

# **Application Note**

## **RTD Nickel Sensor**



# Application Note

## RTD Nickel Sensor

### Content



INNOVATIVE SENSOR TECHNOLOGY



1.	General Information	3
2.	Construction	3
3.	Nominal Value and Temperature Coefficient	3
4.	Long-term Stability	3
5.	Temperature Characteristic Curve	3
6.	Tolerance classes formerly DIN 43760	4
7.	Applied Current	4
8.	Self-heating	4
9.	Response Time	4
10.	Dimensions Tolerances	5
11.	Additional documents	5



# Application Note

## RTD Nickel Sensor



INNOVATIVE SENSOR TECHNOLOGY



### 1. General Information

In many sectors, temperature measurement is one of the most important physically defined parameter to determine product quality, security and reliability. Temperature sensors are produced with different technologies to fit specific application requirements. To this end, IST AG has concentrated the development, manufacturing processes and materials to produce high-end thin-film temperature sensors. This know-how, partially derived from the semiconductor industry, allows IST AG to manufacture sensors in very small dimensions. Thin-film temperature sensors exhibit a very short response time due to their low thermal mass. The technologies and processes of IST AG thin-film sensors combines the positive attributes of traditional wire-wound nickel sensors - accuracy, long-term stability, repeatability and interchangeability within a wide temperature range. The advantages of thin-film mass-production create an optimal price/performance-ratio.

### 2. Construction

The temperature sensor consists of a photolithographically structured nickel meander on a ceramic substrate. The resistivity is laser-trimmed and precisely adjusted to the final value. The resistive structure is covered with a polymer or glass passivation layer protecting the sensor against mechanical and chemical damages. The welded wires are covered with an additional fixation layer.

### 3. Nominal Value and Temperature Coefficient

The nominal value of the sensor is the defined value of the sensor resistance at 0 °C. The temperature coefficient  $\alpha$  (TCR) is defined as:

$$\alpha = \frac{R_{100} - R_0}{100 \times R_0} \quad [\text{K}^{-1}] \text{ according to the DIN 43760 (formerly) numerical value of } 0.00618 \text{ K}^{-1}.$$

Generally, the value is defined in ppm/K.

$R_0$  = resistance value in  $\Omega$  at 0 °C

$R_{100}$  = resistance value in  $\Omega$  at +100 °C

### 4. Long-term Stability

The change in ohmic value after 1,000 h at maximum operating temperature amounts to less than 0.1 %.

### 5. Temperature Characteristic Curve<sup>1)</sup>

The characteristic curve is defined with a polynomial:

$$R(T) = R_0 (1 + A * T + B * T^2 + C * T^3 + D * T^4 + E * T^5 + F * T^6)$$

	Nickel ND (6180 ppm/K)	Nickel NL (5000 ppm/K)	Nickel NJ (6370 ppm/K)	Nickel NA (6720 ppm/K)
A	$5.485 * 10^{-3} [^{\circ}\text{C}^{-1}]$	$4.427 * 10^{-3} [^{\circ}\text{C}^{-1}]$	$5.64742 * 10^{-3} [^{\circ}\text{C}^{-1}]$	$5.88025 * 10^{-3} [^{\circ}\text{C}^{-1}]$
B	$6.65 * 10^{-6} [^{\circ}\text{C}^{-2}]$	$5.172 * 10^{-6} [^{\circ}\text{C}^{-2}]$	$6.69504 * 10^{-6} [^{\circ}\text{C}^{-2}]$	$8.28385 * 10^{-6} [^{\circ}\text{C}^{-2}]$
C	0	$5.585 * 10^{-9} [^{\circ}\text{C}^{-3}]$	$5.68816 * 10^{-9} [^{\circ}\text{C}^{-3}]$	0
D	$2.805 * 10^{-11} [^{\circ}\text{C}^{-4}]$	0	0	$7.67175 * 10^{-12} [^{\circ}\text{C}^{-4}]$
E	0	0	0	0
F	$-2 * 10^{-17} [^{\circ}\text{C}^{-6}]$	0	0	$-1.5 * 10^{-16} [^{\circ}\text{C}^{-6}]$

$R_0$  = resistance value in  $\Omega$  at 0°C

T = temperature at ITS 90

<sup>1)</sup> custom-specific characteristic curve (e.g. Balco) available



# Application Note

## RTD Nickel Sensor



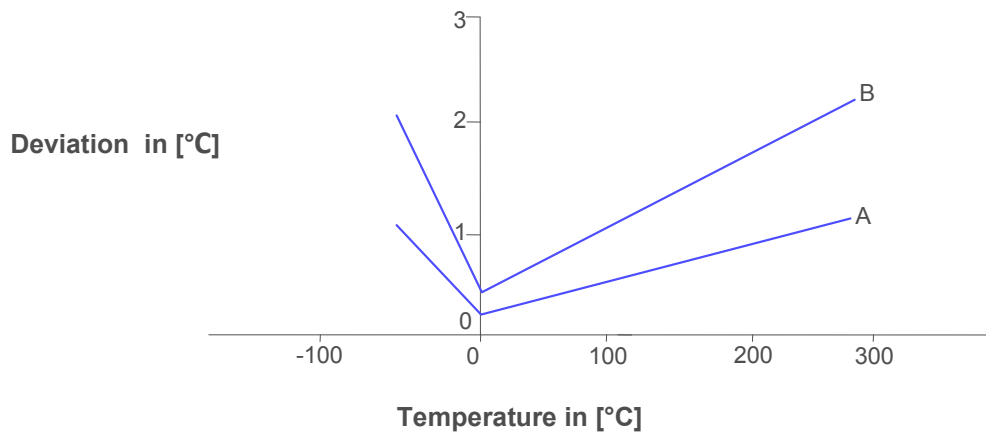
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### 6. Tolerance classes formerly DIN 43760

Class	± limit deviations in °C		IST AG reference
	T < 0 °C	T > 0 °C	
1/2 DIN 43760	$0.2 + 0.014 \times  T $	$0.2 + 0.0035 \times  T $	A
DIN 43760	$0.4 + 0.028 \times  T $	$0.4 + 0.007 \times  T $	B

|T| is the numerical value of the temperature in °C without taking leading signs into account. The tolerances are only guaranteed up to +260 °C.



### 7. Applied Current

The current applied is highly dependent on the application and leads to self-heating effects and temperature measuring errors is  $\Delta T = P/E$  (see self-heating). Depending on the thermal transfer from the sensor into the application, the current can be increased. There is no bottom current limit for nickel thin-film sensors.

Recommended current supplies:

100 Ω	500 Ω	1000 Ω	2000 Ω	10000 Ω
1 mA	0.5 mA	0.3 mA	0.2 mA	0.1 mA

### 8. Self-heating

To measure the resistance, electric current must run through the element. The current generates heat energy, resulting in errors of measurement. To minimize the error, caused by self-heating, the current should be kept as low as possible. Temperature error  $\Delta T = P/E = R \times I^2/E$ .

E = the self-heating coefficient in mW/K, R = resistance in kΩ, I = measured current in mA, P = Power in mW

### 9. Response Time

The response time is defined as the time in seconds the sensor needs to detect the change in temperature.  $t_{0.63}$  describes the time in seconds the sensor needs to measure 63 % of the temperature change. The response time is depending on the sensor dimensions, the thermal contact resistance and the surrounding medium.



# Application Note

## RTD Nickel Sensor



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Dimensions number	Sensor size L x W x H / H2 in mm	Response time in seconds						Self-heating			
		Water (v = 0.4 m/s)			Air (v = 1 m/s)			Water (v = 0 m/s)		Air (v = 0 m/s)	
		t <sub>0.5</sub>	t <sub>0.63</sub>	t <sub>0.9</sub>	t <sub>0.5</sub>	t <sub>0.63</sub>	t <sub>0.9</sub>	E in mW/K	ΔT in [mK] <sup>1)</sup>	E in mW/K	ΔT in [mK] <sup>1)</sup>
232	2.3 x 2.0 x 0.25/0.8	0.09	0.12	0.33	2.7	3.6	7.5	40	2.3	4	22.5
232	2.3 x 2.0 x 0.65/1.3	0.15	0.2	0.55	4.5	6	12	40	2.3	4	22.5
325	3.0 x 2.5 x 0.65/1.3	0.25	0.3	0.7	5.5	7.5	16	90	1	8	11.3
516	5.0 x 1.6 x 0.65/1.3	0.25	0.3	0.7	5.5	7.5	16	80	1.1	7	12.9
520	5.0 x 2.0 x 0.65/1.3	0.25	0.3	0.75	6	8.5	18	80	1.1	7	12.9
525	5.0 x 2.5 x 0.65/1.3	0.33	0.4	0.85	6.5	9	19	90	1	8	11.3
102	10.0 x 2.0 x 0.65/1.3	0.33	0.4	0.85	7.5	10.5	20	140	0.6	10	9
538	5.0 x 3.8 x 0.65/1.3	0.35	0.5	0.9	7.5	10	20	140	0.6	10	9
505	5.0 x 5.0 x 0.65/1.3	0.4	0.5	1.1	8	11	21	150	0.6	11	0.6
SMD 1206	3.2 x 1.6 x 0.4	0.15	0.25	0.45	3.5	4.2	10	55	1.8	7	14.3
SMD 0805	2.0 x 1.2 x 0.4	0.1	0.12	0.33	2.5	3	8	38	2.6	4	25

<sup>1)</sup> Self-heating M(T)inK] was measured for Ni1000 with 0.3 mA measurement current at 0 °C

L: Sensor length (without connections)  
W: Sensor width

H: Sensor height (without connections)  
H2: Sensor height (incl. connections and strain relief)

The values in the table are for informative purposes only. Based on the assembly method and the different measurement conditions, self-heating and response time can variate.

### 10. Dimensions Tolerances

Sensor width (W) ±0.2 mm  
Sensor length (L) ±0.2 mm  
Sensor height (H2) ±0.2 mm

Sensor height (H) ±0.1 mm  
Wire length ±1.0 mm (5 mm to 30 mm)  
Wire length > 30 mm, tolerances on request

### 11. Additional documents

	Document name:	
	English:	German:
Data sheets:	DTN150_E	DTN150_D
	DTN200_E	DTN200_D
	DTN200_E	DTN200_D
	DTNSMD_E	DTNSMD_D



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# 150 °C series

## Nickel sensor with wires

### For low temperatures

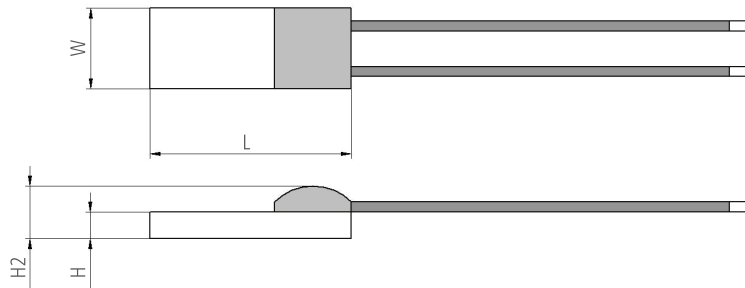


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#### Benefits & Characteristics

- Excellent long-term stability
- Insulated wires
- Easy interchangeability
- Small dimensions
- Simple linearization
- Vibration and temperature shock resistant
- Customer-specific sensor available upon request

#### Illustration<sup>1)</sup>



1) For actual size, see dimensions

#### Technical Data

Operating temperature range:	-60 °C to +150 °C
Nominal resistance:*	100 Ω at 0 °C 500 Ω at 0 °C 1000 Ω at 0 °C
Characteristics curve:*	6180 ppm/K (Nickel ND) 5000 ppm/K (Nickel NL) 6370 ppm/K (Nickel NJ)** 6720 ppm/K (Nickel NA)***
Long-term stability:	< 0.1 % at 1000 h at maximal operating temperature
Tolerance class (dependent on temperature) <sup>1)</sup> :*	IST AG reference T > 0 °C
<small>1) For tolerances &lt;0°C please check application note</small>	A 0.2 + 0.0035 x  t  B 0.4 + 0.007 x  t  C 0.8 + 0.014 x  t
Connection:*	Enameled Cu-wire, Ø 0.2 mm, (solderable, weldable) Enameled Cu-wire, Ø 0.15 mm, (solderable, weldable) Enameled Cu-wire, Ø 0.25 mm, metallized back side, (solderable, weldable)
Alternative wire construction:*	Inverted welding
Recommended applied current: <sup>2)</sup>	1 mA at 100 Ω 0.5 mA at 500 Ω 0.3 mA at 1000 Ω
<small>2) Self-heating must be considered</small>	
Other alternatives:*	Metallized backside



# 150 °C series

## Nickel sensor with wires

### For low temperatures



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Substrate thickness

\* Customer-specific alternatives available

\*\* 6370 ppm/K (Nickel NJ) 891 Ω at 0 °C only

\*\*\* 6720 ppm/K (Nickel NA) 120 Ω at 0 °C only

#### Order Information - 1E (Enameled Cu-wire, Ø 0.2 mm)

Size	Dimensions (L x W x H / H2 in mm)	Class A	Class B
------	-----------------------------------	---------	---------

6180 ppm/K (Nickel ND)

Nominal resistance: 100 Ω at 0 °C

232	2.3 x 2.0 x 0.65 / 1.3	Upon request	ND0K1.232.1E.B.025
Order code			Upon request

Nominal resistance: 1000 Ω at 0 °C

232	2.3 x 2.0 x 0.65 / 1.3	Upon request	ND1K0.232.1E.B.025
Order code			Upon request
520	5.0 x 2.0 x 0.65 / 1.3	Upon request	ND1K0.520.1E.B.025
Order code			Upon request

5000 ppm/K (Nickel NL)

Nominal resistance: 1000 Ω at 0 °C

520	5.0 x 2.0 x 0.65 / 1.3	Upon request	NL1K0.520.1E.B.025
Order code			Upon request

#### Order Information - 1K (Enameled Cu-wire, Ø 0.15 mm)

Size	Dimensions (L x W x H / H2 in mm)	Class A	Class B
------	-----------------------------------	---------	---------

6180 ppm/K (Nickel ND)

Nominal resistance: 100 Ω at 0 °C

232	2.3 x 2.0 x 0.65 / 1.3	Upon request	ND0K1.232.1K.B.007
Order code			Upon request

Nominal resistance: 1000 Ω at 0 °C

232	2.3 x 2.0 x 0.65 / 1.3	Upon request	ND1K0.232.1K.B.007
Order code			Upon request
520	5.0 x 2.0 x 0.65 / 1.3	Upon request	ND1K0.520.1K.B.007
Order code			Upon request



# 150 °C series

## Nickel sensor with wires

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Size	Dimensions (L x W x H / H2 in mm)	Class A	Class B
5000 ppm/K (Nickel NL)			
Nominal resistance: 1000 Ω at 0 °C			
520	5.0 x 2.0 x 0.65 / 1.3	Upon request	NL1K0.520.1K.B.007
Order code			Upon request
6370 ppm/K (Nickel NJ)			
Nominal resistance: 891 Ω at 0 °C			
538	5.0 x 3.8 x 0.65 / 1.3		NJ891.538.1K.K.076
Order code			020.00514

### Order Information - 1K (Enameled Cu-wire, Ø 0.25 mm, metallized back side)

Size	Dimensions (L x W x H / H2 in mm)	Class A	Class B
5000 ppm/K (Nickel NL)			
Nominal resistance: 1000 Ω at 0 °C			
520	5.0 x 2.0 x 0.65 / 1.3		NL1K0.520.1K.B.300.M
Order code			020.00604

### Additional Documents

Application Note:	Document name: ATN_E
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# Order Information

## Nickel sensors

### Secondary reference



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#### Material

N = Nickel

S = special

#### TCR

A = ANSI 6720 ppm/K J = 6370 ppm/K

B = Balco M = 5696 ppm/K

D = 6180 ppm/K C = 4280 ppm/K (GOST 8.625-2006)

L = 5000 ppm/K S = special

#### Resistance in $\Omega$ at 0 °C

#### Size in mm

#### Operating temperature range

1 = -60 °C to +150 °C

2 = -60 °C to +200 °C

3 = -60 °C to +300 °C

#### Connection

S = SIL FK = flat wire customer-specific

I = insulated wire K = customer-specific

W = wire E = enameled Cu-wire

FW = flat wire

#### Tolerance class (T > 0 °C)

A =  $0.2 + 0.0035 \times |t|$

B =  $0.4 + 0.007 \times |t|$

C =  $0.8 + 0.014 \times |t|$

K = customer-specific

#### Wire length in mm

#### Special

T = substrate thickness 0.25 mm M = metallized backside

W = sintered powder U = inverted welding

S = special

N J OK1. 520. 3 FW. B. 015. W



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# 200 °C series

## Nickel sensor with wires

### For medium temperatures

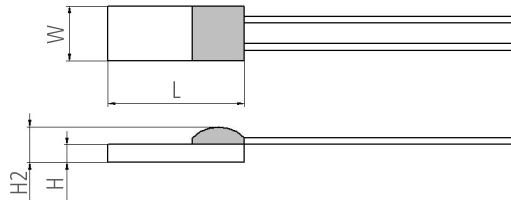


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#### Benefits & Characteristics

- Excellent long-term stability
- Connections remain in shape
- Easy interchangeability
- Small dimensions
- Simple linearization
- Vibration and temperature shock resistant
- Customer-specific sensor available upon request

#### Illustration<sup>1)</sup>



1) For actual size, see dimensions

#### Technical Data

Operating temperature range:	-60 °C to +200 °C	
Nominal resistance:*	100 Ω at 0 °C 500 Ω at 0 °C 1000 Ω at 0 °C	
Characteristics curve: *	6180 ppm/K (Nickel ND) 5000 ppm/K (Nickel NL) 6370 ppm/K (Nickel NJ)** 6720 ppm/K (Nickel NA)***	
Long-term stability:	< 0.1 % at 1000 h at maximal operating temperature	
Tolerance class (dependent on temperature) <sup>1):*</sup>	IST AG reference	T > 0 °C
<small>1) For tolerances &lt;0°C please check application note</small>	A	0.2 + 0.0035 x  t
	B	0.4 + 0.007 x  t
	C	0.8 + 0.014 x  t
Connection:*	Ag-wire, Ø 0.25 mm (solderable, weldable) Cu/Ag-wire, PTFE AWG30 (solderable, weldable) Cu/Ag-wire, PTFE AWG26 (solderable, weldable) Cu/Ag-wire, Ø 0.4 mm (solderable, weldable) Ni/Au-flat wire, 0.2 x 0.4 mm (solderable, weldable, crimpable) CuP-SIL wire post-plated with Sn (solderable, crimpable)	
Alternative wire construction:*	Inverted welding	
Recommended applied current: <sup>2)</sup>	1 mA at 100 Ω 0.5 mA at 500 Ω 0.3 mA at 1000 Ω	
<small>2) Self-heating must be considered</small>		



# 200 °C series

## Nickel sensor with wires

### For medium temperatures



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Other alternatives:*	Metallized backside
	Substrate thickness
	Sintered powder

\* Customer-specific alternatives available

\*\* 6370 ppm/K (Nickel NJ) 891 Ω at 0 °C only

\*\*\* 6720 ppm/K (Nickel NA) 120 Ω at 0 °C only

### Order Information - 2W (Ag-wire, Ø 0.25 mm)

Size	Dimensions (L x W x H / H2 in mm)	Class A	Class B
6180 ppm/K (Nickel ND)			
Nominal resistance: 100 Ω at 0 °C			
232	2.3 x 2.0 x 0.65 / 1.3	ND0K1.232.2W.A.010	ND0K1.232.2W.B.010
Order code		020.00004	020.00002
232	2.3 x 2.0 x 0.65 / 1.3	ND0K1.232.2W.A.015	ND0K1.232.2W.B.015
Order code		020.00003	020.00001
325	3.0 x 2.5 x 0.65 / 1.3	ND0K1.325.2W.A.010	ND0K1.325.2W.B.010
Order code		020.00011	020.00009
505	5.0 x 5.0 x 0.65 / 1.3	Upon request	ND0K1.505.2W.B.010
Order code			020.00529
Nominal resistance: 200 Ω at 0 °C			
520	5.0 x 2.0 x 0.65 / 1.3	Upon request	ND0K2.520.2W.B.015
Order code			020.00031
Nominal resistance: 300 Ω at 0 °C			
520	5.0 x 2.0 x 0.65 / 1.3	Upon request	ND0K3.520.2W.B.015
Order code			020.00357
Nominal resistance: 500 Ω at 0 °C			
520	5.0 x 2.0 x 0.65 / 1.3	Upon request	ND0K5.520.2W.B.010
Order code			020.00044
520	5.0 x 2.0 x 0.65 / 1.3	ND0K5.520.2W.A.015	ND0K5.520.2W.B.015
Order code		020.00683	020.00682
Nominal resistance: 1000 Ω at 0 °C			
232	2.3 x 2.0 x 0.65 / 1.3	ND1K0.232.2W.A.015	ND1K0.232.2W.B.010
Order code		020.00050	020.00049
520	5.0 x 2.0 x 0.65 / 1.3	ND1K0.520.2W.A.010	ND1K0.520.2W.B.010
Order code		020.00062	020.00060



# 200 °C series

## Nickel sensor with wires

### For medium temperatures



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Size	Dimensions (L x W x H / H2 in mm)	Class A	Class B
538	5.0 x 3.8 x 0.65 / 1.3	Upon request	ND1K0.538.2W.B.015
Order code			020.00083
102	10.0 x 2.0 x 0.65 / 1.3	Upon request	ND1K0.102.2W.B.015
Order code			020.00090
Nominal resistance: 5000 Ω at 0 °C			
525	5.0 x 2.5 x 0.65 / 1.3	Upon request	ND5K0.525.2W.B.010
Order code			020.00098

5000 ppm/K (Nickel NL)

Nominal resistance: 1000 Ω at 0 °C

520	5.0 x 2.0 x 0.65 / 1.3	NL1K0.520.2W.A.010	NL1K0.520.2W.B.010
Order code		020.00110	020.00108
525	5.0 x 2.5 x 0.65 / 1.3	Upon request	NL1K0.525.2W.B.010
Order code			020.00117

Nominal resistance: 10000 Ω at 0 °C

525	5.0 x 2.5 x 0.65 / 1.3	Upon request	NL10K.525.2W.B.010
Order code			020.00128

### Order Information - 2I (Cu/Ag-wire, AWG 30, PTFE-insulated)

Size	Dimensions (L x W x H / H2 in mm)	Class A	Class B
6180 ppm/K (Nickel ND)			
Nominal resistance: 100 Ω at 0 °C			
325	3.0 x 2.5 x 0.65 / 1.3	Upon request	ND0K1.325.2I.B.030
Order code			020.00014

Nickel NL (5000ppm/K)

Nominal resistance: 1000 Ω at 0 °C

520	5.0 x 2.0 x 0.65 / 1.3	Upon request	NL1K0.520.2I.B.050
Order code			020.00629
520	5.0 x 2.0 x 0.65 / 1.3	Upon request	NL1K0.520.2I.B.100
Order code			020.00627



# 200 °C series

## Nickel sensor with wires

### For medium temperatures



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#### Order Information - 2K (Cu/Ag-wire, AWG 26)

Size	Dimensions (L x W x H / H2 in mm)	Class A	Class B
6180 ppm/K (Nickel ND)			
Nominal resistance: 1000 Ω at 0 °C			
520	5.0 x 2.0 x 0.65 / 1.3	Upon request	ND1K0.520.2K.B.058
Order code			020.00071
538	5.0 x 3.8 x 0.65 / 1.3	Upon request	ND1K0.538.2K.B.026
Order code			020.00619

5000 ppm/K (Nickel NL)

Nominal resistance: 1000 Ω at 0 °C

520	5.0 x 2.0 x 0.65 / 1.3	Upon request	NL1K0.520.2K.B.165
Order code			020.00605
520	5.0 x 2.0 x 0.65 / 1.3	Upon request	NL1K0.520.2K.B.215
Order code			020.00606

#### Order Information - 2K (Cu/Ag-wire, Ø 0.4 mm)

Size	Dimensions (L x W x H / H2 in mm)	Class A	Class B
6180 ppm/K (Nickel ND)			
Nominal resistance: 1000 Ω at 0 °C			
520	5.0 x 2.0 x 0.65 / 1.3	Upon request	ND1K0.520.2K.B.007
Order code			020.00322
538	5.0 x 3.8 x 0.65 / 1.3	ND1K0.538.2K.A.010	ND1K0.538.2K.B.010
Order code		020.00639	020.00635

5000 ppm/K (Nickel NL)

Nominal resistance: 1000 Ω at 0 °C

520	5.0 x 2.0 x 0.65 / 1.3	Upon request	NL1K0.520.2K.B.007
Order code			020.00201
520	5.0 x 2.0 x 0.65 / 1.3	Upon request	NL1K0.520.2K.B.020
Order code			020.00197



# 200 °C series

## Nickel sensor with wires

### For medium temperatures



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#### Order Information - 2FW (Ni/Au-flat wire, 0.2 x 0.4 mm (HxW))

Size	Dimensions (L x W x H / H2 in mm)	Class A	Class B
6180 ppm/K (Nickel ND)			
Nominal resistance: 1000 Ω at 0 °C			
520	5.0 x 2.0 x 0.65 / 1.3	ND1K0.520.2FW.A.007	ND1K0.520.2FW.B.007
Order code		020.00349	020.00348
325	3.0 x 2.5 x 0.65 / 1.3	Upon request	ND0K1.325.2I.B.030
Order code			020.00014
5000 ppm/K (Nickel NL)			
Nominal resistance: 1000 Ω at 0 °C			
520	5.0 x 2.0 x 0.65 / 1.3	NL1K0.520.2FW.A.007	NL1K0.520.2FW.B.007
Order code		020.00351	020.00350

#### Order Information - 2S (CuP-SIL wire post-plated with Sn, 10 mm)

Size	Dimensions (L x W x H / H2 in mm)	Class A	Class B
6180 ppm/K (Nickel ND)			
Nominal resistance: 100 Ω at 0 °C			
505	5.0 x 5.0 x 0.65 / 1.3	Upon request	ND0K1.505.2S.B
Order code			020.00027
538	5.0 x 3.8 x 0.65 / 1.3	Upon request	ND0K1.538.2S.B
Order code			020.00024
Nominal resistance: 200 Ω at 0 °C			
538	5.0 x 3.8 x 0.65 / 1.3	Upon request	ND0K2.538.2S.B
Order code			020.00034
Nominal resistance: 1000 Ω at 0 °C			
525	5.0 x 2.5 x 0.65 / 1.3	ND1K0.525.2S.A	ND1K0.525.2S.B
Order code		020.00078	020.00077
538	5.0 x 3.8 x 0.65 / 1.3	ND1K0.538.2S.A	ND1K0.538.2S.B
Order code		020.00085	020.00084
Nominal resistance: 5000 Ω at 0 °C			
525	5.0 x 2.5 x 0.65 / 1.3	ND5K0.525.2S.A	ND5K0.525.2S.B
Order code		020.00100	020.00099



# 200 °C series

## Nickel sensor with wires

### For medium temperatures



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Size	Dimensions (L x W x H / H2 in mm)	Class A	Class B
5000 ppm/K (Nickel NL)			
Nominal resistance: 500 Ω at 0 °C			
538	5.0 x 3.8 x 0.65 / 1.3	Upon request	NL0K5.538.2S.B
Order code			020.00203
Nominal resistance: 1000 Ω at 0 °C			
425	4.0 x 2.5 x 0.65 / 1.3	NL1K0.425.2S.A	NL1K0.425.2S.B
Order code		020.00157	020.00106
525	5.0 x 2.5 x 0.65 / 1.3	Upon request	NL1K0.525.2S.B
Order code			020.00118
538	5.0 x 3.8 x 0.65 / 1.3	Upon request	NL1K0.538.2S.B
Order code			020.00122
Nominal resistance: 5000 Ω at 0 °C			
525	5.0 x 2.5 x 0.65 / 1.3	Upon request	NL5K0.525.2S.B
Order code			020.00166

### Additional Documents

Application Note:	Document name:
	ATN_E



# Order Information

## Nickel Sensor

### Secondary reference



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#### Material

N = Nickel

S = special

#### TCR

A = ANSI 6720 ppm/K J = 6370 ppm/K

B = Balco M = 5696 ppm/K

D = 6180 ppm/K C = 4280 ppm/K (GOST 8.625-2006)

L = 5000 ppm/K S = special

#### Resistance in $\Omega$ at 0 °C

#### Size in mm

#### Operating temperature range

1 = -60 °C to +150 °C

2 = -60 °C to +200 °C

3 = -60 °C to +300 °C

#### Connection

S = SIL FK = flat wire customer-specific

I = insulated wire K = customer-specific

W = wire E = enameled Cu-wire

FW = flat wire

#### Tolerance class (T > 0 °C)

A =  $0.2 + 0.0035 \times |t|$

B =  $0.4 + 0.007 \times |t|$

C =  $0.8 + 0.014 \times |t|$

K = customer-specific

#### Wire length in mm

#### Special

T = substrate thickness 0.25 mm M = metallized backside

W = sintered powder U = inverted welding

S = special

N J OK1. 520. 3 FW. B. 015. W



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# 300 °C series

## Nickel sensor with wires

### For high temperatures

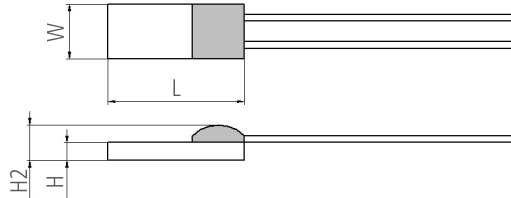


INNOVATIVE SENSOR TECHNOLOGY

#### Benefits & Characteristics

- Very robust connections
- Easy interchangeability
- Small dimensions
- Simple linearization
- Vibration and temperature shock resistant
- Wide temperature range
- Inorganic glass passivation
- Customer-specific sensor available upon request

#### Illustration<sup>1)</sup>



1) For actual size, see dimensions

#### Technical Data

Operating temperature range:	-60 °C to +300 °C	
Nominal resistance:*	100 Ω at 0 °C 500 Ω at 0 °C 1000 Ω at 0 °C	
Characteristics curve:*	6180 ppm/K (Nickel ND) 5000 ppm/K (Nickel NL) 6370 ppm/K (Nickel NJ)** 6720 ppm/K (Nickel NA)***	
Long-term stability:	< 0.1 % at 1000 h at maximal operating temperature	
Tolerance class (dependent on temperature) <sup>1):*</sup>	IST AG reference	T > 0 °C
<small>1) For tolerances &lt;0°C please check application note</small>	A	0.2 + 0.0035 x  t
	B	0.4 + 0.007 x  t
	C	0.8 + 0.014 x  t
Connection:*	Ni-wire, Ø 0.2 mm (solderable, weldable, crimpable) Pt/Ni-wire, Ø 0.2 mm (solderable, weldable, crimpable, brazeable)	
Alternative wire construction:*	Inverted welding	
Recommended applied current: <sup>2)</sup>	1 mA at 100 Ω 0.5 mA at 500 Ω 0.3 mA at 1000 Ω	
<small>2) Self-heating must be considered</small>		
Other alternatives:*	Metallized backside Substrate thickness	

\* Customer-specific alternatives available

\*\* 6370 ppm/K (Nickel NJ) 891 Ω at 0 °C only

\*\*\* 6720 ppm/K (Nickel NA) 120 Ω at 0 °C only



# 300 °C series

## Nickel sensor with wires

### For high temperatures



INNOVATIVE SENSOR TECHNOLOGY



#### Order Information - 3W (Ni-wire, Ø 0.2 mm)

Size	Dimensions (L x W x H / H2 in mm)	Class A or class K - customer-specific	Class B or class K - customer-specific
------	-----------------------------------	--	--

6720 ppm/K (Nickel NA)

Nominal resistance: 120 Ω at 0 °C

232	2.3 x 2.0 x 0.65 / 1.3	NA120.232.3W.K.007	
Order code		020.00346	
420	4.0 x 2.0 x 0.65 / 1.3	NA120.420.3W.K.007	
Order code		020.00588	

6180 ppm/K (Nickel ND)

Nominal resistance: 100 Ω at 0 °C

232	2.3 x 2.0 x 0.65 / 1.3	ND0K1.232.3W.A.010	ND0K1.232.3W.B.010
Order code		020.00658	020.00007
520	5.0 x 2.0 x 0.65 / 1.3	Upon request	ND1K0.520.3W.B.010
Order code			020.00186

5000 ppm/K (Nickel NL)

Nominal resistance: 100 Ω at 0 °C

520	5.0 x 2.0 x 0.65 / 1.3	Upon request	NL0K1.520.3W.B.010
Order code			020.00665

Nominal resistance: 1000 Ω at 0 °C

520	5.0 x 2.0 x 0.65 / 1.3	Upon request	NL1K0.520.3W.B.010
Order code			020.00324

#### Order Information - 3K (Pt/Ni-wire, Ø 0.2 mm)

Size	Dimensions (L x W x H / H2 in mm)	Class A or class K - customer-specific	Class B or class K - customer-specific
------	-----------------------------------	--	--

6720 ppm/K (Nickel NA)

Nominal resistance: 120 Ω at 0 °C

232	2.3 x 2.0 x 0.65 / 1.3	NA120.232.3K.K.007	NA120.232.3K.K.010
Order code		020.00179	020.00355
420	4.0 x 2.0 x 0.65 / 1.3	NA120.420.3K.K.007	
Order code		020.00526	



# 300 °C series

## Nickel sensor with wires

### For high temperatures



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#### Additional Documents

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Document name:

Application note:

ATN\_E



# Order Information

## Nickel Sensor

### Secondary reference



INNOVATIVE SENSOR TECHNOLOGY

#### Material

N = Nickel

S = special

#### TCR

A = ANSI 6720 ppm/K J = 6370 ppm/K

B = Balco M = 5696 ppm/K

D = 6180 ppm/K C = 4280 ppm/K (GOST 8.625-2006)

L = 5000 ppm/K S = special

#### Resistance in $\Omega$ at 0 °C

#### Size in mm

#### Operating temperature range

1 = -60 °C to +150 °C

2 = -60 °C to +200 °C

3 = -60 °C to +300 °C

#### Connection

S = SIL FK = flat wire customer-specific

I = insulated wire K = customer-specific

W = wire E = enameled Cu-wire

FW = flat wire

#### Tolerance class (T > 0 °C)

A =  $0.2 + 0.0035 \times |t|$

B =  $0.4 + 0.007 \times |t|$

C =  $0.8 + 0.014 \times |t|$

K = customer-specific

#### Wire length in mm

#### Special

T = substrate thickness 0.25 mm M = metallized backside

W = sintered powder U = inverted welding

S = special

N J OK1. 520. 3 FW. B. 015. W



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# Order Information

## SMD nickel sensor

### Secondary reference



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Material

N = Nickel

TCR

J = 6370 ppm/K

Resistance in  $\Omega$  at 0 °C

Size in mm

Operating temperature range

2 = -60 °C to +150 °C

Connection

(2)P = contacts tin-coated (100% Sn) (reflow solderable)

Tolerance class

K = customer specific

Special

S = special

N

J

891.

0805.

2

P.

K.

S



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