MEDIUM VOLTAGE PRODUCTS

AdvaSense™ KEVA C

Indoor voltage sensors for Nexans separable connectors

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01 Resistive divider principle

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02 IED and sensor

Parameters for Application	Value
Rated primary voltage of application	up to 40.5 kV

Sensor Parameters	Value
Rated primary voltage, U_{pn}/U_{pr}	22/√3 kV 33/√3 kV 38/√3 kV
Highest voltage for equipment, U_m	24 kV 36 kV 40.5 kV
Rated power frequency withstand voltage	50 kV 70 kV 95 kV
Rated lightning impulse withstand voltage	125 kV 170 kV 200 kV
Rated transformation ratio, K_n/K_r for voltage measurement	10 000:1
Voltage accuracy class	0.5/3P
Length of cable	2.2; 5 m

Sensor principles

AdvaSense™ 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.

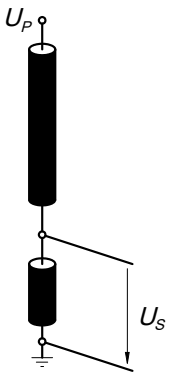
Sensor characteristics

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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03 KEVA C application

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04 Combined accuracy class

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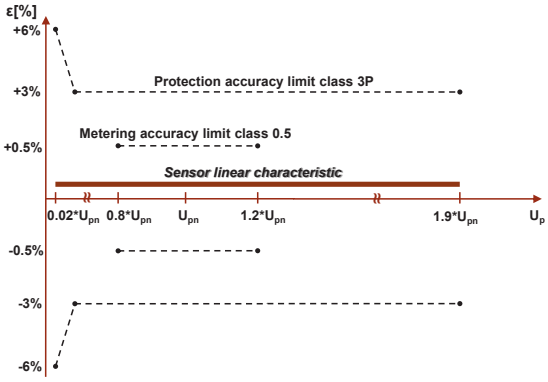
Example of voltage measurement range for metering accuracy class 0.5 and protection accuracy class 3P:
The accuracy limits are described on the graph below.



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Sensor variants

Sensor type designation	Conductive surface	Picture
KEVA 24 C10 KEVA 24 C11 KEVA 24 C24 KEVA 24 C2 4.1 KEVA 36 C2 4.1 KEVA 40.5 C2 4.1	✖	
KEVA 24 C10c KEVA 24 C11c KEVA 24 C24c KEVA 24 C2 4.1c KEVA 36 C2 4.1c KEVA 40.5 C2 4.1c	✔	

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

Sensor type designation	Cable connector	Connecting screw for sensor
KEVA 24 C10 (c)	see Tab. 3.	M16
KEVA 24 C11 (c)	see Tab. 3.	M16
KEVA 24 C24 (c)	see Tab. 3.	M16
KEVA 24 C2 4.1 (c)	see Tab. 3.	M16
KEVA 36 C2 4.1 (c)	see Tab. 3.	M16
KEVA 40.5 C2 4.1 (c)	see Tab. 3.	M16

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.

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.

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

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05b Example of a sensor label (IEC 61869-11)

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

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07 Connector RJ45 for ABB sensors according to IEC 60044-8 standard

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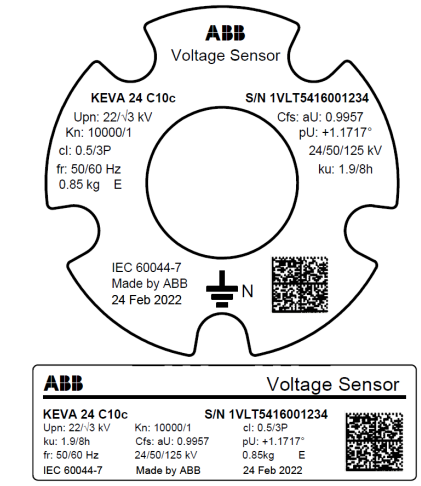
08 Connector RJ45 according to the IEC 61869-10 standard



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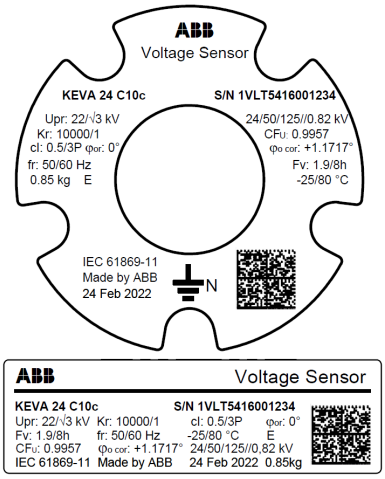

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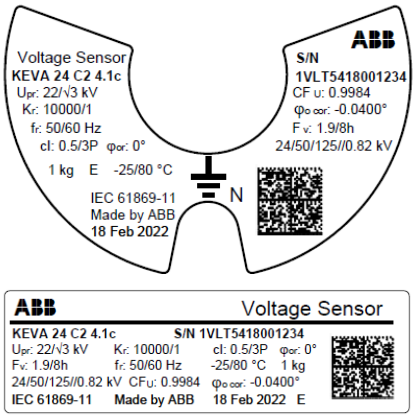
05B



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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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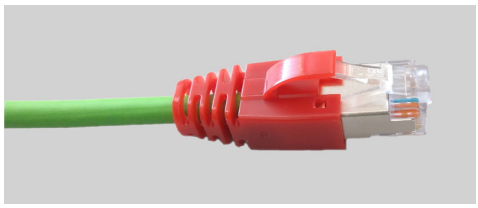

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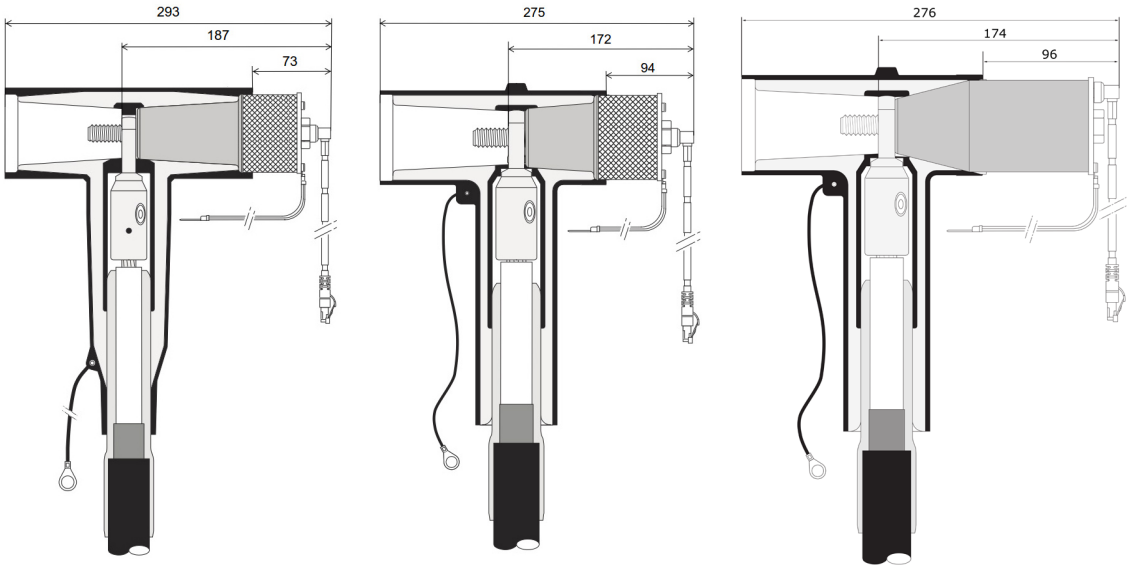
Connector adapters
To provide connectivity between a sensor with a RJ45 cable connector and IEDs with Twin-BNC connectors a group of adapters were designed. To provide connectivity between current and voltage sensors with RJ45 cable connectors and IEDs with RJ45 connector the coupling adapter was designed.

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	Supported type of cable connector		Cable length	Sensor ordering data	
	Manufacturer	Type		IEC 60044-7	IEC 61869-11
KEVA 24 C10	Nexans - Euromold	(K)400 TB/G; (K)440 TB/G (K)944 TB/G; (K)400 TE/G (K)400 BE/G-E KAA4 400PB-xSA (x = up to 24 kV)	**2.2 m**	1VL5400061V0101	1VL5400061V1101
			5 m	1VL5400061V0103	1VL5400061V1103
KEVA 24 C10c			**2.2 m**	1VL5400061V0201	1VL5400061V1201
			5 m	1VL5400061V0203	1VL5400061V1203
KEVA 24 C11	Nexans - Euromold	(K)400 TB/G; (K)440 TB/G (K)944 TB/G; (K)400 TE/G (K)400 BE/G-E KAA4 400PB-xSA (x = up to 24 kV)	**2.2 m**	-	1VL5400175V1101
			5 m	-	1VL5400175V1103
KEVA 24 C11c			**2.2 m**	-	1VL5400175V1201
			5 m	-	1VL5400175V1203
KEVA 24 C24	Nexans - Euromold	(K)430 TB (K)300 PBM/G-630 A 300 SA-10-xN (x = up to 24 kV)	**2.2 m**	1VL5400078V0101	1VL5400078V1101
			5 m	1VL5400078V0103	1VL5400078V1103
KEVA 24 C24c			**2.2 m**	1VL5400078V0201	1VL5400078V1201
			5 m	1VL5400078V0203	1VL5400078V1203
KEVA 24 C2 4.1	Nexans - Euromold	(K)480 TB/G; (K)484 TB/G; (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	**2.2 m**	-	1VL5400084V1101
			5 m	-	1VL5400084V1103
KEVA 24 C2 4.1c			**2.2 m**	-	1VL5400084V1201
			5 m	-	1VL5400084V1203
KEVA 36 C2 4.1	Nexans - Euromold	M480 TB/G 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	**2.2 m**	-	1VL5400085V0101
			5 m	-	1VL5400085V0103
KEVA 36 C2 4.1c			**2.2 m**	-	1VL5400085V0201
			5 m	-	1VL5400085V0203
KEVA 40.5 C2 4.1	Nexans - Euromold	P480 TB/G P800 PB/G P484 TB/G P804 PB/G P489 TB/G P809 PB/G 800 SA-10-xN (x=30,33,36) P480 BE/G	**2.2 m**	-	1VL5400133V1101
			5 m	-	1VL5400133V1103
KEVA 40.5 C2 4.1c			**2.2 m**	-	1VL5400133V1201
			5 m	-	1VL5400133V1203

Tab. 3. Sensor overview.

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



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
KEVA 40.5 C2 4.1(c)	40.5	90	200

Tab. 4. Highest voltage for equipment and test voltages

Standards

- IEC 60044-7 (1999-12) Instrument transformers - Part 7: Electronic voltage transformers - valid for some of the sensors only
- 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
KEVA 40.5 C2 4.1(c)	38/√3

Tab. 5. 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

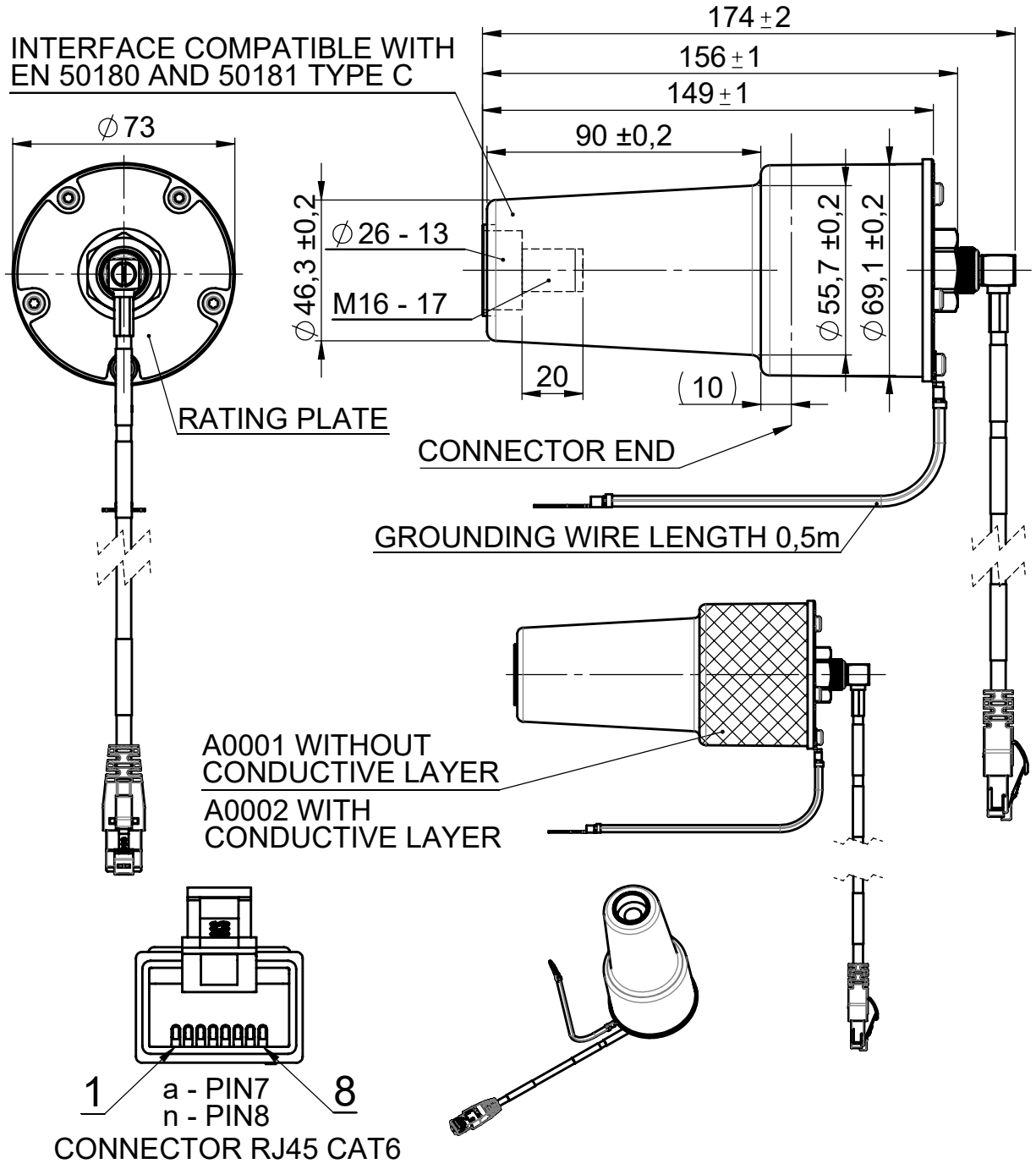
Cable

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

Dimensional Drawings

KEVA 24 C10(c)

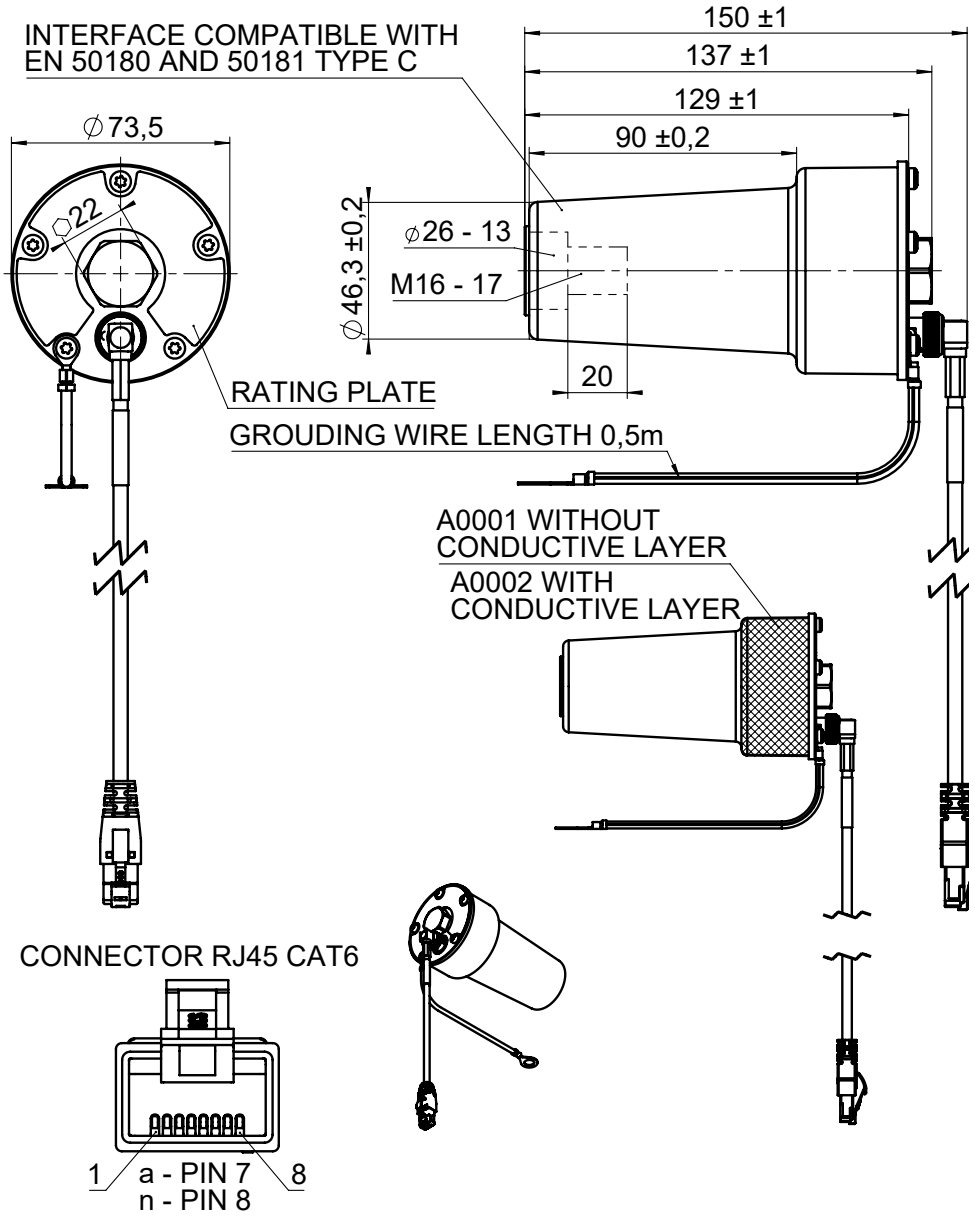
Outline drawing number:
2RKA015654A0001 (KEVA 24 C10)
2RKA015654A0002 (KEVA 24 C10c)
Weight: 0.85 kg



Dimensional Drawing

KEVA 24 C11(c)

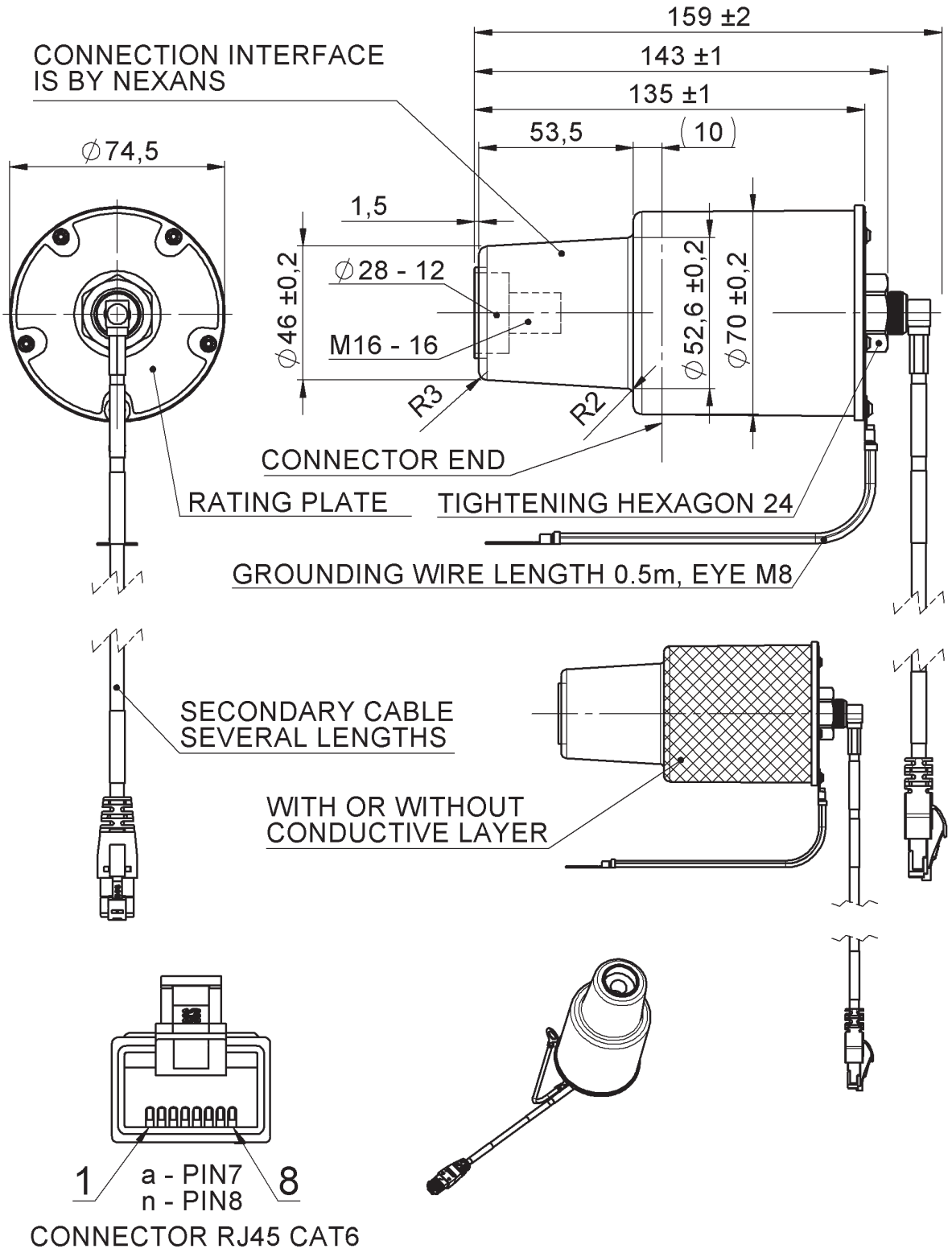
Outline drawing numbers:
2RKA029214A0001 (KEVA 24 C11)
2RKA029214A0002 (KEVA 24 C11c)
Weight: 0.65 kg



Dimensional Drawing

KEVA 24 C24(c)

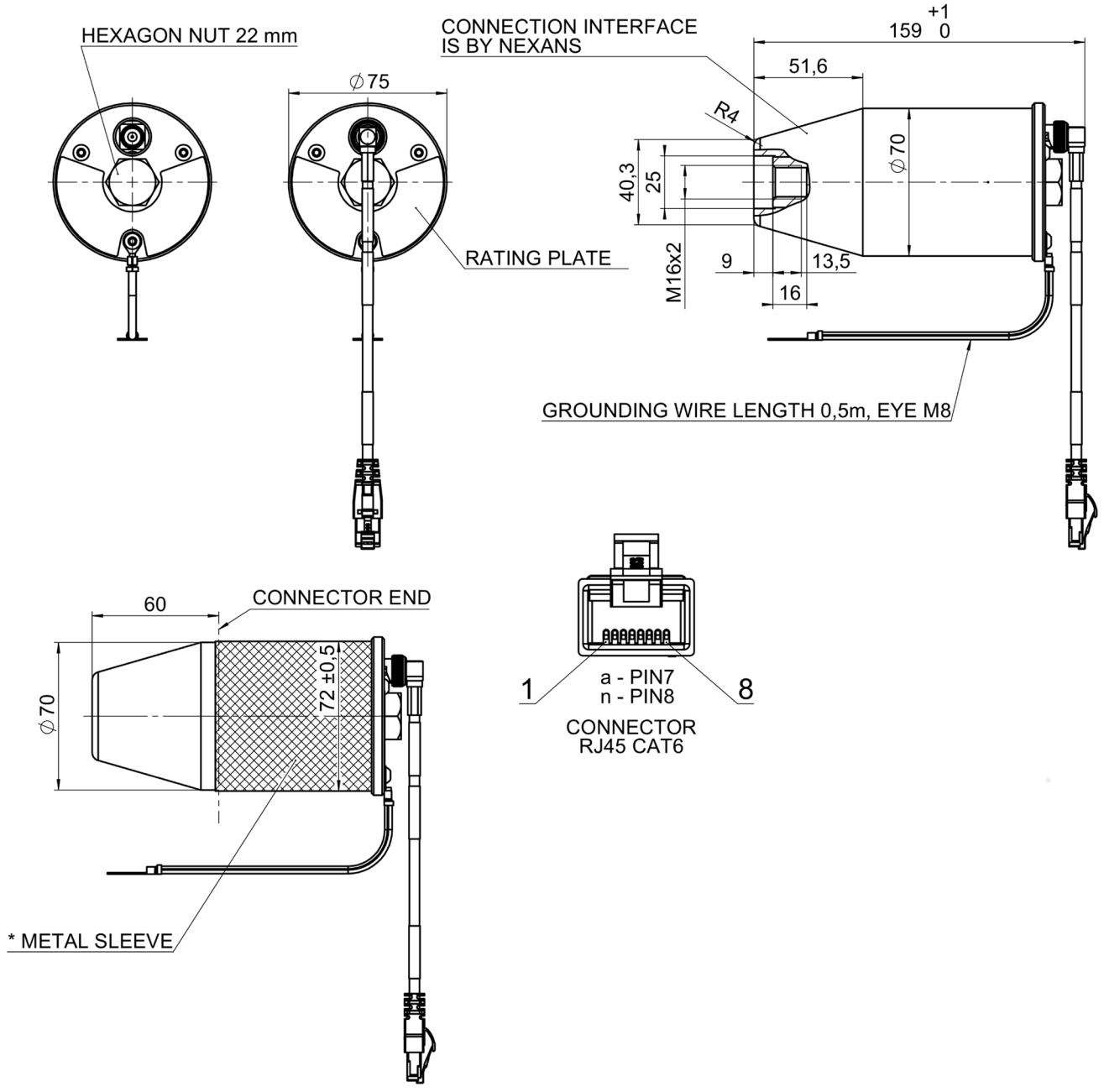
Outline drawing number:
2RKA019520A0001 (KEVA 24 C24)
2RKA019520A0002 (KEVA 24 C24c)
Weight: 0.85 kg



Dimensional Drawings

KEVA 24 C2 4.1(c)
KEVA 36 C2 4.1(c)
KEVA 40.5 C2 4.1(c)

Outline drawing number:
2RKA024667A0001 (KEVA 24 C2 4.1)
2RKA024667A0002 (KEVA 24 C2 4.1c)
2RKA024667A0003 (KEVA 36 C2 4.1)
2RKA024667A0004 (KEVA 36 C2 4.1c)
2RKA024667A0005 (KEVA 40.5 C2 4.1)
2RKA024667A0006 (KEVA 40.5 C2 4.1c)
Weight: 1 kgWeight: 1 kg



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