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Data Sheet 5.21/5

Controlled Resistive Lightning Impulse Reference Voltage Divider, Type SMR ... ref

Application

The controlled resistive lightning impulse reference voltage divider is designed for the precise measurement of full or front-chopped lightning impulse voltages (LI). It is the basic component of the lightning impulse voltage reference measuring system for calibration purposes according to IEC 60060-2:2010.

Design

The controlled resistive lightning impulse reference voltage divider consists of a high-voltage resistor R_1 of extra low inductance, which is housed in an oil-filled insulating tube, and of the low-voltage resistor R_2 .

The mechanical design, and especially the dimensioning of the electrodes, provides an almost linear voltage distribution along the high-voltage resistor as well as a very good screening from interference fields.

The optimally rated damping resistor R_d , which is arranged at the beginning of the connecting lead, minimizes oscillations in the high-voltage measuring circuit. Optimized measuring cables in conjunction with the terminating resistor R_z transfer the measuring signals to the measuring instrument. Type of socket is N-type.

The divider is suitable for indoor installation. It is mobile and therefore equipped with rollers.

Instruments

Beside the controlled resistive lightning impulse voltage reference divider the instrument for the reference measuring system – the transient recorder type HiRES with up to 250 MS/s and 14 bit resolution - may be delivered, too.

Option

For the application of the divider and the instrument for on-site calibrations special transportation boxes can be delivered on request.

Table 1: Operating conditions

Temperature range		
Reference working condition	°C	15 ... 30
Operating working condition	°C	5 ... 40
Relative humidity		
Reference working condition	%	≤ 80 (no condensation)
Operating working condition	%	≤ 80 (no condensation)
Height above sea level	m	≤ 1000
Installation		Indoor to keep the temperature range

Table 2: Measuring uncertainty

Measuring uncertainty of voltage: Measurement for a probability level of 95 %: (under reference working conditions)	%	≤ 0.7 lightning impulse voltage full waves and waves chopped after the peak (\hat{U} and scale factor)
Measuring uncertainty of time parameter: Measurement for a probability level of 95 %: (under reference working conditions and under condition of the measurement of the divider output voltage with a transient recorder, e. g. HiRES)	%	≤ 5 lightning impulse voltage

Table 3: Reference atmospheric conditions

Temperature	°C	20
Absolute pressure	hPa	1013
Absolute humidity	g/m ³	11

Table 4: Technical parameters

Type	High-voltage resistance R_1	Damping resistance R_d	Termination resistance R_z	Nominal LI voltage (peak)	Divider ratio
	k Ω	Ω	Ω	kV	
SMR 10/200 ref	10	-	75	200	268
SMR 7.7/500 ref	7.7	250	50	500	700
SMR 10/700 ref	10	250	50	700	1000
SMR 10/1200 ref	10	250	50	1200	1500

The parameters of the step response are inside the following limits:

Table 5: Dynamic behaviour

Type	Experimental response time T_N	First partial response time T_G	Settling time t_s	Overshoot β
	ns	ns	ns	%
SMR 10/200 ref	30	30	200	10
SMR 7.7/500 ref	10	20	150	30
SMR 10/700 ref	10	20	150	30
SMR 10/1200 ref	10	20	150	30

Table 6: Metrological characteristics

Type	Voltage-dependent non-linearity	Short-term instability	Long-term instability over 1 year	Temperature coefficient of scale factor
	%	%	%	%/K
SMR 10/200 ref	≤ 0.2	≤ 0.1	≤ 0.1	≤ 0.01
SMR 7.7/500 ref	≤ 0.2	≤ 0.1	≤ 0.1	≤ 0.01
SMR 10/700 ref	≤ 0.3	≤ 0.1	≤ 0.1	≤ 0.01
SMR 10/1200 ref	≤ 0.4	≤ 0.1	≤ 0.1	≤ 0.01

Accessories (included in the scope of delivery):

- damping resistor (arranged at the beginning of the lead)
- measuring cable (wave resistance 50 Ohm or 75 Ohm, length 25 m, double screened)
- terminating resistor 50 Ohm or 75 Ohm
- documentation (Record of Performance according to IEC 60060-2:2010)

Table 7: Dimensions and weight (approx.)

Type	Height (H)	Footprint (A x A)	Weight
	mm	mm	kg
SMR 10/200 ref	1190	440 x 440	15
SMR 7.7/500 ref	1770	760 x 760	35
SMR 10/700 ref	2460	1000 x 1000	55
SMR 10/1200 ref	3960	1500 x 1500	75

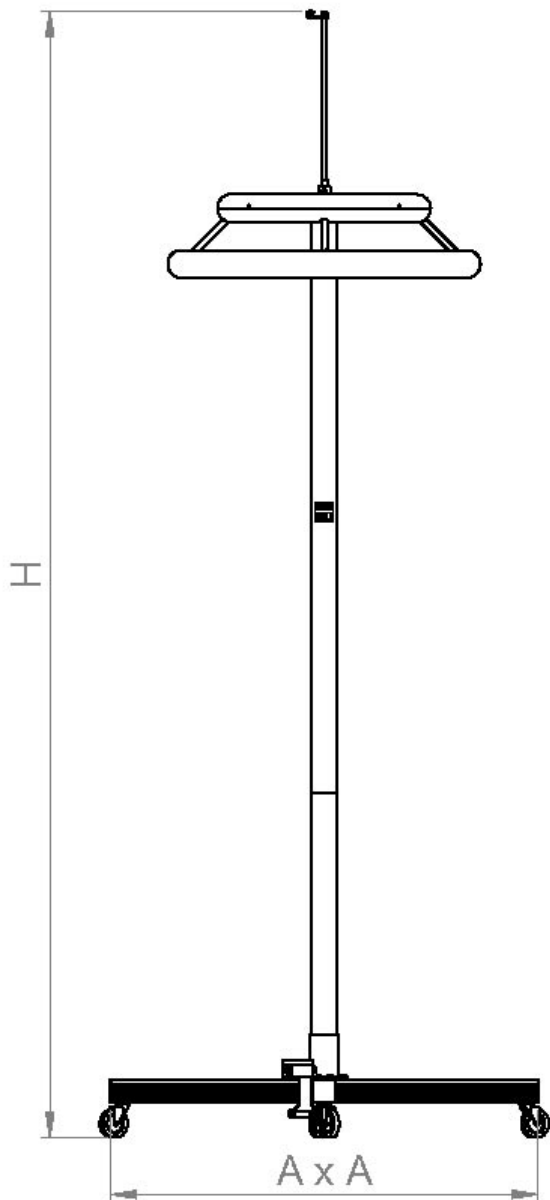


Figure 1: Dimensional drawing



Figure 2: SMR 10/700 ref

Calibration

The controlled resistive lightning impulse reference voltage divider is calibrated by the HIGHVOLT calibration laboratory D-K-19153-01-00. The calibration is documented by a DAkkS-calibration certificate. This calibration certificate documents the traceability to national standards, which realize the units of measurements according to the International System of Units (SI).

Germany's Accreditation Body DAkkS is signatory to the multilateral agreements of the European co-operation for Accreditation (EA) and of the International Laboratory Accreditation Cooperation (ILAC) for the mutual recognition of calibration certificates.

If the application task demands a calibration at a National Institute for Metrology, on request, the controlled resistive lightning impulse reference voltage dividers would be calibrated at the Physikalisch-Technische Bundesanstalt (PTB).

It is recommended to calibrate the controlled resistive lightning impulse reference voltage dividers together with the instruments which will be used together with the divider.



Figure 3: Accreditation (first page)

Type designation

SMR x/y ref

x = high-voltage resistance in k Ω

y = nominal LI voltage (peak) in kV

ref = reference divider