.)
Plastic housing	Degree of protection: IP67

Shock and vibration resistance

4G / 2 to 150 Hz according to IEC 60068-2-6

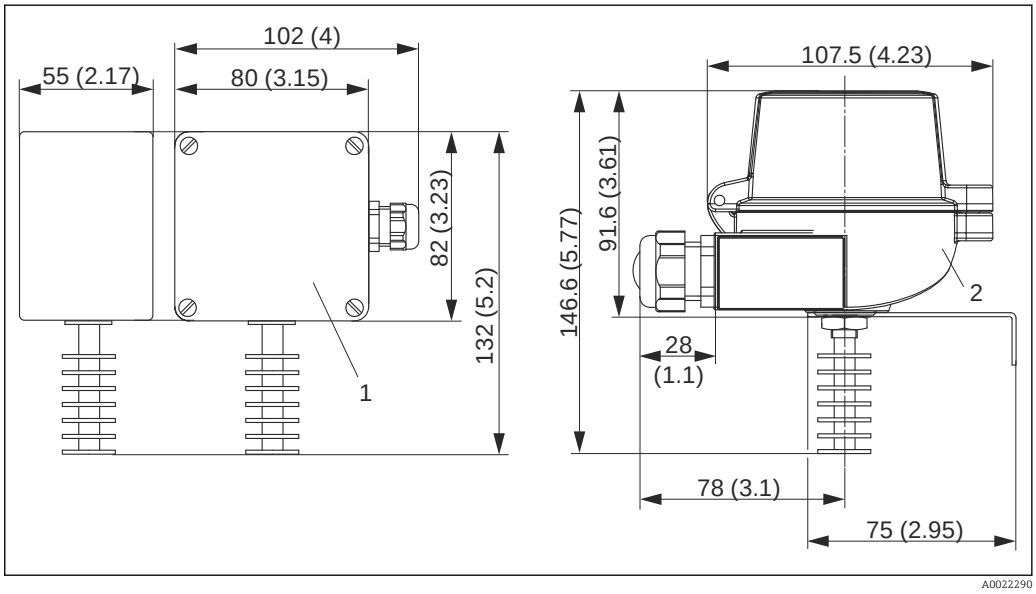
Process

Process pressure range

Maximum static process pressure: 1 bar (14.5 PSI) at ambient temperature of 20 °C (68 °F).

Mechanical construction

All dimensions in mm (in). Specifications without installed head transmitter.



3 Dimensions of the thermometer

1 Plastic housing
2 Terminal head

Specification plastic housing
Color: gray, RAL 7035

Specification terminal head
▪ Head color: blue, RAL 5012 ▪ Cap color: gray, RAL 7035 ▪ Ground terminal, internal and external

Weight

200 to 500 g (7.05 to 17.64 oz), depending on configuration.

Material

Temperature probe, housing

Temperature probe	Anodised aluminum
Housing	Plastic housing made of polycarbonate (PC) or terminal head made of aluminum, polyester powder coated

Spare parts

Spare part	Material No.
Fixing kit cpl.TMT82/85/84 (European) 2x screws, 2x springs, 2x spring rings, 1x sealing CDI-connector	71044061

Certificates and approvals

CE Mark

The device meets the legal requirements of the EC directives if applicable. Endress+Hauser confirms that the device has been successfully tested by applying the CE mark.

Other standards and guidelines

- IEC 61010-1: Protection Measures for Electrical Equipment for Measurement, Control, Regulation and Laboratory Procedures
- IEC 60751: Industrial platinum resistance thermometers
- IEC 61326-1: Electromagnetic compatibility (electrical equipment for measurement, control and laboratory use - EMC requirements)

Ordering information

Detailed ordering information is available from the following sources:

- In the Product Configurator on the Endress+Hauser website: www.endress.com → Select country → Instruments → Select device → Product page function: Configure this product
- From your Endress+Hauser Sales Center: www.endress.com/worldwide

Product Configurator - the tool for individual product configuration

- Up-to-the-minute configuration data
- Depending on the device: Direct input of measuring point-specific information such as measuring range or operating language
- Automatic verification of exclusion criteria
- Automatic creation of the order code and its breakdown in PDF or Excel output format
- Ability to order directly in the Endress+Hauser Online Shop

Accessories

Various accessories, which can be ordered with the device or subsequently from Endress+Hauser, are available for the device. Detailed information on the order code in question is available from your local Endress+Hauser sales center or on the product page of the Endress+Hauser website: www.endress.com.

Communication-specific accessories

Configuration kit TXU10	Configuration kit for PC-programmable transmitter with setup software and interface cable for PC with USB port Order code: TXU10-xx
Commubox FXA195 HART	For intrinsically safe HART communication with FieldCare via the USB interface. For details, see "Technical Information" TI00404F
Commubox FXA291	Connects Endress+Hauser field devices with a CDI interface (= Endress+Hauser Common Data Interface) and the USB port of a computer or laptop. For details, see "Technical Information" TI00405C
HART Loop Converter HMX50	Is used to evaluate and convert dynamic HART process variables to analog current signals or limit values. For details, see "Technical Information" TI00429F and Operating Instructions BA00371F
Wireless HART adapter SWA70	Is used for the wireless connection of field devices. The WirelessHART adapter can be easily integrated into field devices and existing infrastructures, offers data protection and transmission safety and can be operated in parallel with other wireless networks with minimum cabling complexity. For details, see Operating Instructions BA061S
Fieldgate FXA320	Gateway for the remote monitoring of connected 4-20 mA measuring devices via a Web browser. For details, see "Technical Information" TI00025S and Operating Instructions BA00053S
Fieldgate FXA520	Gateway for the remote diagnostics and remote configuration of connected HART measuring devices via a Web browser. For details, see "Technical Information" TI00025S and Operating Instructions BA00051S
Field Xpert SFX100	Compact, flexible and robust industry handheld terminal for remote configuration and for obtaining measured values via the HART current output (4-20 mA). For details, see Operating Instructions BA00060S

Service-specific accessories

Accessories	Description
Applicator	Software for selecting and sizing Endress+Hauser measuring devices: ▪ Calculation of all the necessary data for identifying the optimum measuring device: e.g. pressure loss, accuracy or process connections. ▪ Graphic illustration of the calculation results Administration, documentation and access to all project-related data and parameters over the entire life cycle of a project. Applicator is available: ▪ Via the Internet: https://wapps.endress.com/applicator ▪ On CD-ROM for local PC installation.

Konfigurator+temperature	Software for selecting and configuring the product depending on the measuring task, supported by graphics. Includes a comprehensive knowledge database and calculation tools: ▪ For temperature competence ▪ Quick and easy design and sizing of temperature measuring points ▪ Ideal measuring point design and sizing to suit the processes and needs of a wide range of industries The Konfigurator is available: On request from your Endress+Hauser sales office on a CD-ROM for local PC installation.
W@M	Life cycle management for your plant W@M supports you with a wide range of software applications over the entire process: from planning and procurement, to the installation, commissioning and operation of the measuring devices. All the relevant device information, such as the device status, spare parts and device-specific documentation, is available for every device over the entire life cycle. The application already contains the data of your Endress+Hauser device. Endress +Hauser also takes care of maintaining and updating the data records. W@M is available: ▪ Via the Internet: www.endress.com/lifecyclemanagement ▪ On CD-ROM for local PC installation.
FieldCare	FDT-based plant asset management tool from Endress+Hauser. It can configure all smart field units in your system and helps you manage them. By using the status information, it is also a simple but effective way of checking their status and condition. For details, see Operating Instructions BA00027S and BA00059S

System components

Accessories	Description
Process display RIA15	Compact process display unit with very low voltage drop for universal use to display 4 to 20 mA/HART® signals. The process display unit does not require an external power supply. It is powered directly from the current loop. For details, see "Technical Information" TI01043K
RN221N	Active barrier with power supply for safe separation of 4 to 20 mA standard signal circuits. Offers bidirectional HART transmission. For details, see "Technical Information" TI00073R and Operating Instructions BA00202R
RNS221	Supply unit for powering two 2-wire measuring devices solely in the non-Ex area. Bidirectional communication is possible via the HART communication jacks. For details, see "Technical Information" TI00081R and Brief Operating Instructions KA00110R

Documentation

Technical Information
- iTEMP® temperature head transmitter
  - TMT180, PC-programmable, single-channel, Pt100 (TI088R/09/en)
  - TMT181, PC-programmable, single-channel, RTD, TC, Ω, mV (TI00070R/09/en)
  - HART® TMT182, single-channel, RTD, TC, Ω, mV (TI078R/09/en)
  - HART® TMT82, two-channel, RTD, TC, Ω, mV (TI01010T/09/en)
  - PROFIBUS® PA TMT84, two-channel, RTD, TC, Ω, mV (TI00138R/09/en)
  - FOUNDATION Fieldbus™ TMT85, two-channel, RTD, TC, Ω, mV (TI00134R/09/en)
- Application example:
  - RN221N Active barrier, for supplying loop-powered transmitters (TI073R/09/en)
  - RIA15 process display, loop-powered, with optional HART® communication (TI01043K/09/en)

www.addresses.endress.com

Endress+Hauser

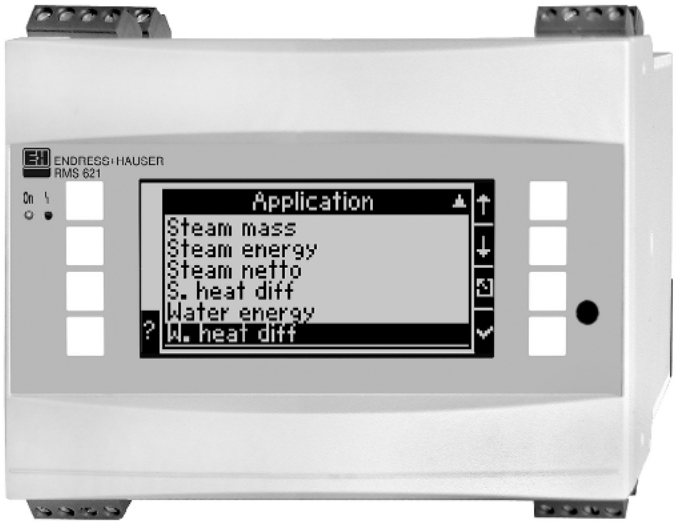
People for Process Automation

Level | Pressure | Flow | Temperature | Liquid Analysis | Registration | Systems Components | Services | Solutions

Technical Information

RMS621

Energy Manager
Steam and Heat Computer for Industrial Energy Calculation of Steam and Water



Applications

- Energy management
- Chemical industry
- Heating and air conditioning
- Pharmaceutical industry
- Food and beverage
- Plant and panel manufacture

Features and benefits

- Calculation of the following applications:
  Steam mass, steam heat quantity, net steam quantity, steam-heat differential, water heat quantity, water-heat differential
- Simultaneous calculation of up to three applications per device
- Real time clock
- Log book function for error messages and parameter changes with date and time
- Presettable allocation of the inputs/outputs to each application
- Configuration and operation using a serial interface and ReadWin® 2000 PC software
- Modular expansion using plug-in cards
- Large back-lit LC display with color change in the event of an error
- Quick and safe configuration with application-guided operation (Quick Setup)
- Online help function on all parameters optional
- Calculation as per IAPWS-IF 97
- Meets standards EN 1434-1, 2, 5 and 6 and OIML R75
- Bi-directional flow applications or energy measurement is possible
- Split-range flow measurements
- Averaging of several input signals
- Flow compensation due to improved differential pressure procedure
- UL recognized component to UL 3111-1

4 Ô

TI092R/09/en
51004476

Endress+Hauser
People for Process Automation

Function and system design

Measuring principle

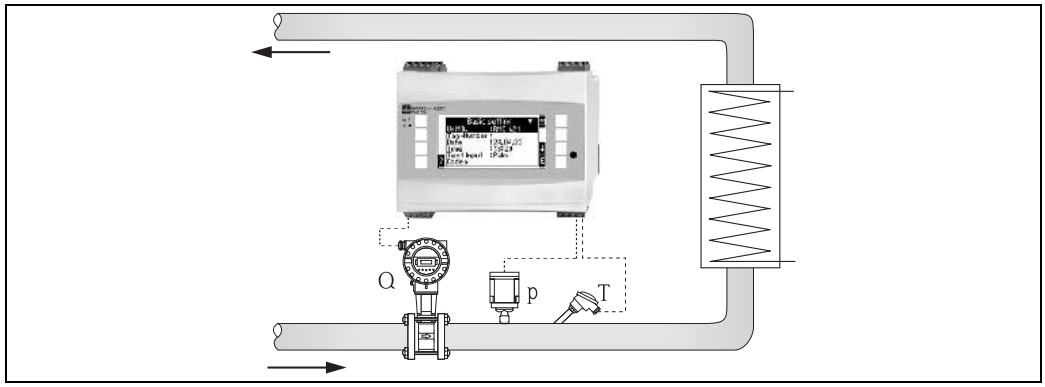
Up to three different applications per device can be processed simultaneously. Two separate counters are available for each application, each of them is resettable.
Connection of measured variables 0/4 to 20 mA, PFM or pulse for sensors such as flow (differential pressure probes, vortex, turbine, orifice plate, among others) or pressure. When measuring temperatures, Pt100, Pt500 and Pt1000 in a 3- or 4-wire system can be connected as a 4 to 20 mA signal directly or using temperature transmitters (e.g. TMT181). A separate transmitter power supply is installed for each analog or pulse input. The available outputs are signal types 0/4 to 20 mA, pulse, digital and relay. The number of inputs, outputs, relays and transmitter power supplies contained in the basic device can be individually extended over a maximum of three plug-in cards.
In applications with overheated steam, the process is monitored for saturated steam or wet steam. If the saturated steam curve is reached, this can be output as an alarm value. The summation of the calculated values is not interrupted when process limits (e.g. saturated steam curve) are exceeded or below set values. The most recently valid values are registered in the event memory when they leave or return to the valid process limits.

Steam mass

Calculation of the mass flow in a steam line from the process variables for flow, pressure and temperature. In saturated steam operation, the mass flow is calculated from two input variables (pressure-compensated or temperature-compensated).

Steam heat quantity

Calculation of the mass flow and its quantity of heat (energy) in a steam line from the process variables for flow, pressure and temperature. Saturated steam operation is possible, calculation is the same as for steam mass.



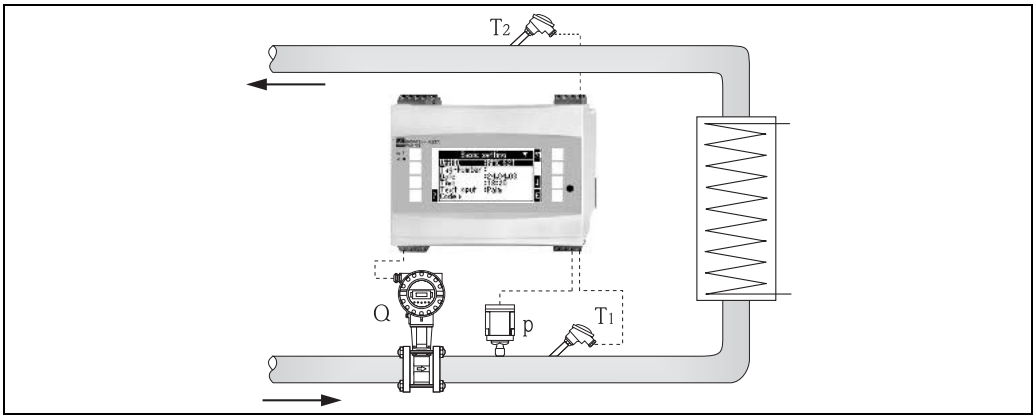
Calculation of the steam mass flow and steam heat quantity from the input variables for flow (Q), pressure (p) and temperature (T)

Steam - heat - differential

Calculation of the quantity of heat emitted or absorbed in a steam application using temperature differential measurement from the process variables for flow, pressure and two temperature values.
Balancing a steam generation process (phase transition: water → steam) or a steam heating process (phase transition: steam → water) is possible.

Net steam quantity

Calculation of the quantity of heat that can be extracted from a steam mass flow until it condenses to water. Process variables: flow, pressure, temperature. For saturated steam, the calculation is made from two input variables.



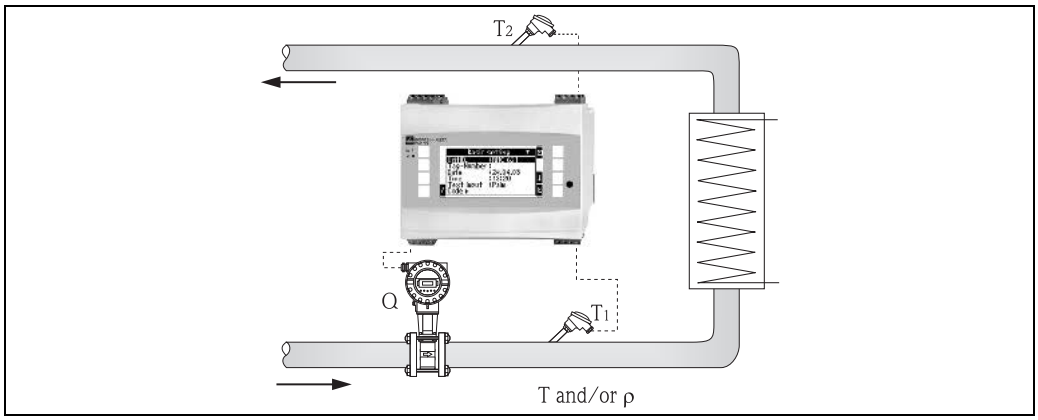
Calculation of the steam-heat differential and net steam quantity from the input variables for flow (Q), pressure (p) and the temperature differential (T_1 - T_2)

Water heat quantity

Calculation of the quantity of heat in a water flow from the process variables for flow and temperature.

Water-heat differential

Calculation of the quantity of heat that is emitted or absorbed by a water flow in a heating or cooling system. The quantity of heat is calculated from the process variable for flow and the differential from the feed and return temperature. Bidirectional energy calculations, such as the calculating systems with changing flow direction (charging/discharging the heat accumulator) are also possible.



Calculation of the water heat quantity and water-heat differential from the input variables for flow (Q) and the temperature differential (T_1 - T_2)

Measuring system

The analog input variables are digitized, the pulse and PFM signals recorded using period length/frequency measurement and processed further in the arithmetic unit controlled by the microcontroller. The energy values are calculated in accordance with the highly precise equations of the international industry standard IAPWS-IF97, which makes the calculation quicker and more precise. This guarantees maximum precision and high calculating speed in all temperature ranges. The internal real time clock with power reserve is used to integrate the flow values. Both the input variables and the results can be transferred via the outputs. When a differential pressure signal is used, the sensor data is recalculated over the entire working range of the flow sensors. Configuration of the inputs, outputs, alarm values, the display as well as commissioning and maintenance of the device can be performed via 8 soft keys with the back-lit dot matrix display, or using the RS232 interface with the ReadWin® 2000 PC software or using an external display and operating unit.
A menu-guided quick setup is available on request for the initial start-up. Online help makes on-site operation easier. The color change of the background lighting visualizes alarm value violations or faults. A function expansion of the device by means of expansion cards can be made at any time.

Input

Measured variable

Current, PFM, pulse, temperature

Input signals

Flow, differential pressure, pressure, temperature

Measuring range

Measured variable	Input		
Current	• 0/4 to 20 mA +10% overreach • Max. input current 150 mA • Input impedance < 10 Ω • Accuracy 0.1% of full scale value • Temperature drift 0.04% / 1 K (1.8 °F) ambient temperature change • Signal attenuation low-pass filter 1st order, filter constants 0 to 99 s configurable • Resolution 13 Bit • Fault recognition 3.6 mA or 21 mA limit as per NAMUR NE 43*		
PFM	• Frequency range 0.01 Hz to 12.5 kHz • Signal level 2 to 7 mA low; 13 to 19 mA high • Measurement method: period length/frequency measurement • Accuracy 0.01% of measured value • Temperature drift 0.1% / 10 K (18 °F) ambient temperature change		
Pulse	• Frequency range 0.01 Hz to 12.5 kHz • Signal level 2 to 7 mA low; 13 to 19 mA high with approx. 1.3 kΩ dropping resistor at max. 24 V voltage level		
Temperature	Resistance thermometer (RTD) according to IEC 751 (α = 0.00385):		
	Designation	Measuring range	Accuracy (4-wire connection)
	Pt100	-200 to 800 °C (-328 to 1472 °F)	0.03% of full-scale value
	Pt500	-200 to 250 °C (-328 to 482 °F)	0.1% of full-scale value
	Pt1000	-200 to 250 °C (-328 to 482 °F)	0.08% of full-scale value
	• Type of connection: 3- or 4-wire system • Measuring current 500 µA • Resolution 16 Bit • Temperature drift 0.01% / 10 K (18 °F) ambient temperature change		

Number:
- 2 x 0/4 to 20 mA/PFM/Pulse
  2 x Pt100/500/1000 (in basic device)

Maximum number:
- 10 (depends on number and kind of plug-in cards)

* Breakdown information to NAMUR NE 43
Breakdown information is created when the measuring information is invalid or not present anymore and gives a complete listing of all errors occuring in the measuring system.

		Signal (mA)
Under ranging	Standard	3.8
Over ranging	Standard	20.5
Sensor break; sensor short circuit low	To NAMUR NE 43	≤ 3.6
Sensor break; sensor short circuit high	To NAMUR NE 43	≥ 21.0

Galvanic isolation

The inputs are galvanically isolated between the individual expansion cards and the basic device (see also 'galvanic isolation' in section "Output").

Output

Output signal

Current, pulse, transmitter power supply and switching output

Galvanic isolation

Basic device:

Connection, terminals	Power supply (L/N)	Input 1/2 0/4 to 20 mA/PFM/ pulse (10/11) or (110/11)	Input 1/2 TPS (82/81) or (83/81)	Input 1/2 temperature (1/5/6/2) or (3/7/8/4)	Output 1/2 0 to 20 mA/ pulse (132/131) or (134/ 133)	Interface RS232/485 housing front or (102/101)	TPS external (92/91)
Power supply		2.3 kV	2.3 kV	2.3 kV	2.3 kV	2.3 kV	2.3 kV
Input 1/2 0/4 to 20 mA/ PFM/pulse	2.3 kV			500 V	500 V	500 V	500 V
Input 1/2 TPS	2.3 kV			500 V	500 V	500 V	500 V
Input 1/2 temperature	2.3 kV	500 V	500 V		500 V	500 V	500 V
Output 1/2 0 to 20 mA/ pulse	2.3 kV	500 V	500 V	500 V	500 V	500 V	500 V
Interface RS232/RS485	2.3 kV	500 V	500 V	500 V	500 V	500 V	500 V
TPS external	2.3 kV	500 V	500 V	500 V	500 V	500 V	

Note!
The specified insulation voltage is the AC testing voltage $U_{eff.}$, which is applied between the connections.
Basis for assessment: IEC 61010-1, protection class II, overvoltage category II

Current - pulse output variable

Current

- 0/4 to 20 mA +10% overreach, invertible
- Max. loop current 22 mA (short-circuit current)
- Max. load 750 Ω at 20 mA
- Accuracy 0.1% of full-scale value
- Temperature drift: 0.1% / 10 K (18 °F) ambient temperature change
- Output ripple < 10 mV at 500 Ω for frequencies < 50 kHz
- Resolution 13 Bit
- Error signals 3.6 mA or 21 mA limit configurable as per NAMUR NE43 (see current inputs, page 4)

Pulse

Basic device:
- Frequency range to 12.5 kHz
- Voltage level 0 to 1 V low, 24 V high ±15%
- Min. load 1 kΩ
- Max. pulse width 0.04 to 1000 ms

Expansion cards (digital passive, open collector):
- Frequency range to 12.5 kHz
- $I_{max.}$ = 200 mA
- $U_{max.}$ = 24 V ± 15%
- $U_{low/max.}$ = 1.3 V at 200 mA
- Max. pulse width 0.04 to 1000 ms

Number

Number:
- 2 x 0/4 to 20 mA/Pulse (in basic device)

	Maximum number: • 8 x 0/4 to 20 mA/Pulse (depends on the number of plug-in cards) • 6 x digital passive (depends on the number of plug-in cards)
Signal sources	All available multifunctional inputs (current, PFM or pulse inputs) and results can be freely allocated to the outputs.

Switching output

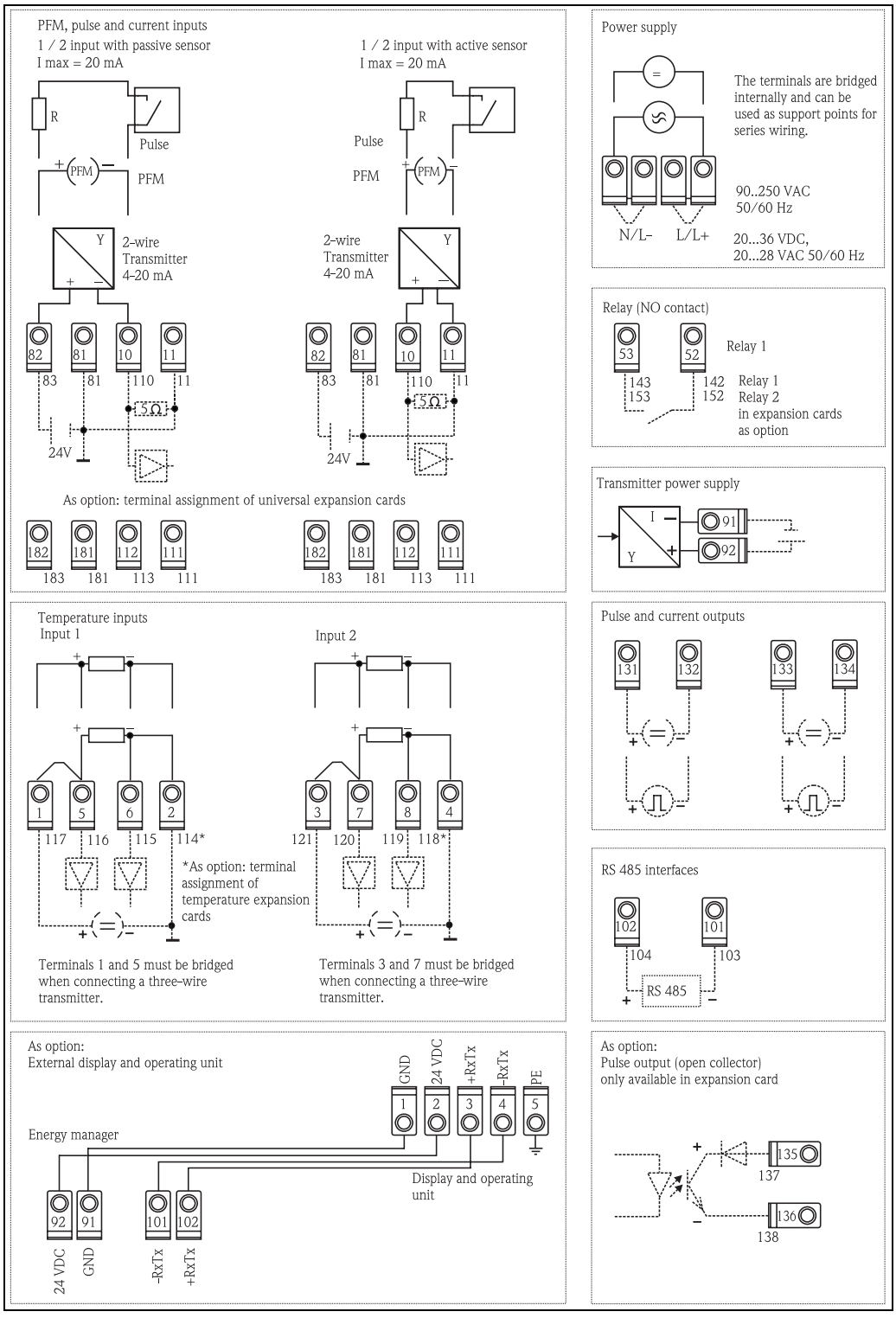
Function	Limit relay switches in these operating modes: minimum, maximum safety, gradient, alarm, saturated steam alarm, frequency/pulse, device error
Switch behavior	Binary, switches when the alarm value is reached (potential-free NO contact)
Relay switching capacity	Max. 250 V AC, 3 A / 30 V DC, 3 A Note! When using relays on expansion cards, a mixture of low voltage and extra-low voltage is not permitted.
Switching frequency	Max. 5 Hz
Switching threshold	Programmable (wet steam alarm is preset to 2 °C (35.6 °F) at the factory)
Hysteresis	0 to 99%
Signal source	All available inputs and calculated variables can be allocated freely to the switching outputs.
Number	1 (in basic device) Max. number: 7 (depends on number and kind of plug-in cards)
Number of output states	100,000
Scan rate	250 ms

Transmitter power supply and external power supply

- Transmitter power supply (TPS), terminals 81/82 or 81/83 (optional universal expansion cards 181/182 or 181/183):
  Supply voltage 24 V DC ± 15%
  Impedance < 345 Ω
  Maximum output current 22 mA (for U_{out} > 16 V)
  Maximum current 30 mA, short-circuit proof
  HART® communication is not accounted for
  Number 2 (in basic device)
  Maximum number: 5 (depends on number and kind of plug-in cards)
- Additional power supply (e.g. external display), Terminals 91/92:
  Supply voltage 24 V DC ± 5%
  Maximum current 80 mA, short-circuit proof
  Number 1
  Source resistance < 10 Ω

Power supply

Electrical connection (wiring diagrams)



RMS621 terminal assignment - basic device + expansion cards (optional)

Supply voltage	• Low voltage power unit: 90 to 250 V AC 50/60 Hz • Extra-low voltage power unit: 20 to 36 V DC or 20 to 28 V AC 50/60 Hz
Power consumption	8 to 26 VA (dependent on the expansion stage)

Connection data interface

RS232

– Connection: 3.5 mm (0.14 in) jack plug on front panel
– Transmission protocol: ReadWin® 2000
– Transmission rate: max. 57,600 Baud

RS-485

– Connection: plug-in terminals 101/102 (in basic device)
– Transmission protocol: (serial: ReadWin® 2000; parallel: open standard)
– Transmission rate: max. 57,600 Baud

Optional: additional RS-485 interface

– Connection: plug-in terminals 103/104
– Transmission protocol and transmission rate same as standard RS-485 interface

Performance characteristics

Reference operating conditions

- Power supply 230 V AC ± 10%; 50 Hz ± 0.5 Hz
- Warm-up period > 30 min
- Ambient temperature 25 °C ± 5 K (77 °F ± 9 °F)
- Humidity 39% ± 10% relative humidity

Arithmetic unit

Medium	Variable	Range
Water	Temperature measuring range	0 to 374 °C (32 to 705.2 °F)
	Maximum Temperature differential range ΔT	0 to 374 °C (0 to 673.2 °F)
	Error limit for ΔT	3 to 20 K (5.4 to 36 °F) < 2.0% of measured value 20 to 250 K (36 to 450 °F) < 0.3% of measured value
	Arithmetic unit accuracy class	as per EN 1434-1 / OIML R75 (< 1.5%)
	Measurement and calculation interval	500 ms
Steam	Temperature measuring range	0 to 800 °C (32 to 1472 °F)
	Pressure measuring range	0 to 1000 bar (0 to 14,500 psi)
	Measurement and calculation interval	500 ms

Installation conditions

Installation instructions

Mounting location

In the cabinet on DIN rail IEC 60715 TH 35

Caution!
When using extension cards, venting with an air current of at least 0.5 m/s is necessary.

Orientation

no restrictions

Environmental conditions

Ambient temperature	-20 to 60 °C (-4 to 140 °F)
Storage temperature	-30 to 70 °C (-22 to 158 °F)
Climate class	as per IEC 60 654-1 Class B2 / EN 1434 Class 'C'
Electrical safety	As per IEC 61010-1: Environment < 2000 m (6560 ft) above sea level
Degree of protection	• Basic device: NEMA 1 (IP 20) • External display: NEMA 4X (IP 65)

Electromagnetic compatibility

NAMUR NE 21

This recommendation is an uniform and practical way of determining whether the devices used in laboratory and process control are immune to interference with an objective to increase its functional safety.

Interference emission

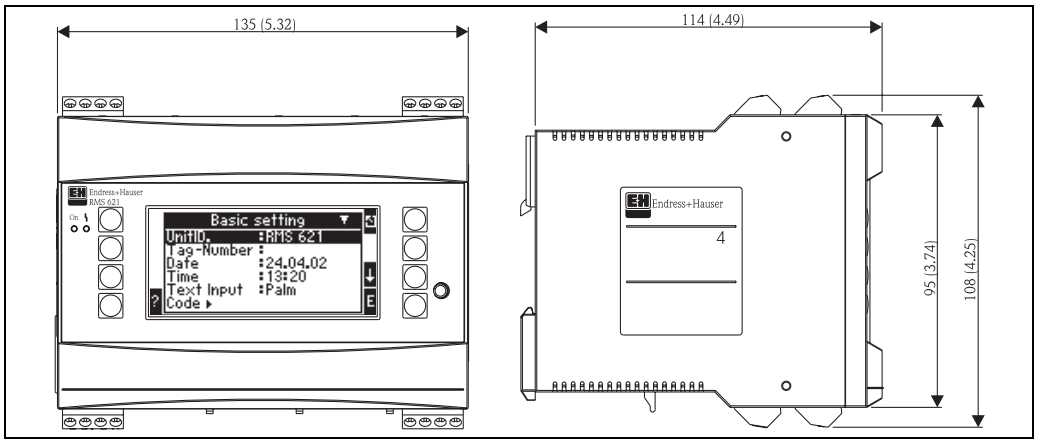
IEC 61326 (EN 61326 Class A)

Interference immunity

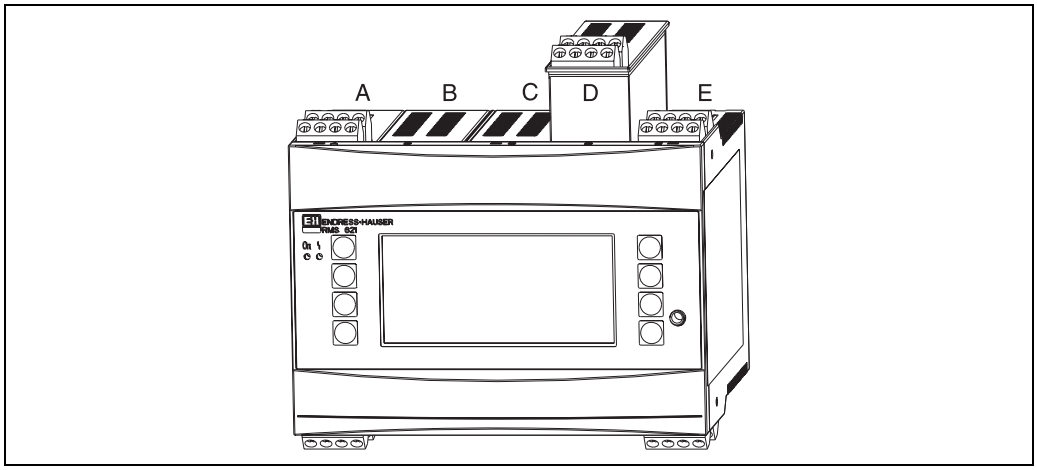
– Power failure: 20 ms, no influence
– Starting current limitation: $I_{max}/I_n \leq 50\%$ (T50% ≤ 50 ms)
– Electromagnetic fields: 10 V/m as per IEC 61000-4-3
– Conducted HF: 0.15 to 80 MHz, 10 V as per IEC 61000-4-3
– Electrostatic discharge: 6 kV contact, indirect as per IEC 61000-4-2
– Burst (power supply): 2 kV as per IEC 61000-4-4
– Burst (signal): 1 kV/2 kV as per IEC 61000-4-4
– Surge (AC power supply): 1 kV/2 kV as per IEC 61000-4-5
– Surge (DC power supply): 1 kV/2 kV as per IEC 61000-4-5
– Surge (signal):500 V/1 kV as per IEC 61000-4-5

Mechanical construction

Design, dimensions



Housing for DIN rail as per IEC 60751 TH35; dimensions in mm (inch)

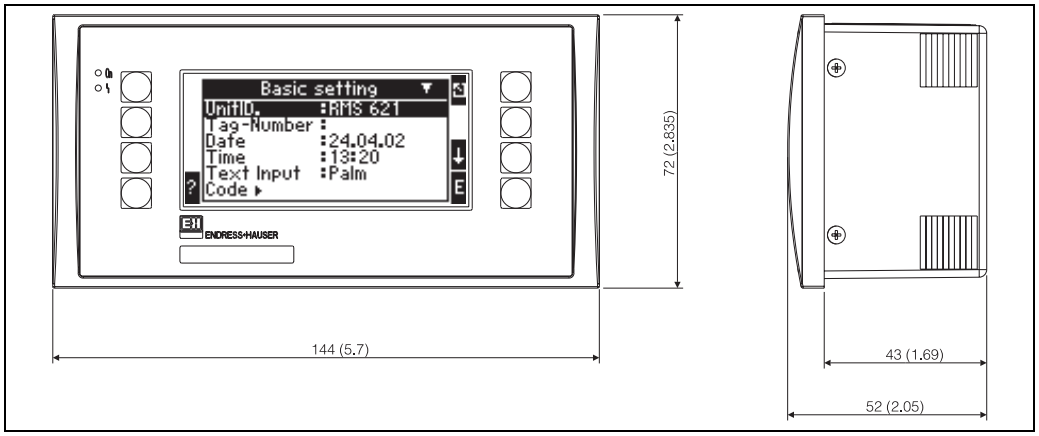


Unit upgrade with expansion cards (optional or available as accessories)
– Slots A and E equipped in the basic device
– Slots B, C and D can be upgraded with expansion cards

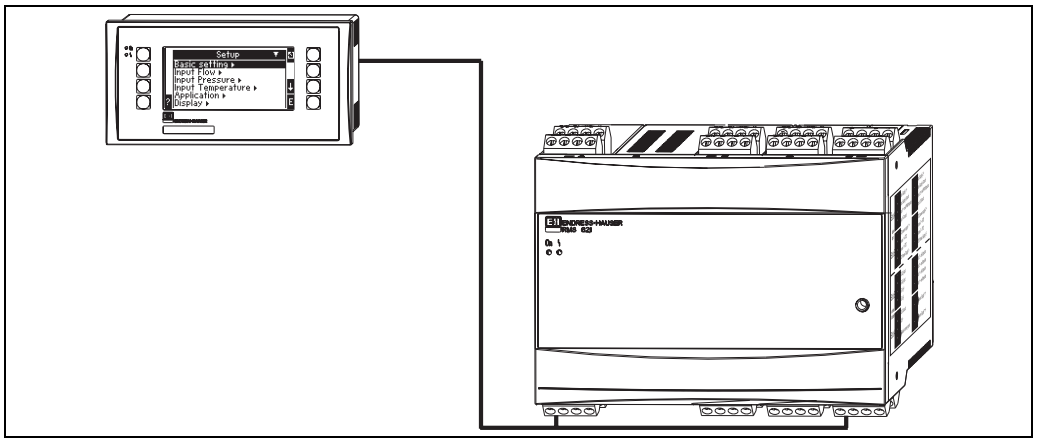
Weight	• Basic device: 500 g (1.1 lb) in maximum configuration with expansion cards • Remote control unit: 300 g (0.7 lb)
Material	Housing: polycarbonate plastic, UL 94V0
Terminals	Coded, pluggable screw terminals; Clamping area 1.5 mm^2 (16 AWG) solid, 1.0 mm^2 (maximum 18 AWG) flexible with wire end ferrule (applies to all connections).

Human interface

Display elements	• Display (optional): 160 x 80 Dot-matrix LCD with blue background lighting Color changes to red in the event of an error (adjustable) • LED status display: Operation: 1 x green (2 mm; 0.079 in) Fault message: 1 x red (2 mm; 0.079 in) • External display and operating unit (optional or as accessory): A display and operating unit can also be connected to the energy manager in the panel mounted housing, dimensions (WxHxT) 144 mm (5.7 in) x 72 mm (2.84 in) x 43 mm (1.7 in). The connection to the integrated RS485 interface is made using the connecting cable, l = 3 m (10 ft), which is included in the accessories set. Parallel operation of the external display unit with a device-internal display in the RMS621 is possible.



External display and operating unit for panel mounting (optional or available as accessory); dimensions in mm (inches)



External display and operating unit in the panel mounted housing

Operating elements	Eight front-panel soft keys interact with the display (function of the keys is shown in the display).
Remote operation	RS232 interface (3.5 mm (0.14 in) jack plug on front panel): configuration via PC with ReadWin® 2000 PC operating software.
Real time clock	• Deviation: 2.6 min per year • Power reserve: 14 days
Mathematical functions	Continuous calculation of dimensions, standard volumes, density, enthalpy, quantity of heat via IAWPS-IF97. Note! How the IAPWS standards relate to the ASME Steam Tables The "ASME Steam Tables" many people are familar with, is a book first published in 1967, with accompanyingsoftware in later editions. The thermodynamic properties in the 1967 ASME Steam Tables book were calculated from a formulation for industrial use known as IFC-67, which was developed and adopted as a standard by the international organization that later became IAPWS. The ASME Steam Tables was just one ofmany books produced from this international standard; several other countries and organizations have issuedbooks based on IFC-67. However, the IFC-67 formulation is now officially obsolete, having been replaced in late 1997 by a new formulation known as IAPWS-IF97. IAPWS-IF97 is now the international standard for calculations in the steampower industry. As a result, the ASME has produced a replacement for the 1967 book, titled ASME Internati-onal Steam Tables for Industrial Use. This book has tables based on the new IAPWS-IF97 formulation.

Certificates and approvals

CE-approval	The device meets the legal requirements of the EC directives. Endress+Hauser confirms that the device has been successfully tested by applying the CE mark.
Other standards and guidelines	• NAMUR NE21, NE43 Standardization association for measurement and control in chemical and pharmaceutical industries. • IAWPS-IF 97 International applicable and recognized calculation standard (since 1997) for steam and water. Issued by the International Association for the Properties of Water and Steam (IAPWS). • OIML R75 International construction regulation and test specification for water energy managers from the Organisation Internationale de Métrologie Légale. • EN 1434-1, 2, 5 and 6 • ISO 5167 Flow measurement of fluids with throttle devices
UL approval	Recognized component to UL 3111-1.

Ordering information

Product structure

RMS621	Steam- and heat computer For calculating steam mass, heat and differential between water/steam. Calculation formula to IAPWS-IF 97; Standard input: 2 x 0/4 to 20 mA/PFM/Pulse, 2 x Pt100/500/1000; Standard output: 2 x 0/4 to 20 mA/Pulse, 1 x relay (closing cont.), 1 x transmitter power supply										
	Operation										
	1	Software ReadWin® 2000, w/o button									
	2	Alphanumeric display, button 8									
	3	Remote, RS485, panel mounting 72 x 144 mm									
	4	Remote, 2 x RS485, panel mounting 72 x 144 mm									
		Power supply									
		1	90 to 250 V AC, 50/60Hz								
		2	20 to 36 V DC / 20 to 28 V AC, 50/60Hz								
			Slot B								
			A	Not used							
			B	Input: 2 x 0/4 to 20 mA/PFM/Pulse + 2 x loop power supply Output: 2 x 0/4 to 20 mA/Pulse 2 x digital, 2 x relays SPST							
			C	Input: 2 x Pt100/500/1000 Output: 2 x 0/4 to 20 mA/Pulse, 2 x digital, 2 x relays SPST							
				Slot C							
				A	Not used						
				B	Input: 2 x 0/4 to 20 mA/PFM/Pulse + 2 x loop power supply Output: 2 x 0/4 to 20 mA/Pulse, 2 x digital, 2 x relays SPST						
				C	Input: 2 x Pt100/500/1000 Output: 2 x 0/4 to 20 mA/Pulse 2 x digital, 2 x relays SPST						
					Slot D						
					A	Not used					
					B	Input: 2 x 0/4 to 20 mA/PFM/Pulse + 2 x loop power supply Output: 2 x 0/4 to 20 mA/Pulse, 2 x digital, 2 x relays SPST					
					C	Input: 2 x Pt100/500/1000 Output: 2 x 0/4 to 20 mA/Pulse, 2 x digital, 2 x relays SPST					
						User Mode					
						1	Basic version				
						2	1 x application, pre-installed				
							Operation Language				
							1	German			
							2	English			
							3	French			
							4	Italian			
							5	Czech			
							6	American			
							7	Polish			
							8	Dutch			
							A	Spanish			
								Communication			
								1	1 x RS232 + 1 x RS485		
								2	1 x RS232 + 1 x RS485 + cable + software ReadWin® 2000		
								3	1 x RS232 + ext. PROFIBUS-DP slave module		
								4	1 x RS232 + cable + ext. PROFIBUS-DP slave module + software ReadWin® 2000		
								5	1x RS232/1x M-Bus + 1x RS485		
								6	1x RS232/1x M-Bus + 1x RS485 + cable + software ReadWin® 2000		
								A	1x RS232 + 1x RS485 + 1x ModBus		
								B	1x RS232 + 1x RS485 + 1x ModBus + cable + software Readwin		
									Additional Option		
									1	Basic version	
									2	Works calib. certif., 5-point	
									K	DIN rail installation kit	
RMS621-											⇐ Order code (complete)

Product structure selection aid

The following table contains an overview of the order codes for the expansion cards with the possible applications in a RMS621 energy manager:

Applications in one unit	Number of input	Order code (expansion cards)
1 x saturated steam mass	1 x Pulse flow 1 x 4 to 20 mA pressure	RMS621-xxAAAxxxx
1 x steam mass	1 x 4 to 20 mA flow 1 x 4 to 20 mA pressure 1 x Pt100 temperature	
1 x steam heat differencial	1 x 4 to 20 mA flow 1 x 4 to 20 mA pressure 2 x Pt100 temperature	
2 x saturated steam mass	2 x Pulse flow 2 x 4 to 20 mA pressure	RMS621-xxBAAxxxx
1 x steam mass 1 x steam heat quantity	2 x PFM flow 2 x 4 to 20 mA pressure 2 x Pt500 temperature	
1 x saturated steam mass 1 x water heat quantity	2 x Pulse flow 1 x 4 to 20 mA pressure 2 x Pt100 temperature	
2 x water heat quantity	2 x 4 to 20 mA flow 4 x Pt100 temperature	RMS621-xxCAAxxxx
1 x water heat quantity 1 x water heat differencial	2 x 4 to 20 mA flow 4 x Pt100 temperature	
3 x saturated steam mass	3 x Pulse flow 3 x 4 to 20 mA pressure	RMS621-xxBBAxxxx
1 x steam heat quantity 1 x water heat differencial	1 x PFM flow 1 x Pulse flow 1 x 4 to 20 mA pressure 3 x Pt100 temperature	RMS621-xxBCAxxxx
1 x steam heat differencial 1 x water heat differencial	2 x PFM flow 1 x 4 to 20 mA pressure 4 x Pt100 temperature	
1 x steam mass 1 x net steam quantity 1 x water heat quantity	3 x PFM flow 2 x 4 to 20 mA pressure 4 x Pt100 temperature	RMS621-xxBBCxxxx
3 x steam mass	3 x 4 to 20 mA flow 3 x 4 to 20 mA pressure 3 x Pt500 temperature	
1 x steam mass 2 x water heat differencial	3 x PFM flow 1 x 4 to 20 mA pressure 5 x Pt100 temperature	RMS621-xxBCCxxxx
3 x water heat differencial	3 x Pulse flow 6 x Pt100 temperature	

Accessories

- PC configuration software ReadWin® 2000 and serial configuration cable with 3.5 mm (0.14 in) stereo type jack plug.
  Order No.: RMS621A-VK
- External display and operating unit in the panel mounted housing 144 x 72 x 43 mm (5.7 x 2.84 x 1.7 inches)
  Order No.: RMS621A-AA
- NEMA 4 (IP 66) protective housing for field mounting DIN rail instrumentation
  Order No.: 52010132
- PROFIBUS Interface
  Order No.: RMS621A-P1

Expansion cards

A function expansion of the device by means of max. 3 extension cards (universal and/or temperature cards) is possible.

Extension card temperature Input: 2 x Pt100/500/1000 Output: 2 x 0/4 to 20 mA/Pulse, 2 x digital, 2 x relays	Order No.: RMS621A-TA
Extension card universal Input: 2 x 0/4 to 20 mA/PFM/Pulse with transmitter power supply Output: 2 x 0/4 to 20 mA/Pulse, 2 x digital, 2 x relays	Order No.: RMS621A-UA

Documentation

- Operating manual 'Energy Manager RMS621' (BA255R/09)
- Technical information "PROline Prowirl 72 flowmeter" (TI070D/06)

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People for Process Automation

TI092R/09/en/01.08
51004476
FM+SGML6.0 ProMoDo

Slovenský metrologický ústav
Karloveská 63, 842 55 Bratislava 4

CERTIFIKÁT TYPU MERADLA

č. 019/311/04, Revízia 1

Slovenský metrologický ústav v súlade s ustanovením § 30 písm. b) a § 32 ods. 2 písm. e) zákona č. 142/2000 Z. z. o metrológii a o zmene a doplnení niektorých zákonov (ďalej len "zákon") na základe žiadosti č. 361 363 vydáva toto rozhodnutie podľa § 11 ods. 1 zákona, ktorým

schvaľuje typ meradla

Názov meradla:	Kalorimetrické počítadlo
Typ meradla:	RMS 621
Žiadateľ:	TRANSCOM TECHNIK, spol. s r. o., Bratislava IČO: 31 386 547
Výrobca:	Endress+Hauser AG, Švajčiarsko

a podľa § 10 ods. 1 zákona potvrdzuje, že uvedený typ meradla vyhovuje svojimi technickými charakteristikami, metrologickými charakteristikami a konštrukčným vyhotovením požiadavkám na daný druh určeného meradla ustanovenými v prílohách č. 51 "Merače tepla" k vyhláške ÚNMS SR č. 210/2000 Z. z. o meradlách a metrologickej kontrole v znení neskorších predpisov (ďalej len „vyhláška 210/2000 Z. z.").

Základné technické charakteristiky a metrologické charakteristiky meradla a výsledky technických skúšok a zistení o splnení požiadaviek na daný druh meradla sú uvedené v protokole č. 036/300/311/14 zo dňa 10. 7. 2014 vydanom Slovenským metrologickým ústavom.

Uvedenému typu meradla sa prideľuje značka schváleného typu:

TSK 311/04 - 017

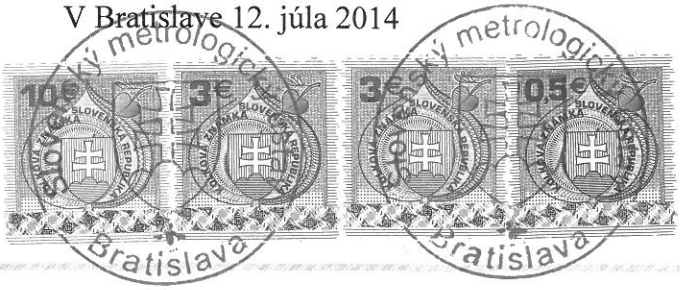
Dovozca je povinný podľa § 14 ods. 2 zákona umiestniť na meradle značku schváleného typu a podľa § 16 ods. 2 zákona zabezpečiť prvotné overenie meradla pred jeho uvedením na trh.

Platnosť do: 11. júla 2024

Poučenie: Proti tomuto rozhodnutiu možno podať do 15 dní odo dňa jeho doručenia odvolanie na Úrad pre normalizáciu, metrológiu a skúšobníctvo Slovenskej republiky, Štefanovičova 3, P.O.BOX 76, 810 05 Bratislava prostredníctvom Slovenského metrologického ústavu.

Revízia 1 nahrádza v plnom rozsahu certifikát typu meradla č. 019/311/04 zo dňa 14. júla 2004

V Bratislave 12. júla 2014



Ing. Arpád Gonda
generálny riaditeľ

Popis meradla:
Kalorimetrické počítadlo RMS 621 je univerzálne meradlo, ktoré je určené na meranie množstva tepla odovzdaného parou. Na počítadlo je možné pripojiť väčší počet rôznych druhov snímačov prietoku, teploty a tlaku. Podľa účelu použitia a stupňa vybavenia má kalorimetrické počítadlo viac možností naprogramovania softvérových funkcií

Kalorimetrické počítadlo je vyrábané v dvoch vyhotoveniach:
- s krytom – montáž na lištu
- bez krytu – montáž na lištu

Merač tepla tvorí kalorimetrické počítadlo v spojení so snímačom teploty, tlaku a prietoku.

Základné technické charakteristiky

Teplonosné médium:	para
Teplotný rozsah- para:	(0 až 800) °C
Rozsah tlaku- médium para:	(0 až 40) MPa, (0 až 400) bar
Napájanie:	(90 – 250) V AC, 50/60 Hz (20 – 36) V DC, alebo (20 – 28) V AC, 50/60 Hz
Teplota okolia:	(-20 až +55) °C
Krytie:	IP 65, IP 20

Základné metrologické charakteristiky

Trieda presnosti:	**0.5** prílohy č. 51 k vyhláške ÚNMS SR č. 210/2000 Z. z. o meradlách a metrologickej kontrole v znení neskorších predpisov, Druhá časť, Oddiel II, bod 3.4.2. alebo

Snímače prietoku, tlaku a teploty musia mať schválenie typu meradla.

Overenie meradla:

Kalorimetrické počítadlo sa overuje podľa Prílohy č. 51 k vyhláške 210/2000 Z. z., Druhá časť, Oddiel II, bod 7. a pokynov uvedených v protokole č. . 036/300/311/14, bod 8.

Čas platnosti overenia je podľa položky 3.1.5 d) prílohy č. 1 k vyhláške 210/2000 Z. z. o meradlách a metrologickej kontrole v znení neskorších predpisov 4 roky.

Umiestnenie overovacích a montážnych značiek:

Meradlo sa proti nežiadúcim zásahom zabezpečí podľa pokynov uvedených v protokole č. 036/300/311/14 , bod 8. 1.

Slovenský metrologický ústav -9- Bratislava

Tento certifikát môže byť rozmnožovaný len celý a nezmenený.
Rozmnožovať jeho časti možno len s písomným súhlasom Slovenského metrologického ústavu.