

## **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  
 ① Germanischer Lloyds, 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 <sup>2)</sup>	5	100	<b>084G2100</b>	
-1 - 5 <sup>2)</sup>	35	200	<b>084G2101</b>	
0.2 - 1	3.2	100	<b>084G2102</b>	
0 - 1	3.2	100	<b>084G2103</b>	
0 - 1.6	3.2	100	<b>084G2104</b>	
0 - 2.5	5	200	<b>084G2105</b>	
0 - 4	8	200	<b>084G2106</b>	<b>084G2206</b>
0 - 6	18	400	<b>084G2107</b>	<b>084G2207</b>
0 - 6	60 <sup>1)</sup>	400	<b>084G2108</b>	
0 - 10	20	400	<b>084G2109</b>	<b>084G2209</b>
0 - 10	60 <sup>1)</sup>	400	<b>084G2110</b>	
0 - 16	32	400	<b>084G2111</b>	<b>084G2211</b>
0 - 25	50	400	<b>084G2112</b>	
0 - 40	80	400	<b>084G2113</b>	<b>084G2213</b>
0 - 60	120	400	<b>084G2114</b>	
0 - 100	200	400	<b>084G2115</b>	
0 - 160	260	640	<b>084G2116</b>	
0 - 250	375	1000	<b>084G2117</b>	
0 - 400	600	1600	<b>084G2118</b>	
-1 - 9 <sup>2)</sup>	20	400	<b>084G2120</b>	

<sup>1)</sup> With pulse snubber

<sup>2)</sup> Sealed gauge

 Pressure in  $kp/cm^2$ 

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 <sup>2)</sup>	3.5	200	<b>084G2131</b>	
0.2 - 1	3.2	100	<b>084G2132</b>	
0 - 1	3.2	100	<b>084G2133</b>	
0 - 1.6	3.2	100	<b>084G2134</b>	
0 - 2.5	5	200	<b>084G2135</b>	<b>084G2235</b>
0 - 4	8	200	<b>084G2136</b>	<b>084G2157</b>
0 - 6	18	400	<b>084G2137</b>	<b>084G2158</b>
0 - 6	60 <sup>1)</sup>	400	<b>084G2138</b>	
0 - 10	20	400	<b>084G2139</b>	<b>084G2179</b>
0 - 10	60 <sup>1)</sup>	400	<b>084G2140</b>	
0 - 15	32	400	<b>084G2141</b>	<b>084G2159</b>
0 - 25	50	400	<b>084G2142</b>	
0 - 40	80	400	<b>084G2143</b>	<b>084G2169</b>
0 - 50	120	400	<b>084G2144</b>	
0 - 100	200	400	<b>084G2145</b>	
0 - 160	260	640	<b>084G2146</b>	
0 - 250	375	1000	<b>084G2147</b>	
0 - 400	600	1600	<b>084G2148</b>	
0 - 20	50	400	<b>084G2154</b>	

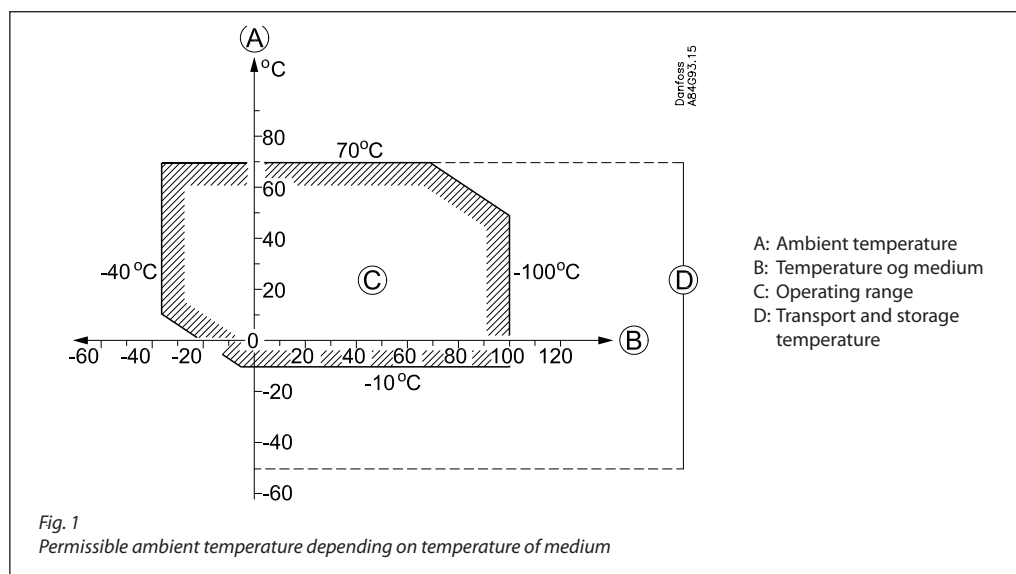
Technical data

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 <sup>2</sup> )
Span adjustment	±5% of range span; but max. ± 5 bar (kp/cm <sup>2</sup> )
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 <sup>2</sup>
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 stell bracket for mounting.

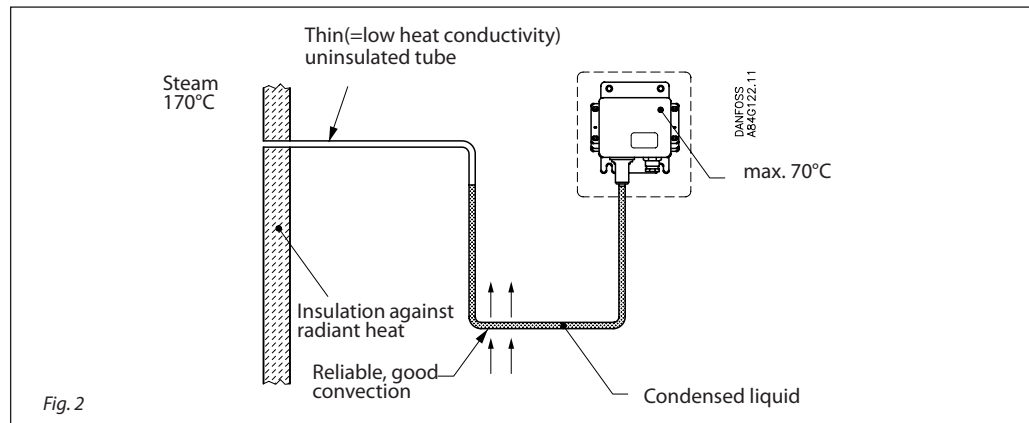
Pressure connection

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



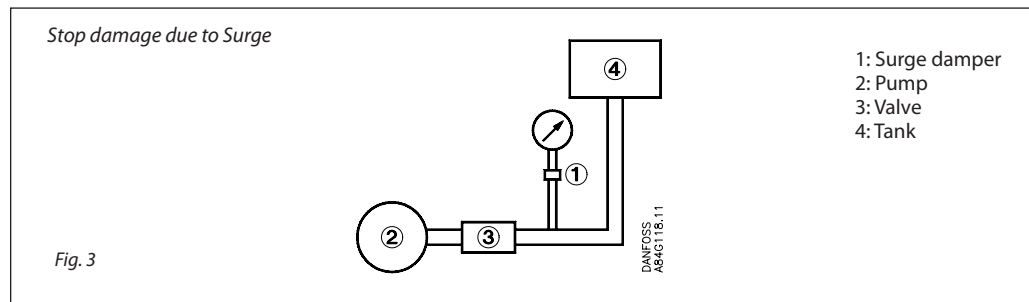
Water systems

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



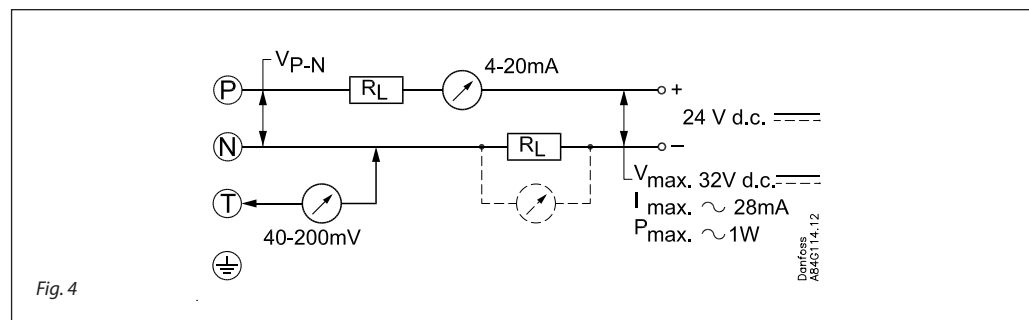
In cases where valves are closed momentarily, surges of a value in excess of that for which the pressure element is designed can occur. To avoid damage to the pressure element, a damping device should

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.

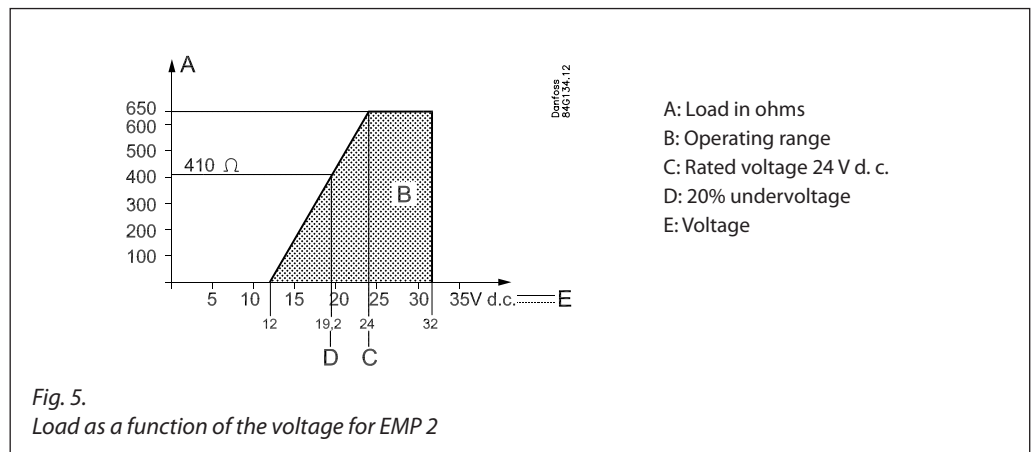


Fig. 5. Load as a function of the voltage for EMP 2

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

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

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

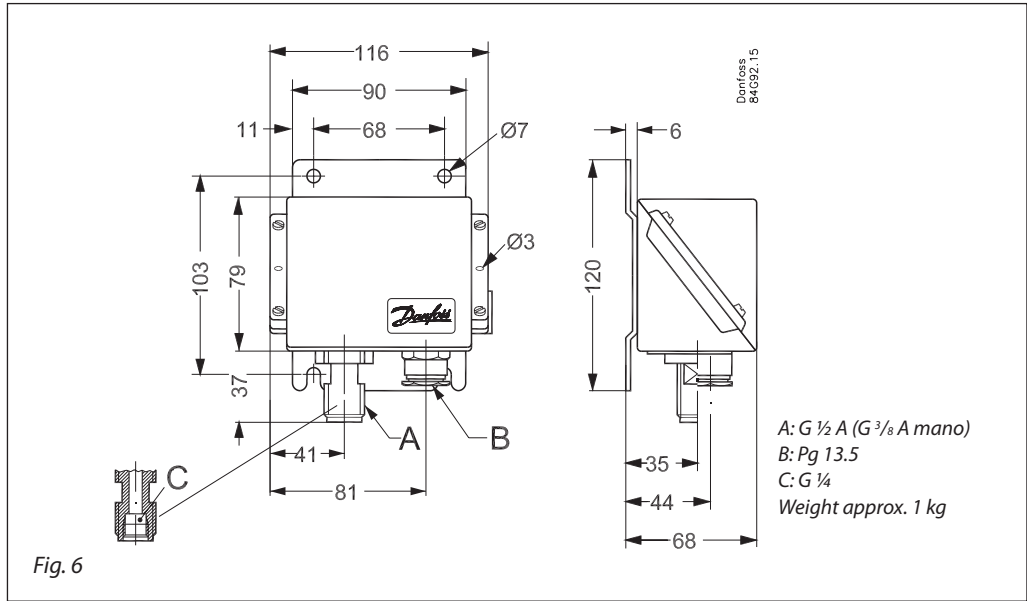
$$R_L (\text{permissible}) = \frac{21.6 - 12}{20 \times 10^{-3}} = 480 \Omega$$

$R_L$  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 3/8 unions and 1.5 m copper capillary tube.	Copper	<b>060-104766</b>
Damping coil		Damping coil with G 1/2 unions and 1 m capillary tube. Standard washers supplied	Stainless steel	<b>060-016966</b>
Damping coil, armoured		Damping coil with G 3/8 unions and 1 m armoured copper capillary tube. Standard washers supplied	Copper	<b>060-333366</b>
Nipple		G 1/4 A x G 3/8 A with copper washer	Brass	<b>060-333266</b>
		G 1/4 A x M10 ext. x 1 with copper washer	Brass	<b>060-333866</b>

**Conversion table**

	Pascal (= Newton per square metre) (N/m <sup>2</sup> ) Pa	Newton per square mm N/mm <sup>2</sup>	bar	Kilopond per square metre (mm H <sub>2</sub> O) kp/m <sup>2</sup>	Meter water gauge m H <sub>2</sub> O	Technical atmosphere (kp/cm <sup>2</sup> ) at	Physical atmosphere atm	Torr (0°C) mm Hg	Inches Hg (0°C) in Hg	Poundforce per Square inch (lbf/in <sup>2</sup> ) psi
1 Pa	1	10 <sup>-6</sup>	10 <sup>-5</sup>	0.1020	1.020 · 10 <sup>-4</sup>	1.020 · 10 <sup>-5</sup>	9.869 · 10 <sup>-5</sup>	7.500 · 10 <sup>-3</sup>	2.953 · 10 <sup>-4</sup>	1.450 · 10 <sup>-4</sup>
1 N/mm <sup>2</sup>	10 <sup>6</sup>	1	10	1.020 · 10 <sup>5</sup>	102.0	10.20	9.869	7.5 · 10 <sup>3</sup>	295.3	145.0
1 bar	10 <sup>5</sup>	0.1	1	10.197 · 10 <sup>3</sup>	10.20	1.020	0.9869	750	29.53	14.50
1 kp/m <sup>2</sup>	9.80665	9.807 · 10 <sup>-6</sup>	9.807 · 10 <sup>-5</sup>	1	10 <sup>-3</sup>	10 <sup>-4</sup>	0.9678 · 10 <sup>-4</sup>	0.07355	2.896 · 10 <sup>-3</sup>	1.422 · 10 <sup>-3</sup>
1 m H <sub>2</sub> O	9806.7	9.807 · 10 <sup>3</sup>	0.09807	1000	1	0.1	0.09678	73.55	2.896	1.422
1 at	98.066 · 10 <sup>3</sup>	0.09807	0.9807	10 <sup>4</sup>	10	1	0.9678	735.5	28.96	14.22
1 atm	101.325 · 10 <sup>3</sup>	0.1013	1.013	10.333 · 10 <sup>3</sup>	10.33	1.033	1	760	29.92	14.70
1 mm Hg	133.32	1.333 · 10 <sup>-4</sup>	1.333 · 10 <sup>-3</sup>	13.60	0.01360	1.360 · 10 <sup>-3</sup>	1.316 · 10 <sup>-3</sup>	1	0.03937	1.934 · 10 <sup>-2</sup>
1 in Hg	3387	3.387 · 10 <sup>-3</sup>	0.03387	345.3	0.3453	0.03453	0.03342	25.4	1	0.4912
1 psi	6895	6.895 · 10 <sup>-3</sup>	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.

