

Mineral Insulated Resistance Thermometers for Industry, Laboratories and Research

Mineral Insulated Metal Sheathed Resistance Thermometer Detectors (MIMS RTD's) supplement the Mineral Insulated Metal Sheathed Thermocouples (MIMS TC's), which are tested and approved over many years. MIMS RTD's can be applied for temperatures from -100 °C up to +550 °C. They combine the advantages of the MIMS RTD's with those of the bendable mineral insulated metal sheathed thermocouples.

Important advantages of the MIMS RTD's:

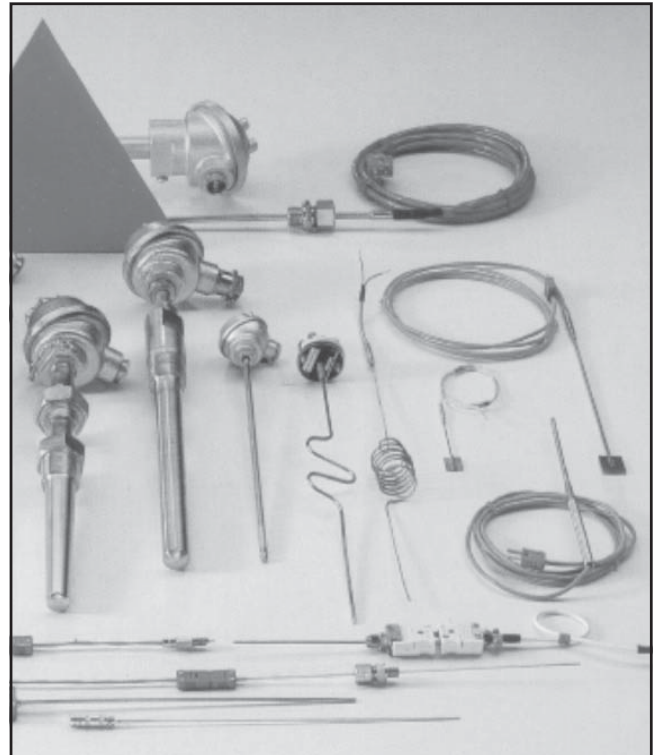
- bendable with small radius
- suitable for high pressures and vacuum
- two-, three- or four-wire circuits are possible
- easy packing and shipment even in the case of long RTD's

As supply wires mineral insulated metal sheathed cables are used. The supply wires are embedded in a MgO compact insulation and surrounded by a metal sheath of stainless steel. The compact insulation fixes the wires completely so that they cannot be damaged neither by vibration nor by strong bending. Short circuits between the wires or between them and the metal sheath are impossible.

The minimum bending radius depends on the outside diameter of the MIMS cable. About 5 to 7 of times the outer diameter is a practicable standard value. The measuring resistor itself complies with the requirements of the DIN EN 60 751 standard.

If in special cases, for example in the case of great lengths, the inner conductor resistance increases more than usual, the resistance is shown on the identification plate.

The temperature sensitive length of the RTD is typically 35 mm. Different lengths can be supplied upon request.



Special advantages:

- Highly resistant against vibrations
- Short response times
- Mechanically resistant
- Easily bendable
- 3- and 4-wire circuits from measuring resistor upon request
- Easy packing and shipment even in the case of long RTD's

MIMS Resistance Thermometer
Form : WA



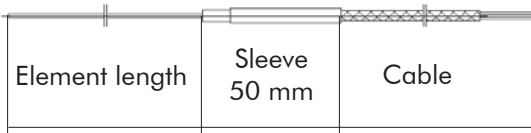
Base version of the MIMS resistance thermometer. For available sheath diameters please turn to „Technical Data“ on page 8. The standard length of the bare connecting wire ends is 20 mm. The metal sheath is hermetically sealed against moisture.

Tmax at potted end is 150 °C.

The metal sheath diameter of the standard version is constant. Upon request tapered or reinforced versions can be supplied.

Please specify details in case of order

Cable firmly connected
Form : WL



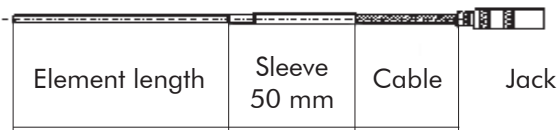
Form WL has a firmly connected stranded copper cable. The transition sleeve has a diameter of 6 or 8 mm, depending on the type of cable. The standard length is 50 mm.

Max. temperature at the sleeve: 150 °C, cable type A. The cable type (i.e. conductor cross-section, insulation material, screening) can be chosen from a wide range.

As a standard wire and cable are TEFLON-insulated with a cross section of 0.38 mm². The bare wire ends are tin-coated.

When ordering please specify the required type

Cable and jack firmly connected
Form : WLS



Form WLS is an extended version of form WL with an additional connector system.

The standard version is fitted with a jack type LEMO -RLK, size 1, with plated brass precision contacts. The outer body is made of matt chromium-plated brass. Max. temperature at the sleeve: 150 °C, cable type A.

On joining, plug and jack are automatically interlocked and thus offer an optimum security of contact.

Other connector systems are available on request as well as the appropriate plugs.

When ordering please specify the required type.

Round jack firmly connected
Form : WS



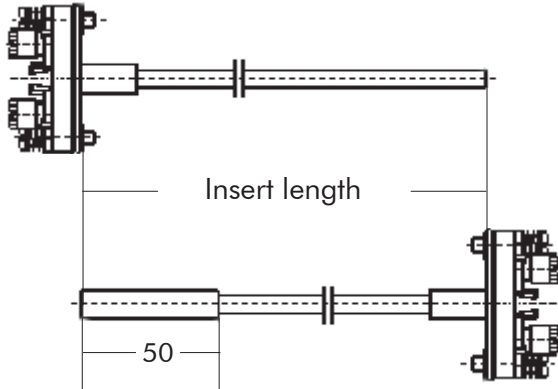
Form WS is an extension of the form WA with an additional connector system. The standard version is fitted with a jack type LEMO - RLK, size 1 (up to 4.8 mm sheath diameter, above that size 2).

Max. temperature at the sleeve: 150 °C.

Other connector systems are available on request as well as the appropriate plugs.

When ordering please specify the required type.

MIMS Measuring insert, with constant diameter or reinforced tip
Form : WMM



Measuring insert with connection socket, terminals and spring-loaded pressuring device. Suitable for mounting in a connection head form B according to DIN 43 729. For mounting in a head form A, an adaptor plate is available upon request.

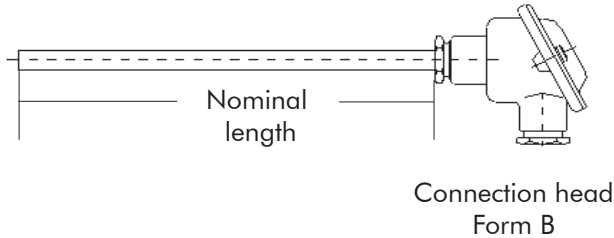
Ordering code see table on page 4
 Connecting diagram see page 5

Standard designs:

- Sheath diameter constant 3.0 mm
- Sheath diameter constant 6.0 mm
- Sheath dia. 5.0 mm, tip 6.0 dia. x 50 mm length
- Sheath dia. 6.0 mm, tip 8.0 dia. x 50 mm length

Please specify details in case of an order.

MIMS Thermometer with connection head form B
Form : WB (B - WMM)



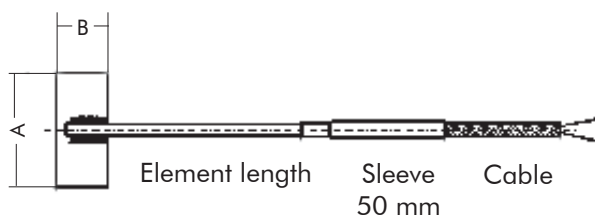
This form consists of a measuring insert with connector socket and cable clip, built into a connecting head form B according to EN 50 446. A special pipe bracket screwing made of stainless steel fixes the measuring insert. The nominal length starts at the bottom edge of the pipe bracket screwing.

Standard designs

Metal sheath diameters: see form WMM
 Connection head form B according to EN 50 446
 Other heads (see page 5) are available upon request.

When ordering please indicate the form needed.

MIMS Thermometer with weld-on plate
Form : WL - RT



This form is used for temperature measurement at pipe-surfaces. The weld-on plate consists of stainless steel for MIMS RTD's and is manufactured in accordance with the sheath diameter. The mounting at the pipe surface may be done by welding, soldering, gluing or clamping.

Max. temp. at the sleeve: 150 °C, cable type A.

All connection forms on pages 2 and 3 can be supplied with weld-on plate. Other designs for special applications are available upon request.

When ordering please specify the required type.

Ordering Code : Form-Diameter-Sensor-Class-Length-Cable length-Cable type

Example:

You want to order a mineral insulated metal sheathed resistance thermometer detector with hard-wired cable and jack. The sheath diameter shall be 3.0 mm and the element length 300 mm. A platinum measuring resistor shall be built in with single winding and 100 Ohms nominal resistance at 0 °C. The permitted deviation must be acc. to Class A. The cable type is specified according to the technical data on page 8 as type A with a length of 3 m. The jack is standard type RLK, size 1. The thermometer shall be fitted with a four-wire circuit ex resistor element. The latter must always be specified separately!

Example : WLS - RT - 3,0 - 1 Pt - A - 300 - 3 - A

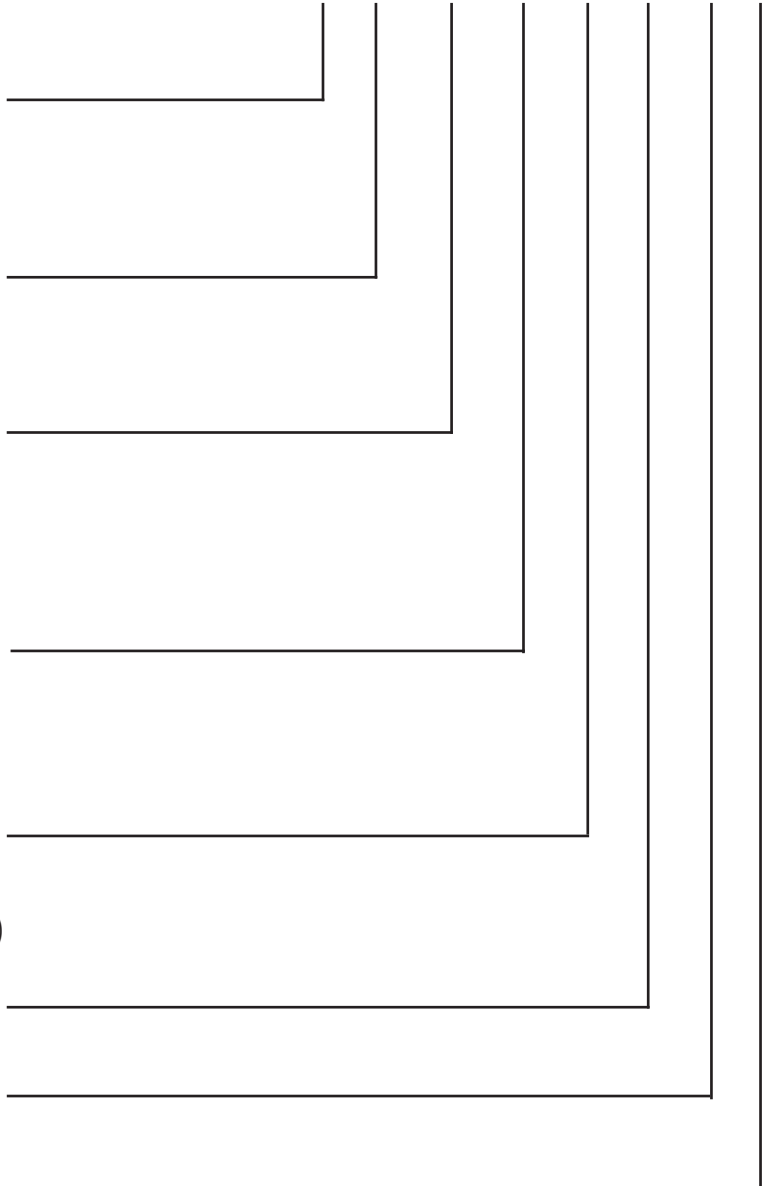
- WA = Base version
- WL = Firmly connected cable
- WLS = Firmly conn. cable and jack
- WS = With round jack
- WMM = MIMS measuring insert
- WB = Connection head form B

- W*-RT = Weld-on plate

- 1,5/1,6 = Ø 1,5/1,6 mm
- 2,0 = Ø 2,0 mm
- 3,0 = Ø 3,0 mm
- 6,0 = Ø 6,0 mm
- 5,0/6,0 = Ø 5,0 to 6,0 mm reinforced
- 6,0/8,0 = Ø 6,0 to 8,0 mm reinforced
- 8,0 = Ø 8,0 mm

- 1 Pt = Single Pt 100/0
- 2 Pt = Duplex Pt 100/0
- 3 Pt = Triplex Pt 100/0

- B = EN 60 751 Class B
- A = EN 60 751 Class A
- 1/3 B = 1/3 Class B (0 .. 200 °C)
- 1/5 B = 1/5 Class B (bei 0 °C)
- 1/10 B = 1/10 Class B (upon request)



Element or measuring insert length in mm

Cable length in m

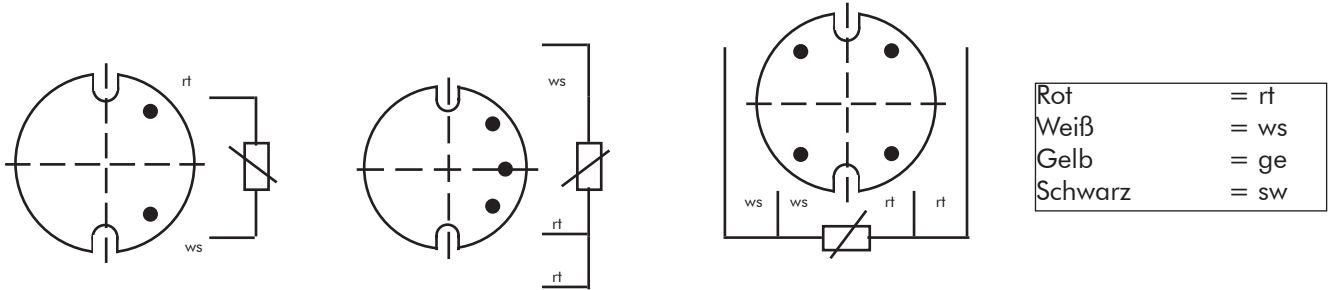
Cable type

- A) TT - 465
- B) SS - 350
- C) PP - 520
- D) TG- 412

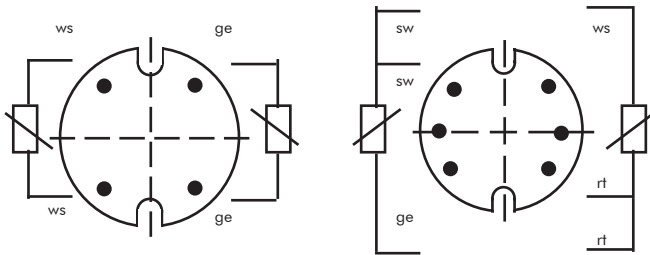
Special cables are available upon request

Note: Please specify particularities separately:
 Circuit (2- , 3- or 4- wire circuit)
 Jack type for forms WS and WLS

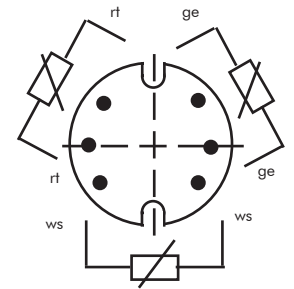
**Socket wiring diagram form WMM resp. WB
 Single Pt 100/0**



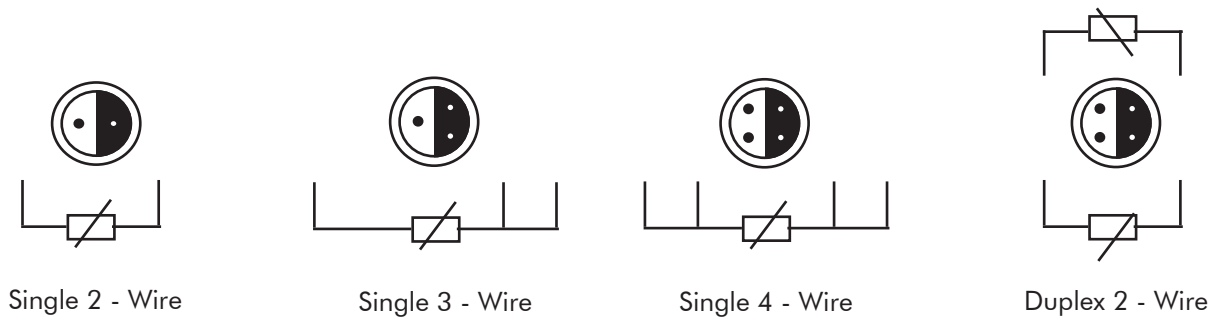
Duplex Pt 100/0



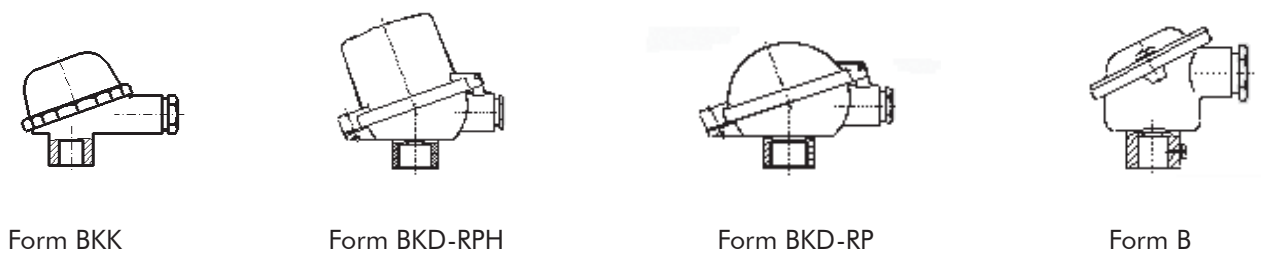
Triplex Pt 100/0



Wiring diagram form WS resp. WLS with round jack



Connection heads for form WB



Temperature resistance relationship according to DIN EN 60 751 (IEC 60 751)

| t ₉₀ in °C | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|-----------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| -100 | 60,256 | 60,661 | 61,066 | 61,471 | 61,876 | 62,280 | 62,684 | 63,088 | 63,492 | 63,896 |
| -90 | 64,300 | 64,703 | 65,106 | 65,509 | 65,912 | 66,315 | 66,717 | 67,120 | 67,522 | 67,924 |
| -80 | 68,325 | 68,727 | 69,129 | 69,530 | 69,931 | 70,332 | 70,733 | 71,134 | 71,534 | 71,934 |
| -70 | 72,335 | 72,735 | 73,134 | 73,534 | 73,934 | 74,333 | 74,732 | 75,131 | 75,530 | 75,929 |
| -60 | 76,328 | 76,726 | 77,125 | 77,523 | 77,921 | 78,319 | 78,717 | 79,114 | 79,512 | 79,909 |
| -50 | 80,306 | 80,703 | 81,100 | 81,497 | 81,894 | 82,290 | 82,687 | 83,083 | 83,479 | 83,875 |
| -40 | 84,271 | 84,666 | 85,062 | 85,457 | 85,853 | 86,248 | 86,643 | 87,038 | 87,432 | 87,827 |
| -30 | 88,222 | 88,616 | 89,010 | 89,404 | 89,798 | 90,192 | 90,586 | 90,980 | 91,373 | 91,767 |
| -20 | 92,160 | 92,553 | 92,946 | 93,339 | 93,732 | 94,124 | 94,517 | 94,909 | 95,302 | 95,694 |
| -10 | 96,086 | 96,478 | 96,870 | 97,261 | 97,653 | 98,044 | 98,436 | 98,827 | 99,218 | 99,609 |
| 0 | 100,000 | 100,391 | 100,781 | 101,172 | 101,562 | 101,953 | 102,343 | 102,733 | 103,123 | 103,513 |
| 10 | 103,903 | 104,292 | 104,682 | 105,071 | 105,460 | 105,849 | 106,238 | 106,627 | 107,016 | 107,405 |
| 20 | 107,794 | 108,182 | 108,570 | 108,959 | 109,347 | 109,735 | 110,123 | 110,510 | 110,898 | 111,286 |
| 30 | 111,673 | 112,060 | 112,447 | 112,835 | 113,221 | 113,608 | 113,995 | 114,382 | 114,768 | 115,155 |
| 40 | 115,541 | 115,927 | 116,313 | 116,699 | 117,085 | 117,470 | 117,856 | 118,241 | 118,627 | 119,012 |
| 50 | 119,397 | 119,782 | 120,167 | 120,552 | 120,936 | 121,321 | 121,705 | 122,090 | 122,474 | 122,858 |
| 60 | 123,242 | 123,626 | 124,009 | 124,393 | 124,777 | 125,160 | 125,543 | 125,926 | 126,309 | 126,692 |
| 70 | 127,075 | 127,458 | 127,840 | 128,223 | 128,605 | 128,987 | 129,370 | 129,752 | 130,133 | 130,515 |
| 80 | 130,897 | 131,278 | 131,660 | 132,041 | 132,422 | 132,803 | 133,184 | 133,565 | 133,946 | 134,326 |
| 90 | 134,707 | 135,087 | 135,468 | 135,848 | 136,228 | 136,608 | 136,987 | 137,367 | 137,747 | 138,126 |
| 100 | 138,506 | 138,885 | 139,264 | 139,643 | 140,022 | 140,400 | 140,779 | 141,158 | 141,536 | 141,914 |
| 110 | 142,293 | 142,671 | 143,049 | 143,426 | 143,804 | 144,182 | 144,559 | 144,937 | 145,314 | 145,691 |
| 120 | 146,068 | 146,445 | 146,822 | 147,198 | 147,575 | 147,951 | 148,328 | 148,704 | 149,080 | 149,456 |
| 130 | 149,832 | 150,208 | 150,583 | 150,959 | 151,334 | 151,710 | 152,085 | 152,460 | 152,835 | 153,210 |
| 140 | 153,584 | 153,959 | 154,333 | 154,708 | 155,082 | 155,456 | 155,830 | 156,204 | 156,578 | 156,952 |
| 150 | 157,325 | 157,699 | 158,072 | 158,445 | 158,818 | 159,191 | 159,564 | 159,937 | 160,309 | 160,682 |
| 160 | 161,054 | 161,427 | 161,799 | 162,171 | 162,543 | 162,915 | 163,286 | 163,658 | 164,030 | 164,401 |
| 170 | 164,772 | 165,143 | 165,514 | 165,885 | 166,256 | 166,627 | 166,997 | 167,368 | 167,738 | 168,108 |
| 180 | 168,478 | 168,848 | 169,218 | 169,588 | 169,958 | 170,327 | 170,696 | 171,066 | 171,435 | 171,804 |
| 190 | 172,173 | 172,542 | 172,910 | 173,279 | 173,648 | 174,016 | 174,384 | 174,752 | 175,120 | 175,488 |
| 200 | 175,856 | 176,224 | 176,591 | 176,959 | 177,326 | 177,693 | 178,060 | 178,427 | 178,794 | 179,161 |
| 210 | 179,528 | 179,894 | 180,260 | 180,627 | 180,993 | 181,359 | 181,725 | 182,091 | 182,456 | 182,822 |
| 220 | 183,188 | 183,553 | 183,918 | 184,283 | 184,648 | 185,013 | 185,378 | 185,743 | 186,107 | 186,472 |
| 230 | 186,836 | 187,200 | 187,564 | 187,928 | 188,292 | 188,656 | 189,019 | 189,383 | 189,746 | 190,110 |
| 240 | 190,473 | 190,836 | 191,199 | 191,562 | 191,924 | 192,287 | 192,649 | 193,012 | 193,374 | 193,736 |
| 250 | 194,098 | 194,460 | 194,822 | 195,183 | 195,545 | 195,906 | 196,268 | 196,629 | 196,990 | 197,351 |
| 260 | 197,712 | 198,073 | 198,433 | 198,794 | 199,154 | 199,514 | 199,875 | 200,235 | 200,595 | 200,954 |
| 270 | 201,314 | 201,674 | 202,033 | 202,393 | 202,752 | 203,111 | 203,470 | 203,829 | 204,188 | 204,546 |
| 280 | 204,905 | 205,263 | 205,622 | 205,980 | 206,338 | 206,696 | 207,054 | 207,411 | 207,769 | 208,127 |
| 290 | 208,484 | 208,841 | 209,198 | 209,555 | 209,912 | 210,269 | 210,626 | 210,982 | 211,339 | 211,695 |
| 300 | 212,052 | 212,408 | 212,764 | 213,120 | 213,475 | 213,831 | 214,187 | 214,542 | 214,897 | 215,252 |
| 310 | 215,608 | 215,962 | 216,317 | 216,672 | 217,027 | 217,381 | 217,736 | 218,090 | 218,444 | 218,798 |
| 320 | 219,152 | 219,506 | 219,860 | 220,213 | 220,567 | 220,920 | 221,273 | 221,626 | 221,979 | 222,332 |
| 330 | 222,685 | 223,038 | 223,390 | 223,743 | 224,095 | 224,447 | 224,799 | 225,151 | 225,503 | 225,855 |
| 340 | 226,206 | 226,558 | 226,909 | 227,260 | 227,612 | 227,963 | 228,314 | 228,664 | 229,015 | 229,366 |
| 350 | 229,716 | 230,066 | 230,417 | 230,767 | 231,117 | 231,467 | 231,816 | 232,166 | 232,516 | 232,865 |
| 360 | 233,214 | 233,564 | 233,913 | 234,262 | 234,610 | 234,959 | 235,308 | 235,656 | 236,005 | 236,353 |
| 370 | 236,701 | 237,049 | 237,397 | 237,745 | 238,093 | 238,440 | 238,788 | 239,135 | 239,482 | 239,829 |
| 380 | 240,176 | 240,523 | 240,870 | 241,217 | 241,563 | 241,910 | 242,256 | 242,602 | 242,948 | 243,294 |
| 390 | 243,640 | 243,986 | 244,331 | 244,677 | 245,022 | 245,367 | 245,713 | 246,058 | 246,403 | 246,747 |
| 400 | 247,092 | 247,437 | 247,781 | 248,125 | 248,470 | 248,814 | 249,158 | 249,502 | 249,845 | 250,189 |
| 410 | 250,533 | 250,876 | 251,219 | 251,562 | 251,906 | 252,248 | 252,591 | 252,934 | 253,277 | 253,619 |
| 420 | 253,962 | 254,304 | 254,646 | 254,988 | 255,330 | 255,672 | 256,013 | 256,355 | 256,696 | 257,038 |
| 430 | 257,379 | 257,720 | 258,061 | 258,402 | 258,743 | 259,083 | 259,424 | 259,764 | 260,105 | 260,445 |
| 440 | 260,785 | 261,125 | 261,465 | 261,804 | 262,144 | 262,483 | 262,823 | 263,162 | 263,501 | 263,840 |
| 450 | 264,179 | 264,518 | 264,857 | 265,195 | 265,534 | 265,872 | 266,210 | 266,548 | 266,886 | 267,224 |

Temperature resistance relationship cont.

| t_{90} in °C | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|----------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| 460 | 267,562 | 267,900 | 268,237 | 268,574 | 268,912 | 269,249 | 269,586 | 269,923 | 270,260 | 270,597 |
| 470 | 270,933 | 271,270 | 271,606 | 271,942 | 272,278 | 272,614 | 272,950 | 273,286 | 273,622 | 273,957 |
| 480 | 274,293 | 274,628 | 274,963 | 275,298 | 275,633 | 275,968 | 276,303 | 276,638 | 276,972 | 277,307 |
| 490 | 277,641 | 277,975 | 278,309 | 278,643 | 278,977 | 279,311 | 279,644 | 279,978 | 280,311 | 280,644 |
| 500 | 280,978 | 281,311 | 281,643 | 281,976 | 282,309 | 282,641 | 282,974 | 283,306 | 283,638 | 283,971 |
| 510 | 284,303 | 284,634 | 284,966 | 285,298 | 285,629 | 285,961 | 286,292 | 286,623 | 286,954 | 287,285 |
| 520 | 287,616 | 287,947 | 288,277 | 288,608 | 288,938 | 289,268 | 289,599 | 289,929 | 290,258 | 290,588 |
| 530 | 290,918 | 291,247 | 291,577 | 291,906 | 292,235 | 292,565 | 292,894 | 293,222 | 293,551 | 293,880 |
| 540 | 294,208 | 294,537 | 294,865 | 295,193 | 295,521 | 295,849 | 296,177 | 296,505 | 296,832 | 297,160 |
| 550 | 297,487 | 297,814 | 298,142 | 298,469 | 298,795 | 299,122 | 299,449 | 299,775 | 300,102 | 300,428 |
| 560 | 300,754 | 301,080 | 301,406 | 301,732 | 302,058 | 302,384 | 302,709 | 303,035 | 303,360 | 303,685 |
| 570 | 304,010 | 304,335 | 304,660 | 304,985 | 305,309 | 305,634 | 305,958 | 306,282 | 306,606 | 306,930 |
| 580 | 307,254 | 307,578 | 307,902 | 308,225 | 308,549 | 308,872 | 309,195 | 309,518 | 309,841 | 310,164 |
| 590 | 310,487 | 310,810 | 311,132 | 311,454 | 311,777 | 312,099 | 312,421 | 312,743 | 313,065 | 313,386 |
| 600 | 313,708 | 314,029 | 314,351 | 314,672 | 314,993 | 315,314 | 315,635 | 315,956 | 316,277 | 316,597 |

Permitted deviations for resistance thermometers

The European Standard EN 60 751 defines the relation between temperature in degrees Celsius and the resistance in Ohms for platinum RTD's with a resistance of 100 Ohms at 0 °C. The overall temperature range is from -200 to + 850 °C. For technical reasons a range cutout from -100 to +550 °C in the 2008-version of the standard has been selected here and the permitted deviations were newly defined. Especially a clear determination between wire-wound and wafer-form resistors on one hand and thermometers on the other hand was established.

Beside resistance thermometers with 100 Ohms nominal resistance at 0 °C (Pt 100/0) those with 500, 1000, 5000 and 10000 Ohms respectively are available.

Permitted deviations for resistors DIN EN 60 751:2008

| Wire-wound resistors | | Wafer-form resistors | | Tolerance in °C |
|----------------------|-------------------------|----------------------|-------------------------|------------------------|
| Tolerance band | Temperature range in °C | Tolerance band | Temperature range in °C | |
| W 0,1 | -100 to 350 | F 0,1 | 0 to 150 | $\pm (0,1+0,0017* t)$ |
| W 0,15 | -100 to 450 | F 0,15 | -30 to 300 | $\pm (0,15+0,002* t)$ |
| W 0,3 | -196 to 550 | F 0,3 | -50 to 500 | $\pm (0,3+0,005* t)$ |
| W 0,6 | -196 to 660 | F 0,6 | -50 to 600 | $\pm (0,6+0,01* t)$ |

| t | = Absolut value of the temperature in °C independent from sign

Permitted deviations for thermometers DIN EN 60 751:2008

| Tolerance band | Temperature range in °C | | Tolerance in °C |
|----------------|-------------------------|----------------------|------------------------|
| | Wire-wound resistors | Wafer-form-resistors | |
| AA | -50 to 250 | 0 to 150 | $\pm (0,1+0,0017* t)$ |
| A | -100 to 450 | -30 to 300 | $\pm (0,15+0,002* t)$ |
| B | -196 to 600 | -50 to 500 | $\pm (0,3+0,005* t)$ |
| C | -196 to 600 | -50 to 600 | $\pm (0,6+0,01* t)$ |

| t | = Absolut value of the temperature in °C independent from sign

Technical data:

Measuring resistor:

Standard Pt 100 acc. to DIN EN 60 751
Other base resistances and standards are available upon request.

Permitted deviation:

Class A or B acc. to DIN EN 60 751:2008
Reduced permitted deviations (f.e. class AA) are available upon request

Sheath diameter:

Standard: 0,25; 0,5; 1,0; 1,5; 3,0; 6,0; 8,0
Special: 0,35; 1,6; 2,0; 3,2; 4,5; 4,8; 10,0

Insulation resistance:

Typical $\geq 5000 \text{ MOhm} \cdot \text{m}$ at 23 °C
Min. $1000 \text{ MOhm} \cdot \text{m}$ (DIN EN 61 515)

Insulation material:

High-purity magnesiumoxide (MgO)

Sheath material:

| | |
|----------------------|------------------|
| INCONEL 600 | W.- Nr.: 2.4816 |
| Heat resistand steel | W.- Nr.: 1.4841 |
| Stainless steel | W.- Nr.: 1. 4541 |

Circuitry:

Standard 2 - wire from measuring resistor

Options:

3- or 4-wire from measuring resistor as single-Pt 100; 3-wire as duplex-Pt 100 in 5,0 resp. 6,0 mm diameter; 4-Wire as duplex-Pt 100 only in 8,0 mm sheath diameter.

Round pin connectors and jacks:

Forms WS resp. WLS are fitted with round jacks type RLK size 1 or 2. Depending on the type of connection the jacks have 2, 3 or 4 poles. The brass precision contacts are gold plated. The outer body is made of matt chromium-plated brass. Other connector systems and sizes are available upon request as well as the appropriate plugs.

Cable types:

A) TT - 465 - 4Cu - 0,38 L:

Wires and cable Teflon-insulated; screen braiding: tin-plated Cu; 4x stranded wire with 0.38 mm² cross section. Suitable for a maximum ambient temperature of 220 °C.

B) SS - 350 - 2Cu - 0,25 L:

Wires and cable silicon-insulated; 2x stranded wire with 0.25 mm² cross section. Suitable for a max. ambient temperature of 180 °C.

C) PP - 520 - 2Cu - 0,25 L:

Wires and cable PVC-insulated;
2x stranded wire with 0.25 mm² cross section.
Maximum ambient temperature 85 °C.

D) TG - 412 - 4Cu - 0,25 L:

Wires: Teflon-insulated. Cable: covered with glass fibres, braided with wires of stainless steel, 4x stranded wire with 0.25 mm² cross section. Suitable for a max. ambient temperature of 240 °C.

Connection heads:

Form WB is fitted with a cast aluminium connection head form B acc. to EN 50 446.

Heads with a bigger volume, e.g. for mounting one or two transmitters inside, are also available (forms BKD-SP, BKD-RP and BKD-RPH respectively form BKK-RPH).

Available is also a version made from cast plastics with a screw or hinged cover.

The standard cable gland at the connection heads is M 20 x 1.5. Other cable glands are available upon request.

The protection classification is IP 43. Other classifications, e.g. IP 54 or 65, are available upon request.

Connection heads forms A and B of other materials (e.g stainless steel) are available upon request.

All data given in this data sheet are typical but do not constitute binding and/or guaranteed characteristics. Any data needs to be verified in detail by the customer in relation to any specific application. We reserve the right to change any specification without prior notice in line with our policy of continuous technical improvement.

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