



-power in control



APPLICATION NOTES



Insulation monitors, AAL-2



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Table of contents

1. WARNINGS AND LEGAL INFORMATION..... 3

LEGAL INFORMATION AND RESPONSIBILITY 3

ELECTROSTATIC DISCHARGE AWARENESS 3

SAFETY ISSUES 3

2. GENERAL GUIDELINES..... 4

1. Warnings and legal information

Legal information and responsibility

DEIF takes no responsibility for installation or operation of the insulation monitor. If there is any doubt about how to install or operate the generator set monitored by the unit, the company responsible for the installation or the operation of the generator set must be contacted.

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

Electrostatic discharge awareness

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

Safety issues

Installing the unit implies 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.

2. General guidelines

These application notes give guidelines for the AAL-2 insulation monitor.

The figure below illustrates the measuring method, which is applied in the AAL-2.

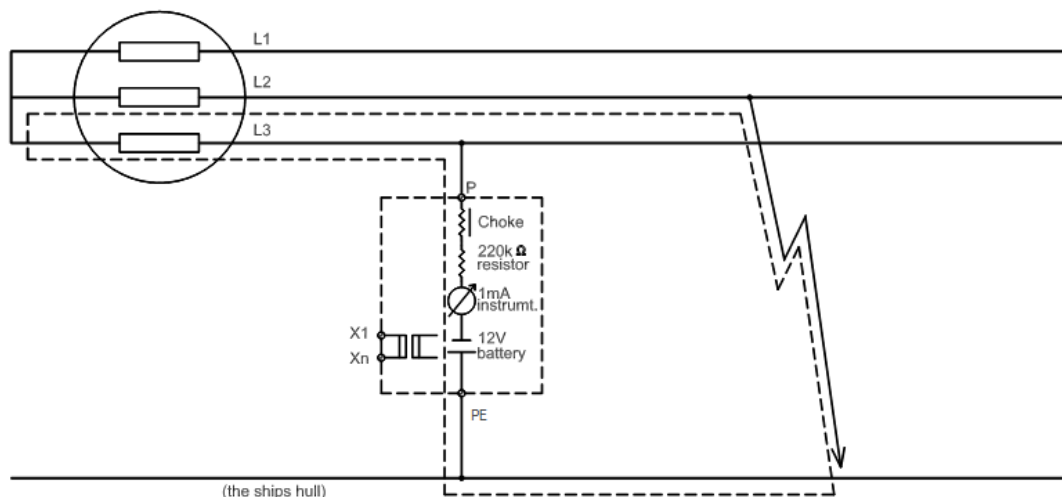


Figure 1

As it appears from figure 1, the measuring method is based on a simple ohmmeter circuit.

When the auxiliary supply, which is galvanically separated from the measuring circuit, is connected, a stable 12 V DC is generated internally. This 12 V DC is applied as the measuring voltage of the ohmmeter.

In series with this voltage, a moving-coil instrument, and a resistance with the same value as the value that can be read from the centre point of the AAL-2 scale are mounted. Normally, this value is set to 220 k Ω , but it can also be 22 k Ω .

The choke shown is mounted to prevent mains frequency from disturbing the measuring circuit.

The dotted line illustrates the flow path for a leakage from phase L2 to safe earth.

The figure shows that it is insignificant to which phase the AAL-2 is connected. This is because the windings in the generator or the externally connected loads always make sure that a DC flow path is established among phase L1, L2 and L3 for the measuring circuit. This also applies if an insulated neutral is used from the star point.

Two AAL-2 on the same network with a tie breaker

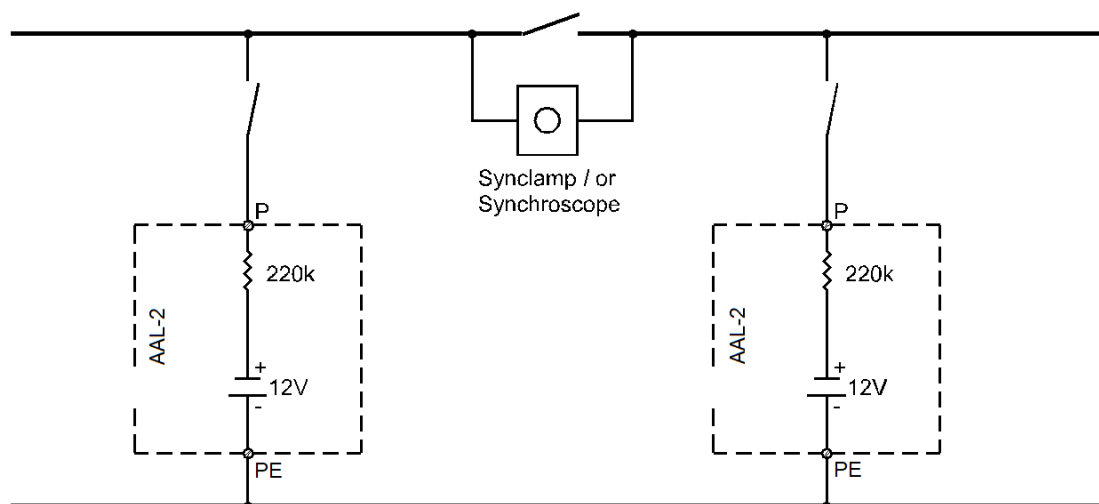


Figure 2

Figure 2 illustrates the situation where two AAL-2 monitors form part of the same installation. Because of the measuring principle, correct insulation measuring is only possible when one instrument is connected at a time.

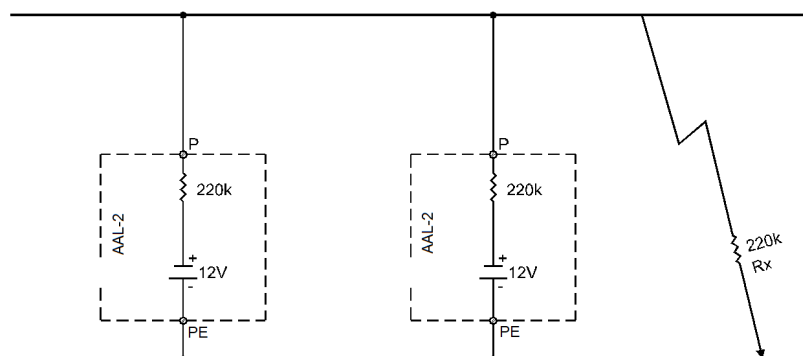
It means that when the circuit breaker is closed, an auxiliary contact on the circuit breaker must disconnect "P" on one of the AAL-2s.

During synchronisation, where a synchroniser is connected in parallel over the circuit breaker, errors in indication will arise as well. If the application (the installation) makes it difficult to disconnect "P" on one AAL-2 before the shown circuit breaker is closed, the result will be that the two shown AAL-2s are connected in parallel in the synchronising period.

This will give two possible faulty measurements, shown in examples 1 and 2 below.

The examples are based on two AAL-2 monitors with a measuring range of 1 k Ω /V and 220 k Ω on the centre of the scale.

Connected in parallel



Indication on both units will be 440 k ($2 \times$ leakage resistor).

Correct indication will only be shown on both units if $R_x = \infty$ or $0\ \Omega$.

If a leakage is present, the indication will not be valid.

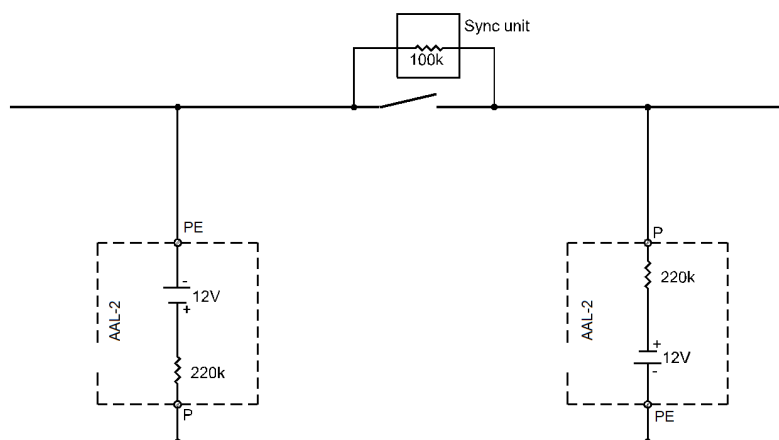
Example 1

Example 1:

If both AAL-2 monitors are connected to auxiliary supply, and "PE" from both AAL-2 monitors is connected to safe earth, and "P" from both units is connected to mains (busbar), a possible leakage will be indicated (measured) on both units as $2 \times$ the actual value in Ω . For example, a leakage of $220\text{ k}\Omega$ will be indicated (measured) as a leakage of $440\text{ k}\Omega$.

Please note that if there is no leakage, both units will show "infinite". Also, if there is a short circuit, this state will be shown as $0\ \Omega$ on both units.

Connected in reverse order with a tie breaker



Indication $50\text{ k}\Omega$ on both units.

When the breaker is closed, both units indicate $0\ \Omega$ (short circuit).

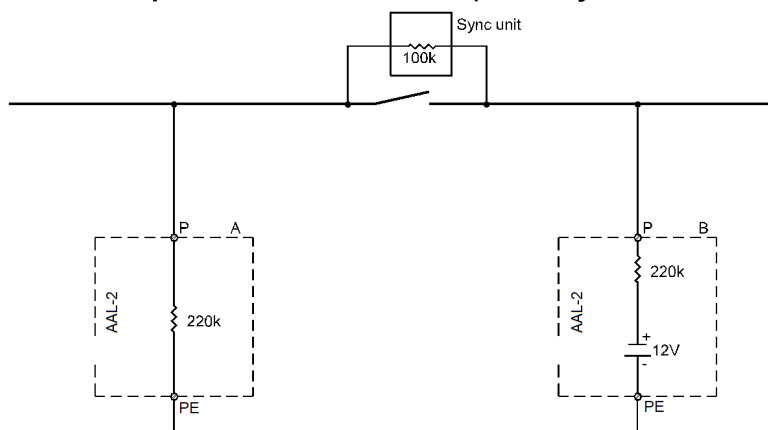
Example 2

Example 2:

If "PE" and "P" are exchanged on one AAL-2 compared to the other AAL-2, so that the measuring voltage of 12 V DC is reverse polarised on one unit compared to the other unit, the leakage will be indicated (measured) as $0.5 \times$ the impedance in the connected synchronising unit. For example, if the impedance in the synchronising unit is $100\text{ k}\Omega$, the AAL-2 will indicate (measure) $50\text{ k}\Omega$. This state is only possible if "PE" and "P" have wrongly been exchanged on one unit compared to the other unit.

Please note that if only one unit is connected, no errors will be observed at the exchange of "PE" and "P".

Connected in parallel with a tie breaker (with only one unit connected to aux.)



Indication 320 k Ω on B and ∞ on A.

When the breaker is closed, B indicates 220 k Ω .

Example 3

Example 3:

If only one of the two AAL-2s is connected to the auxiliary supply, the unit will measure the leakage of the unpowered AAL-2's built-in series resistance + the impedance in the connected synchronising equipment (for example 220 k Ω + 100 k Ω = 320 k Ω).

If it is not possible to disconnect "P" from one AAL-2 before the synchronising unit is connected, example one is the only acceptable alternative. Firstly, example one does not cause a failure alarm, as a possible leakage is registered as the double of the leakage, and a catastrophic leakage arising during the synchronisation will in any case be registered. When the circuit breaker is closed, one AAL-2 is disconnected by an auxiliary contact on the circuit breaker, and the measuring is now correct.

As regards connection of the auxiliary supply, it is insignificant whether the AAL-2 is connected to the mains (busbar), which is monitored by the unit, or whether the auxiliary supply is coming from another mains.

DEIF A/S reserves the right to change any of the above.