



VOLTAGE SENSOR FOR SYMMETRICAL SEPARABLE TEE CONNECTOR



DESCRIPTION OF ACA-1/R10K

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SAFETY SYMBOLS



WARNING OR CAUTION:

This symbol denotes a hazard. Not following the indicated procedure, operation or alike could mean total or partial breakdown of the equipment or even injury to the personnel handling it.



NOTE:

Information or important aspects to take into account in a procedure, operation or alike.

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1 INTRODUCTION

1.1 GENERAL

The ACA-1/R10K is a resistive voltage sensor constructed with high precision elements, and intended for phase to ground voltage measurement in distribution power lines.

It is used in a symmetrical tee connector, in gas insulated switchgear, for fault detection applications, protective relaying, and distribution grid monitoring.

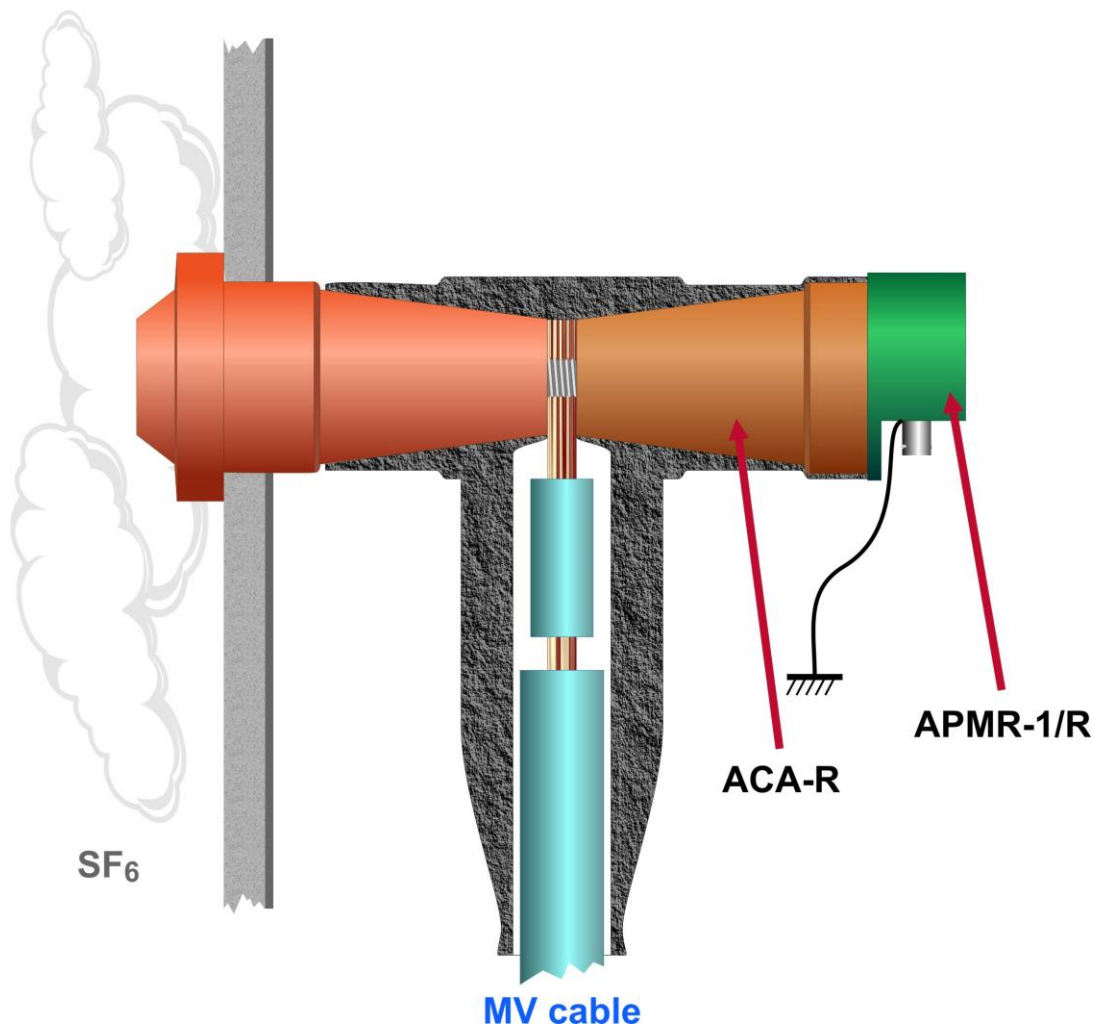
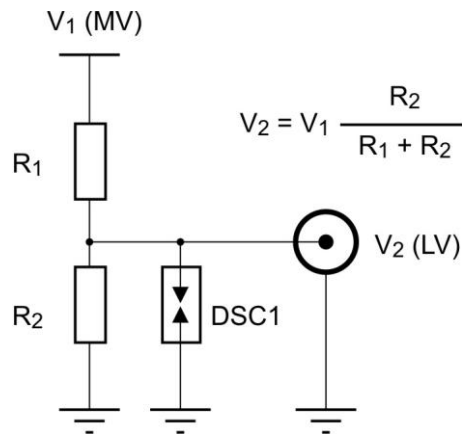


Figure 1 Installation detail of the ACA-1/R10K inside a symmetrical separable tee connector

1.2 CONSTITUTION

The ACA-1/R10K sensor is made up of a resistive divider with a nominal ratio of 10000:1, with an accuracy of 1%. The low-voltage output is protected by means of a DSC1 gas surge arrester (see Figure 2).



NOTE: As in the general case, R1 and R2 may be any combination of series/parallel resistors

Figure 2 Block diagram of the ACA-1/R10K sensor

Figure 3 shows the external appearance of the ACA-1/R10K. The ACA-1/R10K is distributed in two different blocks. The first block, ACA-R, contains the high voltage resistance, designed to be inserted in a symmetrical separable tee connector for dry insulation cable.

The second block, APMR-1/R, see detail in Figure 4, allows the connection to the measurement equipment by means of a BNC connector.



Figure 3 External appearance of the ACA-1/R10K



Figure 4 Detail of the APMR-1/R block connections

Both blocks are supplied fitted together and are therefore not interchangeable in order to maintain accuracy.

1.3 TECHNICAL CHARACTERISTICS

1.3.1 Electrical characteristics

Connection type	Phase-to-ground
Use	Indoor
MV line maximum voltage	24 kV (phase to phase)
Load impedance	$Z_l \geq 10 \text{ M}\Omega$
Load capacitance	$C_l \leq 2.7 \text{ nF}$
Power consumption	1,92 W (a 24 kV / $\sqrt{3}$)
Dielectric strength (50 Hz/1 min)	50 kV _{rms} according to UNE-EN 60060-1
Impulse voltage (1.2/50 μ s)	125 kV with 15(+) and 15 (-) shots according to UNE-EN 61869-3
Partial discharges	< 20 pC at 16.63 kV _{rms} ($1.2V_{\max} / \sqrt{3}$) according to UNE-EN 61869-3
Resistive divider nominal ratio ⁽¹⁾	$N = 10000 \pm 1\%$
Resistive divider ratio shift (with the temperature)	$\left \frac{\Delta N}{N} \right < 1\%$ for the operating temperature range
Phase shift ⁽²⁾	< 1° for the operating temperature range
Accuracy	$\pm 1\%$

Protection elements

Gas surge arrester

Model	CG-90
Nominal Voltage	90 VP
Nominal AC discharge current	20 A (10 x 1 s)
Nominal impulse discharge current	20 kA (10 shots of 8/20 μ s)

⁽¹⁾ The impedance of the measurement equipment have an effect on the nominal ratio. It is recommended an impedance higher than 10 M Ω .

⁽²⁾ The connection cable capacity have an effect on the phase.

1.3.2 Operating and storage conditions

Temperature range	From -10°C to +60°C
Temperature and humidity	In accordance with EN 60870-2-2 class C2 (climatogram 3K6)
Storage conditions	From -20°C to +70°C

1.3.3 Mechanical characteristics

Low-voltage connection	BNC connector ⁽⁴⁾
Ground connection	A2-70 stainless steel M6 rod
Dimensions of ACA-R block ⁽³⁾	See Figure 5
Dimensions of APMR-1/R block	See Figure 6
Whole length	148 mm
Whole weight	0.965 kg
Nominal torque of ACA-R block	See the value specified by the manufacturer. The value should not be higher than 60 Nm. A value from 30 Nm to 40 Nm is recommended

⁽⁴⁾ The BNC connector metallic section is connected internally to the earth terminal.

⁽³⁾ The dimensions of the ACA-R block are suitable for installation inside a symmetrical separable tee connector, the dimensions of which comply with UNE EN-50181 standard.

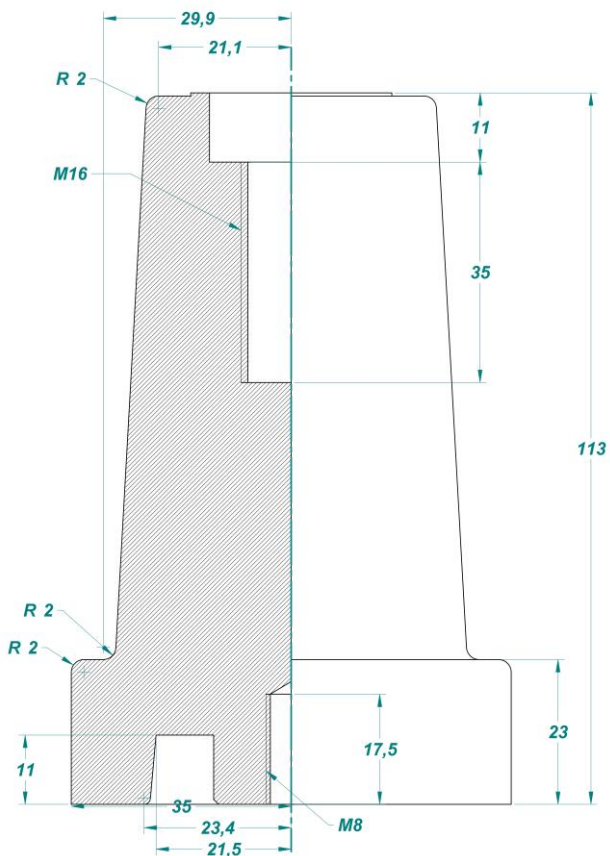


Figure 5 Dimensions of ACA-R block

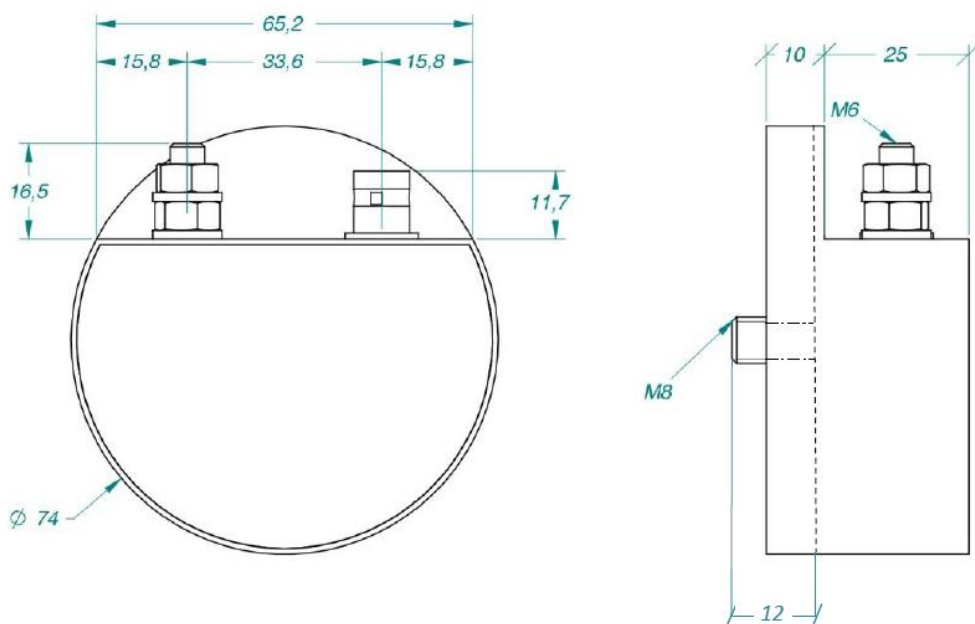


Figure 6 Dimensions of APMR-1/R block

2 INSTALLING THE ACA-1/R10K

2.1 WARNINGS BEFORE INSTALLING



- !
1. The installation of the ACA-1/R10K unit in a medium-voltage power line is generically subject to the fulfilment of all the safety measures and prevention of risks established for this type of work by the electricity company that will use these devices and the Safety standards (EN 50110).
 2. In order to install and handle the ACA-1/R10K voltage sensor the following points must be complied with:
 - Only qualified personnel appointed by the electricity company that owns the installation should carry out the installation and handling of the ACA-1/R10K sensor.
 - The ACA-1/R10K should only be installed WITHOUT VOLTAGE in the medium-voltage power line, and the conductors have to be connected to ground.
 - The environment in which it is to operate should be suitable for the sensor, fulfilling all the conditions indicated in section 1.3, *Technical characteristics*.
 3. ZIV will not accept responsibility for any injury to persons, installations or third parties, caused by the non-fulfilment of points 1 and 2 and of the instructions indicated in section 2.2, *Installation instructions*.

2.2 INSTALLATION INSTRUCTIONS

Figure 7 shows an installation detail of the different blocks of the ACA-1/R10K sensor.



Figure 7 Instructions to assemble the ACA-R (2) and APMR-1/R (4) blocks

The instructions for the ACA-1/R10K installation are the following:

1. Clean the inside of the T connector (piece 1 in figure 7) and that of the ACA-R block (piece 2 in figure 7), using a cloth does not leave any bits, making sure that the surfaces are completely dry and there are no traces of liquid.
2. Spread the dielectric silicone grease inside of the T connector and over the ACA-R block.
3. Put the ACA-R inside the connector until it begins to screw into the rod. It is advisable to use a fishing rope or nylon wire in order to let the air go out during ACA-R cone insertion. In this case, before inserting the ACA-R cone completely, do not forget to remove the nylon wire completely, making sure that no part is trapped.
4. Tighten the ACA-R cone using the torque wrench and the 24 mm socket. The value should not be higher than 60 Nm.
5. Push the black rubber washer supplied to the bottom (piece 3 and detail of fitting in Figure 7) and the APMR-1/R block (piece 4 in figure 7), tightening it hard by hand (a value of 10 Nm is recommended), making sure that the low-voltage connection (BNC connector) and the ground connection (M6) are on the side of interest, usually downwards.

6. Connect the ground connection to the protection earth nearest the connection of the shield of the phase under transmission (a value of 7 Nm is recommended). The cable must be as short as possible. A 16 mm² section is usually enough, as it uses to be the section of the connections of the medium voltage cable shields to ground.
7. Bear in mind the following:



The connection to ground of the ground connection of the APMR-1/R block is important for the security of the terminals and personnel.

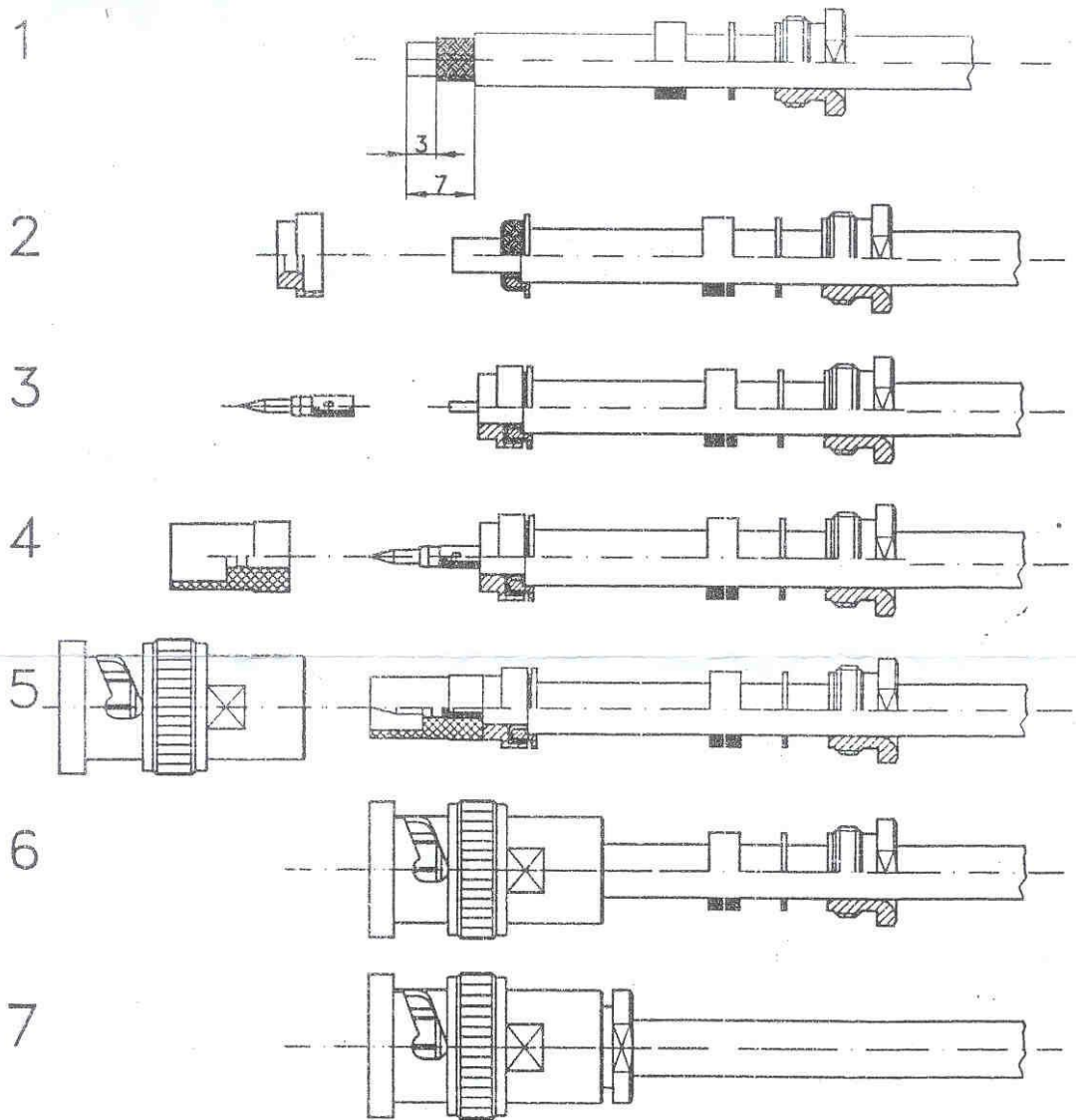
When removing, the two blocks that make up the ACA-1/R10K must be removed and replaced with the BASIC INSULATING PLUG, together with the semiconductor plug, recommended by the manufacturers of the plug.

Should it be necessary, due to any circumstance for the ACA-R to remain connected, the APMR-1/R having been extracted, the M8 screwed terminal must be remain connected to the protection ground for security reasons.

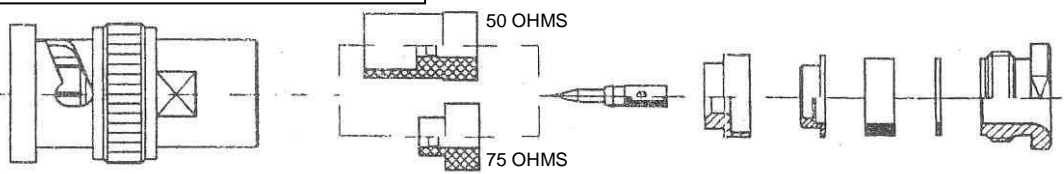
8. The connection cable between the measurement equipment and the ACA-1/R10K must be a 50 Ω impedance characteristic coaxial cable type RG-174U, for example, and length of up to 4 m. This cable can be protected, if necessary, against animals by inserting it in a corrugated PVC pipe.

As a guide when mounting the male BNC connector in the coaxial cable, there are two instructions at the end. One for a soldering connector and the other for a crimping one. The coaxial cable should first be checked in order to avoid having to carry out a new discharge of the medium-voltage line because the cable is wrong.

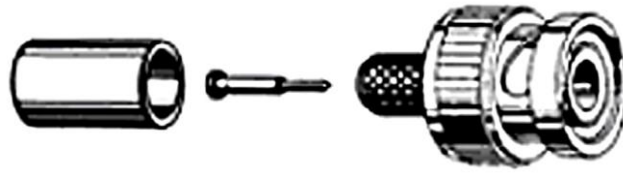
Once the male BNC connector has been mounted, the test should be carried out in the following way: without connecting the coaxial cable to the ACA-1/R10K, an open circuit must be measured at the end of the cable which is communication-terminal side. Once the cable is connected to the ACA-1/R10K BNC connector, in the same end which is communication-terminal side, an impedance of approximately 10KΩ-20KΩ must be measured. If not measured, the cable is wrong and must be replaced.



BNC CONNECTOR PARTS



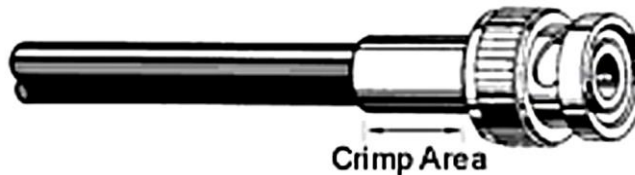
Instructions for a soldering BNC connector



Trim cable as shown, being careful not to nick the inner conductor or braid.



Slip crimp sleeve over cable. Put inner conductor into contact. Note that the end of contact and inner dielectric are butted and square. Crimp with appropriate tool.



Flair outer braid and gently but firmly push the contact into the connector housing until a gentle snap is felt, indicating the contact is in place. Slip the crimp sleeve in place, butting the flange against the connector body, and crimp with appropriate tool.

Instructions for crimping the 3 pieces of a BNC connector