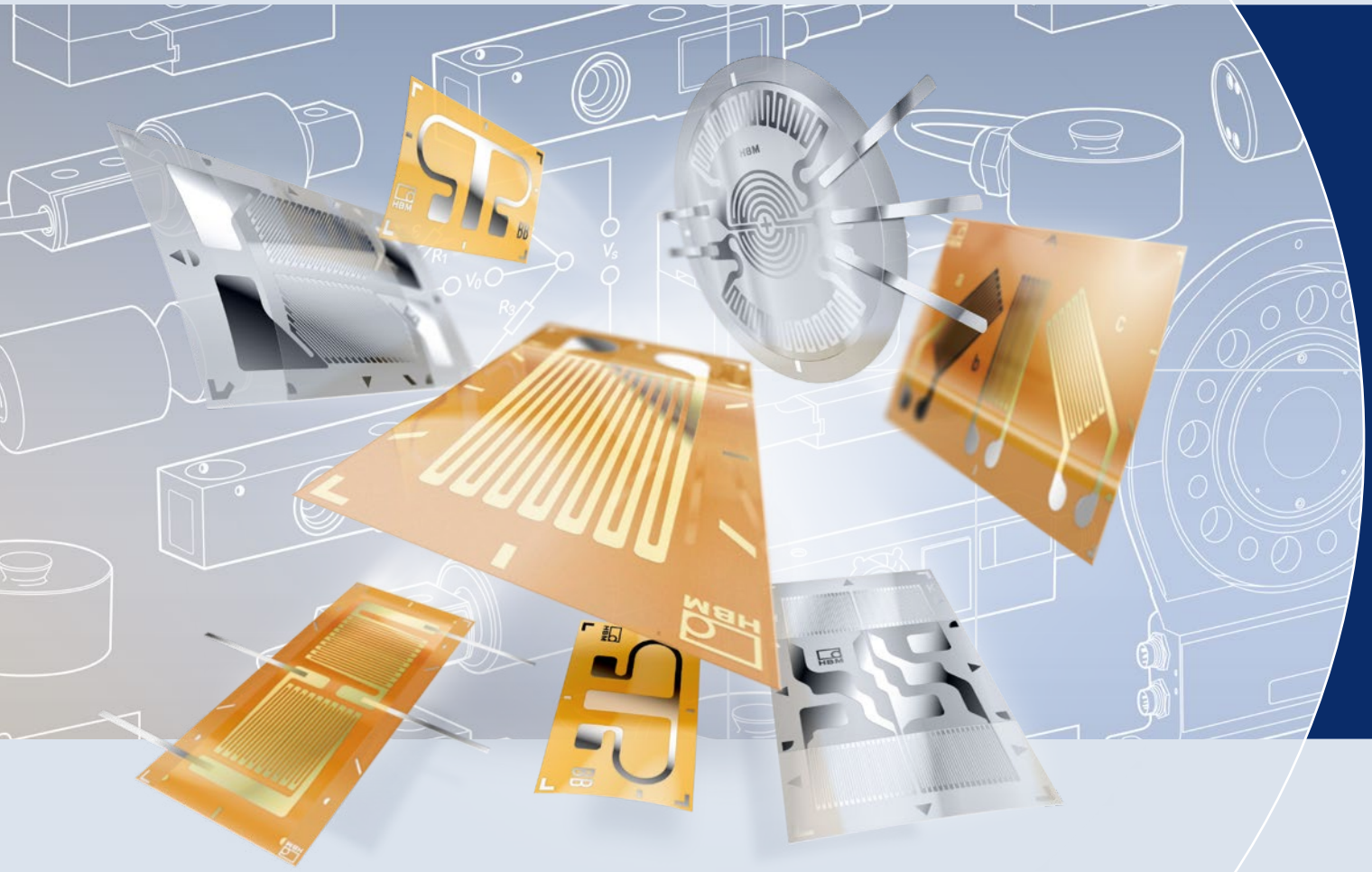
Strain Gauges

for Transducer Manufacturers



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HBM is the global leader in test and measurement.

Our best-in-class, innovative products set standards for precision throughout the world. That is why so many of our customers associate HBM with “measure and predict with confidence”.

Strain gauge materials and options

This chapter provides information about strain gauge construction and, in particular, about the materials used for measuring grid materials, the carrier materials and the options that are available.

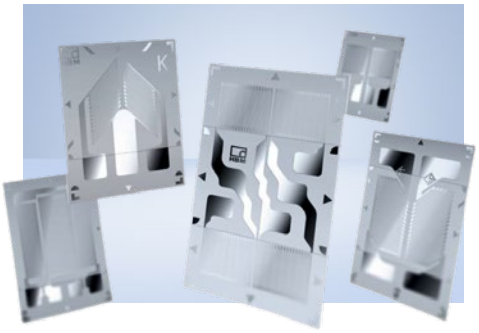
Measuring grid materials

Constantan
Constantan is a copper-nickel alloy. It is the preferred material for strain gauges. The gauge factor of strain gauges with constantan as the measuring grid material is approx. 2.

Nickel-chromium special alloy (Modco)
Modco is an alloy of nickel and chromium. The gauge factor is about 2.2. Due to this, there is a slightly higher output signal from the transducer in comparison to strain gauges with a constantan measuring grid foil. In addition, Modco has a higher specific resistance than constantan and is frequently used for high impedance strain gauges for this reason.
The temperature dependence of the gauge factor in Modco strain gauges is negative, which means that the sensitivity of the strain gauge decreases with rising temperature. In contrast, the spring materials’ modulus of elasticity is reduced which would lead to a greater sensitivity of the transducer under uniform load. Modco strain gauges can compensate for this effect due to the negative temperature dependence of the gauge factor. The sensitivity of the transducer is therefore essentially temperature-independent without the need for additional compensating resistors.

Nickel
Nickel is used in foil-based resistors to compensate for the temperature dependence of both the zero point and the sensitivity of a transducer.
The resistance temperature coefficient is $4.8 \cdot 10^{-3}$/K (0 °C) *(32 °F)*.

Strain gauge carrier materials



Our standard strain gauges for transducer manufacturers are based on the carrier material PEEKF. This carrier material is characterized by the following properties:

- Easy to use during installation and soldering
- Very good metrological properties – therefore suitable for transducers with high accuracy requirements
- Very low humidity absorption, which can significantly improve the stability of the transducer
- Small curvature radii permit installation in, for example, small boreholes.

We also offer strain gauges based on glass fiber reinforced phenolic resin. Glass fiber reinforced phenolic resin also offers excellent metrological properties, especially when the transducer is used in higher temperatures. Due to the higher stiffness of the carrier material, it can break if not handled correctly.

Options

In addition to our standard range of open and covered strain gauges, we offer various options on request:

- Self-adhesive versions, so-called stick-on strain gauges; these are described in more detail below.
- Connection leads made of nickel-plated copper
- Further options on request.

Self-adhesive strain gauges – Stick-on option

New updated version. No post-curing needed anymore.

No additional adhesive is needed anymore for mounting the strain gauge. Self-adhesive stick-on strain gauges are supplied with an adhesive pre-coated on the strain gauge carrier. The adhesive is dry, thus facilitating easy handling and positioning of the gauge.

Saves you one working step – Application of an adhesive.

No post-curing needed.

Long shelf-life of minimum one year.

Strain gauges without leads (nickel-plated Cu leads) can be supplied with the stick-on option.

It´s so easy, using strain gauges with the stick-on option:

Preparation:	▪ Clean and degrease the installation surface (e.g. with RMS1 or RMS1 SPRAY) ▪ Use emery (grain 220 ... 300) or sandblast (e.g. sandblasting grains and grain 80 ... 100) ▪ Clean with high-purity solvent (e.g. RMS1 or RMS1 SPRAY)
Strain gauge:	No preparation necessary
Fixing of strain gauge:	With heat-resistant adhesive tape (e.g. 1-KLEBEBAND)
Pressing of strain gauge:	For instance, with a clamping device, protect the strain gauge with release film (e.g. 1-RELEASEFILM) and pressure compensating pads against damage (e.g. silicone rubber; included in adhesive packets EP150 and EP310S)
Curing of the adhesives:	Summary curing instructions: ▪ Contact pressure: 10 ... 50 N/cm² *(14,5 ... 73 lbf./sq.in)* ▪ Heating rate (under pressure): 2 ... 10 K/min from room temperature to curing temperature ▪ Curing time: 6 h at 160 °C *(T_{min})* or 3 h at 170 °C or 1 h at 190 °C *(T_{max})* ▪ Cooling (under pressure): down to room temperature
Adhesive:	Hot-curing adhesive based on epoxy resin
Layer thickness:	(9 ± 3) µm equivalent to (350 ± 120) microinch
More info:	Detailed curing instructions are provided in the instructions for use. Please refer to www.hbm.com.

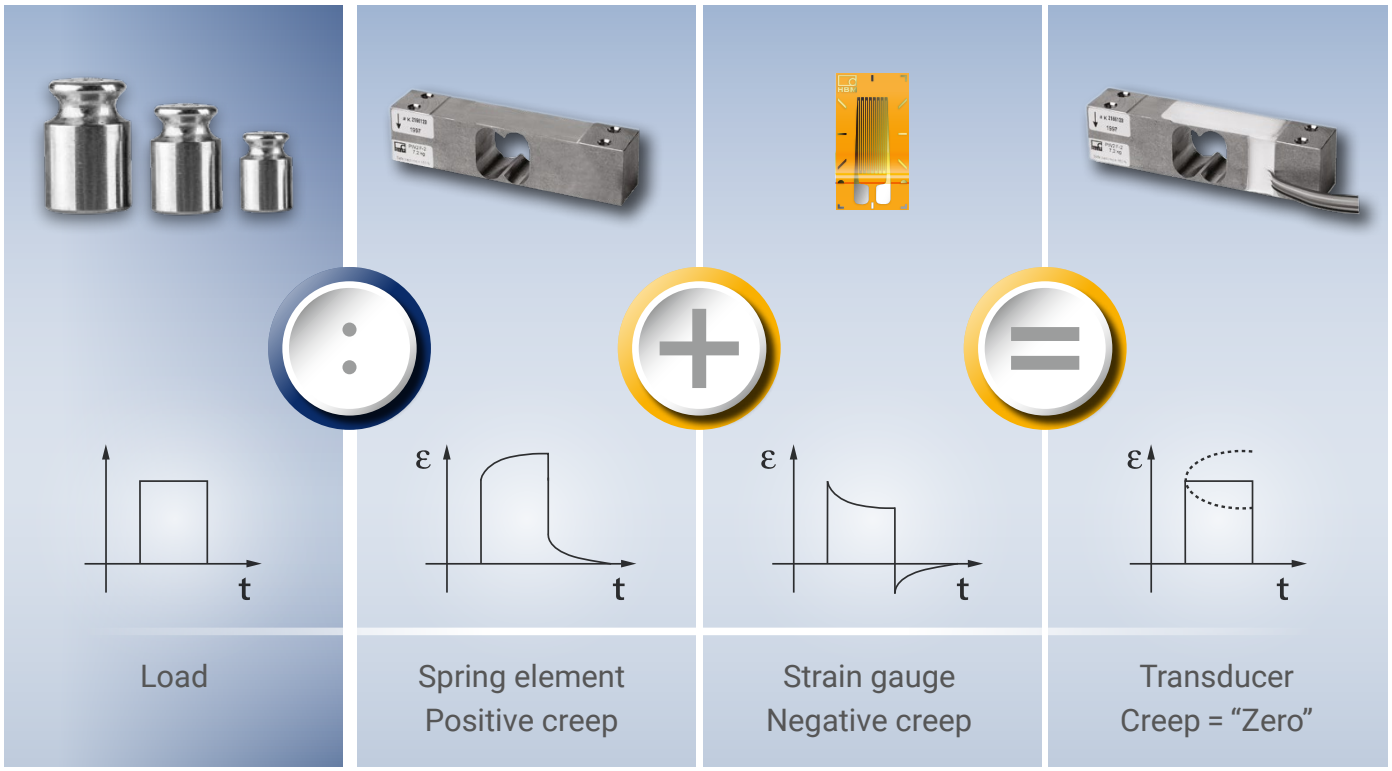
Creep adjustment

Spring element material exhibits a positive creep when it is loaded (elastic after-effect). This means that the material (spring element material) deforms under load even further in the load direction. This leads to a greater signal over time.
Strain gauges behave differently and creep negatively. This means that the signal becomes smaller under load over time.

The signal of a loaded transducer is the sum of both effects. For high accuracy transducers, the strain gauge creep has to be matched as closely as possible to the creep of the spring material.

Creep behavior depends on many parameters such as spring material, strain field, type and thickness of the adhesive, strain gauge carrier material and layout of the strain gauge.
The end loop length (see next page) is one of many parameters affecting creep. The strain gauge creep can be adjusted by changing the end loop length.
Most strain gauges in this catalog are available with different end loop lengths.

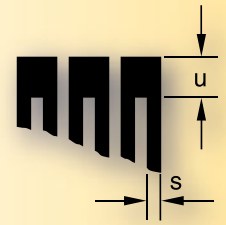
The effects of the various end loop lengths on the transducer creep must be determined experimentally, keeping all other parameters constant.



Schematic diagram of the elastic after-effect of spring elements, strain gauge creep and the behavior of the transducer

End loop length

The end loop length “u” of the strain gauge is a multiple of the grid line width “s”. The data is shown as an alphabetical letter or directly as the ratio between end loop length and grid line width. The following table shows which letter is used for the respective end loop lengths.



A: u = 1 s	M: u = 7 s
C: u = 2 s	O: u = 8 s
E: u = 3 s	Q: u = 9 s
G: u = 4 s	S: u = 10 s
I: u = 5 s	U: u = 11 s
K: u = 6 s	W: u = 12 s

Would you like

- **more information?**
- **an offer?**
- **free samples for tests?**
- **to discuss your application with us?**

Then contact your nearest HBM representative.
You can find our representatives under www.hbm.com. Or email us at:
makingtransducers@hbm.com

Sales quantity unit

The sales quantity unit of series A and U strain gauges, as well as the balancing resistors, is 100 pieces. Only for membrane rosettes is the sales quantity unit 25 pieces.

For further information please see:

Request a catalog at:
info@hbm.com

- **Strain gauges for experimental stress analysis (also available with connection cable)**
- **Further accessories, including adhesives, covering materials and cleaning agents**

Strain gauge – inquiry form

If your requirements are not met by the solutions in this catalog, please use the form below to contact us.

FAX to HBM: +49 6151 803 9100

Strain gauge specifications

Resistance (for a measuring grid)	☐ 120 Ω	☐ 350 Ω	☐ 700 Ω	☐ 1,000 Ω	☐ Other Ω
Grid length	☐ 1.5 mm	☐ 3 mm	☐ 6 mm	☐ 10 mm	☐ Other mm
Grid width	☐ mm	☐ mm			
Carrier dimensions	☐ mm (length)	☐ mm (width)			
Measuring grid material	☐ Constantan	☐ Ni-Cr alloy (Modco)	☐ Nickel (compensating resistors)		
Properties	☐ Connection leads	☐ Integrated solder terminals	☐ Insulated cable	☐ Covered grid	
Carrier material	☐ Glass fiber reinforced phenolic resin	☐ PEEKF	☐ Polyimide		
Temperature response matched to	☐ Steel	☐ Aluminum	☐ Others		
Annual requirement	☐ Pieces				
Your special requirements					
Type number of strain gauge currently in use					
Please provide a sketch of the strain gauge					

Inquiry for customized strain gauges

Your profile:

Company		City	
Department		Postcode	
First name		Street	
Last name		Tel.	
Country		Fax	
State		Email	

Type designation

Option 1: Number of grids and their positions

L	Linear
D	Double-linear or half bridge
X	Single or double shear
T	T rosette or columnar strain gauge
V	Full brigde
M	Membrane rosette

Option 2: Strain gauge series

A	Carrier: PEEKF/ Measuring grid foil: Constantan
U	Carrier: PEEKF/ Measuring grid foil: Ni-Cr alloy Not all combinations are possible; please refer to individual strain gauge examples

Option 3: Layout of grids, type and position of connections

1-9	Please refer to individual strain gauge examples

Option 4: Material to which the strain gauge temperature response is matched

1	Ferritic steel with a = 10.8 · 10^{-6}/K
3	Aluminum with a = 23 · 10^{-6}/K Other matchings available on request

Option 5: Creep adjustment*

A	u = 1 s
C	u = 2 s
E	u = 3 s
G	u = 4 s
I	u = 5 s
K	u = 6 s
M	u = 7 s
O	u = 8 s
Q	u = 9 s
S	u = 10 s

Other creep adjustments on request.

* The end loop length u is equal to a multiple of the grid line width s.

Option 6: Measuring grid length in mm

With membrane rosettes, this is the diameter of the circle that surrounds the measuring grid.

Option 7: Measuring grid resistance in ohms

175	175 Ω
350	350 Ω
1K0	1,000 Ω

Option 8: Covering, connections, stick-on

_E	Measuring grid with covering
BE	Stick-on – self-adhesive strain gauges, strain gauges supplied with adhesive already applied to the carrier; only in combination with measuring grid covering
LE	Nickel-plated Cu leads, approx. 30 mm long; only in combination with measuring grid covering
_W	Measuring grid without covering

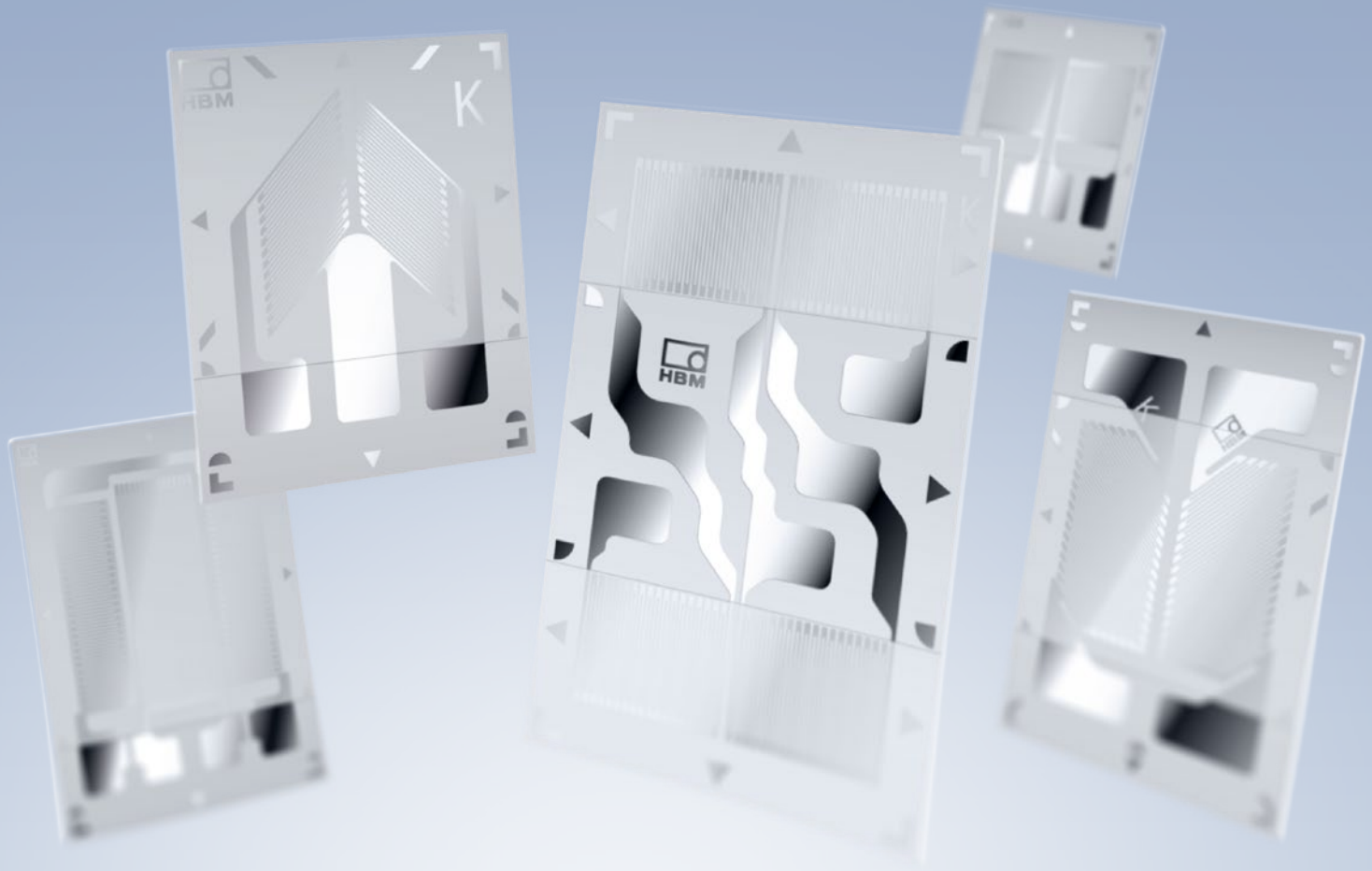
1- ☐ ☐ ☐ ☐ ☐ ☐ / ☐ ☐

Example:
1- L A 1 1 K 1.6 / 350 _E

Preferred types or variants
1- = Preferred types
K- = Variants

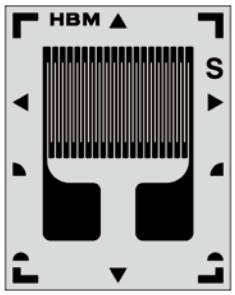
Strain gauges – A series & U series

- Easy handling during installation and long service life
- Suitable for transducers with high accuracy requirements
- Perfect for your solution, regardless of whether it is standard or custom



Specifications		A series	U series
Strain gauge construction		Foil strain gauge	Foil strain gauge
Measuring grid			
Material		Constantan	Nickel-chrome special alloy
Thickness	µm *(microinch)*	3.8 or 5, *(150 or 197)* depending on strain gauge type	5 *(197)*
Carrier			
Material		PEEKF	PEEKF
Thickness	µm *(microinch)*	40 ±5 *(1,575 ±197)*	40 ±5 *(1,575 ±197)*
Cover			
Material		PEEKF	PEEKF
Thickness	µm *(microinch)*	40 ±5 *(1,575 ±197)*	40 ±5 *(1,575 ±197)*
Connections		Nickel-plated Cu leads, approx. 30 mm long	Nickel-plated Cu leads, approx. 30 mm long
in strain gauges without connection leads		integrated solder tabs	Integrated solder tabs, nickel-plated
Nominal resistance	Ω	175 ... 2,000 Ohm (depended on design)	175 ... 5,000 Ohm (depended on design)
Resistance toleranc	%	±0.3 without, ±0.35 with leads	±0.3 without, ±0.35 with leads
Gauge factor		Approx. 2	Approx. 2.2
Nominal value of gauge factor		Data on request	Data on request
Gauge factor tolerance			
at ≤ 1.5 mm measuring grid length	%	±1.5	±1.5
at > 1.5 mm measuring grid length	%	±1	±1
Reference temperature	°C *(°F)*	23 *(73.4)*	23 *(73.4)*
Operating temperature range			
for static, i.e. zero point-related measurements	°C *(°F)*	-40 ... +140*(-40 ... +284)*	-40 ... +140 *(-40 ... +284)*
for dynamic, i.e. non-zero point-related measurements	°C *(°F)*	-70 ... +200 *(-94 ... +392)*	-70 ... +200 *(-94 ... +392)*
Transverse sensitivity		Data on request	Data on request
Temperature response		Data on request	Data on request
Temp. response as required, matched to thermal expansion coefficient			
for ferritic steel	1/K *(1/°F)*	$10.8 \cdot 10^{-6}$ $(6.0 \cdot 10^{-6})$	$10.8 \cdot 10^{-6}$ $(6.0 \cdot 10^{-6})$
for aluminum	1/K *(1/°F)*	$23 \cdot 10^{-6}$ $(12.8 \cdot 10^{-6})$	$23 \cdot 10^{-6}$ $(12.8 \cdot 10^{-6})$
Temperature response tolerance	1/K *(1/°F)*	$\pm 0.3 \cdot 10^{-6}$ $(\pm 0.17 \cdot 10^{-6})$	$\pm 0.6 \cdot 10^{-6}$ $(0 \pm 0{,}33 \cdot 10^{-6})$
Matching of temperature response in the range of	°C *(°F)*	-10 ... +120 *(14 ... 248)*	-10 ... +120 *(14 ... 248)*
Maximum elongation at reference temperature when using Z70 adhesive on strain gauge type K-LA11E3/350_W / K-LU11E3/350_W			
Absolute strain value ε for positive direction	µm/m *(microstrain)*	50,000 (=5 %)	10,000 (=1 %)
Absolute strain value ε for negative direction	µm/m *(microstrain)*	50,000 (=5 %)	35,000 (=3,5 %)
Fatigue life at reference temperature when using Z70 adhesive on strain gauge. Achievable number of load cycles Lw with alternating strain:			
type K-LA11E3/350_W ε_W =±1,200 µm/m and zero point variation of			
$\varepsilon_m \leq$ 300 µm/m		>> 10^7 (test aborted at 10^7)	>> 10^7 (test aborted at 10^7)
$\varepsilon_m \leq$ 30 µm/m		> 10^7 (test aborted at 10^7)	> 10^7 (test aborted at 10^7)
type K-LU11E3/350_W ε_W =±2,000 µm/m and zero point variation of			
$\varepsilon_m \leq$ 300 µm/m		>> 10^7 (test aborted at 10^7)	>> 10^7 (test aborted at 10^7)
$\varepsilon_m \leq$ 100 µm/m		> 10^7 (test aborted at 10^7)	> 10^7 (test aborted at 10^7)
Minimum radius of curvature at reference temperature			
longitudinal	mm *(inch)*	0.5 *(0.020)*	0.5 *(0.020)*
transverse	mm *(inch)*	0.5 *(0.020)*	0.5 *(0.020)*
for strain gauges with leads in the area of the solder terminals	mm *(inch)*	5 *(0.197)*	5 *(0.197)*
Bonding material that can be used			
Cold curing adhesives		X280	X280
Hot curing adhesives		EP150, EP310N, P250	EP150, EP310N, P250

Linear strain gauges: 1.6 mm *(0.063 inch)*, 350 and 1,000 ohms

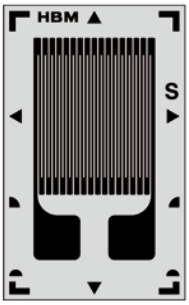


Original size

Dimensions in mm and inch			
Measuring grid length	Measuring grid width	Total length	Total width
1.6 mm	3.0 mm	5.7 mm	4.5 mm
0.063 inch	0.118 inch	0.224 inch	0.177 inch

Preferred types		Variants	Option 4)	Option 5)	Option 8)	
Steel	Aluminum	Other	Temperature resp. matched to	Creep adjustment	Option	Nominal resistance
1-LA11K1.6/350_E	1-LA13K1.6/350_E	K-LA1x[4]x[5]1.6/350xx[8]	1 = Steel 3 = Aluminum	A, C, E, G, I, K, M, O, Q, S	_E, BE, LE, _W	350 Ω ±0.3 %
1-LA11S1.6/350_E	1-LA13S1.6/350_E					350 Ω ±0.3 %
1-LU11K1.6/350_E	1-LU13K1.6/350_E	K-LU1x[4]x[5]3/350xx[8]	1 = Steel 3 = Aluminum	A, C, E, G, I, K, M, O, Q, S	_E, BE, LE, _W	350 Ω ±0.3 %
1-LU11S1.6/350_E	1-LU13S1.6/350_E					350 Ω ±0.3 %
1-LU11K1.6/1K0_E	1-LU13K1.6/1K0_E	K-LU1x[4]x[5]1.6/1K0xx[8]	1 = Steel 3 = Aluminum	A, C, E, G, I, K, M, O, Q, S	_E, BE, LE, _W	1,000 Ω ±0.3 %
1-LU11S1.6/1K0_E	1-LU13S1.6/1K0_E					1,000 Ω ±0.3 %

Linear strain gauges: 3 mm *(0.118 inch)*, 350 and 1,000 ohms



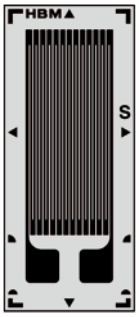
Original size

The 1,000 ohms version has a slightly wider measuring grid; however, the external dimensions are as shown.

Dimensions in mm and inch			
Measuring grid length	Measuring grid width	Total length	Total width
3.0 mm	3.0 mm	7.3 mm	4.5 mm
0.118 inch	0.118 inch	0.287 inch	0.177 inch

Preferred types		Variants	Option 4)	Option 5)	Option 8)	
Steel	Aluminum	Other	Temperature resp. matched to	Creep adjustment	Option	Nominal resistance
1-LA11K3/350_E	1-LA13K3/350_E	K-LA1x[4]x[5]3/350xx[8]	1 = Steel 3 = Aluminum	A, C, E, G, I, K, M, O, Q, S	_E, BE, LE, _W	350 Ω ±0.3 %
1-LA11S3/350_E	1-LA13S3/350_E					350 Ω ±0.3 %
1-LU11K3/350_E	1-LU13K3/350_E	K-LU1x[4]x[5]3/350xx[8]	1 = Steel 3 = Aluminum	A, C, E, G, I, K, M, O, Q, S	_E, BE, LE, _W	350 Ω ±0.3 %
1-LU11S3/350_E	1-LU13S3/350_E					350 Ω ±0.3 %
1-LA11K3/1K0_E	1-LA13K3/1K0_E	K-LA1x[4]x[5]3/1K0xx[8]	1 = Steel 3 = Aluminum	A, C, E, G, I, K, M, O, Q, S	_E, BE, LE, _W	1,000 Ω ±0.3 %
1-LA11S3/1K0_E	1-LA13S3/1K0_E					1,000 Ω ±0.3 %
1-LU11K3/1K0_E	1-LU13K3/1K0_E	K-LU1x[4]x[5]3/1K0xx[8]	1 = Steel 3 = Aluminum	A, C, E, G, I, K, M, O, Q, S	_E, BE, LE, _W	1,000 Ω ±0.3 %
1-LU11S3/1K0_E	1-LU13S3/1K0_E					1,000 Ω ±0.3 %

Linear strain gauges: 6 mm *(0.236 inch)*, 350 and 1,000 ohms

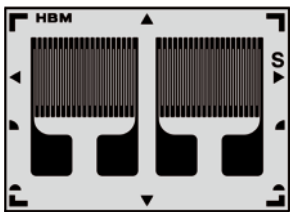


Original size

Dimensions in mm and inch			
Measuring grid length	Measuring grid width	Total length	Total width
6.0 mm	3.0 mm	10.6 mm	4.5 mm
0.236 inch	0.118 inch	0.417 inch	0.177 inch

Preferred types		Variants	Option 4)	Option 5)	Option 8)	
Steel	Aluminum	Other	Temperature resp. matched to	Creep adjustment	Option	Nominal resistance
1-LA11K6/350_E	1-LA13K6/350_E	K-LA1x[4]x[5]6/350xx[8]	1 = Steel 3 = Aluminum	A, C, E, G, I, K, M, O, Q, S	_E, BE, LE, _W	350 Ω ±0.3 %
1-LA11S6/350_E	1-LA13S6/350_E					350 Ω ±0.3 %
1-LA11K6/1K0_E	1-LA13K6/1K0_E	K-LA1x[4]x[5]6/1K0xx[8]	1 = Steel 3 = Aluminum	A, C, E, G, I, K, M, O, Q, S	_E, BE, LE, _W	1,000 Ω ±0.3 %
1-LA11S6/1K0_E	1-LA13S6/1K0_E					1,000 Ω ±0.3 %

Double linear strain gauges: 1.6 mm *(0.063 inch)*, 350 and 1,000 ohms



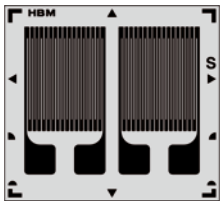
Original size

Dimensions in mm and inch			
Measuring grid length	Measuring grid width	Total length	Total width
1.6 mm	3.0 mm	5.7 mm	8.0 mm
0.063 inch	0.118 inch	0.224 inch	0.315 inch

Preferred types		Variants	Option 4)	Option 5)	Option 8)	
Steel	Aluminum	Other	Temperature resp. matched to	Creep adjustment	Option	Nominal resistance
1-DA11K1.6/350_E	1-DA13K1.6/350_E	K-DA1x[4]x[5]1.6/350xx[8]	1 = Steel 3 = Aluminum	A, C, E, G, I, K, M, O, Q, S	_E, BE, LE, _W	350 Ω ±0.3 %
1-DA11S1.6/350_E	1-DA13S1.6/350_E					350 Ω ±0.3 %
1-DU11K1.6/1K0_E	1-DU13K1.6/1K0_E	K-DU1x[4]x[5]1.6/1K0xx[8]	1 = Steel 3 = Aluminum	A, C, E, G, I, K, M, O, Q, S	_E, BE, LE, _W	1,000 Ω ±0.3 %
1-DU11S1.6/1K0_E	1-DU13S1.6/1K0_E					1,000 Ω ±0.3 %

Double linear strain gauges: 3 mm *(0.118 inch)*, 350 and 1,000 ohms

The 1,000 ohms version has a slightly wider measuring grid; however, the external dimensions are as shown.

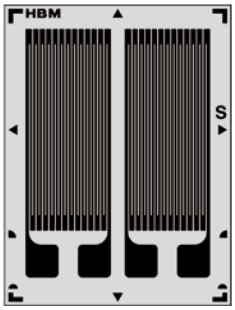


Original size

Dimensions in mm and inch			
Measuring grid length	Measuring grid width	Total length	Total width
3.0 mm	3.0 mm	7.3 mm	8.0 mm
0.118 inch	0.118 inch	0.287 inch	0.315 inch

Preferred types		Variants	Option 4)	Option 5)	Option 8)	
Steel	Aluminum	Other	Temperature resp. matched to	Creep adjustment	Option	Nominal resistance
1-DA11K3/350_E	1-DA13K3/350_E	K-DA1x[4]x[5]3/350xx[8]	1 = Steel 3 = Aluminum	A, C, E, G, I, K, M, O, Q, S	_E, BE, LE, _W	350 Ω ±0.3 %
1-DA11S3/350_E	1-DA13S3/350_E					350 Ω ±0.3 %
1-DA11S3/350_E	1-DA13K3/1K0_E	K-DA1x[4]x[5]3/1K0xx[8]	1 = Steel 3 = Aluminum	A, C, E, G, I, K, M, O, Q, S	_E, BE, LE, _W	1,000 Ω ±0.3 %
1-DA11S3/1K0_E	1-DA13S3/1K0_E					1,000 Ω ±0.3 %

Double linear strain gauges: 6 mm *(0.236 inch)*, 350 and 1,000 ohms



Original size

Dimensions in mm and inch			
Measuring grid length	Measuring grid width	Total length	Total width
6.0 mm	3.0 mm	10.6 mm	8.0 mm
0.236 inch	0.118 inch	0.417 inch	0.315 inch

Preferred types		Variants	Option 4)	Option 5)	Option 8)	
Steel	Aluminum	Other	Temperature resp. matched to	Creep adjustment	Option	Nominal resistance
1-DA11K6/350_E	1-DA13K6/350_E	K-DA1x[4]x[5]6/350xx[8]	1 = Steel 3 = Aluminum	A, C, E, G, I, K, M, O, Q, S	_E, BE, LE, _W	350 Ω ±0.3 %
1-DA11S6/350_E	1-DA13S6/350_E					350 Ω ±0.3 %
1-DA11K6/1K0_E	1-DA13K6/1K0_E	K-DA1x[4]x[5]6/1K0xx[8]	1 = Steel 3 = Aluminum	A, C, E, G, I, K, M, O, Q, S	_E, BE, LE, _W	1,000 Ω ±0.3 %
1-DA11S6/1K0_E	1-DA13S6/1K0_E					1,000 Ω ±0.3 %

Single shear strain gauges: 1.9 mm *(0.075 inch)*, 350 ohms, left version

Original size

Dimensions in mm and inch			
Measuring grid length	Measuring grid width	Total length	Total width
1.9 mm	1.4 mm	7.1 mm	3.2 mm
0.075 inch	0.055 inch	0.280 inch	0.126 inch

Preferred types		Variants	Option 4)	Option 5)	Option 8)	
Steel	Aluminum	Other	Temperature resp. matched to	Creep adjustment	Option	Nominal resistance
1-XU91S1.9/350_W		K-XU9x[4]x[5]1.9/350_W[8]	1 = Steel 3 = Aluminum	A, C, E, G, I, K, M, O, Q, S	_W	350 Ω ±0.3 %

Single shear strain gauges: 1.9 mm *(0.075 inch)*, 350 ohms, right version

Original size

Dimensions in mm and inch			
Measuring grid length	Measuring grid width	Total length	Total width
1.9 mm	1.4 mm	7.1 mm	3.2 mm
0.075 inch	0.055 inch	0.280 inch	0.126 inch

Preferred types		Variants	Option 4)	Option 5)	Option 8)	
Steel	Aluminum	Other	Temperature resp. matched to	Creep adjustment	Option	Nominal resistance
1-XU01S1.9/350_W		K-XUOx[4]x[5]1.9/350_W[8]	1 = Steel 3 = Aluminum	A, C, E, G, I, K, M, O, Q, S	_W	350 Ω ±0.3 %

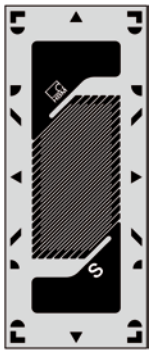
Single shear strain gauges: 1.9 mm *(0.075 inch)*, 350 ohms

Original size

Dimensions in mm and inch			
Measuring grid length	Measuring grid width	Total length	Total width
1.9 mm	2.4 mm	9.0 mm	4.4 mm
0.075 inch	0.094 inch	0.354 inch	0.173 inch

Preferred types		Variants	Option 4)	Option 5)	Option 8)	
Steel	Aluminum	Other	Temperature resp. matched to	Creep adjustment	Option	Nominal resistance
1-XA51S1.9/350_E		K-XA5x[4]x[5]1.9/350xx[8]	1 = Steel 3 = Aluminum	A, C, E, G, I, K, M, O, Q, S	_E, BE, LE, _W	350 Ω ±0.3 %

Single shear strain gauges: 2.8 mm *(0.110 inch)*, 175, 350 and 1,000 ohms, left version

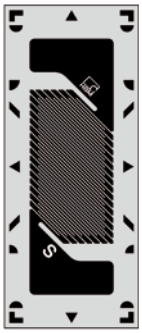


Original size

Dimensions in mm and inch			
Measuring grid length	Measuring grid width	Total length	Total width
2.8 mm	1.4 – 3.5 mm	9.7 mm	4.0 mm
0.110 inch	0.055 – 0.138 inch	0.382 inch	0.157 inch

Preferred types		Variants	Option 4)	Option 5)	Option 8)	
Steel	Aluminum	Other	Temperature resp. matched to	Creep adjustment	Option	Nominal resistance
1-XA91K2.8/175_E		K-XA9x[4]x[5]2.8/175xx[8]	1 = Steel 3 = Aluminum	A, C, E, G, I, K, M, O, Q, S	_E, BE, LE, _W	175 Ω ±0.3 %
1-XA91S2.8/175_E						175 Ω ±0.3 %
1-XU91K2.8/175_E		K-XU9x[4]x[5]2.8/175xx[8]	1 = Steel 3 = Aluminum	A, C, E, G, I, K, M, O, Q, S	_E, BE, LE, _W	175 Ω ±0.3 %
1-XU91S2.8/175_E						175 Ω ±0.3 %
1-XA91K2.8/350_E		K-XA9x[4]x[5]2.8/350xx[8]	1 = Steel 3 = Aluminum	A, C, E, G, I, K, M, O, Q, S	_E, BE, LE, _W	350 Ω ±0.3 %
1-XA91S2.8/350_E						350 Ω ±0.3 %
1-XU91K2.8/350_E		K-XU9x[4]x[5]2.8/350xx[8]	1 = Steel 3 = Aluminum	A, C, E, G, I, K, M, O, Q, S	_E, BE, LE, _W	350 Ω ±0.3 %
1-XU91S2.8/350_E						350 Ω ±0.3 %
1-XU91K2.8/1K0_E		K-XU9x[4]x[5]2.8/1K0xx[8]	1 = Steel 3 = Aluminum	A, C, E, G, I, K, M, O, Q, S	_E, BE, LE, _W	1,000 Ω ±0.3 %
1-XU91S2.8/1K0_E						1,000 Ω ±0.3 %

Single shear strain gauges:
2.8 mm *(0.110 inch)*, 175, 350 and 1,000 ohms, right version



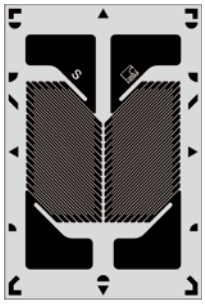
Original size

The 175 and 1,000 ohms versions have a slightly smaller measuring grid;
however, the external dimensions are as shown.

Dimensions in mm and inch			
Measuring grid length	Measuring grid width	Total length	Total width
2.8 mm	3.5 mm	9.7 mm	4.0 mm
0.110 inch	0.138 inch	0.382 inch	0.157 inch

Preferred types		Variants	Option 4)	Option 5)	Option 8)	
Steel	Aluminum	Other	Temperature resp. matched to	Creep adjustment	Option	Nominal resistance
1-XA01K2.8/175_E		K-XA0x[4]x[5]2.8/175xx[8]	1 = Steel 3 = Aluminum	A, C, E, G, I, K, M, O, Q, S	_E, BE, LE, _W	175 Ω ±0.3 %
1-XA01S2.8/175_E						175 Ω ±0.3 %
1-XA01K2.8/350_E		K-XA0x[4]x[5]2.8/350xx[8]	1 = Steel 3 = Aluminum	A, C, E, G, I, K, M, O, Q, S	_E, BE, LE, _W	350 Ω ±0.3 %
1-XA01S2.8/350_E						350 Ω ±0.3 %
1-XU01K2.8/1K0_E		K-XU0x[4]x[5]2.8/1K0xx[8]	1 = Steel 3 = Aluminum	A, C, E, G, I, K, M, O, Q, S	_E, BE, LE, _W	1,000 Ω ±0.3 %
1-XU01S2.8/1K0_E						1,000 Ω ±0.3 %

Double shear strain gauges: 2.8 mm *(0.110 inch)*, 350 and 1,000 ohms



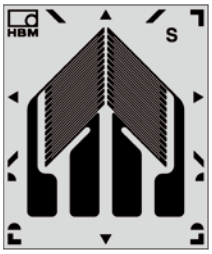
Original size

The 1,000 ohms version has a slightly smaller measuring grid; however, the external dimensions are as shown.

Dimensions in mm and inch			
Measuring grid length	Measuring grid width	Total length	Total width
2.8 mm	3.5 mm	9.7 mm	6.5 mm
0.110 inch	0.138 inch	0.382 inch	0.256 inch

Preferred types		Variants	Option 4)	Option 5)	Option 8)	
Steel	Aluminum	Other	Temperature resp. matched to	Creep adjustment	Option	Nominal resistance
1-XA11K2.8/350_E		K-XA1x[4]x[5]2.8/350x[8]	1 = Steel 3 = Aluminum	A, C, E, G, I, K, M, O, Q, S	_E, BE, LE, _W	350 Ω ±0.3 %
1-XA11S2.8/350_E						350 Ω ±0.3 %
1-XU11K2.8/1K0_E		K-XU1x[4]x[5]2.8/1K0x[8]	1 = Steel 3 = Aluminum	A, C, E, G, I, K, M, O, Q, S	_E, BE, LE, _W	1,000 Ω ±0.3 %
1-XU11S2.8/1K0_E						1,000 Ω ±0.3 %

Double shear strain gauges: 2 mm *(0.079 inch)*, 350 ohms

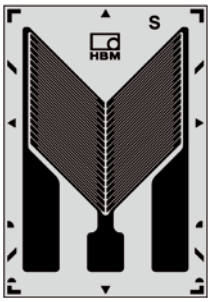


Original size

Dimensions in mm and inch			
Measuring grid length	Measuring grid width	Total length	Total width
2.0 mm	1.8 mm	7.5 mm	6.3 mm
0.079 inch	0.071 inch	0.295 inch	0.248 inch

Preferred types		Variants	Option 4)	Option 5)	Option 8)	
Steel	Aluminum	Other	Temperature resp. matched to	Creep adjustment	Option	Nominal resistance
1-XA31K2/350_E		K-XA3x[4]x[5]2/350xx[8]	1 = Steel 3 = Aluminum	A, C, E, G, I, K, M, O, Q, S	_E, BE, LE, _W	350 Ω ±0.3 %
1-XA31S2/350_E						350 Ω ±0.3 %
1-XU31K2/350_E		K-XU3x[4]x[5]2/350xx[8]	1 = Steel 3 = Aluminum	A, C, E, G, I, K, M, O, Q, S	_E, BE, LE, _W	350 Ω ±0.3 %
1-XU31S2/350_E						350 Ω ±0.3 %

Double shear strain gauges: 3.2 mm *(0.126 inch)*, 350 and 1,000 ohms



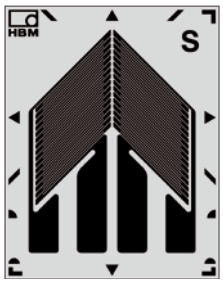
Original size

The 1,000 ohms version has a slightly wider measuring grid; however, the external dimensions are as shown.

Dimensions in mm and inch			
Measuring grid length	Measuring grid width	Total length	Total width
3.2 mm	3.1 mm	11.2 mm	7.8 mm
0.126 inch	0.122 inch	0.441 inch	0.307 inch

Preferred types		Variants	Option 4)	Option 5)	Option 8)	
Steel	Aluminum	Other	Temperature resp. matched to	Creep adjustment	Option	Nominal resistance
1-XA71K3.2/350_E		K-XA7x[4]x[5]3.2/350xx[8]	1 = Steel 3 = Aluminum	A, C, E, G, I, K, M, O, Q, S	_E, BE, LE, _W	350 Ω ±0.3 %
1-XA71S3.2/350_E						350 Ω ±0.3 %
1-XA71K3.2/1K0_E		K-XA7x[4]x[5]3.2/1K0xx[8]	1 = Steel 3 = Aluminum	A, C, E, G, I, K, M, O, Q, S	_E, BE, LE, _W	1,000 Ω ±0.3 %
1-XA71S3.2/1K0_E						1,000 Ω ±0.3 %

Double shear strain gauges: 3.2 mm *(0.126 inch)*, 350 and 1,000 ohms



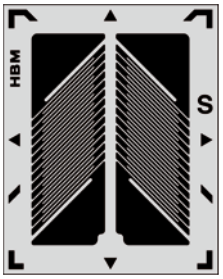
Original size

The 1,000 ohms version has a slightly wider measuring grid; however, the external dimensions are as shown.

Dimensions in mm and inch			
Measuring grid length	Measuring grid width	Total length	Total width
3.2 mm	2.7 mm	10.2 mm	7.9 mm
0.126 inch	0.106 inch	0.402 inch	0.311 inch

Preferred types		Variants	Option 4)	Option 5)	Option 8)	
Steel	Aluminum	Other	Temperature resp. matched to	Creep adjustment	Option	Nominal resistance
1-XA31K3.2/350_E		K-XA3x[4]x[5]3.2/350xx[8]	1 = Steel 3 = Aluminum	A, C, E, G, I, K, M, O, Q, S	_E, BE, LE, _W	350 Ω ±0.3 %
1-XA31S3.2/350_E						350 Ω ±0.3 %
1-XA31K3.2/1K0_E		K-XA3x[4]x[5]3.2/1K0xx[8]	1 = Steel 3 = Aluminum	A, C, E, G, I, K, M, O, Q, S	_E, BE, LE, _W	1,000 Ω ±0.3 %
1-XA31S3.2/1K0_E						1,000 Ω ±0.3 %

Double shear strain gauges: 2 mm *(0.079 inch)*, 350 and 1,000 ohms

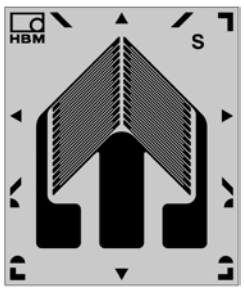


Original size

Dimensions in mm and inch			
Measuring grid length	Measuring grid width	Total length	Total width
2.0 mm	2.3 mm	7.3 mm	5.8 mm
0.079 inch	0.091 inch	0.287 inch	0.228 inch

Preferred types		Variants	Option 4)	Option 5)	Option 8)	
Steel	Aluminum	Other	Temperature resp. matched to	Creep adjustment	Option	Nominal resistance
1-XU11K2/350_W		K-XU1x[4]x[5]2/350_W[8]	1 = Steel 3 = Aluminum	A, C, E, G, I, K, M, O, Q, S	_W	350 Ω ±0.3 %
1-XU11S2/350_W						350 Ω ±0.3 %
1-XU11K2/1K0_W		K-XU1x[4]x[5]2/1K0_W[8]	1 = Steel 3 = Aluminum	A, C, E, G, I, K, M, O, Q, S	_W	1,000 Ω ±0.3 %
1-XU11S2/1K0_W						1,000 Ω ±0.3 %

Double shear strain gauges: 2 mm *(0.079 inch)*, 350 ohms

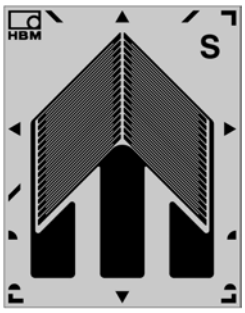


Original size

Dimensions in mm and inch			
Measuring grid length	Measuring grid width	Total length	Total width
2.0 mm	1.8 mm	7.5 mm	6.3 mm
0.079 inch	0.071 inch	0.295 inch	0.248 inch

Preferred types		Variants	Option 4)	Option 5)	Option 8)	
Steel	Aluminum	Other	Temperature resp. matched to	Creep adjustment	Option	Nominal resistance
1-XA41K2/350_E		K-XA4x[4]x[5]2/350xx[8]	1 = Steel 3 = Aluminum	A, C, E, G, I, K, M, O, Q, S	_E, BE, LE, _W	350 Ω ±0.3 %
1-XA41S2/350_E						350 Ω ±0.3 %

Double shear strain gauges: 3.2 mm *(0.126 inch)*, 350 and 1,000 ohms



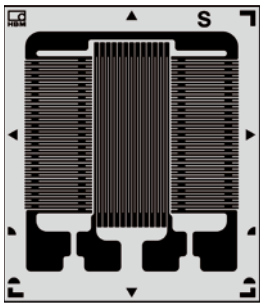
Original size

The 1,000 ohms version has a slightly wider measuring grid; however, the external dimensions are as shown.

Dimensions in mm and inch			
Measuring grid length	Measuring grid width	Total length	Total width
3.2 mm	2.7 mm	10.2 mm	7.9 mm
0.126 inch	0.106 inch	0.402 inch	0.311 inch

Preferred types		Variants	Option 4)	Option 5)	Option 8)	
Steel	Aluminum	Other	Temperature resp. matched to	Creep adjustment	Option	Nominal resistance
1-XA41K3.2/350_E		K-XA4x[4]x[5]3.2/350xx[8]	1 = Steel 3 = Aluminum	A, C, E, G, I, K, M, O, Q, S	_E, BE, LE, _W	350 Ω ±0.3 %
1-XA41S3.2/350_E						350 Ω ±0.3 %
1-XA41K3.2/1K0_E		K-XA4x[4]x[5]3.2/1K0xx[8]	1 = Steel 3 = Aluminum	A, C, E, G, I, K, M, O, Q, S	_E, BE, LE, _W	1,000 Ω ±0.3 %
1-XA41S3.2/1K0_E						1,000 Ω ±0.3 %

Columnar strain gauges: 5.1 mm *(0.201 inch)*, 350 and 1,000 ohms



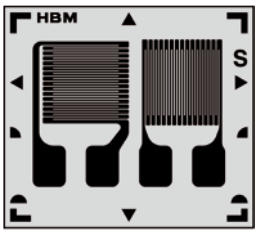
Original size

The 1,000 ohms version has a slightly smaller measuring grid; however, the external dimensions are as shown.

Dimensions in mm and inch			
Measuring grid length 1 and 2	Measuring grid width 1 and 2	Total length	Total width
1.3; 5.1 mm	5.1; 2.5 mm	9.7 mm	8.4 mm
0.051; 0.20 inch	0.201; 0.098 inch	0.382 inch	0.311 inch

Preferred types		Variants	Option 4)	Option 5)	Option 8)	
Steel	Aluminum	Other	Temperature resp. matched to	Creep adjustment	Option	Nominal resistance
1-TA31S5.1/350_E		K-TA3x[4]x[5]5.1/350xx[8]	1 = Steel 3 = Aluminum	A, C, E, G, I, K, M, O, Q, S	_E, BE, LE, _W	350 Ω ±0.3 %
1-TU31S5.1/1K0_E		K-TU3x[4]x[5]5.1/1K0xx[8]	1 = Steel 3 = Aluminum	A, C, E, G, I, K, M, O, Q, S	_E, BE, LE, _W	1,000 Ω ±0.3 %

T rosette: 1.6 mm, *(0.063 inch)*, 350 ohms

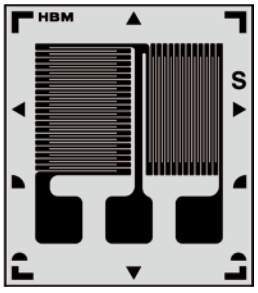


Original size

Dimensions in mm and inch			
Measuring grid length	Measuring grid width	Total length	Total width
1.6 mm	2.0 mm	5.4 mm	6.1 mm
0.063 inch	0.079 inch	0.213 inch	0.240 inch

Preferred types		Variants	Option 4)	Option 5)	Option 8)	
Steel	Aluminum	Other	Temperature resp. matched to	Creep adjustment	Option	Nominal resistance
1-TA11K1.6/350_E		K-TA1x[4]x[5]1.6/350xx[8]	1 = Steel 3 = Aluminum	A, C, E, G, I, K, M, O, Q, S	_E, BE, LE, _W	350 Ω ±0.3 %
1-TA11S1.6/350_E						350 Ω ±0.3 %

T rosette: 1.6 mm *(0.063 inch)*, 350 and 1,000 ohms



Original size

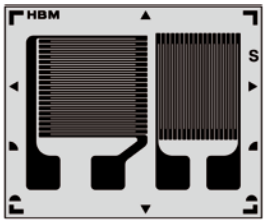
The 1,000 ohms version has a slightly wider and slightly longer measuring grid;
however, the external dimensions are as shown.

Dimensions in mm and inch			
Measuring grid length 1 and 2	Measuring grid width 1 and 2	Total length	Total width
1.6 mm; 2.5 mm	3.1 mm; 1.8 mm	6.6 mm	5.8 mm
0.063 inch; 0.098 inch	0.122 inch; 0.071 inch	0.260 inch	0.228 inch

Preferred types		Variants	Option 4)	Option 5)	Option 8)	
Steel	Aluminum	Other	Temperature resp. matched to	Creep adjustment	Option	Nominal resistance
1-TA21K1.6/350_E		K-TA2x[4]x[5]1.6/350xx[8]	1 = Steel 3 = Aluminum	A, C, E, G, I, K, M, O, Q, S	_E, BE, LE, _W	350 Ω ±0.3 %
1-TA21S1.6/350_E						350 Ω ±0.3 %
1-TU21K1.6/1K0_E		K-TU2x[4]x[5]1.6/1K0xx[8]	1 = Steel 3 = Aluminum	A, C, E, G, I, K, M, O, Q, S	_E, BE, LE, _W	1,000 Ω ±0.3 %
1-TU21S1.6/1K0_E						1,000 Ω ±0.3 %

T rosette: 3 mm *(0.118 inch)*, 350 and 1,000 ohms

The 1,000 ohms version has a slightly wider longitudinal grid and a slightly smaller transverse grid;
however, the external dimensions are as shown.



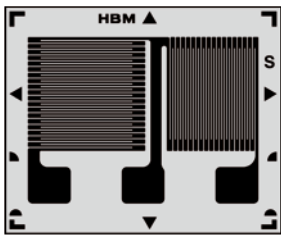
Original size

Dimensions in mm and inch			
Measuring grid length	Measuring grid width 1 and 2	Total length	Total width
3.0 mm	3.0 mm; 3.6 mm	7.5 mm	9.1 mm
0.118 inch	0.118 inch; 0.142 inch	0.295 inch	0.358 inch

Preferred types		Variants	Option 4)	Option 5)	Option 8)	
Steel	Aluminum	Other	Temperature resp. matched to	Creep adjustment	Option	Nominal resistance
1-TA11K3/350_E		K-TA1x[4]x[5]3/350xx[8]	1 = Steel 3 = Aluminum	A, C, E, G, I, K, M, O, Q, S	_E, BE, LE, _W	350 Ω ±0.3 %
1-TA11S3/350_E						350 Ω ±0.3 %
1-TA11K3/1K0_E		K-TA1x[4]x[5]3/1K0xx[8]	1 = Steel 3 = Aluminum	A, C, E, G, I, K, M, O, Q, S	_E, BE, LE, _W	1,000 Ω ±0.3 %
1-TA11S3/1K0_E						1,000 Ω ±0.3 %

T rosette: 3 mm *(0.118 inch)*, 350 and 1,000 ohms

The 1,000 ohms version has a slightly wider longitudinal grid and a slightly smaller transverse grid;
however, the external dimensions are as shown.

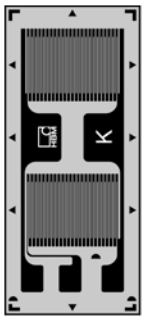


Original size

Dimensions in mm and inch			
Measuring grid length	Measuring grid width 1 and 2	Total length	Total width
3.0 mm	3.0 mm; 3.8 mm	7.5 mm	9.1 mm
0.118 inch	0.118 inch; 0.150 inch	0.295 inch	0.358 inch

Preferred types		Variants	Option 4)	Option 5)	Option 8)	
Steel	Aluminum	Other	Temperature resp. matched to	Creep adjustment	Option	Nominal resistance
1-TA21K3/350_E		K-TA2x[4]x[5]3/350xx[8]	1 = Steel 3 = Aluminum	A, C, E, G, I, K, M, O, Q, S	_E, BE, LE, _W	350 Ω ±0.3 %
1-TA21S3/350_E						350 Ω ±0.3 %
1-TA21K3/1K0_E		K-TA2x[4]x[5]3/1K0xx[8]	1 = Steel 3 = Aluminum	A, C, E, G, I, K, M, O, Q, S	_E, BE, LE, _W	1,000 Ω ±0.3 %
1-TA21S3/1K0_E						1,000 Ω ±0.3 %

Half bridge strain gauges: 2.5 mm *(0.098 inch)*, 1,000 ohms, Measuring grid spacing* 6.5 mm



Original size

* Distance between the centers of both measuring grids

Dimensions in mm and inch			
Measuring grid length	Measuring grid width	Total length	Total width
2.5 mm	4.1 mm	13.8 mm	6.0 mm
0.098 inch	0.161 inch	0.543 inch	0.236 inch

Preferred types		Variants	Option 4)	Option 5)	Option 8)	
Steel	Aluminum	Other	Temperature resp. matched to	Creep adjustment	Option	Nominal resistance
1-DU31K2.5/1K0_E	1-DU33K2.5/1K0_E	K-DU3x[4]x[5]2.5/1K0xx[8]	1 = Steel 3 = Aluminum	A, C, E, G, I, K, M, O, Q, S	_E, BE, LE, _W	1,000 Ω ±0.3 %

Half bridge strain gauges: 3.2 mm *(0.126 inch)*, 1,000 ohms, Measuring grid spacing* 13.2 mm

Original size

* Distance between the centers of both measuring grids

Dimensions in mm and inch			
Measuring grid length	Measuring grid width	Total length	Total width
3.2 mm	4.2 mm	19.0 mm	5.8 mm
0.126 inch	0.165 inch	0.748 inch	0.228 inch

Preferred types		Variants	Option 4)	Option 5)	Option 8)	
Steel	Aluminum	Other	Temperature resp. matched to	Creep adjustment	Option	Nominal resistance
1-DA51K3.2/1K0_E	1-DA53K3.2/1K0_E	K-DA5x[4]x[5]3.2/1K0xx[8]	1 = Steel 3 = Aluminum	A, C, E, G, I, K, M, O, Q, S	_E, BE, LE, _W	1,000 Ω ±0.3 %

Half bridge strain gauges: 2.2 mm *(0.087 inch)*, 350 ohms, Measuring grid spacing* 6.7 mm

Original size

* Distance between the centers of both measuring grids

Dimensions in mm and inch			
Measuring grid length	Measuring grid width	Total length	Total width
2.2 mm	3.0 mm	11.5 mm	4.4 mm
0.087 inch	0.118 inch	0.453 inch	0.173 inch

Preferred types		Variants	Option 4)	Option 5)	Option 8)	
Steel	Aluminum	Other	Temperature resp. matched to	Creep adjustment	Option	Nominal resistance
1-DA61K2.2/350_E	1-DA63K2.2/350_E	K-DA6x[4]x[5]2.2/350xx[8]	1 = Steel 3 = Aluminum	A, C, E, G, I, K, M, O, Q, S	_E, BE, LE, _W	350 Ω ±0.3 %

Half bridge strain gauges: 3.2 mm *(0.126 inch)*, 350 ohms, Measuring grid spacing* 10.5 mm

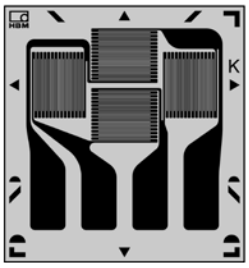
Original size

* Distance between the centers of both measuring grids

Dimensions in mm and inch			
Measuring grid length	Measuring grid width	Total length	Total width
3.2 mm	2.5 mm	16.5 mm	4.1 mm
0.126 inch	0.098 inch	0.650 inch	0.161 inch

Preferred types		Variants	Option 4)	Option 5)	Option 8)	
Steel	Aluminum	Other	Temperature resp. matched to	Creep adjustment	Option	Nominal resistance
1-DA51K3.2/350_E	1-DA53K3.2/350_E	K-DA5x[4]x[5]3.2/350xx[8]	1 = Steel 3 = Aluminum	A, C, E, G, I, K, M, O, Q, S	_E, BE, LE, _W	350 Ω ±0.3 %

Full bridge strain gauges: 1.6 mm *(0.063 inch)*, 350 ohms



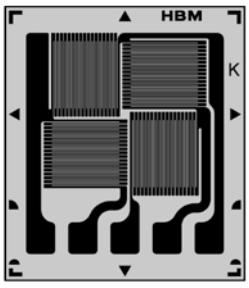
Original size

Bridge output adjusted to ±0.5 mV/V

Dimensions in mm and inch			
Measuring grid length	Measuring grid width	Total length	Total width
1.6 mm	1.7 mm	8.0 mm	7.5 mm
0.063 inch	0.067 inch	0.315 inch	0.295 inch

Preferred types		Variants	Option 4)	Option 5)	Option 8)	
Steel	Aluminum	Other	Temperature resp. matched to	Creep adjustment	Option	Nominal resistance
1-VA71K1.6/350_E	1-VA73K1.6/350_E	K-VA7x[4]x[5]1.6/350xx[8]	1 = Steel 3 = Aluminum	A, C, E, G, I, K, M, O, Q, S	_E, BE, LE, _W	350 Ω ±15 %

Full bridge strain gauges: 2.5 mm *(0.098 inch)*, 350 and 1,000 ohms

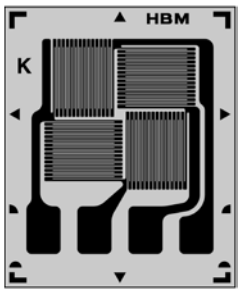


Original size

Dimensions in mm and inch			
Measuring grid length	Measuring grid width	Total length	Total width
2.5 mm	2.6 mm	10.4 mm	9.1 mm
0.098 inch	0.102 inch	0.409 inch	0.358 inch

Preferred types		Variants	Option 4)	Option 5)	Option 8)	
Steel	Aluminum	Other	Temperature resp. matched to	Creep adjustment	Option	Nominal resistance
1-VA61K2.5/350_E	1-VA63K2.5/350_E	K-VA6x[4]x[5]2.5/350xx[8]	1 = Steel 3 = Aluminum	A, C, E, G, I, K, M, O, Q, S	_E, BE, LE, _W	350 Ω ±0.3 %
1-VU61K2.5/1K0_E	1-VU63K2.5/1K0_E	K-VU6x[4]x[5]2.5/1K0xx[8]	1 = Steel 3 = Aluminum	A, C, E, G, I, K, M, O, Q, S	_E, BE, LE, _W	1,000 Ω ±0.3 %

Full bridge strain gauges: 1.8 mm *(0.071 inch)*, 350 ohms



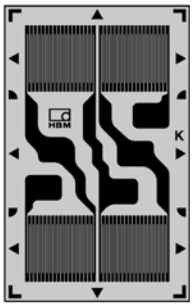
Original size

Bridge output adjusted to ±0.5 mV/V

Dimensions in mm and inch			
Measuring grid length	Measuring grid width	Total length	Total width
1.8 mm	1.8 mm	8.3 mm	6.8 mm
0.071 inch	0.071 inch	0.327 inch	0.268 inch

Preferred types		Variants	Option 4)	Option 5)	Option 8)	
Steel	Aluminum	Other	Temperature resp. matched to	Creep adjustment	Option	Nominal resistance
1-VA51K1.8/350_E	1-VA53K1.8/350_E	K-VA5x[4]x[5]1.8/350xx[8]	1 = Steel 3 = Aluminum	A, C, E, G, I, K, M, O, Q, S	_E, BE, LE, _W	350 Ω ±15 %
1-VA51K1.8/1K0_E	1-VA53K1.8/1K0_E	K-VA5x[4]x[5]1.8/1K0xx[8]	1 = Steel 3 = Aluminum	A, C, E, G, I, K, M, O, Q, S	_E, BE, LE, _W	1,000 Ω ±15 %

Full bridge strain gauges: 1.9 mm *(0.075 inch)*, 350 ohms, Measuring grid spacing* 7.5 mm



Original size

* Distance between the centers of both measuring grids

Dimensions in mm and inch			
Measuring grid length	Measuring grid width	Total length	Total width
1.9 mm	2.8 mm	11.7 mm	7.3 mm
0.075 inch	0.110 inch	0.461 inch	0.287 inch

Preferred types		Variants	Option 4)	Option 5)	Option 8)	
Steel	Aluminum	Other	Temperature resp. matched to	Creep adjustment	Option	Nominal resistance
1-VA31K1.9/350_E	1-VA33K1.9/350_E	K-VA3x[4]x[5]1.9/350xx[8]	1 = Steel 3 = Aluminum	A, C, E, G, I, K, M, O, Q, S	_E, BE, _W	350 Ω ±0.3 %

Full bridge strain gauges: 3 mm *(0.118 inch)*, 350, 1,000 ohms, Measuring grid spacing* 10.3 mm

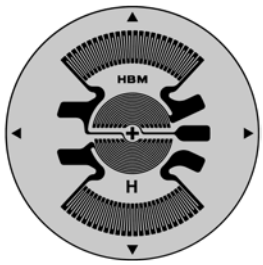
Original size

* Distance between the centers of both measuring grids
Bridge output adjusted to ±0.5 mV/V
The 1,000 ohms version has a slightly wider measuring grid; however, the external dimensions are as shown.

Dimensions in mm and inch			
Measuring grid length	Measuring grid width	Total length	Total width
3.0 mm	2.1 mm	17.8 mm	7.0 mm
0.118 inch	0.083 inch	0.701 inch	0.276 inch

Preferred types		Variants	Option 4)	Option 5)	Option 8)	
Steel	Aluminum	Other	Temperature resp. matched to	Creep adjustment	Option	Nominal resistance
1-VA21K3/350_E	1-VA23K3/350_E	K-VA2x[4]x[5]3/350xx[8]	1 = Steel 3 = Aluminum	A, C, E, G, I, K, M, O, Q, S	_E, BE, LE, _W	350 Ω ±15 %
1-VU21K3/1K0_E	1-VU23K3/1K0_E	K-VU2x[4]x[5]3/1K0xx[8]	1 = Steel 3 = Aluminum	A, C, E, G, I, K, M, O, Q, S	_E, BE, LE, _W	1,000 Ω ±15 %

Membrane rosette: 6.5 mm *(0.256 inch)*, 350 ohms

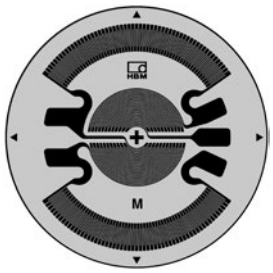


Original size

Dimensions in mm and inch	
Measuring grid diameter	Diameter measuring grid carrier
6.5 mm	8.0 mm
0.256 inch	0.315 inch

Preferred types		Variants	Option 4)	Option 5)	Option 8)	
Steel	Aluminum	Other	Temperature resp. matched to	Creep adjustment	Option	Nominal resistance
1-MU11H6.5/350_W		K-MU1x[4]H6.5/350xx[8]	1 = Steel 3 = Aluminum	H	LE, _W	350 Ω ±0.3 %
1-MU11H6.5/350LE						350 Ω ±0.3 %

Membrane rosette: 10 mm *(0.394 inch)*, 350 and 1,000 ohms

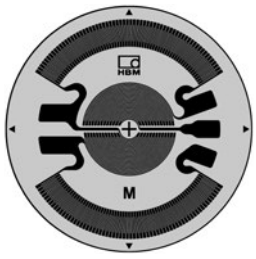


Original size

Dimensions in mm and inch	
Measuring grid diameter	Diameter measuring grid carrier
10.0 mm	11.5 mm
0.394 inch	0.452 inch

Preferred types		Variants	Option 4)	Option 5)	Option 8)	
Steel	Aluminum	Other	Temperature resp. matched to	Creep adjustment	Option	Nominal resistance
1-MA11M10/350_W		K-MA1x[4]M10/350xx[8]	1 = Steel 3 = Aluminum	M	LE, _W	350 Ω ±0.3 %
1-MA11M10/350LE						350 Ω ±0.3 %
1-MU11M10/1K0_W		K-MU1x[4]M10/1K0xx[8]	1 = Steel 3 = Aluminum	M	LE, _W	1,000 Ω ±0.3 %
1-MU11M10/1K0LE						1,000 Ω ±0.3 %

Membrane rosette: 15 mm *(0.591 inch)*, 350 and 1,000 ohms



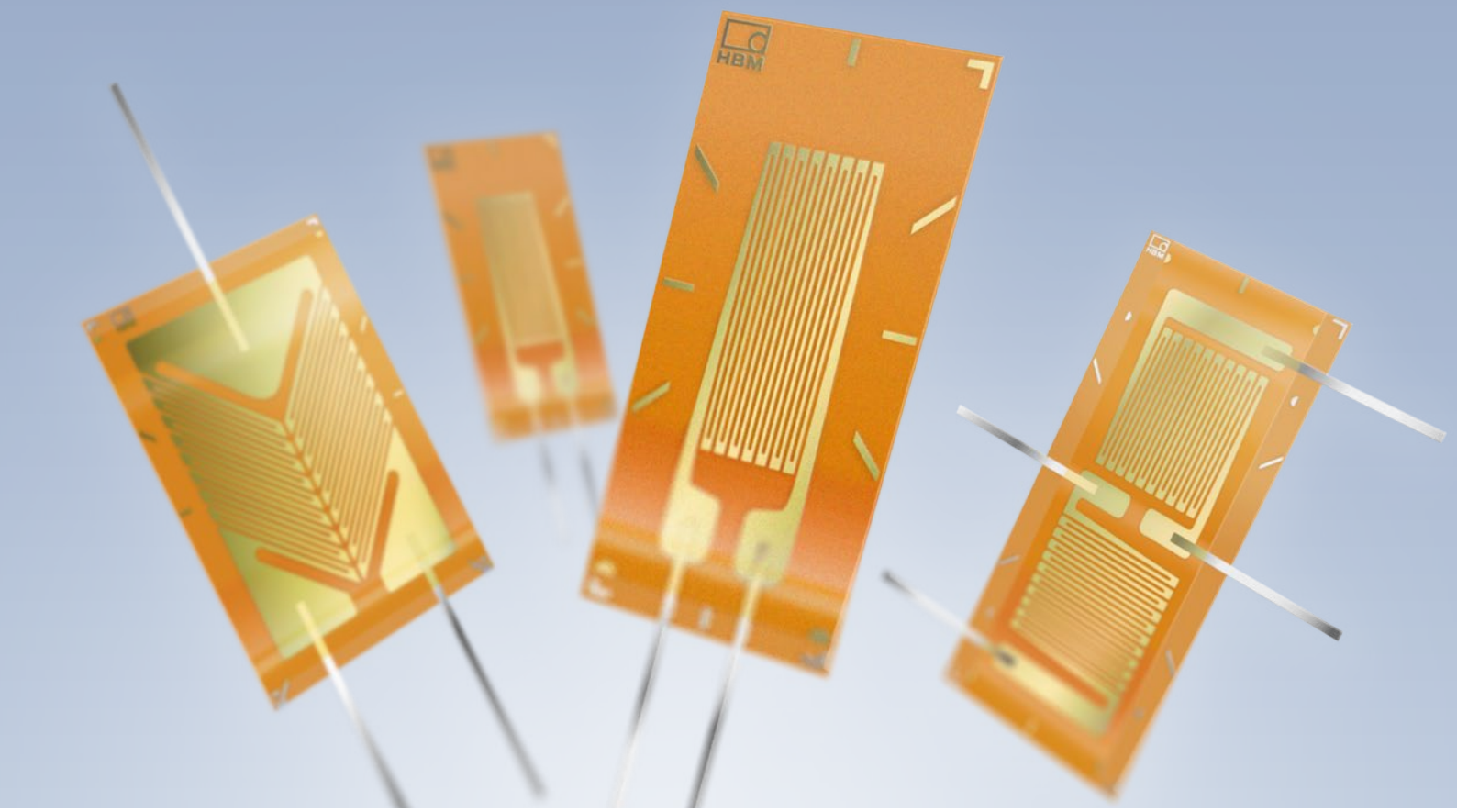
Original size

Dimensions in mm and inch	
Measuring grid diameter	Diameter measuring grid carrier
15.0 mm	16.7 mm
0.591 inch	0.657 inch

Preferred types		Variants	Option 4)	Option 5)	Option 8)	
Steel	Aluminum	Other	Temperature resp. matched to	Creep adjustment	Option	Nominal resistance
1-MA11M15/350_W		K-MA1x[4]M15/350xx[8]	1 = Steel 3 = Aluminum	M	LE, _W	350 Ω ±0.3 %
1-MA11M15/350LE						350 Ω ±0.3 %
1-MA11M15/1K0_W		K-MA1x[4]M15/350xx[8]	1 = Steel 3 = Aluminum	M	LE, _W	1,000 Ω ±0.3 %
1-MA11M15/1K0LE						1,000 Ω ±0.3 %

Strain gauges – G series

- Long service life, especially at high temperatures.
- Nominal resistance 120 Ω and 350 Ω available
- Leads: fitted as standard



Specifications – G series

SG construction		Foil SG with embedded measuring grid
Measuring grid		
Material		Constantan foil
Thickness	µm	3.8 or 5, depending on SG type
Carrier		
Material		Phenolic resin, glass-fiber reinforced
Thickness	µm	35 ± 10
Covering agent		
Material		Phenolic resin, glass-fiber reinforced
Total thickness SG	µm	65 ± 15
Connections		Nickel-plated copper leads, 0.2 or 0.3 x 0.06 x 30 mm
Nominal resistance	Ω	120 or 350, depending on SG type
Resistance tolerance(1)	%	± 0.35
Gauge factor		approx. 2
Nominal (rated) value of the gauge factor		Specified on each package
Gauge factor tolerance for measuring grid length of 0.6 mm and 1.5 mm	%	± 1.5
with measuring grid length of ≧ 3 mm	%	± 0.7
Temperature coefficient of the gauge factor	1/K	approx. (115 ± 10) · 10^{-6}
Nominal (rated) value of the temperature coefficient of the gauge factor		Specified on each package
Reference temperature	°C	23
Application temperature range		
for static, i.e. zero-point related measurements	°C	-70 … +200
for dynamic, i.e. non zero-point related measurements	°C	-200 … +200
Transverse sensitivity		Specified on each package
at reference temperature using adhesive Z 70		
on SG type LG11-6/120	%	+0.1
Temperature response		Specified on each package
Temperature response as required, adapted to coefficients of thermal expansion		
α for ferritic steel	1/K	10.8· 10^{-6}
α for aluminum	1/K	23· 10^{-6}
α for austenitic steel	1/K	16· 10^{-6}
Other adaptation available on request		
Tolerance of temperature response	1/K	± 0.3 · 10^{-6}
Temperature range of temperature response matching	°C	-10 … +120
Mechanical hysteresis(2)		
at reference temperature and strain ε = ± 1,000 µm/m		
on SG type LG11-6/120		
at 1st load cycle and adhesive EP 250	µm/m	0.5
at 3rd load cycle and adhesive EP 250	µm/m	0.5
at 1st load cycle and adhesive X 60	µm/m	3
at 3rd load cycle and adhesive X 60	µm/m	1.5
on SG type LG11-3/350		
at 1st load cycle and adhesive Z 70	µm/m	1.6
at 3rd load cycle and adhesive Z 70	µm/m	0.8
Maximum elongation(2)		
at reference temperature using adhesive Z 70		
on SG type LG11-6/120		
Absolute strain value ε for positive direction	µm/m	20,000 (≙ 2 %)
Absolute strain value ε for negative direction	µm/m	50,000 (≙ 5 %)
Fatigue life(2)		
at reference temperature using adhesive Z 70		
on SG type LG11-6/120		
Achievable number of load cycles L_w with		
alternating strain ε_w = ± 1,000 µm/m and		
variation of zero point $\varepsilon_m \Delta \leqq$ 300 µm/m		>> 10^7
$\varepsilon_m \Delta \leqq$ 30 µm/m		3 · 10^6
on SG type LG11-6/350		
$\varepsilon_m \Delta \leqq$ 300 µm/m		>> 10^7
$\varepsilon_m \Delta \leqq$ 30 µm/m		3 · 10^6
Minimum radius of curvature, longitudinal and transverse, at reference temperature	mm	3
Applicable bonding materials		
Cold curing adhesives		Z 70; X 60; X 280
Hot curing adhesives		EP 150; EP 310N

(1) With measuring grid lengths of 0.6 mm, the nominal resistance may deviate by ± 1 %
(2) The data depend on the various parameters of the specific installation and are therefore stated for representative examples only.

G series

with one measuring grid, with two measuring grids

LG11

Linear strain gauge
Temperature response matched to steel
with a = 10.8 · 10^{-6}/K

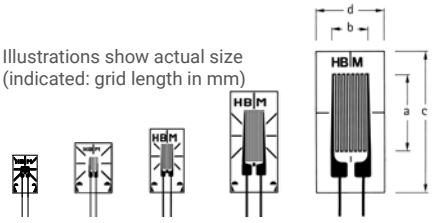
LG13

Temperature response matched to aluminum
with a = 23 · 10^{-6}/K

LG1x

Temperature response matched to customer's choice
see page 16

Illustrations show actual size
(indicated: grid length in mm)



0.6 1.5 3 6 10

Contents per package: 10 pcs.

Types available from stock		Variants	Noml. resistance	Dimensions (mm)				Maximum excitation voltage (*)	Sldr. terminals
				Measuring grid		Meas. grid carrier			
Steel	Aluminum	Other	Ω	a	b	c	d	V	
		1-LG1x-0.6/120(#)	120	0.6	1	5	3.2	1.5	LS 7
		1-LG1x-1.5/120	120	1.5	1.2	6.5	4.7	2.5	LS 7
1-LG11-3/120		1-LG1x-3/120	120	3	1.6	8.5	4.5	4	LS 7
1-LG11-6/120		1-LG1x-6/120	120	6	2.8	13	6	8	LS 5
1-LG11-10/120		1-LG1x-10/120	120	10	4.6	18.5	9.5	13	LS 5
1-LG11-3/350		1-LG1x-3/350	350	3	1.6	8.5	4.5	7	LS 7
1-LG11-6/350	1-LG13-6/350	1-LG1x-6/350	350	6	2.8	13	6	13	LS 5
1-LG11-10/350		1-LG1x-10/350	350	10	5	18.5	9.5	23	LS 5

(*) Maximum excitation voltage for ferritic steel. For other temperature response matchings, the corresponding value is printed on the data sheet included with delivery.
(#) Only available with temperature response matching to ferritic steel, austenitic steel and aluminum

XG11

T rosette
Temperature response matched to steel
with α = 10.8 · 10^{-6}/K

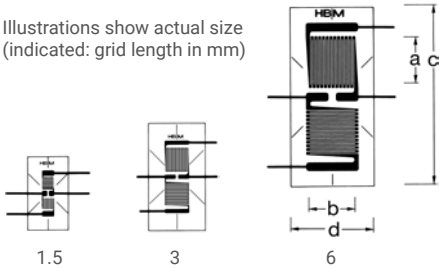
XG13

Temperature response matched to aluminum
with α = 23 · 10^{-6}/K

XG1x

Temperature response matched to customer's choice
see page 16

Illustrations show actual size
(indicated: grid length in mm)



1.5 3 6

Contents per package: 5 pcs.

Types available from stock		Variants	Noml. resistance	Dimensions (mm)				Maximum excitation voltage (*)	Sldr. terminals
				Measuring grid		Meas. grid carrier			
Steel	Aluminum	Other	Ω	a	b	c	d	V	
		1-XG1x-1.5/120	120	1.5	1.5	9	5	3	LS 5
1-XG11-3/120		1-XG1x-3/120	120	3	3.2	14.5	7.5	6	LS 4
1-XG11-6/120		1-XG1x-6/120	120	6	6.5	23.5	11	12	LS 5
1-XG11-3/350	1-XG13-3/350	1-XG1x-3/350	350	3	3.1	14.4	7.3	10	LS 4
1-XG11-6/350		1-XG1x-6/350	350	6	6.3	23.3	10.5	20	LS 5

(*) Maximum excitation voltage for ferritic steel. For other temperature response matchings, the corresponding value is printed on the data sheet included with delivery.

G series

with two measuring grids

XG21

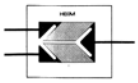
Shear / torsion half bridge
Temperature response matched to steel
with $\alpha = 10.8 \cdot 10^{-6}/K$

XG2x

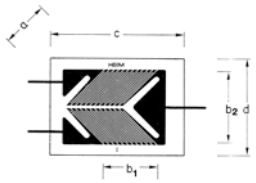
Temperature response matched to customer's choice
see page 16

Illustrations show actual size
(indicated: grid length in mm)

1.5



3



6

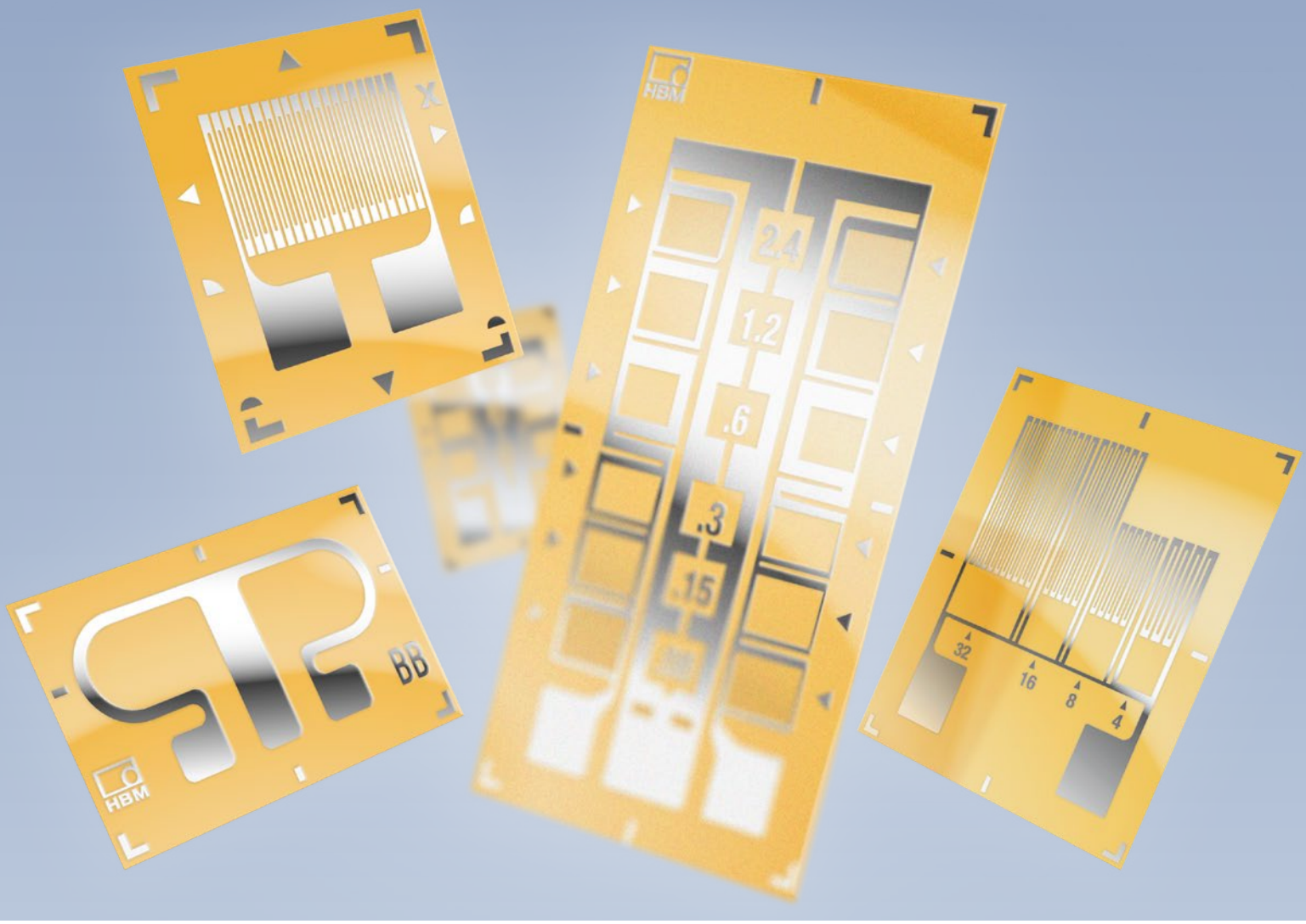
Contents per package: 5 pcs.

Types available from stock		Variants	Noml. resis-tance	Dimensions (mm)					Maximum excitation voltage (*)	Sldr. term-inals
				Measuring grid			Meas. grid carrier			
Steel	Aluminum	Other	Ω	a	b1	b2	c	d	V	
		1-XG2x-1.5/120	120	1.5	1.7	2.5	6.8	4.5	2.5	LS7
		1-XG2x-3/120	120	3	3.7	5.3	11.2	9.5	6	LS5
		1-XG2x-6/120	120	6	7.9	10	17.5	12.7	11	LS4
1-XG21-3/350		1-XG2x-3/350	350	3	4.5	5.3	11.2	9.5	10	LS4
1-XG21-6/350		1-XG2x-6/350	350	6	7.9	10	17.5	12.7	19	LS5

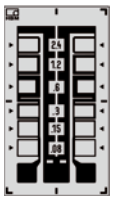
(*) Maximum excitation voltage for ferritic steel. For other temperature response matchings, the corresponding value is printed on the data sheet included with delivery.

Balancing resistors

- Compensation of the Wheatstone bridge circuit's temperature response error (TC0)
- Correction of an imbalance in the Wheatstone bridge circuit (zero balancing)
- Compensation of the transducer sensitivity's temperature dependency (TCS)



Balancing resistor for the zero point 2.4 ohms, 1.2 ohms, 0.6 ohms, 0.3 ohms

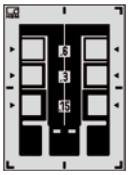


Original size

Dimensions in mm and inch		
Measuring grid width	Total length	Total width
6.0 mm	14.5 mm	8.0 mm
0.236 inch	0.571 inch	0.315 inch

Type	
1-ANA1-6/4.73_W	Adjustable foil resistor for zero point balancing on polyimide carrier with a raw resistance of twice approx. 9 Ω. Each bridge branch can be connected with maximum 4.73 Ω, in steps as follows: 2.4 Ω– 1.2 Ω– 0.6 Ω – 0.3 Ω – 0.15 Ω – 0.08 Ω ±20 %[1)]

Compensating resistors for TCO balancing 0.6 ohms, 0.3 ohms, 0.15 ohms

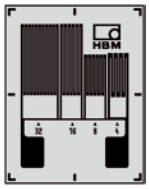


Original size

Dimensions in mm and inch		
Measuring grid width	Total length	Total width
6.0 mm	11.0 mm	8.0 mm
0.236 inch	0.433 inch	0.315 inch

Type	
1-ATN1-3/1.05_W	Adjustable foil resistor for temperature compensation of the zero point (TCO). Nickel foil on polyimide carrier with a raw resistance of twice approx. 0.7 Ω Each bridge branch can be connected with maximum 1.05 Ω, in steps as follows: 0.6 Ω – 0.3 Ω – 0.15 Ω ±20 %1) Temperature coefficient of the resistor: (+20 °C … +70 °C) *(68 °F ... 158 °F)*: 4,9 · 10-3/K *(2.7 . 10-3/°F)*

Compensating resistors for TCS balancing 32 ohms, 16 ohms, 8 ohms, 4 ohms



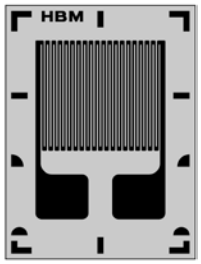
Original size

Dimensions in mm and inch			
Measuring grid length	Measuring grid width	Total length	Total width
4.2 mm	7.0 mm	11.5 mm	9.0 mm
0.165 inch	0.276 inch	0.453 inch	0.354 inch

Type	
1-ATC1-4/60_W	Adjustable foil resistor for temperature compensation of the sensitivity (TCS). Nickel foil on polyimide carrier with a raw resistance of approx. 1 Ω Maximum 60 Ω can be connected, in steps as follows: 32 Ω – 16 Ω – 8 Ω – 4 Ω ±20 %[1)] Temperature coefficient of the resistor: (+20 °C … +70 °C) *(68 °F ... 158 °F)*: 4.9 · 10-3/K *(2.7 . 10-3/°F)*

[1)] *Reference temperature for resistance data: T= 23 °C (73.4 °F)*

Nickel resistors for TCS balancing (temperature coefficient of sensitivity)



Original size

Carrier material: Polyimide

Dimensions in mm and inch			
Measuring grid length	Measuring grid width	Total length	Total width
2.0 ... 2.5 mm	3.2 mm	6.3 mm	4.7 mm
0.079 ... 0.098 inch	0.126 inch	0.248 inch	0.185 inch

Preferred types	Nominal resistance	Variants	Option 8)
1-ATC1-10_E	10 Ω ±0.3 Ω	K-ATC1-10xx[8)]	Option
1-ATC1-12.5_E	12.5 Ω ±0.3 Ω	K-ATC1-12.5xx[8)]	
1-ATC1-15_E	15 Ω ±0.3 Ω	K-ATC1-15xx[8)]	_E, BE, LE, _W
1-ATC1-17.5_E	17.5 Ω ±0.3 Ω	K-ATC1-17.5xx[8)]	
1-ATC1-20_E	20 Ω ±0.3 Ω	K-ATC1-20xx[8)]	
1-ATC1-22.5_E	22.5 Ω ±0.3 Ω	K-ATC1-22.5xx[8)]	
1-ATC1-25_E	25 Ω ±0.3 Ω	K-ATC1-25xx[8)]	
1-ATC1-30_E	30 Ω ±0.3 Ω	K-ATC1-30xx[8)]	
1-ATC1-35_E	35 Ω ±0.4 Ω	K-ATC1-35xx[8)]	
1-ATC1-40_E	40 Ω ±0.4 Ω	K-ATC1-40xx[8)]	
1-ATC1-50_E	50 Ω ±0.5 Ω	K-ATC1-50xx[8)]	
1-ATC1-60_E	60 Ω ±0.6 Ω	K-ATC1-60xx[8)]	
1-ATC1-70_E	70 Ω ±0.7 Ω	K-ATC1-70xx[8)]	

Balancing and compensating resistors for the zero point and TC0 balancing

Original size

Carrier material: Polyimide

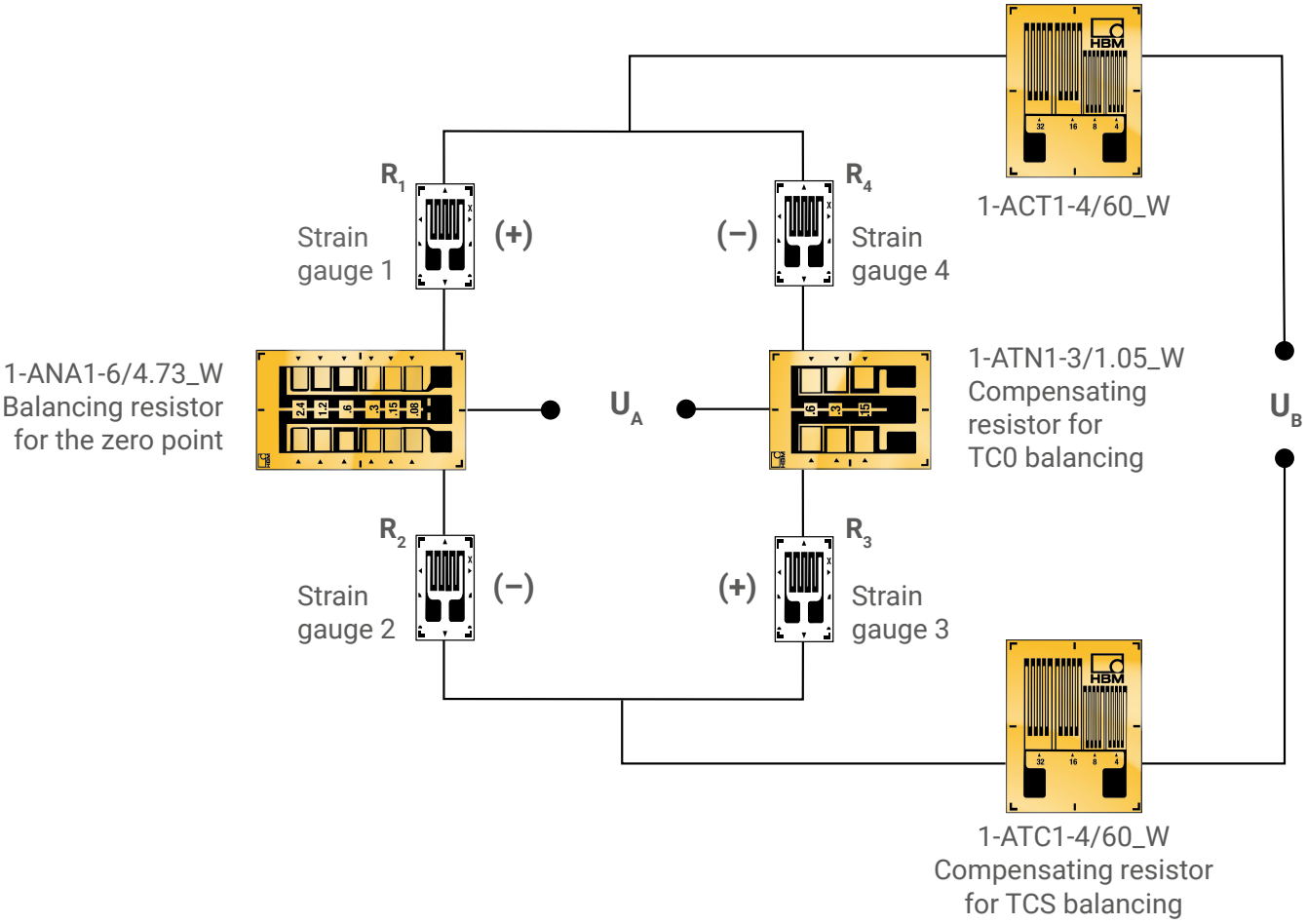
[1)] Balancing resistor for the zero point
[2)] Compensating resistor for TCO balancing (Temperature coefficient of zero point)

Dimensions in mm and inch	
Total length	Total width
5.6 mm	8.9 mm
0.220 inch	0.350 inch

Preferred types	Resistance	Maximum balancing range[3)]
1-ANA-1/0.4_W [1)]	2.5 Ω ±20 % + max 0.4 Ω	0.4 Ω
1-ANA-1/1.0_W [1)]	6 Ω ±20 % + max 1.0 Ω	1.0 Ω
1-ATN-1/0.2_W [2)]	1 Ω ±20 % + max 0.2 Ω	0.2 Ω

[3)] *Per bridge branch*

Typical circuits for balancing and compensating resistors in an strain gauge full bridge



Bonding materials

The most common way in which strain gauges are attached to the test object is by bonding. It is prerequisite to use application-specific adhesives that meet the following requirements:

- Virtually lossless transfer of deformation of the test object to the strain gauges
- Stable behavior across as wide a temperature and strain range as possible
- The strain gauge and test object must not be chemically attacked
- Appropriate and reproducible relaxation behavior.

Adhesives available from HBM

Adhesive	Description	Pot life at room temperature (RT)	Storage life dry	Curing temperature
EP 150 Order no.: 1-EP150	Single-component epoxy resin adhesive, low viscosity	-	12 months when stored in refrigerator	160 °C ... 190 °C *(320 °F ... 374 °F)*
X 280 Order no.: 1-X 280	Two-component epoxy resin adhesive, for smooth and absorbent surfaces	30 minutes	6 months when stored in refrigerator	Room temperature ... 95°C *(203°F)*
EP 310 N Order no.: 1-EP310N	Two-component epoxy resin adhesive, low viscosity	1 month (at room temperature) 6 months (at +2 °C/+36 °F) 12 months (at -32 °C/-26 °F)	6 months	120 °C ... 200 °C *(203 °F ... 401 °F)*
P250 Order no.: 1-P250	Single-component adhesive, low viscosity	-	12 months when stored in refrigerator	160°C (320°F) (post-curing at 180°C [356°F] recommended)

[1] Zero-point based measurement
[2] Non-zero-point based measurement
[3] Curing condition: Relative humidity of 30 - 80 %

P 250 phenolic resin adhesive

EP 310N Epoxy resin adhesive

EP 150 Epoxy resin adhesive

X 280 Epoxy resin adhesive

	Curing time[3]	Contact pressure	Temperature limits			Delivery quantity
			lower	upper static[1]	upper dynamic[2]	
	6 h ...1 h	0.3 ... 0.5 N/mm² *(43 ... 73 lbf/sq. in.)*	−70 °C *(−94 °F)*	+150 °C *(302 °F)*	+ 150 °C *(302 °F)*	2 x 30 ml bottles (EP 150) *(2x1.0 liquid ounce, US)*
	8 h ... 1 h	0.05 ... 2.0 N/mm² *(7 ... 290 lbf/sq. in.)*	−200 °C *(−328 °F)*	+200 °C *(392 °F)*	+280 °C *(536 °F)*	6 double bags at 10 g = 60 g *(6 x 0.35 oz = 2.1 oz)*
	6 h ... 0.5 h	0.1 ... 0.5 N/mm² *(14 ... 73 lbf/sq. in.)*	−270 °C *(−454 °F)*	+260 °C *(500 °F)*	+310 °C *(590 °F)*	Components A = 50 g *(1.76 oz, US)* B = 22 g *(0.77 oz, US)*
	4.5 hours 1 hour (post-curing)	0.1 ... 0.5 N/mm² *(14 ... 73 lbf/sq. in.)*	−196°C *(−320 °F)*	+250°C *(482 °F)*		2 bottles, each 15g ready-to-use

Covering materials

PU 140 Polyurethane paint

NG 150 Nitrile rubber

SG 250 Transparent silicone rubber

Strain gauge covering materials	Temperature range of stability in air	Package contents	Application method	Curing conditions	Storage life at room temperature	Components
NG 150 [1] nitrile rubber Order no.: 1-NG 150	−269 °C ... +150 °C *(-452 °F ... +302 °F)*	3 bottles each with approx. 25 cm^3	Paint on with brush	Air-drying at room temperature	Max. 1 year	Solvent-containing single-component nitrile rubber
SG 250 Transparent silicone rubber Order no.: 1-SG 250	−70 °C ... +250 °C *(-94 °F ... +482 °F)*	Tube with approx. 85 g	Apply from tube	Air-drying at room temperature	6 months	Transparent, solvent-free single-component silicone rubber
PU 140 [1] polyurethane paint Order no.: 1-PU 140	−40 °C ...+140 °C *(-40 °F ... +248 °F)*	3 bottles each with 30 ml	Paint on with brush	Room temperature ... +100 °C *(... 212 °F)*	9 months	Solvent-containing single-component polyurethane paint

[1] Caution: PU 140 and NG 150 cannot be combined

Cleaning agents, materials for gluing and soldering

Cleaning agent RMS1
Environmentally-friendly solvent mixture
Contains 1l cleaning agent and 450 cleaning pads.
Order no.: 1-RMS1

Cleaning agent dispenser RSP120
Protects the solvent from contamination
Order no.: 1-RSP120

Cleaning agent RMS1-SPRAY
Environmentally-friendly solvent mixture
Contains 5 spray cans with 200 ml *(6.67 oz)* cleaning agent each and 450 cleaning pads.
Order no.: 1-RMS1-SPRAY

Fluoropolymer release film
33 m *(108 ft)* Fluoropolymer release film on a roll, suitable for cold and hot-curing strain gauge bonds.
Thickness: 0.05 mm *(0.002 inch)*, width: 60 mm *(2.36 inch)*
Order no.: 1-RELEASEFILM

Polyimide adhesive tape
33 m *(108 ft)* heat-resistant adhesive tape, 19 mm *(0.75 inch)* wide.
Temperature resistant to 270 °C *(518 °F)*
Order no.: 1-KLEBEBAND

Flux pen for resin-cored solder 1-LOT
Soldering aid in felt-tip pen form for small soldering joints.
Suitable for leaded soldering with melting points up to approx. 200 °C *(392 °F)*.
The flux pen contains non-corrosive flux without chloride.
Package contents 5 pieces
Order no.: 1-FS01

Resin-cored solder
Cored solder (contains lead) for strain gauge applications
Diameter: 0.5 mm *(0.02 inch)*; Sn60Pb38Cu2 with resin core type DIN EN 29454-1
Melting range: 183 °C ... 190 °C *(361 °F ... 374 °F)*
Delivery form: 1 kg *(2.2 lb)* on a roll
Order no.: 1-LOT

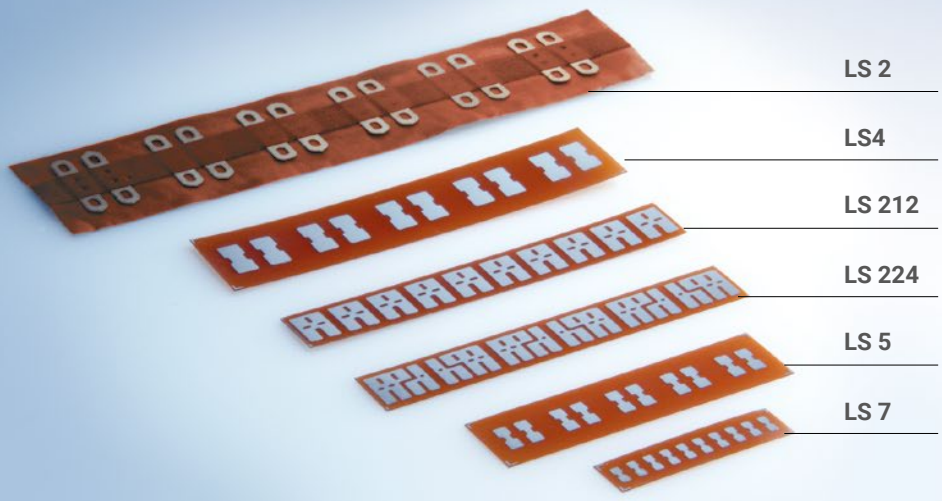
Lead-free solder
Lead-free resin-cored solder for strain gauge applications
Diameter: 0.5 mm *(0.02 inch)*; Sn95.5Ag3.8Cu0.7 ("no clean")
Melting range: 217 °C ... 219 °C *(423 °F ... 426 °F)*
Delivery form: 500 g *(17.637 oz)* on a roll
Order no.: 1-LOT-LF

RSP120 Cleaning agent dispenser

RMS1-SPRAY Cleaning agent

FS01 Flux pen for resin-cored solder

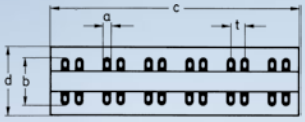
Solder terminals



For strain gauges with leads or wires, solder terminals should be installed between the connection cables and the strain gauge itself. This will facilitate the execution of a perfect solder joint and provide strain relief for the SG connections . The solder terminals are installed in the same way on the measurement object as on the SG and all HBM adhesives can be used. HBM offers solder terminals in various versions and dimensions.

LS2

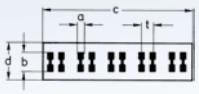
Bronze solder lug, nickel-plated, on polyimide carrier, suitable for dynamic stress Bonding on measurement object: Gluing
Can be used up to 180 °C *(356 °F)*, briefly up to 260 °C *(500 °F)*



Product number	Dimensions (mm)				Spacing	Contents per package
	Solder tag		Carrier			
Steel	a	b	c	d	t	
1-LS 2	2.6	13.5	72	20	4	36 pairs
						(6 strips)

LS7/5/4

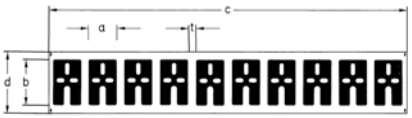
Copper, nickel-plated, on polyimide
Bonding on measurement object: Gluing
Can be used up to 180 °C *(356 °F)*, briefly up to 260 °C *(500 °F)*



Product number	Dimensions (mm)				Spacing	Contents per package
	Solder tag		Carrier			
Steel	a	b	c	d	t	
1-LS 7	1	3	21	6	2	125 pairs
1-LS 5	1.5	4.5	35	10	2.5	125 pairs
1-LS 4	2.5	6.5	50.1	13	4	125 pairs
						(25 strips each)

LS212

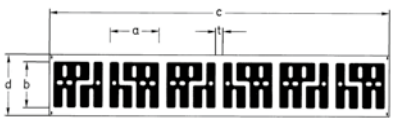
Copper, nickel-plated, on polyimide
Bonding on measurement object: Gluing
Can be used up to 180 °C *(356 °F)*, briefly up to 260 °C *(500 °F)*



Product number	Dimensions (mm)				Spacing	Contents per package
	Solder tag		Carrier			
Steel	a	b	c	d	t	
1-LS 212	3.7	6	47.5	8	1	125 pairs
						(25 strips)

LS224

Copper, nickel-plated, on polyimide
Bonding on measurement object: Gluing
Can be used up to 180 °C *(356 °F)*, briefly up to 260 °C *(500 °F)*



Product number	Dimensions (mm)				Spacing	Contents per package
	Solder tag		Carrier			
Steel	a	b	c	d	t	
1-LS 224	6.5	6	45	8	1	150 pairs
						(25 strips)

Cables and stranded wires

PVC ribbon cable
PVC insulated ribbon cable consisting of six leads each with a cross section of 0.14 mm² *(0.0002 sq. in.),* 50 m *(164 ft)* per reel, resistance 0.131 Ω/m *(0.04 Ω/ft)*.
Order no.: 1-3133.0034

Paint insulated copper wire
Polyurethane-insulated copper wire with a cross section of 0.04 mm² *(6.2 · 10⁻⁵ sq. in.)*, 25 m *(82 ft)* in length.
Order no.: 1-CULD01

Jumper wire
Fluoropolymer-insulated jumper wire with a cross section of 0.05 mm² *(7.75 · 10⁻⁵ sq. in.)* , yellow, 100 m *(328 ft)* per reel, resistance 0.34 Ω/m *(0.104 Ω/ft)*.
Order no.: 1-3130.0239-G

Very flexible stranded wire
For internal, exposed wiring of transducers; cross section of 0.04 mm² *(6.2 · 10⁻⁵ sq. in.)* (multi-wire) and 0.6 mm *(0.024 inch)* outer diameter, resistance 0.417 Ω/m *(0.127 Ω/ft)*, permissible temperature +70 °C *(158 °F)*, 25 m *(82 ft)* per reel, PVC insulation.
Order no. 1-SLI 01

Flexible stranded wire
Fluoropolymer-insulated flexible stranded wire with a cross section of 0.24 mm² *(0.0004 sq. in.)*
(multi-wire) and an outside diameter of 0.9 mm *(0.035 inch)*, 100 m *(328 ft)* per reel, resistance 0.0741 Ω/m *(0.023 Ω/ft)*.
blue Order no.: 1-3301.0092-B
green Order no.: 1-3301.0091-Gr
white Order no.: 1-3301.0094-W
black Order no.: 1-3301.0088-S
red Order no.: 1-3301.0089-R

Designation	Insulation	Thermal resistance	Chemical resistance	Typ. application
Flexible stranded wire 1-3301.0088-S 1-3301.0089-R 1-3301.0091-GR 1-3301.0092-B 1-3301.0094-W	Fluoropolymer	–200 °C ... +260 °C *(-328 °F... +500 °F)*	resistant against nearly all chemicals except elementary fluoride, chlorine trifluoride, molten alkali metals	for internal connection of strain gauge bridges or for contacting from strain gauge through to solder terminal
Jumper wire 1-3130.0239-G	Fluoropolymer	–200 °C ... +260 °C *(-328 °F ... +500 °F)*	see flexible stranded wire	see flexible stranded wire
Very flexible stranded wire 1-SLI 01	PVC	short period 105 °C *(221 °F)* permanent ... 70 °C *(158 °F)*	non resistant against: esters, chlorinated hydrocarbons, ketones, aromatics hydrocarbons, benzene, liquid halogens, nitric acid conc., depending on the softener used, also aqueous solutions	for internal connection of the strain gauges in the transducer
PVC ribbon cable 1-3133.0034	PVC	short period 105 °C *(221 °F)* permanent ... 90 °C *(194 °F)*	see very flexible stranded wire	see very flexible stranded wire
Paint-insulated copper wire 1-CULD 01	Polyurethane	short period 120 °C *(248 °F)* permanent -40 °C ... 80 °C *(-40 °F ... 176 °F)*	non resistant against: strong acids, strong lyes, alcohols, aromatic, hydrocarbons, saturated vapor, hot water	for internal connection of the strain gauges in the transducers

Amplifiers and calibrations

Amplifiers for calibration

Calibration is implemented successfully around the world using HBM precision amplifiers. The DMP41 and ML38B amplifiers bring you to the cutting edge of a long-term metrological development.

The DMP41 with an accuracy class of 0.0005 is the norm as yet unachieved worldwide and sets the standards regarding accuracy in national metrological institutes. The ML38B module, with an accuracy class of 0.0025, in the modular amplifier system MGCplus, offers intelligent additional functions such as e.g. polynomial correction of transducer characteristic curves.

Reference transducers

HBM has a range of various reference transducers for calibration of standard parameters such as force and torque with which you can check the accuracy of your transducers.

Do your reference transducers need calibrating? We carry out calibrations for the parameters force, pressure, torque and voltage ratio mV/V in our accredited DAkkS calibration laboratory.

www.hbm.com/calibration

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