

# High Ohm Measurement Electrode HOW 1

for measurement of surface resistance according to valid standards of DIN, EN, IEC and ASTM



Hand-operated measuring HOW 1 with Milli-TO 3 (optional)

- ▶ Hand-held surface electrode with 2 conductive elastomer stripes
- ▶ optimized for fast measurement of surfaces of objects, flat specimens, for example painted sampling plates, pads or plastic foils
- ▶ for the fast hand-operated overview measuring without Conductive Silver Lacquer
- ▶ no treatment of specimen surface through with Conductive Silver Lacquer
- ▶ suitable for resistance values over 1.000 Ohm at 1 Volt test voltage
- ▶ measuring length 100 mm
- ▶ measuring distance 10 mm
- ▶ optional guard ring for Leakage of surface offset currents
- ▶ can be connected to Milli-TO 3 and TO 3
- ▶ recommended measurement range:
  - at 100 V test voltage  $10^5$  to  $10^{13}$  Ohm
  - at 1 V test voltage  $10^3$  to  $10^{13}$  Ohm

**optional accessories:**

- Base platte GP 14
- Base platte GP 15
- Base platte GP 25
- Guard ring
- High-Ohm Measuring cable set

The hand-held electrode HOW 1 was especially developed for the fast hand/operated measurement of resistance of surfaces of objects.

By the handy form of the electrode surfaces can independently be contacted by the position of the test optimally.

In connection with the measurement devices Milli-TO 3 or TO 3 accurate measurement in the high ohm range are possible.

By using of elastomer stripes the electrode is especially suitable for flat specimens, Folien, coated materials e.g. painted or powder coated metals .

The electrode completes with a bed-plate or a guard ring, is suitable for further applications allows further applications.



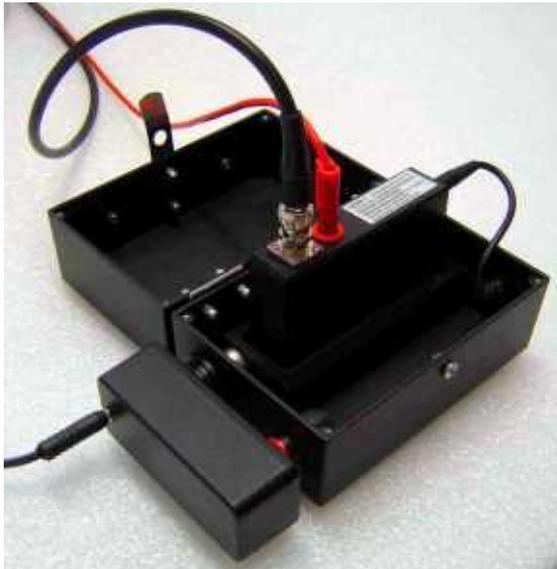
HOW 1 with rack



HOW 1 contact area

# High-ohm calibration box KB-HOW1

for calibration hand-held electrode HOW 1 in connection with additional calibrated standard resistors



KB-HOW1 with HOW 1 (optional) and calibration resistor (optional)

- ▶ calibration box for easy check/calibration the handheld electrode HOW 1
- ▶ precise positioning and connecting of the electrode
- ▶ universally applicable through connecting with our calibration resistors
- ▶ 4 mm connecting sockets
- ▶ easy connection to Milli-TO 3 and TO 3
- ▶ maximum test voltage: 500 V
- ▶ further explanations and adapters for a selection other electrodes

**accessories**

High-ohm calibration resistors  
Hand-held electrode HOW 1

The calibration box KB-HOW1 was developed for quick and easy checking of the hand-held electrode HOW 1.

In connection with our TeraOhmmeters Milli-TO 3 and TO 3 are precise and reproducible high-ohm measurements possible.

additional high-ohm calibration resistors:

Typ	value *	calibration tolerance
N3	1 E 3 Ω (1 kΩ)	0,1 % at 1 Volt test voltage
N4	1 E 4 Ω (10 kΩ)	0,1 % at 10 Volt test voltage
N5	1 E 5 Ω (100 kΩ)	0,1 % at 100 Volt test voltage
N6	1 E 6 Ω (1 MΩ)	0,1 % at 100 Volt test voltage
N7	1 E 7 Ω (10 MΩ)	0,3 % at 100 Volt test voltage
N8	1 E 8 Ω (100 MΩ)	0,5 % at 100 Volt test voltage
N9	1 E 9 Ω (1 GΩ)	0,5 % at 100 Volt test voltage
N10	1 E 10 Ω (10 GΩ)	0,5 % at 100 Volt test voltage
N11	1 E 11 Ω (100 GΩ)	1 % at 100 Volt test voltage
N12	1 E 12 Ω (1 TΩ)	1 % at 100 Volt test voltage

\* nominal value tolerance +0 up to -10 %



KB-HOW1 with HOW 1\*, calibration resistor\* and Milli-TO 3\* (\* optional)

# High Ohm Measuring Electrode HOW 3

for measurement of surface resistance according to valid standards of DIN, EN, IEC and ASTM



HOW 3 with GP 14 (optional)

- ▶ with 2 conductive elastomer stripes
- ▶ optimized for the measurement of surfaces of objects, flat specimens, for example varnished sampling plates or plastic foils
- ▶ no treatment of specimen surface through with conductive varnish necessary
- ▶ for quick overview measurement without conductive varnish
- ▶ also suitable for resistance values over 1.000 Ohm at 1 Volt test voltage
- ▶ measuring length 50 mm
- ▶ interval 5 mm
- ▶ measuring area 2,5 cm<sup>2</sup>
- ▶ optional protective ring for bleeddeed of fault currents on surfaces
- ▶ connectable to Milli-TO 3 and TO-3
- ▶ range
 

10 <sup>5</sup> to 10 <sup>13</sup> Ohm at 100 V test voltage
10 <sup>3</sup> to 10 <sup>13</sup> Ohm at 1 V test voltage

The hand-held electrode HOW 3 was especially developed for measurement of resistance of surfaces of objects

In conjunction with the measurement device Milli-TO 3 or TO-3 accurate measurement in the high ohm range are possible.

By using of elastomer stripes the electrode is especially suitable for flat specimens, for example varnished sampling plates or plastic foils. There is no treatment of the specimens' surface with conductive varnish necessary and no contamination of the specimens occurs.

The dead load of the electrode ensures an optimal contacting with the specimen. The protecting ring can be used to bleed fault currents on surfaces and to avoid errors in measurements. The optional ground plate allows further applications.



HOW 3 with ground plate GP 14 (optional) and Milli-TO 3



HOW 3 and protective ring

## High Ohm Electrode

# HOW 16

for measurement of surface resistance at planar or at shaped samples



The HOW16 is a electrode arrangement to measure the resistance of surface layer according to EN, DIN und IEC.

The 65 gold plated precision spring contacts allow a good contacting also at shaped surfaces.

The measuring area for the calculation of the specific surface resistance is 16,5 cm<sup>2</sup>.

In connection with the measuring devices Milli-TO 3 and TO-3 precise measurements in the high ohm range are possible.

The electrode form factor F, for the programming of the TeraOhmmeter is F = 7,33 .

The connecting cable is 1,5 m long and fixed.



HOW16 connection with Milli-TO 3

- ▶ 65 gold plated precision spring contacts
- ▶ measurement range 10<sup>5</sup> to 10<sup>13</sup> Ohm at 100 V test voltage
- ▶ max. test voltage 500 V
- ▶ connectable to Milli-TO 3 and TO-3
- ▶ 1,5 m connecting cable, fixed
- ▶ electrode form factor F = 7,33
- ▶ size:
  - outer ring: diameter 50 mm
  - inner ring: diameter 20 mm
  - electrode gap 15 mm
- ▶ minimum sample size 55 mm x 55 mm

## High Ohm Guard Ring Electrode

# FE 50

for measurement of volume and surface resistance according to standard DIN EN IEC 62631(DIN IEC 60093), ISO 21178 and others



GP 14 (optional)

- ▶ high grade steel quality (V2A)
- ▶ measuring area diameter: 50 mm
- ▶ diameter of guard ring: 80 mm outside  
60 mm inside
- ▶ resulting measuring gap: 5 mm  
(surface resistance)
- ▶ resulting measuring gap: 1 mm  
(volume resistance)
- ▶ effective circumference of the guarded electrode: 17,28 cm
- ▶ effective measuring area for measurement of volume resistance with volume ring: 20.43 cm<sup>2</sup>
- ▶ max. test voltage: 500 V
- ▶ recommended measuring range:
 

at 100 V test voltage	10 <sup>5</sup> to 10 <sup>15</sup> Ohm
at 500 V test voltage	10 <sup>6</sup> to 10 <sup>15</sup> Ohm
at 1 V test voltage	10 <sup>3</sup> to 10 <sup>13</sup> Ohm

**Accessories:**

- Base plate GP 14
- Adapter volume ring (reduces the measuring gap to 1 mm for volume measurement)
- High resistance measuring cable set
- High-ohm calibration box, high-ohm calibration resistors
- Conductive elastomer
- Conductive gel

The guard ring electrode FE 50 is suitable for various measuring of volume and surface resistance.

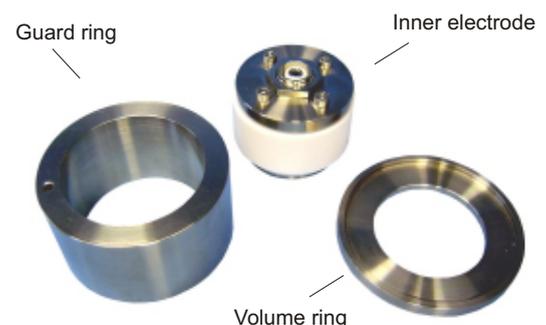
In connection with the measuring devices Milli-TO 3 and TO 3 precise measuring in the high ohm range are possible.

With the optional volume ring the measuring gap can be reduced to 1 mm for the measurement of the volume resistance.

For quick and easy checking of the measurement accuracy, we recommend our high-ohm calibration box KB-FE50 in connection with our high-ohm calibration resistors.

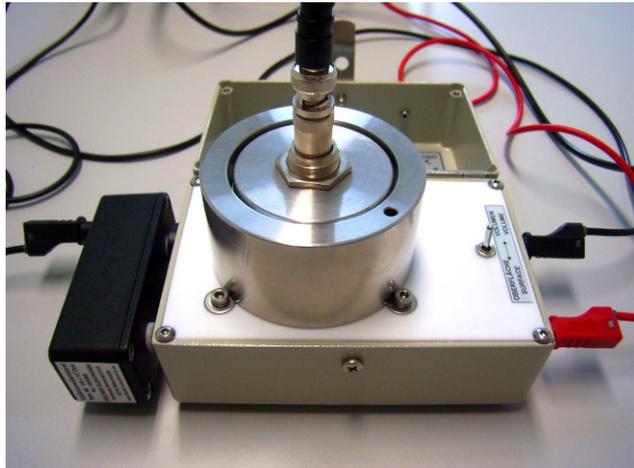


Surface resistance measurement with grounded baseplate GP 14 (optional) and Milli-TO 3 (optional)



# High-ohm calibration box KB-FE50

for calibration guard ring electrode FE 50 in connection with additional calibrated standard resistors



KB-FE50 with FE 50 (optional) and calibration resistor (optional)

- ▶ calibration box for easy check/calibration the high ohm guard ring electrode FE 50
- ▶ precise positioning and connecting und Kontaktierung of the electrode
- ▶ universally applicable through connecting with our calibration resistors
- ▶ 4 mm connecting sockets
- ▶ switchable for measuring surface and volume resistance
- ▶ easy connection to Milli-TO 3 and TO 3
- ▶ maximum test voltage: 500 V
- ▶ further explanations and adapters for a selection other electrodes

**accessories**

High-ohm calibration resistors  
guard ring electrode FE 50  
Milli- and TeraOhmmeter Milli-TO 3  
TeraOhmmeter TO 3

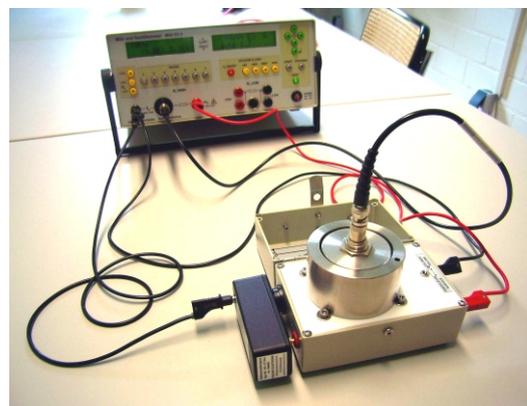
The calibration box KB-FE50 was developed for quick and easy checking of the guard ring electrode FE 50.

In connection with our TeraOhmmeters Milli-TO 3 and TO 3 are precise and reproducible high/ohm measurements possible.

additional high-ohm calibration resistors:

Typ	value *	calibration tolerance
N3	1 E 3 Ω (1 kΩ)	0,1 % at 1 Volt test voltage
N4	1 E 4 Ω (10 kΩ)	0,1 % at 10 Volt test voltage
N5	1 E 5 Ω (100 kΩ)	0,1 % at 100 Volt test voltage
N6	1 E 6 Ω (1 MΩ)	0,1 % at 100 Volt test voltage
N7	1 E 7 Ω (10 MΩ)	0,3 % at 100 Volt test voltage
N8	1 E 8 Ω (100 MΩ)	0,5 % at 100 Volt test voltage
N9	1 E 9 Ω (1 GΩ)	0,5 % at 100 Volt test voltage
N10	1 E 10 Ω (10 GΩ)	0,5 % at 100 Volt test voltage
N11	1 E 11 Ω (100 GΩ)	1 % at 100 Volt test voltage
N12	1 E 12 Ω (1 TΩ)	1 % at 100 Volt test voltage

\* nominal value tolerance +0 up to -10 %



KB-FE50 with FE 50\*, calibration resistor\* and Milli-TO 3\* (\* optional)

## High Ohm Guard Ring Electrode

# FE 25

for measurement of volume and surface resistance according to standard DIN EN IEC 62631 and others



GP 14 (optional)

- ▶ high grade steel quality (V2A)
- ▶ measuring area diameter: 25 mm
- ▶ diameter of guard ring: 40 mm outside
  - Top side: 35 mm inside
  - Underside: 27 mm inside
- ▶ resulting measuring gap: 5 mm or 1 mm
- ▶ effective measuring area for measurement of volume resistance: 5,31 cm<sup>2</sup> (1 mm gap)
- ▶ max. test voltage: 500 V
- ▶ recommended measuring range:
  - at 100 V test voltage 10<sup>5</sup> to 10<sup>15</sup> Ohm
  - at 500 V test voltage 10<sup>6</sup> to 10<sup>15</sup> Ohm
  - at 1 V test voltage 10<sup>3</sup> to 10<sup>13</sup> Ohm

#### Accessories:

base plate GP 14  
High-Ohm Measuring cable set  
High ohm calibration box, high ohm calibration resistors  
Conductive elastomer  
Conductive gel

The guard ring electrode FE 25 is suitable for versatile measuring of volume and surface resistance.

In connection with measuring instrument series **Milli-TO** precise measuring in the high ohm range are possible.

Because of the small dimension the FE 25 is suited for smaller specimen objects very well. She is used everywhere there where the standard electrode FE 50 is too big.

Because of the special construction of the guard ring measuring is possible with 5 mm and 1 mm measuring gap.

For quick and easy checking of the measurement accuracy, we recommend our high-ohm calibration box KB-FE25 in connection with our high-ohm calibration resistors.



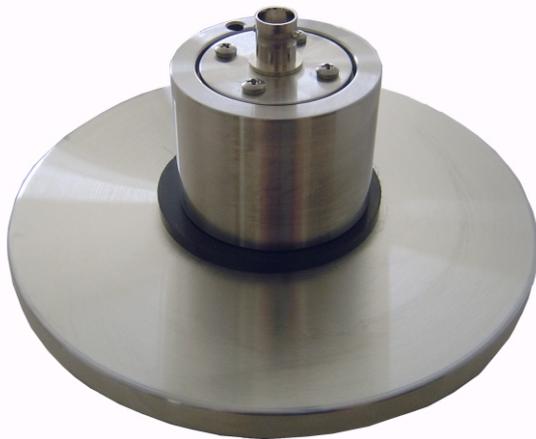
surface measurement with grounded baseplate GP 14 (optional) and Milli-TO 3 (optional)



## High Ohm Guard Ring Electrode

# FE 25-1

for measurement of volume and surface resistance according to standard DIN EN IEC 62631-3-2 and ASTM D 257



GP 14 (optional)

- ▶ high grade steel quality (V2A)
- ▶ measuring area diameter: 25 mm
- ▶ diameter of guard ring: 50 mm outside  
38 mm inside
- ▶ resulting measuring gap: 6,5 mm
- ▶ effective measuring area for measurement of volume resistance: 7.79 cm<sup>2</sup>
- ▶ max. test voltage: 500 V
- ▶ recommended measuring range:
 

at 100 V test voltage	10 <sup>5</sup> to 10 <sup>15</sup> Ohm
at 500 V test voltage	10 <sup>6</sup> to 10 <sup>15</sup> Ohm
at 1 V test voltage	10 <sup>3</sup> to 10 <sup>13</sup> Ohm

**Accessories:**

base plate GP 14  
High-Ohm Measuring cable set  
High ohm calibration box, high ohm calibration resistors  
Conductive elastomer  
Conductive gel

The guard ring electrode FE 25-1 is suitable for versatile measuring of volume and surface resistance.

In connection with measuring instrument series **Milli-TO** precise measuring in the high ohm range are possible.

Because of the small dimension the FE 25-1 is suited for smaller specimen objects very well.

For quick and easy checking of the measurement accuracy, we recommend our high-ohm calibration box KB-FE25 in connection with our high-ohm calibration resistors.



surface measurement with grounded baseplate GP 14 (optional) and Milli-TO 3 (optional)



## High Ohm Guard Ring Electrode

# FE 76

for measurement of volume and surface resistance according to standard  
DIN EN IEC 62631-3-2 and ASTM D 257



GP 14 (optional)

The guard ring electrode FE 76 is suitable for versatile measuring of volume and surface resistance.

In connection with measuring instrument series **Milli-TO** precise measuring in the high ohm range are possible.

For quick and easy checking of the measurement accuracy, we recommend our high-ohm calibration box KB-FE76 in connection with our high-ohm calibration resistors.



surface measurement with grounded baseplate  
GP 14 (optional) and Milli-TO 3 (optional)

- ▶ high grade steel quality (V2A)
- ▶ measuring area diameter: 76 mm
- ▶ diameter of guard ring: 100 mm outside  
88 mm inside
- ▶ resulting measuring gap: 6 mm
- ▶ effective measuring area for measurement of volume resistance: 52.81 cm<sup>2</sup>
- ▶ max. test voltage: 500 V
- ▶ recommended measuring range:
 

at 100 V test voltage	10 <sup>5</sup> to 10 <sup>15</sup> Ohm
at 500 V test voltage	10 <sup>6</sup> to 10 <sup>15</sup> Ohm
at 1 V test voltage	10 <sup>3</sup> to 10 <sup>13</sup> Ohm

**Accessories:**

- Base plate GP 14
- Adapter volume ring (reduces the measuring gap to 2 mm for volume measurement)
- High resistance measuring cable set
- High-ohm calibration box, high-ohm calibration resistors
- Conductive elastomer
- Conductive gel



# Leak Electrode AE 30-DIN

for resistance measurement according to standard DIN EN 61340-2-3



The Leak Electrode AE 30-DIN was developed especially for the measuring of surface resistance at antistatic flat materials to the DIN EN 61340-2-3.

The electrode is suitable for the measuring of the volume resistance very well because of the resulting measuring gap of 13.25 mm between the measuring electrode and the protection ring. The measuring gap reduces the leak current.

The weight of the AE 30-DIN and the use of conductive elastomer at the measuring areas guarantees an optimal contacting of the specimen.

A precise measuring is possible in connection with the measuring instruments Milli-TO 3 und TO 3 in the high ohm area.

- ▶ high grade stell quality (V2A)
- ▶ measuring area with conductive elastomer
- ▶ measuring area diameter: 30,5 mm
- ▶ diameter of guard ring:
  - outside: 63,0 mm
  - inside: 57,0 mm
- ▶ weight: 2,5 kg
- ▶ BNC- and  $V_M$ -connector
- ▶ max. test voltage: 500 V
- ▶ recommended measuring range:
  - at 100 V test voltage  $10^5$  to  $10^{15}$  Ohm
  - at 500 V test voltage  $10^6$  to  $10^{15}$  Ohm
  - at 1 V test voltage  $10^3$  to  $10^{13}$  Ohm

**Accessories:**  
Base plate GP 14  
Insulation plate IP 14  
High-Ohm Measuring cable set



surface measurement with AE 30-DIN and grounded base plate GP 14 (optional) connected to Milli-TO 3

## Leak Electrode

# AE 30-ANSI

for resistance measurement according to standard ANSI/ESD STM11.11



The Leak Electrode AE 30-ANSI was developed especially for the measuring of surface resistance at antistatic flat materials to the ANSI/ESD STM11.11.

The electrode is suitable for the measuring of the volume resistance very well because of the resulting measuring gap of 13.325 mm between the measuring electrode and the protection ring. The measuring gap reduces the leak current.

The weight of the AE 30-ANSI and the use of conductive elastomer at the measuring areas guarantees an optimal contacting of the specimen.

A precise measuring is possible in connection with the measuring instruments Milli-TO 3 und TO 3 in the high ohm area.

- ▶ high grade stell quality (V2A)
- ▶ measuring area with conductive elastomer
- ▶ measuring area diameter: 30,5 mm
- ▶ diameter of guard ring:
  - outside: 63,5 mm
  - inside: 57,15 mm
- ▶ weight: 2,27 kg
- ▶ BNC- and  $V_M$ -connector
- ▶ max. test voltage: 500 V
- ▶ recommended measuring range:
  - at 100 V test voltage  $10^5$  to  $10^{15}$  Ohm
  - at 500 V test voltage  $10^6$  to  $10^{15}$  Ohm
  - at 1 V test voltage  $10^3$  to  $10^{13}$  Ohm

#### Accessories:

Base plate GP 14  
Insulation plate IP 14  
High-Ohm Measuring cable set



surface measurement with AE 30 and grounded base plate GP 14 (optional) connected to Milli-TO 3

## Leak Electrode

# AE 50 with base plate GP 8.3

for resistance measurement according to the standards JIS K 6271 and TSM1669G



The Leak Electrode AE 50 was developed especially for the measuring of surface and volume resistance at rubber, vulcanized or thermoplastic materials according to the standards JIS K 6271 and TSM1669G.

The electrode is suitable for the determination of the volume resistance also very well.

The distance of 10 mm between measuring electrode and protection ring prevents leak currents disturbing effectively.

The weight of the AE 50 guarantees an optimal contacting of the specimen.

A precise measuring is possible in connection with the measuring instruments Milli-TO 3 und TO 3 in the high ohm area.

- ▶ high grade stell quality (V2A)
- ▶ measuring area diameter: 50 mm
- ▶ diameter of guard ring:
  - outside: 80 mm
  - inside: 70 mm
- ▶ resulting measuring gap: 10 mm
- ▶ weight: 4.0 kg
- ▶ base plate GP 8.3 (V2A): 83 mm
- ▶ BNC- and 4 mm connector
- ▶ max. test voltage: 500 V
- ▶ recommended measuring range:
  - at 100 V test voltage  $10^5$  to  $10^{15}$  Ohm
  - at 500 V test voltage  $10^6$  to  $10^{15}$  Ohm
  - at 1 V test voltage  $10^3$  to  $10^{13}$  Ohm



surface measurement with AE 50, grounded base plate GP 8.3 and Milli-TO 3 (optional)

**Accessories:**  
High-Ohm Measuring cable set

## High Ohm Floor Electrode

# FBE 3 and FBE 4

for measurement of floor covering and installed floors according to standard DIN IEC 61340-4-1



The floor electrodes FBE 3 and FBE 4 are suitable for a variety of measurements of surface and volume resistances.

**resistance against earth**, measured with a single electrode between earth or providing grounding point, which are mounted on the running side of a floor covering or floor laid.

**Surface resistance between two points**, measured between two electrodes which are mounted on the running side of a floor covering or floor laid.

**Volume resistance**, measured between a single electrode which is disposed on the running side of a floor covering, and its rear side.

In conjunction with the ohmmeters Milli-TO 3 and TO-3 are high-precision measurements in the highohm range possible.

- ▶ high grade steel quality (V2A)
- ▶ measuring area FBE 3: high grade steel quality (V2A)
- ▶ measuring area FBE 4: conductive elastomer
- ▶ measuring area diameter: 65 mm
- ▶ weight FBE 3: 5 kg
- ▶ weight FBE 4: 2,5 kg
- ▶ BNC-connector
- ▶ max. test voltage: 500 V
- ▶ recommended measuring range:
 

at 100 V test voltage	10 <sup>5</sup> bis 10 <sup>15</sup> Ohm
at 500 V test voltage	10 <sup>6</sup> bis 10 <sup>15</sup> Ohm
at 1 V test voltage	10 <sup>3</sup> bis 10 <sup>13</sup> Ohm

**accessories:**

insulating plate PMMA 600 x 600 x 5 mm  
 earth plate V2A 600 x 600 x 6 mm  
 High-Ohm Measuring cable set  
 adapter BNC plug to 4 mm socket



Volume resistance measurement with FBE 4 and earth plate GP 14 \* and Milli-TO 3 \*

\* optional

# High Ohm Protective Ring Electrode 3604FE

for measurement of volume resistance according to standard  
DIN IEC 60093 and others



volume measurement with GP 14 baseplate  
and Milli-TO 3

The protective ring electrode 3604FE is suitable for versatile measuring of volume resistance at small plate-shaped specimen.

In connection with the measuring devices Milli-TO 3 and TO 3 precise measuring in the high ohm range are possible.

A PTFE insulation ensures high measurement accuracy with high ohm applications.



3604FE with baseplate GP 14

- ▶ high grade steel quality (V2A)
- ▶ Inner electrode diameter: 24,2 mm
- ▶ diameter of protection ring: 26,2 mm inside  
46 mm outside
- ▶ resulting measuring gap: 1 mm
- ▶ effective measuring area: 5,0 cm<sup>2</sup>
- ▶ max. Test voltage: 500 V
- ▶ recommended measuring range:
  - at 100 V test voltage 10<sup>5</sup> to 10<sup>15</sup> Ohm
  - at 500 V test voltage 10<sup>6</sup> to 10<sup>15</sup> Ohm
  - at 1 V test voltage 10<sup>3</sup> to 10<sup>13</sup> Ohm
- ▶ diameter GP 14: 140 mm

## High Ohm Flexible Tongue Electrode

# 3501 FE

for resistance measurement at surfaces of foils according to DIN 53 482 and DIN EN 62631-3-2



- ▶ electrode according to DIN 53 482 / DIN EN 62631-3-2
- ▶ fine, precise flexible tongue stripes
- ▶ especially for measuring of foils
- ▶ stripe interval 10 mm
- ▶ measuring length 100 mm
- ▶ measuring area 10 cm<sup>2</sup>
- ▶ connectable to Milli-TO 3 and TO-3
- ▶ range: 10<sup>5</sup> to 10<sup>15</sup> Ohm at 100 V test voltage

The flexible tongue electrode 3501 FE was especially developed for the measurement of high ohm surface resistance at foils..

Fine and precise measurement stripes with interval of 10 mm, arranged on a length of 100 mm, form the measuring area named in DIN 53 482 and DIN EN 62631-3-2.

The realization of the measuring is easy by a simple contacting and clear arranged measuring setup.



## Bow electrode

**BUE 01**

for measurement of surface resistance at cylindrical test objects



- ▶ special mechanical design for measuring at cylindrical test objects
- ▶ contact surfaces with conducting elastomer
- ▶ BNC- and  $V_M$ -connector
- ▶ diameter specimen: 50 mm up to 200 mm

The bow electrode BUE 01 is suitable for measuring the surface resistance at tubes, rollers and other cylindrical test objects.

The special mechanical design of the electrode offers a high mobility, allowing a fast and safe adaptation to cylindrical surfaces.

For an optimal contact the electrode has conducting elastomer at the contact surfaces.

In connection with the measurement devices Milli-TO 3 or TO 3 accurate measurement in the high ohm range are possible.



Measurement of surface resistance with BUE 01 and Milli-TO 3 (optional)



**optional accessories:**  
High-Ohm Measuring cable set

## High Ohm Textile Electrode

# TE 50

for measuring volume and surface resistivities of textiles according to standard DIN 54345-1, DIN EN 1149-1 and DIN EN 1149-2

Milli-TO3 optional



Volume measurement

- ▶ ring electrode in high-grade steel and aluminium quality
- ▶ diameter measuring surface: 50,4 mm
- ▶ inner measuring surface: 1995,0 mm<sup>2</sup>
- ▶ diameter of protection ring: 89,0 mm outside  
69,2 mm inside
- ▶ diameter of baseplate: 110 mm
- ▶ total weight: 1020 g (± 20 g)
- ▶ weight of inner electrode: 460 g (± 10 g)
- ▶ weight of ring electrode: 560 g (± 10 g)
- ▶ max. measuring voltage: 500 V
- ▶ recommended measuring range:
  - with 100 V measuring voltage: 10<sup>5</sup> bis 10<sup>15</sup> Ohm
  - with 500 V measuring voltage 10<sup>6</sup> bis 10<sup>15</sup> Ohm
  - with 1 V measuring voltage: 10<sup>3</sup> bis 10<sup>13</sup> Ohm
- ▶ with insulating cylinder and insulating disc for the baseplate

The protection ring electrode TE 50 is arranged for a variety of measurements of volume and surface resistance of textile fabrics and yarns and fibers.

In connection with the measuring devices Milli-TO 3 and TO-3 high-precision measurements in the high ohm range are possible.

The insulating cylinder is needed for the measurement of the volume resistance of yarns and fibers.



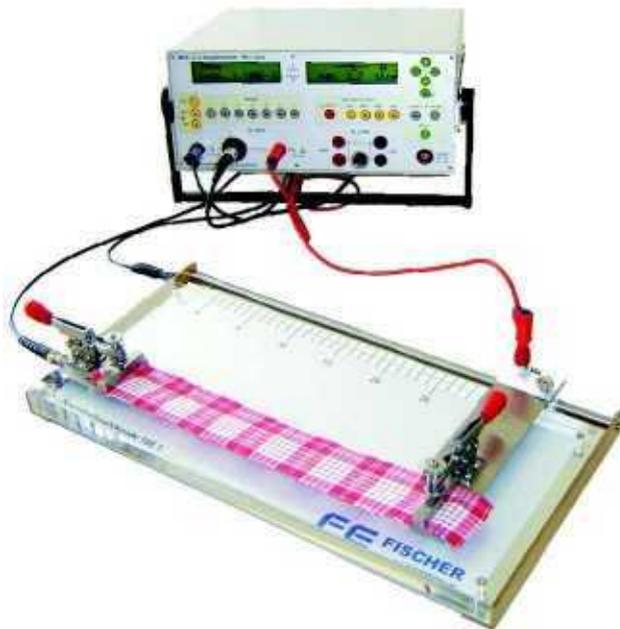
Surface measurement  
with grounded baseplate



Volume measurement  
Yarns and fibers

# High Ohm Textile Strip Electrode TSE 1

for resistance measurement on strips of textile fabrics according to standard DIN 54345



measurement with Milli-TO 3 (optional)

The textile strip electrode TSE 1 is suitable for measuring the electrical resistance of strips of textile fabrics which include improving the conductivity of electrostatic charges admixtures of materials whose resistance is much lower than that of the textile material.

The special feature of the TSE 1 is one of the electrode array, this allows the setting of a variable electrode spacing.

In conjunction with the instruments Milli-TO 3 and TO-3 precision measurements in high-ohm range are possible.

- ▶ contact surfaces high grade steel quality (V2A)
- ▶ electrode size W/D/H: 450 x 235 x 100 mm
- ▶ textile strip size: max. 350 x 50 mm
- ▶ weight: approx. 4,5 kg
- ▶ connection BNC / 4 mm
- ▶ max. Test voltage: 500 V
- ▶ recommended measuring range:
 

at 100 V test voltage	$10^5$ to $10^{15}$ Ohm
at 500 V test voltage	$10^6$ to $10^{15}$ Ohm
at 1 V test voltage	$10^3$ to $10^{13}$ Ohm

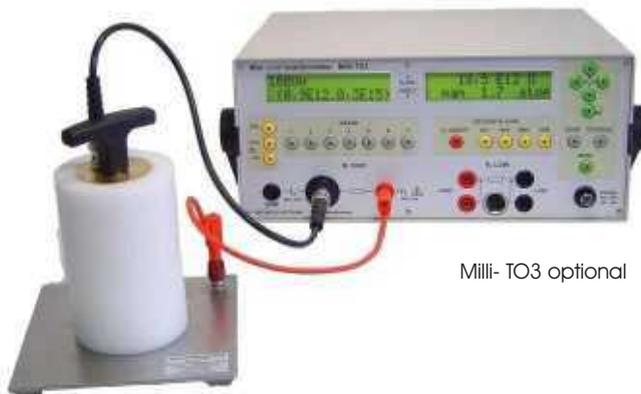


**accessories:**  
High-Ohm-Measuring-Cableset

## Powder Electrode

**PE 01**

for measurement of volume resistance of powdered specimen



Milli- TO3 optional

The powder electrode PE01 for the measuring of high-ohm volume resistances at pulverized specimen.

A simple contact and a clear test set to facilitate the implementation of the measurement.

- ▶ specifically for the measurement of powdered specimen
- ▶ Diameter of 50 mm measuring area
- ▶ Measuring surface 19,6 cm<sup>2</sup>
- ▶ maximum stack height 80 mm
- ▶ Range 10<sup>5</sup>-10<sup>12</sup> ohm at 100 V test voltage
- ▶ Maximum measuring voltage: 500 V
- ▶ Weight of the inner electrode 2000 g
- ▶ Connection via BNC and 4 mm laboratory plug
- ▶ The base plate is removable for cleaning.
- ▶ For extremely high-impedance measurements in noisy environment, the measuring system optionally be expanded with a shield or screen chamber.



## High Ohm Liquid Electrode

# FSE 2

for measuring volume resistivities of liquid electric insulating materials according to standards GOST 6581-75

The liquid electrode FSE 2 is suitable for measuring of volume resistivity of liquid electric insulating materials according to the standard GOST 6581-75. The electrode corresponds to the structure represented in these standards.

A precise measuring is possible in connection with the measuring instruments Milli-TO 3 and TO 3 in high ohm area.

The electrode can easily be taken to pieces into the component parts represented below for the cleaning.



- ▶ high grade steel quality (V2A)
- ▶ idle capacity between inside and the outside electrode: ca. 15 pF
- ▶ liquid capacity: approx. 40 cm<sup>3</sup>
- ▶ Drilling for temperature sensor
- ▶ max. test voltage: 500 V
- ▶ recommended measuring range:
  - at 1 V test voltage: 10<sup>3</sup> to 10<sup>13</sup> Ohm
  - at 100 V test voltage: 10<sup>5</sup> to 10<sup>15</sup> Ohm
  - at 500 V test voltage: 10<sup>6</sup> to 10<sup>15</sup> Ohm



## High Ohm Liquid Electrode

# FSE 3

for measuring volume resistivities of liquid electric insulating materials according to standards DIN 51412-1



- ▶ high grade steel quality (V2A)
- ▶ insulating base plate material PTFE
- ▶ liquid capacity: approx. 100 ml
- ▶ cell constant K at 100 ml: 1,00 m<sup>-1</sup>
- ▶ max. test voltage: 500 V
- ▶ recommended measuring range:
  - at 1 V test voltage: 10<sup>3</sup> to 10<sup>13</sup> Ohm
  - at 100 V test voltage: 10<sup>5</sup> to 10<sup>15</sup> Ohm
  - at 500 V test voltage: 10<sup>6</sup> to 10<sup>15</sup> Ohm

**Accessories:**  
High-Ohm Measuring cable set

The liquid electrode FSE 3704 is suitable for measuring of volume resistivity of liquid electric insulating materials according to standards DIN 51412-1.

The electrode corresponds to the structure represented in these standards.

A precise measuring is possible in connection with the measuring instruments Milli-TO 3 and TO 3 in high ohm area.

The electrode can easily be taken to pieces into the component parts represented below for the cleaning.

In addition, a high flexibility guarantees the separation from measuring cell and base body.

By use of several measuring cells, e.g. longer down times can be avoided in series tests.



FSE 3 with Milli- and TeraOhmmeter Milli-TO 3 (optional)



## Conveyor belt electrode

# FGE 1

for resistance measurement according to the standards DIN EN ISO 284, ISO 21178 and EN 13415



The conveyor belt electrode FGE 1 was developed especially for the determination of the electrical resistance on conveyor belts according to the standards DIN EN ISO 284, ISO 21178 and EN 13415.

This measurement is intended to ensure that the belt is sufficiently conductive to prevent an increase in electrostatic charges that may occur during operation.

In connection with the measuring instruments Milli-TO 3 and TO 3, precise measurements in the high-ohm range are possible.

- ▶ Electrode material brass
- ▶ inner electrode: Ø 25 mm
- ▶ ring electrode outside: Ø 150 mm  
inside: Ø 125 mm
- ▶ weight inner electrode: min. 115 g
- ▶ weight ring electrode: min. 900 g
- ▶ BNC- and  $V_M$ -connector (4 mm)
- ▶ maximum test voltage: 500 V
- ▶ recommended measuring range:
 

at 100 V test voltage	$10^5$ to $10^{15}$ Ohm
at 500 V test voltage	$10^6$ to $10^{15}$ Ohm
at 1 V test voltage	$10^3$ to $10^{13}$ Ohm



Measuring surface resistance with FGE 1 in connection with Milli-TO 3 (optional)

**accessories:**

High ohm measuring cable set  
Base plates (V2A) in different dimensions  
Insulating plates (POM, PTFE, PMMA) in different dimensions

# Measuring Electrode HOF 2

for the measurement of surface resistance electrically conductive layers in the aerospace industry based on DIN 65181 according to AIRBUS Radom Test NTX-CMM 53-15-11



Measuring electrode HOF 2

The measuring electrode HOF 2 consists of two point electrodes and a holder made of insulating material.

The point electrodes are made of brass. The contact surfaces also consist of highly conductive silicone elastomer.

4 mm connection sockets allow universal use in connection with numerous resistance measuring devices.

The scope of delivery also includes 2 replacement contacts and protection / stand for the sensitive contact surfaces.

With the HOF 2, precise and reproducible resistance measurements are also possible on concave and convex components.

- ▶ Surface resistance measurement according based on DIN 65181 according to AIRBUS Radom Test NTX-CMM 53-15-11
- ▶ optimized for measurements on concave and convex specimens in air and space
- ▶ two point electrodes made of conductive Silicone elastomer
- ▶ Electrode diameter of 4 mm
- ▶ Electrode distance 50 mm
- ▶ 4 mm connection sockets
- ▶ Resistance range 1  $\Omega$  bis 100 M $\Omega$
- ▶ Measuring voltage to 500 volts
- ▶ delivery also includes 2 replacement contacts and protection / stand

**Optional accessories:**  
portable ohmmeter Metriso Base  
Lowohm measuring cable LMK 3-1-GSP



HOF 2 with optional Metriso Base + LMK 3-1-GS



HOF 2 scope of delivery

## High Ohm Electrode

# EH 15/10, EH 15/20

for measurement of volume and surface resistance at small pads according to effective standards



The measuring electrodes EH15/10 and EH15/20 are suitable for the measurement of volume and surface resistance at small pads.

In connection with the measuring devices Milli-TO 3 und TO-3 precise measurements in the high ohm range are possible.

The electrodes are also applicable for the measurement of colour samples on test pads and allow an easy and reliable positioning on the test area.

By the small measurement area the homogeneity can be controlled easily.

### EH15/20 with Milli-TO 3

- ▶ diameters
  - EH 15/10:
    - inner electrode 10 mm
    - protective ring inside 12 mm
    - outside 18 mm
  - EH 15/20:
    - inner electrode 20 mm
    - protective ring inside 25 mm
    - outside 31 mm
- ▶ optimized for the measurement at small pads
- ▶ measuring gap 1 mm (EH 15/10)  
2,5 mm (EH 15/20)
- ▶ measuring area for measurement of surface resistance:
  - 34,56 mm<sup>2</sup> (EH 15/10)
  - 176,7 mm<sup>2</sup> (EH 15/20)
- ▶ measurement of volume resistance with protective ring
- ▶ connectable to Milli-TO 3 and TO-3
- ▶ measurement range 10<sup>5</sup> to 10<sup>15</sup> Ohm at 100 V test voltage



## High Ohm Measurement Electrode

**EH 16**

for measurement of volume resistance without protection ring at small pads or foils according to effective standards



- ▶ diameter of measuring electrode  
5 mm/ 10 mm/ 15 mm/ 20 mm/ 25,3 mm  
*more available on request*
- ▶ object mounting plate  
50 x 50 mm  
*more available on request*
- ▶ connectable to Milli-TO 3 and TO-3
- ▶ measurement range from  $10^5$  up to  $10^{15}$  Ohm at 100 V test voltage

The measurement electrode EH16 are suitable for the measuring of resistance of small pads or foils.

With the small changeable measuring areas it is easy to analyse the homogeneity of the volume resistance, punctiform allotted over the whole upper area.

Especially self-adhesive foils and fleece can be measured precisely in affixed state.

Object plate and measurement electrode area are easy to prepare and to clean after measuring.

In connection with the measuring devices Milli-TO 3 and TO-3 precise measuring in the high ohm range is possible.

Specimen with specific volume resistance of about 300 ohm meter up to Tera ohm meter can be measured with a test voltage from 1 V to 500 V.



EH 16 with Milli-TO 3

## Four-pole electrode

# 4P-1

for measuring of the electric resistance of conductive materials with the four-pole method (Kelvin) according DIN EN ISO 3915



- ▶ Potential electrode from two knife-blade contacts stored one by one according to DIN EN ISO 3915
- ▶ Cutting length of the knife-blade contacts: 20 mm
- ▶ Distance of the knife-blade contacts: 10 mm
- ▶ Pen force of the knife-blade contacts: 0.6 N
- ▶ Spindle drive for an exact positioning
- ▶ mobile specimen holder
- ▶ specimen size (W/D/H): min. 70 x 10 x 1 mm  
max. 150 x 20 x 20 mm
- ▶ connection with Milli-TO 3 und MO 3
- ▶ measuring range: 100 E-3 Ohm (100 mΩ) with 10 μOhm of resolution to 180 E 3 Ohm (180 kΩ)

The four-pole electrode was developed for the measuring of the electric volume and surface impedance of conductive materials according to the four-pole method. The structure of the electrode complies with the norm DIN EN ISO 3915.

The special constructive design of the electrode particularly the knife-blade contacts stored one by one, make a simple and sure bonding of the test specimen possible.

The horizontally mobile specimen holder allows measuring in different places of the specimen object without having to place or to contact the test specimen newly. A precise measuring is possible in connection with the measuring instruments Milli-TO 3 and MO 3 in the low ohm range.

The specimen holder also can be employed for high ohm measuring, in connection with a tera-ohmmeter at unexpected measured values or measuring overranging in the highest measurement range.



4P-1 with Milli-TO 3 (optional)

## Four-pole bar electrode

# BPT 1

for measuring of the electric resistance of solid insulating materials according to the standard DIN EN 62631-3-3:2016 and additional of conductive materials according to the standard DIN IEC 60167



- ▶ Four-pole bar electrode with wobble contacts
- ▶ Arbor contact : 10 mm x 10 mm x 50 mm
- ▶ Distance between bar contacts: 25 ± 0,5 mm
- ▶ Contact material brass
- ▶ Wobble contasts with knurled nut for for easy and safe positioning of the specimen
- ▶ can be used for measurements in high and low resistance ranges
- ▶ Measuring range low ohm with Milli-TO 3/MO 3: 100 E-3 Ohm (100 mΩ) with 10 μOhm resolution up to 180 E 3 Ohm (180 kΩ)
- ▶ Measuring range high ohm with Milli-TO 3/TO 3: 1 E 3 Ohm (1 kΩ) up to 1 E 12 Ohm (1 TΩ)

#### Optional accessories:

Lowohm-Measuring cable set 1 m, 4 x 4 mm laboratory plugs on both sides  
Dynamometric screwdriver

The four-pole bar electrode BPT 1 was developed for the measuring of the electric insulating resistance of solid insulate materials according to the standard DIN EN 62631-3-3:2016.

In addition, the electrode also allows measurements of the volume resistivity of conductive materials (DIN IEC 60167) according to the four-terminal method.

The special constructive design of the electrode, in particular the design with wobble contacts, allow a simple and secure contacting of the test object.

The sample holder with source and sense connection sockets allows both bipolar and four-pole resistance measurements.

In connection with our measuring instruments Milli-TO 3, TO 3 and MO 3, precise measurements in the high and low ohm range are possible.



BPT 1 with Milli-TO 3 (optional)

## Four-pole electrode VE - D 991

for measuring of the volume resistivity of electrically conductive and antistatic materials with the four-pole method (Kelvin) according to ASTM D 991



The four-pole electrode VE - D 991 was developed for the measuring of the volume resistivity of electrically conductive and antistatic materials according to the four-pole method.

The structure of the electrode complies with the standard ASTM D 991.

The special constructive design of the electrode allows a simple and sure bonding of the test specimen.

A precise measuring is possible in connection with the measuring instruments Milli-TO 3 and MO 3 in the low ohm range.



VE - D 991 with Milli-TO 3 (optional)

- ▶ construction made of high grade steel quality (V2A) and PVC black
- ▶ contact surfaces made of high-grade steel (V2A)
- ▶ four-pole electrode according to ASTM D 991
- ▶ distance between potential electrodes: 50 mm
- ▶ spezimen size (mm):
 

min. length	100
max. depth	150
max. high	25
- ▶ connection with Milli-TO 3 und MO 3
- ▶ weight potential electrode: approx.. 0.9 kg
- ▶ weight current electrode: approx.. 3.0 kg

# Cable Measuring Fixture KMV 1000

for measuring of the electrically resistance of cable-, wire- and other material specimens according to the standard DIN IEC 60468



Die cable measuring fixture KMV 1000 was developed for measuring of the electrically resistance of cable-, wire- and other material specimens with an ohmmeter.

A precise measuring is possible in connection with the measuring instruments Milli-TO 3 and MO 3 in the low ohm range.

The constructive structure allows to execute measurements at wire cross section of  $0.1 \text{ mm}^2$  to  $100 \text{ mm}^2$ . The distance of the potential blades amounts as described in the standard to exactly 1000 mm.

The plastic material guide rail being part of the extent of supply prevents this sags of thin wires. A special groove in the guide rail protects the specimen in front of temperature fluctuations and against draughts at the same time.

- ▶ wire cross section:  $0,1 \text{ mm}^2$  bis  $100 \text{ mm}^2$
- ▶ Distance potential blades:  $1000 \text{ mm} \pm 0,2 \text{ mm}$
- ▶ connection: 4 mm socket
- ▶ curent connection: 4 mm socket and bolted connection
- ▶ maximum current: 100 A
- ▶ size in mm:  $1300 \times 120 \times 150$  (W/D/H)
- ▶ weight: 9 kg



## High Ohm Calibration Resistors

# N3 to N12 ( $10^3 \Omega$ to $10^{12} \Omega$ )

For the measurement and calibration of Ohmmeters



- ▶
- ▶ measuring voltage max. 500 V at 500 kΩ
- ▶ factory calibration certificate
- ▶ further calibration resistance values and High Ohm calibration resistor decades on request
  - also with 4 mm connection socket or customized connections
  - special versions for Cable-devices
  - special versions for measurement of the flexible tongue electrode 3501FE
  - special versions for measurement of guard ring electrodes (e.g. FE 50)



TO 3(optional) with High Ohm calibration resistor N8

The High Ohm calibration resistors are suited for the fast measurement and calibration of Ohmmeters.

A solid metal housing offers protection from external influences. The arrangement of the 4mm connection plugs allows the direct connection of the calibration resistors to our measurement devices series Milli-TO.

All calibration resistors were delivered with factory calibration certificate. This factory calibration certificate documents the traceability to national standards and contains a protocol of all measured values and their deviation.

Type	Value *	Calibration tolerance
N3	1 E 3 Ω (1 kΩ)	0.1 % measured at 1 Volts
N4	1 E 4 Ω (10 kΩ)	0.1 % measured at 10 Volts
N5	1 E 5 Ω (100 kΩ)	0.1 % measured at 100 Volts
N6	1 E 6 Ω (1 MΩ)	0.1 % measured at 100 Volts
N7	1 E 7 Ω (10 MΩ)	0.3 % measured at 100 Volts
N8	1 E 8 Ω (100 MΩ)	0.5 % measured at 100 Volts
N9	1 E 9 Ω (1 GΩ)	0.5 % measured at 100 Volts
N10	1 E 10 Ω (10 GΩ)	0.5 % measured at 100 Volts
N11	1 E 11 Ω (100 GΩ)	1 % measured at 100 Volts
N12	1 E 12 Ω (1 TΩ)	1 % measured at 100 Volts

\* Tolerance +0 to -10 % from the nominal value

Max. operating voltage: 500 Volts of 500 kΩ  
 Calibration temperature: 23 °C  
 Operating temperature: 20 °C ... 23 °C ... 25 °C  
 Size in mm: 92 x 38 x 31 (W/D/H)  
 weight: ca. 100 g