# Strain gage accessories ... Bonding

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

- Loss-free of the transmission deformations of the test object to the strain gages
- Stable behavior across a temperature and strain range which is as wide as possible
- Strain gage and test object must not be chemically attacked
- Appropriate and reproducible relaxation behavior.


*EP 150 Epoxy resin adhesive*

| Adhesive | Description | Pot life at room temperature (RT) | Storage life dry | Curing temperature |
|---|---|---|---|---|
| Z 70<br><br>Order no.: 1-Z70 | Cyanacrylate adhesive, low viscosity | - | 6 months;<br>at -15 °C *(+5 °F)*:<br>at least 2 years | 5 °C [3] *(41 °F)*<br>20 °C *(68 °F)*<br>30 °C *(86 °F)* |
| EP 150 and EP 150 GP<br><br>Order no.: 1-EP150<br>1-EP150-GP | Single-components Epoxy resin adhesive, low viscosity | - | 12 months when stored in refrigerator (7 °C) *(44 °F)* | 160 °C ...190 °C<br>*( 320 °F ... 374 °F)* |
| EP 250<br><br>Order no.: 1-EP250 | Two-component Epoxy resin adhesive, pasty, also for use on absorbent surfaces | 24 h | 1 year | 95 ... 200 °C<br>*(203 °F ... 392 °F)* |
| EP 310 S<br><br>Order no.: 1-EP310S | Two-component Epoxy resin adhesive, low viscosity | 1 month (at RT)<br>6 months (at + 2 °C/ *+36 °F)*<br>12 months (at - 32 °C/ *-26 °F)* | 6 months | 95 ... 205 °C<br>*(203 °F ...401 °F)* |

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

# materials

*Cyanacrylate adhesive*

*EP 310S Epoxy resin adhesive*


*EP 150 -GP*
*Epoxy resin adhesive*

*EP 250 Epoxy resin adhesive*

| Curing time | Contact pressure | Temperature limits | | | Delivery quantity |
|---|---|---|---|---|---|
| | | lower | upper static[1)] | upper dynamic[2)] | |
| 10 minute<br>1 minute<br>0.5 minute | Z70: thumb pressure | – 55 °C<br>*(-67 °F)* | + 100 °C<br>*(212 °F)* | +120 °C<br>*(248 °F)* | 10 ml *(0.34 liquid ounce, US)* |
| 6 h ...1 h | EP150: 0.3... 0.5 N/mm²<br>*(43 ... 73 lbf/sq. in.)* | – 70 °C<br>*(-94 °F)* | + 150 °C<br>*(302 °F)* | + 150 °C<br>*( 302 °F)* | 2 x 30 ml bottles (EP 150)<br>*(2x1.0 liquid ounce, US)*<br>10 x 20 ml bottles (EP 150-GP)<br>*(10x 0.7 liquid ounce, US)* |
| 16 h ... 0.5 h | EP250: 0.1... 1.5 N/mm²<br>*(14 ... 217 lbf/sq. in.)* | – 240 °C<br>*(-400 °F)* | + 250 °C<br>*(428 °F)* | + 315 °C<br>*(599 °F)* | 5 double bags at<br>10.5 g = 52.5 g<br>*(5 x 0.35 oz =1.75 oz)* |
| 5 h ... 0.5 h | EP310S: 0.1... 0.5 N/mm²<br>*(14 ... 73 lbf/sq. in.)* | -270 °C<br>*(-454 °F)* | + 260 °C<br>*(500 °F)* | + 310 °C<br>*(590 °F)* | Components<br>A = 60 ml *(2.0 liquid ounce, US)*<br>B = 30 ml *(1.0 liquid ounce, US)* |

# ...Covering materials




*PU 120 Polyurethane paint*

*NG 150 Nitrile rubber*


*SG 250 Transparent silicone rubber*

| Strain gage 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 |
| 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 120 [1] polyurethane paint Order no.: 1-PU 120 | – 40°C ...+ 120°C *(-40°F...+248°F)* | 3 bottles each with 30 ml | Paint on with brush | Room temperature ... + 100°C *(...212°F)* | 1 year | Solvent-containing single-component polyurethane |

[1] Caution: PU 120 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 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


*Cleaning agent RMS1 SPRAY*

## Teflon foil
33 m *(108 ft)* Teflon foil on a roll, suitable for cold and hot-curing strain gage bonds.
Thickness: 0.05 mm *(0.002 inch)*, width: 60 mm *(2.36 inch)*
Order no.: 1-Teflon

## 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

*Flux pen for resin-cored solder 1-LOT*

## 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

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

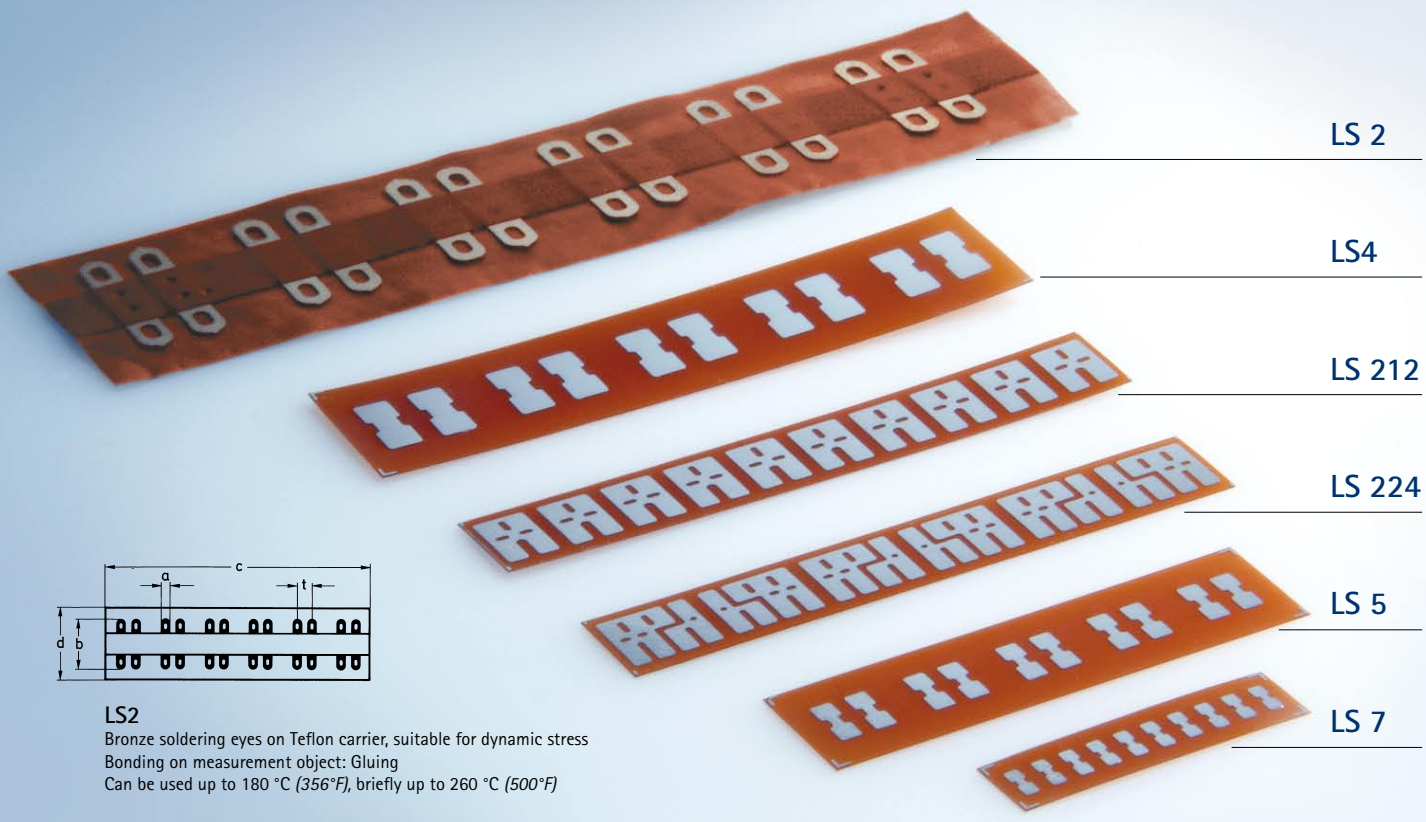
*Cleaning agent dispenser*

## Resin-cored solder
Cored solder (contains lead) for strain gage applications
Diameter: 0.5 mm *(0.02 inch)*; Sn60Pb38Cu2 with resin core type F-SW32
Melting range: 183 ... 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 gage applications
Diameter: 0.5 mm *(0.02 inch)*; Sn95.5Ag3.8Cu0.7 ("no clean")
Melting range: 217 °C to 219 °C *(423°F to 426°F)*
Delivery form: 500 g *(17.637 oz)* on a roll
Order no.: 1-Lot-LF

# ...Solder terminals

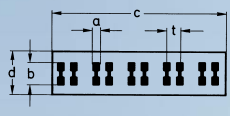
For strain gages with leads or wires, solder terminals should be installed between the connecting cables and the strain gage itself. This facilitates the perfect soldering joint and provides strain relief of the strain gage connections. The solder terminals are installed in the same manner as the strain gages onto the test object. HBM offers solder terminals in different designs and dimensions.



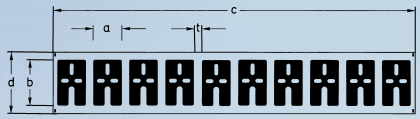




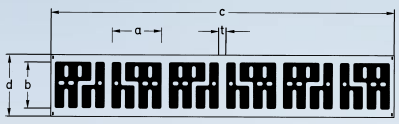
**LS2**
Bronze soldering eyes on Teflon carrier, suitable for dynamic stress
Bonding on measurement object: Gluing
Can be used up to 180 °C *(356°F)*, briefly up to 260 °C *(500°F)*




**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)*




**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)*




**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)*

| Order designation | Dimensions in mm/*inch* | | | | | Contents per pack |
|---|---|---|---|---|---|---|
| | Solder tag | | Carrier | | Spacing | |
| | a | b | c | d | t | |
| 1-LS 2 | 2.5<br>*0.098* | 14<br>*0.551* | 72<br>*2.835* | 20<br>*0.787* | 4<br>*0.157* | 36 pairs |
| 1-LS 7 | 1<br>*0.039* | 3<br>*0.118* | 20<br>*0.787* | 6<br>*0.236* | 2<br>*0.079* | 125 pairs |
| 1-LS 5 | 1.5<br>*0.059* | 4.5<br>*0.177* | 35<br>*1.378* | 10<br>*0.394* | 2.5<br>*0.098* | 125 pairs |
| 1-LS 4 | 2.5<br>*0.098* | 6.5<br>*0.256* | 50<br>*1.969* | 13<br>*0.512* | 4<br>*0.157* | 125 pairs |
| 1-LS 212 | 3.7<br>*0.146* | 6<br>*0.236* | 47.5<br>*1.870* | 8<br>*0.315* | 1<br>*0.039* | 125 pairs |
| 1-LS 224 | 6.5<br>*0.256* | 6<br>*0.236* | 45<br>*1.772* | 8<br>*0.315* | 1<br>*0.039* | 150 pairs |

# ...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 *($6.2 \cdot 10^{-5}$ sq. in.)*, 25 m *(82 ft)* in length.
Order no.: 1-CULD01

## Jumper wire

Teflon insulated jumper wire with a cross section of 0.05 mm² *($7.75 \cdot 10^{-5}$ 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 *($6.2 \cdot 10^{-5}$ 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

Teflon-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**<br>1-3301.0088-S<br>1-3301.0089-R<br>1-3301.0091-GR<br>1-3301.0092-B<br>1-3301.0094-W | Teflon | – 200...+ 260 °C<br>*(-328°F...+500°F)* | resistant against nearly all chemicals except elementary fluoride, chlorine trifluoride, molten alkali metals | for internal connection of strain gage bridges or for contacting from strain gage through to solder terminal |
| **Jumper wire**<br>1-3130.0239-G | Teflon | – 200...+ 260 °C<br>*(-328°F...+500°F)* | see flexible stranded wire | see flexible stranded wire |
| **Very flexible stranded wire**<br>1-SLI 01 | PVC | short period 105° C *(221°F)*<br>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 gages in the transducer |
| **PVC ribbon cable**<br>1-3133.0034 | PVC | short period 105° C *(221°F)*<br>permanent ...90 °C *(194°F)* | see very flexible stranded wire | see very flexible stranded wire |
| **Paint-insulated copper wire**<br>1-CULD 01 | Polyurethane | short period 120° C *(248°F)*<br>permanent -40...80 °C<br>*(-40°F... 176°F)* | non resistant against: strong acids, strong lyes, alcohols, aromatic, hydrocarbons, saturated vapor, hot water | for internal connection of the strain gages in the transducers |

# Amplifiers and calibrations

## Amplifiers for calibration

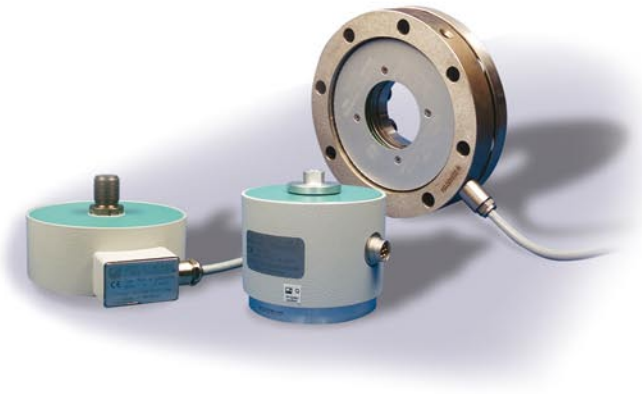
Calibration is implemented successfully around the world using HBM precision amplifiers. The DMP40 and ML38B amplifiers bring you to the cutting edge of a long-term metrological development.

The DMP40 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 DKD calibration laboratory.



**www.hbm.com/calibration**