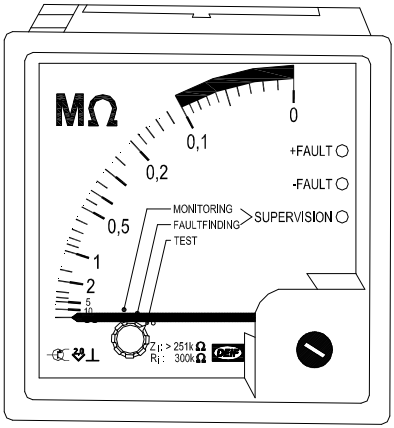
Installation/operation instructions

Insulation monitor type SIM-Q/SIM-Q LF

4189330016D (UK)



- ***Monitoring of insulation resistance on an AC network***
- ***Working voltage up to 690V AC, withstands up to 1000V DC***
- ***Measuring range 1...0Mohm or 10...0Mohm***
- ***Working frequency down to 5Hz (SIM-Q LF)***
- ***Alarm on exceeding the adjusted set point***
- ***3 functions: Monitoring, fault finding, test***
- ***AC and DC auxiliary voltage***

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Generally

Description

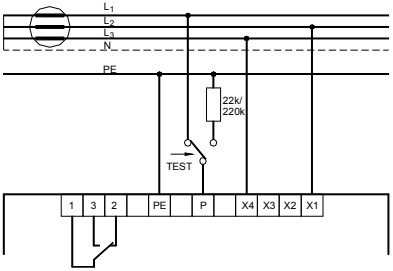
The SIM-Q is intended for insulation monitoring on a single-phase or a 3-phase IT power system with or without neutral. The special characteristic of an IT power system is the fact that no live conductor is connected directly to earth. The SIM-Q is connected to the power system by connecting the terminal marked **P** to one of the phases (or the neutral). The PE 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 **PE** (protective earth).

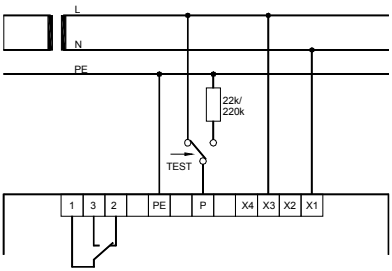
Installation

Connection

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

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



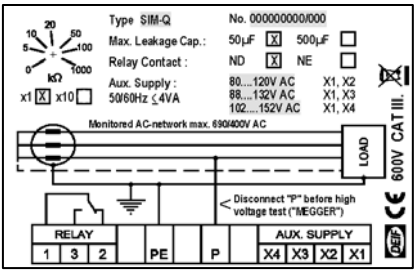


With the switch in monitoring mode, the SIM-Q will run a fast measuring mode the first 15 seconds after a power-up. This mode can be used to perform a switchboard test. When a known resistor is connected for testing, the aux. supply is disconnected and reconnected at the same time (not shown in the illustration). The response time for measuring the known resistor will be approx. 6 seconds. The 2 red LEDs will be illuminated, but the relay contact will not be activated. After 15 seconds the SIM-Q 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 position “Test”, an internal function test of the SIM-Q is carried out. The reading on the scale during the test is 0 ohm, and the relay output is activated.

Connection of AC auxiliary supply

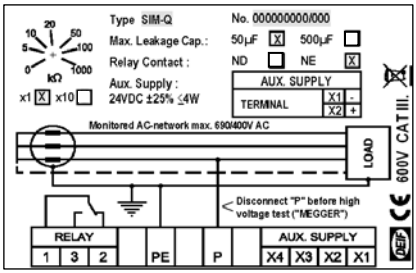
Type: 80...152V AC	Type: 176...288V AC	Type: 320...576V AC
X_1, X_2: 100V AC ±20%	X_1, X_2: 220V AC ±20%	X_1, X_2: 400V AC ±20%
X_1, X_3: 110V AC ±20%	X_1, X_3: 230V AC ±20%	X_1, X_3: 450V AC ±20%
X_1, X_4: 127V AC ±20%	X_1, X_4: 240V AC ±20%	X_1, X_4: 480V AC ±20%



Label for AC version

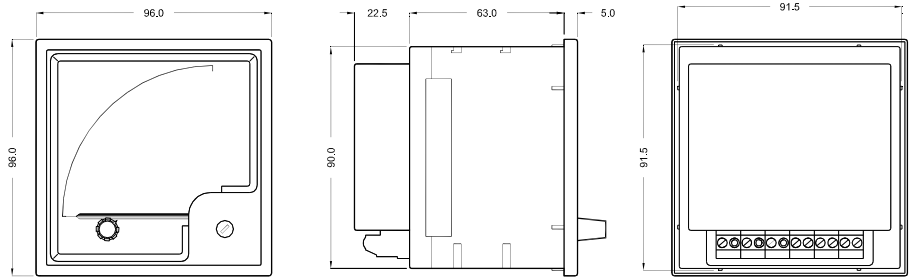
Connection of DC auxiliary supply

Type: 24V DC
X_1 -
X_2 +



Label for DC version

Dimensions



Configuration of the relay function

The relay contact can be configured to either a normally energised contact (NE) or a normally de-energised contact (ND). ND function is recommended, if the SIM-Q is supplied from the IT system under supervision, because a disconnection of the supply will not result in an alarm. Figure 1 below shows the location of the switch S1 on the PCB for selection of either ND or NE relay function. The PCB is located under the lid.

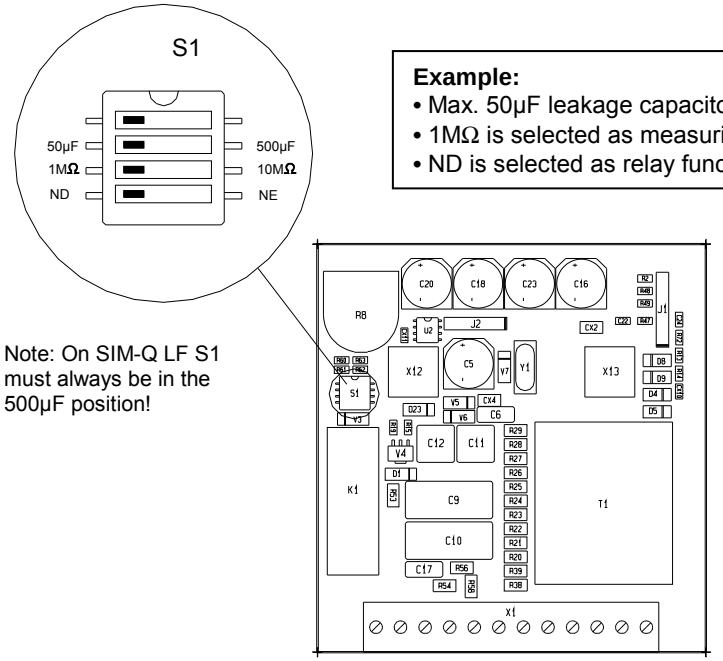


Figure 1

IMPORTANT - 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.

Configuration of the max. leakage capacitor (stray earth capacitance)

The leakage capacitor is normally a phenomenon based on the cables in the power system. When the cables are mounted close to the metal structure, e.g. the hull of the ship, a capacitive coupling is unavoidable. The size of the capacitor can be measured using insulation test equipment based on a known frequency and a known test voltage.

If only the cables contribute to the leakage capacitor, the capacitor will be small - less than 1µF. On the other hand, the leakage capacitor can be very big, if the loads connected to the power system are based on frequency converters cooling containers

and other electronics equipment. The reason is that all these loads normally have decoupling capacitors mounted on the power port, and these decoupling capacitors are normally connected to the ground and then also connected to the protective earth (PE). Regarding measurement of the total leakage capacitor, please see the appendix.

Configuration of the measuring range

The SIM-Q can be configured for measuring range 1…0MΩ with 22kΩ on the scale centre or for 10…0MΩ with 220kΩ on the scale centre. Figure 1 shows the position of the switch for selection of either 1MΩ or 10MΩ measuring range. Please notice that a change of measuring range also involves a change of scale. Change of scale can be done by following the instructions below.

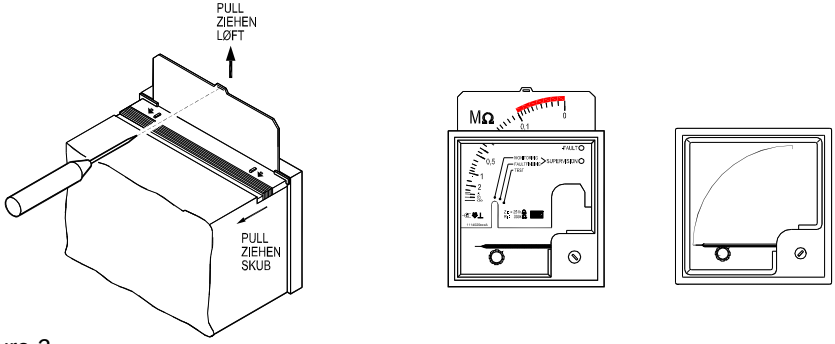


Figure 2

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

Adjustment of the set point

The requested alarm limit value is set on an ohm scale on the rear of the instrument, see Figure 3.

Range "x10" is marked:
The scale values on the ohm scale are multiplied by 10.

Typical setting:
Insulation resistance corresponding to lower limit of the section marked with red on the instrument scale.

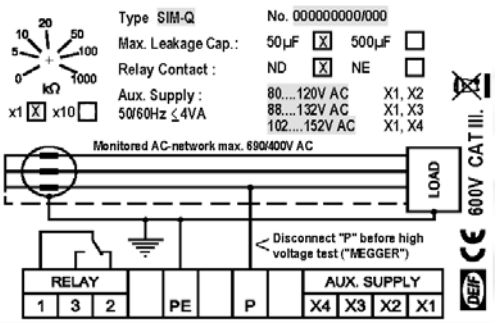


Figure 3

If precise alarm settings are wanted, a known resistor corresponding to the red section on the instrument scale is 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.

Operation

Indicators

The SIM-Q is equipped with 3 LED indicators, one green LED and 2 red LEDs. Only the green indicator marked SUPERVISION is lit when the unit is connected to auxiliary supply and no insulation error is detected. If the SIM-Q detects a change in the insulation measurement, the SUPERVISION LED starts flashing with a fast rate. If the insulation error detected is fluctuating, the internal integration time is automatically extended, which is indicated by a slower flash rate. As long as the SUPERVISION LED is flashing, the latest measured value is kept and indicated on the instrument until a new value is found, then the reading on the instrument is updated. Please notice that if the insulation is fluctuating, the green LED will flash most of the time, but updates will be performed within 450 seconds (setting 50µF) or 2400 seconds (setting 500µF) as a maximum.

The 2 red LED indicators marked +FAULT and -FAULT are illuminated, if an insulation error below the set point is detected. If a DC voltage (component) occurs on the system together with an insulation error, the +FAULT or the -FAULT LED is illuminated, indicating the polarity of the DC voltage. This function will indicate where to look for the insulation error. In case only one red LED is illuminated, the fault is to be found in a load with a built-in rectifier, e.g. a frequency converter.

If a DC voltage is detected, but the alarm limit value is not yet reached, the +FAULT or the -FAULT LED will flash to indicate that there is a DC component higher than 50V DC between the power system and earth (PE), but no insulation error below the alarm limit value yet. Figure 4 below illustrates a situation where a DC can occur between the P and the PE input of the SIM-Q.

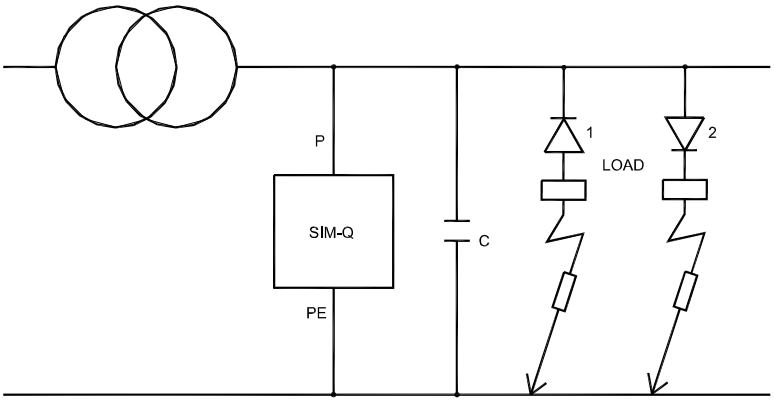
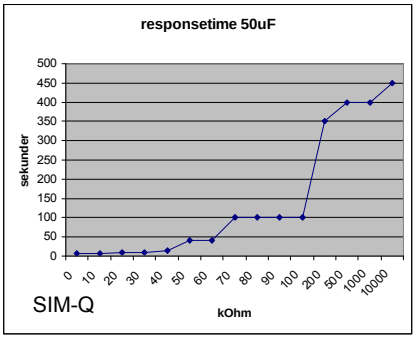
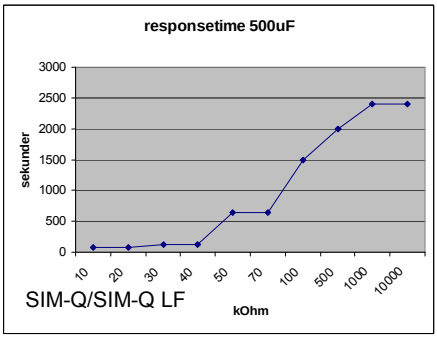


Figure 4

The capacitor marked C illustrates the leakage capacitor.
The diodes marked 1 and 2 illustrate the rectifier in the load.
If the situation is as illustrated at diode marked 2, the +FAULT LED is illuminated.
If the situation is as illustrated at diode marked 1, the -FAULT LED is illuminated.

Response time





The above curves illustrate the response time with an actual leakage capacitor of 50µF and 500µF. If the leakage capacitor is less than 50/500µF, the response time will then be reduced in time accordingly.

Note:
If the insulation error is fluctuating, the above response times will be prolonged, however, no longer than the above max. values (450 seconds/2400 seconds).

If there is a leakage capacitor in the system, the SIM-Q will indicate an insulation error for the first 15 seconds after a power-up. If the set point is exceeded, the 2 red LEDs will be lit, but the relay output is inhibited for the first 15 seconds after power-up.

If the installation contains frequency converters working down below 20Hz, the SIM-Q LF should be used instead, providing reliable measurements down to 5Hz.

Fuses:
Recommended fuse for aux. supply X2, X3, X4 max. 2A.

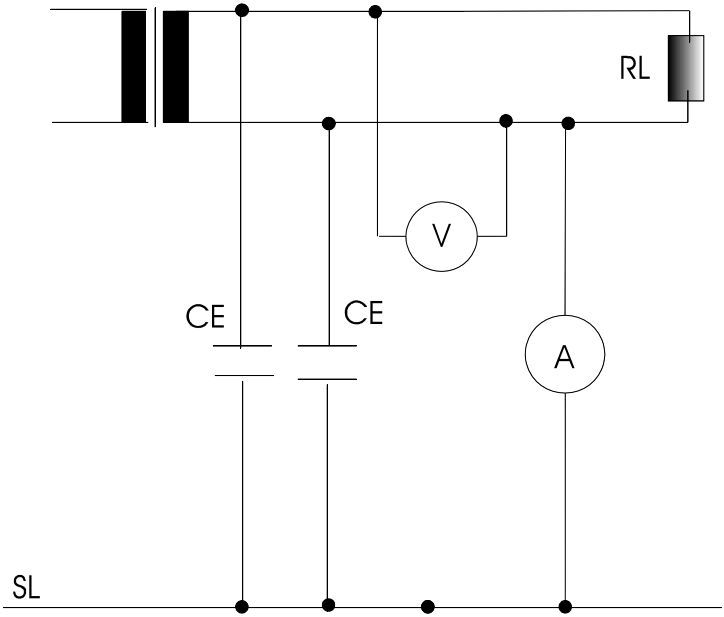
Warning:
If the installation is to be tested by means of a high-voltage "MEGGER", the measuring leads to the SIM-Q at terminal "p" must be disconnected before testing is carried out. Omitting this may result in damage to the SIM-Q, if the test voltage is higher than 1000V AC/DC. Besides the insulation test will be affected by the built-in DC voltage generator impedance (approx. 250kΩ).

Technical specifications

Please see the data sheet, document no. 4921230020.

Appendix

Measuring of the leakage capacitance in a connected network using a voltmeter and amp meter (SL = PE)

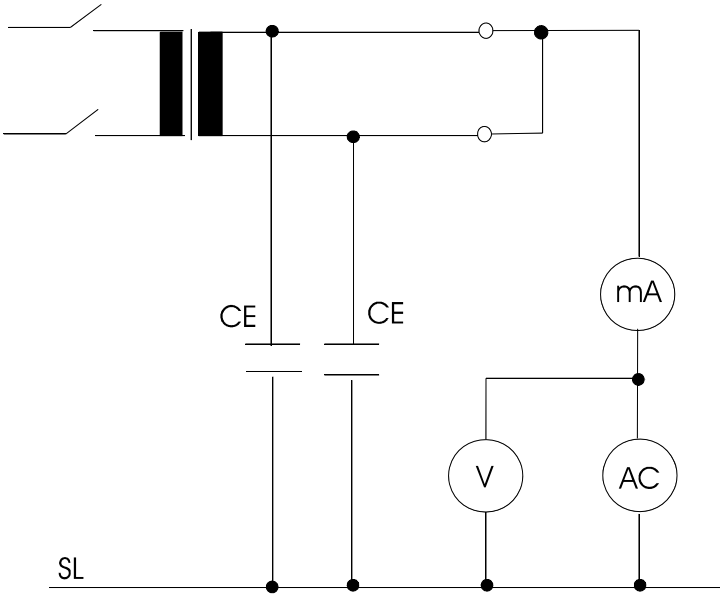


Single phase:
CE = A/(V x 2 x phi x f). Phi is 3.14 and f is the frequency in Hz.

3 phases:
CE = A/(V x √3 x 2 x phi x f).

Example for a 3-phase system:
The amp is measured to 30A and the voltage is measured to 400V:
CE = 30A/400V x √3 x 2 x 3.14 x 50Hz = 137µF per phase, total CE is 3 x 137µF = 411µF. For a 4-wire network the CE total = CE x 4.

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



CE total = mA/(V x 2 x phi x f). Phi = 3.14 and f is the frequency in Hz.
Example where the mA is measured to 100mA and the voltage from the AC source is measured to 50V AC:

CE total = 0.1A/50V x 2 x 3.14 x 50) = 6.3µF.

Using the fault finding function of the SIM-Q to estimate the size of the leakage capacitor

Please notice that this method can only be used in cases where no insulation error is present.

Set the switch in fault finding position.
Discharge the leakage capacitor by short-circuiting P and PE by means of a low impedance load, e.g. a bulb suitable for the AC voltage level on the system.
Open the short circuit between P and PE. Then measure the time (t) that elapses until the instrument indicates approx. 0.5 (0.05) Mohm on the scale.
Using the formula C = t/0.3, the approx. leakage capacitor in µF (microfarad) can be calculated. Example: t = 10 seconds, C = 33µF.

Errors and changes excepted