



USER MANUAL

HIGH-CURRENT DECADE RESISTOR

SRM-0R1-4k1



USER MANUAL

HIGH-CURRENT DECADE RESISTOR SRM-0R1-4k1




SONEL S.A.
Wokulskiego 11
58-100 Świdnica

CONTENTS

1	Introduction	3
2	Intended use	4
3	Technical specifications	4
4	Structure and principle of operation	5
5	Marking and sealing	7
6	General guidelines for using the device	7
7	Safety measures	7
8	Operating the device	7
8.1	Procedures for adjusting the resistance of the device	8
8.1.1	Adjusting the first decade	8
8.1.2	Adjusting the second decade	8
8.1.3	Adjusting the third decade	9
8.1.4	Adjusting the fourth decade	9
8.1.5	Adjusting the fifth decade	10
8.1.6	Simulation of fault loop impedance	10
9	Calibration of the device	11
10	Operation and maintenance	11
11	Transport	12
11.1	Packaging	12
11.2	Transport conditions	12
12	Manufacturer	12



NOTE!

- Due to ongoing improvement works on the product, enhancing its technical and operational parameters, the design of the device may be subject to minor changes not specified in this publication.
- Before operating the device, store it in normal climatic conditions for at least 12 hours.
- Before operating the device, it must be earthed using the connector on its front panel.  Then, connect the power cord to the appropriate connector on the back of the device. Operating the device without earthing is prohibited.
- After connecting SRM-0R1-4k1 to the mains, set the device in a manner that does not prevent its disconnection.

1 Introduction

This manual contains information about the design and operation of SRM-0R1-4k1 high-current decade resistor, including its operating limits and operational safety measures. The manual is intended for persons working with the set, as well as for the operating/maintenance personnel.

Symbols shown on the instrument:



Read the manual before using the instrument. Strictly comply with the safety rules and manufacturer's recommendations.



Alternating current



Operational earthing terminal



Warning, dangerous voltage

2 Intended use

SRM-0R1-4k1 is a high-current decade resistor designed for simulation and inducing fault loop resistance using mains voltage of 220/380 V (230/400 V), 50 Hz AC.

SRM-0R1-4k1 high-current decade resistor is used as a reference device for calibration and certification tests of measuring instruments included in MZC, MIE, MRP, MPI series and others according to the parameters of "phase-neutral", "phase-to-earth" "phase-PE" "phase-phase" fault loop, applying a short-term (30-40 ms) test current of 45 A.

SRM-0R1-4k1 high-current decade resistor (hereinafter: the device) provides a gradual resistance adjustment in the range from 0.1 Ω to 4111 Ω, within the allowable basic error ± 0.1% in the first decade and up to ± 0.05% in other decades.

The device has a high allowable dissipation power, making it useful for measuring circuits.

Resistors of the device meet all requirements for decade resistors to be used in calibration laboratories and for testing measuring instruments and may be used in other AC/DC measuring systems.

3 Technical specifications

Decade No. of the device	Nominal resistance values [Ω]	Maximum permissible measurement error	Maximum surge current (30 - 40 ms) [A]
1st decade	0.1 / 0.2 / 0.3 / 0.4 / 0.5 / 0.6 / 0.7 / 0.8 / 0.9 / 1.0	± 0.001·R	45
2nd decade	1 / 2 / 3 / 4 / 5 / 6 / 7 / 8 / 9 / 10	± 0.0005·R	35
3rd decade	10 / 20 / 30 / 40 / 50 / 60 / 70 / 80 / 90 / 100	± 0.0005·R	15
4th decade	100 / 200 / 300 / 400 / 500 / 600 / 700 / 800 / 900 / 1000	± 0.0005·R	2
5th decade	1000 / 2000 / 3000	± 0.0005·R	0.3

Initial resistance of the device (the resistance during setting the switches of all the decades to 'zero' indication) does not exceed 0.025 Ω.

The device is designed to operate in the ambient temperature range from 10°C to 30°C, relative humidity from 25% to 60% and atmospheric pressure from 630 to 800 mm Hg. Storage conditions of the device are described in section 11 of this manual.

Additional technical parameters

Permissible limit of the additional measurement error caused by changes in ambient temperature (compared to the normal operating temperature range) is equal to the accuracy precision class.

- a) nominal temperature (20 ± 5)°C
- b) operating temperature range (20 ± 10)°C
- c) maximum operating voltage 450 V
- d) measurement cycle duration T_{meas} ≤30-40 ms
- e) cooling time (pause) T_{paus} at U_{meas}. up to 230 V ≥ 20 s
 at U_{meas}. up to 450 V ≥ 25 s
- f) insulation resistance >100 MΩ
- g) dimensions 500 x 340 x 170 mm
- h) weight approx. 12 kg

4 Structure and principle of operation

The front panel of the device with functional switches is shown in Fig. 1; the connection diagram of decades in the device is shown in Fig. 2; the connection diagram of the device when simulating fault loop impedance is shown in Fig. 3.

SRM-0R1-4k1 consists of five decades connected in series. The first position is for the decade with lowest resistance values ($\Omega \times 0.1$), and the last for the decade with highest resistance values ($\times 1000 \Omega$). Setting the resistance starts from the lowest decade and ends at the highest decade, always remembering that all the decades set below must have the maximum value.



Fig. 1. Front panel of SRM-0R1-4k1

- 1 - connector for external voltage phase (H)
- 2 - connector for protective conductor (PE)
- 3 - connector for connecting tested measuring device (L)
- 4 - rotary switch (multiplier) of the first decade
- 5 - rotary switch (multiplier) of the second decade
- 6 - rotary switch (multiplier) of the third decade
- 7 - rotary switch (multiplier) of the fourth decade
- 8 - rotary switch (multiplier) of the fifth decade



Fig. 1. Side panel of SRM-0R1-4k1

- 1 - fans
- 2 - switch of cooling system
- 3 - fuse (F 0.5 A)
- 3 – connector for the power cord

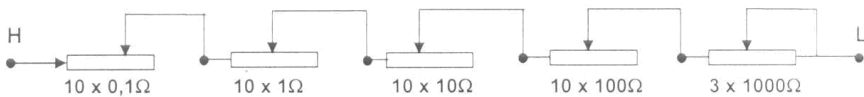


Fig. 2. Connection diagram of decades in the device

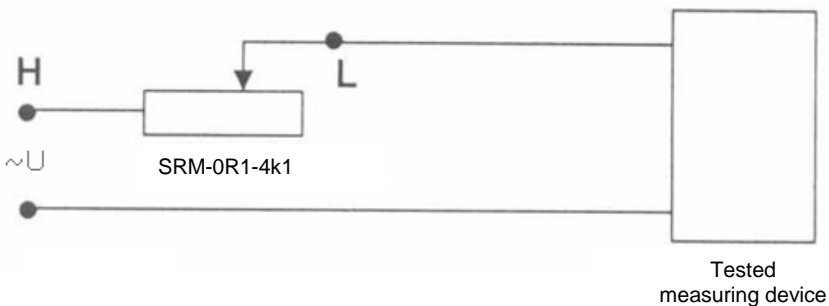


Fig. 3. Measuring system for testing fault loop meters

5 Marking and sealing

Name, symbol and trade mark of the device are placed at the top of its front panel.

Serial number and year of manufacture of the device are shown on the rear panel.

The set received by the quality control department is sealed with self-adhesive seals (self-destructing when device is opened), located on the latches of the top panel.

6 General guidelines for using the device

Maintenance activities on the device are carried out in order to ensure its interrupted operation and readiness for use.

During the maintenance activities on the device, check the following:

- intact seals;
- completeness of the device;
- external mechanical damage;
- cleanliness of connectors and sockets;
- condition of coatings, electroplating and precision of engraving;
- condition of connecting cables and cable glands.

During operation, the measuring device must not be placed on its front or rear panel, as this may damage its controls and power cord connection.

7 Safety measures

The instrument may be operated only by persons with appropriate training in safe work with electrical equipment.

Before connecting the device to the mains, make sure the power cord is intact.

Before commencing measurements, make sure the test leads are connected to the appropriate measurement sockets;

Repairs must be performed only by an authorised service point.



NOTE!

It is forbidden to use the device without activating the cooling system and/or with impaired air exhaust.

8 Operating the device

Task (example): the resistance value must be at the level of $2\ \Omega$. To achieve this, set the decade marked as 10×0.1 into position "10" ($1\ \Omega$), and the decade marked as $10 \times 1\ \Omega$ set into position "1" ($1\ \Omega$); then the required value of $2\ \Omega$ is achieved. Using the above method of adjustment, the circuit will be connected to 11 resistors and each of them will generate a proportional part of the power consumed in the circuit.

It is not allowed to set the second decade in position "2" ($2\ \Omega$), when decade $10 \times 0.1\ \Omega$ is set in position "0" as the power provided to resistor $2\ \Omega$, in the second decade will exceed by 100% the permissible dissipation power.

The algorithm of correct resistance setting for decades is presented in section 8.1.



NOTE!

Failure to follow the above set-up procedure may lead to excessive overheating of the device and its damage.

8.1 Procedures for adjusting the resistance of the device

8.1.1 Adjusting the first decade

In the first decade (marked as $10 \times 0.1 \Omega$) any resistance value can be set in the range of $0.1 \Omega \dots 1.0 \Omega$ (a higher decade must be set to "0") - Fig. 4.

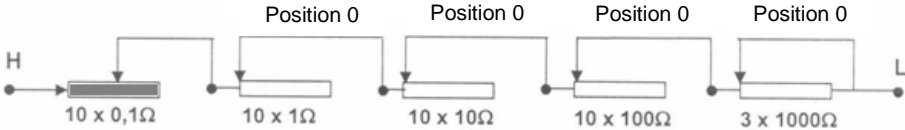


Fig. 4. Connection diagram for adjusting the resistance of the first decade

8.1.2 Adjusting the second decade

In order to start the adjustment of resistance in the second decade, the first decade must remain in position "10" (i.e. a value of 1Ω) - Fig. 5.

In the second decade (marked as $10 \times 1 \Omega$) the user may set any resistance value in the range from 1Ω to 11Ω (higher decades must be set at "0"), thus the total resistance value obtained is in the range of: $R_{min} < R < R_{max}$.

$$R_{min} = 1 \Omega + 1 \Omega = 2 \Omega$$

$$R_{max} = 1 \Omega + 10 \Omega = 11 \Omega$$



Any other settings are not recommended, e.g. 3.2Ω ; 5.7Ω etc.

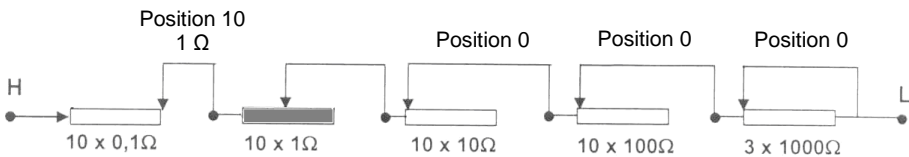


Fig. 5. Connection diagram for adjusting the resistance of the second decade

8.1.3 Adjusting the third decade

In order to start the adjustment of resistance in the third decade, the first decade must remain in position "10" (i.e. the value of 1 Ω) and the second decade must be set at "9" (i.e. the value of 9 Ω) – Fig. 6.

In the third decade (marked as 10 x 10 Ω) the user may set any resistance value in the range from 10 Ω to 110 Ω (higher decades must be set at "0"), thus the total resistance value obtained is in the range:

$$\text{from } R_{\min} = 1 \Omega + 10 \Omega + 10 \Omega = 21 \Omega$$

$$\text{to } R_{\max} = 1 \Omega + 10 \Omega + 100 \Omega = 111 \Omega$$

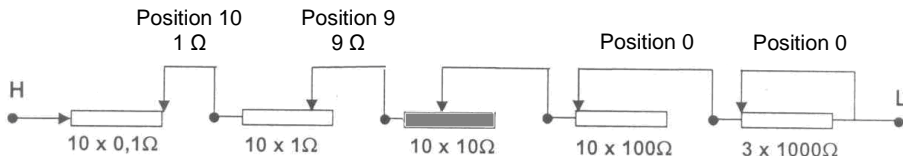


Fig. 6. Connection diagram for adjusting the resistance of the third decade



Any settings other than those specified above are not recommended.

8.1.4 Adjusting the fourth decade

In order to start the adjustment of resistance in the fourth decade, the first decade must remain in position "10" (i.e. the value of 1 Ω), the second decade must be set at "9" (i.e. the value of 9 Ω) and the third decade must be set at "9" (i.e. the value of 90 Ω) – Fig. 7.

In the fourth decade (marked as 10 x 100 Ω) the user may set any resistance value in the range from 100 Ω to 1100 Ω (higher decades must be set at "0"), thus the total resistance value obtained is in the range:

$$\text{from } R_{\min} = 1 \Omega + 10 \Omega + 100 \Omega + 100 \Omega = 211 \Omega$$

$$\text{to } R_{\max} = 1 \Omega + 10 \Omega + 100 \Omega + 1000 \Omega = 1111 \Omega$$

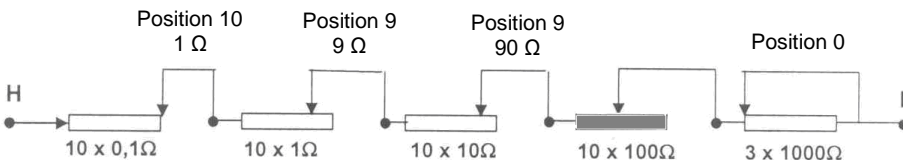


Fig. 7. Connection diagram for adjusting the resistance of the fourth decade



Any other settings are not recommended.

8.1.5 Adjusting the fifth decade

In order to start the adjustment of resistance in the fifth decade, the first decade must remain in position "10" (i.e. the value of $1\ \Omega$), the second decade must be set at "9" (i.e. the value of $9\ \Omega$), the third decade must be set at "9" (i.e. the value of $90\ \Omega$) and the fourth decade must be set at "9" (i.e. the value of $900\ \Omega$) – Fig. 8.

In the fifth decade (marked as $3 \times 1000\ \Omega$) the user may set any resistance value in the range from $1000\ \Omega$ to $4000\ \Omega$, thus the total resistance value obtained is in the range:

$$\text{from } R_{\min} = 1\ \Omega + 10\ \Omega + 100\ \Omega + 1000\ \Omega + 1000\ \Omega = 2111\ \Omega$$

$$\text{to } R_{\max} = 1\ \Omega + 10\ \Omega + 100\ \Omega + 1000\ \Omega + 3000\ \Omega = 4111\ \Omega$$

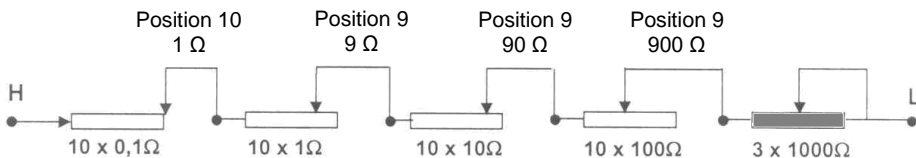


Fig. 8. Connection diagram for adjusting the resistance of the fifth decade

Fault loop measurement devices may be checked starting from the highest resistance value. For this purpose, set the decades of the device as shown in Fig. 8. Then, the adjustment starts from the fifth decade, and then the values of the fourth, third, second and first decade are successively reduced.

The described method of setting the device ensures that all used resistors are included in the series, significantly reducing the power dissipated on them.

8.1.6 Simulation of fault loop impedance

When it is necessary to simulate the fault loop impedance in series using the device, activate an external calibration coil. Connection diagram of the measuring circuit is shown in Fig. 9.

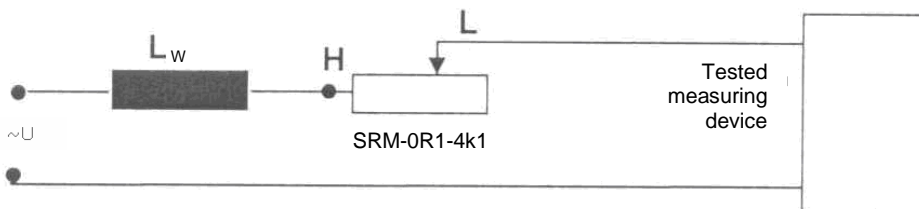


Fig. 9. Simulation of fault loop impedance

9 Calibration of the device

It is advised to check the device every 12 months.

10 Operation and maintenance

The operator carrying out the measurements using SRM-0R1-4k1, may perform the following maintenance activities:

- fuse replacement – type F 0.5 A;
- cleaning the device.



NOTE!

Before replacing the fuse, it is mandatory to disconnect the device from the power supply.

The housing of SRM-0R1-4k1 may be cleaned with a soft, dry cloth. Do not use solvents or abrasive cleaners (powders, pastes, etc.). The electronic circuit of SRM-0R1-4k1 does not require cleaning, except for the sockets of test leads.

Any other maintenance works are performed only by authorized service of the manufacturer.

The cooling system of the device is powered from mains - AC 230 V, 50 Hz.

SRM-0R1-4k1 packed in the shipping box may be transported by any means of transport to any distance.

SRM-0R1-4k1 packaged in the shipping box, should be stored before operation at the ambient temperature of 5°C ... 40°C and relative humidity of 80% at 25 °C

When storing SRM-0R1-4k1 without packaging, the ambient temperature must be in the range of 10°C - 35°C and relative humidity up to 80% at +35°C.

Storage rooms/areas must be free from dust, fumes acids, and corrosive alkalis.

Standard environmental conditions

- up to 2000 m above sea level;
- operating temperature 10°C...35°C
- storage temperature -20°C...+60°C
- at the maximum relative humidity of 80% for temperatures up to 31°C and a linear decrease in relative humidity to 50% at a temperature increase to 40°C

Shelf life in the manufacturer's original packaging: 5 years.

11 Transport

11.1 Packaging

To ensure safety of the device during transport, a protective cardboard box is used.

Pack the device in the following order:

- put the device placed in a plastic bag, which must be tied and inserted in the box,
- insert documentation in a separate plastic bag and place it on the packaged device or between the side wall of the box and the device,
- wrap the box with a plastic tape and seal it.

11.2 Transport conditions

The device packed in the transport box may be shipped using all kinds of transport and to any distance.

During the transport, the packaging must be protected against rain and dust. Do not tilt the device.

12 Manufacturer

The manufacturer of the device and provider of guarantee and post-guarantee service:

SONEL S.A.

Wokulskiego 11

58-100 Świdnica

Poland

tel. +48 74 858 38 60

fax +48 74 858 38 09

E-mail: export@sonel.pl

Web page: www.sonel.pl



NOTE!

Service repairs must be performed only by the manufacturer.

Made in Russia.



SONEL S.A.
Wokulskiego 11
58-100 Świdnica
Poland



+48 74 858 38 60
+48 74 858 38 00
fax +48 74 858 38 09

e-mail: export@sonel.pl
www.sonel.pl