MEDIUM VOLTAGE PRODUCTS

# KEVA C

## Indoor voltage sensors

| Parameters for Application | Value |
|---|---|
| Rated primary voltage of application | up to 36 kV |

| Sensor Parameters | Value |
|---|---|
| Rated primary voltage, $U_{pn}/U_{pr}$ | 22/√3 kV<br>33/√3 kV |
| Highest voltage for equipment, $U_m$ | 24 kV<br>36 kV |
| Rated power frequency withstand voltage | 50 kV<br>70 kV |
| Rated lightning impulse withstand voltage | 125 kV<br>170 kV |
| Rated transformation ratio, $K_n/K_r$ for voltage measurement | 10 000:1 |
| Voltage accuracy class | 0.5/3P |
| Length of cable | 2.5; 5; 8; 10 m |

## Sensor principles

Voltage sensors (Electronic voltage transformers according to IEC 60044-7 and low-power passive voltage transformers according to IEC 61869-11 standards) offer an alternative way of making the voltage measurement needed for the protection and monitoring of medium voltage power systems. Sensors based on alternative principles have been introduced as successors to conventional instrument transformers in order to significantly reduce size, increase safety, and to provide greater rating standardization and a wider functionality range. These well known principles can only be fully utilized in combination with versatile electronic relays.

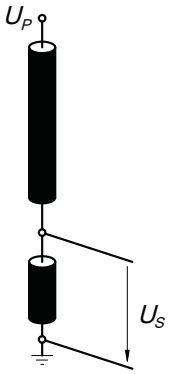
## Sensor characteristics

Construction of ABB's voltage sensors is done without the use of a ferromagnetic core. This fact results in several important benefits for the user and the application.

The main benefit is that the behavior of the sensor is not influenced by non-linearity and width of hysteresis curve, which results in a highly accurate and linear response over a wide dynamic range of measured quantities. A linear and highly accurate sensor characteristic in the full operating range enables the combination of metering and protection classes in one device.

## Voltage sensor

Voltage measurement in KEVA C sensors is based on the resistive divider principle. The output voltage is directly proportional to the input voltage:




$$U_s = \frac{R_2}{R_1 + R_2} U_p$$

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In all cases, the transmitted output signal reproduces the actual waveform of the primary voltage signal.

## Protection and control IEDs (Intelligent Electronic Devices)

Protection and control IEDs incorporate the functions of a traditional relay, as well as allow new additional functions. The information transmitted from the sensors to the IED is very accurate, providing the possibility of versatile relay functionality.

However, the IED must be able to operate with sufficient accuracy at a sensor's low input signal level. Modern IEDs (such as ABB's 615 series relays) are designed for such sensor use.

Modern digital apparatuses (microprocessor based relays) allow protection and measurement functions to be combined. They fully support voltage sensing realized by the single sensor with double the accuracy class designation (e.g.: voltage sensing with combined accuracy class 0.5/3P).

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01 Resistive divider principle

02 IED and sensor

03 KEVA C application

## Sensor applications

The voltage sensors type KEVA C are intended for use in voltage measurement in gas insulated medium voltage switchgear. The voltage sensors are designed as easy replacement of originally used insulating plugs in the cable connectors. Due to their compact size and optimized design sensors can be used for retrofit purposes as well as in new installations.

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## Sensor variants

| Sensor type designation | Metal coated (conductive surface) | Picture |
|---|---|---|
| KEVA 24 Cxx<br>KEVA 24 C2 4.1<br>KEVA 36 C2 4.1 | ✖ |  |
| KEVA 24 Cxxc<br>KEVA 24 C2 4.1c<br>KEVA 36 C2 4.1c | ✔ |  |

Tab. 1. Sensor design variants (with and without conductive surface)

**Note: Voltage sensor KEVA 24 C30 is available only in sensor design variant without conductive surface.**

| Sensor type designation | Cable connectors | | |
|---|---|---|---|
| | Manufacturer | Type | Connecting screw for sensor |
| KEVA 24 C10<br>KEVA 24 C10c | Nexans-Euromold | (K)400 TB/G; (K)440 TB/G | M16 |
| | | (K)944 TB/G; (K)400 TE/G | |
| | | (K)400 BE/G-E | |
| | | KAA4 | |
| | | 400PB-xSA (x = up to 24 kV) | |
| | Cellpack | CTS-S 630A | |
| | Prysmian | FMCTs-400 | |
| | | FMCTs-400/1250 (C/D) | |
| | | FMCTXs-630/C | |
| | | MSCT/EC-630-C | |
| | Südkabel | SEHDT 13, 23 | |
| | | MUT 33 | |
| KEVA 24 C21<br>KEVA 24 C21c | ABB Kabeldon | CSE-A 12630, CSE-A 24630 | M16 |
| | | CSEP-A 12630, CSEP-A 24630 | |
| | | SOC 630 (older) | |
| | | CSAP-A 6/12/24 kV | |
| KEVA 24 C22<br>KEVA 24 C22c | NKT | CB 12-630, CB 24-630 | M12 |
| | | CC 12-630, CC 24-630 | |
| | | CBC 40,5 630 (max for 24 kV) | |
| | | CSA M12 | |
| | | CB 36-400 (for max 24 kV) | |
| | TE connectivity | RSTI L56xx | |
| | | RSTI-CC L56xx | |
| KEVA 24 C23<br>KEVA 24 C23c | TE connectivity | RSTI 58xx/39xx | M16<br>(For use in NKT connectors with M16 screw shall be used the correct screw) |
| | | RSTI-CC 58xx/39xx | |
| | | RSTI LCxx/LAxx (older) | |
| | NKT | CB 12-630, CB 24-630 | |
| | | CC 12-630, CC 24-630 | |
| | | CBC 40,5 630 (max for 24 kV) | |
| | | CSA M16 | |

— 04 Combined accuracy class

| Sensor type designation | Cable connectors | | |
|---|---|---|---|
| | Manufacturer | Type | Connecting screw for sensor |
| KEVA 24 C24<br>KEVA 24 C24c | Nexans-Euromold | (K)430 TB | M16 |
| | | (K)300 PBM/G-630 A | |
| | | 300 SA-10-xN (x = up to 24 kV) | |
| | Prysmian | FMCEAs 630/400 | |
| | | MSCEA/EC-630-C | |
| KEVA 24 C25<br>KEVA 24 C25c | Cellpack | CTS 630A 24kV | M16 |
| | | CTKS 630A 24 kV | |
| | | CTKSA 630A 24kV | |
| KEVA 24 C26<br>KEVA 24 C26c | Südkabel | SET 12, 24, SAT 12,24 | M16 |
| | | SEHDK 13.1, 23.1, SAK 12,24 | |
| | | SEHDT 23.1 | |
| | | MUT 23, MUT 23.1 | |
| | | AD 23.1 SP | |
| KEVA 24 C30 | TE connectivity | RICS 51x3, 51x9, 51x7 | M16 |
| KEVA 24 C2 4.1<br>KEVA 24 C2 4.1c | Nexans - Euromold | (K)480 TB/G; (K)484 TB/G; | **M16** |
| | | (K)489 TB/G; (K)800 PB/G; | |
| | | (K)804 PB/G; (K)809 PB/G; | |
| | | (K)480 BE/G; | |
| | | 800 SA-10-xN (x = up to 24 kV) | |
| | | KAA8 | |
| KEVA 36 C2 4.1<br>KEVA 36 C2 4.1c | Nexans - Euromold | M480 TB/G | M16 |
| | | M800 PB/G | |
| | | M484 TB/G | |
| | | M804 PB/G | |
| | | M489 TB/G | |
| | | M809 PB/G | |
| | | 800 SA-10-xN (x=30,33,36) | |
| | | M480 BE/G | |

Tab. 2. Sensor variants and use in cable connectors

**Note: For use in alternative cable connectors please contact ABB.**

**Differences between Sensors and Instrument Transformers**

There are some noticeable differences between Sensors and conventional Instrument Transformers:

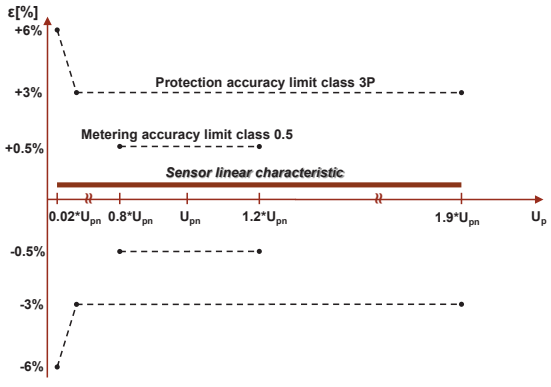
**Linearity**

Due to the absence of a ferromagnetic core the sensor has a linear response over a very wide primary voltage range.

Example of voltage measurement range for metering accuracy class 0.5 and protection accuracy class 3P: The accuracy limits are described on the graph (see picture 4).

**Rated parameters**

Because the sensors are highly linear within a very wide range of voltages, the same single sensor can be used for the various rated voltages associated with each specific application up to the specified maximum voltage for equipment. There is no need to specify other parameters such as burden etc. since they are standard over the defined range. To achieve the correct function of the protection and control IED, the selected rated voltage as well as the rated transformation ratio, must be properly set into the IED.

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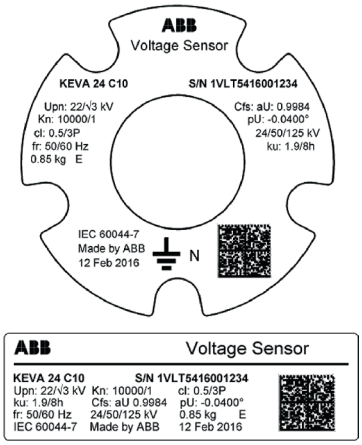
## Correction factors

The amplitude and phase error of a voltage sensor is, in practice, constant and independent of the primary voltage. Due to this fact it is an inherent and constant property of each sensor and it is not considered as unpredictable and influenced error. Hence, it can be easily corrected in the IED by using appropriate correction factors, stated separately for every sensor.

Values of the correction factors for the amplitude and phase error of a voltage sensor are mentioned on the sensor label (for more information please refer to Instructions for installation, use and maintenance) and should be uploaded without any modification into the IED before the sensors are put into operation (please check available correction in the IED manual). To achieve required accuracy classes it is recommended to use both correction factors: amplitude correction factor (aU/CFu) and phase error correction factor (pU/$\varphi_{0\ cor}$) of a voltage sensor.

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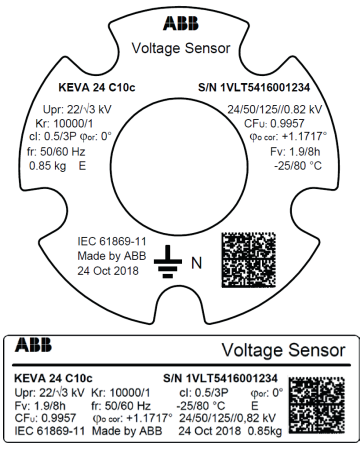
05 Example of a sensor label (IEC 60044-7)

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06 Example of a sensor label (IEC 61869-11)

## Secondary cables

The sensor is equipped with a cable for connection with the IED. The cable connector is type RJ45. The sensor accuracy classes are verified up to the connector, i.e. considering also its secondary cable. These cables are intended to be connected directly to the IED, and subsequently neither burden calculation nor secondary wiring is needed. Every sensor is therefore accuracy tested when equipped with its own cable and connector.

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07 Connector RJ45

## Connector adapters

To provide connectivity between a sensor with a RJ45 cable connector and IEDs with Twin-BNC connectors a group of adapters were designed. To provide connectivity between current and voltage sensors with RJ45 cable connectors and IEDs with RJ45 connector the coupling adapter was designed.

The use of connector or coupling adapters has no influence on the current and/or voltage signal and accuracy of the sensor with the cable.

For more information about connector adapters and coupling adapter refer to Doc. No. 1VLC000710 - Sensor accessories.

| Sensor type designation | Highest voltage for equipment Um (kV) | Rated power frequency test voltage (kV) | Rated lightning impulse test voltage (kV) |
|---|---|---|---|
| KEVA 24 Cxx | 24 | 50 | 125 |
| KEVA 24 C2 4.1(c) | 24 | 50 | 125 |
| KEVA 36 C2 4.1(c) | 36 | 70 | 170 |

Tab. 3. Highest voltage for equipment and test voltages

**Standards**

- IEC 60044-7 (1999-12) Instrument transformers - Part 7: Electronic voltage transformers
- IEC 61869-11 (2017-12) Instrument transformers - Part 11: Additional requirements for low-power passive voltage transformers
- HD 629.1 S2 (02/2006) + A1 (09/2008) Table 10, test requirements (KEVA 24 C10(c)/ C24(c)/ C25(c)/ C2 4.1(c))
- HD 629.1 S3 (2019) Table 17 on cable accessories for system 18/30 (36) kV + HD 629.1 S2 (2006-02) DC voltage dry for (KEVA 36 C2 4.1 / C2 4.1c)

**Insulation requirements for secondary terminals according to IEC 61869-11**

- Power frequency voltage withstand capability: 0.82 kV
- Impulse voltage withstand capability: 1.5 kV 1.2/50 µs

**Voltage sensor, rated values**

| Sensor type designation | Rated primary voltage Upn/Upr (kV) |
|---|---|
| KEVA 24 Cxx | 22/√3 |
| KEVA 24 C2 4.1(c) | 22/√3 |
| KEVA 36 C2 4.1(c) | 33/√3 |

Tab. 4. Rated primary voltage, $U_{pn}$ / $U_P$

- Rated frequency, $f_r$: 50/60 Hz
- Accuracy class: 0.5/3P
- Rated burden, $R_{br}$:
  - IEC 60044-7 10 MΩ
  - IEC 61869-11 2 MΩ; 50 pF
- Rated transformation ratio, $K_n$ /$K_r$: 10 000:1
- Rated voltage factor, $k_u$/Fv: 1.9/8h

**Temperature category**

- Operation: -25°C/+80°C
- Transport and storage: -40°C/+80°C

**Cable**

- Length: 2.2; 5; 8; 10 m
- Connector: RJ45 (CAT-6)
- Grounding wire length: 0.5 m

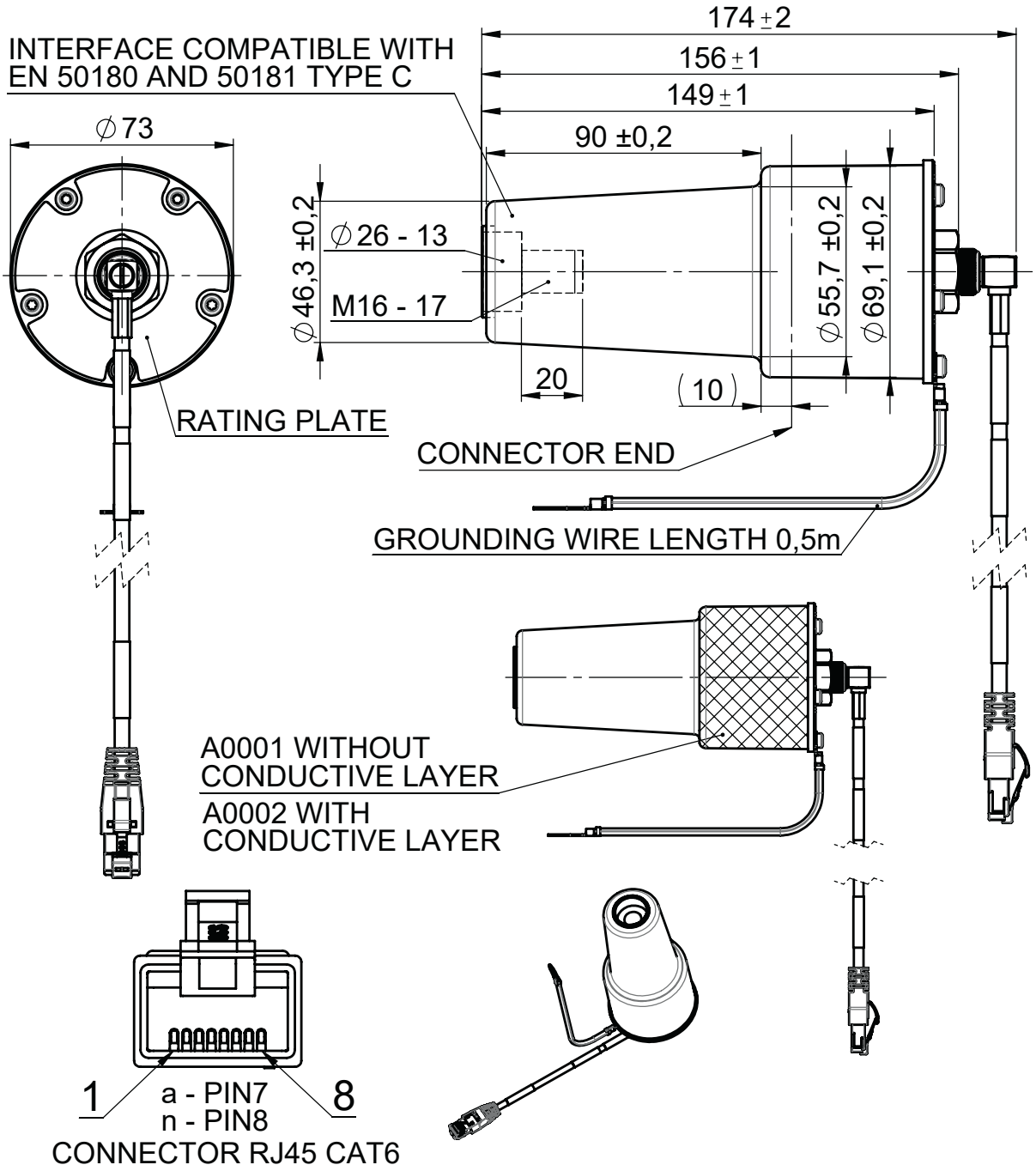
| Sensor type designation | IEC Standard | Secondary cable length | | | |
|---|---|---|---|---|---|
| | | 2.2 m | 5 m | 10 m | 8 m |
| KEVA 24 C10 | IEC 60044-7 | 1VL5400061V0101 | 1VL5400061V0103 | 1VL5400061V0102 | 1VL5400061V0104 |
| | IEC 61869-11 | 1VL5400061V1101 | 1VL5400061V1103 | 1VL5400061V1102 | 1VL5400061V1104 |
| KEVA 24 C10c | IEC 60044-7 | 1VL5400061V0201 | 1VL5400061V0203 | 1VL5400061V0202 | 1VL5400061V0204 |
| | IEC 61869-11 | 1VL5400061V1201 | 1VL5400061V1203 | 1VL5400061V1202 | 1VL5400061V1204 |
| KEVA 24 C21 | IEC 60044-7 | 1VL5400062V0101 | 1VL5400062V0103 | 1VL5400062V0102 | 1VL5400062V0104 |
| | IEC 61869-11 | 1VL5400062V1101 | 1VL5400062V1103 | 1VL5400062V1102 | 1VL5400062V1104 |
| KEVA 24 C21c | IEC 60044-7 | 1VL5400062V0201 | 1VL5400062V0203 | 1VL5400062V0202 | 1VL5400062V0204 |
| | IEC 61869-11 | 1VL5400062V1201 | 1VL5400062V1203 | 1VL5400062V1202 | 1VL5400062V1204 |
| KEVA 24 C22 | IEC 60044-7 | 1VL5400063V0101 | 1VL5400063V0103 | 1VL5400063V0102 | 1VL5400063V0104 |
| | IEC 61869-11 | 1VL5400063V1101 | 1VL5400063V1103 | 1VL5400063V1102 | 1VL5400063V1104 |
| KEVA 24 C22c | IEC 60044-7 | 1VL5400063V0201 | 1VL5400063V0203 | 1VL5400063V0202 | 1VL5400063V0204 |
| | IEC 61869-11 | 1VL5400063V1201 | 1VL5400063V1203 | 1VL5400063V1202 | 1VL5400063V1204 |
| KEVA 24 C23 | IEC 60044-7 | 1VL5400064V0101 | 1VL5400064V0103 | 1VL5400064V0102 | 1VL5400064V0104 |
| | IEC 61869-11 | 1VL5400064V1101 | 1VL5400064V1103 | 1VL5400064V1102 | 1VL5400064V1104 |
| KEVA 24 C23c | IEC 60044-7 | 1VL5400064V0201 | 1VL5400064V0203 | 1VL5400064V0202 | 1VL5400064V0204 |
| | IEC 61869-11 | 1VL5400064V1201 | 1VL5400064V1203 | 1VL5400064V1202 | 1VL5400064V1204 |
| KEVA 24 C24 | IEC 60044-7 | 1VL5400078V0101 | 1VL5400078V0103 | 1VL5400078V0102 | 1VL5400078V0104 |
| | IEC 61869-11 | 1VL5400078V1101 | 1VL5400078V1103 | 1VL5400078V1102 | 1VL5400078V1104 |
| KEVA 24 C24c | IEC 60044-7 | 1VL5400078V0201 | 1VL5400078V0203 | 1VL5400078V0202 | 1VL5400078V0204 |
| | IEC 61869-11 | 1VL5400078V1201 | 1VL5400078V1203 | 1VL5400078V1202 | 1VL5400078V1204 |
| KEVA 24 C25 | IEC 60044-7 | 1VL5400079V0101 | 1VL5400079V0103 | 1VL5400079V0102 | 1VL5400079V0104 |
| | IEC 61869-11 | 1VL5400079V1101 | 1VL5400079V1103 | 1VL5400079V1102 | 1VL5400079V1104 |
| KEVA 24 C25c | IEC 60044-7 | 1VL5400079V0201 | 1VL5400079V0203 | 1VL5400079V0202 | 1VL5400079V0204 |
| | IEC 61869-11 | 1VL5400079V1201 | 1VL5400079V1203 | 1VL5400079V1202 | 1VL5400079V1204 |
| KEVA 24 C26 | IEC 60044-7 | 1VL5400080V0101 | 1VL5400080V0103 | 1VL5400080V0102 | 1VL5400080V0104 |
| | IEC 61869-11 | 1VL5400080V1101 | 1VL5400080V1103 | 1VL5400080V1102 | 1VL5400080V1104 |
| KEVA 24 C26c | IEC 60044-7 | 1VL5400080V0201 | 1VL5400080V0203 | 1VL5400080V0202 | 1VL5400080V0204 |
| | IEC 61869-11 | 1VL5400080V1201 | 1VL5400080V1203 | 1VL5400080V1202 | 1VL5400080V1204 |
| KEVA 24 C30 | IEC 60044-7 | 1VL5400081V0101 | 1VL5400081V0103 | 1VL5400081V0102 | 1VL5400081V0104 |
| KEVA 24 C2 4.1 | IEC 61869-11 | 1VL5400084V1101 | 1VL5400084V1103 | - | - |
| KEVA 24 C2 4.1c | IEC 61869-11 | 1VL5400084V1201 | 1VL5400084V1203 | - | - |
| KEVA 36 C2 4.1 | IEC 61869-11 | 1VL5400085V1101 | 1VL5400085V1103 | - | - |
| KEVA 36 C2 4.1c | IEC 61869-11 | 1VL5400085V1201 | 1VL5400085V1203 | - | - |

Tab. 5. Ordering numbers by sensor type, standard and cable length

## Dimensional Drawings

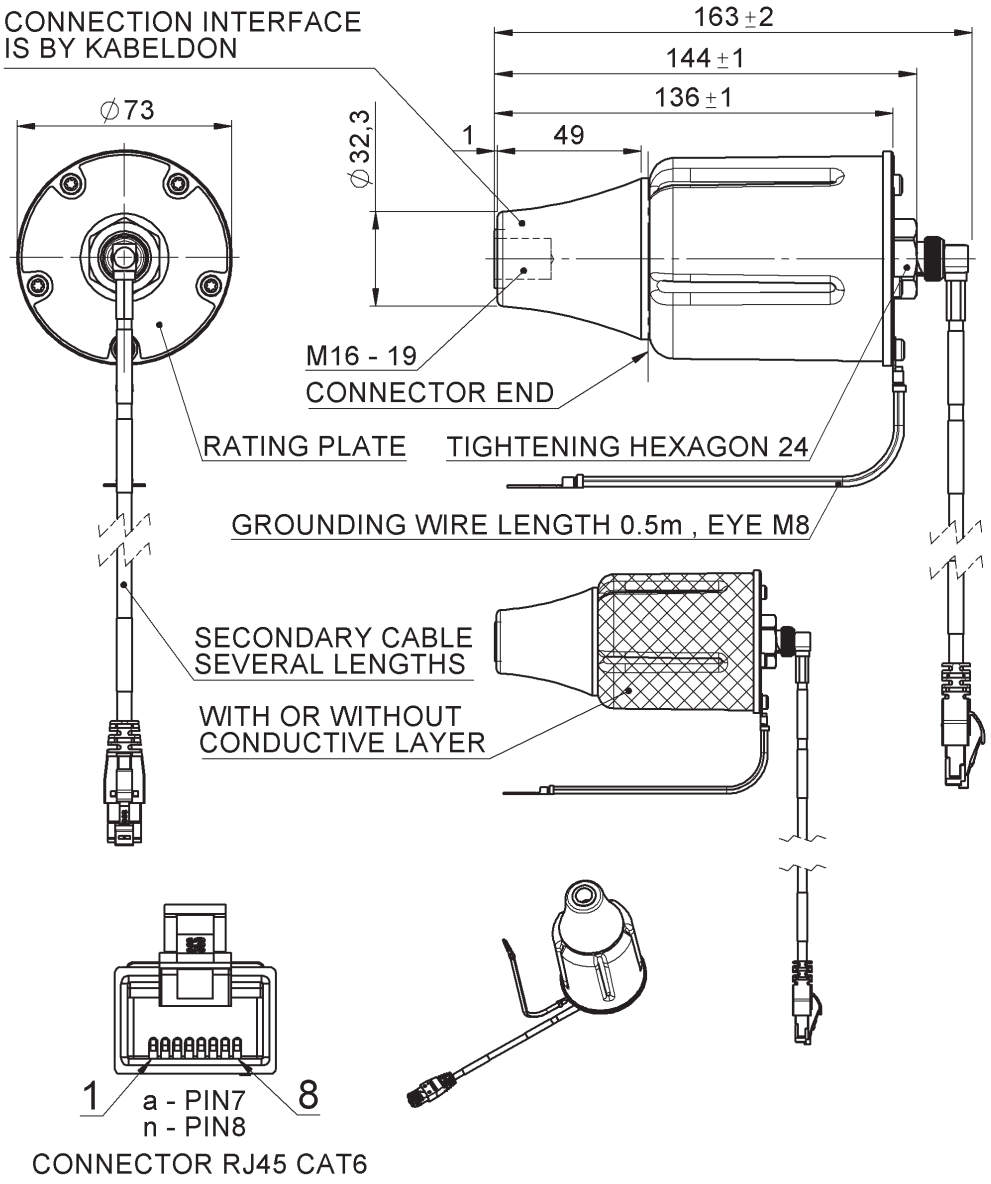
### KEVA 24 C10(c)

Outline drawing numbers:
2RKA015654A0001 (KEVA 24 C10)
2RKA015654A0002 (KEVA 24 C10c)
Weight: 0.85 kg



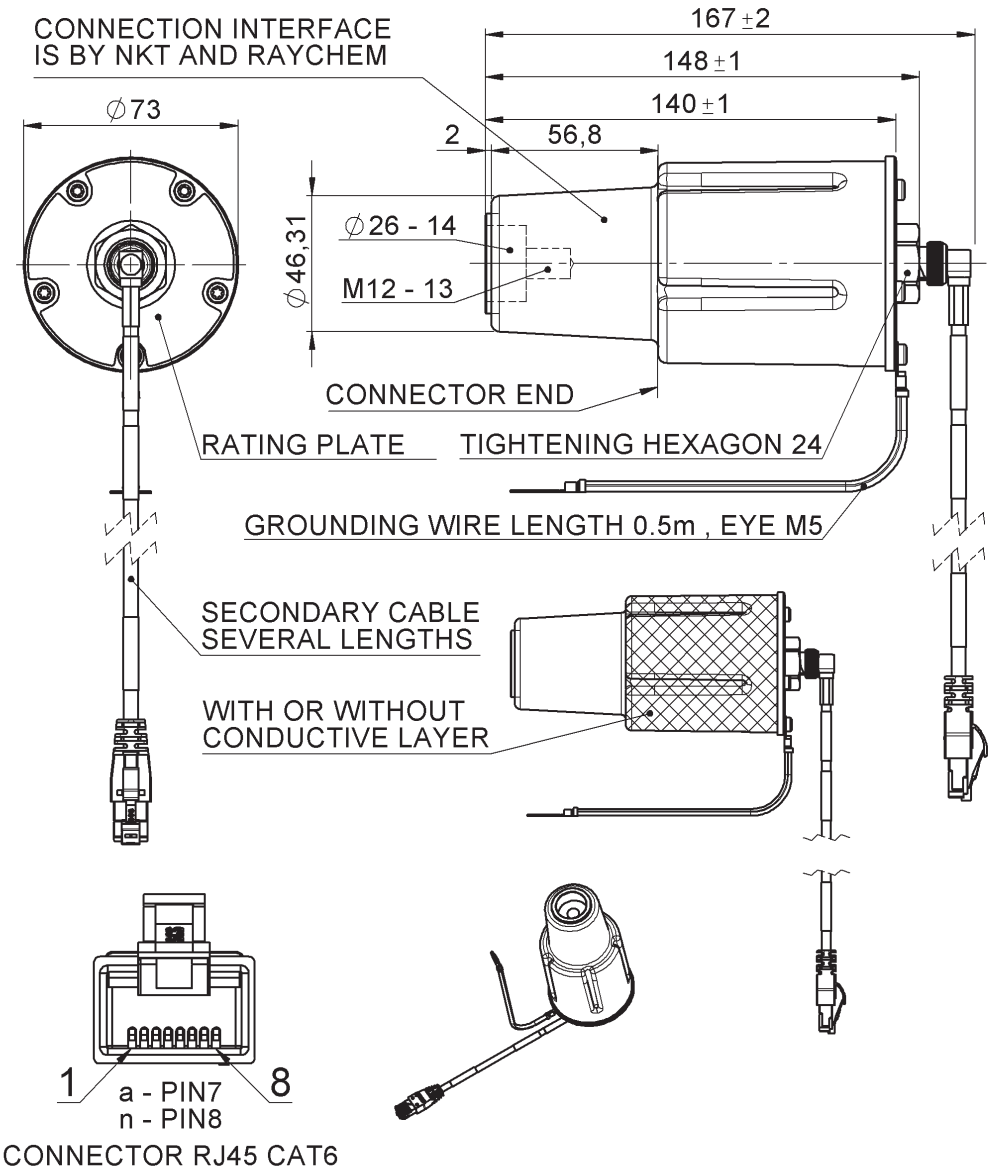
## KEVA 24 C21(c)

Outline drawing numbers:
2RKA017064A0001 (KEVA 24 C21)
2RKA017064A0002 (KEVA 24 C21c)
Weight: 0.85 kg



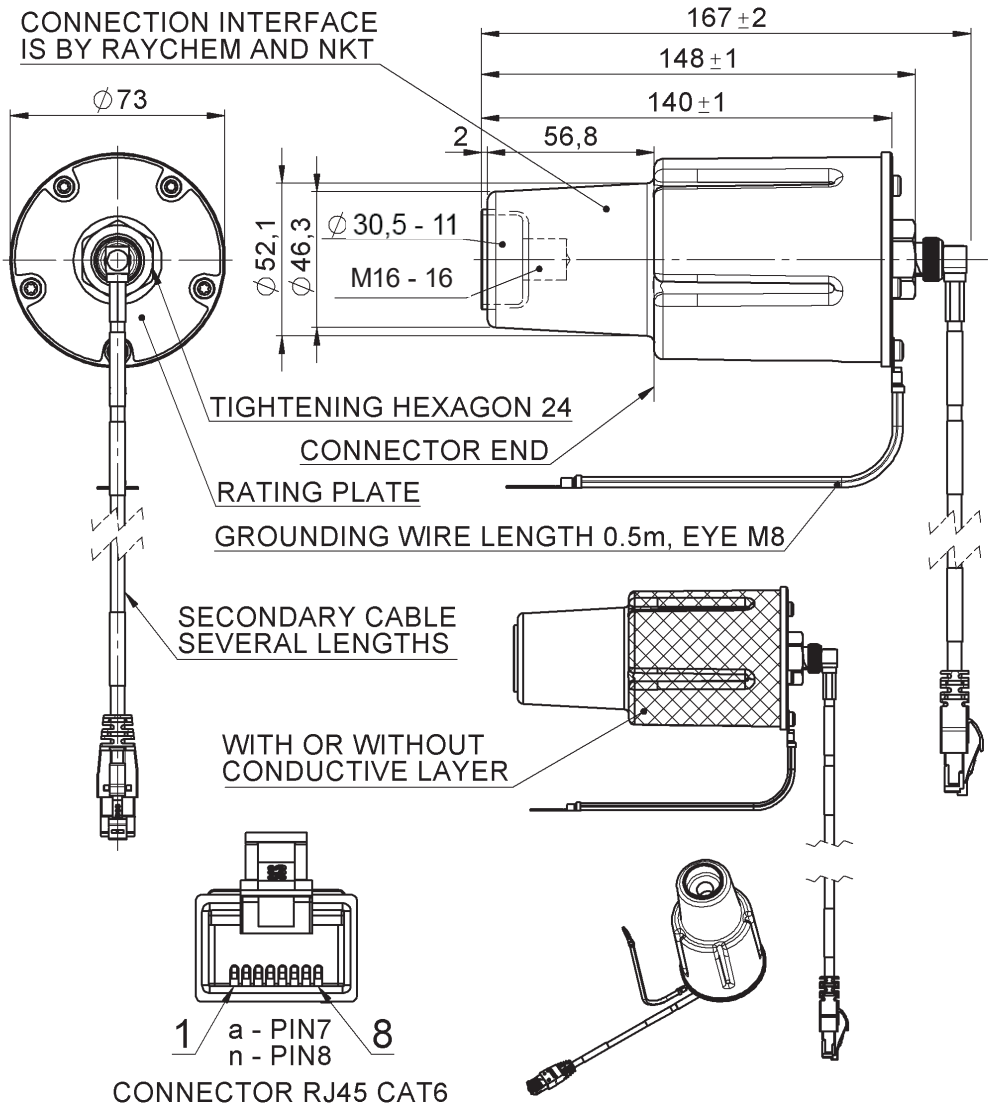
## KEVA 24 C22(c)

Outline drawing numbers:
2RKA017065A0001 (KEVA 24 C22)
2RKA017065A0002 (KEVA 24 C22c)
Weight: 0.85 kg



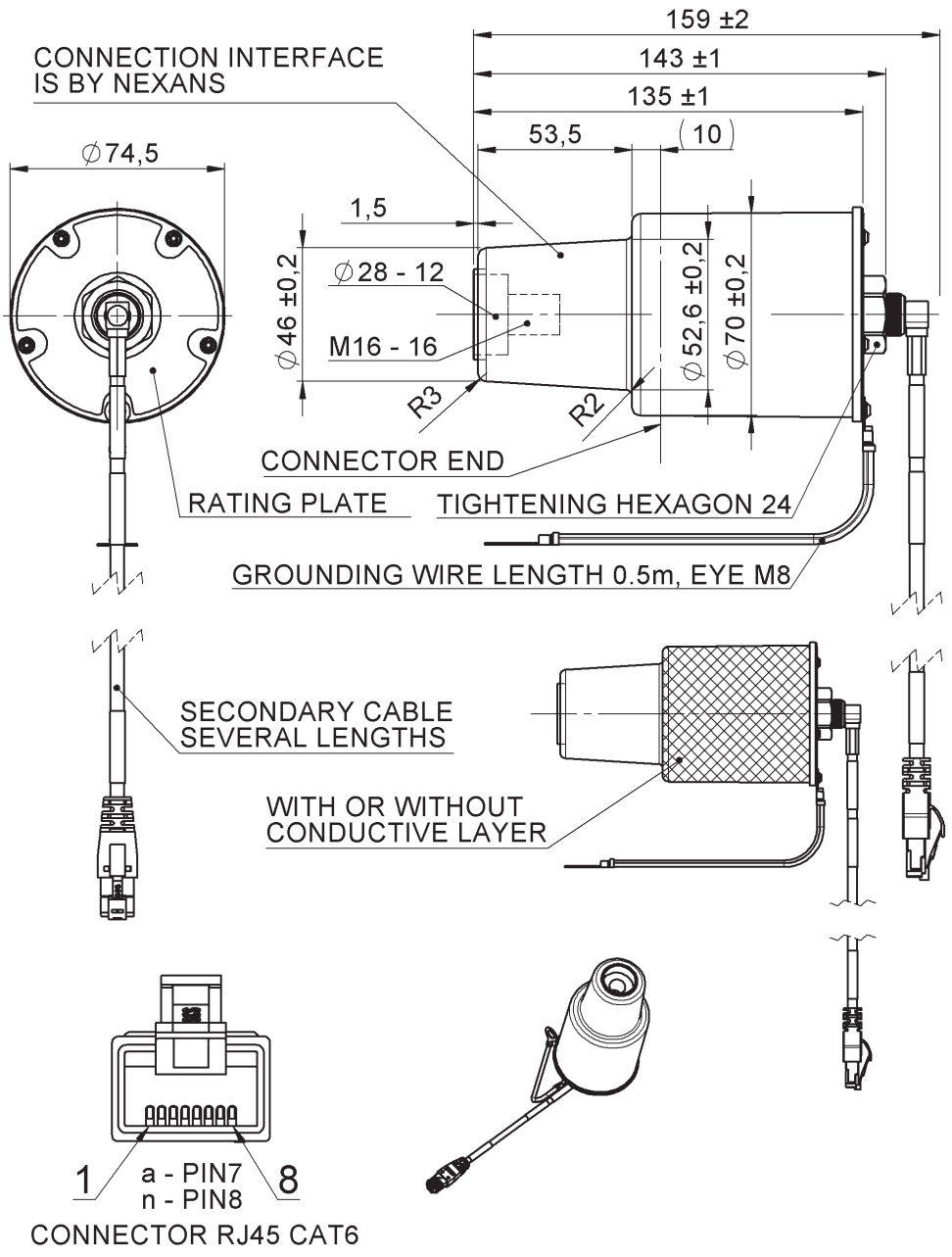
## KEVA 24 C23(c)

Outline drawing numbers:
2RKA017066A0001 (KEVA 24 C23)
2RKA017066A0002 (KEVA 24 C23c)
Weight: 0.85 kg



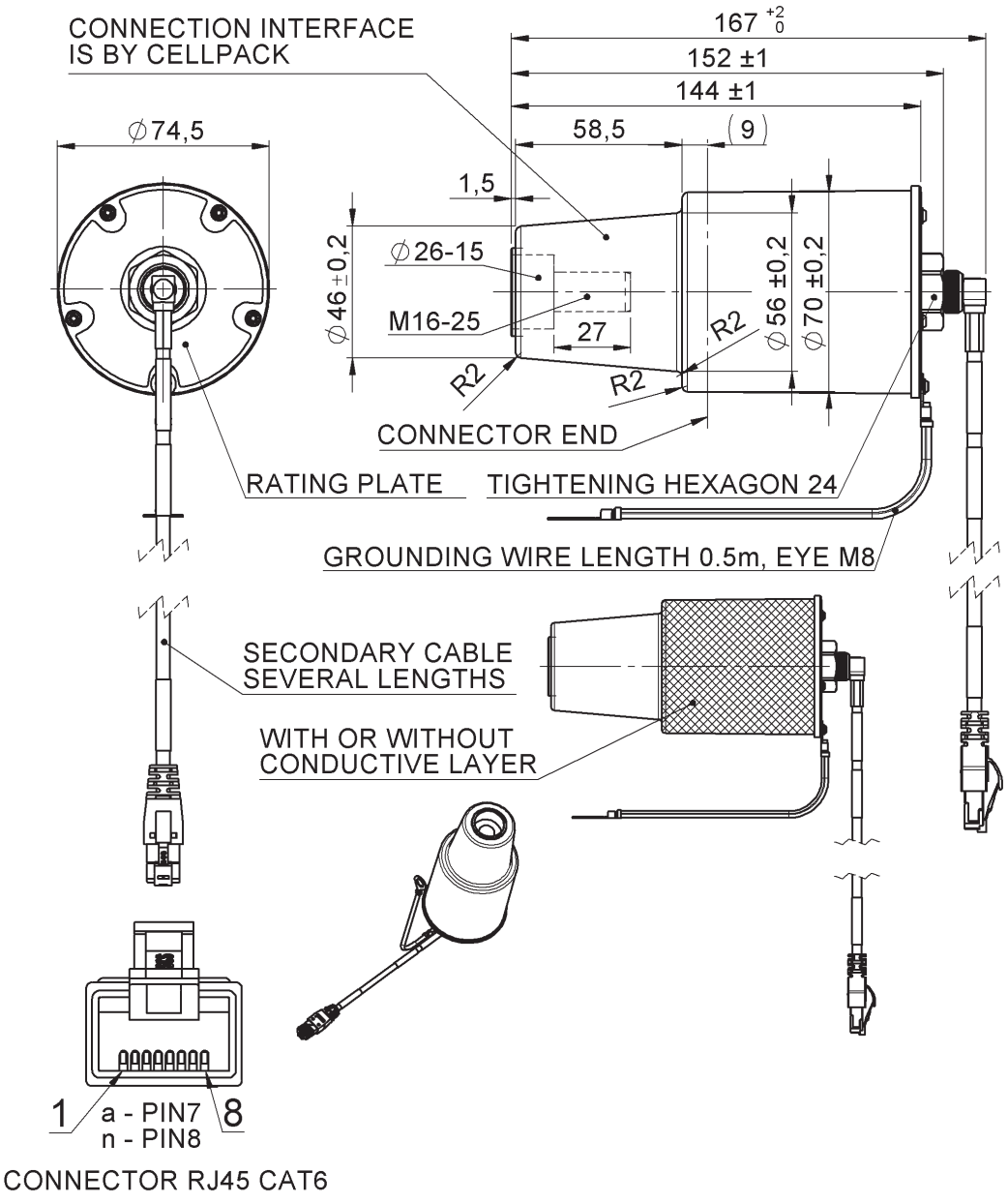
## KEVA 24 C24(c)

Outline drawing numbers: 2RKA019520
Weight: 0.85 kg



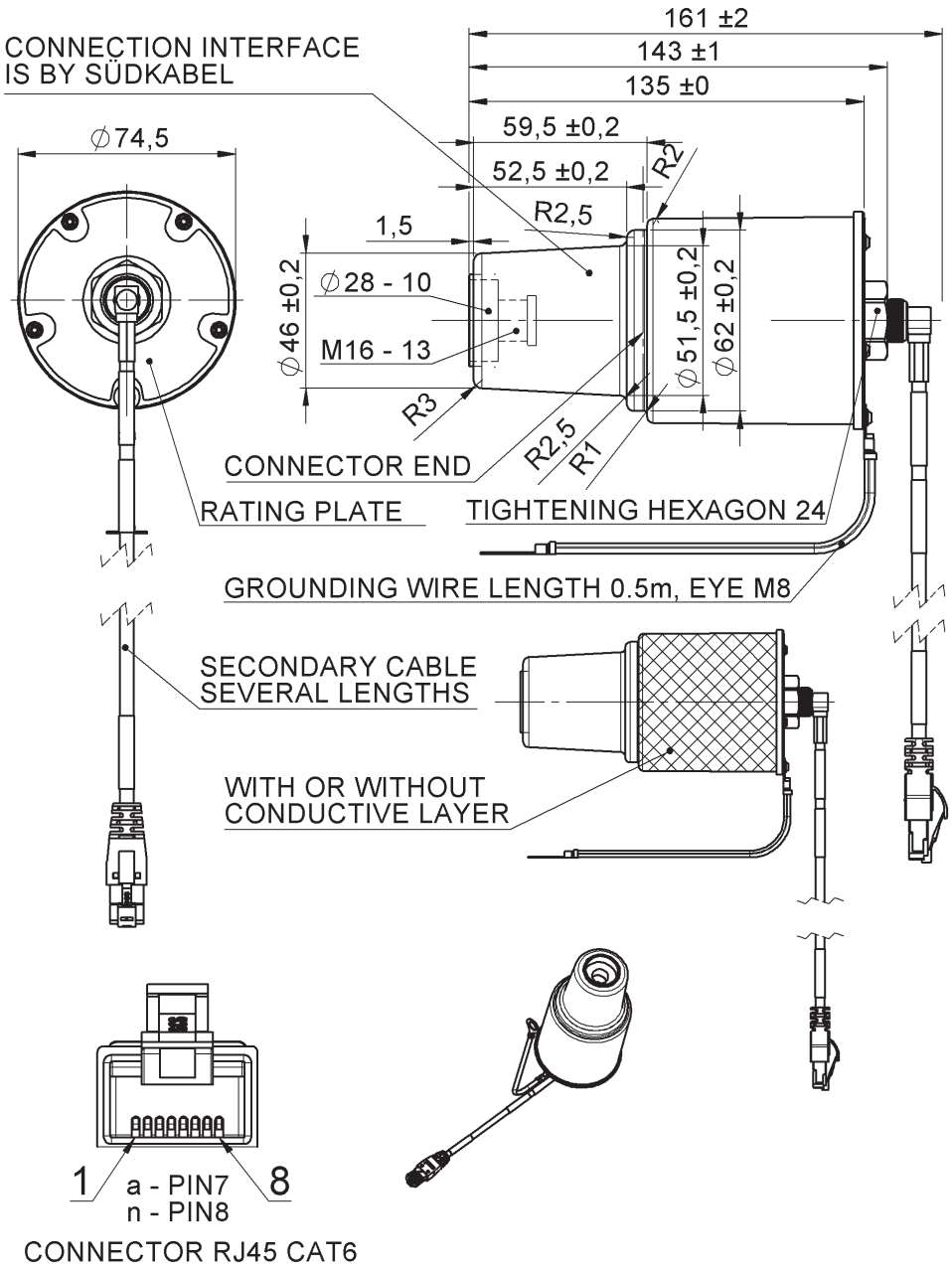
## KEVA 24 C25(c)

Outline drawing numbers: 2RKA019522
Weight: 0.85 kg



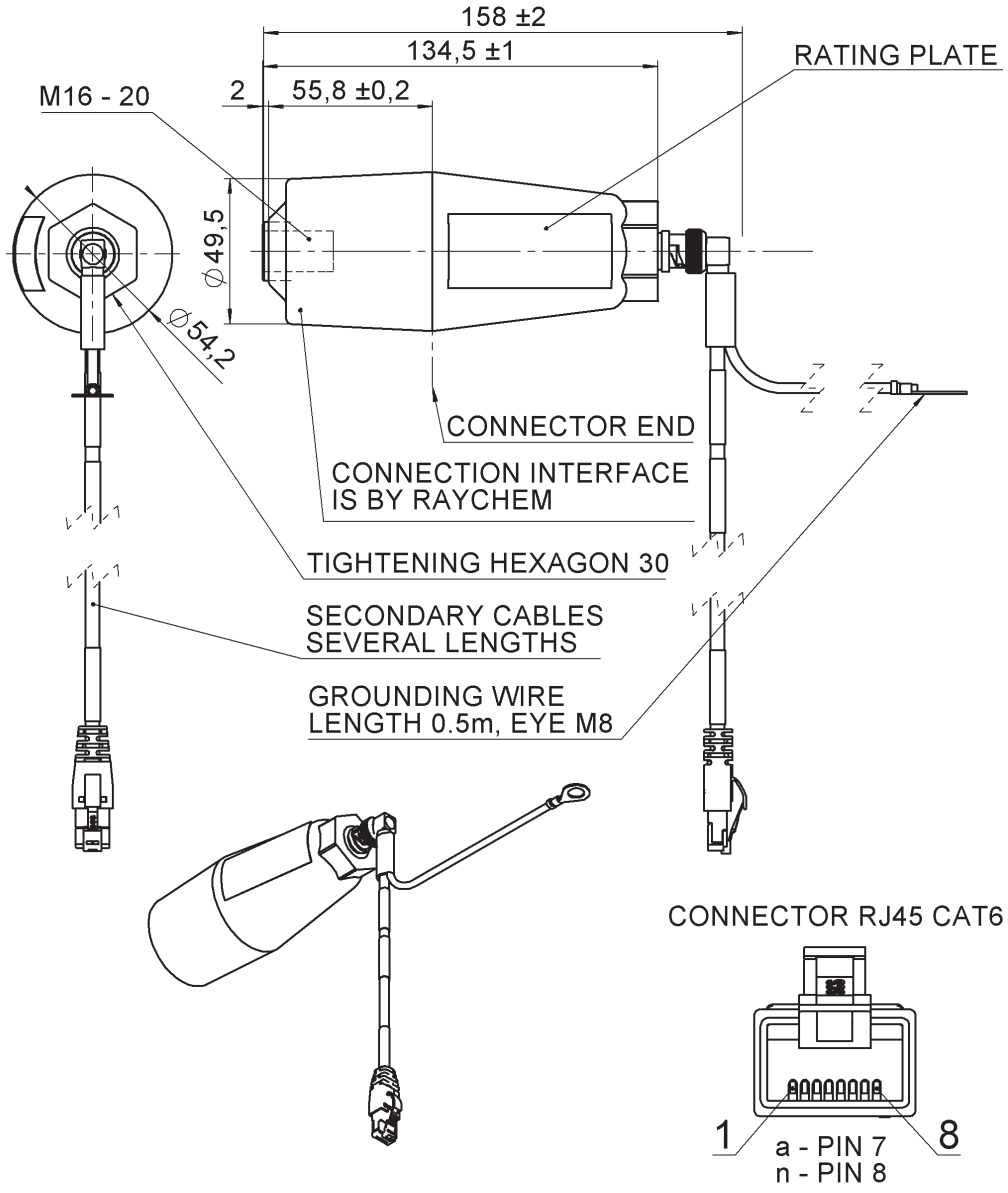
## KEVA 24 C26(c)

Outline drawing numbers:
2RKA019784A0001 (KEVA 24 C26)
2RKA019784A0002 (KEVA 24 C26c)
Weight: 0.85 kg

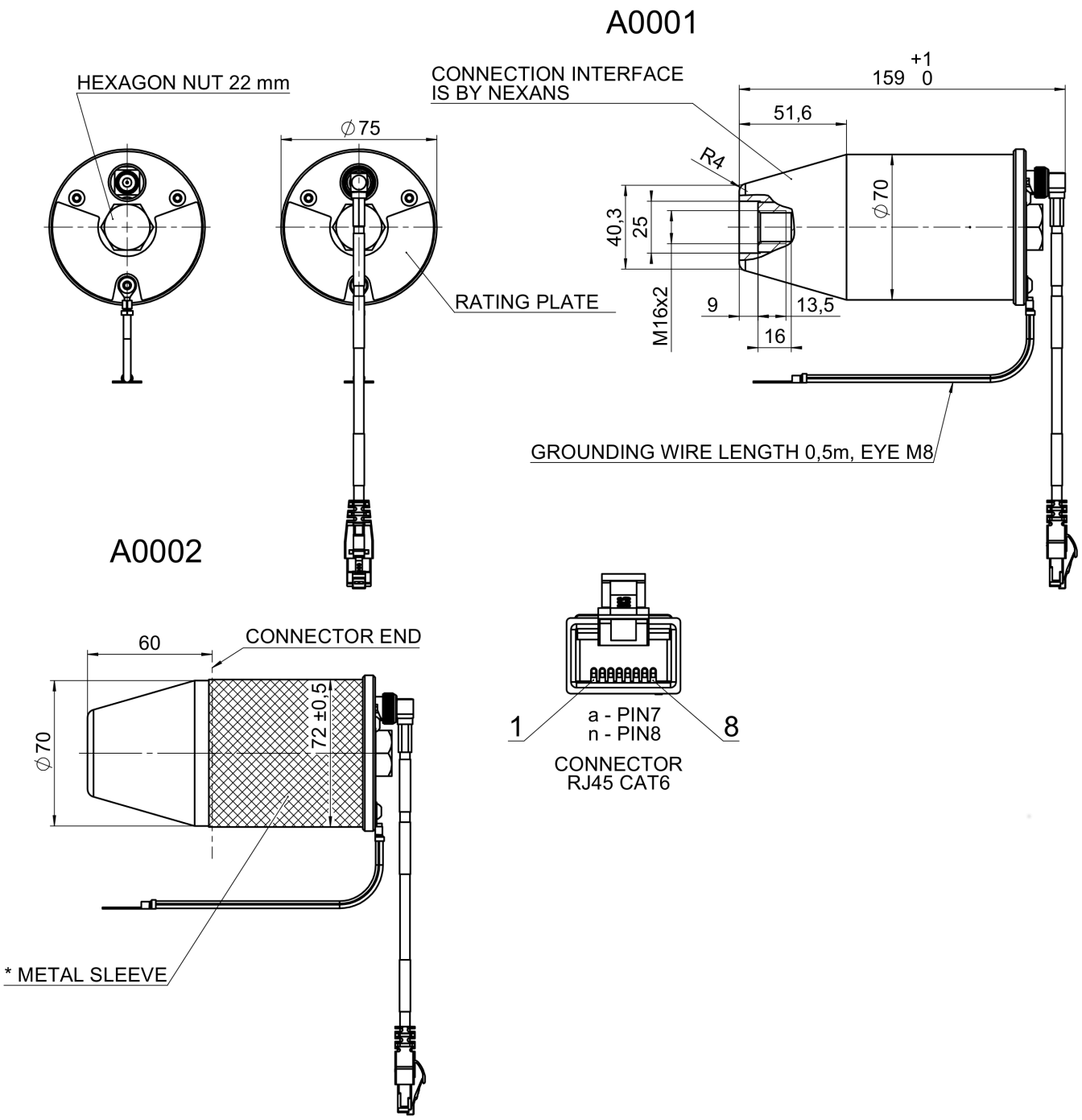


## KEVA 24 C30

Outline drawing number:
2RKA020039A0001 (KEVA 24 C30)
Weight: 0.85 kg



## KEVA 24 C2 4.1(c)
## KEVA 36 C2 4.1(c)



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