

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 | |

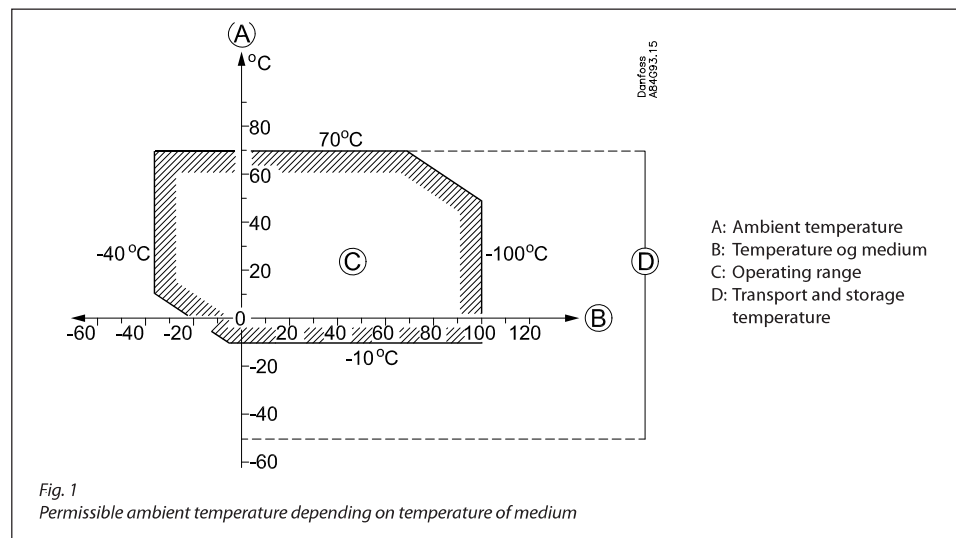
Technical data

| | |
|--|---|
| 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.

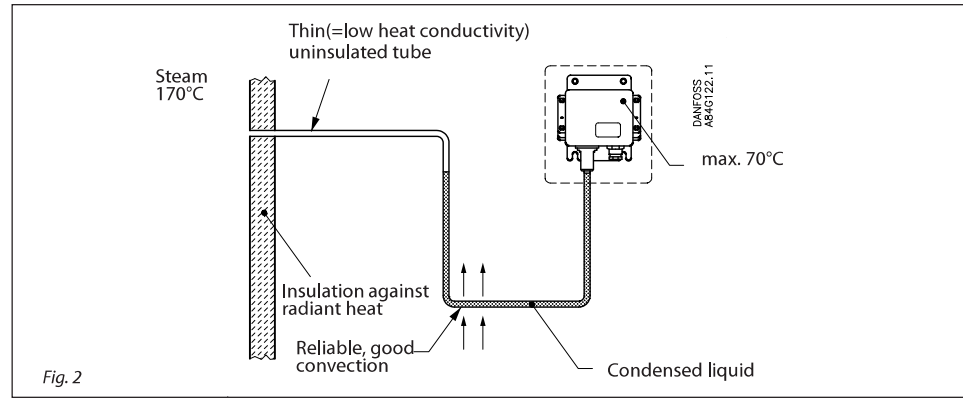
Pressure connection

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



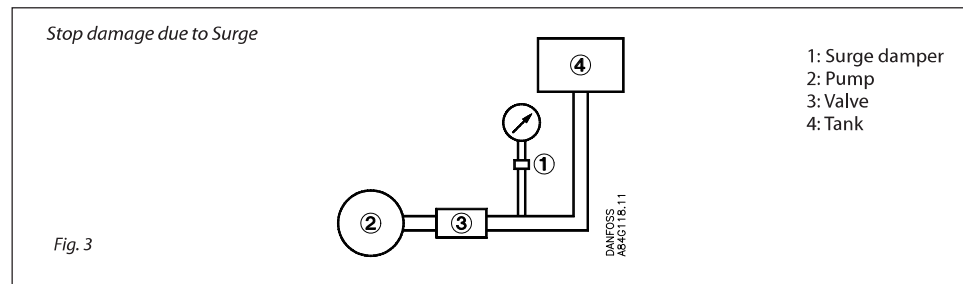
Water systems

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



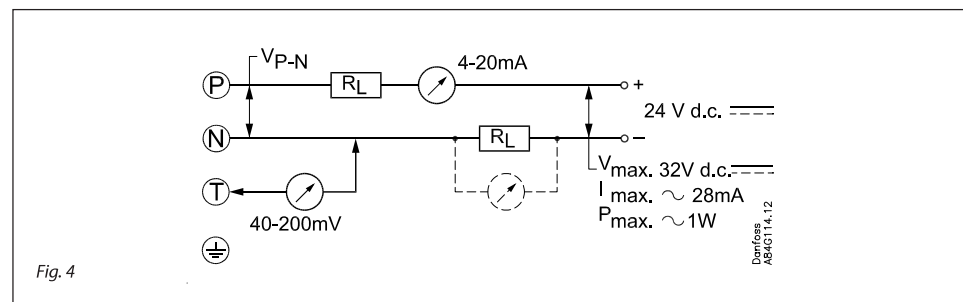
In cases where valves are closed momentarily, surges of a value in excess of that for which the pressure element is designed can occur. To avoid damage to the pressure element, a damping device should

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

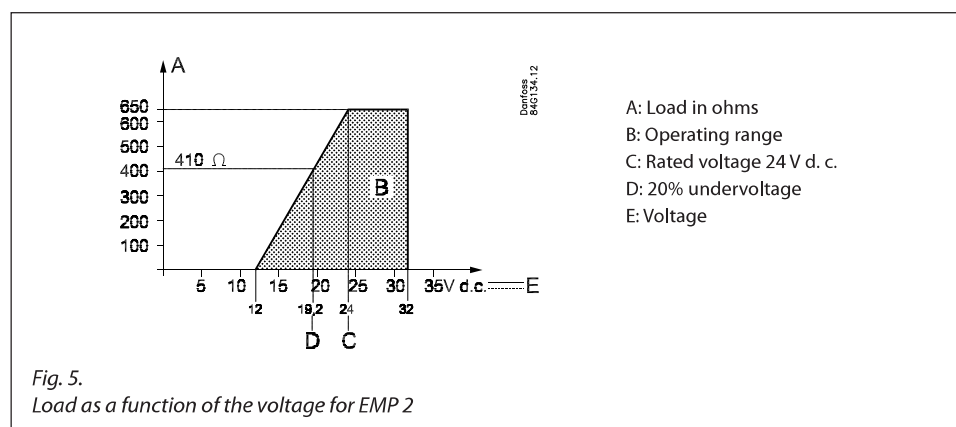
The maximum permissible load resistance R_L for insertion between transmitter and voltage source can be calculated from the formula:

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

The load is the sum of all resistances in 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 ±10% ripple voltage

Lead resistance in lead N 10 Ω

Measuring resistance inserted in lead N 270 Ω

Lead resistance in lead P 10 Ω

Measuring resistance inserted in lead P 50 Ω

$$R_L = 340 \Omega$$

Calculation

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

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

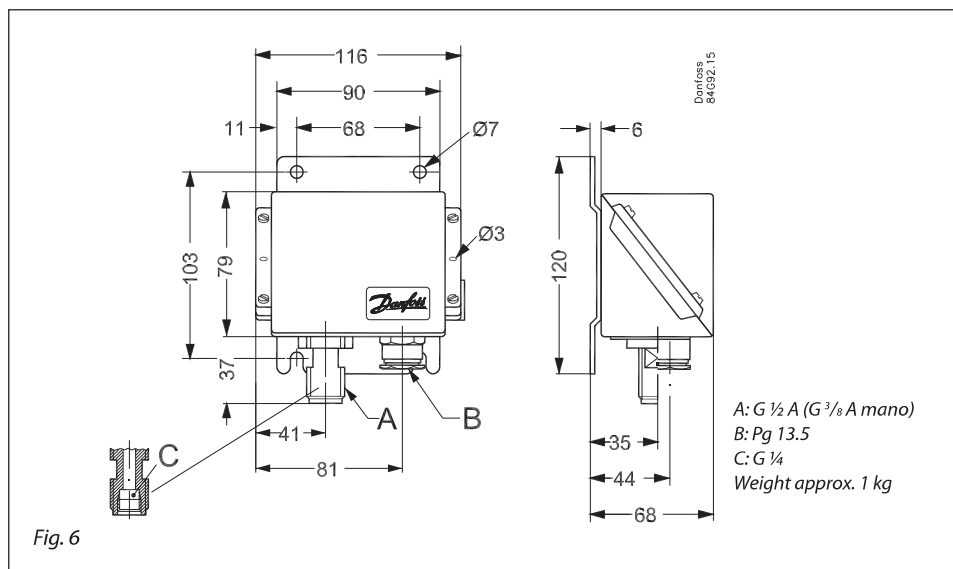
$$R_L (\text{permissible}) = \frac{21.6 - 12}{20 \times 10^{-3}} = 480 \Omega$$

R_L of 340 Ω is less than 480 Ω

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 $G \frac{3}{8}$ unions and 1.5 m copper capillary tube. | Copper | 060-104766 |
| Damping coil | | Damping coil with $G \frac{1}{2}$ unions and 1 m capillary tube. Standard washers supplied | Stainless steel | 060-016966 |
| Damping coil, armoured | | Damping coil with $G \frac{3}{8}$ unions and 1 m armoured copper capillary tube. Standard washers supplied | Copper | 060-333366 |
| Nipple | | $G \frac{1}{4} A \times G \frac{3}{8} A$ with copper washer | Brass | 060-333266 |
| | | $G \frac{1}{4} A \times M10$ ext. $\times 1$ with copper washer | Brass | 060-333866 |

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.