Introduction

The measurement of electrical power has become a key part of improvement projects in energy performance, but measurements can be used for different purposes:

• monitoring consumption and analysing distributions,
• monitoring load levels and monitoring the installation,
• billing and invoicing.

Applications requiring the installation of meters dedicated to invoicing purposes in Europe must comply with the MID directive.

The MID (Measuring Instrument Directive) is a European directive dating back to March 31, 2004 (2004/22/EC). It applies to devices and systems with a measuring function, such as water, gas, electrical and heat meters and weighing instruments used in commercial transactions. The objective of the MID is to ensure a high level of reliability and metrological assurance so that any involved party can trust the measurement readings.
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Applicable MID directive

The directives are as follows

- **New directive MID 2014/35/EU** applicable as of 20 April 2016. This new directive does not change the requirements of measuring instruments.

The annexes of the directive detail the 10 categories of affected measuring instruments

- MI-001: water meters.
- MI-002: gas meters and volume conversion devices.
- **MI-003: active electrical energy meters.**
- MI-004: heat meters.
- MI-005: measuring systems for the continuous and dynamic measurement of quantities of liquids other than water.
- MI-006: automatic weighing instruments.
- MI-007: taximeters.
- MI-008: material measures.
- MI-009: dimensional measuring instruments.
- MI-010: exhaust gas analysers.

General rules

The MID directive applies to devices and systems with a measuring function (MI-00x).
In particular, annex MI-003 details the requirements for active electrical energy meters.
It is relevant to all European Union Member States and applies in commercial transactions to ensure their loyalty.
The conformity of measuring devices is assessed by an agent from a notified body.

For electricity meters, different conformity assessment procedures are possible: **B+D, B+F or H1**.

- Module B: assessing the conformity of the product’s technical design.
- Module D: quality assurance of the production process.
- Module F: verifying the production of the product.
- Module H1: full quality and design control assurance.

**Socomec has selected assessment procedure B+D for all its MID products.**
This selection is open to ISO 9001-certified companies. The same procedure was chosen by most other manufacturers of MID electricity meters.
In practice, for Module B, the notified body verifies the technical documentation, carries out the necessary tests and examinations and issues an EC type examination certificate (technical design meets the applicable requirements).
For Module D, there is a declaration of conformity to type, based on the quality assurance of the manufacturing process.
Requirements of active electrical energy meters

The MID and electricity meters

This concerns only active electrical energy meters used for any commercial transaction with an end-customer if there is a direct relationship between the measured consumption and the invoice. Meters must be intended for the following use:

- residential,
- commercial,
- light industrial.

The MID is not for:

- measurement transformer units (CTs),
- reactive energy meters,
- reference meters (for calibration),
- portable meters,
- active energy meters used by heavy industrial clients.

EN 50470 product standards

The EN 50470 set of product standards assumes conformity with the MID directive. If a product is designed in accordance with this set of standards, it will meet the requirements of the MID. The notified body will use these standards to verify the conformity of the products.

A static active energy meter must respond to the two following standards:

- **EN 50470-1**: electrical metering equipment
  - Part 1: general provisions, testing and testing methods,
- **EN 50470-3**: electrical metering equipment
  - Part 3: specific requirements, static active energy meters.

3 precision classes have been defined. The meters must meet at least one of these classes:

- precision class A: equivalent to class 2 of IEC 62053-21*,
- precision class B: equivalent to class 1 of IEC 62053-21*,
- precision class C: equivalent to class 0.5S of IEC 62053-22*.

The meters designed and tested under standards EN 50470-1 and EN 50470-3 conform to MID requirements.

* Note:

Standard IEC 62053: electricity metering equipment (c.a.). Particular requirements:

- Part 21: static meters for active energy (classes 1 and 2),
- Part 22: static meters for active energy (classes 0.2S and 0.5S).
Product requirements set out by the MID and EN 50470

The product requirements set out by the MID and EN 50470 standards for products can be summarised as follows:

**Unit**
- Metrological LED on front panel.
- Display of consumption (kWh or MWh).
- IP rating 51.
- Specific name-plate.

**Settings and protection**
- Sealable measuring terminals.
- Sealing of programming mode for installed products.
- Protection against metrology-related settings.
- No settings options on PC software.
- Internal metrological firmware that cannot be modified without new certification.

**Electrical characteristics**
- Single-phase 2 wire meter, three-phase 3-wire meter, three-phase 4-wire meter.
- Accuracy of measurement of active energy (class A, B or C).
- Continuity of the metering in case 1 or 2 phases are lost.
- Set operating conditions.
- Maximum permissible errors (current and T°).
- Tolerated effect of disruptions (unbalance, harmonics, continuous current, temporary, etc.).

**Specific name-plate**

An MID product must have a specific rating plate indicating all the data leading to its certification.
SOCOMEC’s MID range

Socomec offers a range of MID (COUNTIS) meters, mainly to measure the following types of energy consumption.

### MID meter COUNTIS E

<table>
<thead>
<tr>
<th>Type of network - Input current</th>
<th>Single-phase Direct 32 A</th>
<th>Single-phase Direct 40 A</th>
<th>Single-phase Direct 63 A</th>
<th>Single-phase Direct 80 A</th>
<th>Three-phase Direct 60 A</th>
<th>Three-phase Direct 100 A</th>
<th>Three-phase CT 5 A 3000 A</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Energy meters: COUNTIS E</td>
<td>E02</td>
<td>E04 / 06</td>
<td>E12</td>
<td>E14 / E16 / E18</td>
<td>E22 / E24 / E26 / E28</td>
<td>E32 / E34 / E36</td>
<td>E42 / E44 / E46</td>
</tr>
<tr>
<td>Precision class active energy</td>
<td>B</td>
<td>B</td>
<td>B</td>
<td>B</td>
<td>B</td>
<td>B</td>
<td>C</td>
</tr>
<tr>
<td>Output</td>
<td>Pulse</td>
<td>Pulse/Modbus M-Bus</td>
<td>Pulse</td>
<td>Pulse/Modbus M-Bus/Ethernet</td>
<td>Pulse/Modbus M-Bus/Ethernet</td>
<td>Pulse/Modbus M-Bus</td>
<td>Pulse/Modbus M-Bus</td>
</tr>
</tbody>
</table>

Figure 2 - MID-COUNTIS range.

Socomec also offers a PMD measuring unit (DIRIS A14) that allows you to measure both the system’s electrical parameters (U, I, P, PF...) and the THD.

### MID PMD DIRIS A14

- Three-phase TC 5 A - 2500 A.
- Active energy precision class C.
- Modbus output.
- IEC 61557-12 conformity.
MID fields of application

Fields covered by the MID

In Europe, the MID establishes:
- key requirements, applicable from the design to the market launch or commissioning of the new devices,
- specific requirements for each device category,
- a conformity assessment based on standards,
- an assessment procedure on the conformity by notified bodies,
- designation criteria from notified bodies,
- principles of device identification.

Implementation by member states

The directives are subject to national transpositions. As such, a state may add national requirements depending on the use, such as the following for accuracy.

Where a member state imposes measuring for residential use, the measurement is carried out using a class A meter.

For specific purposes, the member state is authorised to demand a class B meter.

Where a member state imposes measuring for commercial use, the measurement is carried out using a class B meter.

For specific purposes, the member state is authorised to demand a class C meter.

Similarly, some points remain the responsibility of each State, such as:
- legal control (calibration),
- regular check on devices in operation (recalibration, life of calibration, maximum transaction errors).

For example, in France the transposition and implementing rules are described in the following orders and decrees:
- Decree no. 2006-447 of 12 April 2006 relating to the market launch and implementation of specific measuring instruments.
  ➔ Transposition into French law of the MID directive.
- Decree of 28 April 2006 sets out the implementation rules of the decree no. 2006-447 of 12 April 2006 relating to the market launch and implementation of specific measuring instruments.
  ➔ Rules for implementing the MID directive into French law.
  ➔ Postponement of the implementation of decree no. 2006-447 of 1 January 2010 for meters installed in France and used in combination with external instrument transformers.
- The decree of 1 August 2013 relating to active electrical energy meters.

In the United Kingdom, the MID is applied through implementing legislation:
- 15 texts (all combined meters) have been notified to the European Commission for the implementation of MID 2004/22/EC.
  ➔ Applicable text for active energy meters.
- Notes for Guidance the measuring instruments (Active Electrical Energy Meters).
  ➔ Implementation guide.
Use of MID products for “non-MID” applications?

As detailed in previous sections, the MID is intended for metering active energy. Electricity meters are suitable for this need, but they do not address the monitoring and quality of the electrical system carried out with a PMD*, with its electrical parameter measurements (voltage, current, power, PF, THD, harmonics) or putting alerts in place.

An MID product can be used for non-commercial transaction applications. However, the user must take into account the constraints imposed by the MID with the aim to secure the transaction. If these constraints are not helpful, it is important to be aware of:

- additional costs of the measuring point,
- protection against corruption constraints,
- local display restriction,
- no measurement precision for electrical parameters,
- external current sensors (ct) only in A,
- limitation in the use of innovative measuring systems.

* PMD: Performance measuring and monitoring device.

Additional costs of the measuring point

MID constraints do not allow the use of multipoint solutions that reduce the cost of the installed measuring point.

Protection against corruption and programming of meters

The tamperproofing requirements make it hard to upgrade the system in place:

- lock programming options,
- block terminals,
- reset unauthorised meters.

In addition, parameters can be programmed only at installation. After installation and blocking, it is no longer possible to access the programming options.
For the same security and tamperproofing reasons, it is not possible to program the measuring parameters (network type, primary current and CT transformation rate) via the communication bus.

The MID limits the scope of programming, above all via the communication bus.
About precision

The MID only refers to the active energy meter readings expressed in kWh or MWh.

- **Accuracy is only guaranteed for the active energy.**

The MID scope does not guarantee the measuring accuracy of the electrical parameters (U, I, P, PF).

To guarantee the precision of these parameters, the meter or the PMD must be based on a different standard, such as IEC 61557-12 for measuring devices (PMDs).

The MID guarantees the precision of the active energy (Ea) but not that of the other electrical parameters (U, I, P, PF…).

**CTs in relation to the MID:**

For meters with external sensors, the MID does not take into account the overall measurement chain; meter + CT.

The MID does not apply to external current measuring transformers (CTs).

However, these do have a significant influence on the overall measurement chain and must be taken into account when assessing the accuracy of the measurement.

With standard IEC 61557-12, for example, to assess the overall performance class, we apply a formula that takes into account the accuracy of every element in the measuring chain:

\[
\text{Overall performance class} = 1.15 \times \sqrt{\text{Class (current_sensor)}^2 + \text{Class (voltage_sensor)}^2 + \text{Performance class (PMD SS)}^2}
\]

Figure 3 - Overall performance class.

In addition, the MID only considers CTs in Amperes, which does not allow the use of mv output CTs offering added features: disconnection when charging, compactness, precision, etc.

Mixed-measurement system

If certain measuring points within a system need to be MID-certified, there is no need for the entire system to be MID-certified.

In the example of a shopping centre, the shops must be equipped with MID products to enable rebilling, but the offices and technical systems do not need to be:

Figure 4 - Electrical installation of a shopping centre.
Innovation and MID

To ensure the energy measuring is safe, the MID imposes a certain number of product constraints that are understandable and necessary for applications involving a commercial transaction. On the other hand, applied outside this kind of application, certain constraints may limit innovation and functional benefits for the customer.

DIRIS Digiware for example, offers a number of innovations, such as:
• dynamic load management ➔ measuring multiple loads on a single module,
• range of PMD-related meters ➔ precision class of the overall measurement chain,
• RJ12/RJ45 connectivity ➔ implementation time quartered,
• U measure for multiple meters only ➔ reduced footprint,
• specific current sensors ➔ automatic detection and opening when secondary loaded.

The MID ensures reliable and tamperproof metering. In return, its strict framework may limit innovation or hinder certain functional benefits.

In summary

The MID (Measuring Instrument Directive) applies to the devices and systems with a measuring function, such as water, gas, electric and heat meters and weighing instruments used for commercial transactions.

The MID provides a high level of metrological protection so anyone involved can trust the measurement results. These protections translate into a specific design and implementation of the electricity meters.

Outside of commercial transactions, these constraints could mean for the application an additional cost of the measurement point and a limitation to the deployment of innovative measurement solutions that deliver significant user benefits (compactness, ease of installation, implementation and measurement accuracy).