

EMP 2 Pressure Transmitters

Description



Pressure transmitters type EMP 2 convert pressure to an electric signal.

This is proportional to, and linear with, the value of the pressure to which the pressure-sensitive element is subjected by the medium. The units are supplied as two-wire transmitters with an output signal of 4-20 mA.

The transmitters have a zero-point displacement facility for equalizing static pressure. Span adjustment is also possible. The EMP 2 series can be used for continuous measurement of liquid, steam or gas pressure.

The transmitters are designed for monitoring and control in marine and industrial applications. They have all necessary marine approvals.

Approvals

Lloyds Register of Shipping, England
Det Norske Veritas, Norway
Nippon Kaiji Kyokai, Japan
American Bureau of Shipping, USA
Germanischer Lloyd, BRD
Registro Italiano Navale, Italy

Bureau Veritas, France
China Classification society, China
Korean Register, Korea

Technical data and ordering

(When ordering please state type and code number)

Pressure in bar

Operating pressure P_e bar	Test pressure P_e bar	Min. burst pressure P_e bar	Code no. EMP 2	
			G 1/2 A	G 3/8 A
-1 - 1.5 ²⁾	5	100	084G2100	
-1 - 5 ²⁾	35	200	084G2101	
0.2 - 1	3.2	100	084G2102	
0 - 1	3.2	100	084G2103	
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 ¹⁾	400	084G2108	
0 - 10	20	400	084G2109	084G2209
0 - 10	60 ¹⁾	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	
0 - 400	600	1600	084G2118	
-1 - 9 ²⁾	20	400	084G2120	

¹⁾ With pulse snubber

²⁾ Sealed gauge

Pressure in kp/cm²

Operating pressure P_e kp/cm ²	Test pressure P_e kp/cm ²	Min. burst pressure P_e kp/cm ²	Code no. EMP 2	
			G 1/2 A	G 3/8 A
-1 - 5 ²⁾	3.5	200	084G2131	
0.2 - 1	3.2	100	084G2132	
0 - 1	3.2	100	084G2133	
0 - 1.6	3.2	100	084G2134	
0 - 2.5	5	200	084G2135	084G2235
0 - 4	8	200	084G2136	084G2157
0 - 6	18	400	084G2137	084G2158
0 - 6	60 ¹⁾	400	084G2138	
0 - 10	20	400	084G2139	084G2179
0 - 10	60 ¹⁾	400	084G2140	
0 - 15	32	400	084G2141	084G2159
0 - 25	50	400	084G2142	
0 - 40	80	400	084G2143	084G2169
0 - 50	120	400	084G2144	
0 - 100	200	400	084G2145	
0 - 160	260	640	084G2146	
0 - 250	375	1000	084G2147	
0 - 400	600	1600	084G2148	
0 - 20	50	400	084G2154	

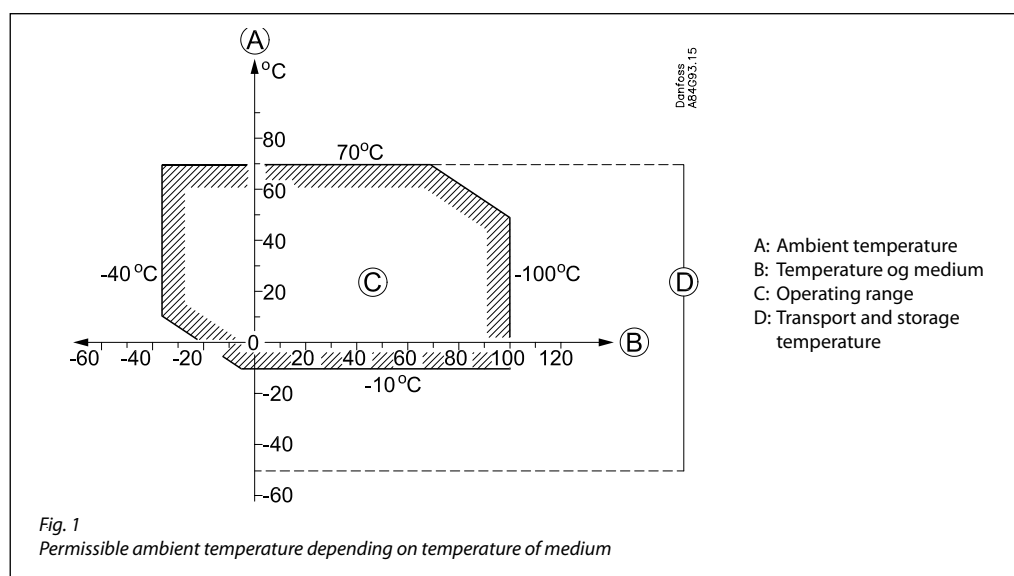
Technical data

Operating temperature	-10°C to 70°C, see also fig. 1
Storage temperature	-50°C to 70°C
Temperature of medium	-40°C to 100°C, depending to some extent on ambient temperature (fig. 1)
Media	Water, fuel, oil, lubricating oil, refrigerants, ammonia, gas etc. The media must however be neutral in respect of materials AISI 316L
Voltage supply	Max. 32 V and min. 12 V d.c. between terminals N and P
Load resistance	A. max. 410 Ohm at 24 V d.c. +50%/-20% B. max. 650 Ohm at 24 V d.c. +50%/-0%
Zero point adjustment	-5% 20% range span; but max. -1 1.5 bar (kp/cm ²)
Span adjustment	±5% of range span; but max. ± 5 bar (kp/cm ²)
Combination of span and zero point adjustments	-5% 20% of range span
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	Linearity: ± 0.3% in all pressure ranges ± 2.3% FS for -1 to xx bar or kp/cm ²
Temperature dependence	1. Thermal zero point shift 2. Thermal sensitivity (span) shift
	1. ± 0.06 % FS/°C 2. ± 0.06 % FS/°C
Voltage dependence	±0.01% FS/ 10V
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 4 G Extended specifications by prior arrangement
Time constant	Less than 4 ms
Shock stability	500 g for 1 ms to IEC 60068-2-27
Enclosure	IP 67 IEC 529 or DIN 40050. Housings are made of enamelled pressure-die-cast aluminium (GD-AISI 12)
Pressure connection	G 1/4, G 1/2 A standard, G 3/8 A mano
Weight	approx. 1 kg
Cable entry	Pg 13,5 for cable diameters 5-14 mm

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



Mounting

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

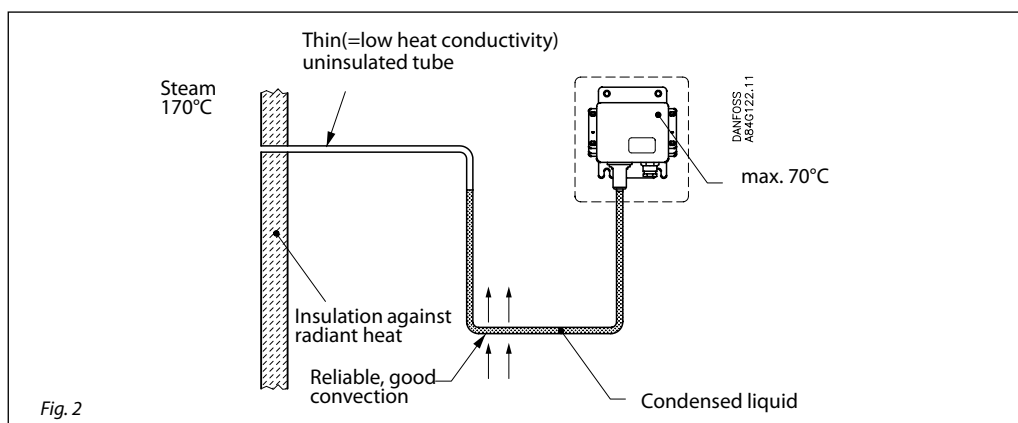
Pressure connection

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.

Installation conditions



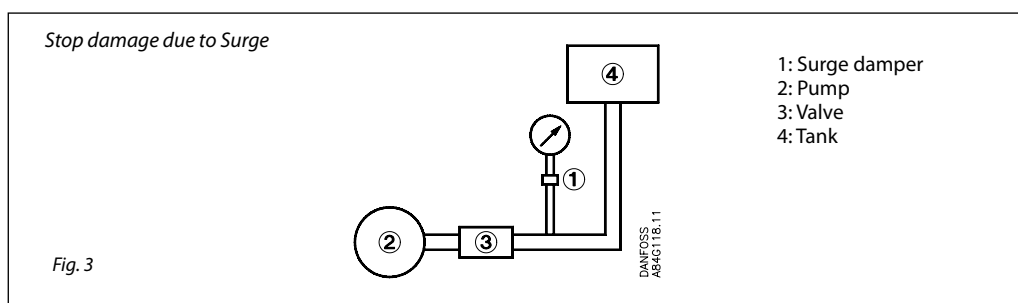
Water systems

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, fig. 2, insulation against radiant heat is also shown.

Surge



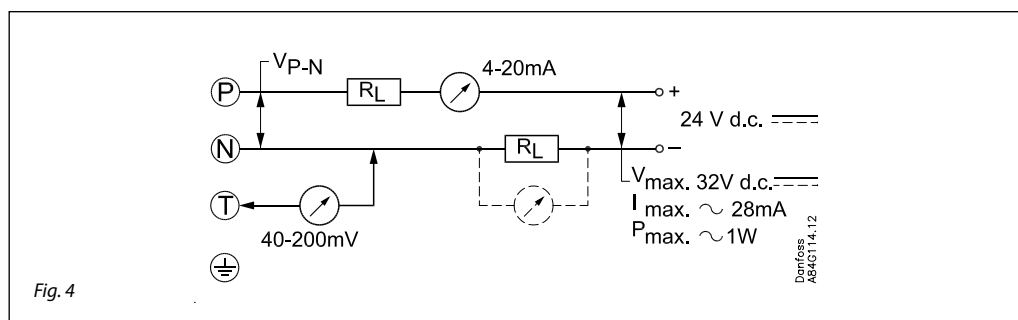
In cases where valves are closed momentarily, surges of a value in excess of that for which the pressure element is designed can occur. To avoid damage to the pressure element, a damping device should

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 range pressure of the pressure transmitter.

Electrical connection

The transmitter has a wiring diagram, see fig. 4. 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

EMP 2 with the pressure range 0 - 6 bar and 0 - 10 bar at extended test pressure is provided with an integrated pulse snubber for protection of the sensor element against cavitations and air bubbles in the media due to extreme pressure peaks and pulsations. Such conditions may be caused by pumps or fast operation valves in both high and low pressure systems.

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 viscosities up to 100 Cst. the response time will not exceed 4 msec.

Sizing

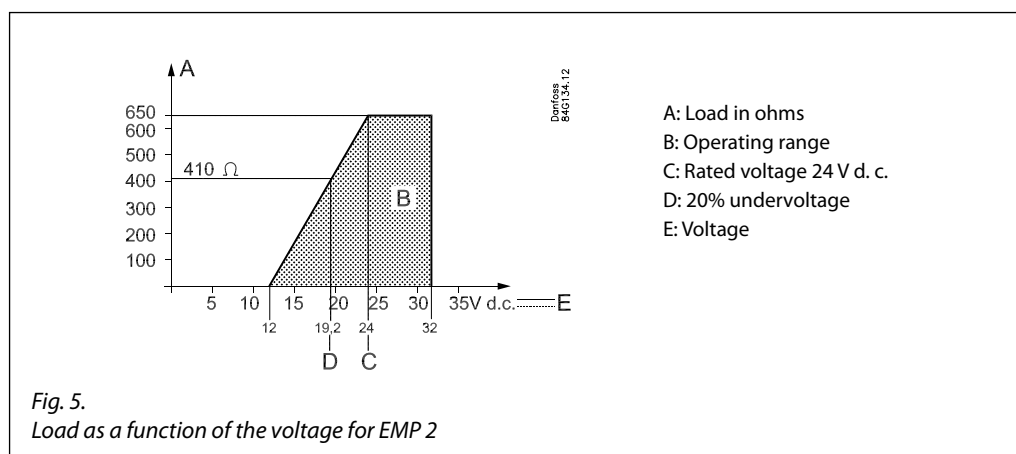
The maximum permissible load resistance R_L for insertion between transmitter and voltage source can be calculated from the formula:

$$R_L () = \frac{V-12}{20 \times 10^{-3}}$$

The load is the sum of all resistances i both leads.

Any superimposed ripple voltages or voltage changes in a downward direction must be subtracted to find the smallest value of V.

Any superimposed ripple voltages or voltage changes in an upward direction must not result in the stated maximum voltage of 32 V being exceeded.



The intersection between supply voltage and load resistance graphs must lie within the shaded area (marked B in diagram).

Example

Given:

Supply voltage 24 V $\pm$ 10%

ripple voltage

Lead resistance in lead N

Measuring resistance inserted

in lead N

Lead resistance in lead P

Measuring resistance inserted

in lead P

10

270

10

50

$R_L = 340$

Calculation

$$V = 24 V \pm 10\% \quad V_{upper} = 24 V + 10\% = 26.4 V$$

$$V_{lower} = V - 10\% = 21.6$$

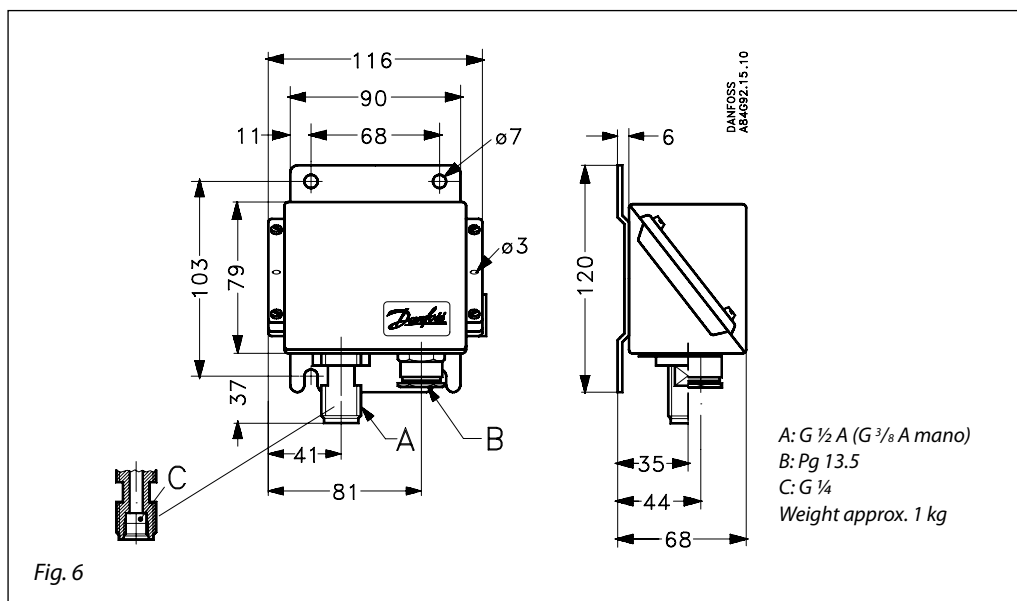
$$R_L (\text{permissible}) = \frac{21.6 - 12}{20 \times 10^{-3}} = 480$$

R_L of 340 is less than 480

V_{upper} of 26,4 V d.c. is less than $V_{max.}$ of 32 V d.c.

Thus, R_L and V lie within the permissible operating range.

Dimensions and weight



Accessories

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 3/8 A with copper washer	Brass	060-333266
		G 1/4 A x M10 ext. x 1 with copper washer	Brass	060-333866
		G 1/4 A x G 1/4 - 18 NPT with copper washer	Brass	060-333966
		G 1/4 A x G 7/16 - 20 UNF with aluminium washer	Brass	084G0160
Ship's screwed cable entry		M24 x 1.5		060-105866
Connector with welding nipple		Connector, G 1/2 Welding nipple, 10 mm	Plain carbon steel W.no. 1.0718	084G0132

Conversion table

	Pascal (= Newton per square metre) (N/m ²) Pa	Newton per square mm N/mm ²	bar	Kilopond per square metre (mm H ₂ O) kp/m ²	Meter water gauge m H ₂ O	Technical atmosphere (kp/cm ²) at	Physical atmosphere atm	Torr (0°C) mm Hg	Inches Hg (0°C) in Hg	Poundforce per Square inch (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	102.0	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	10 ⁴	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

ISO 9001 quality approval

ISO
9001

Danfoss A/S is certificated in accordance with international standard ISO 9001. This means that Danfoss fulfils the international standard in respect of product development, design production and sale.

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