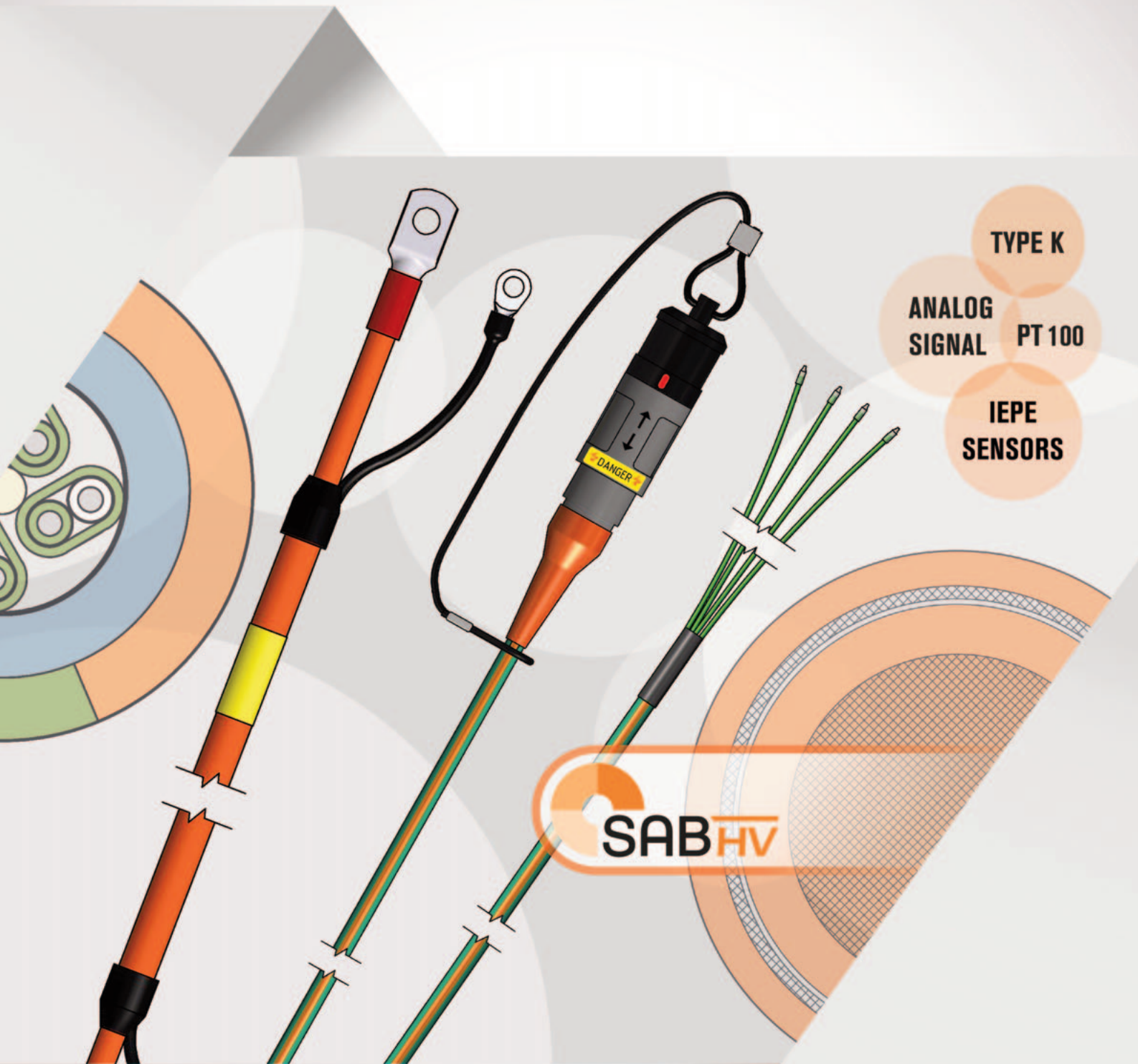


E-MOBILITY

HIGH VOLTAGE MEASUREMENT TECHNOLOGY



TYPE K

ANALOG
SIGNAL

PT 100

IEPE
SENSORS

SAB HV

Family business in the third generation

75 years of experience in cable and wire manufacturing as well as in temperature measurement technology turned a one-man business into a company with more than 550 employees. We prove our strength every year with more than 1500 special products according to customers' requirements. Each product is a new challenge for our creative technical team. We at **SAB** see ourselves as a manufacturer and a service provider – in the sense of true partnership and the greatest possible customer orientation.

Today, the quality of our products is known and appreciated in more than 100 countries around the world. In all product ranges, we are certified according to DIN EN ISO 9001. Furthermore, we have implemented an environmental management system for our company according to DIN EN ISO 14001, an occupational health and safety management system according to NLF/ILO-OSH and DIN ISO 45001, and an energy management system according to DIN EN ISO 50001.

And also for the future, our slogan is: **"WE GO FORWARD!"**

| | |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FOUNDED: | 1947 by Peter Bröckskes sen. an independent, medium-sized company. |
| CEO: | Peter Bröckskes and Sabine Bröckskes-Wetten |
| PLANT/LOCATION: | In Viersen (Lower Rhine) 110.000 m ² company site. Own manufacturing from copper conductor to outer sheath. VDE approved burnchamber and laboratory within the company. |
| EMPLOYEES/WORKERS: | Approx. 430 at the plant in Viersen, 550 worldwide |
| YEARLY SALES: | Approx. 134 Mio. € worldwide |
| PRODUCTS: | Special Cables Measurement Technology Cable Harnessing |

CERTIFICATES AND APPROVALS:



Quality management system acc. to DIN EN ISO 9001 for every manufacturing field

Environmental management system acc. to DIN EN ISO 14001

Occupational health and safety management acc. to NLF/ILO-OSH and DIN ISO 45001

Energy management system acc. to DIN EN ISO 50001

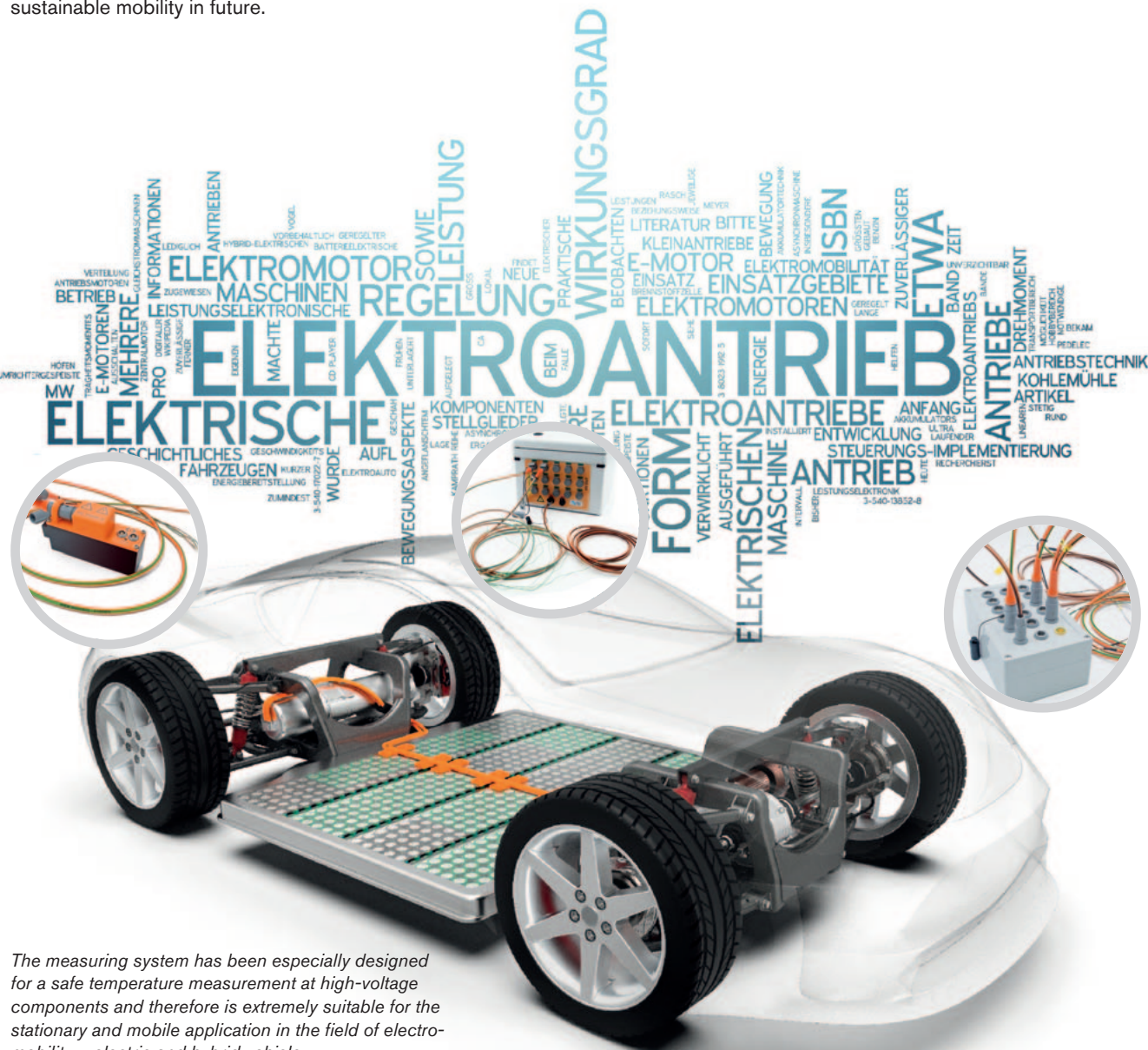
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NEW

Reliable temperature measurement at HV components

For more than 10 years SAB Bröckses as a worldwide leading cable manufacturer is confronted with the challenges of development and optimization of high-voltage cables as well as high-voltage measurement technology for components in electro-mobility. As a leading manufacturer we optimize our products with regard to the steadily changing requirements and develop continuously new products in the range of temperature measurement technology and wiring for a better and sustainable mobility in future.



4

The measuring system has been especially designed for a safe temperature measurement at high-voltage components and therefore is extremely suitable for the stationary and mobile application in the field of electro-mobility – electric and hybrid vehicle.

The transport sector is the third biggest polluter with greenhouse gases after the energy sector and industry with approximately 20 percent CO₂-emission (2019). The biggest part of transport pollution (94 percent) is caused by traffic. Fuel and diesel powered cars are responsible for 59 percent thereof“.

(German government)

This is the reason why the development of electric drives are of greatest importance for the transport sector. E-mobility has become much more than a niche market.

Safe and efficient measurement with CSM measurement technology

A safe and precise collection of temperatures (thermocouples and PT sensors) and analogue measuring signals can be realized by CSM HV measuring modules in HV environments. CSM HV measuring modules offer tested safety acc. to DIN EN 61010 and due to the multi-level safety concept a measuring chain is set up between sensor and data collection by special sensor cables and HV measuring modules. Furthermore, also standard sensors of LV environments can be used for HV applications.

The measuring modules are appropriate for use in road tests or for test benches as 19 " insert module.



For more information, please see www.csm.de



T641 page 15

HV PT2 / HV PT8
temperature measurement
with PT100- and PT1000
resistance thermometers



T141 / T151
page 8-14

HV TH4 evo / HV TH8 evo
temperature measurement
with thermocouples:
NiCr-Ni temperature
input (type K)



T642
page 17

HV IEPE3 FL100
safe measurement
of acceleration,
power and pressure
with IEPE sensors



T644 page 18

HV STG4 pro BS20
for measurements
with strain gauges

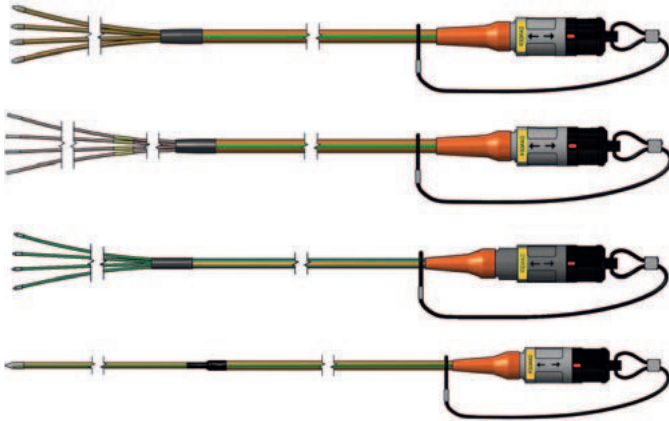


T641/T645 page 19-21

HV CAN and ECAT AD measuring modules
for direct voltage measurement and
standard sensors (analogue measurements)

Product presentation

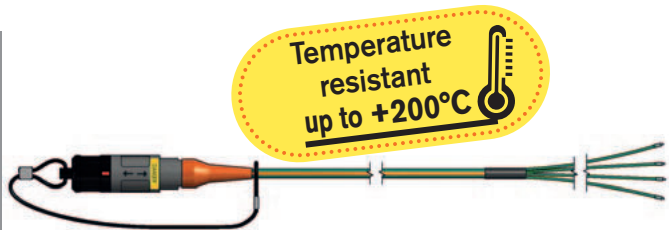
► HV SENSORS TYPE K



The use of HV type K sensors in HV environments is wide-ranging in vehicle technology and guarantees a safe measurement especially wherever a robust sensor and an exact temperature collection is needed. The sensors are used in HV components as for example inverters, electric motors, HV batteries and power electronics. The HV sensors are appropriate for the stationary as well as for mobile test drives.

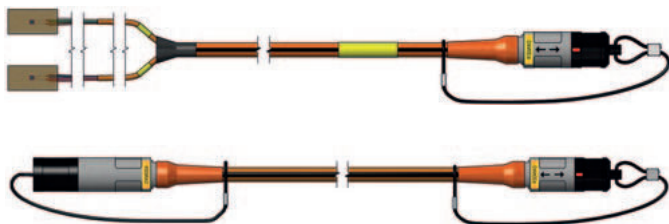
► HV SENSORS TYPE K HT

HV type K sensors with high temperature design can be used in HV environments of vehicle technology as well as the standard HV sensors especially whenever high process temperatures are expected in the whole environment. This can be for example a thermal hardening process of insulating materials in E-units or other HV components.



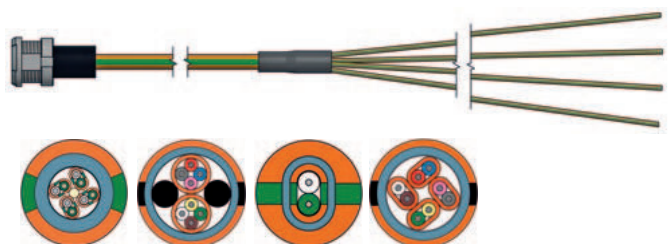
► HV SENSORS PT100/1000

The use of HV PT sensors in HV environments is wide ranging in vehicle technology especially whenever a small thermal mass, short response times by full-surface contact as well as a thin construction combined with an exact measurement are required. The application includes among others the temperature collection between the individual cells of a HV battery.



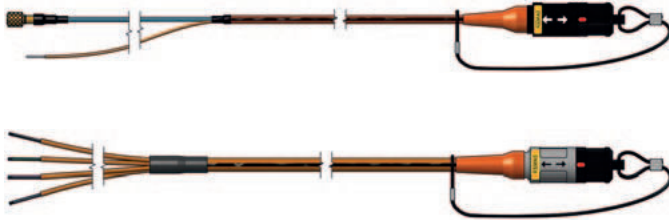
► HV TEST ADAPTER

HV test adapters are used for the adaptation of HV sensors in fixed installation and are available for all sensor types in high voltage environments. The test adapter is among others appropriate to test installed sensors for potential equalisation measurements or the fixed mounting in empty housings.



Product presentation

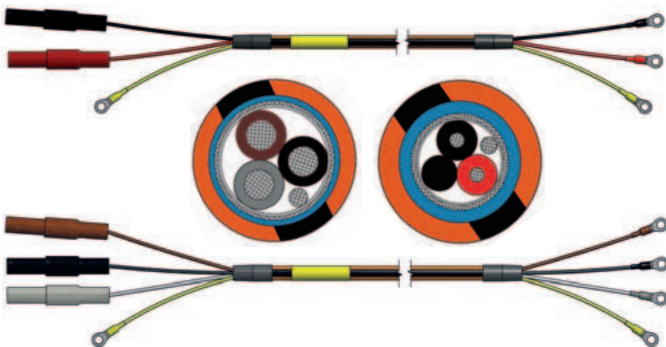
▶ HV SENSOR CABLE ACCELERATION & STRAIN GAUGES



In order to measure acceleration and mechanical tension (strain gauge), HV sensor cables are needed. By the use of these special sensor cables for example tri-axial IEPE acceleration sensors and strain gauges in full and half bridge of the standard low voltage ranges can be used. In combination with the CSM measuring modules HV IEPE3 FL100 and HV STG4 pro BS20 reliable measurements in stationary as well as mobile application for example at test benches can be realised.

▶ HV ANALOGUE MEASURING CABLE AND VOLTAGE MEASURING CABLE

The analogue and voltage measuring cable are especially appropriate for the creation of safe HV measuring chains for example between sensors with analogue voltage output and the CSM measuring modules of series HV AD. By the use of these HV measuring cables combined with the suitable measuring module a voltage up to 90 V and a high voltage up to 1000 V in the stationary test field or mobile road test can be measured.



▶ HV VOLTAGE MEASUREMENT

By the use of HV measuring cables (two of three core types) reliable measurements of DC and AC voltage in HV environments can be made. The measuring cables are designed for an operating voltage of up to 1800 V. Furthermore, the cores are colour coded acc. to the voltage type - red and black for plus and minus pole as well as brown, black and grey for the phases L1, L2 and L3.

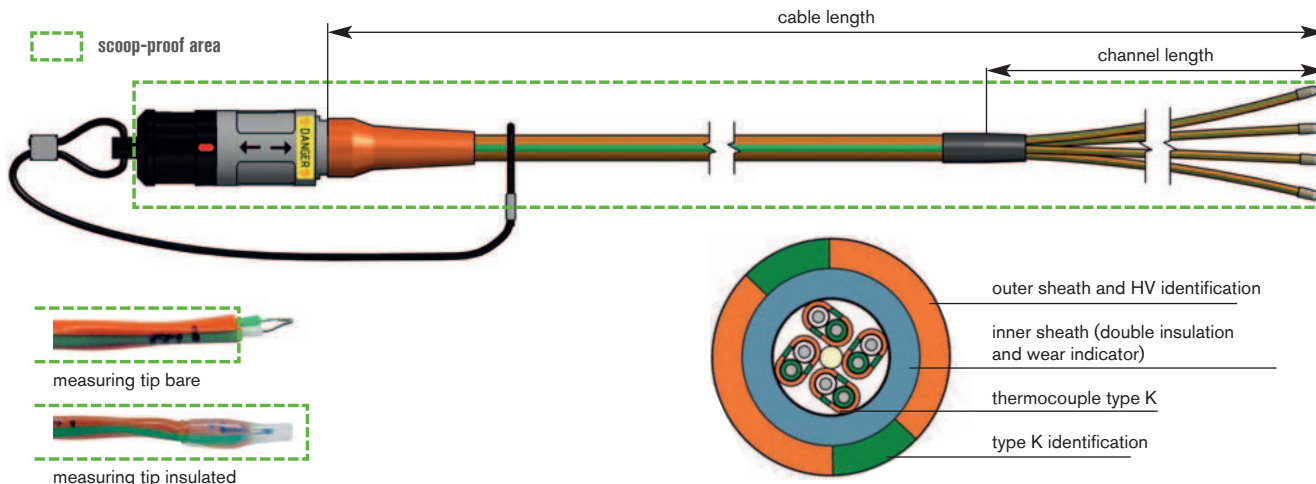
▶ HIGHLY FLEXIBLE HV CABLES

Our highly flexible HV single cores and sensor cables are especially appropriate for the laying at HV test benches. The HV single cores are an optimal feed line for electric motors or battery systems. By the use of silicone as insulating material combined with a fine stranding, the cables can be installed easily. The screened HV single core offers a 100% EMC protection by a double screening of braid and aluminium foil.



HV temperature sensor type K

HV 4-channel thermocouple with FEP insulated thermo channels



Application range:

Safe HV temperature measurement in HV environments

Connector:

Lemo Redel male connector with orange kink protection sleeve and black protecting cap, 8-pin, B-coded 1000 V AC voltage-stable – IP 67 when connected

Sensor:

| | |
|-----------------------------------|-----------------------------------------|
| Thermocouple: | 4 x type K |
| Limit deviation: | class 1 |
| Measuring point: | bare or electrically insulated (1000 V) |
| Temperature range single channel: | -40°C / +180°C |
| Response time: | on request |

Cable data:

| | |
|---------------------------------|----------------------------------------------------------------------|
| Connection cable: | HV thermo cable type K |
| Insulation: | FEP – green and white |
| Pair sheath: | FEP – orange with green vertical stripes |
| Inner sheath: | FEP – blue acc. to RAL 5024 |
| Outer sheath: | PUR |
| Sheath colour: | orange with green vertical stripes |
| Stranding: | paired construction (for EMC) |
| Outer diameter: | approx. 6,1 mm |
| Dielectric strength: | 1000 V AC over single channel |
| Temperature range fixed laying: | -50°C / +150°C |
| flexible application: | -40°C / +150°C |
| Special characteristics: | contact protection of individual channels ✓ mechanically rugged ✓ |

Tests:

► Cable test

over single channel in water bath – 5000 V AC – 5 min – with reference to EN 50264-2-1

► Sensor test

routine test of harnessed connector with reference to standard 61010-1 for measuring devices as well as VDE indications in our in-house ball bath (released by VDE). Control of contact protection towards outside – 3000 V/1 min AC

Issue of HV test certificate with reference to batch number due to optimum traceability

Optional: Test and repair of already used sensors on request

CONFIGURATION EXAMPLES

| item no. | connection cable length [mm] | single channel length [mm] | | | | type of measuring tip |
|--------------|------------------------------|----------------------------|-----------|-----------|-----------|-----------------------|
| | | channel 1 | channel 2 | channel 3 | channel 4 | |
| T141-056-330 | 2400 | 400 | 400 | 400 | 400 | insulated |
| T141-051-650 | 2400 | 400 | 400 | 400 | 400 | bare |
| T141-061-909 | 3000 | 580 | 560 | 575 | 355 | insulated |

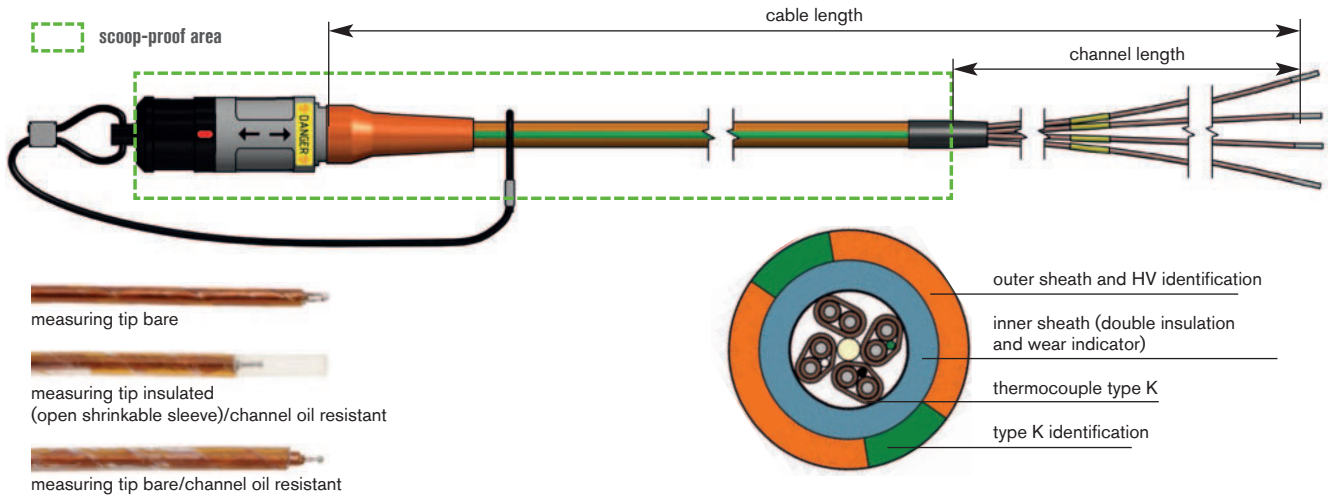
Total cable and channel lengths can be realised on customer's request.

SAB identification:

item number, batch number

HV temperature sensor type K

HV 4-channel thermocouple with PI (polyimide) insulated thermo channels



Application range:

Safe HV temperature measurement in HV environments

Connector:

Lemo Redel male connector with orange kink protection sleeve and black protecting cap, 8-pin, B-coded 1000 V AC voltage-stable – IP 67 when connected

Sensor:

| | |
|-----------------------------------|-----------------------------------------|
| Thermocouple: | 4 x type K |
| Limit deviation: | class 1 |
| Measuring point: | bare or electrically insulated (1000 V) |
| Temperature range single channel: | -40°C / +250°C |
| Response time: | on request |

Cable data:

| | |
|---------------------------------|------------------------------------------|
| Connection cable: | HV thermo cable type K |
| Insulation: | PI foil |
| Pair sheath: | PI foil |
| Inner sheath: | FEP – blue acc. to RAL 5024 |
| Outer sheath: | PUR |
| Sheath colour: | orange with green vertical stripes |
| Stranding: | optimised in layers |
| Outer diameter: | approx. 4,5 mm |
| Dielectric strength: | 1000 V AC over inner sheath |
| Temperature range fixed laying: | -50°C / +150°C |
| flexible application: | -40°C / +150°C |
| Special characteristics: | small cable diameter for narrow spaces ✓ |

Tests:

► Cable test

over inner sheath in water bath – 5000 V AC – 5 min – with reference to EN 50264-2-1

► Sensor test

routine test of harnessed connector with reference to standard 61010-1 for measuring devices as well as VDE indications in our in-house ball bath (released by VDE). Control of contact protection towards outside – 3000 V/1 min AC

Issue of HV test certificate with reference to batch number due to optimum traceability

Optional: Test and repair of already used sensors on request

CONFIGURATION EXAMPLES

| item no. | connection cable length [mm] | single channel length [mm] | | | | type of measuring tip |
|--------------|------------------------------|----------------------------|-----------|-----------|-----------|------------------------------|
| | | channel 1 | channel 2 | channel 3 | channel 4 | |
| T141-058-907 | 2400 | 400 | 400 | 400 | 400 | bare / channel oil resistant |
| T141-051-415 | 2400 | 400 | 400 | 400 | 400 | bare |
| T141-060-960 | 3000 | 570 | 620 | 560 | 385 | insulated |

Total cable and channel lengths can be realised on customer's request.

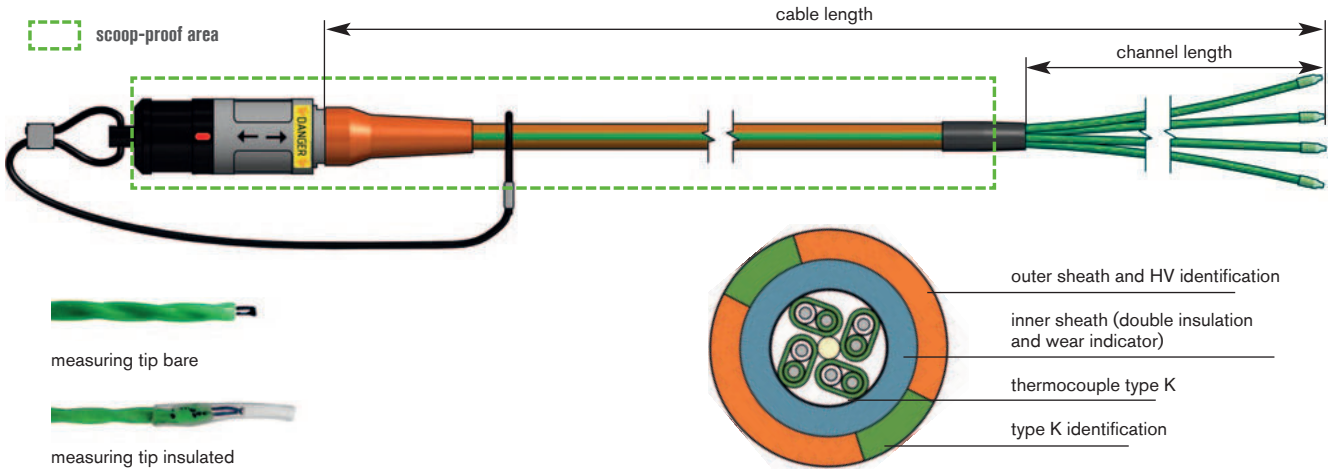
SAB identification:

item number, batch number



HV temperature sensor type K

HV 4-channel thermocouple with PFA insulated thermo channels



Application range:

Safe HV temperature measurement in HV environments

Connector:

Lemo Redel male connector with orange kink protection sleeve and black protecting cap, 8-pin, B-coded
1000 V AC voltage-stable – IP 67 when connected

Sensor:

| | |
|-----------------------------------|-----------------------------------------|
| Thermocouple: | 4 x type K |
| Limit deviation: | class 1 |
| Measuring point: | bare or electrically insulated (1000 V) |
| Temperature range single channel: | -40°C / +250°C |
| Response time: | on request |

Cable data:

| | |
|---------------------------------|------------------------------------------|
| Connection cable: | HV thermo cable type K |
| Insulation: | PFA – green and white |
| Pair sheath: | PFA – green acc. to RAL 6018 |
| Inner sheath: | FEP – blue acc. to RAL 5024 |
| Outer sheath: | PUR |
| Sheath colour: | orange with green vertical stripes |
| Stranding: | paired construction (for EMC) |
| Outer diameter: | approx. 4,4 mm |
| Dielectric strength: | 1000 V AC over inner sheath |
| Temperature range fixed laying: | -50°C / +150°C |
| flexible application: | -40°C / +150°C |
| Special characteristics: | small cable diameter for narrow spaces ✓ |

Tests:

► Cable test

over single channel in water bath –
5000 V AC – 5 min – with reference to EN 50264-2-1

► Sensor test

routine test of harnessed connector
with reference to standard 61010-1 for measuring devices
as well as VDE indications in our in-house ball bath
(released by VDE). Control of contact protection
towards outside – 3000 V/1 min AC

Issue of HV test certificate with reference to batch number due to optimum traceability

Optional: Test and repair of already used sensors on request

CONFIGURATION EXAMPLES

| item no. | connection cable length [mm] | single channel length [mm] | | | | type of measuring tip |
|--------------|------------------------------|----------------------------|-----------|-----------|-----------|-----------------------|
| | | channel 1 | channel 2 | channel 3 | channel 4 | |
| T141-063-016 | 2400 | 400 | 400 | 400 | 400 | bare |
| T141-063-018 | 3000 | 500 | 500 | 500 | 500 | bare |
| T141-063-019 | 2400 | 400 | 400 | 400 | 400 | insulated |
| T141-063-020 | 3000 | 500 | 500 | 500 | 500 | insulated |

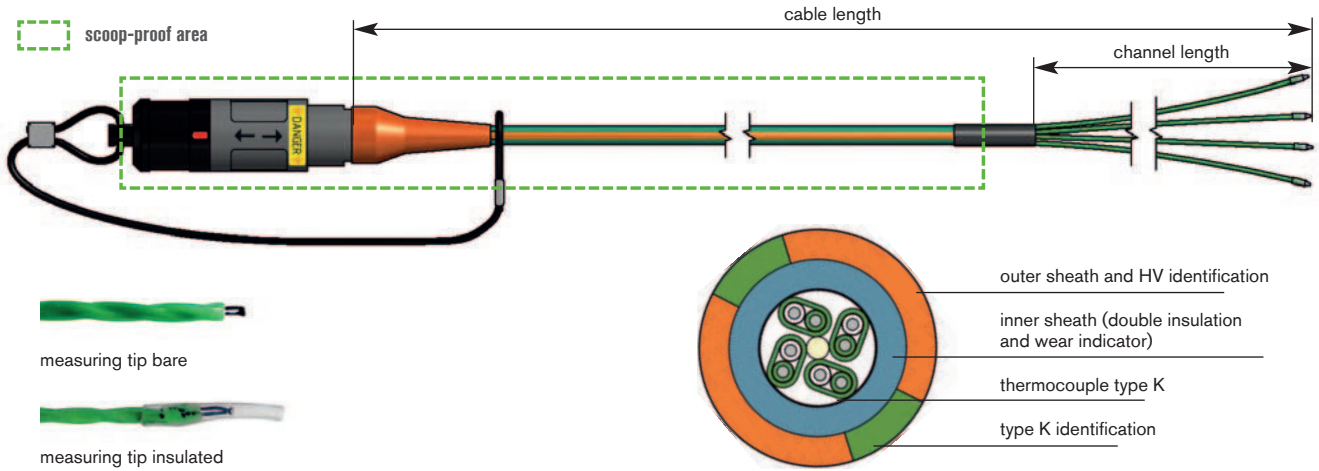
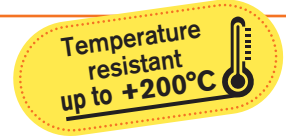
Total cable and channel lengths can be realised on customer's request.

SAB identification:

item number, batch number

HV temperature sensor type K

HV 4-channel thermocouple as high temperature version



Application range:

Safe HV temperature measurement with ambient temperatures up to + 200°C (for example in hardening processes of impregnated motor windings)

Connector:

Lemo Redel male connector with orange kink protection sleeve and black protecting cap, 8-pin, B-coded 1000 V AC voltage-stable – IP 67 when connected

Sensor:

| | |
|-----------------------------------|-----------------------------------------|
| Thermocouple: | 4 x type K |
| Limit deviation: | class 1 |
| Measuring point: | bare or electrically insulated (1000 V) |
| Temperature range single channel: | -40°C / +250°C |
| Response time: | on request |

Cable data:

| | |
|---------------------------------|-----------------------------------------------------------------------------------------------|
| Connection cable: | HV thermo cable type K HT |
| Insulation: | PFA – green and white |
| Pair sheath: | PFA – green acc. to RAL 6018 |
| Inner sheath: | FEP – blue acc. to RAL 5024 |
| Outer sheath: | Besilen® |
| Sheath colour: | orange with green vertical stripes |
| Stranding: | paired construction (for EMC) |
| Outer diameter: | approx. 4,4 mm |
| Dielectric strength: | 1000 V AC over inner sheath |
| Temperature range fixed laying: | -40°C / +220°C |
| flexible application: | -25°C / +220°C |
| Special characteristics: | high temperature resistant ✓ highly flexible ✓ small cable diameter for narrow spaces ✓ |

Tests:

► Cable test

over blue inner sheath in water bath – 5000 V AC – 5 min – with reference to EN 50264-2-1

► Sensor test

routine test of harnessed connector with reference to standard 61010-1 for measuring devices as well as VDE indications in our in-house ball bath (released by VDE). Control of contact protection towards outside – 3000 V/1 min AC

Issue of HV test certificate with reference to batch number due to optimum traceability

Optional: Test and repair of already used sensors on request

CONFIGURATION EXAMPLES

| item no. | connection cable length [mm] | single channel length [mm] | | | | type of measuring tip |
|--------------|------------------------------|----------------------------|-----------|-----------|-----------|-----------------------|
| | | channel 1 | channel 2 | channel 3 | channel 4 | |
| T151-061-737 | 3000 | 500 | 500 | 500 | 500 | insulated |
| T151-061-736 | 3000 | 500 | 500 | 500 | 500 | bare |

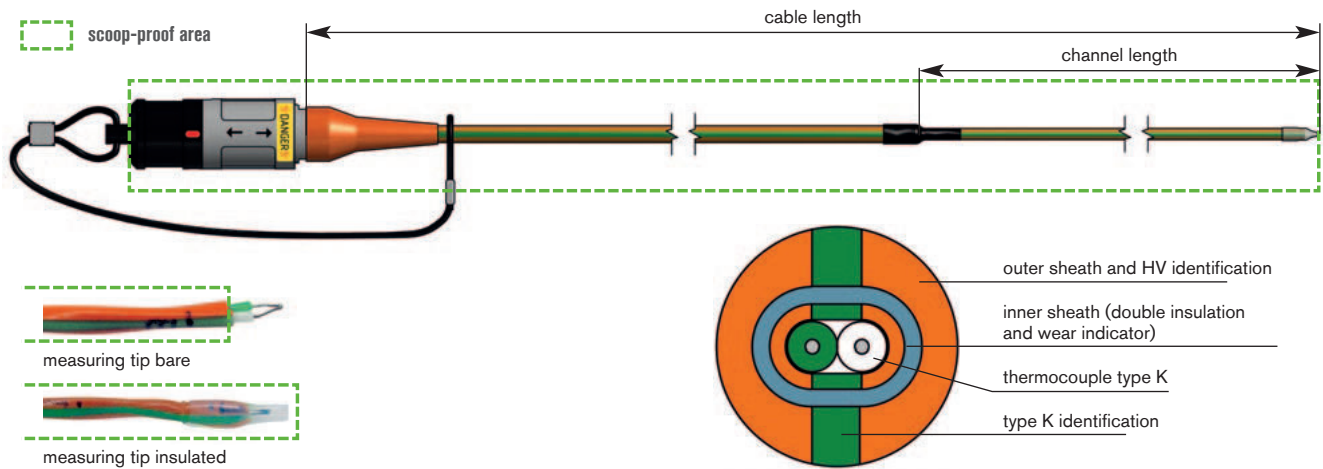
Total cable and channel lengths can be realised on customer's request.

SAB identification:

item number, batch number

HV temperature sensor type K

HV 1-channel thermocouple



Application range:

Safe HV temperature measurement in HV environments

Connector:

Lemo Redel male connector with orange kink protection sleeve and black protecting cap, 2-pin, C-coded 1000 V AC voltage-stable – IP 67 when connected

Sensor:

| | |
|-----------------------------------|-----------------------------------------|
| Thermocouple: | 1 x type K |
| Limit deviation: | class 1 |
| Measuring point: | bare or electrically insulated (1000 V) |
| Temperature range single channel: | -40°C / +180°C |
| Response time: | on request |

Cable data:

| | |
|---------------------------------|------------------------------------------|
| Connection cable: | HV thermo cable type K |
| Insulation: | FEP – green and white |
| Pair sheath: | FEP – orange with green vertical stripes |
| Inner sheath: | FEP – blue acc. to RAL 5024 |
| Outer sheath: | PUR |
| Sheath colour: | orange with green vertical stripes |
| Stranding: | paired construction (for EMC) |
| Outer diameter: | approx. 3,4 mm |
| Dielectric strength: | 1000 V AC over single channel |
| Temperature range fixed laying: | -50°C / +150°C |
| flexible application: | -40°C / +150°C |
| Special characteristics: | contact protection over single channel ✓ |

Tests:

► Cable test

over pair sheath in water bath – 5000 V AC – 5 min – with reference to EN 50264-2-1

► Sensor test

routine test of harnessed connector with reference to standard 61010-1 for measuring devices as well as VDE indications in our in-house ball bath (released by VDE). Control of contact protection towards outside – 3000 V/1 min AC

Issue of HV test certificate with reference to batch number due to optimum traceability

Optional: Test and repair of already used sensors on request

CONFIGURATION EXAMPLES

| item no. | connection cable length [mm] | single channel length [mm] | type of measuring tip |
|--------------|------------------------------|----------------------------|-----------------------|
| | | channel 1 | measuring tip |
| T141-059-052 | 2400 | 400 | insulated |
| T141-058-124 | 3000 | 400 | bare |

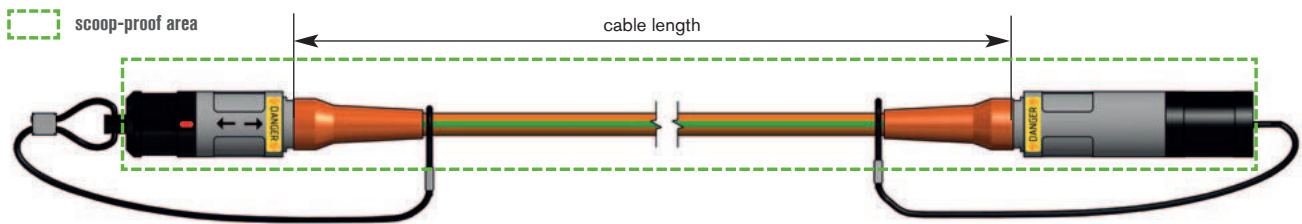
Total cable and channel lengths can be realised on customer's request.

SAB identification:

item number, batch number

HV extension cable type K

HV 4- and 1-channel extension cable with FEP insulated thermo channels



Application range:

Extension of 4- or 1-channel high voltage sensors type K

Connectors:

Lemo Redel connector - male and female, with orange kink protection sleeve and black protecting cap

4-channel:
8-pin, B-coded
1000 V AC voltage-stable - IP 67 when connected

2-channel:
2-pin, C-coded
1000 V AC voltage-stable - IP 67 when connected



Cable data:

| | 4-channel | 1-channel |
|---------------------------------|------------------------------------------|------------------------------------------|
| Connection cable: | HV thermo cable type K | HV thermo cable type K |
| Insulation: | FEP – green and white | FEP – green and white |
| Pair sheath: | FEP – orange with green vertical stripes | FEP – orange with green vertical stripes |
| Inner sheath: | FEP – blue acc. to RAL 5024 | FEP – blue acc. to RAL 5024 |
| Outer sheath: | PUR | PUR |
| Sheath colour: | orange with green vertical stripes | orange with green vertical stripes |
| Stranding: | paired construction (for EMC) | paired construction (for EMC) |
| Outer diameter: | approx. 6,1 mm | approx. 3,4 mm |
| Dielectric strength: | 1000 V AC | 1000 V AC over single channel |
| Temperature range | | |
| fixed laying: | -50°C / +150°C | -50°C / +150°C |
| flexible application: | -40°C / +150°C | -40°C / +150°C |
| Special characteristics: | contact protection over all components ✓ | contact protection over all components ✓ |

Tests:

► Cable test

over pair sheath in water bath –
5000 V AC – 5 min – with reference to EN 50264-2-1

► Product test

routine test of harnessed connector with reference to standard 61010-1 for measuring devices as well as VDE indications in our in-house ball bath (released by VDE). Control of contact protection towards outside – 3000 V/1 min AC

Issue of HV test certificate with reference to batch number due to optimum traceability

Optional: Test and repair of already used sensors on request

CONFIGURATION EXAMPLES

| item no. | connection cable length [mm] | channels |
|--------------|------------------------------|----------|
| T141-054-030 | 1000 | 4 |
| T141-054-143 | 2000 | 4 |
| T141-058-575 | 3000 | 4 |
| T141-058-576 | 5000 | 4 |

Total lengths can be realised on customer's request.

CONFIGURATION EXAMPLES

| item no. | connection cable length [mm] | channels |
|--------------|------------------------------|----------|
| T141-062-840 | 1000 | 1 |
| T141-062-843 | 3000 | 1 |
| T141-062-844 | 5000 | 1 |

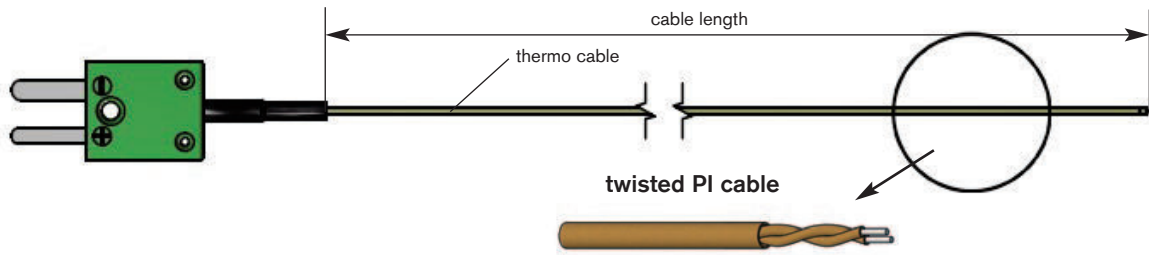
Total lengths can be realised on customer's request.

SAB identification:

item number, batch number, length

Special thermocouple type K

surface thermocouple made of twisted thermo cable



Application range:

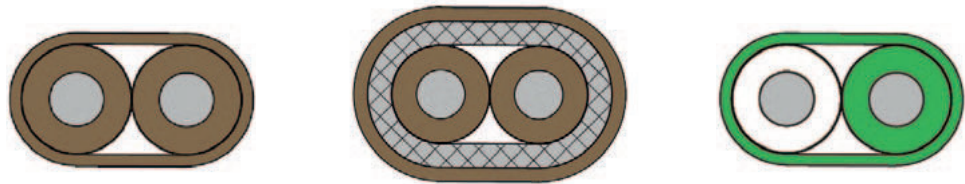
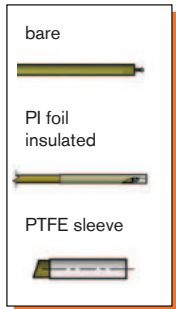
for example for temperature collection at Hairpin windings in the stator of E-drives. The scattering effect of electromagnetic radiation from the surrounding copper windings shall not distort the measuring result.

Connector:

e.g. miniature thermo plug type K (as shown in the figures)

Sensor:

| | |
|-----------------------------------|------------------------------------|
| Thermocouple: | 1 x type K |
| Limit deviation: | class 1 |
| Measuring point: | see Illustration of measuring tips |
| Temperature range single channel: | -40°C / +250°C |
| Response time: | on request |



Cable data:

| | PI (polyimide) | PI (polyimide) | PFA |
|--------------------------|-------------------------------|--------------------------------------|-------------------------------|
| Designation: | twisted PI thermo cable | screened and twisted PI thermo cable | twisted PFA thermo cable |
| Insulation: | PI foil insulation | PI foil insulation | PFA |
| Outer sheath: | PI foil insulation | PI foil insulation | PFA |
| Stranding: | paired construction (for EMC) | paired construction (for EMC) | paired construction (for EMC) |
| Outer diameter: | approx. 0,85 mm | approx. 1,05 mm | approx. 0,80 mm |
| Temperature range | | | |
| fixed laying: | -40°C / +250°C | -40°C / +250°C | -40°C / +250°C |
| flexible application: | -40°C / +250°C | -40°C / +250°C | -40°C / +250°C |

1.2.1

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CONFIGURATION EXAMPLES

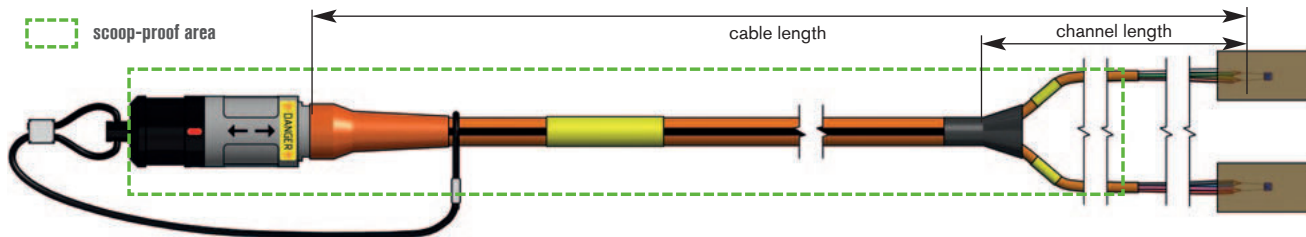
| item no. | type | measuring tip | cable | cable length m | connection end |
|--------------|------|---------------|------------------------|----------------|----------------------|
| T100-061-046 | K | PTFE sleeve | 2 x 0,20 mm PI twisted | 1.5 | miniature thermoplug |
| T100-061-998 | K | PI foil | 2 x 0,20 mm PI twisted | 2.0 | bare |
| T100-060-628 | K | bare | 2 x 0,20 mm PI twisted | 2.0 | miniature thermoplug |
| T100-060-629 | K | bare | 2 x 0,20 mm PI twisted | 3.0 | miniature thermoplug |
| T100-061-276 | K | bare | 2 x 0,20 mm PI twisted | 1.0 | bare |

SAB identification:

item number, batch number

HV temperature sensor PT100/PT1000

HV 2 x PT100/PT1000 resistance thermometer



Application range:

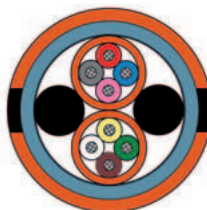
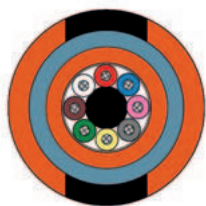
Safe HV temperature measurement in HV environments

Connector:

Lemo Redel male connector with orange kink protection sleeve and black protecting cap, 8-pin, C-coded 1000 V AC voltage-stable – IP 67 when connected

Sensor:

| | |
|-----------------------------------|---------------------------------------------------------------------------------------------------|
| Type of sensor: | 2 x PT100 |
| Limit deviation: | class A |
| Wire circuit: | 4-wire |
| Measuring point: | embedded in Pi adhesive pad |
| Dimension of sensor: | for example 2,3 mm x 2,0 mm x 0,47 mm (appropriate for pouch cells) or 3,0 mm x 0,80 mm x 0,60 mm |
| Temperature range single channel: | -30°C / +180°C |



Cable data:

| | FEP | FEP |
|---------------------------------|----------------------------------------------|-------------------------------------|
| Designation: | HV measuring cable – 1 x 8 cores | HV measuring cable – 4 x 2 cores |
| Insulation: | FEP – acc. to DIN 47100 1-8 (core-Ø 0,45 mm) | FEP – acc. to DIN 47100 1-8 |
| Outer sheath: | PUR | PUR |
| Stranding: | optimised in layers | optimised in layers |
| Outer diameter: | approx. 4,6 mm | approx. 7,3 mm |
| Dielectric strength: | 1000 V AC over orange inner sheath | 1000 V AC over orange bundle sheath |
| Temperature range fixed laying: | -40°C / +150°C | -40°C / +150°C |
| flexible application: | -40°C / +150°C | -40°C / +150°C |

Tests:

► Cable test

core/core – 2500 V AC - 5 min
over orange bundle sheath –
5000 V AC – 5 min – with reference to EN 50264-2-1

► Sensor test

routine test of harnessed connector with reference to standard 61010-1 for measuring devices as well as VDE indications in our in-house ball bath (released by VDE). Control of contact protection towards outside – 3000 V/1 min AC

Issue of HV test certificate with reference to batch number due to optimum traceability

Optional: Test and repair of already used sensors on request

CONFIGURATION EXAMPLES

| item no. | connection cable length [mm] | single channel length [mm] | |
|--------------|------------------------------|----------------------------|-----------|
| | | channel 1 | channel 2 |
| T641-060-817 | 2000 | 70 | 70 |
| T641-060-870 | 5000 | 700 | 700 |

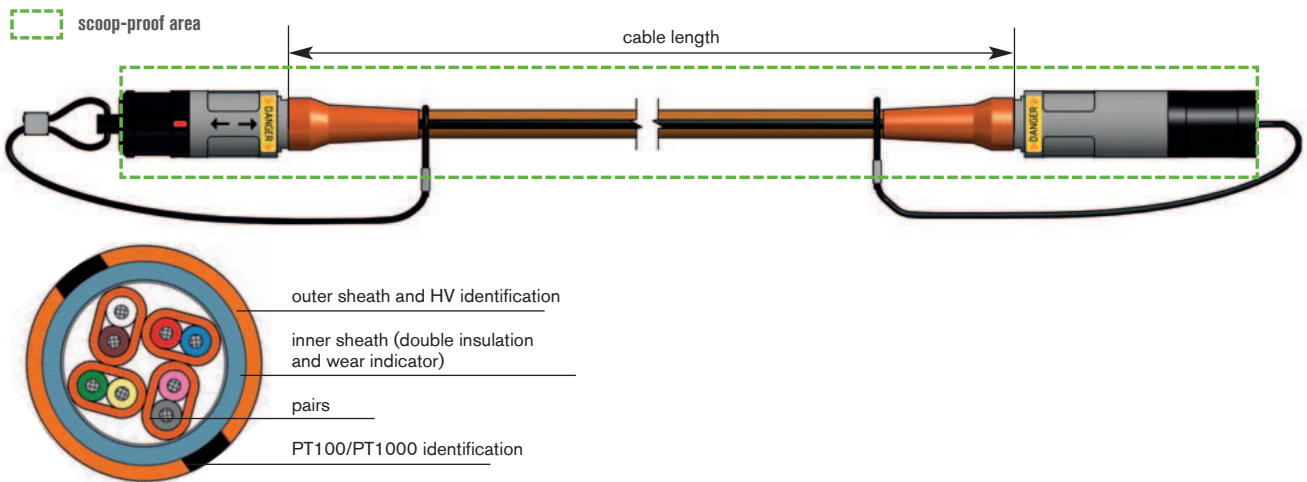
Total cable and channel lengths can be realised on customer's request.

SAB identification:

item number, batch number

HV extension cable PT100/PT1000

HV 2 x PT100/PT1000 extension cable



Application range:

Extension of HV 2 x Pt 100 sensors

Connectors:

Lemo Redel male connector -
male/female connector with orange kink protection sleeve
and black protecting cap, 8-pin, C-coded
1000 V AC voltage-stable – IP 67 when connected

CONFIGURATION EXAMPLES

| item no. | connection cable length [mm] |
|--------------|------------------------------|
| T641-056-497 | 1000 |
| T641-058-117 | 3000 |
| T641-058-574 | 5000 |

Total cable and channel lengths can be realised on customer's request.

Cable data:

| | |
|--------------------------|------------------------------------------|
| Connection cable: | HV measuring cable |
| Insulation: | FEP – acc. to DIN 47100 1-8 |
| Pair sheath: | FEP – orange acc. to RAL 2004 |
| Inner sheath: | PUR – blue acc. to RAL 5024 |
| Outer sheath: | PUR |
| Sheath colour: | orange with green vertical stripes |
| Stranding: | optimised in layers |
| Outer diameter: | approx. 7,4 mm |
| Dielectric strength: | 1000 V AC over pair sheath |
| Temperature range | |
| fixed laying: | -40°C / +150°C |
| flexible application: | -40°C / +150°C |
| Special characteristics: | contact protection over all components ✓ |

1.3.2

16

Tests:

► Cable test

core/core – 2500 V AC - 5 min
over pair sheath –
5000 V AC – 5 min – with reference to EN 50264-2-1

► Product test

routine test of harnessed connector
with reference to standard 61010-1 for measuring devices
as well as VDE indications in our in-house ball bath
(released by VDE). Control of contact protection
towards outside – 3000 V/1 min AC

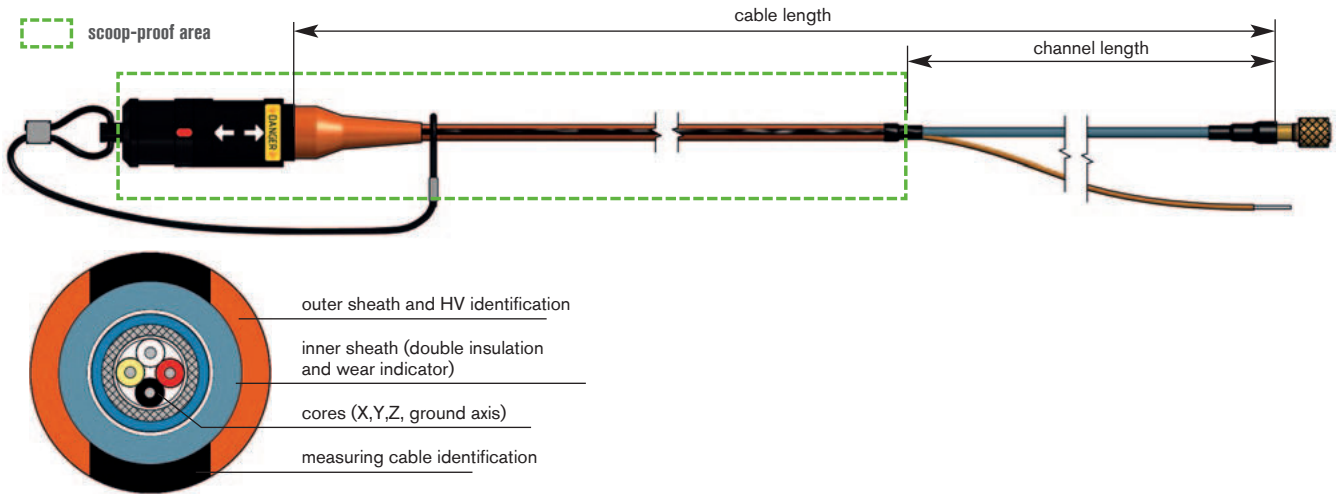
Issue of HV test certificate with reference to batch number due to optimum traceability

Optional: Test and repair of already used sensors on request

SAB identification:

item number, batch number, length

HV connecting cable for acceleration sensors (IEPE)



Application range:

Safe HV acceleration measurement for example with CSM HV IEPE3 FL 100 measuring module

Connector:

Lemo Redel male connector with orange kink protection sleeve and black protecting cap, 8-pin, C-coded 1000 V AC voltage-stable – IP 67 when connected

Sensor connection side:

| | |
|------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|
| Connector: | 4-pin ¼-28 UNF socket for the connection of a triaxial IEPE acceleration sensor (also with 4-pin 8-36 UNF and 4-pin M4,5) |
| Screen: | led out in bundle and insulated with shrinkable sleeve |
| Temperature range bundle channel: | -55°C / +250°C |

Cable data:

| | |
|---------------------------------|---------------------------------------|
| Connection cable: | HV IEPE sensor cable |
| Core insulation: | PFA – red, white, black, yellow |
| Bundle sheath: | PFA – blue acc. to RAL 5015 |
| Inner sheath: | PUR – blue acc. to RAL 5024 |
| Outer sheath: | PUR |
| Sheath colour: | orange with black vertical stripes |
| Stranding: | optimised in layers |
| Outer diameter: | approx. 4,3 mm |
| Dielectric strength: | 1000 V AC over second inner sheath |
| Temperature range | |
| fixed laying: | -50°C / +150°C |
| flexible application: | -40°C / +150°C |
| Special characteristics: | contact protection see presentation ✓ |

Tests:

► Cable test

core/core – 600 V AC – 1 min – acc. to IEC 60584-1 over second inner sheath in water bath – 5000 V AC – 5 min – with reference to EN 50264-2-1

► Product test

routine test of harnessed connector with reference to standard 61010-1 for measuring devices as well as VDE indications in our in-house ball bath (released by VDE). Control of contact protection towards outside – 3000 V/1 min AC

Issue of HV test certificate with reference to batch number due to optimum traceability

Optional: Test and repair of already used sensors on request

CONFIGURATION EXAMPLES

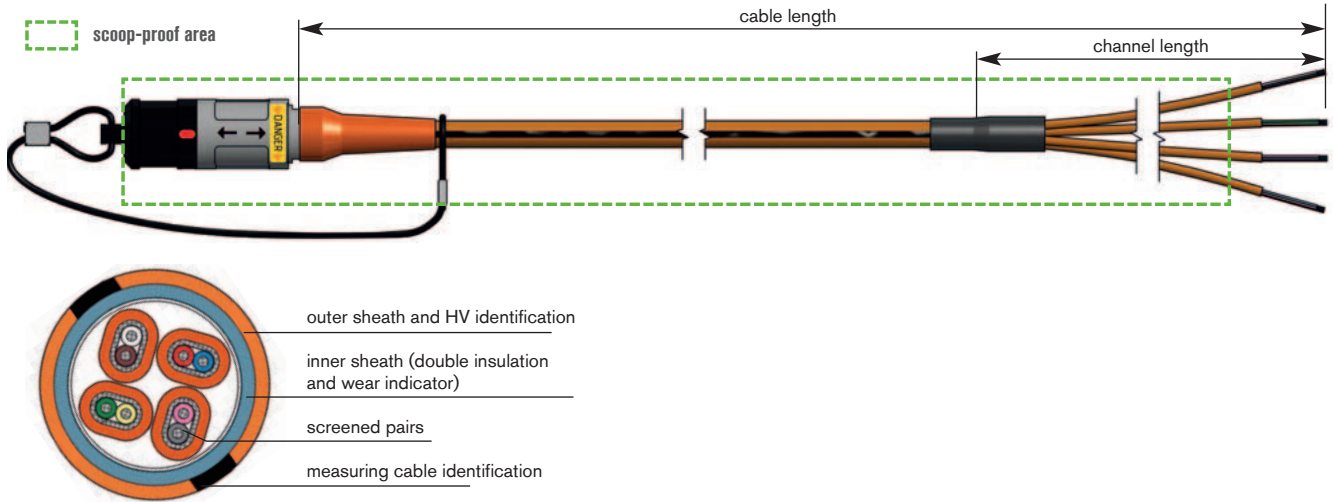
| item no. | connection cable length [mm] | single channel length [mm] | | male connector |
|--------------|------------------------------|----------------------------|-----------|-----------------|
| | | channel 1 | grounding | |
| T642-062-666 | 3000 | 100 | 200 | 4-Pin ¼ -28 UNF |
| T642-062-794 | 6000 | 100 | 200 | 4-Pin ¼ -28 UNF |
| T642-062-635 | 3000 | 100 | 200 | 4-Pin 8-36 UNF |

SAB identification:

item number, batch number

Total cable and channel lengths can be realised on customer's request.

HV connecting cable for strain gauges



Application range:

Safe HV strain gauge measurement (full / half bridge)
for example with CSM HV STG4 pro BS20
measuring module

Connector:

Lemo Redel male connector with orange kink protection
sleeve and black protecting cap, 8-pin, E-coded
1000 V AC voltage-stable – IP 67 when connected

Connection end:

| | |
|--------------------------------------|-------------------------------------------|
| Outer sheath: | 122 mm stripped |
| Pair sheath: | 22 mm |
| Open end: | 2 mm |
| Connection: | tinned |
| Screen: | small cable diameter for narrow spaces |
| Temperature range single channel: | -55°C / +180°C |

Cable data:

| | |
|------------------------------------|----------------------------------------------|
| Connection cable: | HV strain gauge sensor cable |
| Core insulation: | FEP – acc. to DIN 47100 1-8 (core-Ø 0,55 mm) |
| Screen: | tinned copper braiding incl. drain wire |
| Pair sheath: | FEP – orange acc. to RAL 2004 |
| Inner sheath: | PUR – blue acc. to RAL 5024 |
| Outer sheath: | PUR |
| Sheath colour: | orange with black vertical stripes |
| Stranding: | paired construction (for EMC) |
| Outer diameter: | approx. 7,4 mm |
| Dielectric strength: | 1000 V AC over pair sheath |
| Temperature range fixed laying: | -50°C / +150°C |
| flexible application: | -40°C / +150°C |

Tests:

► Cable test

core/core – 600 V AC – 1 min – acc. to IEC 60584-1
over pair sheath in water bath –
5000 V AC – 5 min – with reference to EN 50264-2-1

► Product test

routine test of harnessed connector
with reference to standard 61010-1 for measuring devices
as well as VDE indications in our in-house ball bath
(released by VDE). Control of contact protection
towards outside – 3000 V/1 min AC

Issue of HV test certificate with reference to batch number due to optimum traceability

Optional: Test and repair of already used sensors on request

CONFIGURATION EXAMPLES

| item no. | connection cable length [mm] | single channel Length [mm] | | | connection type |
|--------------|------------------------------------|----------------------------|-------------|-------------|-----------------|
| | | Length sheath | Length pair | Length core | connection |
| T644-061-009 | 2000 | 122 | 22 | 2 | tinned |
| T644-061-014 | 3000 | 122 | 22 | 2 | tinned |

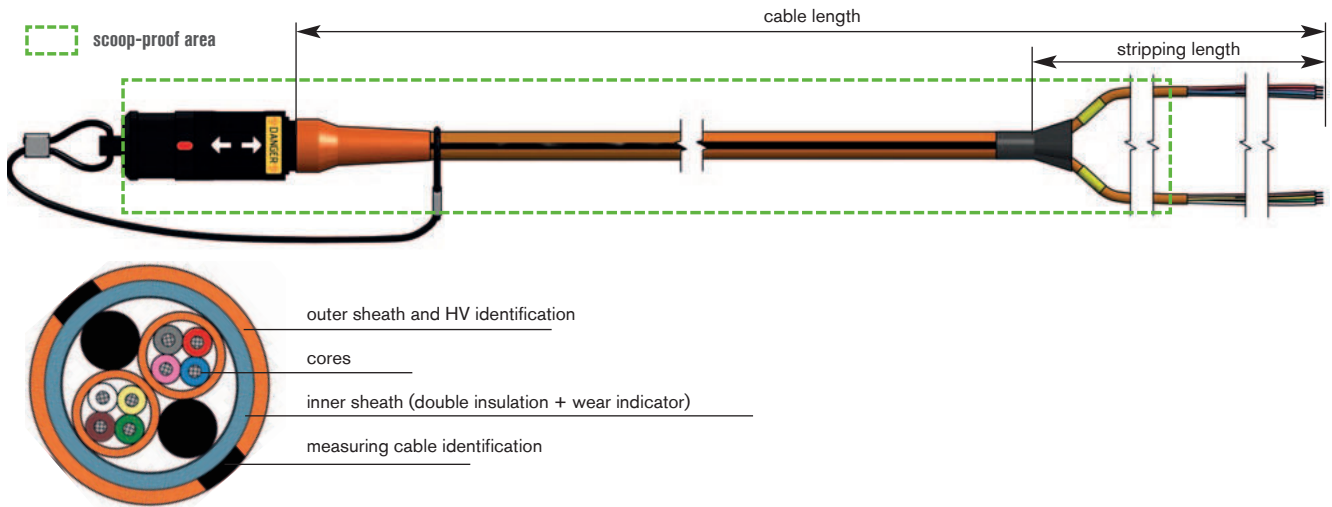
Total cable and channel lengths can be realised on customer's request.

SAB identification:

item number, batch number

HV analogue measuring cable

HV 2-channel analogue measuring cable for CSM measurement technology (90 V)



Application range:

Safe HV analogue measurements with standard sensors combined with CSM measuring modules
 HV AD2 IF20, HV AD4 IF20 & HV AD4 IF1000

Connector:

Lemo Redel male connector with orange kink protection sleeve and black protecting cap, 8-pin, C-coded
 1000 V AC voltage-stable – IP 67 when connected

Connection end:

(stripping lengths)

| | |
|---------------|--------|
| Outer sheath: | 100 mm |
| Pair sheath: | 10 mm |
| Open end: | 2 mm |
| Connection: | tinned |

Cable data:

| | |
|-----------------------|-------------------------------------|
| Connection cable: | HV measuring cable |
| Core insulation: | FEP – acc. to DIN 47100 1-8 |
| Pair sheath: | FEP – orange acc. to RAL 2004 |
| Inner sheath: | PUR – blue acc. to RAL 5024 |
| Outer sheath: | PUR |
| Sheath colour: | orange with black vertical stripes |
| Stranding: | optimised in layers |
| Outer diameter: | approx. 7,3 mm |
| Dielectric strength: | 1000 V AC over orange bundle sheath |
| Temperature range | |
| fixed laying: | -50°C / +150°C |
| flexible application: | -40°C / +150°C |

Tests:

► Cable test

core/core – 600 V AC - 1 min - acc. to IEC 60584-1
 over orange bundle sheath –
 5000 V AC – 5 min – with reference to EN 50264-2-1

► Product test

routine test of harnessed connector
 with reference to standard 61010-1 for measuring devices
 as well as VDE indications in our in-house ball bath
 (released by VDE). Control of contact protection
 towards outside – 3000 V/1 min AC

Issue of HV test certificate with reference to batch number due to optimum traceability

Optional: Test and repair of already used sensors on request

CONFIGURATION EXAMPLES

| item no. | connection cable length [mm] | single channel length [mm] | | |
|--------------|------------------------------|----------------------------|------|------|
| | | sheath | pair | core |
| T641-056-710 | 2000 | 100 | 10 | 2 |
| T641-056-711 | 3000 | 100 | 10 | 2 |

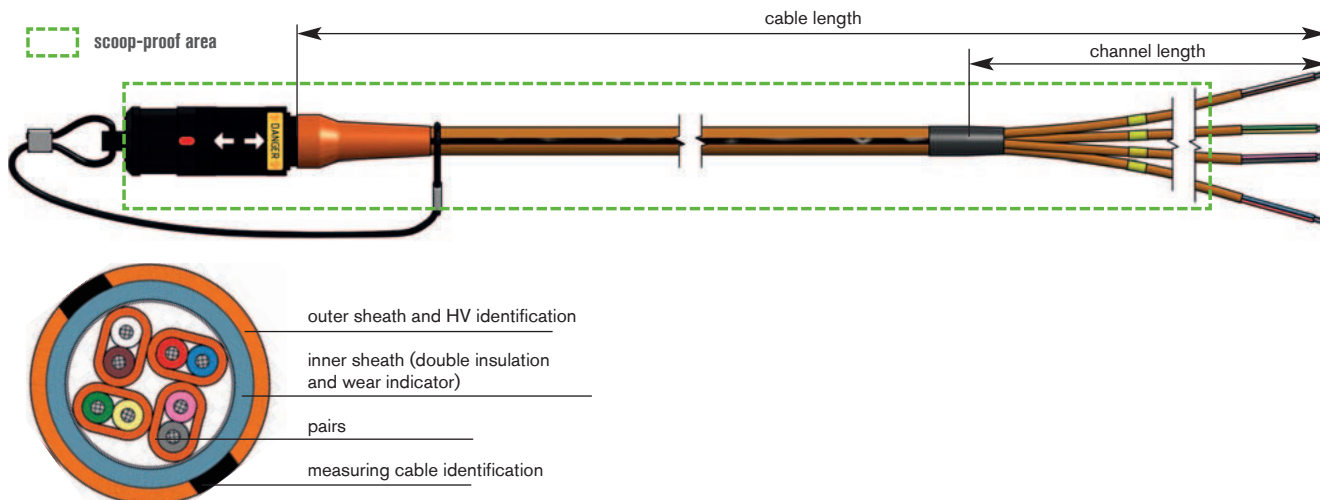
Total cable and channel lengths can be realised on customer's request.

SAB identification:

item number, batch number

HV voltage measuring cable (90 V)

HV 4-channel voltage measuring cable for CSM measurement technology (90 V)



Application range:

Safe HV measurements of analogue voltage combined with CSM measuring modules HV AD4 OW20, HV AD8 OW20 & HV AD4 OW1000*

*test bench & road test

Connector:

Lemo Redel male connector with orange kink protection sleeve and black protecting cap, 8-pin, B-coded 1000 V AC voltage-stable – IP 67 when connected

Connection end:

(stripping lengths)

| | |
|-----------------------------------|-----------------|
| Outer sheath: | 122 mm stripped |
| Pair sheath: | 22 mm |
| Open end: | 2 mm |
| Connection: | tinned |
| Temperature range single channel: | -55°C / +180°C |

Cable data:

| | |
|---------------------------------|----------------------------------------------------|
| Connection cable: | HV measuring cable |
| Core insulation: | FEP – acc. to DIN 47100 1-8 |
| Pair sheath: | FEP – orange acc. to RAL 2004 |
| Inner sheath: | PUR – blue acc. to RAL 5024 |
| Outer sheath: | PUR |
| Sheath colour: | orange with black vertical stripes |
| Stranding: | paired construction (for EMC) |
| Outer diameter: | approx. 7,4 mm |
| Dielectric strength: | 1000 V AC over pair sheath |
| Temperature range fixed laying: | -50°C / +150°C |
| flexible application: | -40°C / +150°C |
| Special characteristics: | contact protection also over individual channels ✓ |

Tests:

► Cable test

core/core – 2500 V AC - 5 min
over pair sheath –
5000 V AC – 5 min – with reference to EN 50264-2-1

► Product test

routine test of harnessed connector with reference to standard 61010-1 for measuring devices as well as VDE indications in our in-house ball bath (released by VDE). Control of contact protection towards outside – 3000 V/1 min AC

Issue of HV test certificate with reference to batch number due to optimum traceability

Optional: Test and repair of already used sensors on request

CONFIGURATION EXAMPLE

| item no. | connection cable length [mm] | single channel length [mm] | | | connection type |
|--------------|------------------------------|----------------------------|------|------|-----------------|
| | | sheath | pair | core | connection |
| T645-062-738 | 2000 | 122 | 22 | 2 | tinned |

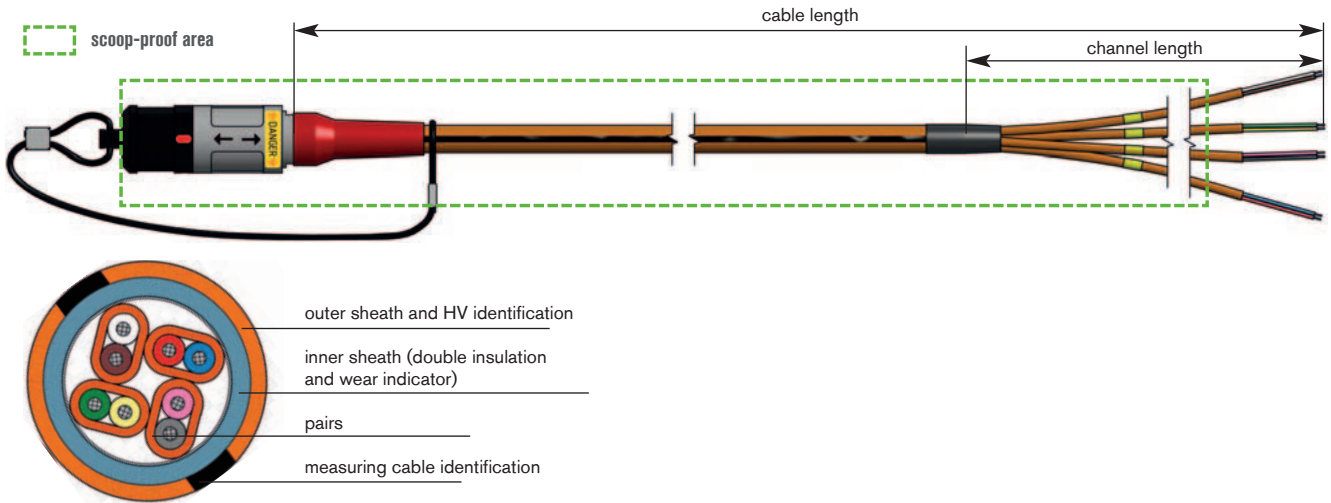
Total cable and channel lengths can be realised on customer's request.

SAB identification:

item number, batch number

HV voltage measuring cable (1000 V)

HV 4-channel voltage measuring cable for CSM measurement technology (1000 V)



Application range:

Safe HV measurements of high voltage combined with CSM measuring modules HV AD4 XW1000* & HV AD4 XW20

*test bench & road test

Connector:

Lemo Redel male connector with red kink protection sleeve and black protecting cap, 8-pin, D-coded 1000 V AC voltage-stable – IP 67 when connected

Connection end:

(stripping lengths)

| | |
|-----------------------------------|-----------------|
| Outer sheath: | 122 mm stripped |
| Pair sheath: | 22 mm |
| Open end: | 2 mm |
| Connection: | tinned |
| Temperature range single channel: | -55°C / +180°C |

Cable data:

| | |
|---------------------------------|----------------------------------------------------|
| Connection cable: | HV measuring cable |
| Core insulation: | FEP – acc. to DIN 47100 1-8 |
| Pair sheath: | FEP – orange acc. to RAL 2004 |
| Inner sheath: | PUR – blue acc. to RAL 5024 |
| Outer sheath: | PUR |
| Sheath colour: | orange with black vertical stripes |
| Stranding: | paired construction (for EMC) |
| Outer diameter: | approx. 7,4 mm |
| Dielectric strength: | 1000 V AC over pair sheath |
| Temperature range fixed laying: | -50°C / +150°C |
| flexible application: | -40°C / +150°C |
| Special characteristics: | contact protection also over individual channels ✓ |

Tests:

► Cable test

core/core – 2500 V AC - 5 min
over pair sheath –
5000 V AC – 5 min – with reference to EN 50264-2-1

► Product test

routine test of harnessed connector with reference to standard 61010-1 for measuring devices as well as VDE indications in our in-house ball bath (released by VDE). Control of contact protection towards outside – 3000 V/1 min AC

Issue of HV test certificate with reference to batch number due to optimum traceability

Optional: Test and repair of already used sensors on request

CONFIGURATION EXAMPLE

| item no. | connection cable length [mm] | single channel length [mm] | | | connection type |
|--------------|------------------------------|----------------------------|------|------|-----------------|
| | | sheath | pair | core | connection |
| T645-062-695 | 2000 | 122 | 22 | 2 | tinned |
| T645-063-151 | 3000 | 122 | 22 | 2 | tinned |

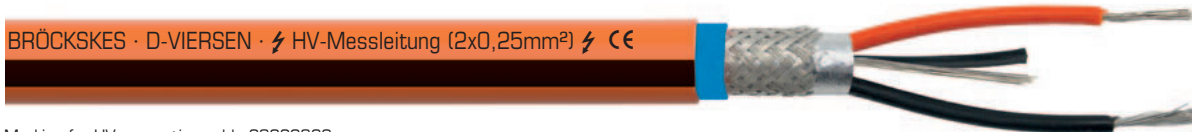
Total cable and channel lengths can be realised on customer's request.

SAB identification:

item number, batch number

HV measuring cable (DC)

for DC voltage measurement



Marking for HV connecting cable 38339800:

SAB BRÖCKSKES · D-VIERSEN · HV-Messleitung (2x0,25mm²) ⚡ CE

Application range: The high voltage measuring cable is used in the development of electric vehicles where scoop-proof testing and measuring of up to 1800 V DC operating voltage and application in the HV environment of electromobility take place. Examples of applications are HV power electronics, HV batteries, electric motors, inverters, etc. High voltage measuring cables are used on the test benches and in test vehicles.

Construction:

| | |
|-------------------------|---------------------------------------------------|
| Conductor: | tinned copper strands, extra fine wires |
| Core insulation: | FEP |
| Colour code: | red and black |
| Stranding: | together with tinned copper drain wire, AWG 24 |
| Screen: | alu foil and tinned copper braiding |
| Inner sheath: | FEP - blue acc. to RAL 5024 |
| Outer sheath: | PUR |
| Sheath colour: | orange with black vertical stripes |

Outstanding features:



- temperature resistance up to +150 °C (up to 3000 hours)
- high flexibility
- high abrasion resistance
- easy harnessing

Technical data:

| | |
|-----------------------------------------|----------------------------------------------|
| Scoop-proof: | 1000 V DC over blue inner sheath |
| Testing voltage: | 5000 V AC over blue inner sheath |
| Operating voltage U_o: | 1000 V DC |
| Operating voltage U: | 1800 V DC |
| Testing voltage: | core/core 5000 V AC core/screen 5000 V AC |
| Min. bending radius | |
| fixed laying: | 5 x d |
| flexible application: | 10 x d |
| Temperature range | |
| fixed laying: | -50/+125 °C |
| flexible application: | -40/+125 °C |
| short time use: | +150 °C (up to 3000 h) |
| Absence of harmful substances: | acc. to RoHS directive of the European Union |

| item no. | no. of cores x cross section n x mm ² | outer-ø approx. mm | copper figure kg/km | cable weight ≈ kg/km | ohmic resistance max. Ω/km |
|-----------|--------------------------------------------------------|--------------------------|---------------------------|----------------------------|----------------------------------|
| 3833-9800 | 2 x 0,25 | 6,5 | 21,3 | 58 | 80,0 |
| 3833-9819 | 2 x 0,34 | 6,7 | 24,9 | 63 | 58,8 |
| 3833-9801 | 2 x 0,50 | 7,1 | 28,1 | 70 | 40,1 |
| 3833-9802 | 2 x 1,00 | 7,8 | 42,5 | 90 | 20,0 |
| 3833-9803 | 2 x 1,50 | 8,4 | 55,8 | 108 | 13,7 |

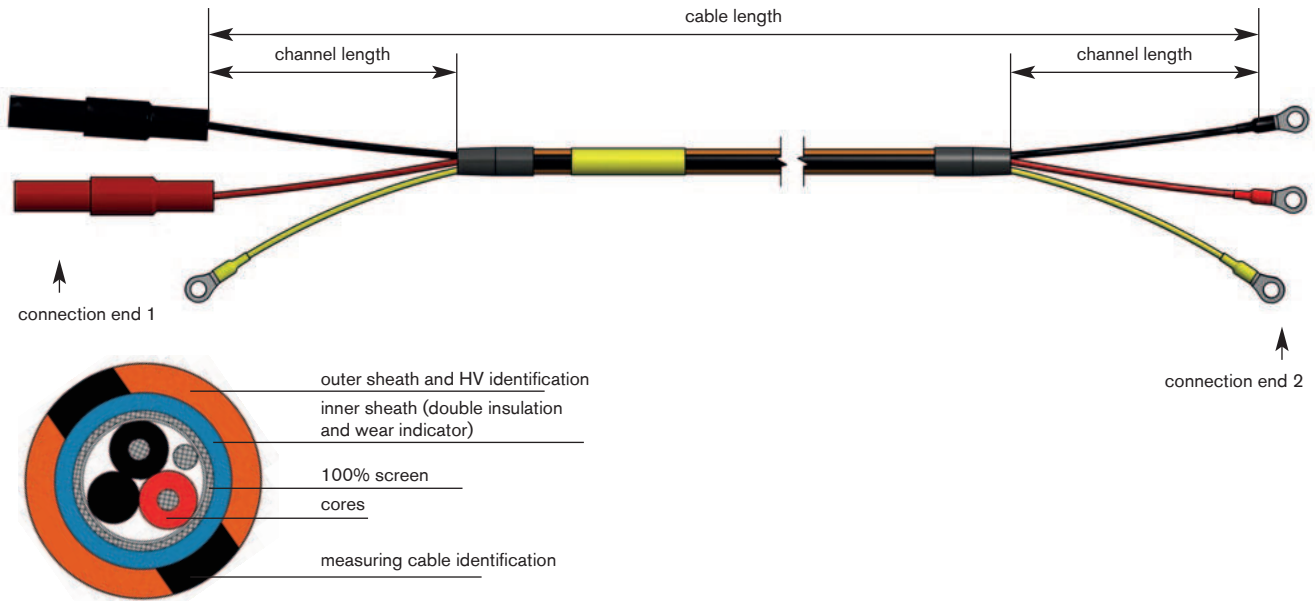
Other dimensions and colours are possible on request.

Possible on request:

As harnessed measuring cable
with connected lab plugs
to collect the tension at HV components
- see next page -

HIGH VOLTAGE MEASUREMENT

HV measuring cable (DC) for DC voltage measurement (as cable harness)



Application range:

Safe HV measurement of DC voltages

Connectors:

Safety lab plugs 1000 V, CAT III, red and black, 4 mm cable lug M4

Connection end:

| | |
|-----------------------------------|----------------------------------------------------------|
| Stripping length: | 250 mm |
| Screen: | led out with filler and insulated with shrinkable sleeve |
| Temperature range of single core: | -55°C / +180°C |

Cable data:

| | |
|-----------------------|------------------------------------------------|
| Connection cable: | HV measuring cable |
| Core insulation: | FEP – red and black |
| Stranding: | together with tinned copper drain wire, AWG 24 |
| Screen: | 100% screen with alu foil and braiding |
| Inner sheath: | PUR – blue acc. to RAL 5024 |
| Outer sheath: | PUR |
| Sheath colour: | orange with black vertical stripes |
| Outer diameter: | see table on page 22 |
| Scoop-proof: | 1000 V DC over blue inner sheath |
| Operating voltage: | 1800 V DC |
| Temperature range | |
| fixed laying: | -50°C / +125°C |
| flexible application: | -40°C / +125°C |
| short time use: | +150°C (up to 3000 h) |

CONFIGURATION EXAMPLE

| item no. | connection cable length [mm] | single channel length [mm] | | |
|--------------|------------------------------|----------------------------|-----------|----------------------------------|
| | | channel 1 | channel 2 | safety lab plugs + M4 cable lugs |
| T645-062-912 | 6500 | 250 | 250 | |

Total cable and channel lengths can be realised on customer's request.

SAB identification:

item number, batch number

HV measuring cable (AC)

for AC voltage measurement



Marking for HV connecting cable 38339813:

SAB BRÖCKSKES · D-VIERSEN · HV-Messleitung (3x1,50mm²) CE

Application range: The high voltage measuring cable is used in the development of electric vehicles where scoop-proof testing and measuring of up to 1800 V DC operating voltage and application in the HV environment of electromobility take place. Examples of applications are HV power electronics, HV batteries, electric motors, inverters, etc. High voltage measuring cables are used on the test benches and in test vehicles.

Construction:

| | |
|-------------------------|---------------------------------------------------|
| Conductor: | tinned copper strands, extra fine wires |
| Core insulation: | FEP |
| Colour code: | brown, black, grey |
| Stranding: | together with tinned copper drain wire, AWG 24 |
| Screen: | alu foil and tinned copper braiding |
| Inner sheath: | FEP - blue acc. to RAL 5024 |
| Outer sheath: | PUR |
| Sheath colour: | orange with black vertical stripes |

Outstanding features:



- temperature resistance up to +150 °C (up to 3000 hours)
- high flexibility
- high abrasion resistance
- easy harnessing

Technical data:

| | |
|---------------------------------------|---------------------------------------------------------------|
| Scoop-proof: | 1000 V DC over blue inner sheath |
| Testing voltage: | 5000 V AC over blue inner sheath |
| Operating voltage: | core/core 1800 V DC core/core 1000 V ASC |
| Testing voltage: | core/core 5000 V AC core/screen 5000 V AC |
| Min. bending radius | |
| fixed laying: | 5 x d |
| flexible application: | 10 x d |
| Temperature range | |
| fixed laying: | -50/+125 °C |
| flexible application: | -40/+125 °C |
| short time use: | +150 °C (up to 3000 h) |
| Temperature range of cores: | up to +180 °C (short time use up to +205 °C) |
| Oil resistance: | very good - TMPU acc. to EN 50363-10-2 + VDE 0207-363-10-2 |
| Absence of harmful substances: | acc. to RoHS directive of the European Union |

| item no. | no. of cores x cross section n x mm ² | outer-ø approx. mm | copper figure kg/km | cable weight ≈ kg/km | ohmic resistance max. Ω/km |
|----------|--------------------------------------------------------|--------------------------|---------------------------|----------------------------|----------------------------------|
| 38339820 | 3 x 0,25 | 6,8 | 25,5 | 66 | 80,0 |
| 38339816 | 3 x 0,34 | 7,0 | 28,3 | 71 | 58,8 |
| 38339815 | 3 x 0,50 | 7,4 | 34,5 | 81 | 40,1 |
| 38339814 | 3 x 1,00 | 8,1 | 53,3 | 106 | 20,0 |
| 38339813 | 3 x 1,50 | 8,8 | 71,7 | 130 | 13,7 |

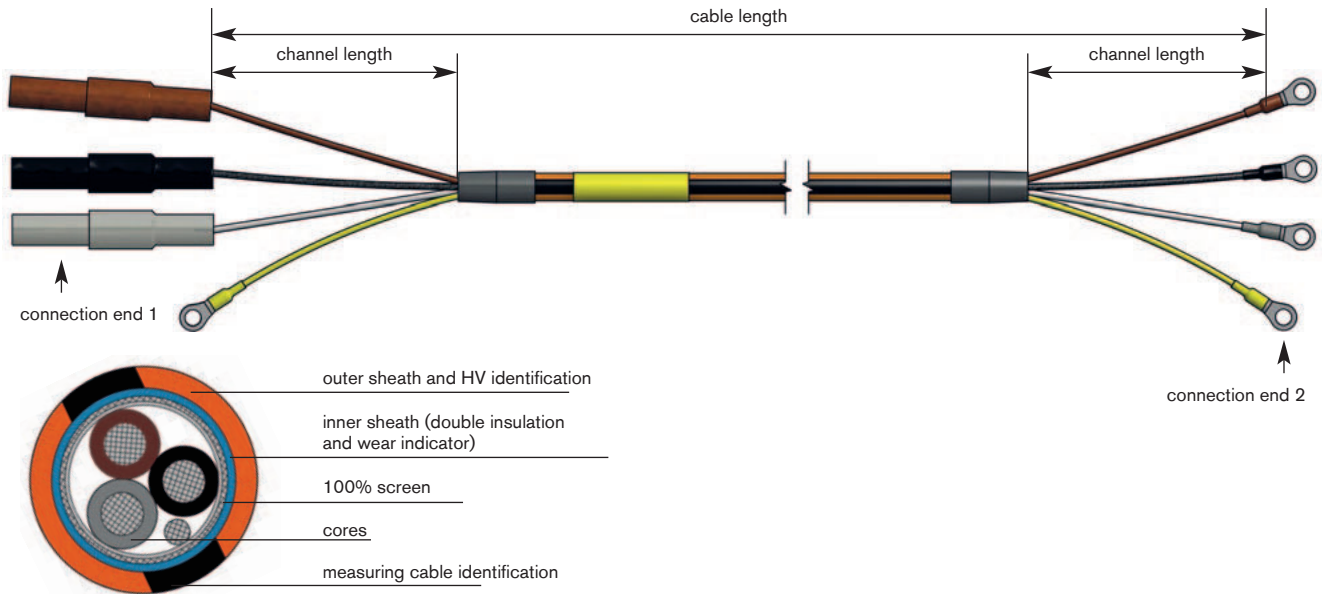
Other dimensions and colours are possible on request.

Possible on request:

As harnessed measuring cable
with connected lab plugs
to collect the voltage at HV components
- see next page -



HV measuring cable (AC) for AC voltage measurement (as cable harness)



Application range:

Safe HV measurement of AC voltages

Connectors:

Safety lab plugs 1000 V, CAT III,
brown, grey and black, 4 mm cable lug M4

Connection end:

| | |
|-----------------------------------|----------------------------------------------------------|
| Stripping length: | 250 mm |
| Screen: | led out with filler and insulated with shrinkable sleeve |
| Temperature range of single core: | -55°C / +180°C |

Cable data:

| | |
|-----------------------|------------------------------------------------|
| Connection cable: | HV measuring cable |
| Core insulation: | FEP – brown, black and grey |
| Stranding: | together with tinned copper drain wire, AWG 24 |
| Screen: | 100% screen with alu foil and braiding |
| Inner sheath: | PUR – blue acc. to RAL 5024 |
| Outer sheath: | PUR |
| Sheath colour: | orange with black vertical stripes |
| Outer diameter: | see table on page 24 |
| Scoop-proof: | 1000 V DC over blue inner sheath |
| Operating voltage: | 1800 V DC |
| Temperature range | |
| fixed laying: | -50°C / +125°C |
| flexible application: | -40°C / +125°C |
| short time use: | +150°C (up to 3000 h) |

CONFIGURATION EXAMPLE

| item no. | connection cable length [mm] | stripping length [mm] | | |
|--------------|------------------------------|-----------------------|--------------|----------------------------------|
| | | connection 1 | connection 2 | safety lab plugs + M4 cable lugs |
| T645-062-913 | 6500 | 250 | 250 | |

Total cable and channel lengths can be realised on customer's request.

SAB identification:

item number, batch number

HIGHLY FLEXIBLE HIGH VOLTAGE CABLE

Nominal voltage up to
U₀/U 1.8/3 kV AC

B 110 C

highly flexible Besilen® HV single core, shielded



Marking for B 110 C 01109507:

SAB BRÜCKSKES · D-VIERSEN · B 110 C U₀/U 1,8/3 kV 95,0mm²

Application range: The connection cable is for example appropriate to connect converters to electric-mobility test benches. Due to the high voltage rating, the cable can be used for various components and power electronics. The extremely flexible cable design enables an easy laying.

Construction:

| | |
|-------------------------|----------------------------------------------------------------|
| Conductor: | bare copper strands, extra fine wires |
| Core insulation: | Besilen® EI2 acc. to EN 50363-1 + VDE 0207-363-1, orange |
| Screen: | alu foil and tinned copper braiding |
| Sheath material: | Besilen® EM9 acc. to EN 50363-2-1 + VDE 0207-363-2-1 |
| Sheath colour: | orange (similar RAL 2004) |

Technical data:

| | |
|----------------------------------------------|------------------------------------------------------------------------------------|
| Nominal voltage: | U ₀ /U 1,8/3,0 kV AC U ₀ /U 2,7/5,4 kV DC |
| Testing voltage: | 6500 V |
| Current-carrying capacity: | acc. to VDE 0298-4 |
| Min. bending radius | |
| fixed laying: | 6 x d |
| flexible application: | 10 x d |
| Temperature range | |
| fixed laying: | -40/+180 °C |
| flexible application: | -25/+180 °C |
| short time use: | +250 °C |
| Halogen-free: | acc. to IEC 60754-1 + VDE 0482-754-1 |
| Fire performance: | flame retardant and self-extinguishing acc. to IEC 60332-1-2 + VDE 0482-332-1-2 |
| Corrosiveness of conflagration gases: | IEC 60754-2 + VDE 0482-754-2 - no development of corrosive conflagration gases |
| Weather resistance: | very good |
| Absence of harmful substances: | acc. to RoHS directive of the European Union |

Outstanding features:



- extremely flexible
- good EMC characteristics
- halogen-free
- heat resistant
- flexible at low temperatures
- flame retardant and self-extinguishing
- weather resistant

| item no. | nominal cross section mm ² | largest single wire ø mm | ø over inner sheath approx. mm | outer-ø mm | copper figure kg/km | cable weight ≈ kg/km |
|----------|---------------------------------------|--------------------------|--------------------------------|------------|---------------------|----------------------|
| 01100107 | 1,00 | 0,07 | 4,3 | 7,6 | 27,2 | 62 |
| 01100157 | 1,50 | 0,07 | 4,7 | 8,0 | 34,4 | 81 |
| 01100257 | 2,50 | 0,07 | 5,2 | 8,5 | 44,6 | 96 |
| 01100407 | 4,00 | 0,07 | 5,9 | 9,1 | 59,2 | 97 |
| 01100607 | 6,00 | 0,07 | 6,3 | 9,6 | 108,8 | 143 |
| 01101007 | 10,00 | 0,07 | 8,2 | 11,7 | 147,7 | 229 |
| 01101607 | 16,00 | 0,07 | 8,5 | 12,0 | 205,7 | 280 |
| 01102507 | 25,00 | 0,10 | 11,2 | 14,7 | 307,4 | 420 |
| 01103507 | 35,00 | 0,10 | 12,6 | 16,3 | 432,6 | 548 |
| 01105007 | 50,00 | 0,10 | 14,5 | 18,2 | 593,6 | 724 |
| 01107007 | 70,00 | 0,10 | 16,5 | 20,4 | 804,4 | 952 |
| 01109507 | 95,00 | 0,10 | 18,4 | 22,3 | 1064,5 | 1232 |
| 01101207 | 120,00 | 0,10 | 20,1 | 24,2 | 1311,0 | 1494 |
| 01101507 | 150,00 | 0,10 | 23,3 | 27,4 | 1627,6 | 1834 |
| 01101857 | 185,00 | 0,15 | 24,9 | 29,2 | 1970,9 | 2228 |
| 01102407 | 240,00 | 0,15 | 27,5 | 32,0 | 2546,1 | 2837 |
| 01103007 | 300,00 | 0,15 | 30,0 | 34,7 | 3108,6 | 3349 |

Other dimensions and colours are possible on request.

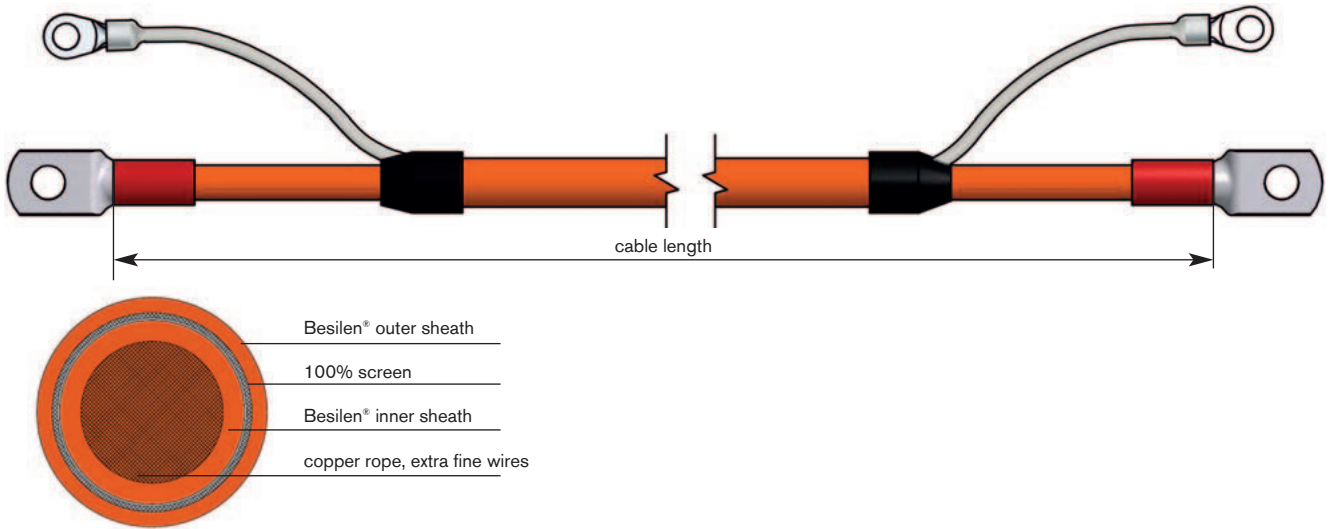


HIGHLY FLEXIBLE HIGH VOLTAGE CABLE

Nominal voltage up to
U₀/U 1.8/3 kV AC

B 110 C

highly flexible Besilen® HV single core, shielded (as cable harness)



Application range:

for example at HV test benches
for the transmission of high current load

Connection end:

| | |
|----------------------------|-------------------------------------------------------------|
| Outer sheath: | 50 mm stripped |
| Connection end 1+2: | tube cable lug (single core) and ring cable lug (screen) |
| Screen: | led out, twisted and insulated with shrinkable sleeve |

Cable data:

| | |
|--------------------------|--------------------------------------------------------------------|
| Connection cable: | highly flexible HV single core, screened |
| Core insulation: | Besilen® |
| Screen: | 100% screen with alu foil and braiding |
| Outer sheath: | Besilen® |
| Sheath colour: | orange |
| Outer diameter: | see table on page 26 |
| Nominal voltage: | U ₀ /U 1,8/3,0 kV AC U ₀ /U 2,7/5,4 kV DC |
| Temperature range | |
| fixed laying: | -40°C / +180°C |
| flexible application: | -25°C / +180°C |
| short time use: | +250°C |

CONFIGURATION EXAMPLE

| item no. | connection cable length [mm] | stripping lengths + conductor cross section | | |
|------------------|---------------------------------|---------------------------------------------|--------|--------------------|
| | | side 1 | side 2 | cross section |
| S0110-1006-00075 | 750 | 50 mm | 50 mm | 16 mm ² |

Total cable and channel lengths can be realised on customer's request.

SAB identification:

item number, batch number

HIGHLY FLEXIBLE HIGH VOLTAGE CABLE

Nominal voltage up to
U₀/U 1,8/3 kV AC

B 107

highly flexible Besilen® HV single core, unshielded



Marking for B 107 01079507:

SAB BRÖCKSKES · D-VIERSEN · B 107 U₀/U 1,8/3 kV 95,0mm²

Application range: The highly flexible single core is particularly appropriate for the application on electric test benches. Due to the fine stranding and the resulting flexibility, the cable can be installed easily. The high voltage single core is designed for a voltage range of 1,8/3 kV. In this way it fulfils the increasing demands within the voltage class.

Construction:

| | |
|-------------------------|-----------------------------------------------------|
| Conductor: | bare copper strands, extra fine wires |
| Core insulation: | Besilen® EI2 acc. to EN 50363-1 + VDE 0207-363-1 |
| Sheath colour: | orange (similar RAL 2004) |

Outstanding features:

- extremely flexible
- halogen-free
- heat resistant
- flexible at low temperatures
- flame retardant and self-extinguishing
- weather resistant

Technical data:

| | |
|----------------------------------------------|------------------------------------------------------------------------------------|
| Nominal voltage: | U ₀ /U 1,8/3,0 kV |
| Testing voltage: | 6500 V |
| Current-carrying capacity: | acc. to VDE 0298-4 |
| Min. bending radius: | 5 x d |
| Temperature range | |
| fixed laying: | -40/+180 °C |
| flexible application: | -25/+180 °C |
| short time use: | +250 °C |
| Halogen-free: | acc. to IEC 60754-1 + VDE 0482-754-1 |
| Fire performance: | flame retardant and self-extinguishing acc. to IEC 60332-1-2 + VDE 0482-332-1-2 |
| Corrosiveness of conflagration gases: | IEC 60754-2 + VDE 0482-754-2 - no development of corrosive conflagration gases |
| Weather resistance: | very good |
| Absence of harmful substances: | acc. to RoHS directive of the European Union |

| item no. | nominal cross section mm ² | largest single wire ø mm | outer-ø mm | copper figure kg/km | cable weight ≈ kg/km |
|----------|---------------------------------------|--------------------------|------------|---------------------|----------------------|
| 01070107 | 1,00 | 0,07 | 4,3 | 9,6 | 25 |
| 01070157 | 1,50 | 0,07 | 4,7 | 14,4 | 32 |
| 01070257 | 2,50 | 0,07 | 5,2 | 24,0 | 43 |
| 01070407 | 4,00 | 0,07 | 5,9 | 38,4 | 60 |
| 01070607 | 6,00 | 0,07 | 6,3 | 57,6 | 80 |
| 01071007 | 10,00 | 0,07 | 9,0 | 96,0 | 146 |
| 01071607 | 16,00 | 0,07 | 9,3 | 153,6 | 196 |
| 01072507 | 25,00 | 0,10 | 12,0 | 240,0 | 314 |
| 01073507 | 35,00 | 0,10 | 13,8 | 336,0 | 426 |
| 01075007 | 50,00 | 0,10 | 15,7 | 480,0 | 581 |
| 01077007 | 70,00 | 0,10 | 17,7 | 672,0 | 777 |
| 01079507 | 95,00 | 0,10 | 18,8 | 912,0 | 1012 |
| 01071207 | 120,00 | 0,10 | 20,5 | 1152,0 | 1244 |
| 01071507 | 150,00 | 0,10 | 23,7 | 1440,0 | 1551 |
| 01071857 | 185,00 | 0,15 | 25,3 | 1776,0 | 1893 |
| 01072407 | 240,00 | 0,15 | 27,9 | 2304,0 | 2509 |
| 01073007 | 300,00 | 0,15 | 30,8 | 2880,0 | 3003 |

Other dimensions and colours are possible on request.

for E-Mobility
HV test benches

HIGHLY FLEXIBLE HIGH VOLTAGE CABLE

B 110 C Sense Cable

halogen-free Besilen® Sense cable, shielded



Marking for B 110 C Sense Cable:

SAB BRÖCKSKES · D-VIERSEN · B 110 C Sense Cable 2x1,0mm² 0110-9001

Construction:

| | |
|-------------------------|---------------------------------------------------------|
| Conductor: | bare copper strands, extra fine wires |
| Core insulation: | Besilen® EI2 acc. to EN 50363-1 + VDE 0207-363-1 |
| Colour code: | black and red |
| Stranding: | together with tinned copper drain wire, AWG 26 |
| Screen: | alu foil and tinned copper braiding |
| Sheath material: | Besilen® EM9 acc. to EN 50363-2-1 + VDE 0207-363-2-1 |
| Sheath colour: | orange (similar RAL 2004) |

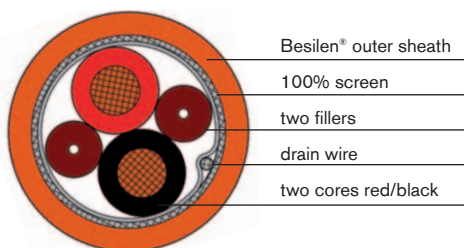
Technical data:

| | |
|----------------------------------------------|------------------------------------------------------------------------------------|
| Nominal voltage: | 1500 V AC 2200 V DC |
| Testing voltage: | 4000 V |
| Current-carrying capacity: | acc. to VDE 0298-4 |
| Min. bending radius | |
| fixed laying: | 6 x d |
| flexible application: | 10 x d |
| Temperature range | |
| fixed laying: | -40/+180 °C |
| flexible application: | -25/+180 °C |
| short time use: | +250 °C |
| Halogen-free: | acc. to IEC 60754-1 + VDE 0482-754-1 |
| Fire performance: | flame retardant and self-extinguishing acc. to IEC 60332-1-2 + VDE 0482-332-1-2 |
| Corrosiveness of conflagration gases: | IEC 60754-2 + VDE 0482-754-2 - no development of corrosive conflagration gases |
| Weather resistance: | very good |
| Absence of harmful substances: | acc. to RoHS directive of the European Union |

Outstanding features:



- extremely flexible
- good EMC characteristics
- halogen-free
- heat resistant
- flexible at low temperatures
- flame retardant and self-extinguishing
- weather resistant



| item no. | no. of cores x cross section n x mm ² | core-ø max. mm | outer-ø mm | copper figure kg/km | cable weight ≈ kg/km | ohmic resistance at 20 °C max. Ω/km |
|----------|--------------------------------------------------------|----------------------|---------------|---------------------------|----------------------------|-------------------------------------------|
| 01109006 | 2 x 0,25 | 3,50 | 10,7 | 32,8 | 111 | 80,0 |
| 01109007 | 2 x 0,34 | 3,60 | 11,1 | 53,5 | 129 | 58,8 |
| 01109008 | 2 x 0,50 | 3,80 | 11,7 | 57,3 | 141 | 39,0 |
| 01109001 | 2 x 1,00 | 4,35 | 12,7 | 72,7 | 169 | 20,0 |
| 01109002 | 2 x 1,50 | 4,75 | 13,5 | 90,1 | 197 | 13,3 |
| 01109003 | 2 x 2,50 | 5,25 | 14,6 | 111,0 | 237 | 7,98 |
| 01109004 | 2 x 4,00 | 5,95 | 16,1 | 146,5 | 296 | 4,95 |
| 01109005 | 2 x 6,00 | 6,35 | 17,1 | 216,3 | 364 | 3,3 |

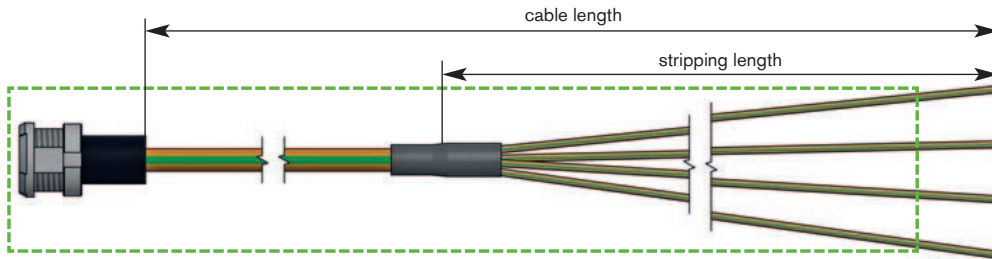
Other dimensions and colours are possible on request.

Possible on request:

As harnessed cable
acc. to customer's specification

HV test adapter

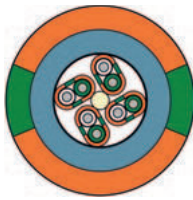
 scoop-proof area



 For all sensor types available!

e.g. HV test adapter for HV 4-channel type K sensors

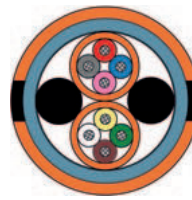
4-channel type K



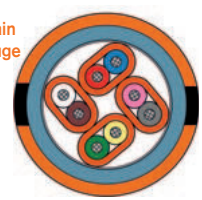
1-channel type K



2-channel PT100



strain gauge



Application range: The HV test adapter is used for the adaptation of HV sensors in fixed installation and are available for all sensor types in high voltage environments. The connection to test installed sensors for potential compensating measurements or the fixed installation in empty housings are only some of the application fields for which a test adapter can be used.

Application range:

for example to test installed HV sensors

Connector:

Lemo Redel 2P apparatus socket with black potting sleeve, 8-pole, coding acc. to sensor type
1000 V AC voltage-proof
– only suitable for fixed installation.

Connection end:

stripping length acc. to customer's request /
open end: 2 mm
dimensions for mounting cut-out on request

Cable data:

| | |
|-----------------------------|-----------------------------------------------|
| Description: | high voltage cable acc. to sensor type |
| Core insulation: | FEP |
| Inner sheath: | PUR – blue acc. to RAL 5024 |
| Outer sheath: | PUR |
| Sheath colour: | orange with vertical stripes (black or green) |
| Stranding: | paired construction (for EMC) |
| Outer diameter: | depending on the used cable |
| Dielectric strength: | 1000 V AC – depending on the used cable |
| Temperature range | |
| fixed laying: | -50°C / +150°C |
| flexible application: | -40°C / +150°C |

Tests:

► Cable test

core/core – 600 V AC - 1 min - acc. to IEC 60584-1
over pair sheath/inner sheath in water bath –
5000 V AC – 5 min – with reference to EN 50264-2-1

► Product test

routine test of harnessed connector
with reference to standard 61010-1 for measuring devices
as well as VDE indications in our in-house ball bath
(released by VDE). Control of contact protection
towards outside – 3000 V/1 min AC

Issue of HV test certificate with reference to batch number due to optimum traceability

Optional: Test and repair of already used sensors on request

CONFIGURATION EXAMPLES

| item no. | connection cable length | single channel length | type |
|--------------|-------------------------|-----------------------|------------------------------------|
| T141-056-583 | 115 mm | 100 mm | 4 x type K |
| T141-055-568 | 200 mm | 50 mm | 1 x type K |
| T641-057-773 | 150 mm | 100 / 50 mm | 2 x PT100/PT1000 analogue (90V) |
| T644-062-235 | 115 mm | 100 mm | strain gauge |
| T645-xxx-xxx | 115 mm | 100 mm | voltage (90V) |
| T645-xxx-xxx | 155 mm | 100 mm | voltage (1000V) |

SAB identification:

item number, batch number

nel lengths can be realised on customer's request.

Accessories

Application range:

HV cap

HV cap black, universally coded with fixing cord for HV connector.

CONFIGURATION EXAMPLES

| item no. | configuration |
|--------------|---------------|
| T021-061-745 | plug |
| T021-062-719 | socket |



Application range:

dual shrinkable sleeve

Dual shrinkable sleeve natural, PTFE/FEP, Ø before shrinking 1,65 mm - Ø after shrinking 0,00 mm -190°C up to +200°C (for example for the later insulation of measuring tips)

CONFIGURATION EXAMPLE

| item no. | configuration |
|--------------|---------------|
| T020-024-319 | 1000 mm |



Application range:

spare pads

Replacement of adhesive pads to apply the measuring tip on surfaces.

CONFIGURATION EXAMPLES

| item no. | configuration |
|--------------|---------------------|
| T095-044-258 | glass cloth 25 x 25 |
| T095-056-403 | PI foil 12,5 x 25 |



Application range:

automatic hinged cover

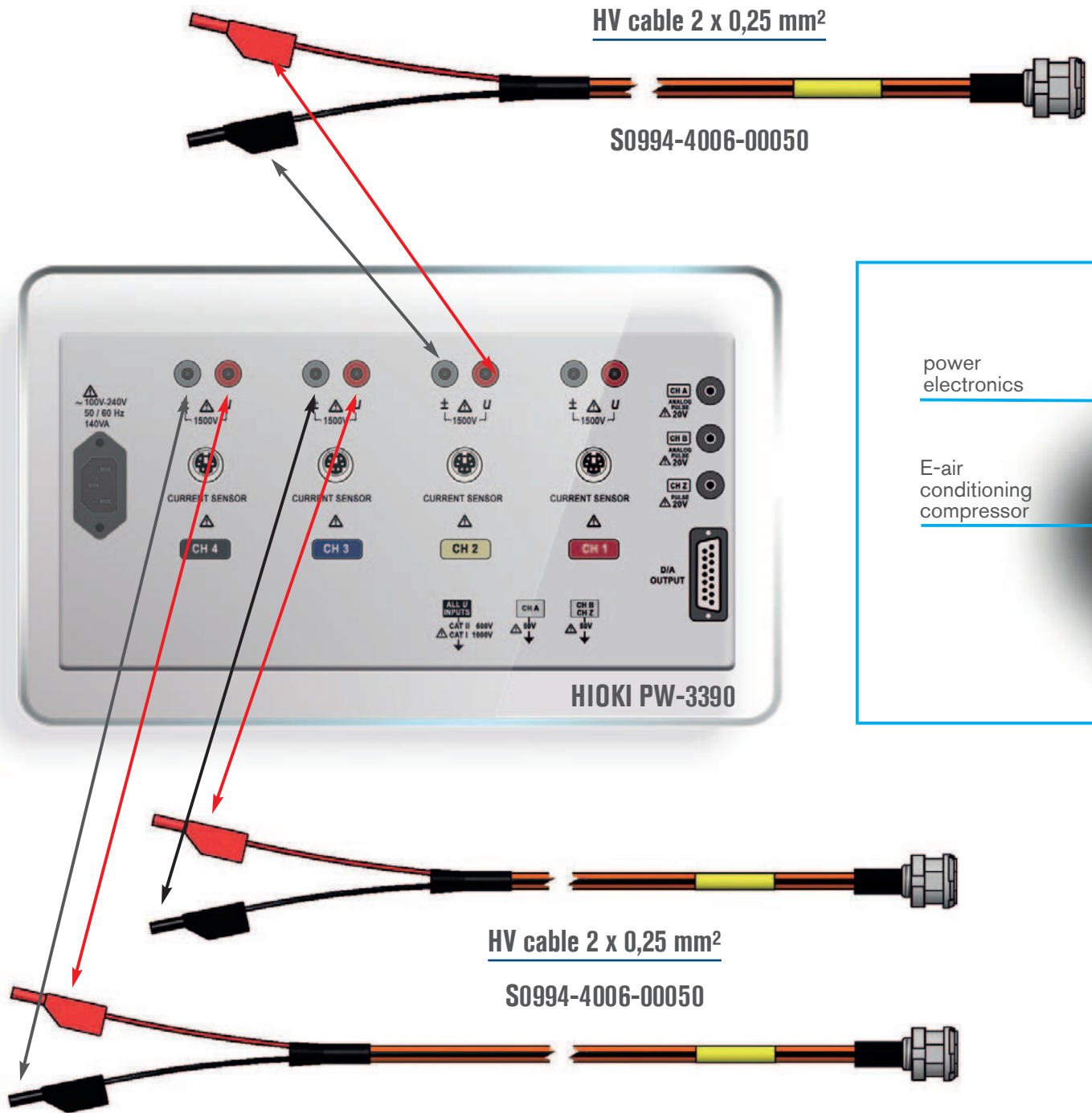
Conversion kit to automatic hinged cover for Redel socket / size 2P to protect the socket from dust, dirt and moisture

CONFIGURATION EXAMPLE

| item no. | configuration |
|--------------|----------------|
| T021-060-467 | conversion kit |



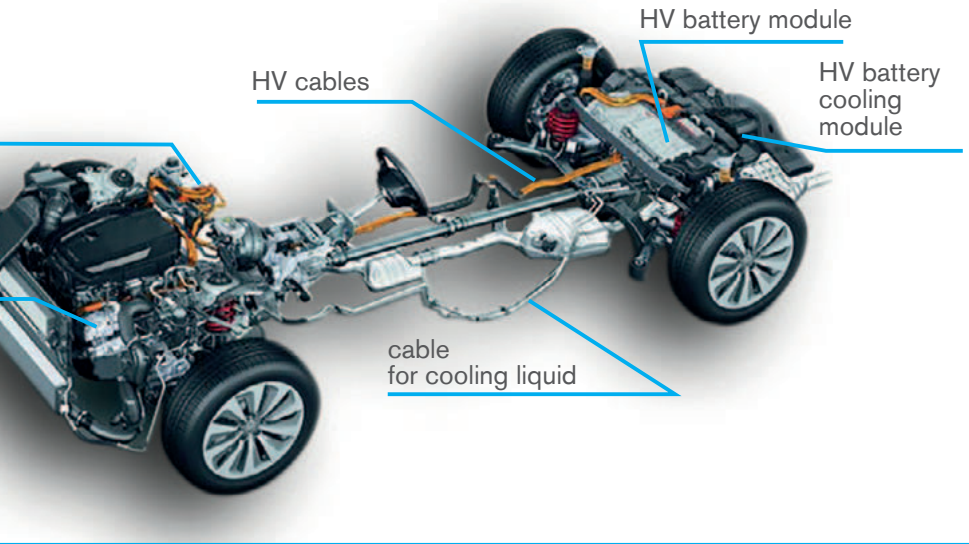
Application example for high voltage measuring cables



LV cable 2 x 0,5 mm² screened



ELECTRIC VEHICLE



LV connection

(e.g. 12V vehicle battery)

HV adapter with clamping points

(vehicle specific)

HV cable 2 x 0,25 mm² screened

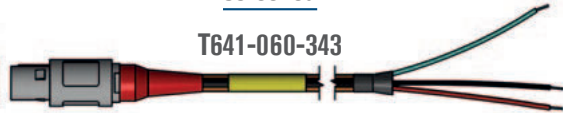
S3833-3002-00015



connection box with Redel socket and 2 connection cables with Redel plug

HV cable 2 x 0,25 mm² screened

T641-060-343



extension

T641-061-127



S3833-3003-00025

connection box with Redel socket and 3 connection cables with Redel plug

SALES AND SERVICE

From our central stock in Viersen-Süchteln or our external stocks, we supply standard lengths as well as special dimensions, often within 24 hours. It is our strength to be at different places at the same time. This shows also our wide product range. Being always ready to deliver our products of constant quality is our strength at SAB Bröckskes. Challenge, obligation - but also guarantee at the same time. This is your advantage - we are present whenever you need our assistance.



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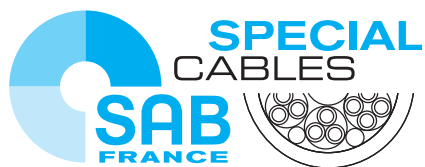
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