



-power in control



INSTALLATION/OPERATION INSTRUCTIONS



Selectable Insulation Monitor, SIM-Q MKII

- 3 functions: Normal, Fast and Test
- Easy adjustment and verification
- 2000 μ F leakage capacitance
- Working voltage up to 690 V AC and up to 1000 V DC
- IEC 61557-8
- Class approval



DEIF A/S · Frisenborgvej 33 · DK-7800 Skive
Tel.: +45 9614 9614 · Fax: +45 9614 9615
info@deif.com · www.deif.com

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1 General information

1.1 Warnings, legal information and safety

1.1.1 Warnings and notes

Throughout this document, a number of warnings and notes with helpful user information will be presented. To ensure that these are noticed, they will be highlighted as follows in order to separate them from the general text.

Warnings



Warnings indicate a potentially dangerous situation, which could result in death, personal injury or damaged equipment, if certain guidelines are not followed.

Notes



Notes provide general information, which will be helpful for the reader to bear in mind.

1.1.2 Legal information and disclaimer

DEIF takes no responsibility for installation or operation of the product. If there is any doubt about how to install or operate the product, please contact DEIF.



The unit is not to be opened by unauthorised personnel. If opened anyway, the warranty will be lost.

Disclaimer

DEIF A/S reserves the right to change any of the contents of this document without prior notice.

The English version of this document always contains the most recent and up-to-date information about the product. DEIF does not take responsibility for the accuracy of translations, and translations might not be updated at the same time as the English document. If there is a discrepancy, the English version prevails.

1.1.3 Safety issues

Installing and operating the unit may imply work with dangerous currents and voltages. Therefore, the installation should only be carried out by authorised personnel who understand the risks involved in working with live electrical equipment.



Be aware of the hazardous live currents and voltages. Do not touch any AC measurement inputs as this could lead to injury or death.

1.1.4 Electrostatic discharge awareness

Sufficient care must be taken to protect the terminal against static discharges during the installation. Once the unit is installed and connected, these precautions are no longer necessary.

1.1.5 Factory settings

The product is delivered from factory with certain factory settings. These are based on average values and are not necessarily the correct settings for the product. Precautions must be taken to check the settings before running the product.

1.2 About the installation instructions

1.2.1 General purpose

The general purpose of this document is to give the user important information to be used in the installation of the unit.



Make sure to read this document before starting to work with the unit. Failure to do this could result in human injury or damage to the equipment.

1.2.2 Intended users

These Installation Instructions are mainly intended for the operator and the person responsible for the design and installation. In most cases, this would be a panel builder designer. Naturally, other users might also find useful information in the document.

1.2.3 Contents and overall structure

This document is divided into chapters, and to make the structure simple and easy to use, each chapter will begin from the top of a new page.

2 Description

2.1 General description of SIM-Q MKII

The SIM-Q MKII is intended for insulation monitoring on a single-phase AC/DC or a 3-phase AC IT power system with or without neutral. The special characteristic of an IT power system is the fact that no live conductor is connected directly to earth. The SIM-Q MKII is connected to the power system by connecting the terminal marked **P** to one of the phases (or the neutral). The FE input is then connected to the safety cable. To be able to monitor any kind of insulation failure, all accessible conductive building structures must be connected to the cable marked **FE** (functional earth).

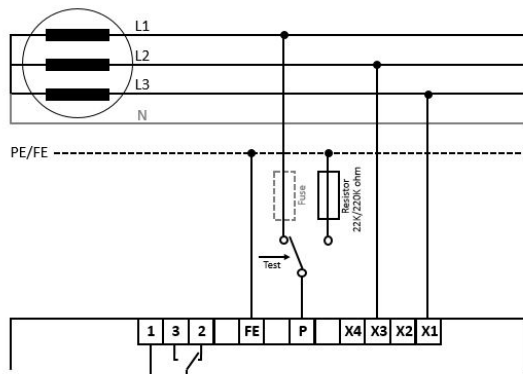
3 Installation

3.1 Connection

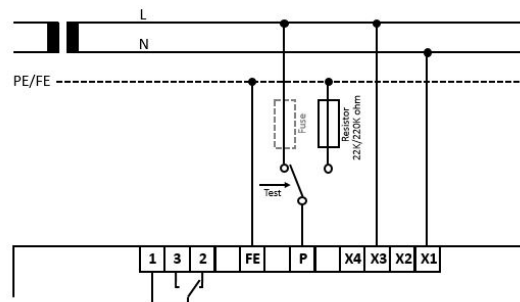
If a test function is wanted, an arrangement based on a resistor and a push-button can be mounted as illustrated in the drawings below. The value of the resistor can be any value from 0 Ω to the max. allowed insulation value. The SIM-Q MKII can be supplied from the IT system under supervision, but it can also be supplied from another source, for example a 24 V DC source; see the label for supply information.

The following functions can be selected by means of the switch that is available at the front of the SIM-Q MKII: Monitoring, fault finding and test.

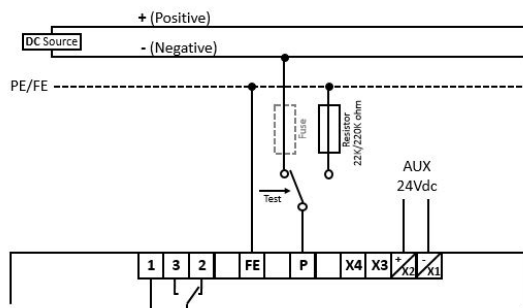
3-phase, AC



1-phase, AC



1-phase, DC



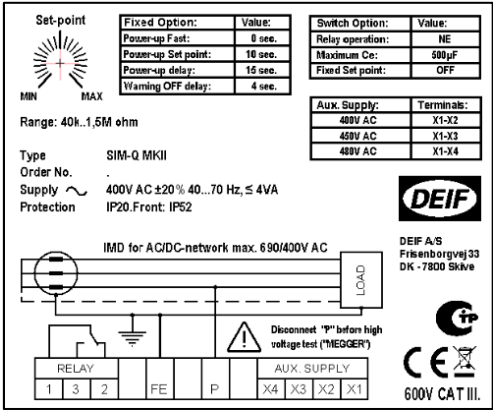
Recommended fuse size: max 2 A.

With the switch in monitoring mode, the SIM-Q MKII will run a fast measuring mode the first 15 seconds after a power-up. This mode can be used to perform a switchboard. When a known resistor is connected for testing, the auxiliary supply is disconnected and reconnected at the same time (not shown in the illustration). The response time for measuring the known resistor will be approximately 6 seconds. The two red LEDs will be illuminated, but the relay contact will not be activated. After 15 seconds, the SIM-Q MKII automatically changes to normal monitoring mode.

As an alternative, the test can be carried out in fault finding mode. The response time will be 1 second, and if the set point is exceeded the relay output will be activated. If the switch is moved to the "Test" position, an internal function test of the SIM-Q MKII is carried out. The reading on the scale during the test is 0 Ω , and the relay output is activated.

3.1.1 Connection of AC auxiliary supply

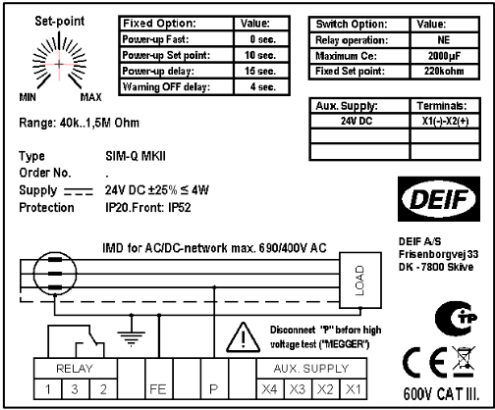
Type: 100/110/127 V AC	Type: 220/230/240 V AC	Type: 400/450/480 V AC
X ₁ , X ₂ : 100 V AC ±20 %	X ₁ , X ₂ : 220 V AC ±20 %	X ₁ , X ₂ : 400 V AC ±20 %
X ₁ , X ₃ : 110 V AC ±20 %	X ₁ , X ₃ : 230 V AC ±20 %	X ₁ , X ₃ : 450 V AC ±20 %
X ₁ , X ₄ : 127 V AC ±20 %	X ₁ , X ₄ : 240 V AC ±20 %	X ₁ , X ₄ : 480 V AC ±20 %



Label for AC version

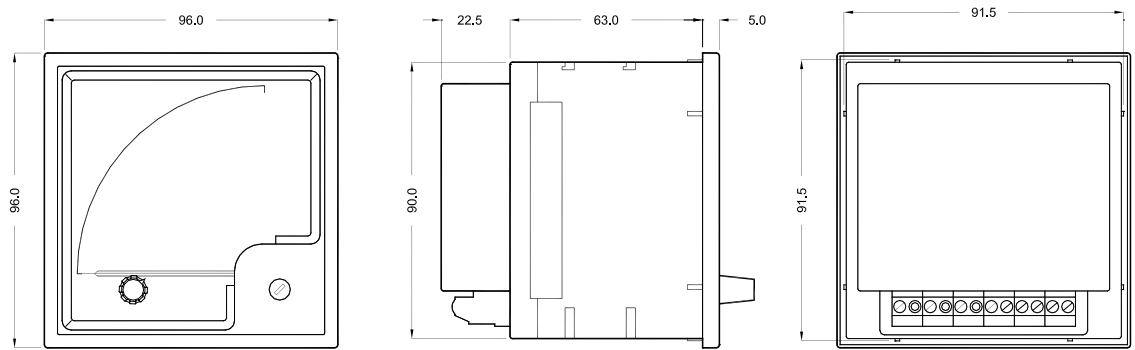
3.1.2 Connection of DC auxiliary supply

Type: 24 V DC	
X1:	- 0 V DC Zero
X2:	+ 24 V DC -15 %/+25 %



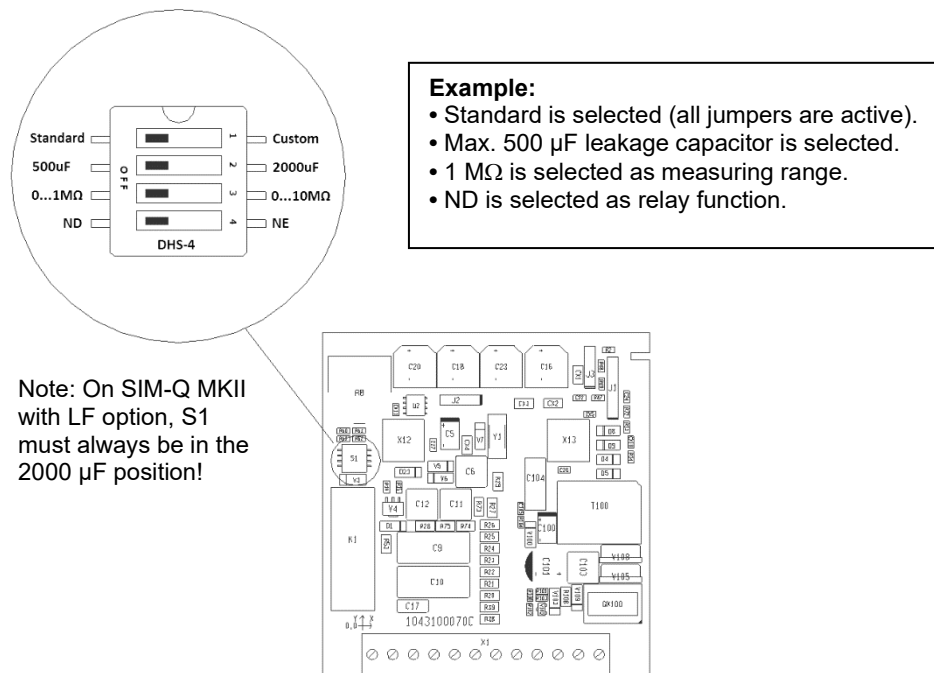
Label for DC version

3.2 Dimensions



3.3 Changing the default settings

The SIM-Q MKII can be reconfigured by means of four jumpers. (The original configuration is marked on the label). The jumpers are placed on the PCB behind the rear cover, under the set point potentiometer. See the drawing below for clarification.



DIP#1 = STANDARD/CUSTOM
DIP#2 = 500 μF /2000 μF
DIP#3 = 0 to 1 $\text{M}\Omega$ /0 to 10 $\text{M}\Omega$
DIP#4 = ND/NE

DIP#1 can be set to OFF (STANDARD), and the SIM-Q MKII will load its settings from a hard-coded memory area. If it is set to ON (CUSTOM), the SIM-Q MKII will load its settings from a configurable memory area that is used for custom settings and is set up by DEIF upon ordering.

DIP#2 can be set to either OFF (500 μF) or ON (2000 μF). The chosen setting will determine the maximum leakage capacitance. Note that this will also change the measuring time. See the chapter "Calculation of capacity within an application" for determination of the needed max. capacity setting.

DIP#3 can be configured to OFF (measuring range 0 to 1 $\text{M}\Omega$) with 22 $\text{k}\Omega$ on the scale centre, or it can be set to ON (measuring range 0 to 10 $\text{M}\Omega$) with 220 $\text{k}\Omega$ on the scale centre. Notice that a change in measuring range also involves a change of scale.

DIP#4 settings will determine the SIM-Q MKII relay output. If it is set to OFF (ND), the output is configured as a normally de-energised contact. If it is set to ON (NE), the output is configured as a normally energised contact.

Use electrostatic discharge protection!
 Sufficient care must be taken to protect the PCB against static discharges during the configuration. Once the unit is installed and connected, these precautions are no longer necessary.

3.4 Configuration of the measuring range

The SIM-Q MKII can be configured for measuring range 1 M Ω to 0 M Ω (1000 to 0 k Ω) with 22 k Ω on the scale centre, or for 10 M Ω to 0 M Ω with 220 k Ω on the scale centre. The figure above shows the position of the switch for selection of either 1 M Ω or 10 M Ω measuring range. Notice that a change of measuring range also involves a change of scale. Change of scale can be done by following the instructions below.

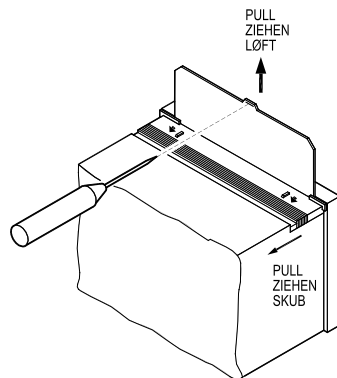


Figure 2

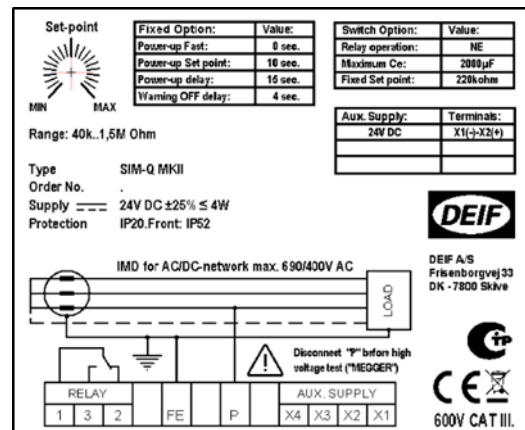
- Disconnect signal/supply to the terminals before you exchange the scale.
- Push the scale cover towards the rear edge.
- Remove the scale by means of a screwdriver or the like.
- Insert the new scale and press gently till it snaps into place.
- Push the scale cover back again; after this the unit is ready for mounting.

3.5 Adjustment of the set point

The warning set point is adjusted on the rear of the housing by means of a screwdriver, see the figure to the right. Also in test mode, the actual set point is shown on the meter, and it can be reconfigured on the rear of the housing. When you power up the product, the first 10 seconds (default) are used to show the actual set point that is configured on the meter.

Two ranges available:

13 k Ω to 200 k Ω or 40 k Ω to 1.5 M Ω .
See example on the label to the right.



Typical setting:

Insulation resistance corresponding to position of the red marking pointer or lower limit of the section marked with red on the instrument scale. Typically, the insulation alarm limit is 1 k Ω per volt. For example, 400 V system voltage could have an alarm limit of 0.4 M Ω .

If needed, the precise set point can be pre-set in the product from DEIF before delivery (fixed set point). See data sheet, section "Order specifications".

If you want precise alarm settings, a known resistor corresponding to the red section on the instrument scale must be connected between P and PE. Then adjust the potentiometer until alarm is transmitted. For fast response, set the switch on the front in the fault-finding position.

3.6 Fuse

Recommended fuse for auxiliary supply X2, X3, X4 is max. 2 A.




3.7 WARNING - Megger test during commissioning

If the installation is to be tested by means of a high-voltage "MEGGER", the SIM-Q MKII must be disconnected at terminal "p" before testing is carried out. Ignoring this may result in damage to the SIM-Q MKII if the test voltage is higher than 1000 V DC/ 828 V AC (690 V AC + 20%). Besides, the insulation test will be affected by the built-in DC voltage generator impedance (approximately 250 k Ω).

4 Operation






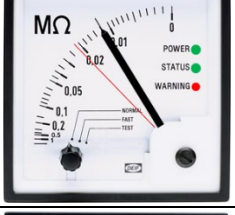

4.1 LED indicators

The SIM-Q MKII is equipped with three LED indicators: two green LEDs and one yellow LED placed as the lowest one. The LED colours are as described in the table below:







Power Top LED 	OFF	MCU not yet initialised, or no power.
	ON	Power on product and MCU has initialised.
	Flashing	Power-up sequence.
Status Middle LED 	OFF	No valid measurement.
	ON	Valid measurement.
	Flashing	Fast mode: Measurement is not steady. Normal mode: Last measurement failed.
Warning Bottom LED 	OFF	Measured insulation resistance is higher than set point.
	Long flash (75 %, 500 mHz)	Measured insulation resistance is lower than set point but relay is not active. (ON delay). (Fast mode during power-up).
	Short flash (25 %, 500 mHz)	Measured insulation resistance is higher than set point but relay is still active. (OFF delay).
	ON	Measured insulation resistance is lower than set point and relay is activated.

The next paragraphs explain more about LEDs in combination with the meter and switch positions.


4.1.1 Normal mode

Start-up Normal mode Fast measurement (Fast mode measurement)		Power LED is flashing Status LED is flashing (1 Hz 50 % duty cycle) Warning LED is set according to insulation resistance and set point Meter shows the measured resistance in fast mode Relay is deactivated independently of the measured insulation resistance “Power-up fast mode” is programmable in the range 0 to 30 s. Default = 0 s
Start-up Normal mode Show set point		Power LED is flashing Status LED is flashing (0.5 Hz 50 % duty cycle) Warning LED is off Meter shows the set point Relay is deactivated “Power-up set point” is programmable in the range 0 to 30 s. Default = 15 s
Start-up Normal mode Initial measurement		Power LED is on Status LED is flashing Warning LED is off Meter starts at unlimited insulation resistance Relay is deactivated
Change from other mode to Normal mode		Power LED is on Status LED is flashing Warning LED is off Meter starts at unlimited insulation resistance Relay is deactivated
Valid measurement Insulation resistance is higher than set point		Power LED is on Status LED is on => valid measurement Warning LED is off => no insulation error Meter shows the measured insulation resistance Relay is deactivated
Valid measurement Insulation resistance is lower than set point		Power LED is on Status LED is on => valid measurement Warning LED is on => insulation error Meter shows the measured insulation resistance Relay is activated
Measurement failed Resistance drop / Resistance jump Fail to converge, max. measurement time DC error (fluctuating DC)		Power LED is on Status LED is flashing with varying duty cycle to indicate failure Warning is set according to last valid measurement (on or off) Meter shows last valid measurement Relay is set according to last valid measurement

4.1.2 Fast mode

Power up in Fast mode Show set point		Power LED is flashing Status LED is flashing (0.5 Hz 50 % duty cycle) Warning LED is off Meter shows the set point Relay is deactivated "Power-up set point" is programmable in the range 0 to 30 s. Default = 15 s
Change from other state to Fast mode		Power LED is on Status LED is flashing Warning LED is off => no insulation error Meter shows unlimited insulation resistance Relay is deactivated
Steady input measurement Measured insulation resistance is lower than set point		Power LED is on Status LED is on => valid data Warning LED is on => insulation error Meter shows the measured insulation resistance Relay is activated
Steady input measurement Measured insulation resistance is higher than set point		Power LED is on Status LED is on => valid data Warning LED is off => no insulation error Meter shows the measured insulation resistance Relay is deactivated
Unsteady Input Measurement Measured insulation resistance is higher than set point Insulation resistance is changed more than 1 %/min		Power LED is on Status LED is flashing => resistance is not steady. The more constant the light, the closer to a valid result Warning LED is off => no insulation error Meter shows the measured insulation resistance Relay is deactivated
Unsteady Input Measurement Measured insulation resistance is lower than set point Insulation resistance is changed more than 1 %/min		Power LED is on Status LED is flashing => resistance is not steady. The more constant the light, the closer to a valid result Warning LED is on => insulation error Meter shows the measured insulation resistance Relay is activated

4.1.3 Test mode

Test mode		<p>Power LED is on Status LED is on Warning LED is on</p> <p>Meter shows insulation resistance set point Relay is activated</p>
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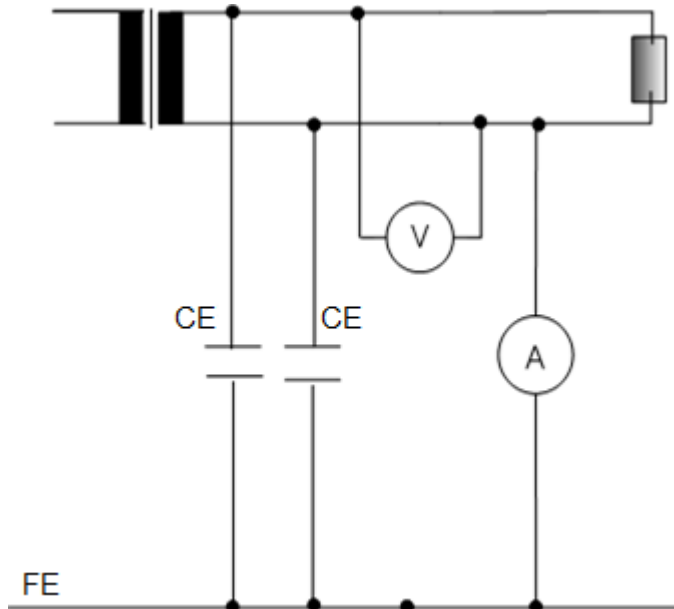
4.2 Technical specifications

See the data sheet, document no. 4921230028

5 Determination of capacity within an application

5.1 Leakage capacitance in a connected network

Measuring of the leakage capacitance in a connected network using a voltmeter and an ammeter (FE).



Single phase:

$CE = A / (V \times 2 \times \pi \times f)$. π is 3.14 and f is the frequency in Hz.

3 phases:

$CE = A / (V \times \sqrt{3} \times 2 \times \pi \times f)$.

Example for a 3-phase system:

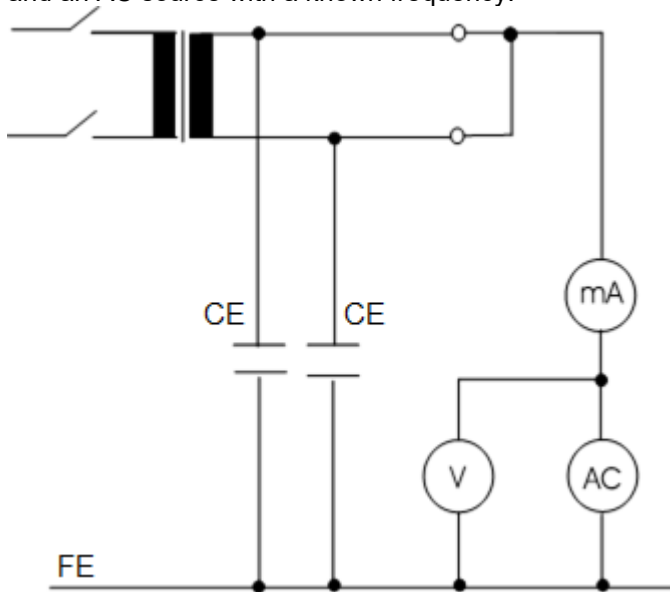
The current is measured to 30 A and the voltage is measured to 400 V:

$CE = 30 \text{ A} / 400 \text{ V} \times \sqrt{3} \times 2 \times 3.14 \times 50 \text{ Hz} = 137 \text{ } \mu\text{F}$ per phase, total CE is $3 \times 137 \text{ } \mu\text{F} = 411 \text{ } \mu\text{F}$.

For a 4-wire network, the CE total = $CE \times 4$.

5.2 Leakage capacitance in a disconnected network

Measuring of the leakage capacitance in a disconnected network using a mA meter, a voltmeter and an AC source with a known frequency.



$CE_{total} = mA / (V \times 2 \times \phi \times f)$. $\phi = 3.14$ and f is the frequency in Hz.

In the example below, the mA is measured to 100 mA and the voltage from the AC source is measured to 50 V AC:

$CE_{total} = 0.1 A / 50 V \times 2 \times 3.14 \times 50 = 6.3 \mu F$.

5.3 Leakage capacitance using the SIM-Q MKII fault finding function

The fault-finding function of the SIM-Q MKII can be used to estimate the size of the leakage capacitor. Notice that this method can only be used when no insulation error is present.

Set the switch in fault finding position.

Discharge the leakage capacitor by short-circuiting P and FE by means of a low impedance load, for example a bulb suitable for the AC voltage level on the system.

Open the short circuit between P and FE. Then measure the time (t) that elapses until the instrument indicates approximately 0.5 (0.05) MΩ on the scale.

By using the formula $C = t/0.3$, the approximate leakage capacitor in μF can be calculated.

Example: $t = 10$ seconds, $C = 33 \mu F$.