

Data Sheet

Pressure transmitter **EMP 2**

For monitoring and control in marine and industrial applications



The high accuracy pressure transmitter EMP 2 is designed for monitoring and control in marine and industrial applications and offers a reliable pressure measurement, even under harsh environmental conditions.

The pressure transmitter programme covers absolute or gauge (relative) versions with a 4 – 20 mA output signal.

It has all the necessary marine approvals. Special versions with integrated pulse-snubber available, designed for severe medium influences like cavitation, liquid hammer or pressure peaks.

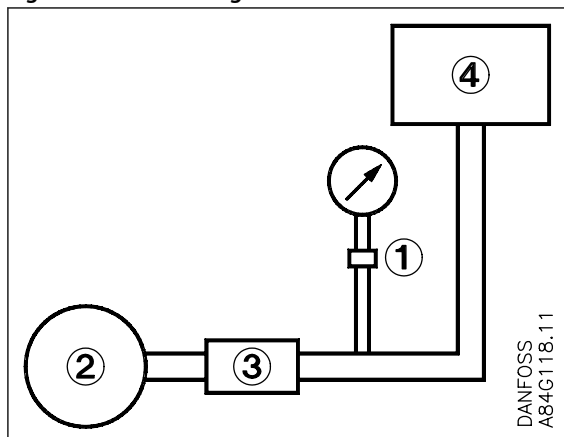
Features

- For use in Zone 2 explosive atmosphere
- Fully digitally compensated

Applications

Application and media conditions

Figure 1: Pressure range



1	Surge damper
2	Pump
3	Valve
4	Tank

In cases where valves are closed momentarily, surges of a value in excess of that for which the pressure element is designed can occur. To avoid damage to the pressure element, a damper should be fitted.

The device can consist of a flexible pipe, a throttle, a shock valve, or a combination of these items. The amplitude of surges should never exceed the maximum pressure range of the pressure transmitter.

Product specification

Technical data

Table 1: Performance (EN 60770)

Sensor temperature range	Normal	-10 – 70 °C, (Ref. Figure 3: Max. ambient temperature as a function of temperature)
	ATEX Zone 2	-10 – 55 °C
Transport / storage temperature		-50 – 70 °C
Media temperature		-40 – 100 °C, (Ref. Figure 3: Max. ambient temperature as a function of temperature)
Media		Water, fuel, oil, lubricating oil, refrigerants, ammonia, gas etc.
Voltage supply		Max. 32 V and min. 12 V DC between terminals N and P
Load resistance		A. max. 410 Ω at 24 V DC 50% / -20%
		B. max. 650 Ω at 24 V DC 50% / 0%
Noise – immunity		Complies with the standard for industrial apparatus EN 61000-6-2. The standard contains tests for the following: HF fields, mains transmitted HF, voltage transients, electrostatic immunity, supply voltage variations, low-frequency radiation and transient protection in accordance with Germanischer Lloyd
Noise – emission		Complies with standard EN 61000-6-3
Accuracy at 20 °C		$\leq \pm 1\%$ FS (max)
Voltage dependence		$\leq \pm 0.1\%$ FS / 10 V
Total Error Band		Figure 2: Total Error Band (incl. non-linearity, hysteresis, repeatability, thermal
Power-up time		< 50 ms
Vibration stability		3 – 30 Hz amplitude 1.13 mm and 30 – 300 Hz acceleration 4G according to IEC 60068-2-6. The requirements of the ship classification societies are up to 100 Hz, acceleration 4G. Extended specifications by prior arrangement
Time constant	Liquids with viscosity < 100 cSt	< 4 ms
	Air and gas in combination with pulse snubber:	< 35 ms
Shock stability		500 g for 1 ms to IEC 60068-2-27
Enclosure		IP65, Housings are made of enamelled pressure-die-cast aluminium (GD-AISI 12), IP54 in ATEX Zone 2 application
Pressure connection		G 1/4, G 1/2 A standard, G 3/8 A mano
Net weight		approx. 1 kg
Cable entry		Pg 13.5 for cable diameters 5 – 14 mm

Figure 2: Total Error Band (incl. non-linearity, hysteresis, repeatability, thermal

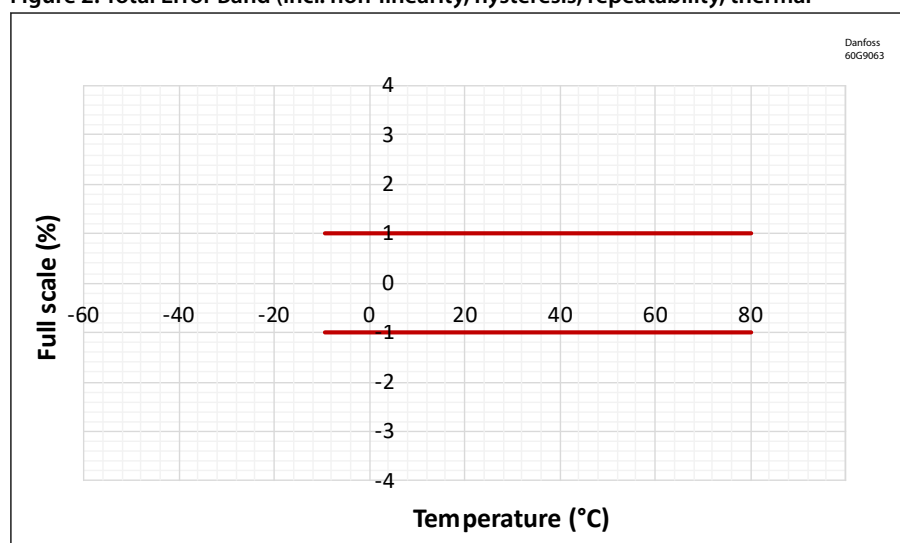


Table 2: Explosive atmospheres

Zone 2 applications ⁽¹⁾	II 3G Ex ec IIA T4 Gc -10°C<Ta<+55°C	EN60079-0; EN60079-7
------------------------------------	--	----------------------

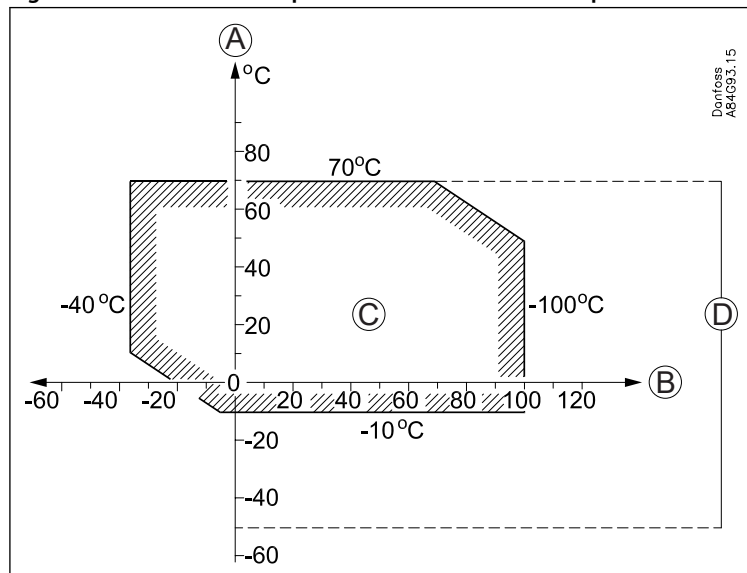
⁽¹⁾ The Pressure transmitter must be installed where it cannot be exposed to impact in normal use

Identification

The type designation and code number of the transmitter is embossed on the side of the housing at the bottom close to the pressure connector.

Installation conditions

Figure 3: Max. ambient temperature as a function of temperature



A	Ambient temperature
B	Media temperature
C	Operating range
D	Transport and storage temperature

Mounting

Type EMP 2 is equipped with a 3 mm steel bracket for mounting.

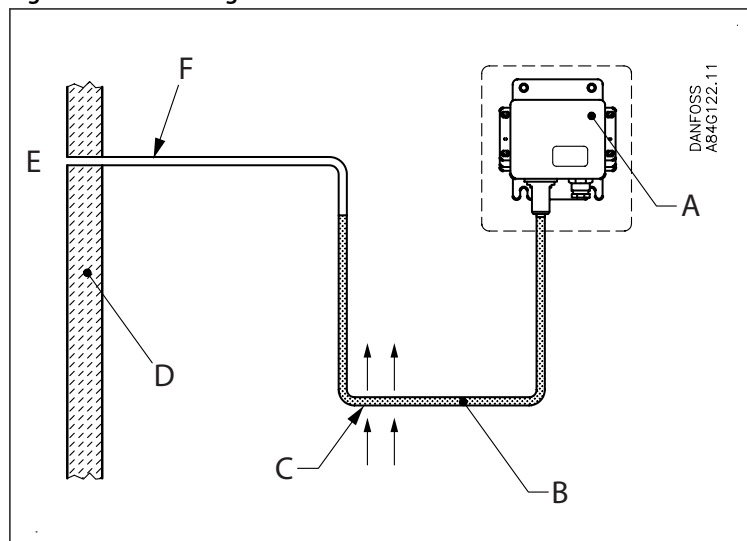
Pressure connection

Connector with outside cylindrical thread G 1/2, some types available with G 3/8 A mano, and inside cylindrical thread G 1/4, to ISO 228.

The primary insertion length of the connector corresponds to EN 837. Connection to the transmitter is made through a connector with a spanner flat, 14 mm across flats.

When fitting or removing pressure lines, the spanner flats on the pressure connector should be used to apply counter-torque.

Figure 4: Insulation against radiant heat



A	max. 70 °C
B	Condensed liquid
C	Reliable, good convection
D	Insulation against radiant heat
E	Steam 170 °C
F	Thin (=low heat conductivity) uninsulated tube

Water systems

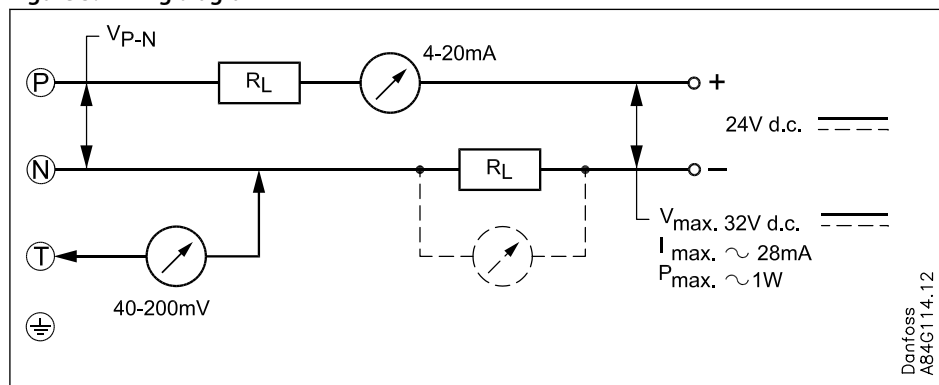
Water in the pressure element is not harmful, but in the event of frost a water-filled pressure element may burst. To prevent this the transmitter should be allowed to operate on an air cushion.

Steam plant

To protect the pressure element against temperatures in excess of the maximum temperature for the medium (100 °C), the insertion of a water-filled loop is recommended. In the example, **Figure 4: Insulation against radiant heat**, insulation against radiant heat is also shown.

Electrical connection

Figure 5: Wiring diagram

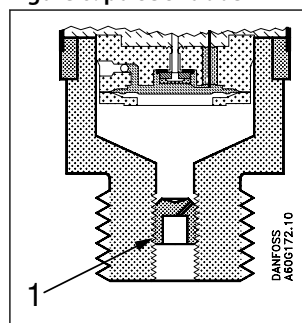


The transmitter has a wiring diagram, see above figure. Terminals P (positive) and N (negative) are connection terminals for the supply voltage.

The same leads are used for supply voltage and output signal. A function test can be performed between terminals N and T without cutting off the current loop.

Pulse snubber

Figure 6: pulse snubber



1 Pulse-snubber

Cavitation, liquid hammer and pressure peaks may occur in liquid filled hydraulic systems with changes in flow velocity, e.g. fast closing of a valve or pump starts and stops.

Liquid backlash can create huge pressure peaks of a non uniform nature and damage the diaphragm.

The problem may occur on the inlet and outlet side, even at rather low operating pressures.

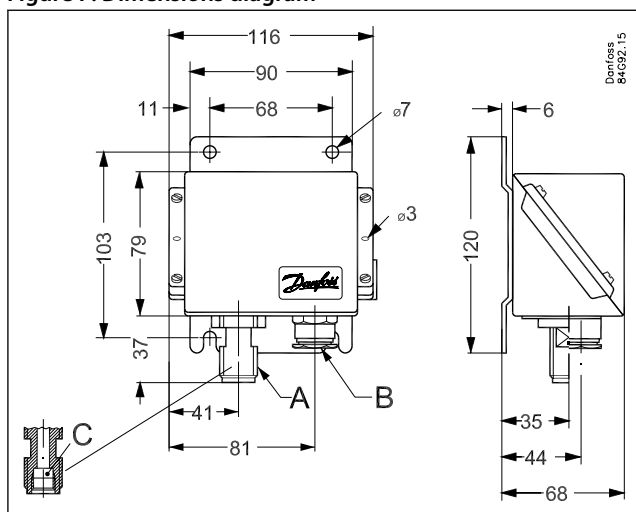
The integrated pulse snubber is designed as an 0.3 mm orifice mounted in the pressure connection. The medium should not contain particles which may clog up in the orifice.

The viscosity has only little effect on the response time. Even at liquid viscosities up to 100 Cst the response time will not exceed 4 ms.

Dimensions and weight

Net weight 1 kg

Figure 7: Dimensions diagram



A G ½ A (G 3/8 A mano)

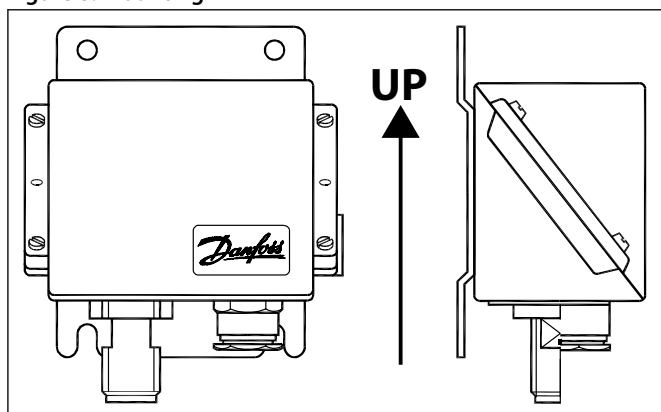
B Pg 13.5

C G ¼

Mounting

The Mounting orientation is given according to the danfoss instruction for EMP 2 084R9308. See picture below:

Figure 8: Mounting



Ordering

Table 3: Pressure in bar

Operating pressure	Test pressure	Min. burst pressure	Code no. EMP 2	
p_e [bar]	p_e [bar]	p_e [bar]	G ½ A	G ¾ A
-1 – 1.5 ⁽¹⁾	5	100	084G2100	-
-1 – 5 ⁽¹⁾	35	200	084G2101	-
0.2 – 1	3.2	100	084G2102	-
0 – 1.6	3.2	100	084G2104	-
0 – 2.5	5	200	084G2105	-
0 – 4	8	200	084G2106	084G2206
0 – 6	18	400	084G2107	084G2207
0 – 6	60 ⁽²⁾	400	084G2108	-
0 – 10	20	400	084G2109	084G2209
0 – 10	60 ⁽²⁾	400	084G2110	-
0 – 16	32	400	084G2111	084G2211
0 – 25	50	400	084G2112	-
0 – 40	80	400	084G2113	084G2213
0 – 60	120	400	084G2114	-
0 – 100	200	400	084G2115	-
0 – 160	260	640	084G2116	-
0 – 250	375	1000	084G2117	-
-1 – 9 ⁽¹⁾	20	400	084G2120	-

⁽¹⁾ Sealed gauge

⁽²⁾ With pulse snubber

Table 4: Pressure in kp/cm²

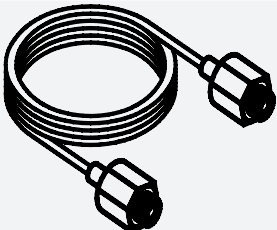
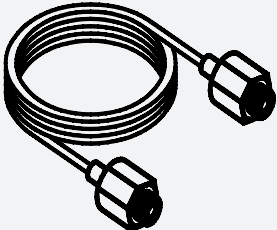
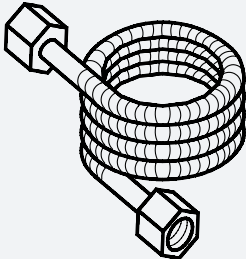
Operating pressure	Test pressure	Min. burst pressure	Code no. EMP 2	
p_e [kp/cm²]	p_e [kp/cm²]	p_e [kp/cm²]	G ½ A	G ¾ A
-1 – 5 ⁽¹⁾	35	200	084G2131	-
0 – 4	8	200	084G2136	084G2157
0 – 6	18	400	084G2137	084G2158
0 – 10	20	400	-	084G2179
0 – 15	32	400	084G2141	084G2159
0 – 25	50	400	084G2142	-
0 – 40	80	400	084G2143	084G2169
0 – 50	120	400	084G2144	-
0 – 20	50	400	084G2154	-

NOTE:

When ordering please state type and code number

Accessories

Table 5: Accessories list

Part	Symbol	Description	Material	Code no.
Damping coil		Damping coil with G 3/8 unions and 1.5 m copper capillary tube.	Copper	060-104766
Damping coil		Damping coil with G 1/2 unions and 1 m capillary tube. Standard washers supplied	Stainless steel	060-016966
Damping coil, armoured		Damping coil with G 3/8 unions and 1 m armoured copper capillary tube. Standard washers supplied	Copper	060-333366
Nipple		G 1/4 A x G 3/8A with copper washer	Brass	060-333266
		G 1/4 A x M10 ext. x 1 with copper washer	Brass	060-333866

Conversion table

Table 6: Conversion values

	Pascal (= Newton per square metre)	Newton per square [mm]	[bar]	Kilopond per square metre [mm] H ₂ O	Meter water gauge	Technical atmosphere [kp/cm ²]	Physical atmosphere	Torr [0 °C]	Inches Hg [0 °C]	Poundforce per Square inch
	[N/m ²] Pa	[N/mm ²]		[kp/m ²]	[m] H ₂ O	[at]	[atm]	[mm] Hg	[in] Hg	[lbf/in ²] psi
1 Pa	1	10 ⁻⁶	10 ⁻⁵	0.1020	1.020 • 10 ⁻⁴	1.020 • 10 ⁻⁵	9.869 • 10 ⁻⁵	7.500 • 10 ⁻³	2.953 • 10 ⁻⁴	1.450 • 10 ⁻⁴
1 N/mm ²	10 ⁶	1	10	1.020 • 10 ⁵	10.20	10.20	9.869	7.5 • 10 ³	295.3	145.0
1 bar	10 ⁵	0.1	1	10.197 • 10 ³	10.20	1.020	0.9869	750	29.53	14.50
1 kp/m ²	9.80665	9.807 • 10 ⁻⁶	9.807 • 10 ⁻⁵	1	10 ⁻³	10 ⁻⁴	0.9678 • 10 ⁻⁴	0.07355	2.896 • 10 ⁻³	1.422 • 10 ⁻³
1 m H ₂ O	9806.7	9.807 • 10 ⁻³	0.09807	1000	1	0.1	0.09678	73.55	2.896	1.422
1 at	98.066 • 10 ³	0.09807	0.9807	104	10	1	0.9678	735.5	28.96	14.22
1 atm	101.325 • 10 ³	0.1013	1.013	10.333 • 10 ³	10.33	1.033	1	760	29.92	14.70
1 mm Hg	133.32	1.333 • 10 ⁻⁴	1.333 • 10 ⁻³	13.60	0.01360	1.360 • 10 ⁻³	1.316 • 10 ⁻³	1	0.03937	1.934 • 10 ⁻²
1 in Hg	3387	3.387 • 10 ⁻³	0.03387	345.3	0.3453	0.03453	0.03342	25.4	1	0.4912
1 psi	6895	6.895 • 10 ⁻³	0.06895	703.1	0.7031	0.07031	0.06804	51.71	2.036	1

Certificates, declarations, and approvals

The list contains all certificates, declarations, and approvals for this product type. Individual code number may have some or all of these approvals, and certain local approvals may not appear on the list.

Some approvals may change over time. You can check the most current status at danfoss.com or contact your local Danfoss representative if you have any questions.

Table 7: Certificates and declarations

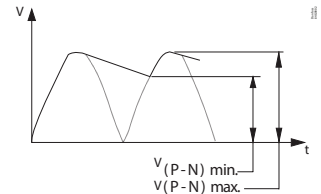
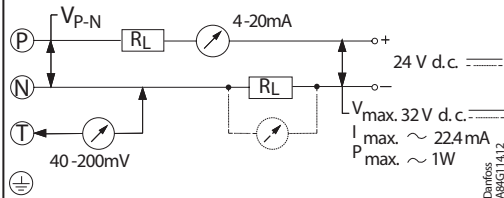
File name	Document type	Document topic	Approval authority
BV 02280-I1 BV	Safety certificate	Marine approval	BV
TJ22PTB00047	Safety certificate	Marine approval	CCS
DNV TAA000012U Rev.2	Safety certificate	Marine approval	DVN
KR DLN 34014-AE003	Safety certificate	Marine approval	KR
LR 2002547TA-02	Safety certificate	Marine approval	LR
TA22497M	Safety certificate	Marine approval	NKK
CRN.OF18477.5123467890YTN	Pressure - Safety certificate	CRN	TSSA
064G9615.11	EU Declaration	ATEX/EMCD/RoHS	Danfoss
RINA ELE106622XP	Safety certificate	Marine approval	RINA
E494625	Safety certificate	Hazardous Locations	UL
ABS 22-2311484-PDA	Safety certificate	Marine approval	ABS
E227388	Safety certificate	Hazardous Locations	UL
E510763	Safety certificate	Hazardous Locations	UL

EMP 2

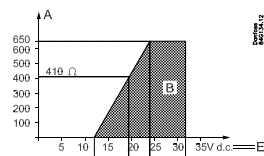
A = G ½ A
B = Pg 13,5
C = G ½

Danfoss
SMC224A11

The technical drawing illustrates the dimensions of the Danfoss SMC224A11 valve. The main view shows a rectangular body with a width of 116 mm and a height of 108 mm. Key dimensions include mounting hole spacing (90 mm), port diameters (7 mm), and connection thread specifications (A, B, C). A detailed cross-section at the bottom left shows the internal components and the G ½ connection. The side view shows a depth of 68 mm and a mounting flange diameter of 120 mm.



V = Indgangsspænding
Input voltage
Eingangsspannung
Entrée tension
Tensione di entrata
Tensione di entrata



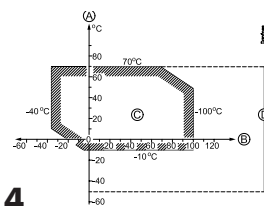
A = Belastning i Ω
Load in Ω
Belastung in Ω
Charge en Ω
Carga en Ω
Carica in Ω

B = Arbejdsområde
Operating range
Betriebsbereich
Plage de travail
Gama de trabajo
campo di funzion

C = Normal spænding 24 V d.c.
Normal Voltage 24 v d.c
Normale Spannung 24 V d.c.
Tension normale 24 v d.c.
Tensión normal 24 v d.c.
Tensione normale 24 V c.c

D = 20% underspænding
20% undervoltage
20% Underspannung
20% de sous-tension
20% de subtensión
sottoalimentazione 20%

E = Indgangsspænding
Input voltage
Eingangsspannung
Entrée tension
Tensione di entrata
Tensione di entrata



A = Omgivelsestemperatur
Ambient temperture
Umgebungstempauratur
Température ambiante
Temperatura ambiente
Temperatura ambiente

B = Medietemperatur
Media temperature
Medientemperatur
Température du média
Temperatura media
Temperatura dei fluido

C = Arbejdsområde
Operating range
Betriebsbereich
Plage de travail
Gama de trabajo
campo di funzionamento

D = Lagringstemperatur
Storage Temperature
Lagerungstemperatur
Température de stockage
Temperatura di immagazzinamento

For temperature ranges, see fig. 4.

temperatura, veàse figura 4.

Conexión eléctrica

La unidad est diseñada para una tensión de alimentación de 24 V c.c.
Tensión de alimentación mín.: 9 V
Tensión de alimentación máx.: 32 V
La resistencia de carga máxima permisible depende de la tensión de alimentación y se indica en la figura 3.
Conectar la tensión de alimentación al terminal P (positivo) y al terminal N (negativo), véase figura. 2.

El terminal T es el punto de prueba y el terminal de tierra. Una resistencia de 10 ohmios está intercalada entre los terminales N y T. La comprobación del funcionamiento puede realizarse con un milivoltímetro situado entre los terminales N y T. La comprobación de funcionamiento se puede hacer conectando un voltímetro a los terminales N y T (aprox. 40-200 mV).

ITALIANO

Identificazione

Il numero di codice, i valori di pressione misurabili e la pressione di prova sono stampati sulla parte superiore dell'apparecchiatura.

Installazione

Il trasmettitore EMP è equipaggiato con una staffa di fissaggio. Il raccordo per la presa di pressione è provvisto di G $\frac{1}{2}$ A y G $\frac{1}{4}$. Questo raccordo reca dei piani di appoggio per una chiave (14 mm) che deve essere usata quando si monta e si smonta l'apparecchiatura. Se intervengono oscillazioni nel mezzo oggetto della misura, la loro ampiezza non deve superare la pressione di prova dell'apparecchiatura. Se la temperatura del mezzo può superare i 100°C (per esempio in impianti di vapore), occorre inserire un anello tampone ad acqua. Come protezione contro rischi di gelo, l'EMP 1 può

funzionare con cuscino d'aria. (Per quanto concerne i campi di temperatura, vedere fig. 4).

Collegamenti elettrici

L'apparecchiatura è progettata per una tensione di alimentazione di 24 V in continua.
Tensione di alimentazione minima: 9 V
Tensione massima di alimentazione: 32 V
La massima resistenza di carico accettabile dipende dalla tensione di alimentazione ed è fornita in fig.3.

Collegare la tensione di alimentazione al morsetto P (positivo) e N (negativo), vedere fig. 2. Il terminale T è il punto di prova ed il morsetto di terra. Una resistenza di 10 ohm è inserita tra i morsetti N e T. La funzione <<prova>> può essere effettuata con un millivoltmetro tra i morsetti N e T. La prova di funzionamento può essere eseguita con un voltmetro fra i terminali N e T (circa 40-200 mV).

American and Canadian approvals:

1. Automatic electrical controls acc. to UL 60730-1 and part 2-6 / CAN/CSA E60730 and part 2-6, file E31024.
 2. Equipment for process measurement and control acc. to UL 61010-1 / CSA C22.2 No. 61010-12, file E494625.
 3. Nonincendive electrical equipment for use in Class I, Div. 2, Groups A, B, C, and D, hazardous locations in acc. To UL 121201 / C22.2 No. CSA-213, file E227388 and E510763. Combinations of equipment in systems are subject to investigation by the local Authority Having Jurisdiction at the time of installation. These components are to be installed within a suitable tool-secured enclosure in end application.
- WARNING - EXPLOSION HAZARD** – Do not disconnect equipment unless power has been removed or the area is known to be non-hazardous.
4. The MWP (max. working pressure) in the range from 1 to 250 bar depending on sensor pressure range. Refer to product label. (E494625)
 5. Evaluated for pollution Degree 3.
 6. Altitude up to 8,000 m.
 7. Max. R.H. 95% non-condensing.
 8. Overvoltage--e category I.
 9. Powered by class 2 supply.

Type	EMP 2
Max. ambient temperature/ T-code	70 °C
Electrical connections	For UL approved see overview page 1
Voltage supply	+9 to 32 V DC
Output	4 - 20 mA



**ATEX
ZONE 2**

CE Ex II 3G
Ex ec IIA T4 Gc
-20 °C < Ta < + 55 °C

EN60079-0; EN60079-7

Applicable in ATEX Zone 2 with medias classified as IIA in accordance to EN 60079-20-1:

Alle elektriske tilslutninger skal udføres iht. ATEX Zone 2 regulativet - samt EN 60079-14.
All electrical connections must comply with the ATEX requirements for Zone 2 - and EN 60079-14.
Alle elektrischen Anschlüsse müssen gemäß ATEX Zone2 Regeln und EN 60079-14 durchgeführt werden.
Tous les raccordements électriques doivent être effectués conformément aux règles ATEX zone 2 et EN 60079-14.
Todas las conexiones eléctricas deben ser realizadas de acuerdo a los requerimientos de la normativa ATEX zona 2 y EN 60079-14.
Tutti i collegamenti elettrici devono essere eseguiti secondo le normative ATEX Zone e EN 60079-14.

Ved anvendelser i ATEX Zone 2 områder ved temperaturer <-10 °C skal kabel og stik beskyttes mod slag.
When used in ATEX Zone2 areas at temperatures <-10 °C the cable and plug must be protected against impact.
Wenn in ATEX Zone 2 bei Temperaturen <-10 °C verwendet werden, müssen die Kabel und Stecker gegen Stöße geschützt werden.
Lorsqu'ils sont utilisés en zone 2 ATEX à des températures <-10 °C, le câble et le connecteur doivent être protégés contre les chocs.
Cuando se usa en áreas ATEX Zona 2, a temperaturas <-10 °C, el cable y conector deben protegerse contra impactos.
Per l'uso in ATEX Zona 2 a temperature <-10 °C, il cavo ed il connettore devono essere protetti contro gli urti.

Stikket må ikke fjernes, når transmitteren er tilsluttet.
Plug must not be removed when sensor is energized.
Stecker darf nicht entfernt werden, wenn der sensor aktiviert ist.
Le connecteur ne doit pas être retiré lorsque le capteur est encore sous tension.
El conector no debe retirarse cuando el sensor esté activado.
Il connettore elettrico non deve essere scollegato quando il sensore è in funzione.

Kablet må ikke udsættes for nogen mekaniske skader, korrosion, vibration, varme eller UV stråling.
Cable must neither be exposed for any mechanical damage, corrosion, vibration, heat nor UV radiation.
Kabel müssen weder auf mechanische Beschädigungen, Korrosion, Vibration, Hitze noch UV-Strahlung ausgesetzt werden.
Le câble ne doit être exposé à aucun dommage mécaniques, à la corrosion, aux vibrations, à la chaleur ou aux radiations UV.
El cable no deber estar expuesto a ningún tipo de radiación, daños mecánicos, corrosión, vibraciones, calor ó UV.
Il cavo non deve essere esposto a danni meccanici, corrosione, vibrazioni, fonti di calore o raggi UV.