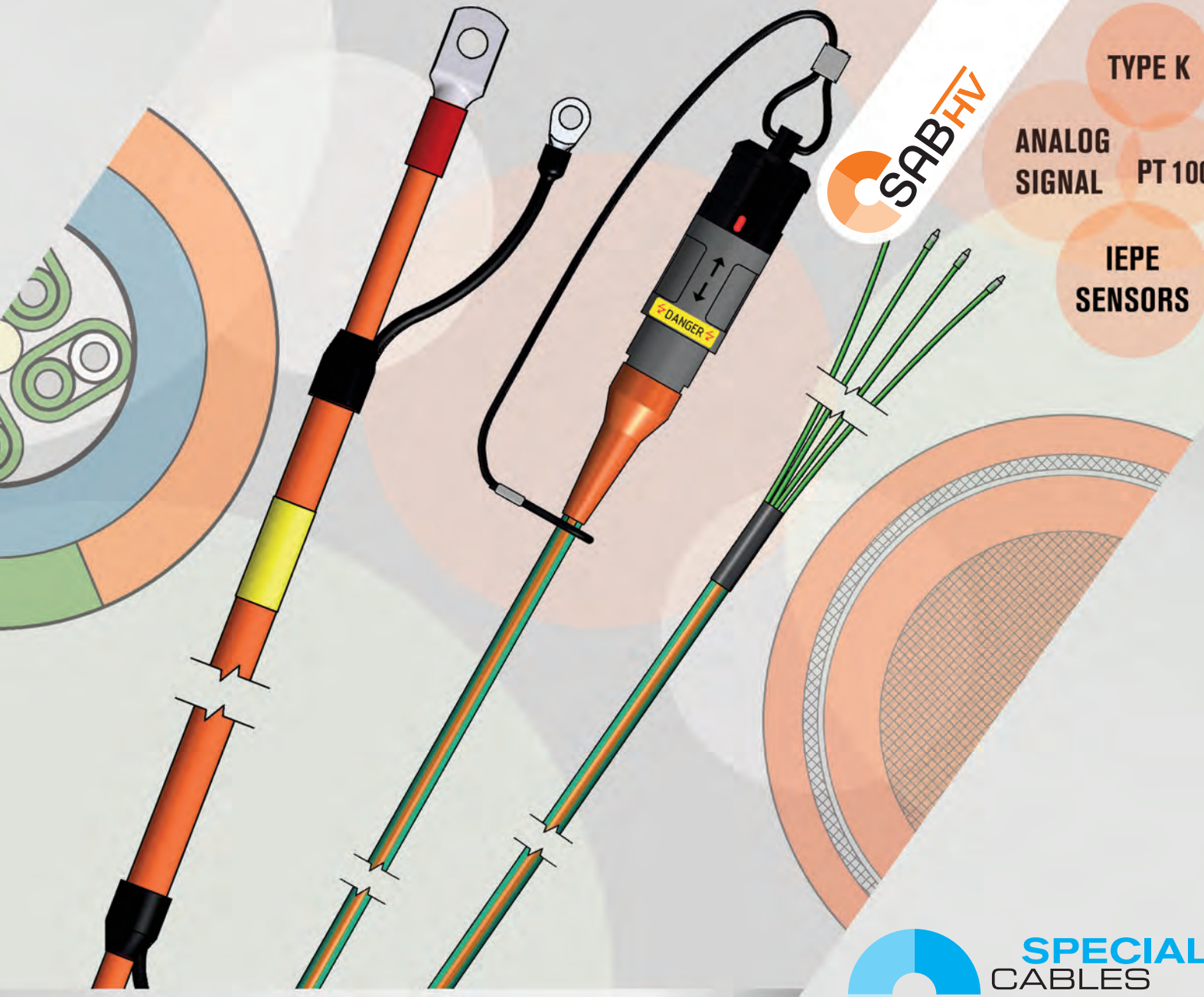
E-MOBILITY

HIGH VOLTAGE MEASUREMENT TECHNOLOGY

75 Years



SABHV

TYPE K

ANALOG SIGNAL

PT 100

IEPE SENSORS

SPECIAL CABLES

SAB North America

www.sabcable.com
866-722-2974 ■ info@sabcable.com

About Us

SAB North America is a focused supplier for the automation, aerospace, medical, high temperature, and robotics industries, providing cable and thermocouple solutions that meet, exceed, and set new standards in the flexible cable market. In addition to flexible cable products, we offer an extensive inventory of high-quality cable accessories, including cord grips, grounding glands and other accessories that complement our flexible control and automation cables.

Whatever the need may be, look to SAB North America for Special Cables that can, for example, help minimize maintenance costs and increase productivity, reduce downtime, and solve specific problems. Here is a small sample of some of the challenges that Special Cables from SAB North America can help address:

- Hybrid designs for multiple functions
- Harsh environments
- Difficult applications
- Industry-specific requirements

For more than 10 years, SAB Bröckskes has been meeting the challenges of developing and optimizing high-voltage cables as well as high-voltage measurement technology for components in electromobility. SAB has designed an HV measurement system with HV measuring modules from our partner CSM, which is ideally suited for mobile and stationary use in the field of electromobility (electric vehicles and hybrid vehicles).

The HV measuring modules are tested for safety according to DIN EN 61010 and thanks to the multi-level safety concept, a safe measurement chain from sensor to data acquisition is easily established with special sensor cables and HV measurement modules. These allow for the safe temperature measurement on high voltage components such as HV batteries.

SAB's level of speed and service as a supplier is unmatched. SAB lives up to its name in not only flexible cable but also flexible manufacturing.

SAB Advantage...We make it Easy

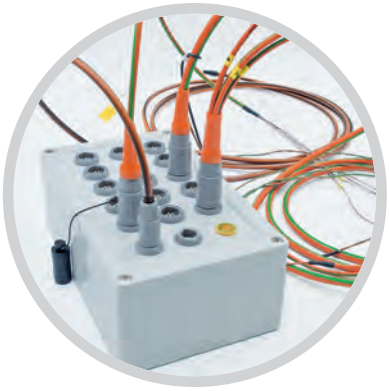
- Engineering & technical assistance
- Cut to length with no cut charges
- Prepaid freight within US for orders over $2,500
- Specialty cable designs (1500 ft minimum)
- No minimum on orders from stock
- Free drop shipments (no surcharges)
- 24-hour shipments from stock
- Cord Grips for securing and grounding cables

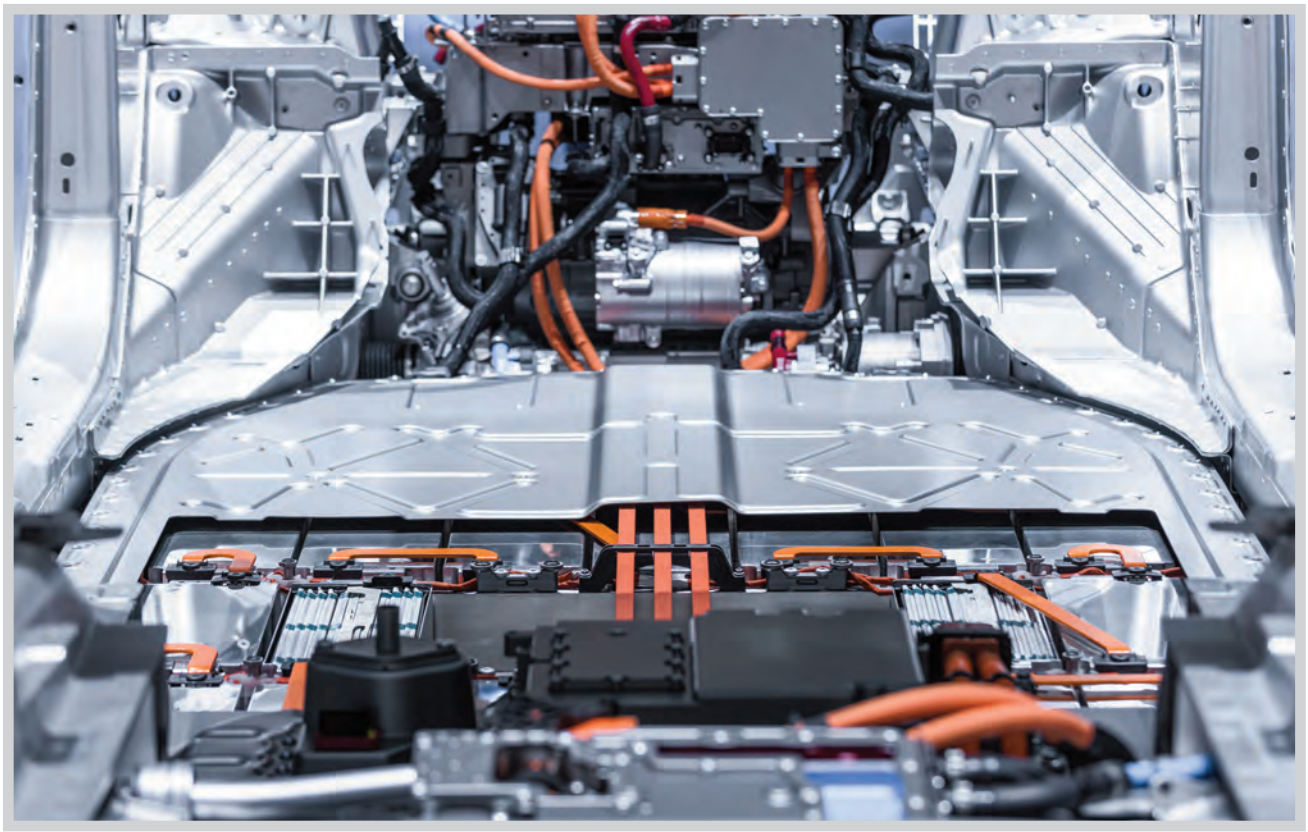
Content

High-Voltage Measurement Systems

For more than 10 years, SAB Bröckskes as a worldwide leading cable manufacturer has been confronted with the challenges of development and optimization of high-voltage cables as well as high-voltage measurement technology for components in electro-mobility. At SAB Bröckskes, we accept the ever changing requirements and challenges of HV Measurement by developing a range of solutions to support the sustainability of HV Meaurement Systems.

These measuring systems have been especially designed for safe temperature measurement within high-voltage components and therefore is extremely suitable for stationary and mobile applications in the field of electro-mobility – electric and hybrid vehicles.





CSM HV Measuring Modules

A safe and precise measurement of temperatures (thermocouples and PT sensors) and analog signals can be achieved by using CSM HV measuring modules in high-voltage environments. CSM HV measuring modules offer reliable modules tested to DIN EN 61010 ensuring the upmost safety. Due to the multi-level safety concept, a measuring chain can be set up between the sensor and data collection point by special sensor cables and HV measuring modules. In addition, standard sensors for 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.

CSM

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

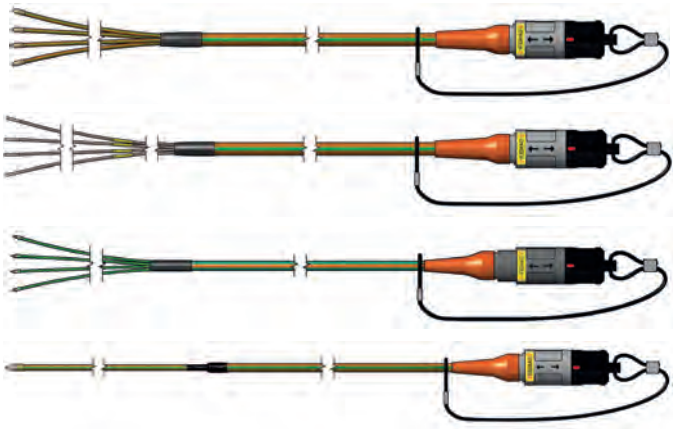
T644 **page 18**

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 (analog measurements)

Product presentation

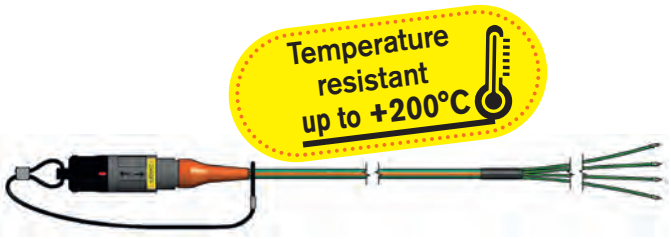


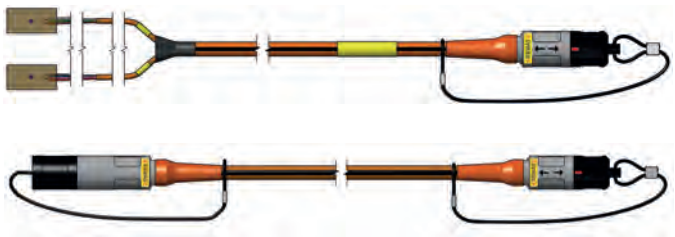
HV SENSORS TYPE K

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 such as inverters, electric motors, HV batteries and power electronics. The HV sensors are appropriate for stationary applications 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 used in the thermal hardening process of insulating materials in E-units or other HV components.



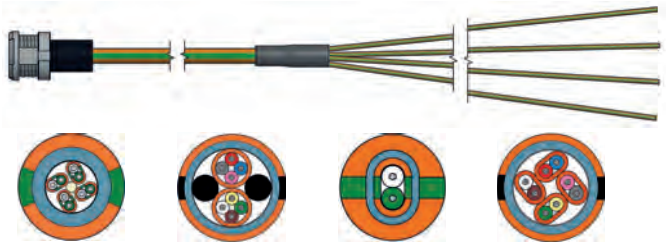


HV SENSORS PT100/1000

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. Applications include 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 appropriate to test installed sensors for potential equalization measurements or the fixed mounting in empty housings.



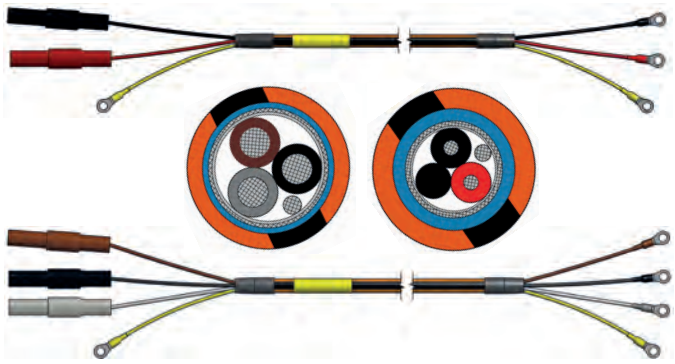
Product presentation

HV SENSOR CABLE ACCELERATION & STRAIN GAUGES

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

HV ANALOG MEASURING CABLE AND VOLTAGE MEASURING CABLE

The analog and voltage measuring cables create safe HV measuring chains between sensors with analog voltage output and the CSM HV AD series measuring modules. By using these HV measuring cables combined with the suitable measuring module a voltage up to 90 V and a high voltage up to 1000 V can be measured in the stationary test field or mobile road test.



HV VOLTAGE MEASUREMENT

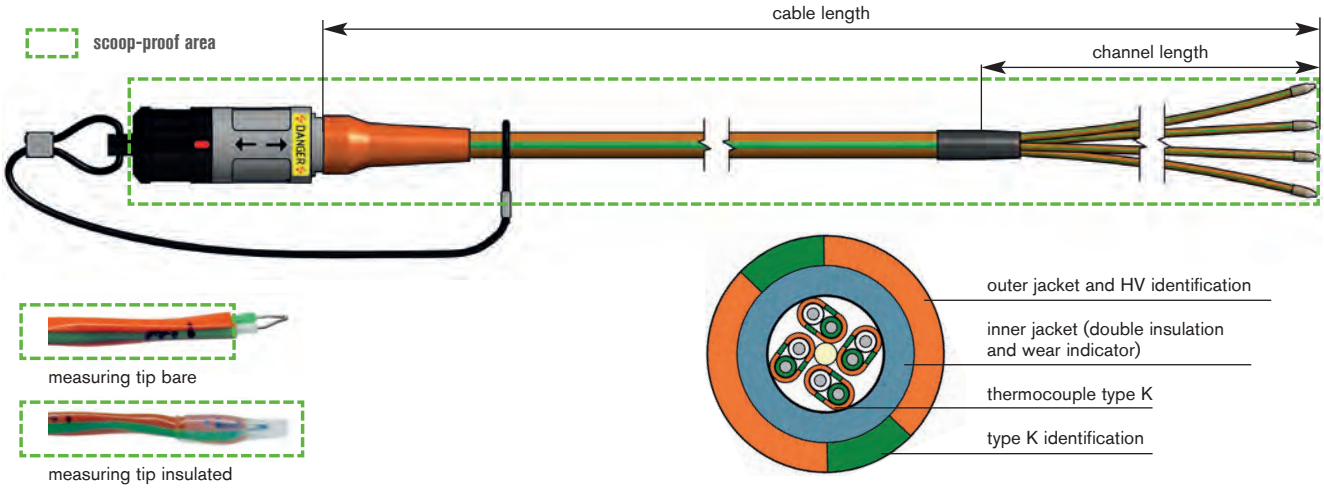
Two or three conductor HV measuring cables allow for the reliable measurements of DC and AC voltage in HV environments. The measuring cables are designed for an operating voltage of up to 1800 V. Furthermore, the conductors are color coded acc. to the voltage type - red and black for plus and minus pole as well as brown, black and grey for the phases L1, L2 and L3.

HIGHLY FLEXIBLE HV CABLES

Our highly flexible HV single conductor and sensor cables are especially appropriate for the installation at HV test benches. The HV single conductors are an optimal feed line for electric motors or battery systems. With the use of silicone insulation combined with a fine stranding, the cables can be installed easily. The shielded HV single conductor offers a 100% EMC protection by a double shielding of braid and aluminum 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 jacket:	FEP – orange with green vertical stripes
Inner jacket:	FEP – blue acc. to RAL 5024
Outer jacket:	PUR
Jacket color:	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 static: flexible:	-50°C / +150°C -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

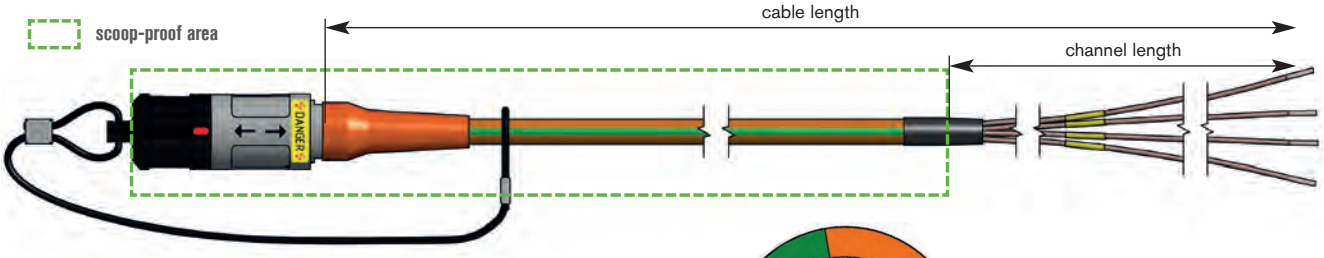
item no.	connection cable length [mm]	single channel length [mm]				type of measuring tip
		channel 1	channel 2	channel 3	channel 4	measuring tip
T141-056-330	2400	400	400	400	400	insulated
T141-051-650	2400	400	400	400	400	bare
T141-061-909	3000	580	560	575	355	insulated

Total cable and channel lengths per customer's requirements

SAB identification:
item number, batch number

HV temperature sensor type K

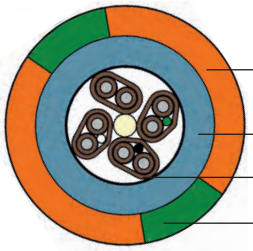
HV 4-channel thermocouple with PI (polyimide) insulated thermo channels



measuring tip bare

measuring tip insulated
(open shrinkable sleeve)/channel oil resistant

measuring tip bare/channel oil resistant



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 jacket:	PI foil
Inner jacket:	FEP – blue acc. to RAL 5024
Outer jacket:	PUR
Jacket color:	orange with green vertical stripes
Stranding:	optimized in layers
Outer diameter:	approx. 4.5 mm
Dielectric strength:	1000 V AC over inner jacket
Temperature range static: flexible:	-50°C / +150°C -40°C / +150°C
Special characteristics:	small cable diameter for narrow spaces ✓

Tests:

▶ **Cable test**
over inner jacket 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	measuring tip
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

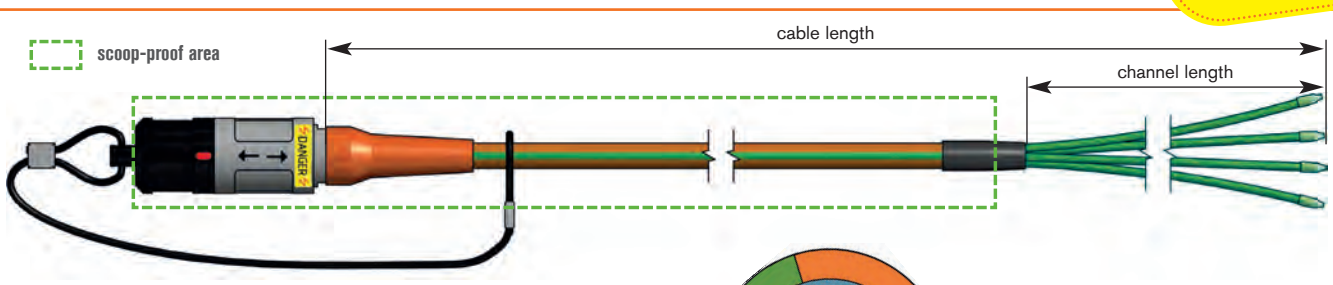
Total cable and channel lengths per customer's requirements

SAB identification:
item number, batch number

HV temperature sensor type K

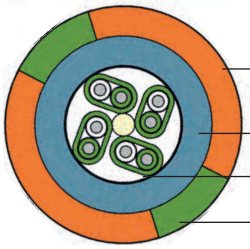
HV 4-channel thermocouple with PFA insulated thermo channels

NEW



measuring tip bare

measuring tip insulated



outer jacket and HV identification

inner jacket (double insulation and wear indicator)

thermocouple type K

type K identification

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 jacket:	PFA – green acc. to RAL 6018
Inner jacket:	FEP – blue acc. to RAL 5024
Outer jacket:	PUR
Jacket color:	orange with green vertical stripes
Stranding:	paired construction (for EMC)
Outer diameter:	approx. 4.4 mm
Dielectric strength:	1000 V AC over inner jacket
Temperature range static: flexible:	-50°C / +150°C -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

HV test certificate issued with batch number reference

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	measuring tip
T141-063-016	2400	400	400	400	400	bare
T141-063-017	3000	500	500	500	500	bare
T141-063-018	2400	400	400	400	400	insulated
T141-063-019	3000	500	500	500	500	insulated

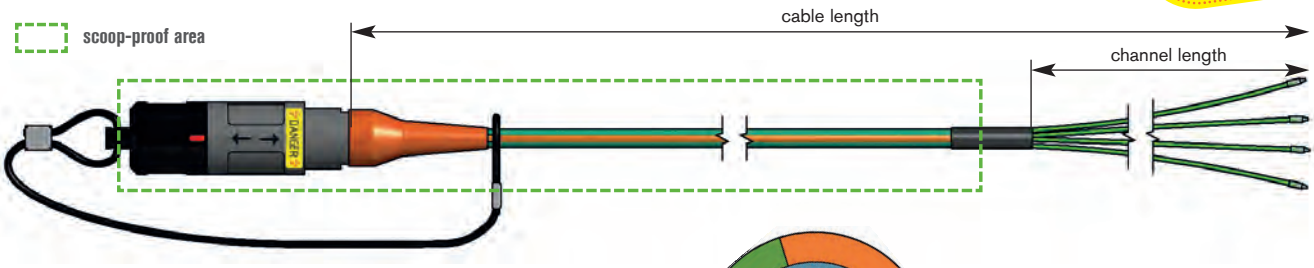
SAB identification:
item number, batch number

Total cable and channel lengths per customer's requirements

HV temperature sensor type K

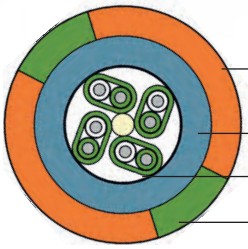
HV 4-channel thermocouple as high temperature version

Temperature resistant up to +200°C



measuring tip bare

measuring tip insulated



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 jacket:	PFA – green acc. to RAL 6018
Inner jacket:	FEP – blue acc. to RAL 5024
Outer jacket:	Besilen®
Jacket color:	orange with green vertical stripes
Stranding:	paired construction (for EMC)
Outer diameter:	approx. 4.4 mm
Dielectric strength:	1000 V AC over inner jacket
Temperature range static: flexible:	-40°C / +220°C -25°C / +220°C
Special characteristics:	high temperature resistant ✓ highly flexible ✓ small cable diameter for narrow spaces ✓

Tests:

▶ **Cable test**
over blue inner jacket 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

HV test certificate issued with batch number reference

Optional: Test and repair of already used sensors on request

CONFIGURATION EXAMPLES

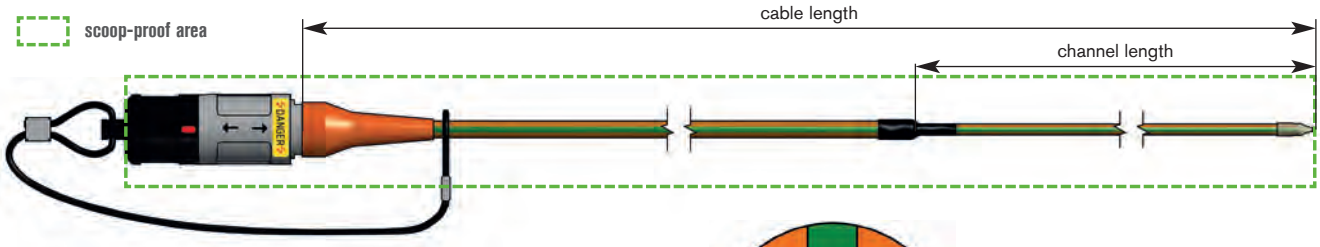
item no.	connection cable length [mm]	single channel length [mm]				type of measuring tip
		channel 1	channel 2	channel 3	channel 4	measuring tip
T151-061-737	3000	500	500	500	500	insulated
T151-061-736	3000	500	500	500	500	bare

Total cable and channel lengths per customer's requirements

SAB identification:
item number, batch number

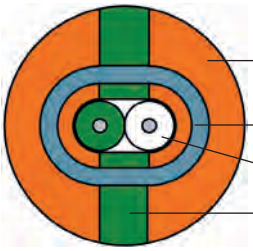
HV temperature sensor type K

HV 1-channel thermocouple



measuring tip bare

measuring tip insulated



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 jacket:	FEP – orange with green vertical stripes
Inner jacket:	FEP – blue acc. to RAL 5024
Outer jacket:	PUR
Jacket color:	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 static: flexible:	-50°C / +150°C -40°C / +150°C
Special characteristics:	contact protection over single channel ✓

Tests:

▶ **Cable test**

over pair jacket 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

HV test certificate issued with batch number reference

Optional: Test and repair of already used sensors on request

CONFIGURATION EXAMPLES

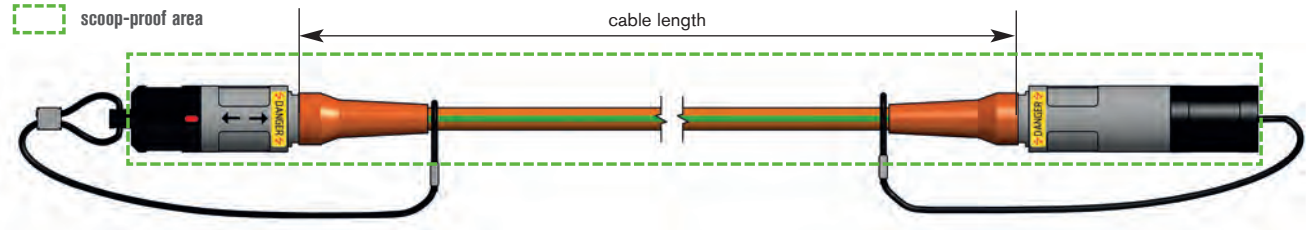
item no.	connection cable length [mm]	single channel length [mm]	type of measuring tip
		channel 1	measuring tip
T141-059-052	2400	400	insulated
T141-058-124	3000	400	bare

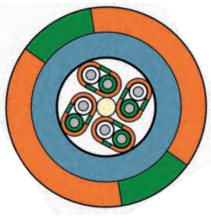
SAB identification:
item number, batch number

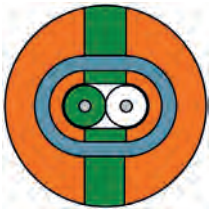
Total cable and channel lengths per customer's requirements

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 connectors - 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 jacket:	FEP – orange with green vertical stripes	FEP – orange with green vertical stripes
Inner jacket:	FEP – blue acc. to RAL 5024	FEP – blue acc. to RAL 5024
Outer jacket:	PUR	PUR
Jacket color:	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 static: flexible:	 -50°C / +150°C -40°C / +150°C	 -50°C / +150°C -40°C / +150°C
Special characteristics:	contact protection over all components ✓	contact protection over all components ✓

Tests:

▶ **Cable test**
over pair jacket 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

HV test certificate issued with batch number reference

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 cable and channel lengths per customer's requirements

CONFIGURATION EXAMPLES

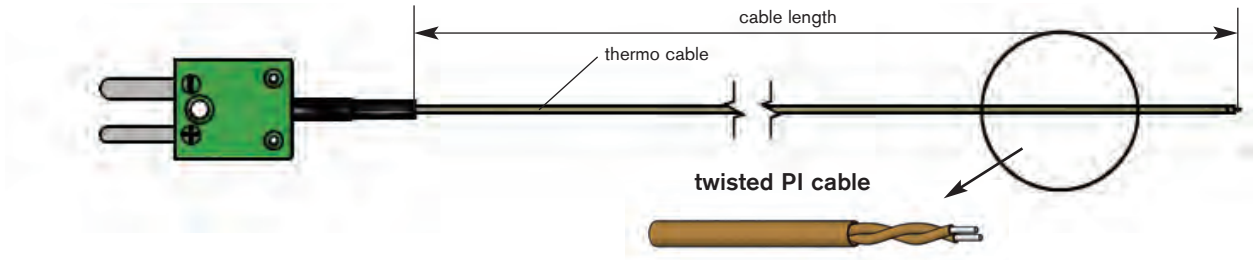
item no.	connection cable length [mm]	channels
T141-062-840	1000	1
T141-062-843	3000	1
T141-062-844	5000	1

Total cable and channel lengths per customer's requirements

SAB identification:
item number, batch number, length

Special thermocouple type K

Surface thermocouple made of twisted thermo cable



Application range:

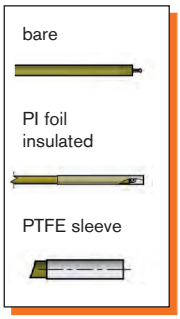
for example for temperature collection at Hairpin windings in the stator of E-drives. The scattering effect of electromagnetic radiation from the surrounding copper windings shall not distort the measuring result.

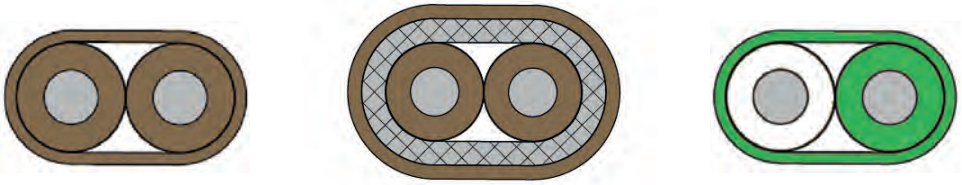
Connector:

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	shielded and twisted PI thermo cable	twisted PFA thermo cable
Insulation:	PI foil insulation	PI foil insulation	PFA
Outer jacket:	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 static: flexible:	-40°C / +250°C -40°C / +250°C	-40°C / +250°C -40°C / +250°C	-40°C / +250°C -40°C / +250°C

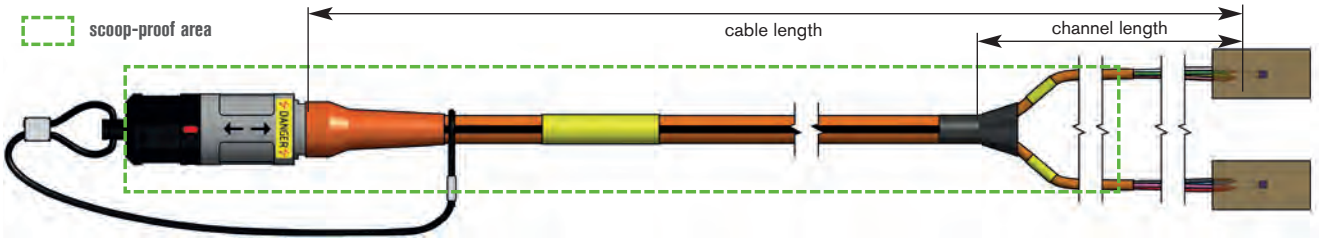
CONFIGURATION EXAMPLES

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 conductors	HV measuring cable – 4 x 2 conductors
Insulation:	FEP – acc. to DIN 47100 1-8 (conductor-Ø 0.45 mm)	FEP – acc. to DIN 47100 1-8
Outer jacket:	PUR	PUR
Stranding:	optimized in layers	optimized in layers
Outer diameter:	approx. 4.6 mm	approx. 7.3 mm
Dielectric strength:	1000 V AC over orange inner jacket	1000 V AC over orange bundle jacket
Temperature range static: flexible:	-40°C / +150°C -40°C / +150°C	-40°C / +150°C -40°C / +150°C

Tests:

▶ **Cable test**

conductor/conductor – 2500 V AC - 5 min
over orange bundle jacket –
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

HV test certificate issued with batch number reference

Optional: Test and repair of already used sensors on request

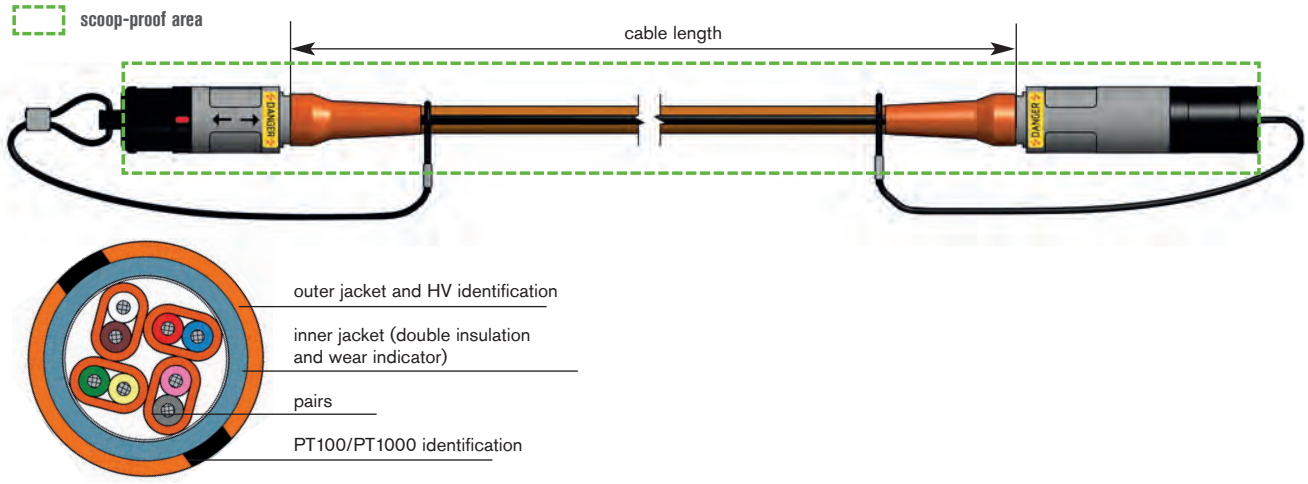
CONFIGURATION EXAMPLES

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 per customer's requirements

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 connectors -
male and 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 realized on customer's request.

Cable data:

Connection cable:	HV measuring cable
Insulation:	FEP – acc. to DIN 47100 1-8
Pair jacket:	FEP – orange acc. to RAL 2004
Inner jacket:	PUR – blue acc. to RAL 5024
Outer jacket:	PUR
Jacket color:	orange with green vertical stripes
Stranding:	optimized in layers
Outer diameter:	approx. 7.4 mm
Dielectric strength:	1000 V AC over pair jacket
Temperature range static: flexible:	 -40°C / +150°C -40°C / +150°C
Special characteristics:	contact protection over all components ✓

Tests:

▶ **Cable test**

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

HV test certificate issued with batch number reference

▶ **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

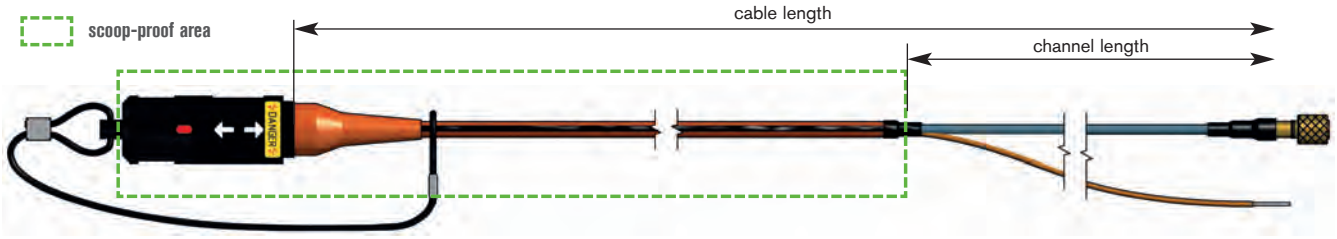
Optional: Test and repair of already used sensors on request

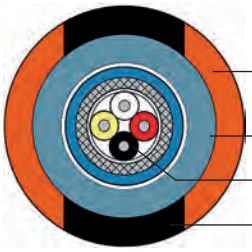
SAB identification:

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)
Shield:	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
Conductor insulation:	PFA – red, white, black, yellow
Bundle jacket:	PFA – blue acc. to RAL 5015
Inner jacket:	PUR – blue acc. to RAL 5024
Outer jacket:	PUR
Jacket color:	orange with black vertical stripes
Stranding:	optimized in layers
Outer diameter:	approx. 4.3 mm
Dielectric strength:	1000 V AC over second inner jacket
Temperature range static: flexible:	-50°C / +150°C -40°C / +150°C
Special characteristics:	contact protection see presentation ✓

Tests:

▶ **Cable test**

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

HV test certificate issued with batch number reference

▶ **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

Optional: Test and repair of already used sensors on request

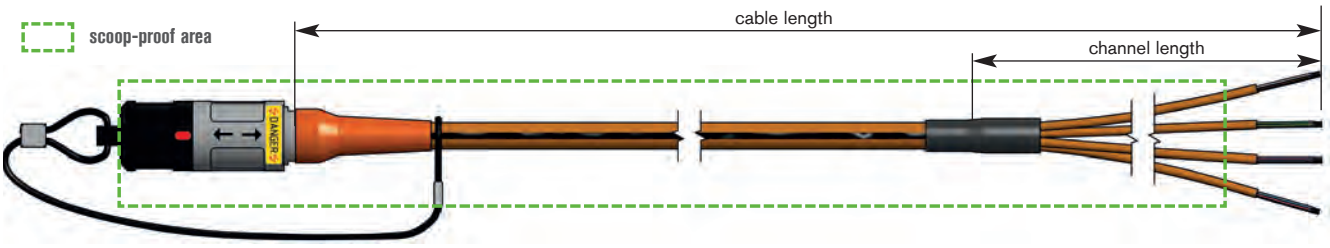
CONFIGURATION EXAMPLES

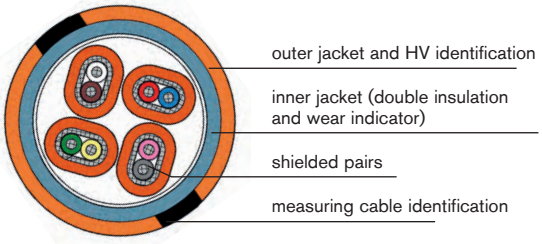
item no.	connection cable length [mm]	single channel length [mm]		male connector
		channel 1	grounding	
T642-062-666	3000	100	200	4-Pin ¼ -28 UNF
T642-062-794	6000	100	200	4-Pin ¼ -28 UNF
T642-062-635	3000	100	200	4-Pin 8-36 UNF

Total cable and channel lengths per customer's requirements

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

Cable data:

Connection cable:	HV strain gauge sensor cable
Conductor insulation:	FEP – acc. to DIN 47100 1-8 (conductor-Ø 0.55 mm)
Shield:	tinned copper braiding incl. drain wire
Pair jacket:	FEP – orange acc. to RAL 2004
Inner jacket:	PUR – blue acc. to RAL 5024
Outer jacket:	PUR
Jacket color:	orange with black vertical stripes
Stranding:	paired construction (for EMC)
Outer diameter:	approx. 7.4 mm
Dielectric strength:	1000 V AC over pair jacket
Temperature range static: flexible:	-50°C / +150°C -40°C / +150°C

Tests:

▶ **Cable test**
conductor/conductor –
600 V AC - 1 min - acc. to IEC 60584-1
over pair jacket in water bath –
5000 V AC – 5 min – with reference to EN 50264-2-1

HV test certificate issued with batch number reference

▶ **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

Optional: Test and repair of already used sensors on request

CONFIGURATION EXAMPLES

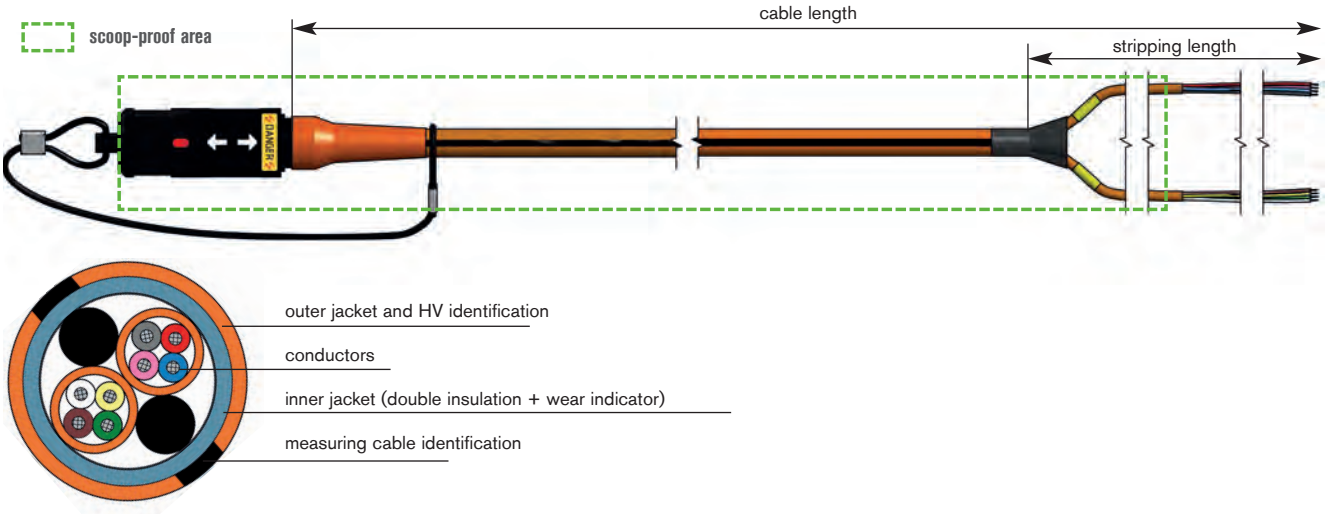
item no.	connection cable length [mm]	single channel Length [mm]			connection type
		Length jacket	Length pair	Length conductor	connection
T644-061-009	2000	122	22	2	tinned
T644-061-014	3000	122	22	2	tinned

Total cable and channel lengths per customer's requirements

SAB identification:
item number, batch number

HV analog measuring cable

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



Application range:

Safe HV analog 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 jacket:	100 mm
Pair jacket:	10 mm
Open end:	2 mm
Connection:	tinned

Cable data:

Connection cable:	HV measuring cable
Conductor insulation:	FEP – acc. to DIN 47100 1-8
Pair jacket:	FEP – orange acc. to RAL 2004
Inner jacket:	PUR – blue acc. to RAL 5024
Outer jacket:	PUR
Jacket color:	orange with black vertical stripes
Stranding:	optimized in layers
Outer diameter:	approx. 7.3 mm
Dielectric strength:	1000 V AC over orange bundle jacket
Temperature range	
static:	-50°C / +150°C
flexible:	-40°C / +150°C

Tests:

▶ **Cable test**
conductor/conductor –
600 V AC - 1 min - acc. to IEC 60584-1
over orange bundle jacket –
5000 V AC – 5 min – with reference to EN 50264-2-1

HV test certificate issued with batch number reference

▶ **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

Optional: Test and repair of already used sensors on request

CONFIGURATION EXAMPLES

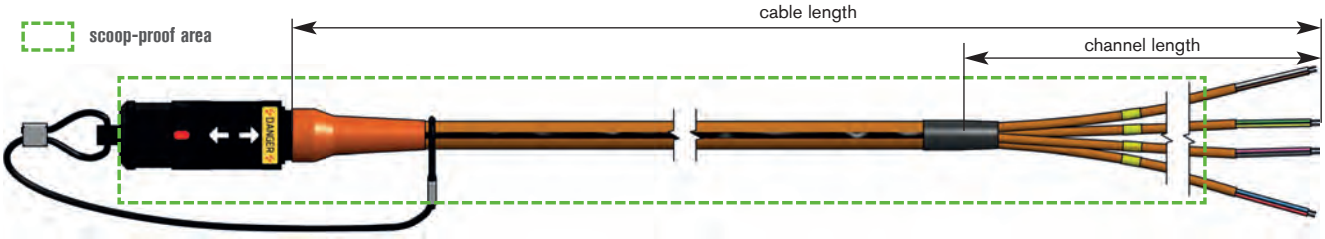
item no.	connection cable length [mm]	single channel length [mm]		
		jacket	pair	conductor
T641-056-710	2000	100	10	2
T641-056-711	3000	100	10	2

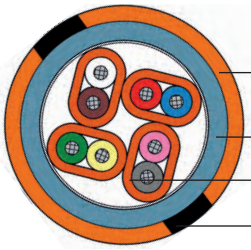
Total cable and channel lengths per customer's requirements

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

Cable data:

Connection cable:	HV measuring cable
Conductor insulation:	FEP – acc. to DIN 47100 1-8
Pair jacket:	FEP – orange acc. to RAL 2004
Inner jacket:	PUR – blue acc. to RAL 5024
Outer jacket:	PUR
Jacket color:	orange with black vertical stripes
Stranding:	paired construction (for EMC)
Outer diameter:	approx. 7.4 mm
Dielectric strength:	1000 V AC over pair jacket
Temperature range	
static:	-50°C / +150°C
flexible:	-40°C / +150°C
Special characteristics:	contact protection also over individual channels ✓

Tests:

▶ **Cable test**
conductor/conductor –
2500 V AC - 5 min
over pair jacket –
5000 V AC – 5 min – with reference to EN 50264-2-1

HV test certificate issued with batch number reference

▶ **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

Optional: Test and repair of already used sensors on request

CONFIGURATION EXAMPLE

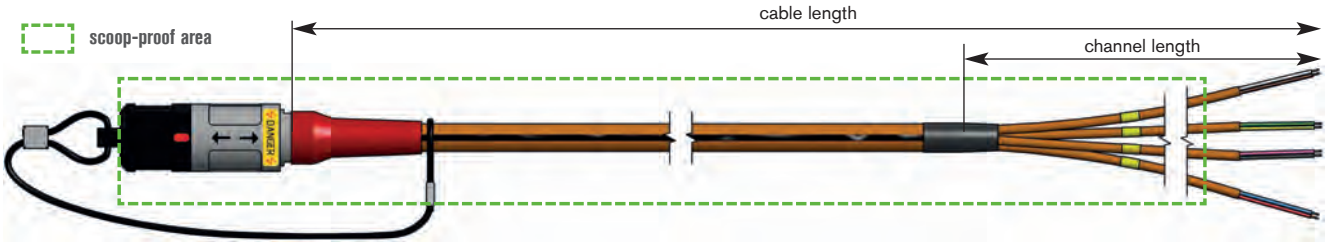
item no.	connection cable length [mm]	single channel length [mm]			connection type
		jacket	pair	conductor	connection
T645-062-738	2000	122	22	2	tinned

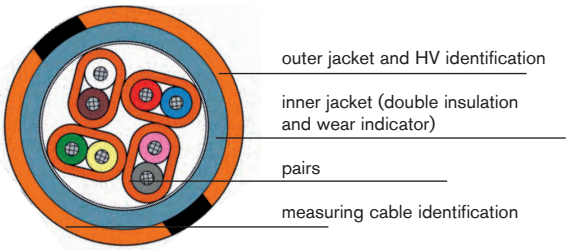
Total cable and channel lengths per customer's requirements

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

Cable data:

Connection cable:	HV measuring cable
Conductor insulation:	FEP – acc. to DIN 47100 1-8
Pair jacket:	FEP – orange acc. to RAL 2004
Inner jacket:	PUR – blue acc. to RAL 5024
Outer jacket:	PUR
Jacket color:	orange with black vertical stripes
Stranding:	paired construction (for EMC)
Outer diameter:	approx. 7.4 mm
Dielectric strength:	1000 V AC over pair jacket
Temperature range static: flexible:	-50°C / +150°C -40°C / +150°C
Special characteristics:	contact protection also over individual channels ✓

Tests:

▶ **Cable test**
conductor/conductor –
2500 V AC - 5 min
over pair jacket –
5000 V AC – 5 min – with reference to EN 50264-2-1

HV test certificate issued with batch number reference

▶ **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

Optional: Test and repair of already used sensors on request

CONFIGURATION EXAMPLE

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

Total cable and channel lengths per customer's requirements

SAB identification:
item number, batch number

HV measuring cable (DC)

High-voltage multi-conductor shielded cable for DC Voltage Measurement, scoop-proof

Marking for HV measuring cable 38339800:
SAB BRÖCKSKES · D-VIERSEN · ϟHV-Messleitung (2x0.25mm²) ϟ CE

CE RoHS

Application: This high voltage measuring cable is used in the development of electric vehicles where scoop-proof testing & measuring of up to 1800 V DC operating voltage and application in the high voltage environment of electromobility takes 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 wire
Insulation:	FEP
Color code:	red and black
Stranding:	in layers with tinned copper drain wire, 24 AWG
Shielding:	alu. foil and tinned copper braiding
Inner jacket:	FEP - blue acc. to RAL 5024
Jacket material:	PUR
Jacket color:	orange with black vertical stripes

Outstanding features:

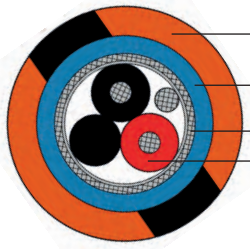
- **temperature resistance up to +150°C (up to 3,000 hours)**
- **high flexibility**
- **high abrasion resistance**
- **easy harnessing**

Technical data:

Scoop-proof testing voltage:	1000 V DC over the blue inner jacket 5000 V AC over the blue inner jacket
Operating voltage:	Uo 1000 V DC U 1800 V DC
Testing voltage:	conductor/conductor: 5000 V AC conductor/shielding: 5000 V AC
Min. bending radius: *fixed installation:* *free movement:*	 5 x O.D. 10 x O.D.
Temperature range: *static:* *flexible:* *short-term use:*	 -50/+125°C -40/+125°C +150°C (3,000 h)
Approvals:	CE, RoHS
Absence of harmful substances:	acc. to RoHS directive of the European Union see page O/30

item no.	AWG/c	outer-ø inch	outer-ø mm	cable weight ≈lbs/mft	ohmic resistance at 20°C max. Ω/km
▶ 38339800	24 AWG/2c	0.256	6.5	39	80.0
▶ 38339819	22 AWG/2c	0.264	6.7	42	58.8
▶ 38339801	20 AWG/2c	0.280	7.1	47	40.1
▶ 38339802	18 AWG/2c	0.307	7.8	60	20.0
▶ 38339803	16 AWG/2c	0.331	8.4	763	13.7

Other dimensions and colors are available on request



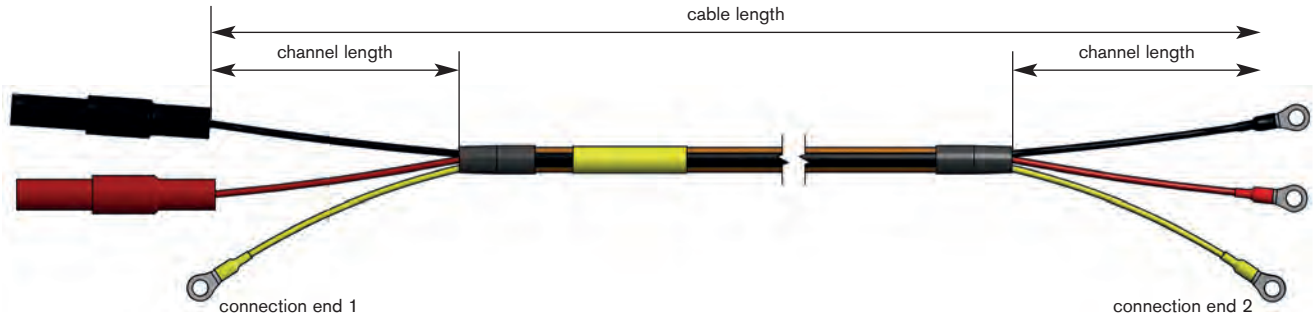
Possible on request:

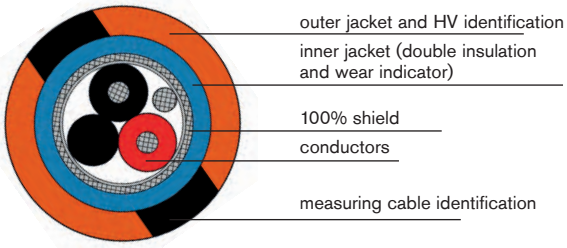
As harnessed measuring cable with connected lab plugs to collect the voltage at HV components

- see next page -

HV measuring cable (DC)

for DC voltage measurement (as cable assembly)





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
Shield:	led out with filler and insulated with shrinkable sleeve
Temperature range of single conductor:	-55°C / +180°C

Cable data:

Connection cable:	HV measuring cable
Conductor insulation:	FEP – red and black
Stranding:	together with tinned copper drain wire, 24 AWG
Shielding:	100% shield with alu foil and braiding
Inner jacket:	PUR – blue acc. to RAL 5024
Outer jacket:	PUR
Jacket color:	orange with black vertical stripes
Outer diameter:	see table on page 22
Scoop-proof:	1000 V DC over blue inner jacket
Operating voltage:	1800 V DC
Temperature range	
static:	-50°C / +125°C
flexible:	-40°C / +125°C
short-term use:	+150°C (up to 3,000 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 per customer's requirements

SAB identification:
item number, batch number

HV measuring cable (AC)

High-voltage multi-conductor shielded cable for AC voltage measurement, scoop-proof

CE RoHS

Marking for HV connecting cable 38339813:
SAB BRÖCKSKES · D-VIERSEN · ϟHV-Messleitung (3x1.50mm²) ϟ CE

Application: 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 wire
Insulation:	FEP
Color code:	brown, black, grey
Stranding:	in layers with tinned copper drain wire, 24 AWG
Shielding:	alu. foil and tinned copper braiding
Inner jacket:	FEP - blue acc. to RAL 5024
Jacket material:	PUR
Jacket color:	orange with black vertical stripes

Outstanding features:

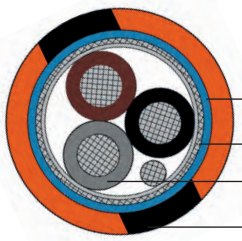
- **temperature resistance up to +150°C (up to 3,000 hours)**
- **high flexibility**
- **high abrasion resistance**
- **easy harnessing**

Technical data:

Scoop-proof testing voltage:	1000 V DC over the blue inner jacket 5000 V AC over the blue inner jacket
Operating voltage:	conductor/conductor: 1800 V DC conductor/conductor: 1000 V AC
Testing voltage:	conductor/conductor: 5000 V AC conductor/shielding: 5000 V AC
Min. bending radius: *fixed installation:* *free movement:*	 5 x O.D. 10 x O.D.
Temperature range: *static:* *flexible:* *short-term use:*	 -50/+125°C -40/+125°C +150°C (3,000 h)
Temperature range of conductors:	up to +180°C (short-term use up to + 205°C)
Oil resistance:	very good - TMPU acc. to EN 50363-10-2 + VDE 0207-363-10-2
Approvals:	CE, RoHS
Absence of harmful substances:	acc. to RoHS directive of the European Union see page O/30

item no.	AWG/c	outer-ø inch	outer-ø mm	cable weight ≈lbs/mft	ohmic resistance at 20°C max. Ω/km
► 38339820	24 AWG/3c	0.268	6.8	44	80.0
► 38339816	22 AWG/3c	0.276	7.0	48	58.8
► 38339815	20 AWG/3c	0.291	7.4	54	40.1
► 38339814	18 AWG/3c	0.319	8.1	71	20.0
► 38339813	16 AWG/3c	0.346	8.8	87	13.7

Other dimensions and colors are available on request



outer jacket and HV identification

inner jacket (double insulation and wear indicator)

100% shield

conductors

measuring cable identification

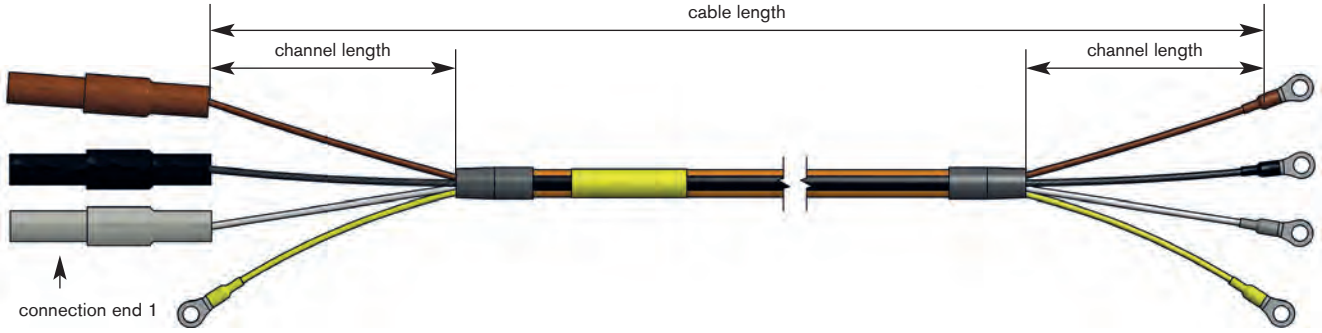
Possible on request:

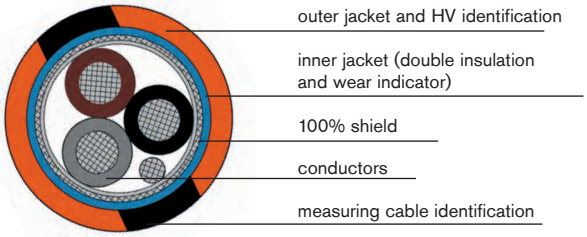
As harnessed measuring cable with connected lab plugs to collect the voltage at HV components

- see next page -

HV measuring cable (AC)

for AC voltage measurement (as cable assembly)





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
Shield:	led out with filler and insulated with shrinkable sleeve
Temperature range of single conductor:	-55°C / +180°C

Cable data:

Connection cable:	HV measuring cable
Conductor insulation:	FEP – brown, black and grey
Stranding:	together with tinned copper drain wire, 24 AWG
Shielding:	100% shield with alu. foil and braiding
Inner jacket:	PUR – blue acc. to RAL 5024
Outer jacket:	PUR
Jacket color:	orange with black vertical stripes
Outer diameter:	see table on page 24
Scoop-proof:	1000 V DC over blue inner jacket
Operating voltage:	1800 V DC
Temperature range	
static:	-50°C / +125°C
flexible:	-40°C / +125°C
short-term use:	+150°C (up to 3,000 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 per customer's requirements

SAB identification:
item number, batch number

nominal voltage Uo/U 1.8/3 kV AC

SABHV

B 110 C

Silicone insulated shielded copper rope with overall copper shield

c UL us RoHS

Marking for B 110 C 1109507:

SAB BRÖCKSKES · D-VIERSEN · B 110 C Uo/U 1.8/3.0 kV 95.0mm² c UL us AWM Style 30123 AWM I/II A/B 150°C 3000V FT1 FT2

Application: 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
Insulation:	Besilen® EI2 acc. to EN 50363-1 + VDE 0207-363-1, orange
Shielding:	alu. foil and tinned copper braiding
Jacket material:	Besilen® EM9 acc. to EN 50363-2-1 + VDE 0207-363-2-1
Jacket color:	orange (similar RAL 2004)

Outstanding features:

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

Technical data:

Nominal voltage:	Uo/U 1.8/3.0 kV AC Uo/U 2.7/5.4 kV DC
Voltage cURus:	3000 V
Testing voltage:	6500 V
Current carrying capacity:	acc. to VDE 0298-4, see page O20 & O21
Min. bending radius: *fixed installation:* *free movement:*	 6 x O.D. 10 x O.D.
Temperature range: *static:* *flexible:* *short-term use:*	**DIN VDE:** **cURus:** up to +150°C -40/+180°C -25/+180°C +250°C
Halogen-free:	acc. to IEC 60754-1 + VDE 0482-754-1
Burning characteristics:	flame retardant and self-extinguishing acc. to IEC 60332-1-2 + VDE 0482-332-1-2 cURus FT1, FT2
Corrosivity:	IEC 60754-2 + VDE 0482-754-2 - no development of corrosive conflagration gases
Weather resistance:	very good
Approvals:	cURus AWM, RoHS
Absence of harmful substances:	acc. to RoHS directive of the European Union see page O/30

item no.	mm²	AWG		ø over inner jacket approx. inch	ø over inner jacket approx. mm	outer-ø ±10% inch	outer-ø ±10% mm	cable weight ≈lbs/mft
▶ 1100107	1.00	18		0.169	4.3	0.299	7.6	47
▶ 1100157	1.50	16		0.185	4.7	0.315	8.0	54
▶ 1100257	2.50	14		0.205	5.2	0.335	8.5	65
▶ 1100407	4.00	12	(≈ 224/34)	0.232	5.9	0.358	9.1	66
▶ 1100607	6.00	10	(≈ 186/32)	0.248	6.3	0.378	9.6	96
▶ 1101007	10	8	(≈ 320/32)	0.323	8.2	0.461	11.7	149
▶ 1101607	16	6	(≈ 504/32)	0.335	8.5	0.472	12.0	183
▶ 1102507	25	4	(≈ 760/32)	0.441	11.2	0.579	14.7	280
▶ 1103507	35	2	(≈ 1083/32)	0.496	12.6	0.642	16.3	368
▶ 1105007	50	1	(≈ 703/28)	0.571	14.5	0.717	18.2	487
▶ 1107007	70	2/0	(≈ 988/28)	0.650	16.5	0.803	20.4	641
▶ 1109507	95	3/0	(≈ 1340/28)	0.724	18.4	0.878	22.3	836
▶ 1101207	120	4/0	(≈ 1680/28)	0.791	20.1	0.953	24.2	1017
▶ 1101507	150	250 MCM	(≈ 2122/28)	0.917	23.3	1.079	27.4	1258
▶ 1101857	185	350 MCM	(≈ 1472/26)	0.980	24.9	1.150	29.2	1499
▶ 1102407	240	450 MCM		1.083	27.5	1.260	32.0	1909
▶ 1103007	300	550 MCM		1.181	30.0	1.366	34.7	2254

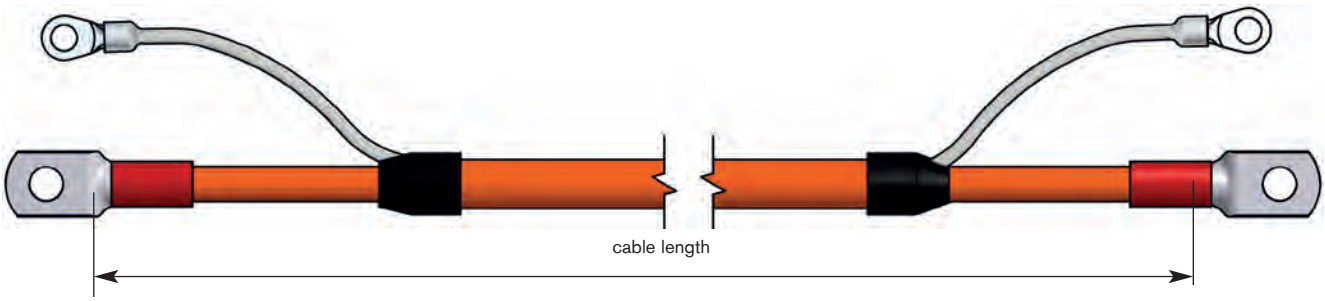
Other dimensions and colors are available on request

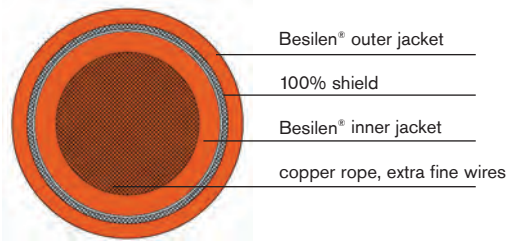
nominal voltage Uo/U 1.8/3 kV AC

SABHV

B 110 C

Highly flexible silicone HV single conductor, shielded (as cable assembly)





Application range:

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

Connection end:

Outer jacket:	50 mm stripped
Connection end 1+2:	tube cable lug (single conductor) and ring cable lug (shield)
Shield:	led out, twisted and insulated with shrinkable sleeve

Cable data:

Connection cable:	highly flexible HV single conductor, shielded
Conductor insulation:	Besilen®
Shielding:	100% shield with alu foil and braiding
Outer jacket:	Besilen®
Jacket color:	orange
Outer diameter:	see table on page 26
Nominal voltage:	Uo/U 1.8/3.0 kV AC Uo/U 2.7/5.4 kV DC
Temperature range *static*: *flexible*: *short-term use*:	 -40°C / +180°C -25°C / +180°C +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 mm²

Total cable and channel lengths per customer's requirements

SAB identification:
item number, batch number

nominal voltage Uo/U 1.8/3 kV AC

SABHV

B 107 HV

Highly flexible silicone HV single conductor, unshielded, cULus recognized

c us RoHS

Marking for B 107 HV 1079507:
SAB BRÖCKSKES · D-VIERSEN · B 107 Uo/U 1.8/3.0 kV 95.0mm² c us AWM Style 30122 AWM I A/B 150°C 3000V FT2

Application: 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 up to 1.8/3 kV. In this way it fulfills the increasing demands within the voltage class.

Construction:

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

Outstanding features:

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

Technical data:

Nominal voltage:	Uo/U 1.8/3.0 kV AC Uo/U 2.7/5.4 kV DC
Voltage cURus:	3000 V
Testing voltage:	6500 V
Current carrying capacity:	acc. to VDE 0298-4, see page O20 & O21
Min. bending radius:	5 x O.D.
Temperature range: *static:* *flexible:* *short-term use:*	**DIN VDE:** **cURus:** up to +150°C -40/+180°C -25/+180°C up to 250°C
Halogen-free:	acc. to IEC 60754-1 + VDE 0482-754-1
Burning characteristics:	flame retardant and self-extinguishing acc. to IEC 60332-1-2 + VDE 0482-332-1-2 cURus FT1, FT2
Corrosivity:	IEC 60754-2 + VDE 0482-754-2 - no development of corrosive conflagration gases
Weather resistance:	very good
Approvals:	cURus AWM, RoHS
Absence of harmful substances:	acc. to RoHS directive of the European Union see page O/30

item no.	mm²	AWG		outer-ø inch	outer-ø mm	cable weight ≈lbs/mft
▶ 1070107	1.00	18		0.169	4.3	17
▶ 1070157	1.50	16	(≈ 84/34)	0.185	4.7	21
▶ 1070257	2.50	14	(≈ 140/34)	0.205	5.2	29
▶ 1070407	4.00	12	(≈ 224/34)	0.248	6.3	40
▶ 1070607	6.00	10	(≈ 186/32)	0.248	6.3	49
▶ 1071007	10.00	8	(≈ 32032)	0.354	9.0	97
▶ 1071607	16.00	6	(≈ 504/32)	0.366	9.3	130
▶ 1072507	25.00	4	(≈ 760/32)	0.472	12.0	212
▶ 1073507	35.00	2	(≈ 1083/32)	0.543	13.8	290
▶ 1075007	50.00	1	(≈ 703/28)	0.618	15.7	397
▶ 1077007	70.00	2/0	(≈ 988/28)	0.697	17.7	522
▶ 1079507	95.00	3/0	(≈ 1340/28)	0.740	18.8	694
▶ 1071207	120.00	4/0	(≈ 1680/28)	0.807	20.5	860
▶ 1071507	150.00	250 MCM	(≈ 2122/28)	0.933	23.7	1076
▶ 1071857	185.00	350 MCM	(≈ 1472/26)	0.996	25.3	1301
▶ 1072407	240.00	450 MCM		1.098	27.9	1686
▶ 1073007	300.00	550 MCM		1.213	30.8	2018

Other dimensions and colors are available on request

Copper rope with orange jacket for E-Mobility HV test benches

nominal voltage Uo/U 1.8/3 kV AC

SABHV

B 110 C Sense Cable

Halogen-free, high temperature and voltage shielded silicone cable

cULus RoHS

Marking for B 110 C Sense Cable 1109001:

SAB BRÖCKSKES · D-VIERSEN · B 110 C Sense Cable 2x1.0mm² 1109001 cULus AWM Style 4659 AWM I/II A/B 150°C 3000V FT1 FT2

Application: Sensor cable is required to check and monitor the transferred power of the B 110 C on test benches.

Construction:

Conductor:	bare copper strands, extra fine wires
Insulation:	Besilen® EI2 acc. to EN 50363-1 + VDE 0207-363-1
Color code:	black and red
Stranding:	conductor twisted with tinned copper drain wire, AWG 26
Shield:	alu. foil and tinned copper braiding
Jacket material:	Besilen® EM9 acc. to EN 50363-2-1 + VDE 0207-363-2-1
Jacket color:	orange (similar RAL 2004)

Outstanding features:

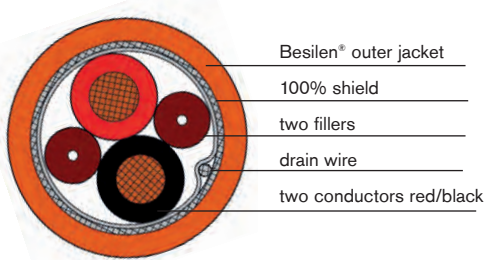
- **extremely flexible**
- **good EMC characteristics**
- **halogen-free**
- **heat resistant**
- **flexible at low temperatures**
- **flame retardant and self-extinguishing**
- **weather resistant**
- **cURus recognized**

Technical data:

Nominal voltage:	Uo/U 1.8/3.0 kV AC Uo/U 2.7/5.4 kV DC
Voltage cURus:	3000 V
Testing voltage:	4000 V
Current carrying capacity:	acc. to VDE 0298-4, see page O20 & O21
Min. bending radius: *fixed installation:* *free movement:*	 6 x O.D. 10 x O.D.
Temperature range: *static:* *flexible:* *short-term use:*	**DIN VDE:** **cURus:** up to +150°C -40/+180°C -25/+180°C +250°C
Halogen-free:	acc. to IEC 60754-1 + VDE 0482-754-1
Burning characteristics:	flame retardant and self-extinguishing acc. to IEC 60332-1-2 + VDE 0482-332-1-2 cURus FT1, FT2
Corrosivity:	IEC 60754-2 - no development of corrosive conflagration gases
Weather resistance:	very good
Approvals:	cURus AWM, RoHS
Absence of harmful substances:	acc. to RoHS directive of the European Union see page O/30

item no.	mm²	AWG	outer-ø approx inch	outer-ø approx mm	cable weight ≈lbs/mft	ohmic resistance at 20 °C max. Ω/km
► 1109006	0.25	24 AWG/2c	0.421	10.7	75	80.0
► 1109007	0.34	22 AWG/2c	0.437	11.1	87	58.8
► 1109008	0.50	20 AWG/2c	0.461	11.7	95	39.0
► 1109001	1.00	18 AWG/2c	0.500	12.7	114	20.0
► 1109002	1.50	16 AWG/2c	0.531	13.5	133	13.3
► 1109003	2.50	14 AWG/2c	0.575	14.6	160	7.98
► 1109004	4.00	12 AWG/2c	0.634	16.1	200	4.95
► 1109005	6.00	10 AWG/2c	0.673	17.1	245	3.30

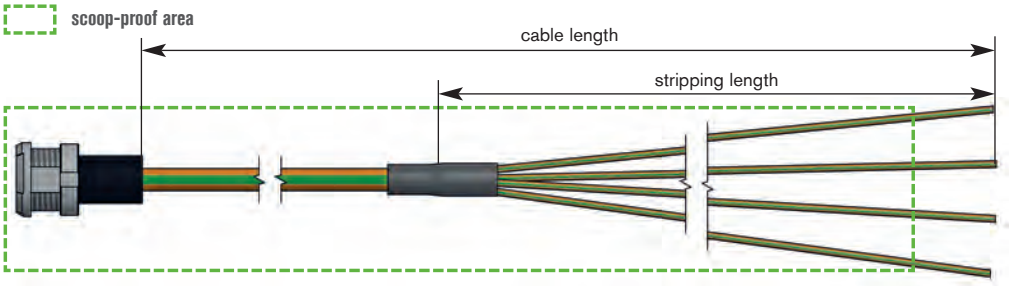
Other dimensions and colors are available on request



Possible on request:

As harnessed measuring cable with connected lab plugs to collect the voltage at HV components

HV test adapter



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
Conductor insulation:	FEP
Inner jacket:	PUR – blue acc. to RAL 5024
Outer jacket:	PUR
Jacket color:	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 static: flexible:	 -50°C / +150°C -40°C / +150°C

Tests:

▶ **Cable test**
conductor/conductor –
600 V AC - 1 min - acc. to IEC 60584-1
over pair jacket/inner jacket in water bath –
5000 V AC – 5 min – with reference to EN 50264-2-1

HV test certificate issued with batch number reference

▶ **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

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 analog (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

Total cable and channel lengths per customer's requirements

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 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

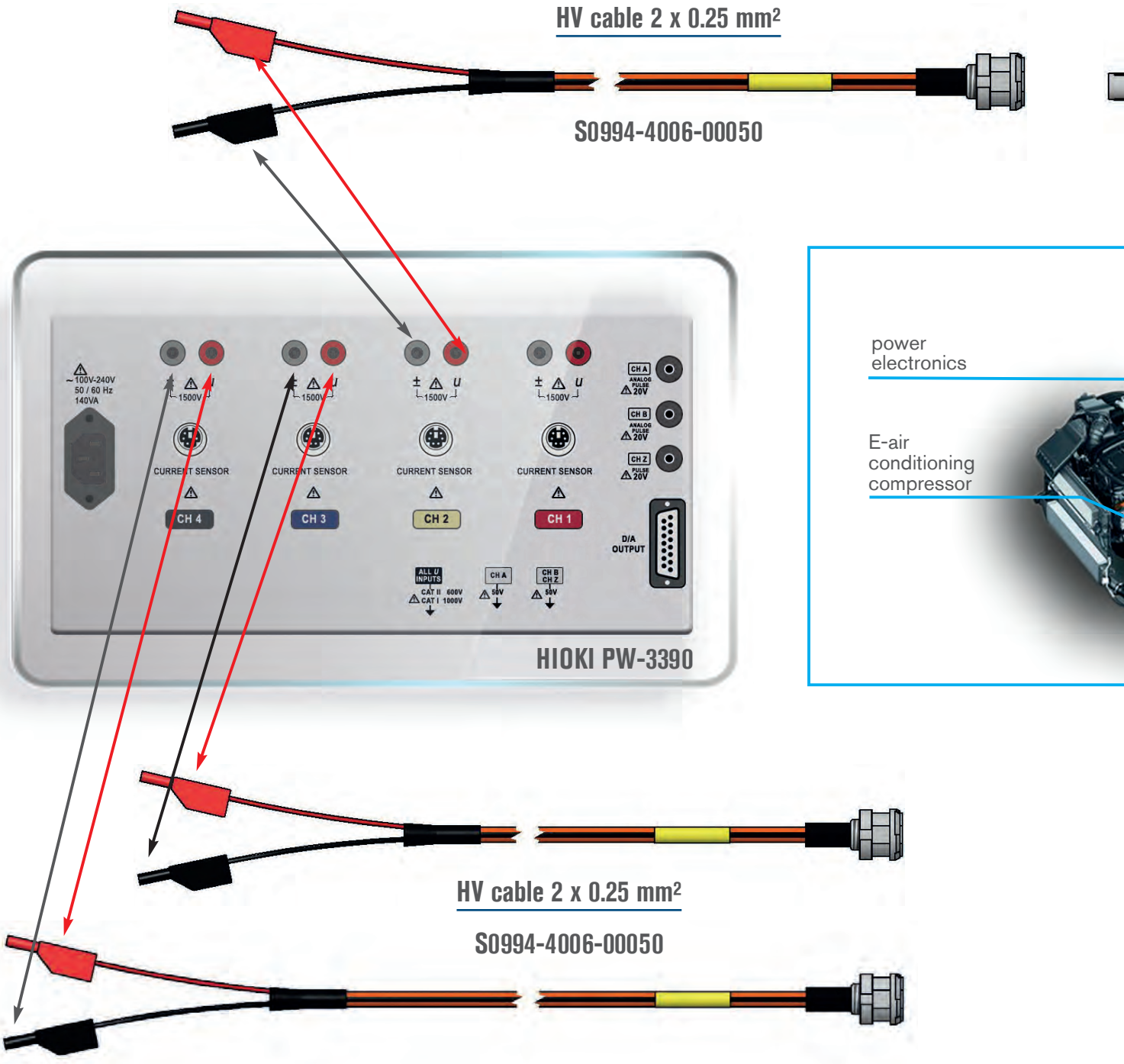
Conversion kit to automatic hinged cover
for Redel socket / size 2P
to protect the socket from dust, dirt and moisture

CONFIGURATION EXAMPLE

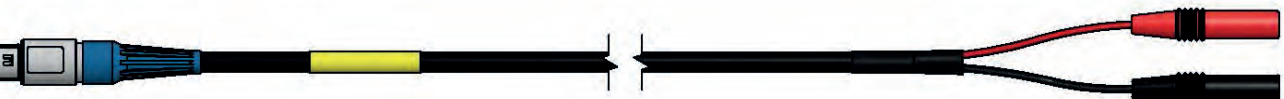
item no.	configuration
T021-060-467	conversion kit

Application example

for high voltage measuring cables on electric vehicles

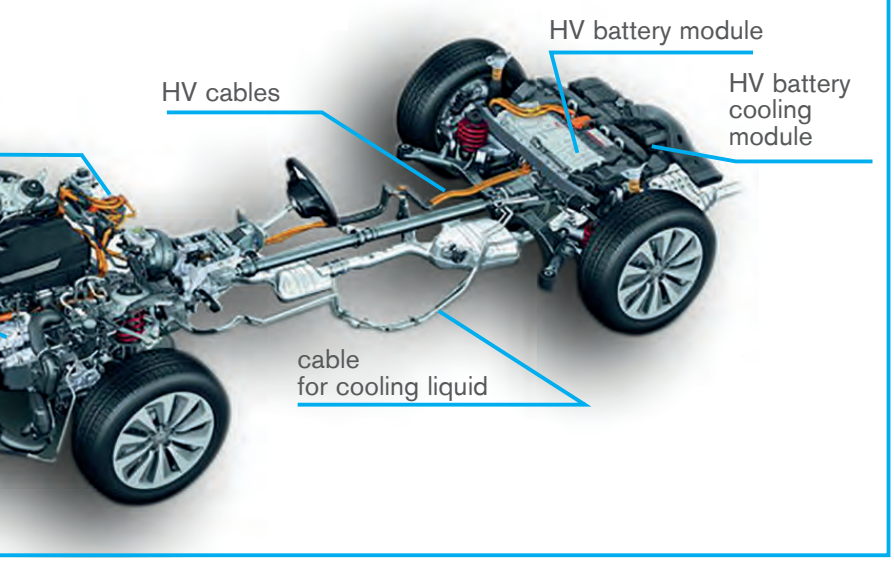


LV cable 2 x 0.5 mm² shielded



S3833-4555-00700

ELECTRIC VEHICLE



LV connection

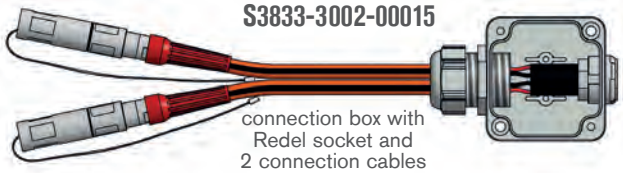
(e.g. 12V vehicle battery)

HV adapter with clamping points

(vehicle specific)

HV cable 2 x 0.25 mm² shielded

S3833-3002-00015



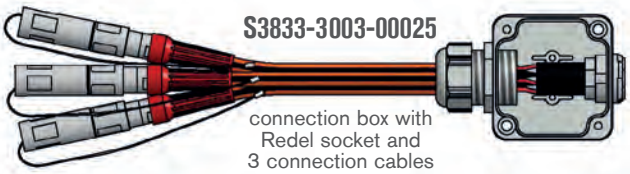
connection box with Redel socket and 2 connection cables with Redel plug

HV cable 2 x 0.25 mm² shielded

T641-060-343

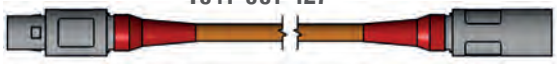
extension

S3833-3003-00025



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

T641-061-127



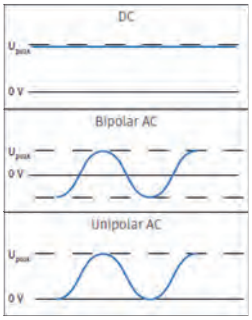
Glossary

AC voltage

Alternating current (AC) refers to a type of electric current that changes its direction periodically and in constant repetition. Alternating current is often used for electrical energy supply. It flows through high-voltage lines and reaches ordinary households via socket.

Bipolar (unipolar)

In connection with SAB HV sensors unipolar is the voltage that in contrast to real direct voltage – does not change sign but has got an alternating value. In fact it is a mixture out of direct and alternating voltage. In contrast to unipolar, bipolar means that the sign of voltage can change.



Breakdown voltage

The breakdown voltage is the voltage required to allow current to flow through an insulator. This results in an electrical voltage breakdown. In a statistical series of breakdown voltage tests, this is the upper limit of the measured values.

DC voltage

Direct current (DC) refers to electrical current whose strength and direction do not change over time. Batteries and solar cells, for example, supply direct current.

Dielectric strength

The dielectric strength (usually specified in kV/mm) of an insulator is the maximum electric field strength that may prevail in the material without a voltage breakdown (arc or spark) occurring. In a statistical series of breakdown voltage tests, this is the lower limit of the measured values.

High voltage

An electrical voltage above 1000V AC or 1500V DC is generally referred to as high voltage. In the VDE regulations, standardized voltages up to 1kV are referred to as low voltage and over 1kV as high voltage. In electrical power engineering, further conceptual subdivisions of high voltage into the sub-terms “medium voltage”, “high voltage” and “extra-high voltage” are common, although the limits are not standardized. In the context of this glossary, “high voltage” refers to the 60 kV and 110 kV range for supplying smaller towns, overland supply and the connection of smaller power stations.

Within the range of electrical technology in vehicles, we also talk about high voltage. When the term “high voltage” (HV for short) is used, it clearly refers to a voltage in motor vehicles that is higher than 25V (AC) or higher than 60V (DC). The reason for this is that the term “high voltage” clearly indicates the potential danger.

HV identification

The term HV identification refers to the labeling of the cables and connection components of the HV sensors. The connection component is labeled with an orange bend protection sleeve and a “Danger” label, the measuring cable with a corresponding identification strip in orange. This signal color warns of the new sources of danger in hybrid and electric vehicles. The use or marking with the color orange (known as “high-voltage orange”) can be found in the ISO 6469-3 and ECE-R 100 standards.

Insulated measuring tip

With the “insulated measuring tip”, the bare measuring tip is hermetically sealed. The insulation at the bare point (measuring tip) is stronger than the basic insulation, but weaker than the reinforced insulation. However, it fulfills the criteria for a dielectric strength of 1000V AC and is considered as scoop-proof.

With the “mechanically insulated measuring tip”, the bare measuring tip is provided with additional basic insulation, but this is open on the side of the measuring tip. It offers no protection against accidental contact, but fulfills the criteria for 1000V AC. If the insulation fails, there is no additional protection in the area of the measuring tip.

Insulation

Basic insulation:

Insulation of dangerously active parts that ensures basic protection.

Additional insulation:

Independent insulation applied in addition to the basic insulation to ensure protection against electric shock in the event of failure of the basic insulation.

Double insulation:

Insulation consisting of the basic insulation and the additional insulation.

Reinforced insulation:

Insulation that provides protection against electric shock that is not less than the protection provided by the double insulation.

Glossary

Leakage distance (acc. to IEC 61010-031)

The leakage distance is the shortest distance along the surface of a solid insulating material between two conductive parts. The leakage distance for measuring accessories means the shortest distance along the surface of an insulating material between a part that is dangerous to touch and a part of the user's body.

Nominal voltage

The nominal voltage is the basis of assessment for out items. Certain operational characteristics refer to this nominal voltage.

Operating voltage (in accordance with EN 61010-031)

Highest effective value of the direct or alternating voltage that can be permanently applied to an insulation during normal operation.

Protection against contact

Constructive precautions at electric operating equipment that protect against hazardous contact with energized components (for example insulation). The term “contact protection” is related to voltage rating that indicates the upper limit of electric voltage with which measuring equipment can be operated safely. This upper limit (nominal voltage) depends on the operational environment of the measuring accessories.

Recognized rules of technology

The (generally) recognized rules of technology are technical rules or guidelines for the design and execution of structural or technical objects. These are rules that are recognized as theoretically correct and established in science, as well as being known in practice by technicians trained in accordance with the latest state of knowledge and have proven themselves on the basis of continuous practical experience. The generally recognized rules of technology are not identical to standards.

Routine test

Conformity tests on each individual unit during or after production.

Scoop-proof

The indication “scoop-proof” means in connection with our SAB HV sensors the following:

The item has been designed and tested in a way that there is no risk of an electric shock for the user if he touches the cable under condition that the measuring tip is conductively connected with a component that does not exceed the indicated nominal voltage. Herewith, it is always indicated until which point or layer safety is guaranteed. Some items have for example a colored inner jacket that indicates when mechanical wear threatens the safety described before. Other multi-pair cables have partial elements. Here the pairwise insulation already fulfills the safety requirements.

Due to the risk to mix it up with the normative term “tangible”, the term “voltage-proof” is preferred for this characteristic as it is not used in standards.

Sparking distance in air (acc. to IEC 61010-031)

The sparking distance in air is defined as the shortest distance in air between two conductive parts.

Standard test finger

The purpose of the test finger is to simulate the non-touch ability of active parts by the human finger. The dimensions are specified in EN 61010-031. A distinction is made between rigid test fingers and articulated ones.

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Tangible (with regard to one part) (acc. to EN 61010-031) (please see also “scoop-proof” and “voltage-proof”)

Conditioned in a way that it can be touched by a standardized test pin. This term could be confused with the term “scoop-proof”.

Testing voltage

Testing voltage is the voltage that a test specimen (connector, cable, other components) can withstand without breakdown or flashover when handled as specified. This voltage is significantly higher than the specified nominal voltage.

Common scales are $2xU_{nenn}$ + 1000V.

VDE

The VDE, originally Verband Deutscher Elektrotechniker (Association of German Electrical Engineers), since 1998 the Association for Electrical Engineering, Electronics and Information Technology is committed to the sciences in these fields and the technologies based on them. The VDE's work focuses on safety in electrical engineering, the development of recognized rules of technology as national and international standards and the testing and certification of devices and systems.

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