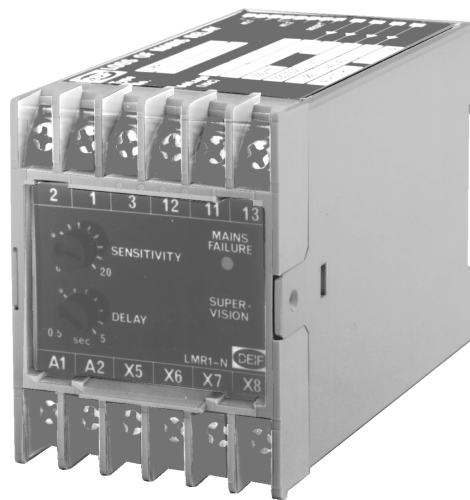


Mains loss relays

Type LMR-1N

4921240038C



- *Disconnection of generator on mains failure (frequency gradient)*
- *Protection against overload*
- *Indication for activated LMR-1N*
- *Mains failure indication*

Application

The mains loss relay LMR-1N is used to protect synchronous generators, running in parallel with the mains. Provided a disconnection at an arbitrary point of the network results in a swift change of the generator frequency corresponding to a rotation of at least 2 electr. degrees, a disconnection signal will be transmitted to the mains circuit breaker within 20...40 ms. When a fast operating mains circuit breaker is applied, the generator will thus be protected against damages caused by an automatic reconnection to the high-voltage network. An automatic reconnection may be carried out as early as 300 ms after opening a high-voltage circuit breaker in the network. The circuit breaker time must in this case thus not exceed 260 ms. The LMR-1N will on the other hand not detect the normal relatively slow and acceptable changes of the frequency of the network. The LMR-1N is CE marked for residential, commercial and light industry plus industrial environment.

By disconnecting the generator as described on mains failure the following are achieved:

- protection of the generator against serious damage caused by asynchronous reconnection of the mains voltage.
- that the generator will not continue in island operation, supplying consumers connected to the remaining network close to the generator.
- protection of the generator against overload and subsequent disconnection when transferring load to the faulty network.
- that the generator may continue as an emergency generator, supplying local, essential consumers.

Furthermore, separation of a generator from the mains in case of mains failure is also stipulated as a condition in most national rules for connection of synchronous generators to the mains. Regarding Great Britain, see Engineering Recommendation G59.

Construction

The LMR-1N is housed in a case for mounting on DIN rail and the front plate of the relay is equipped with 2 scales and 2 LED's with the following functions:

SENSITIVITY:	Scale for setting of max. vectorial deviation on mains failure. Range: 2...20 electr. degrees.
DELAY:	Scale for setting of delayed supervision after connecting a generator in parallel with the mains. Range: 0.5...5 s (allows the generator to stabilize).
MAINS FAILURE:	Red LED lit on disconnection due to mains failure.
SUPERVISION:	Green LED lit when the LMR-1N is active.

Connection (See diagram page 4)

Measuring voltage:	Normally connected to the network between 2 phase voltages but may be connected between 1 phase voltage and the neutral.
Input "RESET":	Connected to potential free auxiliary contacts of the generator circuit breaker and the mains circuit breaker respectively. The 2 contacts are connected in parallel and should close when the circuit breakers are open (NC). When the "RESET" terminals are short-circuited, the LMR-1N will not detect a possible mains failure. This function ensures that the LMR-1N is only active when both circuit breakers are closed and the generator thus is running in parallel with the mains.
Relay output:	The output relay is provided with 2 potential free changeover contacts, connected direct to the disconnection signal to the mains circuit breaker and an alarm unit respectively.
Synchronisation:	Carried out by means of an external synchronisation unit.

Function

The measuring signal - which also supplies the electronics - is fed to a special integrated custom-designed circuit supervising the angular velocity of the phases of the mains. The velocity is supervised by comparing the time for a full cycle of the present period and the time for a full cycle of the previous period. If the difference between these two measurements exceeds the value set on the scale marked "SENSITIVITY", the following are carried out:

1. Output relay changes position (is de-energized) within 20...40 ms.
2. Opening signal is transmitted to mains circuit breaker.
3. LED marked "MAINS FAILURE" is lit.
4. LED marked "SUPERVISION" is switched off.
5. Mains circuit breaker is opened.
6. Auxiliary contact of mains circuit breaker short-circuits "RESET" input.
7. Internal timer is started.
8. Timer expires after approx. 2 s.
9. Output relay changes position (is energized).
10. Opening signal to mains circuit breaker is interrupted.
11. LED marked "MAINS FAILURE" is switched off.
12. LMR-1N is again ready for connection, provided mains voltage is present.

Reconnection to the mains is initiated manually or by an automatic supervision of this.

1. Generator frequency is controlled manually or by an automatic synchronisation unit.
2. Synchronisation signal is transmitted to mains circuit breaker.
3. Mains circuit breaker closes.
4. Auxiliary contact of mains circuit breaker opens across "RESET" input.
5. Timer "DELAY" is started (scaled: 0.5...5 s.)
6. Timer "DELAY" expires.
7. Supervision function of the LMR-1N is activated.
8. LED marked "SUPERVISION" is lit.
9. The LMR-1N supervises the mains.

The mains is supervised until either a mains failure is detected or one of the two circuit breakers is opened.

The time delay "DELAY" ensures that supervision of the mains is not started until this has stabilized after synchronisation of either the mains or the generator circuit breaker.

Limitation of range of application

In practice the LMR-1N will ensure a very reliable protection of the generator, however, if complete protection under all circumstances is wanted, voltage and frequency relays must be included in the protection scheme.

The LMR-1N will correctly detect a possible mains failure:

- if an interruption of the mains results in a change of the generator power corresponding to minimum 5% of the maximum generator power.
- if one or more generators are running in parallel with a "rigid" network.
- if the generator bus bar is connected to the mains at one point only.

The LMR-1N will not detect a possible mains failure:

- if the generator power change corresponds to less than 5% of the maximum generator power.
A continuous import of power from the mains corresponding to at least 5% of the maximum generator power will ensure disconnection on mains failure. This is only possible when the generator is operating as an emergency unit as well.
- if a bus bar is connected to the mains at more than one point.
Should a failure occur on only one of the mains connections, the generator will continue to run synchronously with the remaining connections, and a rapid change of frequency, detectable by the LMR-1N, will not occur.

The LMR-1N will cause unwanted disconnections:

- if one or more generators are running in parallel with a "soft" network, e.g. a larger group of smaller diesel generators. As relatively fast, but quite normal frequency deviations are to be expected in such a network, using the LMR-1N will result in frequent, unwanted disconnections.
- if the major part of the load of the generator bus bar is frequency converters for control of asynchronous motors.

Synchronisation of more generators

If more than one generator is to run in parallel with the mains, blocking the LMR-1N briefly by short-circuiting the "RESET" input is recommended, when synchronising signal is transmitted to a circuit breaker.

This function may, if required, be combined with a timer running for approx. 1 sec, which is started when the synchronising signal is transmitted. If the circuit breaker is not closed after the preset period of time, an alarm signal for "connection fault" is released, and the blocking of the LMR-1N is simultaneously cancelled.

Setting of the LMR-1N

"SENSITIVITY": If the generator solely operates as a co-generation plant, supplying the total generator power to the mains, changes of the generator load may be simulated only with difficulty. It is thus recommended to set this to the red dot on the scale (5 electr. degrees), and then, if necessary, adjust the setting on the basis of practical experience.

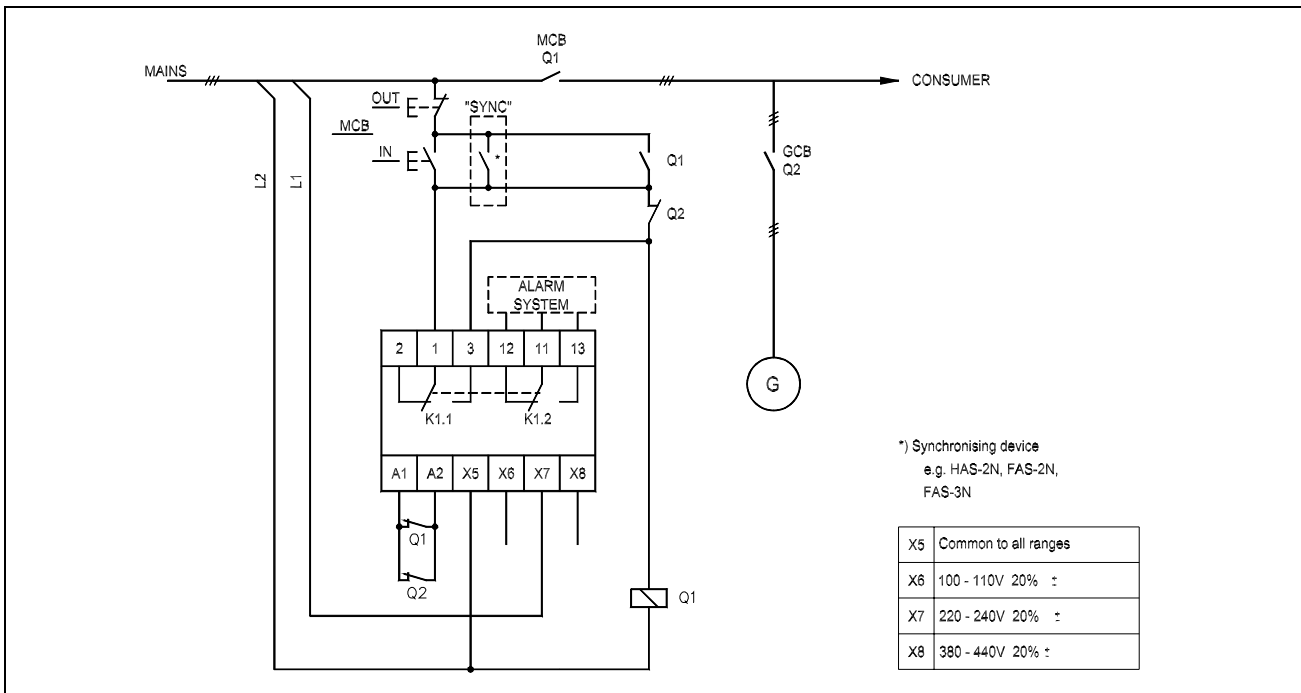
If the generator also operates as an emergency generator and much of the generator power is used locally, it will normally be possible to change the generator load. The N/C auxiliary contact across the "RESET" input of the mains circuit breaker is removed. While the mains circuit breaker is open, the sensitivity is adjusted so that disconnection signal to the mains circuit breaker is transmitted at a load variation of 5...10%. Reconnect the above auxiliary contact.

"DELAY": In both cases this is typically set to the red dot (1 sec.), however, the delay may be prolonged if unwanted disconnection occurs immediately after synchronisation of the generator to the mains.

Technical specifications

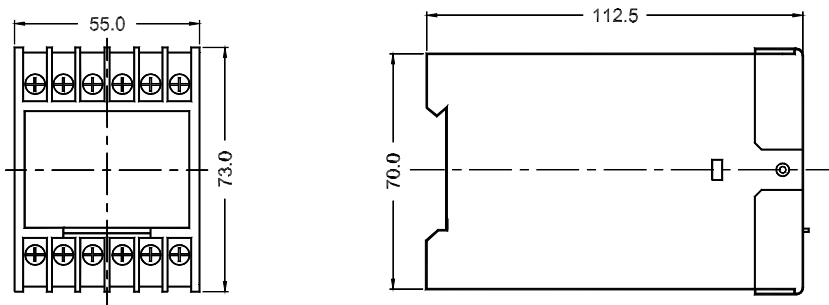
Disconnection signal:	Max. 40 ms after mains failure
Delayed supervision:	Range 0.5...5 s. Accuracy: $\pm 20\%$ of setting
Sensitivity:	Range: 2...20 electr. degrees. Accuracy: $\pm 20\%$ of setting
Measuring voltage:	100 - 110 - 220 - 230 - 240 - 380 - 400 - 415 - 440V AC $\pm 20\%$ (approx. 3VA)
Measuring frequency:	40...70Hz
Isolation/safety:	Galvanic separation between all circuits. Test voltage: 2,2kV - 50Hz - 1 min.
"RESET" input:	Supervision blocked when terminals "A1" and "A2" are short-circuited. Response time: approx. 2 ms.
Relay output:	2 changeover contacts, max. 250V - 2A - 400VA (AC), max. 250V - 1A - 50W (DC).
Temperature:	-10...55°C (nominal), -25...70°C (operating), -40...70°C (storage)
Climate:	Class HSE, to DIN 40040
EMC:	To EN 50081-1/2, EN 50082-1/2, SS4361503 (PL4) and IEC 255-4 (class 3)
Materials:	Plastic parts: self-extinguishing, to UL94 (V0). Metal parts: corrosion-resistant surface finish.
Connections:	Screw terminals, max. 2 mm ²
Protection:	Case: IP40. Terminals: IP20, to IEC 529 and EN 60529

Connections



Dimensions

All dimension in mm



LMR-1N

Weight: approx. 0.400 kg

Order specifications

Type	Measuring voltage (universal)
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Due to our continuous development we reserve the right to supply equipment which may vary from the described.



DEIF A/S, Frisenborgvej 33
DK-7800 Skive, Denmark

Tel.: +45 9614 9614, Fax: +45 9614 9615
E-mail: deif@deif.com, URL: www.deif.com

