



Pressure transmitter  
type EMP 2

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## Introduction Application

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.

## Overview

| 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 bar | Operating pressure<br>$p_e$ (bar)<br>(kp/cm <sup>2</sup> ) | Type<br>bar<br>G $\frac{1}{2}$ A | Type<br>(kp/cm <sup>2</sup> )<br>G $\frac{1}{2}$ A |
|---|----|----|----|----|----|----|----|--------|--|----------------------------------|--|
|   |    |    |    |    |    |    |    |        | -1 - 1,5   | 084G2100                         | 084G2130   |
|   |    |    |    |    |    |    |    |        | -1 - 5   | 084G2101                         | 084G2131   |
|   |    |    |    |    |    |    |    |        | -1 - 9   | 084G2120                         |  |
|   |    |    |    |    |    |    |    |        | 0,2 - 1  | 084G2102                         | 084G2132   |
|   |    |    |    |    |    |    |    |        | 0 - 1  | 084G2103                         | 084G2133   |
|   |    |    |    |    |    |    |    |        | 0 - 1,6  | 084G2104                         | 084G2134   |
|   |    |    |    |    |    |    |    |        | 0 - 2,5  | 084G2105                         | 084G2135 <sup>6)</sup>                             |
|   |    |    |    |    |    |    |    |        | 0 - 4  | 084G2106 <sup>1)</sup>           | 084G2136 <sup>7)</sup>                             |
|   |    |    |    |    |    |    |    |        | 0 - 6  | 084G2107 <sup>2)</sup>           | 084G2137 <sup>8)</sup>                             |
|   |    |    |    |    |    |    |    |        | 0 - 6  | 084G2108                         | 084G2138   |
|   |    |    |    |    |    |    |    |        | 0 - 10   | 084G2109 <sup>3)</sup>           | 084G2139 <sup>9)</sup>                             |
|   |    |    |    |    |    |    |    |        | 0 - 10   | 084G2110                         | 084G2140 <sup>10)</sup>                            |
|   |    |    |    |    |    |    |    |        | 0 - 15   |                                  | 084G2141 <sup>11)</sup>                            |
|   |    |    |    |    |    |    |    |        | 0 - 16   | 084G2111 <sup>4)</sup>           |  |
|   |    |    |    |    |    |    |    |        | -1 - 20  |                                  | 084G2154   |
|   |    |    |    |    |    |    |    |        | 0 - 25   | 084G2112                         | 084G2142   |
|   |    |    |    |    |    |    |    |        | 0 - 40   | 084G2113 <sup>5)</sup>           | 084G2143 <sup>12)</sup>                            |

| 0 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 bar | Operating pressure<br>$p_e$ (bar)<br>(kp/cm <sup>2</sup> ) | Type<br>bar | Type<br>(kp/cm <sup>2</sup> ) |
|---|----|-----|-----|-----|-----|-----|-----|---------|--|-------------|-------------------------------|
|   |    |     |     |     |     |     |     |         | 0 - 50   |             | 084G2144                      |
|   |    |     |     |     |     |     |     |         | 0 - 60   | 084G2114    |                               |
|   |    |     |     |     |     |     |     |         | 0 - 100  | 084G2115    | 084G2145                      |
|   |    |     |     |     |     |     |     |         | 0 - 160  | 084G2116    | 084G2146                      |
|   |    |     |     |     |     |     |     |         | 0 - 250  | 084G2117    | 084G2147                      |
|   |    |     |     |     |     |     |     |         | 0 - 400  | 084G2118    | 084G2148                      |

| G $\frac{3}{8}$ A mano |                            |          |
|------------------------|----------------------------|----------|
| 1)                     | 0 - 4 bar                  | 084G2206 |
| 2)                     | 0 - 6 bar                  | 084G2207 |
| 3)                     | 0 - 10 bar                 | 084G2209 |
| 4)                     | 0 - 16 bar                 | 084G2211 |
| 5)                     | 0 - 40 bar                 | 084G2213 |
| 6)                     | 0 - 2,5 Kp/cm <sup>2</sup> | 084G2235 |
| 7)                     | 0 - 4 Kp/cm <sup>2</sup>   | 084G2157 |
| 8)                     | 0 - 6 Kp/cm <sup>2</sup>   | 084G2158 |
| 9)                     | 0 - 10 Kp/cm <sup>2</sup>  | 084G2179 |
| 10)                    | 0 - 10 kp/cm <sup>2</sup>  | 084G2149 |
| 11)                    | 0 - 15 Kp/cm <sup>2</sup>  | 084G2159 |
| 12)                    | 0 - 40 Kp/cm <sup>2</sup>  | 084G2169 |

### Technical data and ordering

(When ordering please state type and code number)



#### Pressure in bar

| Operating pressure<br>$P_e$<br>bar | Test pressure<br>$P_e$<br>bar | Min. burst pressure<br>$P_e$<br>bar | Code no.<br>EMP 2 |                 |
|------------------------------------|-------------------------------|-------------------------------------|-------------------|-----------------|
|                                    |                               |                                     | G 1/2 A           | G 3/8 A         |
| -1 - 1.5                           | 5                             | 100                                 | <b>084G2100</b>   |                 |
| -1 - 5                             | 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                            | 400                                 | <b>084G2108</b>   |                 |
| 0 - 10                             | 20                            | 400                                 | <b>084G2109</b>   | <b>084G2209</b> |
| 0 - 10                             | 60                            | 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                             | 20                            | 400                                 | <b>084G2120</b>   |                 |

#### Pressure in $kp/cm^2$

| Operating pressure<br>$P_e$<br>$kp/cm^2$ | Test pressure<br>$P_e$<br>$kp/cm^2$ | Min. burst pressure<br>$P_e$<br>$kp/cm^2$ | Code no.<br>EMP 2 |                 |
|--|-------------------------------------|---|-------------------|-----------------|
|  |                                     |   | G 1/2 A           | G 3/8 A         |
| -1 - 1.5                                 | 5                                   | 100                                       | <b>084G2130</b>   |                 |
| -1 - 5                                   | 35                                  | 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                                  | 400                                       | <b>084G2138</b>   |                 |
| 0 - 10                                   | 20                                  | 400                                       | <b>084G2139</b>   | <b>084G2179</b> |
| 0 - 10                                   | 60                                  | 400                                       | <b>084G2140</b>   | <b>084G2149</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>   |                 |
| -1 - 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.<br>The media must however be neutral in respect of materials 17-4 PH (AISI S17400) W. No. 1.4540 and 17 Cr + Mo AISI 440 W. No. 1.4122   |
| Voltage supply                                 | Max. 36 V and min. 11 V d.c. between terminals N and P  |
| Load resistance                                | A. max. 410 Ohm at 24 V d.c. +50%/ -20%<br>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 50082-2. 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 50081-1   |
| Voltage peaks                                  | Protected against voltage surges up to 1 kV in accordance with the stipulations of Germanischer Lloyd   |
| Turn-on time                                   | Less than 50 ms at 100% pressure  |
| Accuracy                                       | Linearity: ≤ ± 0.3% in pressure range ≥ 6 bar ( $kp/cm^2$ )<br>≤ ± 0.5% in pressure range ≤ 4 bar ( $kp/cm^2$ )<br>Hysteresis and repeatability: ≤ 0.1%   |
| Temperature dependence                         | 1. ± 0,06%/°C F.S.O.*:<br>For code nos. 084G2101, 02, 03, 17, 18, 30, 31, 32, 33, 47, 48: 0,12% F.S.O./°C*<br>For code nos. 084G2110 and 40: 0,15% F.S.O./°C*<br>For code nos. 084G2110 and 38: 0,25% F.S.O./°C*<br>2. ± 0,06% F.S.O./°C*<br>For code nos. 084G2108, 10, 38 and 40 are special versions designed for measurements on diesel engine fuel systems, where relatively high pressure peaks can occur. The units are therefore calibrated at an ambient temperature of 40°C |
| Voltage dependence                             | ±0,003% V F.S.O.*   |
| Vibration stability                            | 3-30 Hz amplitude 1.13 mm and 30-300 Hz acceleration 4G according to IEC 68-2-6. The requirements of the ship classification societies are up to 100 Hz, acceleration 4 G. Extended specifications by prior arrangement   |
| Time constant                                  | Less than 20 ms   |
| Shock stability                                | 240 g for 3.2 ms to IEC 68-2-29   |
| 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   |

\*) F.S.O. = Full scale output

### Identification

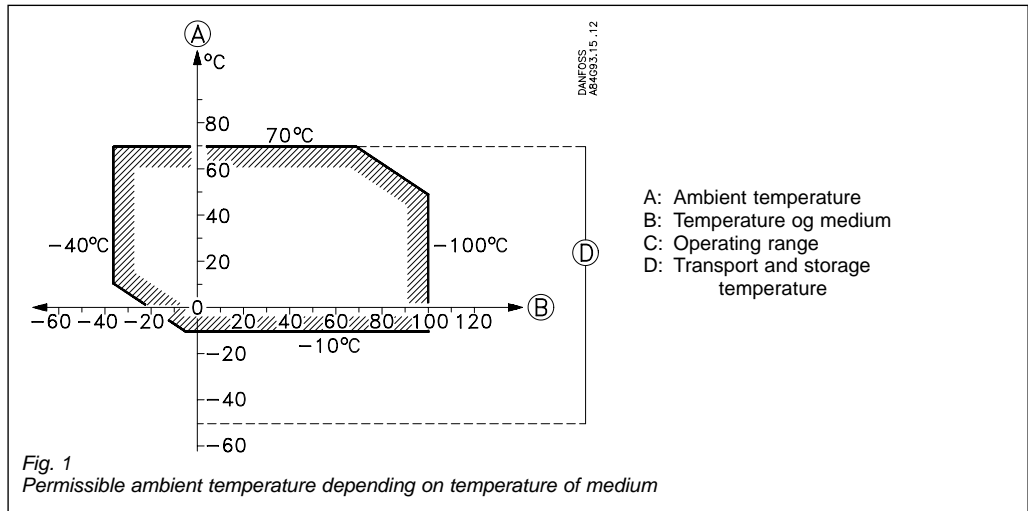
The type designation and code number of the transmitter is embossed on the side of the housing at the bottom close to the pressure connector.

Approvals

|   |                                      |
|---|--------------------------------------|
|   | Lloyds Register of Shipping, England |
|   | Det Norske Veritas, Norway           |
|   | Nippon Kaiji Kyokai, Japan           |
|   | American Bureau of Shipping, USA     |
| F | Germanischer Lloyds, BRD             |
|   | Bureau Veritas, France               |

|   |                                       |
|---|---------------------------------------|
|   | Registro Italiano Navale, Italy       |
| P | Polski Rejestr Statków, Poland        |
|   | Russian Maritime Register of Shipping |

Installation conditions



Mounting

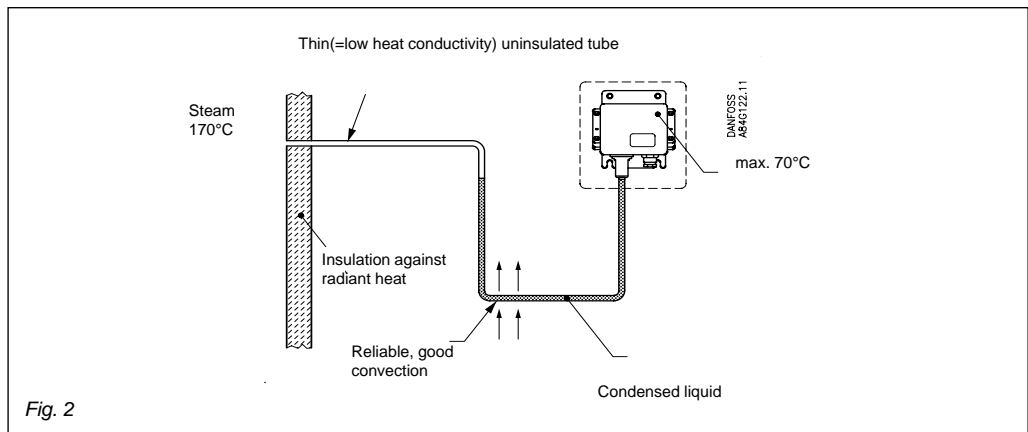
Type EMP 2 is equipped with a 3 mm steel bracket for mounting.

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 DIN 16288. Connection to the transmitter is made through a connector with a spanner flat, 14 mm across flats.

Adjustment is made with the unit in the horizontal position (pressure connector downwards).

If installation results in a different pressure connector position (e.g. turned 180°C) this will mean a zero-point displacement of approximately +1% for the lowest pressure range (decreasing for higher pressure ranges). The displacement can be eliminated by using a zero-point potentiometer. When fitting or removing pressure lines, the spanner flats on the pressure connector should be used to apply counter-torque.



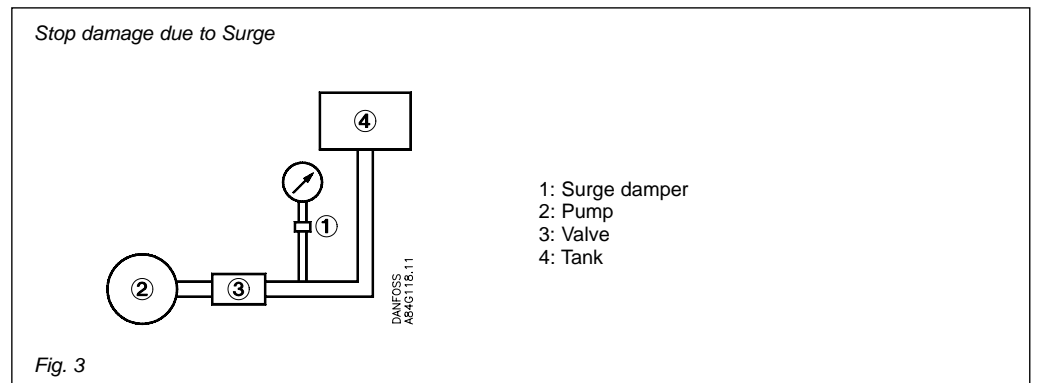
Water systems

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



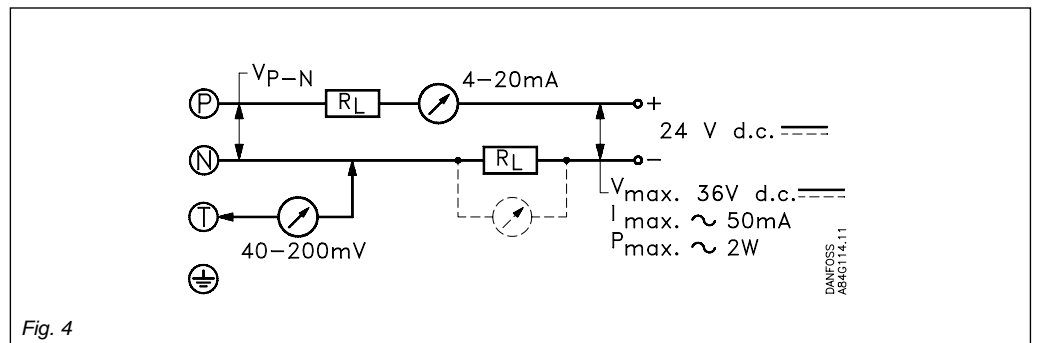
In cases where valves are closed momentarily, surges of a value in excess of that for which the pressure element is designed can occur. To avoid damage to the pressure element, a damping device should

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.



Sizing

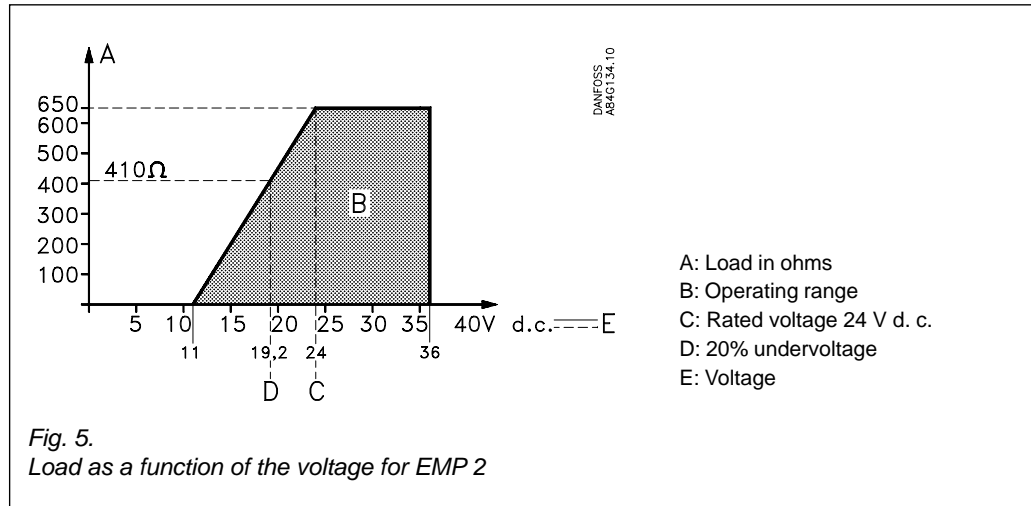
The maximum permissible load resistance  $R_L$  for insertion between transmitter and voltage source can be calculated from the formula:

$$R_L (\Omega) = \frac{V-11}{20 \times 10^{-3}}$$

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 36 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

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

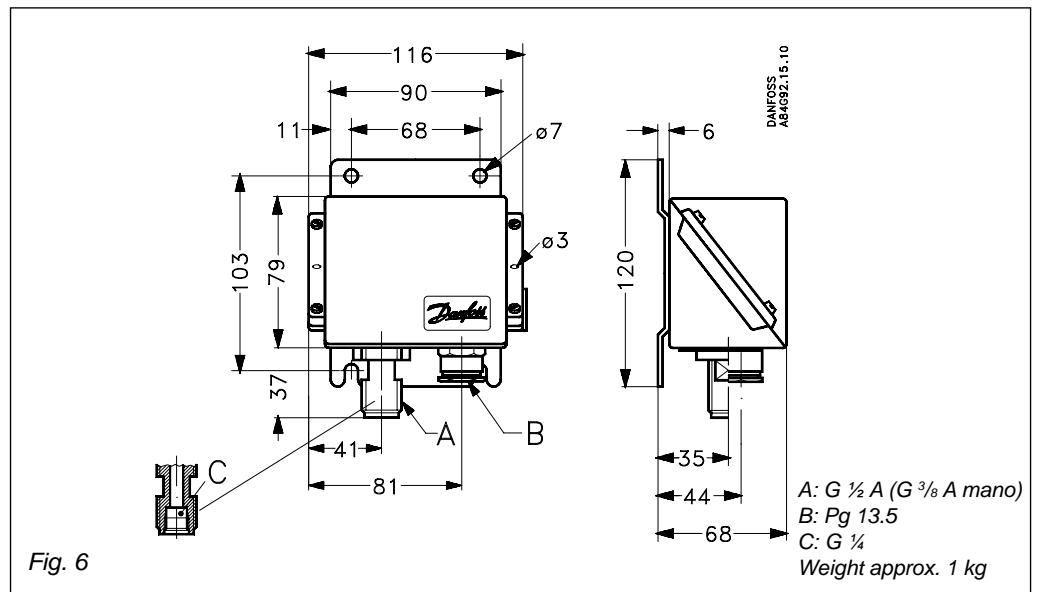
$$V_{lower} = V - 10\% = 21.6$$

$$R_L (\text{permissible}) = \frac{21.6 - 11}{20 \times 10^{-3}} = 530 \Omega$$

$R_L$  of 340 Ω is less than 530 Ω  
 $V_{upper}$  of 26,4 V d.c. is less than  $V_{max.}$  of 36 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. Standard washers supplied        | Copper                          | 060-1047 |
| Damping coil                  |        | Damping coil with G 1/2 unions and 1 m capillary tube. Standard washers supplied                 | Stainless steel                 | 060-0169 |
| Damping coil, armoured        |        | Damping coil with G 3/8 unions and 1 m armoured copper capillary tube. Standard washers supplied | Copper                          | 060-3333 |
| Nipple                        |        | G 1/4 A x G 3/8 A with copper washer   | Brass                           | 060-3332 |
|                               |        | G 1/4 A x M10 ext. x 1 with copper washer  | Brass                           | 060-3338 |
|                               |        | G 1/4 A x G 1/4 - 18 NPT with copper washer  | Brass                           | 060-3339 |
|                               |        | G 1/4 A x G 7/16 - 20 UNF with aluminium washer  | Brass                           | 084G0160 |
| Ship's screwed cable entry    |        | M24 x 1.5  |                                 | 060-1058 |
| Connector with welding nipple |        | Connector, G 1/2<br>Welding nipple, 10 mm  | Plain carbon steel W.no. 1.0718 | 084G0132 |

## Conversion table

|                      | Pascal<br>(= Newton<br>per. square<br>metre)<br>(N/m <sup>2</sup> )<br>Pa | Newton per<br>square mm<br>N/mm <sup>2</sup> |                          | Kilopond<br>per square<br>metre<br>(mm H <sub>2</sub> O)<br>kp/m <sup>2</sup> | Meter<br>water<br>gauge<br>m H <sub>2</sub> O | Technical<br>atmosphere<br>(kp/cm <sup>2</sup> )<br>at | Physical<br>atmosphere<br>atm | Torr<br>(0°C)<br>mm Hg   | Inches<br>Hg (0°C)<br>in Hg | Poundforce<br>per Square<br>inch<br>(lb/in <sup>2</sup> )<br>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

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