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CE

Insulation Monitoring

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DEIF A/S

Insulation monitors

Type AAL-111Q96

- ***Monitoring of insulation resistance***
- ***High or low ohms measurement***
- ***Alarm on low insulation resistance***
- ***Interchangeable scales***
- ***AC or DC auxiliary voltage***

CE

Application

The AAL-111Q96 is used for supervision of the insulation resistance between an insulated low-voltage distribution network and earth cable/safety cable. The instrument is applicable in conjunction with single phase networks and 3-phase networks with/without neutral for voltages up to 440V AC. The AAL-111Q96 is CE marked for residential, commercial and light industry plus industrial environment.

This type of insulation measurement is only carried out on AC networks where the neutral/star point of the generator or supply transformer is **not** connected to earth.

The AAL-111Q96 is used for marine installations and other types of insulated low-voltage networks.

An AC or DC auxiliary voltage is required for the instrument. This may be selected independently of the monitored network. The instrument is supplied for either an AC auxiliary voltage with transformer taps for all typical nominal voltages between 100V and 440V or for 24V DC. Instruments for AC auxiliary voltage may be fed by the monitored network. If the instrument is fed by a separate voltage source, the current network may also be monitored in power-down condition.

A high insulation resistance between the mains supply and the hull of a ship is of importance because of safety and counteraction of galvanic corrosion of the hull. Another typical application is monitoring of the insulation resistance of transformer-coupled supply voltages in a control room.

Measurement

The insulation is monitored between the complete AC network - irrespective of number of wires - and an earthed safety cable.

The measurement is carried out by applying a DC voltage between a point on the safety cable and a point on the AC network (see Fig. 2). So it is a condition for monitoring of the complete network that the remaining parts are galvanically connected. This is normally achieved via the windings of the generator or the supply transformer and the connected loads.

If measurement of cables disconnected at both ends is required, the individual wires must be mutually connected by means of choke coils.

Measuring principle

Leakages between the AC network and earth will induce a current, the size of which expresses the insulation resistance. The current is processed in an amplifier circuit, the output signal of which is fed to a relay circuit and an indicating instrument equipped with a scale graduated in ohms. If this exceeds a preset limit, the built-in relay is deactivated (normally energised) and a red LED marked "FAULT" is lit. If the failure current then drops below the limit value, the relay is activated and the LED marked "FAULT" is switched off. The relay circuit is not provided with a hold-on function.

A green LED marked "READY" indicates whether the auxiliary voltage of the instrument is present. If this auxiliary voltage drops out, the built-in relay is deactivated which results in transmission of an alarm signal.

The two LEDs are visible through holes in the scale.

Power up

Notice that during power-up the AAL-111Q96 will indicate a leakage for about 1 sec. depending on the actual leakage capacitor. This will result in activation of the relay and transmission of an alarm.

Measuring ranges

The AAL-111Q96 can be delivered with 2 different measuring ranges, either 1…0MΩ (scale centre 0.022MΩ) or 10…0MΩ (scale centre 0.22MΩ).

Standard scales

The lowest permissible insulation resistance for an insulated network is typically either 0.1kΩ/V or 1kΩ/V (calculated according to nominal phase to phase voltage on 3-phase networks). This lower insulation resistance limit is selected on the basis of varying national standards, or it is determined by a classification society for measurements on marine installations.

This means that for any typical nominal mains voltage, a scale corresponding to both 0.1kΩ/V and 1kΩ/V is available. The range from the lowest permissible insulation resistance to zero is marked in red.

Scale exchange is possible through a slot in the top of the instrument, thereby enabling quick adaption to the mains voltage in use and the required insulation resistance limit.

The following **standard** scales are available:

Standard scales

1...0MΩ SCALES	10...0MΩ SCALES	TYPICALLY USED FOR MAINS VOLTAGE *)
0.010...0MΩ	0.100…0MΩ	100V AC
0.011...0MΩ	0.110…0MΩ	110V AC
0.012...0MΩ	0.120…0MΩ	120V AC
0.022...0MΩ	0.220…0MΩ	220V AC
0.023...0MΩ	0.230…0MΩ	230V AC
0.024...0MΩ	0.240…0MΩ	240V AC
0.038...0MΩ	0.380…0MΩ	380V AC
0.040...0MΩ	0.400…0MΩ	400V AC
0.042...0MΩ	0.415…0MΩ	415V AC
0.044...0MΩ	0.440…0MΩ	440V AC

*) The scale selected is not limited to a certain mains voltage, but often 0.1kΩ/V or 1kΩ/V is used.

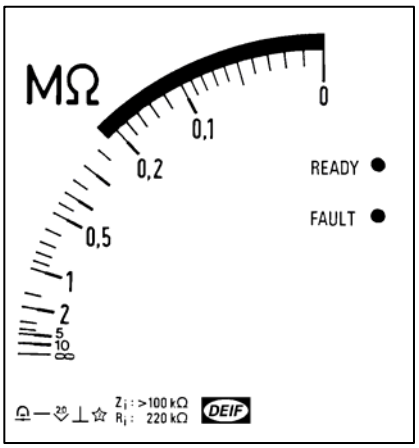


Fig. 1

Limitations

Max. one instrument per insulated network may be connected. If the network on the other hand is divided into a number of insulated networks, e.g. by means of transformers, one measurement may be carried out for each individual group.

Test

If a periodical test function is required, this can be achieved as shown on the connection diagrams. If a value less than the preset limit value is selected as test resistance, alarm is obtained upon activation of the test button.

Warning: *If the installation is to be tested by means of a high-voltage "MEGGER", the measuring leads to the AAL-111Q96 at terminal "p" must be disconnected* ***before*** *testing is carried out. Omitting this may result in damage to the AAL-111Q96.*

If the installation contains directly connected AC loads with rectifiers such as magnetic valves or frequency converters, an error in this type of loads will result in indication error and error alarm on the AAL-111Q96. It is recommended to use SIM-Q instead of AAL-111Q96 to avoid this problem.

Setpoint

The requested limit value is set on an ohm scale on the rear of the instrument (see Fig. 2).

Range "x1" is marked:
The actual limit value is set directly on the ohm scale.
(For all instrument scales with "22kΩ" at scale centre).

Range "x10" is marked:
The scale values on the ohm scale are multiplied by 10.
(For all instrument scales with "220kΩ" at scale centre).

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

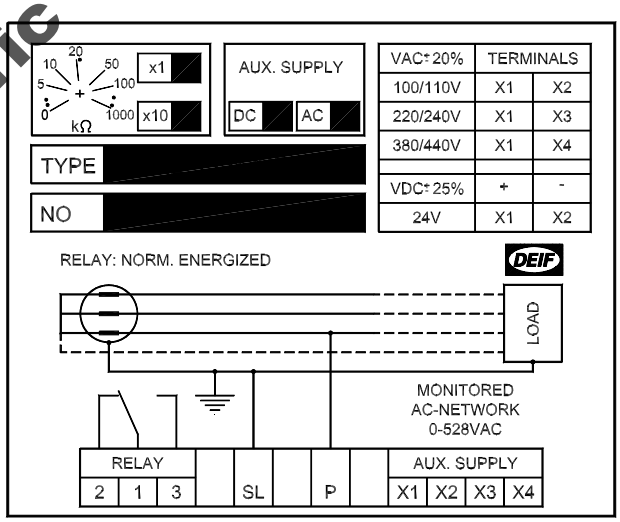


Fig. 2

Marking

On the rear of the instrument, blank squares are provided for marking of:

Auxiliary voltage: AC or DC (fixed)
Measuring range: "x1" or "x10" (fixed)

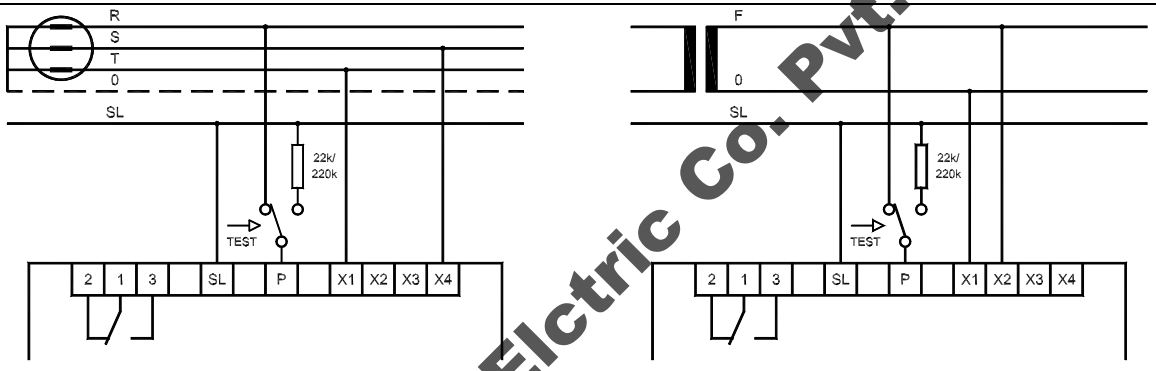
Technical specifications

Measuring circuit	DC resistance (R_i):	22kΩ or 220kΩ ±5% (dependent on scale range)
	AC impedance (Z_i):	>100kΩ at 50Hz
	Measuring output voltage:	12V DC ±10%
	Mains input voltage:	Max. 440V AC +20% continuously
Instrument	Measuring scale range:	1MΩ with scale centre at 0.022MΩ or 10MΩ with scale centre at 0.22MΩ
	- Accuracy:	±2% of scale length
	- Temperature drift:	Max. 0.5% of scale length per 10°C
	- Voltage drift	Max. 0.2% of scale length at U_s ±20%
	- Response time:	0.1kΩ/V: 1 s, 1kΩ/V: 3 s
	Scale:	Exchangeable, with red section

Relay function	Setpoint	0…1000kΩ for 1MΩ scale range	0…10,000kΩ (x10) for 10MΩ scale range
	- Accuracy:	±5% of scale length	
	- Reproduceability	±1% of scale length	
	- Hysteresis:	±2% of scale length	
	- Temperature drift:	Max. 0.2% of scale length per 10°C	
	- Voltage drift:	Max. 0.2% of scale length at U_S ±20%	
	- Response time:	0.1kΩ/V: 1 s, 1kΩ/V: 3 s	
	- Indication:	Red LED is lit when resistance is lower than setpoint	
	Relay output:	Change-over contact	
	Contact rating:	250V - 2A - 400VA (AC). 250V - 1A - 50W (DC)	
	Relay coupling:	Normally energised	

General technical specifications	
Auxiliary voltage:	Select between: **DC**: 24V DC ±25% (ca. 4W) or **AC**: 100, 110, 220, 230, 240, 380, 415, 440V AC ±20%, 45...65Hz (ca. 4VA)
"READY" indication:	Green LED is lit, when auxiliary voltage is present
EMC:	To EN 61000-6-1, EN 61000-6-2, EN 61000-6-3, EN 61000-6-4, IEC 60255-22-1
Galvanic separation:	Relay output/measuring circuit/aux. voltage: 2kV - 50Hz - 1 min.
Temperature:	-10...55°C (nominal) -25...60°C (operating), -25...65°C (storage)
Climate:	97% RH, IEC 60068-2-30, test Db
Protection:	Instrument: IP52 (IP54 as option). Electronics: IP20. Terminals: IP20. To IEC 529 and EN 60529
Connections:	Screw terminals: 2.5 mm^2 (multi-stranded), 4 mm^2 (single-stranded)
Materials:	All plastic materials self-extinguishing to UL94 (V0)

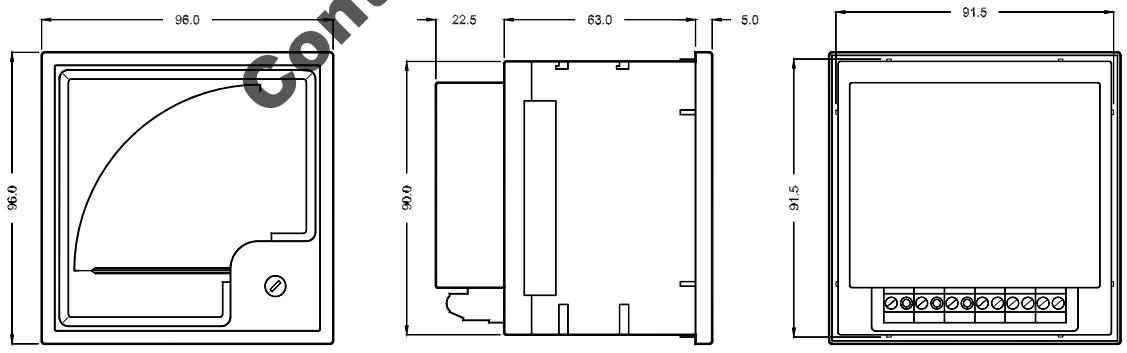
Connections



3- or 4-wire networks 2-wire networks

Dimensions

All dimensions in mm



AAL-111Q96 Weight: Approx. 0.450 kg (Panel cut-out: 92.0 x 92.0 +0.8)

Order specifications

	Type	**Scale range**	**Red section**	**Auxiliary voltage**
Example 1:	AAL-111Q96	1...0MΩ	0.022...0MΩ	DC
Example 2:	AAL-111Q96	10...0MΩ	0.44...0MΩ	AC