Application Note

Best practice for EMN devices installation:

How to choose the best Line Protection Unit

REVISIONS

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1. Introduction

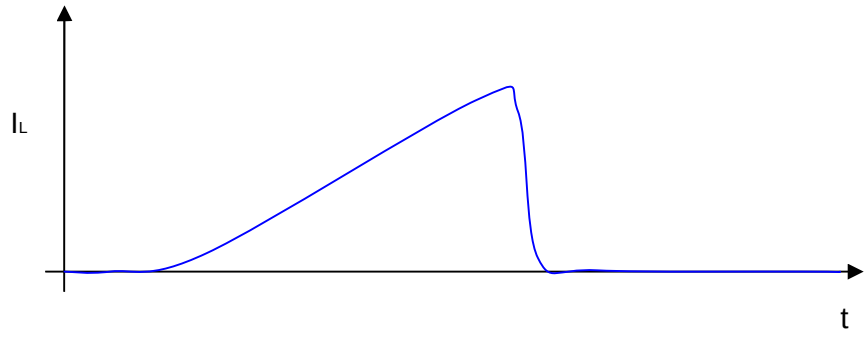
Purpose of such note is to aware any Wi-LEM integrator of the supply current really required by each EMN in order to correctly size the power line protection.

As mentioned in the user guide, chapter 3.4.4 Voltage input connection, fuse or circuit breaker must be installed between the main supply and the EMN for line protection.

2. EMN Supply Characteristics

In standard versions, EMN device is line powered from (L1-N) inputs.

The EMN absorbs pulsed current between the inputs L1 and N.
The pulses are repeated every line period and reach up to 2.5A over 1 ms maximum depending on the voltage input (which may be between 90 and 300 Vac).
The shape of the pulses is a triangle as shown below:



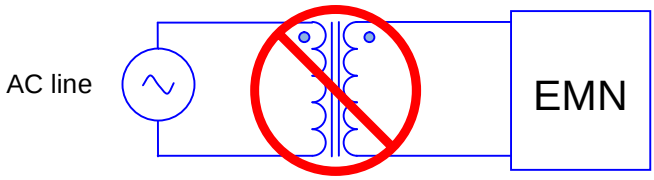
If the rms value of this current remains very low, the peak value may reach the tripping point of a magnetic circuit breaker if its range and curve type have not been well selected.
It's also relevant to know that the first pulse at power on (inrush current) is easily 3 or 4 times bigger than the repetitive ones and may last up to 3ms. In any case, this first pulse is limited by a 33 Ohms series resistor (maximum 10A under 230 Vac).

So, during the fuse or circuit-breaker selection, you must consider a maximal peak current value of 10 A for each device, during a short time (few milliseconds).

3. Line protection selection

3-1 Impedance issue.

We must first consider the impedance of the power line.
Always keep in mind that the upstream impedance must be as low as possible for a correct functioning of the internal power supply of the EMN, please take the following information into consideration:



Depending on the application it may be tempting to use an isolation transformer or a variable transformer on the AC line.
However, the high inductance of the transformer (frequently in the mH's) interferes with the normal operation of the EMN internal power supply and **should not be used**. This is not a concern with the normal inductance of the AC line or for AC line filters.
The EMN draws current from the AC line in short, high current pulses. The transformer's high inductance tends to limit the current pulse. Furthermore, inductive kickback on the falling edge of the current pulse can create high voltage spikes which must be absorbed by the transient protector.

3-2 Acoustic Noise issue

When the upstream protection of the EMN is ensured by a thermal-magnetic circuit-breaker, some noise may be emitted by the latter if the range is below 10A. This is actually due to the internal coil (magnetic tripping device) which resonates because of the pulsed current drawn by the EMN. This phenomenon depends on the size of the coil which is related to the range; generally the noise is not audible for 10A circuit-breakers or above. The phenomenon may also be emphasized if more than one EMN are powered by the same circuit-breaker (peak pulsed current is proportional to the number of EMNs).

When several EMN devices are installed in the same cabinet, it is not recommended to supply all of them from the same protected line, or this must be done with special care, as the total required current is the sum of each. Effectively, all devices will be exactly synchronized on the 50/60 Hz line and in particular the current peaks will occur exactly at the same time, so will be summed for the unit supplying the EMN devices.

So, in case of supplying several EMN devices from one unit, you must absolutely consider the sum of each individual current (peak value required by each EMN)

3-3 Sizing the protection device (with magnetic tripping).

The protection device must be in accordance with the total current drawn by one or several EMNs fed by it.

In order to withstand the total peak current, it is recommended to select a circuit-breaker with a magnetic fault protection whose level is much higher than the rated current, during tens of milliseconds, covering the maximum current peak required by all EMN devices.

As a reminder, considering the magnetic fault protection, you can generally find 4 different types of circuit-breakers (typical data):

- type A trips between 2 and 3 times full load current, after 100 ms
- type B trips between 3 and 5 times full load current, after 100 ms
- type C trips between 5 and 10 times full load current, after 100 ms
- type D trips between 10 and 20 times full load current, after 100 ms

Please refer to the actual curve shown in the manufacturer's datasheet to select the circuit-breaker accordingly to the required total current.

Concrete example with 10 EMNs installed in a cabinet:

At power on, the total peak value may reach 10 x 10A, i.e. 100 A.

Here are some possible configurations with a thermal-magnetic circuit-breaker:

Circuit breaker type, rated current	Usage
2A,4A, 6A, 8A any type	Not recommended, as lower than 10A (refer to § 3-2 Acoustic Noise issue)
10A, type C	Not recommended, as withstands only 50A min.
20A, type A or B	Not recommended, as withstands only 40A or 60A min.
20A, type C	OK, as withstands 100A over 100 ms
10 A, type D	OK, as withstands 100A over 100 ms
2 x (10 A, type C)	OK if 5 EMNs for each (as withstands 50A)

3-4 Protection device is a fuse

Based only on thermal consideration, this technology should not be an issue. Nevertheless, the number of EMNs in parallel must be taken into consideration and fast fuses must be avoided. In any case, the best is to refer to the curve of the fuse with regard to the peak value, duration of the pulse and number of EMN unit.
In case of doubt, it can be recommended to use aM type designed for motor protection to withstand the initial startup surge.