Y

| Order designation of preference types | | Variable order designation | Nominal resis-tance | Dimensions (mm) [1 inch = 25.4 mm] | | | | Max. perm. effective bridge supply voltage | Solder terminals |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Measuring grid | | Measuring grid Carrier | | | |
| Steel | Aluminum | Other | Ω | a | b | c | d | V | |
| 1-VY11-3/120 | | 1-VY1x-3/120 | 120 | 3 | 7 | 13.5 | 13.5 | 6 | LS 5/7 |
| 1-VY11-6/120 | | 1-VY1x-6/120 | 120 | 6 | 14 | 23 | 23 | 12 | LS 5/7 |

## VY11

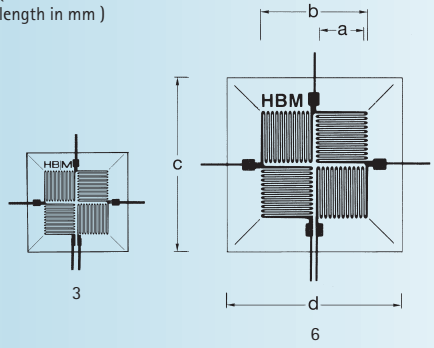
**90° – full bridge rosette**
Temperature variation adjusted to steel with $\alpha = 10.8 \cdot 10^{-6}/K$

## VY1x

Temperature variation adjusted acc. to customer specification

see page 12

Illustrations show actual size
( Dimensions: Grid length in mm )




| Order designation of preference types | | Variable order designation | Nominal resis-tance | Dimensions (mm) [1 inch = 25.4 mm] | | | | Max. perm. effective bridge supply voltage | Solder terminals |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Measuring grid | | Measuring grid Carrier | | | |
| Steel | Aluminum | Other | Ω | a | b | c | d | V | |
| | | 1-MY2x-6/120 | 120 | 6 | – | 7.3 | – | 3.5 | LS 7 |
| 1-MY21-15/350 | | 1-MY2x-15/350 | 350 | 15 | – | 17 | – | 13 | LS 5 |

## MY21

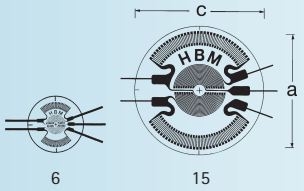
**Diaphragm rosette**
Temperature variation adjusted to steel with $\alpha = 10.8 \cdot 10^{-6}/K$

## MY2x

Temperature variation adjusted acc. to customer specification

see page 12

Illustrations show actual size
( Dimensions: a in mm )




Contents per package: 5 pcs.

The quality of a measuring point with strain gages is not only dependent on the strain gage itself but also on the type of application and its implementation. A perfectly functioning measuring point requires a thorough preparation of the application surface, careful bonding, correct connection, and a protective coating. It is therefore important to provide the applicator with all necessary aids. With its strain gage accessories, the HBM product range offers everything necessary for a good strain gage application.


*Strain gage protective coatings*

## Strain Gage Protective Coatings

In general, it is recommended that strain gages be protected against external effects such as humidity or mechanical damage since even small fluctuations in the atmospheric humidity affect the measured signal of an open gage.

The following table will help in the selection of a suitable means of gage protection, which for special requirements can also be carried out in several steps. For instance, it would make sense to apply AK22, with - in extremely humid environments - additional sealing by ABM 75.

| Strain gage protective coating | Temperature range of resistance in air in °C | Package contents | one package suffices for approx. | Application method | Curing conditions | Storage capability at room temperature | Components |
|---|---|---|---|---|---|---|---|
| **AK 22**<br>viscous putty<br>Order no.: 1-AK 22 | – 50 . . . + 170 | 1 kg | 30 strain gages | Kneading on by hand | – | unlimited | viscous, kneadable sticky putty |
| **ABM 75**<br>aluminum foil c/w knead. compound<br>Order no.: 1-ABM 75 | – 196 . . . + 75 | 11 pcs. 205 mm x 100 mm | 200 strain gages | Pressing on by hand | – | unlimited | 0,05 mm thick aluminum foil, coated with 3 mm thick kneading compound |
| **NG 150**<br>nitrile rubber<br>Order no.: 1-NG 150 | – 269 . . . + 150 | 3 bottles c/w approx. 25 $cm^3$ each | 35 strain gages | Brush application | air drying at room temperature | max. 1 year | single component nitrile rubber cont. solvents |
| **SG 250**<br>transparent silicon rubber<br>Order no.: 1-SG 250 | – 70 . . . + 250 | tube with approx. 85 g | 20 strain gages | Tube application | air drying at room temperature | 6 month | transparent single component silicon rubber without any solvents |
| **PU 120**<br>polyurethane paint<br>Order no.: 1-PU 120 | – 40 . . . + 120 | 4 bottles c/w approx. 30 ml each | 250 strain gages | Brush application | room temperature . . . + 100°C | 1 year | single component polyurethane paint with solvents |
| **SL 450**<br>transparent silicon resin<br>Order no.: 1-SL 450 | – 50 . . . + 450 | 3 bottles c/w approx. 25 g each | 90 strain gages | Brush application | in temperature steps from 95°C bis 315°C | 6 months | transparent silicon resin cont. solvents |

## Chemical resistance of HBM protective coatings

| Chemical substance | AK 22 | ABM 75 | NG 150 | SG 250 | PU 120 | SL 450 |
|---|---|---|---|---|---|---|
| **Exposure** | yes | yes | yes | yes | yes | yes |
| **Water:** | yes | yes | yes | yes | yes | yes |
| Water under pressure (400 bar) | yes | – | – | – | – | – |
| condensation | – | – | – | – | yes | – |
| tropical climate | – | – | – | – | yes | – |
| vapour | no | – | – | – | – | – |
| **Oils:** | no | no | yes | yes | yes | – |
| engine oil (RT/70°C) | – | – | yes | – | – | – |
| mineral oil (RT/70°C) | – | – | yes | – | – | – |
| hydraulic oil (RT/70°C) | – | – | yes | – | – | – |
| **Fats** | – | – | – | – | yes | – |
| **Solvents** general | no | conditional | conditional | no | conditional | conditional |
| **Fuels:** | no | no | yes | no | – | – |
| petrol | no | no | yes | no | – | – |
| kerosene | – | – | yes | – | – | – |
| **Aromatic substances/aliphatic mixtures** | – | – | conditional | – | – | – |
| **Aromatic substances:** | no | no | conditional | no | conditional | no |
| benzene | – | – | no | – | – | – |
| toluene | no | no | conditional | no | yes | no |
| xylene | no | no | conditional | no | conditional | no |
| **Chlorinated solvents** | no | no | no | no | no | no |
| dichloromethane | no | no | no | no | no | no |
| carbon tetrachloride | – | – | no | – | – | – |
| perchloroethylene | – | – | no | – | – | – |
| 1.2-dichloroethane | – | – | no | – | – | – |
| o-dichlorobenzene | – | – | no | – | – | – |
| **Alcohols** | conditional | yes | conditional | conditional | conditional[1] | yes |
| ethyl alcohol | conditional | yes | conditional | conditional | conditional | yes |
| methyl glycole | – | – | no | – | conditional | – |
| butyl alcohol | – | – | conditional | – | conditional | – |
| iso-propyl alcohol | – | – | conditional | – | conditional | – |
| ethylene glycole | – | – | yes | – | – | – |
| **Ketone:** | conditional | conditional | no | no | no | conditional |
| acetone | conditional | conditional | no | no | no | yes |
| methyl ethyl ketone (MEK) | no | no | no | no | no | conditional |
| **Terpene:** | – | – | conditional | – | – | – |
| dipenten | – | – | conditional | – | – | – |
| turpentine | – | – | yes | – | – | – |
| **Acids:** | no | conditional[2] | conditional | yes | no | yes |
| hydrochloric conc. | no | – | conditional | yes | no | yes |
| sulphuric acid 50 % | no | – | yes | yes | no | yes |
| acetic acid 50 % | no | – | no | yes | no | conditional |
| nitric acid 50 % | no | – | no | yes | no | yes |
| oleic acid conc. | – | – | yes | – | – | – |
| lactic acid conc. | – | – | conditional | – | – | – |
| air which contains acid | – | – | – | – | yes | – |
| **Lyes** | conditional | conditional[2] | conditional | no | conditional | yes |
| sodium hydroxide 10 % | conditional | – | no | no | no | yes |
| potassium hydroxide 10 % | – | – | no | – | – | – |
| ammonia 28 % | – | – | conditional | – | – | – |
| air which contains alkaline | – | – | – | – | yes | – |
| **Liquified gas** (except oxygen) | – | – | yes | – | – | – |
| **UV resistance** | yes | yes | yes | yes | yes | – |

[1] low alcohol
[2] up to 5 % (destruction of aluminum foil)
conditional = conditionally resistant (minimum 10 days at RT)

**Chemical resistance:**

Unless identified specifically, the resistance referred to is room temperature. No information can be provided on long term effects. The data is based on our own experience or was taken from literature. Since the specific conditions vary with each user, it is recommended individual users carry out their own tests on resistance. Some protective coatings become milky when in contact with some chemicals.

## Cleaning agent RMS 1

Satisfactory bonding joints are only achieved if the adhesive covers the bonded surfaces well. Therefore, the application surfaces must be cleaned prior to bonding with a chemically pure solvent and a clean cleaning pad. RMS 1 is an environmentally friendly solvent which dissolves all normal contamination.
Order no.: 1-RMS 1

*Cleaning agent dispenser*

## Cleaning pads

Cellulose for cleaning of strain gages and strain gage application surfaces.
Format 5 cm x 5 cm.
Package contents: 500 pcs.
Order no.: 3-8402.0026

## Cleaning agent dispenser „RSP 120"

In order to avoid contamination of the solvent during the course of time, we recommend the cleaning dispenser „RSP 120".
Order no.: 1-RSP 120

## Teflon foil

33 m Teflon foil on reel, suitable for cold curing and hot curing strain gage bonding.
Thickness: 0.05 mm, width: 60 mm
Order no.: 1-Teflon

## Polyimide tape

33 m heat resistant tape, 19 mm in width. Suitable for all standard strain gage application procedures to ensure safe positioning of the strain gage on the workpiece.
Order no.: 1-Klebeband

## Resin cored solder

Resin cored solder as used in strain gage applications. Soldering wire
Ø 0.5 mm consisting of solder
S-SN60Pb38Cu2 c/w resin core, type
F-SW32. Melting range: 183 to 190 C.
Delivery form: 1 kg on reel
Order no.: 1-Lot

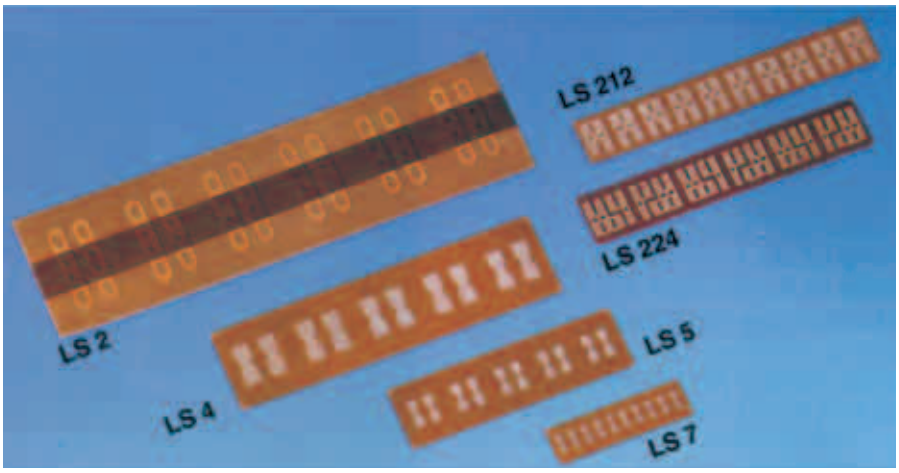
## Flux pen

Soldering aid in felt pen format helps to achieve perfect small soldering connections. Suitable for solders with melting points up to 350°C. The flux pen contains non-corrosive flux without chloride.
Package contents: 5 pcs.
Order no.: 1-FS 01

*Fluxpen FS 01*

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 strain relief of the gage connection. The solder terminals are installed in the same manner as the strain gages onto the object to be measured.

HBM offers solder terminals in different designs and dimensions.




*HBM's range of solder terminals*

## Technical Data

| Type / Illustrations | Type | Dimensions (mm) Soldering ear a | Soldering ear b | Carrier c | Carrier d | Distance t | Contents per package |
|---|---|---|---|---|---|---|---|
| **LS2**<br>bronze soldering ears on teflon carrier suitable for dynamic loads<br>attachement to measured object: bonding<br>usable up to 180°C, for short periods up to 260°C | 1-LS 2 | 2.5 | 14 | 72 | 20 | 4 | 36 Pairs |
| **LS7/5/4**<br>copper, nickel-plated, on polyimide<br>attachment to measured object: bonding<br>usable up to 180°C, for short periods up to 260°C | 1-LS 7<br>1-LS 5<br>1-LS 4 | 1<br>1.5<br>2.5 | 3<br>4.5<br>6.5 | 20<br>35<br>50 | 6<br>10<br>13 | 2<br>2.5<br>4 | 125 Pairs<br>125 Pairs<br>125 Pairs |
| **LS212**<br>copper nickel-plated on polyimide<br>attachement to measured object: bonding<br>usable up to 180°C, for short periods up to 260°C | 1-LS 212 | 3.7 | 6 | 47.5 | 8 | 1 | 125 Pairs |
| **LS224**<br>copper nickel-plated on polyimide<br>attachement to measured object: bonding<br>usable up to 180°C, for short periods up to 260°C | 1-LS 224 | 6.5 | 6 | 45 | 8 | 1 | 75 Pairs |

## PVC-flat strip cable

PVC insulated flat band strip cable consisting of six leads with a cross section of each 0.14 mm², 50 m per reel, resistance 0.131 Ω/m.
Order no.: 4-3133.0034

*HBM Jumper wire and Paint insulated Cu-wire*

## Paint insulated copper wire

Polyurethane-insulated copper wire with a cross section of 0.04 mm², 25 m in length.
Order no.: 1-CULD01

## Jumper wire

Teflon insulated jumper wire with a cross section of 0.05 mm², yellow, 100 m per reel, resistance 0.34 Ω/m.
Order no.: 1-3130.0239-G

## Very flexible wire

For internal, exposed wiring of transducers; cross section of 0.04 mm² with 20 cores and 0.6 mm outer diameter, resistance 0.417 Ω/m, permissible temperature +70°C, 25 m per reel, PVC insulation.
Order no. 1-SLI 01

## Flexible wire

Teflon-insulated flexible wire with a cross section of 0.24 mm² with 19 cores and an external diameter of 0.9 mm, 100 m per reel, resistance 0.0741 Ω/m.

| | |
|---|---|
| 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 |
|---|---|---|---|
| **Flexible 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 | Resistant against nearly all chemicals:<br>Except:<br>elementary flouride, chlorine triflouride, molten alkali metals |
| **Jumper wire**<br>1-3130.0239-G | Teflon | – 200 . . . + 260 °C | see flexible wire |
| **Very flexible wire**<br>1-SLI 01 | PVC | short period 105 °C<br>permanent ...90 °C | non resistant against:<br>ester, chlorinated hydrocarbons, ketone, aromatic hydrocarbons, benzene, liquid halogens, nitric acid conc., depending on the softener used, also aqueous solutions |
| **PVC flat strip cable**<br>4-3133.0034 | PVC | short period 105 °C<br>permanent ...90 °C | see very flexible wire |
| **Paint insulated copper wire**<br>1-CULD 01 | polyurethane | short period 120 °C<br>permanent -40...80 °C | non resistant against:<br>strong acids, strong lyes, alcohols, aromatic hydrocarbons, saturated vapour, hot water |

## Resistance half bridges

Resistance half bridges are wired together with the strain gages on the measuring point to set up the Wheatstone bridge circuit. In accordance with the nominal strain gage resistances, HBM offers various different resistance values.

2 x 120 Ω, Order no.: 3-3054.0334
2 x 350 Ω, Order no.: 3-3054.0282

## Resistance measuring unit TO 3

The TO 3 is an electronic measuring unit (ohmmeter and megohmmeter) for determining resistances within the range 0 to 50 G Ω.

This pocket megohmmeter has been designed, and is particularly suitable, for fast checking of the insulation resistance of strain gage installations and strain gage resistances in the field and in service. It features a total of 16 measuring ranges for insulation resistance and throughput measurements. Four measuring voltages (50 V, 25 V, 10 V, and 2,5 V) provide for adjustment to the measuring task in hand and prevent any possible destruction of a test piece by a test voltage which is too high.

The megohmmeter is accommodated in a solid plastic housing complete with carrying handle, and it is supplied with a protective bag and two measuring cables.

Order no.: 1-TO3

| Technical Data | | Resistance measuring unit TO 3 |
|---|---|---|
| measuring ranges | MΩ | 0 – 50 000 |
| number of measuring ranges | | 16 |
| minimum resistance | Ω | 20 is the minimum value that can still be read off |
| measuring voltages | V | 2;5; 10; 25 und 50, dep. on measuring range |
| open circuit voltage | | 1.1 x UN max. |
| display | | analog display c/w mirror scale, scale length 110 mm |
| application position | | horizontal |
| precision class | | 2.5 (IEC publication 51) |
| adjustment time, max. | s | 4 |
| operational temperature range | °C | 0...+40 (30% up to 60% rel. humidity) |
| temperature fault | %/10K | ±1.5 |
| batteries | | 6 pcs. 1.5 V, rod batteries (type IEC LR 14) |
| measuring time/numberof measurements | | approx. 2000 with a single battery set |
| protection class acc. to EN 60529 (IEC 529) | | IP 50 (measuring mechanism), IP 20 (other parts) |
| safety | | EN 61010-1 class 2, (tested at 1 kV AC / 1 Min.) |
| conformity (CE symbol) | | EN 45014, EN 50081-1, EN 50082-1, EN 61010-1, IEC 51, IEC 529, VDE 0410 |
| housing | | plastic, impact resistant, c/w carrier strap |
| dimensions | mm | 205 x 128 x 100 |
| weight, approx. | kg | 1 |

## Strain gage starter kit DAK 1

The starter kit DAK1 provides the first time user with a low cost and interesting option to start with the application of strain gages. The well-designed and robust plastic case contains all aids required for initial applications. An original package containing 10 strain gages and the cold curing adhesives X60 and Z70 ensure the best possible results from different measurements in experimental stress analysis. In addition to the practical components of the starter kit DAK1, the specialist book on strain gages „An Introduction to Measurements using Strain Gages" by Karl Hoffmann, an experienced specialist in strain gage technology, is also included in the scope of delivery. This book is available in a German as well as an English language version. Due to many years of DAK1 use in company-internal strain gage and instrumentation seminars, the contents of this book has been constantly optimized.

Order no.: 1-DAK1

**Contents of DAK 1**

| | |
|---|---|
| 10 pieces | Strain gages LY11-6/120A |
| 1 | Z 70, cold curing adhesive |
| 1 | X 60, cold curing adhesive |
| 1 | AK 22, protective coating |
| 1 | ABM 75, protective coating |
| | Solder terminals |
| | Connecting wire |
| | Sand paper |
| | Cleaning agent RMS 1 |
| | Cleaning pads |
| | Solder |
| 1 | Specialist book on strain gages „An Introduction to Measurements using Strain Gages" |
| 1 | Petri dish |

*Starter kit DAK 1*

## Strain gage installation case DAK 2

The strain gage installation case DAK 2 contains all tools and aids required for strain gage installations. It is portable and lockable.

Dimensions: 470 x 170 x 360 mm
Weight: approx. 6 kg
(incl. standard scope of delivery)
Order no.: 1-DAK 2

In the bottom part of the strain gage installation case there is empty space for various adhesives and other uses, below the removable insert.

**Contents of DAK 2**

| | |
|---|---|
| 1 | Ersa soldering iron (16 W) |
| 1 | flat brush |
| 1 | folding magnifying glass (6 times) |
| 1 | graduated ruler, 150 mm |
| 1 | glass fibre erasing brush, plus 1 spare brush |
| 1 | pair of scissors, toothed |
| 1 | pair of pointed scissors |
| 1 | wide pair of tweezers |
| 1 | pointed pair of tweezers |
| 1 | flexible ruler, 300 mm |
| 1 | dental probe with bent tip |
| 1 | cement spatula |
| 1 | cutting pliers with wire strippers |
| 1 | Petri dish 60/15 |
| 1 | scalpel holder, plus 6 blades |
| 10 m | flat strip cable 6 x 0.14 $mm^2$, multi-coloured |
| 25 g | solder diameter Ø 1 mm |
| 1 | flux pen |
| 1 | roll of Scotch tape |
| 1 | rubber |
| 1 | HBM pen |
| 1 each | sheets of sand paper grade 180/220/360 |
| 100 $cm^3$ | cleaning agent RMS 1 |
| 200 | cleaning pads 50 x 50 mm |