

## VOLTAGE SENSOR INTENDED FOR MV DISTRIBUTION LINES



### DESCRIPTION OF DRMT-1/10K

Rev. 0 - January 2018

ZIV  
Antonio Machado,78-80  
08840 Viladecans, Barcelona-Spain

Tel.: +34 933 490 700  
Fax: +34 933 492 258  
Mail to: [ziv@zivautomation.com](mailto:ziv@zivautomation.com)

[www.zivautomation.com](http://www.zivautomation.com)

## **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.

**TABLE OF CONTENTS**

	Page
1 INTRODUCTION	4
1.1 GENERAL	4
1.2 CONSTITUTION	4
1.3 TECHNICAL CHARACTERISTICS	6
1.3.1 Electrical characteristics	6
1.3.2 Protection elements	7
1.3.3 Mechanical characteristics	7
1.3.4 Operating and storage conditions	8
2 INSTALLING THE DRMT-1/10K	9
2.1 WARNINGS BEFORE INSTALLING	9
2.2 INSTALLATION	9
2.3 FASTENING	10
2.3.1 Deciding the installation position of the fitting	10
2.3.2 Fixing the sensors to the fitting	11
2.3.3 Grounding	12
2.3.4 Installing the fitting	13
2.4 ELECTRICAL CONNECTIONS	13
2.4.1 Connection to ground	13
2.4.2 Electrical connection to the medium-voltage power line	13
2.4.3 Connection to the monitoring electronic equipment	14

# 1 INTRODUCTION

## 1.1 GENERAL

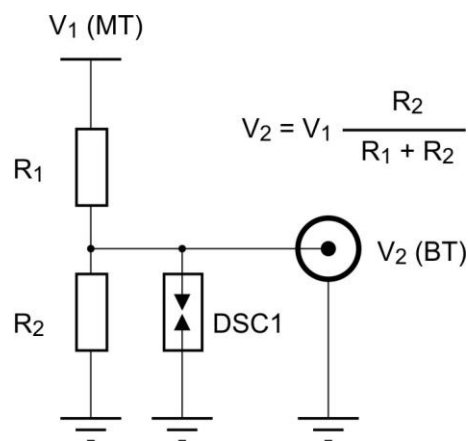
The DRMT-1/10K is a resistive voltage sensor constructed with high precision elements, and designed for phase-to-ground voltage measurement in distribution power lines.

It is used for installation in masonry switchgear and air insulated switchgear (AIS), for fault detection applications, protective relaying and distribution grid monitoring.

## 1.2 CONSTITUTION

The DRMT-1/10K sensor is made up of a resistive divider with a nominal ratio of 10000:1, an accuracy of 1%.

The divider is made up by special high-voltage resistors moulded in an epoxide resin block designed to comply with the creepage distance and insulation requirements in order to be used as a voltage sensor in underground MV power lines (voltage up to 24 kV). The low-voltage output is protected by means of a DSC1 gas surge arrester (see Figure 1).



NOTE: This diagram is only for explanatory purposes.  
R1 and R2 may be any combination of series/parallel resistors

Figure 1 Block diagram of the DRMT-1/10K sensor

## DRMT-1/10K

Figure 2 shows the external appearance of the DRMT-1/10K sensor.



Figure 2 External appearance of the DRMT-1/10K sensor

The DRMT-1/10K has the following connection elements: a M10 rod at the top for connection to the line, a M12 groove of 20 mm depth at the bottom for connection to ground or an external M8 earth connection, and a BNC connector at the side for connection to monitoring electronic equipment.

## 1.3 TECHNICAL CHARACTERISTICS

### 1.3.1 Electrical characteristics

Connection type	Phase-to-ground
Use	Indoor
MV line maximum voltage	24 kV <sub>rms</sub> (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 (at 24 kV / $\sqrt{3}$ )
Dielectric strength (50 Hz/1 min)	50 kV <sub>rms</sub> according to UNE-EN 60060-1
Impulse voltage (1.2/50 $\mu$ s)	125 kV with 15(+) and 15 (-) shots according to UNE-EN 61869-3
Partial discharges	<20 pC at 16.63 kV <sub>rms</sub> ( $1.2 V_{max} / \sqrt{3}$ ) according to UNE-EN 61869-3
Creepage distance	480 mm
Resistive divider nominal ratio <sup>(1)</sup>	$N = 10000 \pm 1\%$
Resistive divider ratio shift with the temperature	$\left  \frac{\Delta N}{N} \right  < 1\%$ for the operating temperature range
Phase shift <sup>(2)</sup>	<1° for the operating temperature range
Accuracy	$\pm 1\%$

<sup>(1)</sup> The impedance of the monitoring electronic equipment has an effect on the nominal ratio. It is recommended an impedance higher than 10 M $\Omega$ .

<sup>(2)</sup> The connection cable capacity has an effect on the phase.

## 1.3.2 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 $\mu$ s)

## 1.3.3 Mechanical characteristics

Connection to monitoring electronic equipment (low-voltage connection)	By means of BNC <sup>(4)</sup> connector and RG-174/U cable
Connection to line	By means of A2-70 stainless steel M10 rod or M10 groove of approx. 20 mm in depth
Connection to earth/mounting	By means of A2-70 stainless steel M12 groove of 20 mm in depth (the suitable screw connection is supplied at factory). It is also available an external A2-70 stainless steel M8 earth connection
Dimensions	See Figure 3
Shed diameter	105 mm
Encapsulation material	Epoxide resin
Weight	1.350 kg

---

<sup>(4)</sup> The BNC connector metallic section is connected internally to the groove at the bottom (earth).

**1.3.4 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 -25°C to +70°C

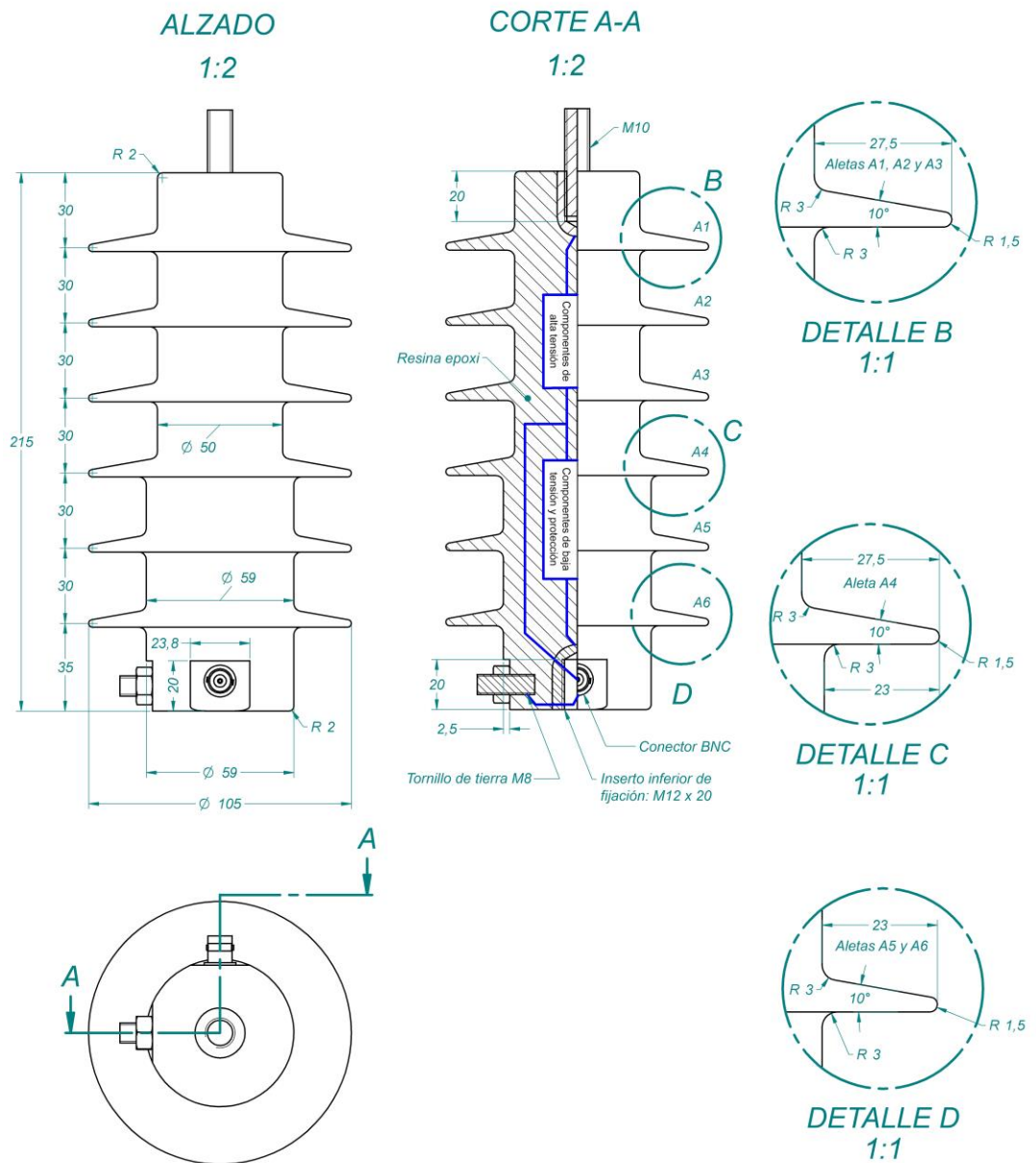


Figure 3 General dimensions of the DRMT-1/10K sensor



## 2 INSTALLING THE DRMT-1/10K

### 2.1 WARNINGS BEFORE INSTALLING



- !
1. Installation of the DRMT-1/10K must comply with the Medium Voltage safety standards and all safety and occupational workplace risk prevention measures established for this work environment by the electricity company using these devices.
  2. Specifically, for the installation and handling of the DRMT-1/10K the following requirements must be satisfied:
    - Only qualified staff and personnel designated by the company owning the facility may perform the installation and handling of the DRMT-1/10K.
    - Prior to installation and handling of the DRMT-1/10K, disconnect the voltage from the MV line and connect it to ground.
    - The operating environment must be appropriate for the sensor, ensuring compliance with the conditions indicated in section 1.3, *Technical characteristics*.
  3. ZIV shall not be held liable for any harm or damages caused to people, facilities or third parties arising from any failure to comply with points 1 and 2.

### 2.2 INSTALLATION

The installation of the DRMT-1/10K sensor involves various phases, beginning with the fastening and ending with the electrical connections, that is, connection to ground, connection to the medium-voltage power line and to the monitoring electronic equipment.

The DRMT-1/10K sensor is installed in air insulated switchgear (AIS) and masonry switchgear, directly on the floor or on the wall of the cell or by means of a fitting (prefabricated metallic shelf) as shown in the plane 1/2 (*Metallic plate for 3 DRMTs*) that is attached at the end of the manual.

**2.3 FASTENING**

**!** The fastening procedure that is indicated below begins with the fixing of the sensors on the fitting (prefabricated metallic shelf), following with grounding wiring and ending with the installation of the fitting on the selected site. However, the person in charge of installation should be the one to decide, in accordance with his own criteria, whether it is more appropriate to begin with the installation of the fitting on the selected site and then fixing each of the sensors on the fitting together with the cables.

**2.3.1 Deciding the installation position of the fitting**

Decide the installation position of the fitting considering the dimensions of the sensor (see Figure 3) and electrical safety distances (see Table 1).

The connection cables must also respect the electrical safety distances.

Once the position has been decided, clearly mark the location of the fixing holes of the fitting in the selected area and drill the four holes of 8 mm diameter.

**Safety distances**

The location of the sensor inside the cell must be decided taking into account the minimum clearance distance between the high-voltage terminal and metallic parts, walls and non-insulated parts of the cell (see Table 1).

Rated Voltage (kV)	Distance (mm)
3.6	60
7.2	90
12	120
24	220

Table 1 Minimum distances between the high-voltage connection and earth metallic parts

## 2.3.2 Fixing the sensors to the fitting

Unpack the DRMT-1/10K sensors and prepare screws.

Fix the three DRMT-1/10K sensors to the base of the fitting by means of the screws and washers provided (see Figure 4).

**! When installing the sensor on the fitting, make sure that the BNC connector and the external M8 earth connection are on the side of interest.**

A torque from 40 Nm to 50 Nm is recommended. Use a 19 wrench.

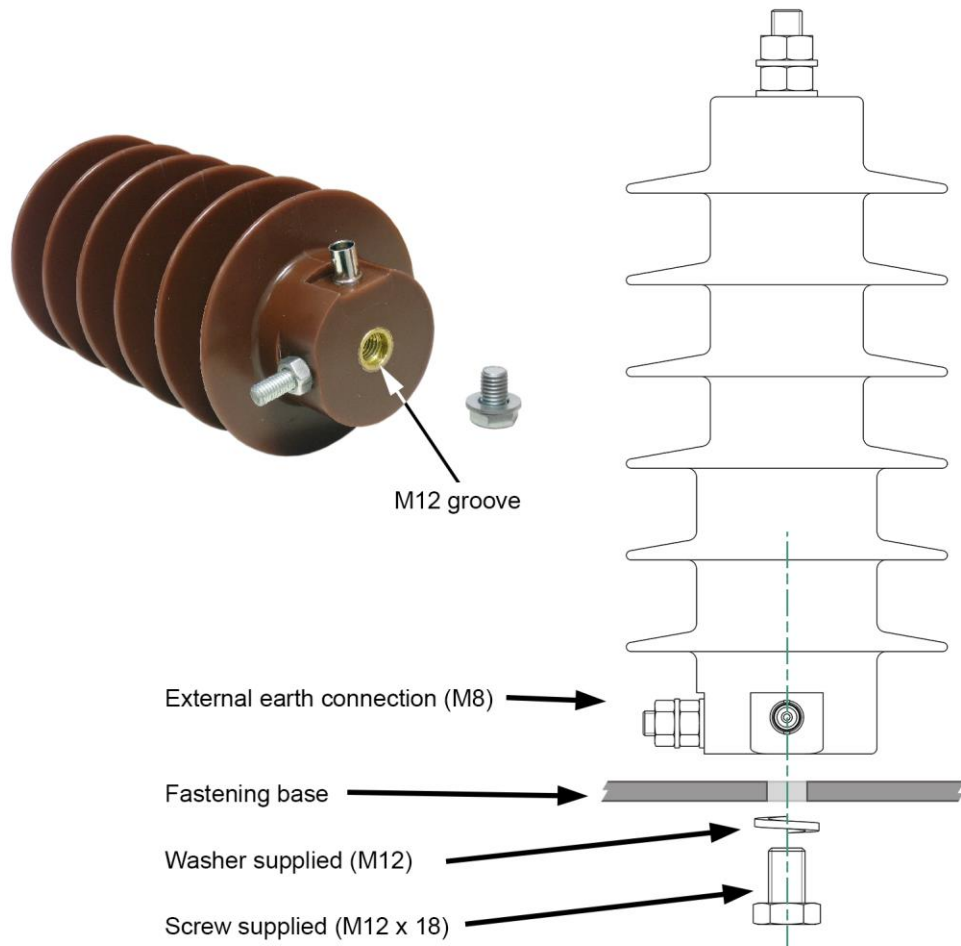


Figure 4 Fastening of the DRMT-1/10K sensor to the base of the fitting

## 2.3.3 Grounding

As shown in the plane 2/2 (*Metallic plate for 3 DRMTs*) that is attached at the end of the manual, the fastening has a ground screw, which can be placed on either end. Verify that the ground screw of the fastening is installed at the end of interest.

**For great safety** the external M8 earth connection of each DRMT-1/10K sensor must be connected to the ground screw of the fitting, see example in Figure 5. Use cables of at least 16 mm<sup>2</sup> of section.

The ground screw of the fastening must then be connected to the protection earth of the cell. The length of the cable must be in accordance with the safety distances (see Table 1).

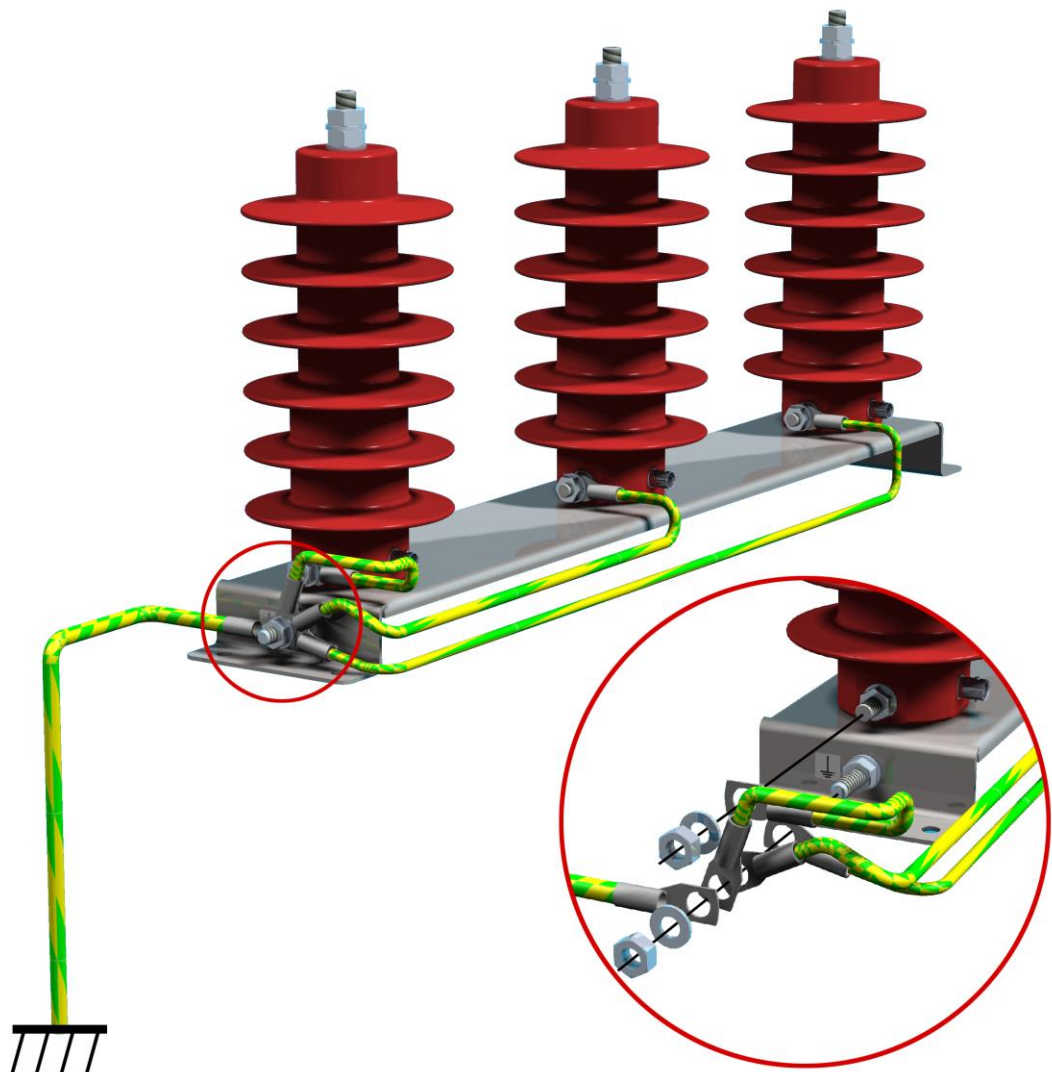


Figure 5 Wiring of grounding

## 2.3.4 Installing the fitting

Install the fitting in the position selected in point 2.3.1 by using the holes drilled.

Once the fitting has been installed on the selected site, carry out the electrical connections, that is, connection to ground, connection to the medium-voltage power line and connection to the monitoring electronic equipment.

## 2.4 ELECTRICAL CONNECTIONS

### 2.4.1 Connection to ground

Check the correct grounding of the cable arranged in the ground screw of the fitting, making sure that the fixing nut is tight. A torque of 10 Nm is recommended.

The ground-screw cable of the fastening must then be connected to the protection earth of the cell.

### 2.4.2 Electrical connection to the medium-voltage power line

The connection cable must be as short as possible. The recommended section is of 16 mm<sup>2</sup>. It must also be flexible in order to maintain the connection shape that complies with the distances indicated in Table 1.

At the top of each sensor, a M10 screw base of approximately 20 mm in depth is available for the installation of a rod.

When using the M10 rod, it is advisable to fix the cable to the rod by means of two nuts and two washers, in the order shown in Figure 6. A torque of 15 Nm is recommended.

The M10 rod can be removed from the unit by means of a number 5 ALLEN spanner.

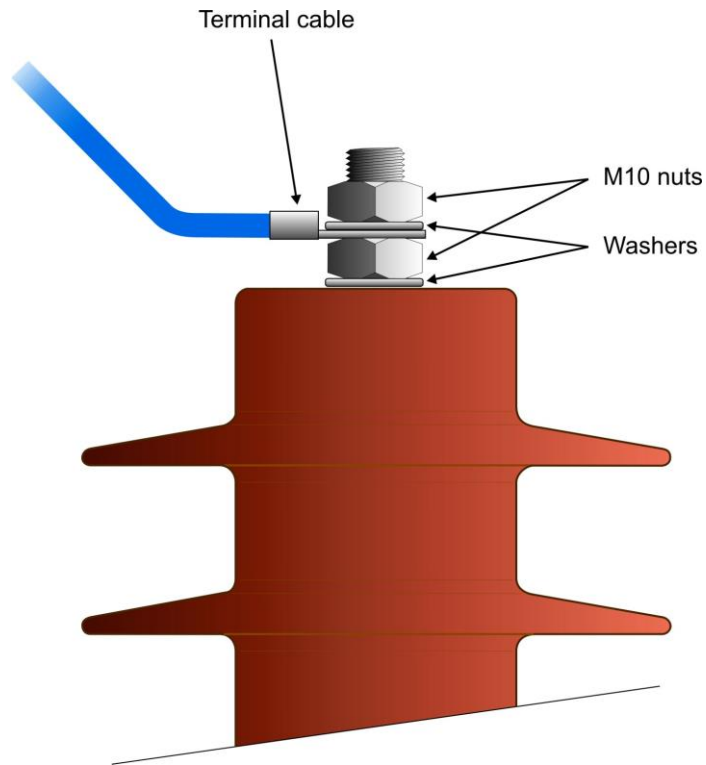


Figure 6 Connection to the medium-voltage power line

### 2.4.3 Connection to the monitoring electronic equipment

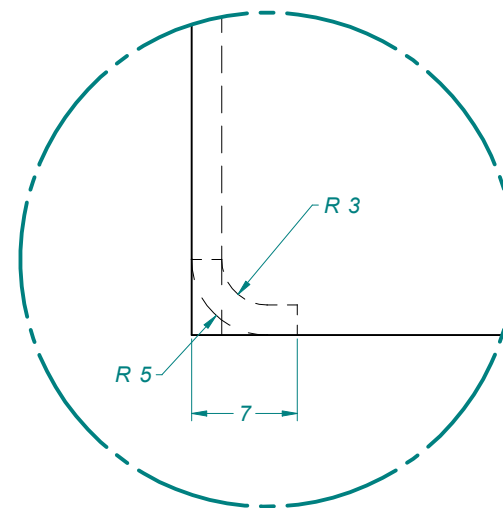
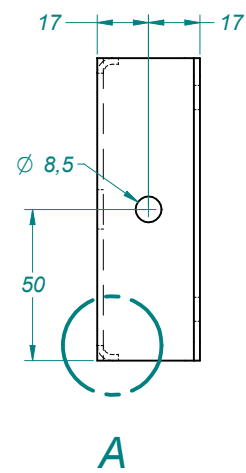
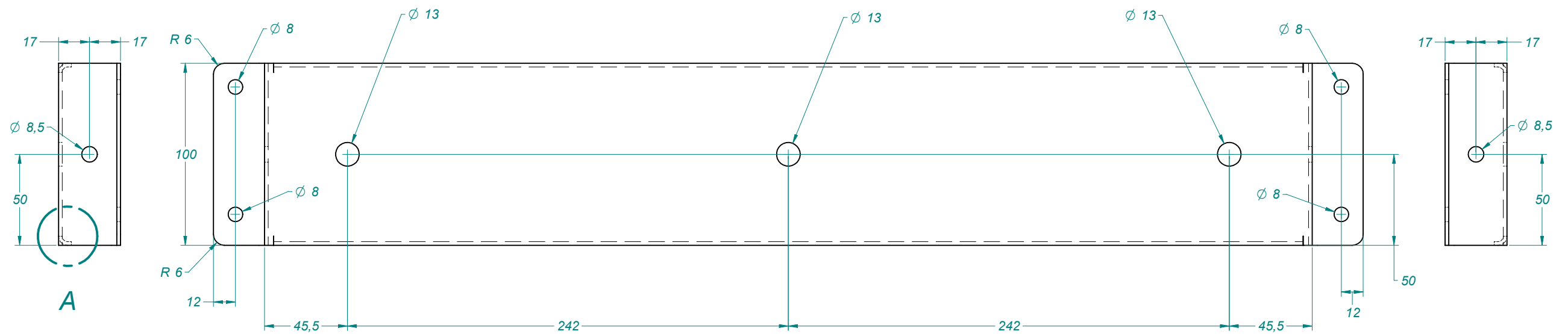
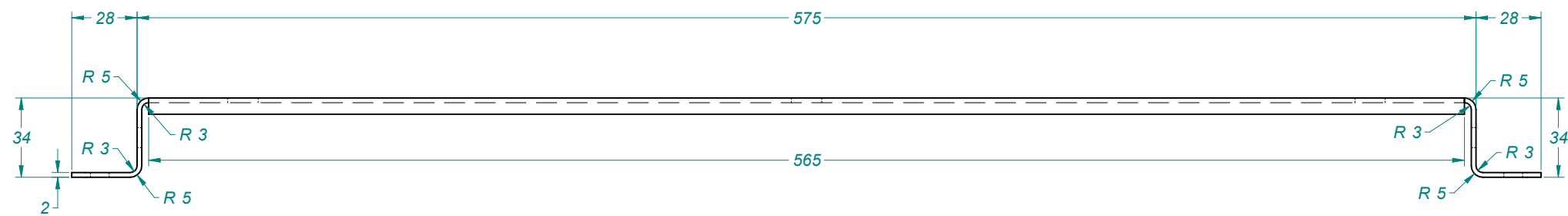
The connection cable between the monitoring electronic equipment and the DRMT-1/10K must be a 50  $\Omega$  impedance characteristic coaxial cable type RG-174U and length of up to 10 m. This cable can be protected, if necessary, against animals by inserting it in a corrugated PVC pipe.

The connection of the cable coming from the monitoring electronic equipment is carried out in the BNC connector.

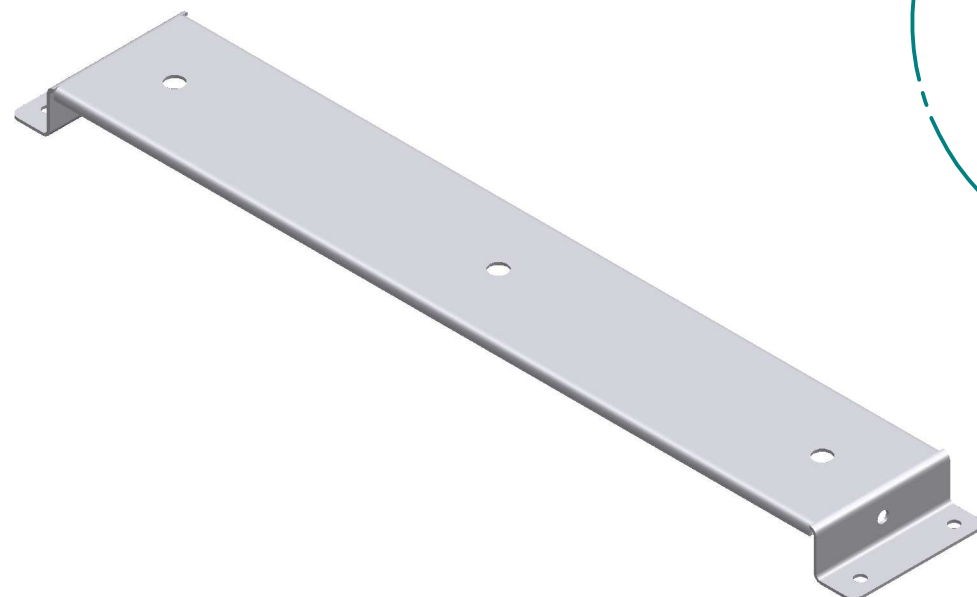
The coaxial cable should first be checked in order to avoid having to carry out a new discharge of the medium-voltage line because the cable is wrong.


Without connecting the coaxial cable to the DRMT-1/10K, an open circuit must be measured at the end of the cable which is communication-terminal side. Second, it must perform a short circuit at one end of the cable and measure it at the other end.

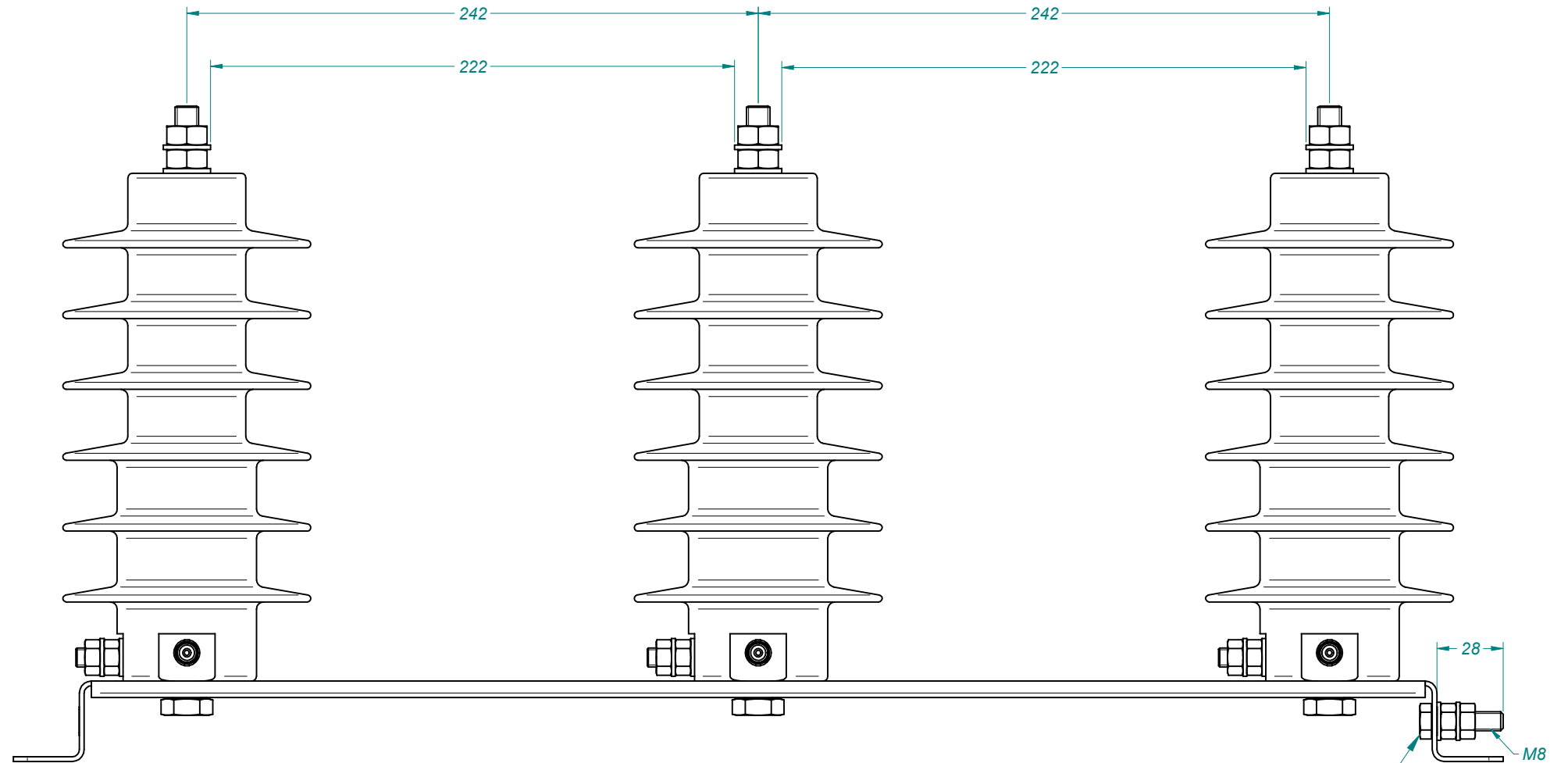
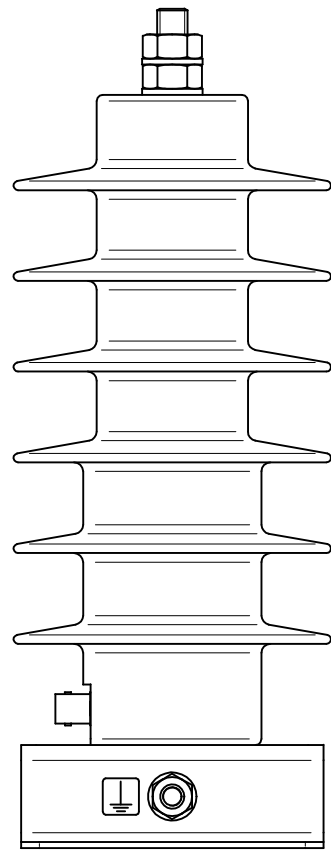
The cable verification is finished when both tests are made. If one of the tests is not complied, the cable is wrong and must be replaced.



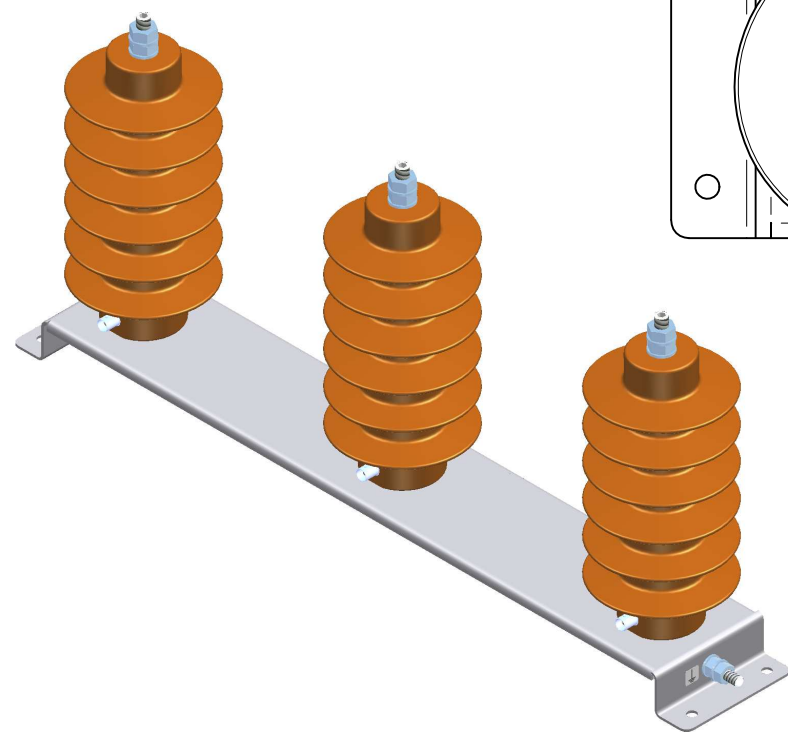
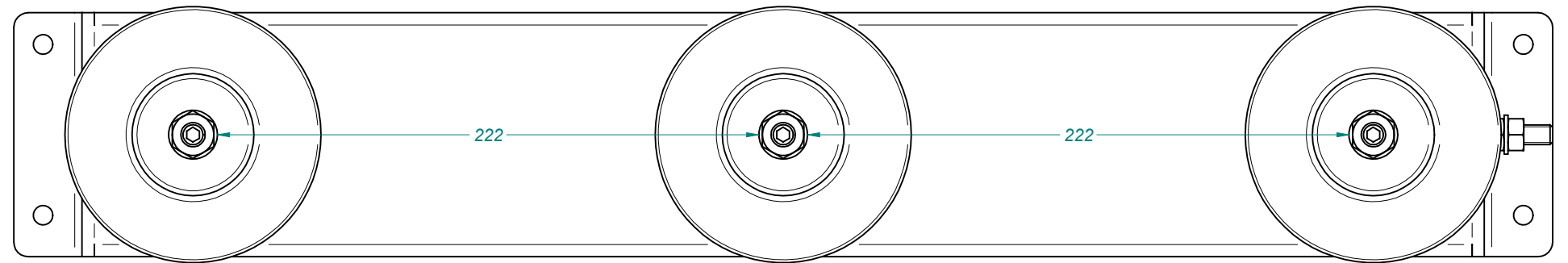
DETALLE A  
2:1



Escala 1:2,5	Tolerancia ±0,5 mm	Material Plancha de acero inox. de 2 mm	Acabado -
Pertenece a: DRMT			Cód. Prod. BASE_3DRMT
Rev. 0	Fecha 06/06/2014	Realizado juanfrancisco.gil	Vº Bº <i>[Signature]</i>
REVISADO Por salvador.pons fecha 9:34, 13/06/2014	Aprobado J.A.Moreno	Vº Bº <i>[Signature]</i>	Archivo BASE_3DRMT ...dft
			Siglas DRMT
Soporte para 3 DRMTs			Hoja 1/2



El tornillo de tierra puede colocarse, indistintamente, en uno u otro extremo del soporte.



Escala 1:2,5	Tolerancia ±0,5 mm	Material Plancha de acero inox. de 2 mm	Acabado -
Pertenece a: DRMT			Cód. Prod. BASE_3DRMT
Fecha 06/06/2014	Realizado juanfrancisco.gil	Vº Bº <i>[Signature]</i>	Rev. 0
		REVISADO Por salvador.pons fecha 9:36, 13/06/2014	Aprobado J.A.Moreno
			<b>Soporte para 3 DRMTs</b>
			Siglas DRMT
			Hoja 2/2