

METAS
Ihre Referenz.

Regulation related to EV charging stations

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Scope: Why EV charging stations?

Application much talked about these days
EU Commission requested standard to give presumption of conformity with MID (2014/32/EU) (M/541)

But:

- Legal metrology perspective: Application like any other

- Measurement function (“MID meter”) is conformity assessed and integrated into products with other (non-metrological) functions

- Many applications where measurement function (“MID meter”) is integrated into a product with additional functions
  - EV charging stations
  - Communication systems
  - Electric switchboards
  - Heat pumps
  - Photovoltaic systems
  - Vending machines
  - …

Need for legal metrology

Assumptions:

- **Green deal and digital transition will only work with the consumers**, not against them
  - Consumers need to have confidence
  - Infrastructure must be available
  - Risk-based targeting of measures: Costs easy to explain and to accept
- **Natural point of comparison: Established solutions**

Legal metrology framework in the EU

Fundamental principle: Legal metrology is competence of the Member states

- **MID: Harmonisation for new instruments**
  - **Aim:** Union market without discussion about mutual recognition and legitimate public interest grounds
  - **Scope:** Measurement function for active electrical energy ("active electrical energy meter")
    MID applies – whatever other function might be integrated in the same box
  - **Legal document:** High level of abstraction. Interpretation more involved than that of a technical standard
  - **Key points:**
    - Active electrical energy defined as electrical energy transformable into some other form of energy (also DC)
    - Measurement of energy consumed in circuit (i.e. referred property boundary)
    - Indirect measurement technique possible
    - When indirect measurement: MID covers only the meter, not external devices (removed from draft in 2002)
      Aim: Avoid practical problems when assessing conformity of whole system (risk and cost-benefit analyses)
    - Prepayment functions: Not related to metrology (removed from draft in 2002)
  - **Applicable and applied (for ≈ 10 years) to EV charging applications**

  - **Currently under revision**

Legal metrology framework in the EU

Fundamental principle: Legal metrology is competence of the Member states

- **In use: Not harmonised** (no impact on Union market)
  - **General inspection:**
    - Is the meter conformity assessed and (still) legal to use?
    - Is the meter used as intended by the manufacturer and specified in the manual?
    - Is the result indicated to all affected parties?
    - Is the measurement correct at the property boundary?
    - If indirect measurement technique with instrument transformers or similar external devices is used: Does the configuration of the meter match the reality?
      - Transformer ratio
      - Cable losses
      - Other parameters for indirect measurement technique
    - If synchronisation is relevant: Is the meter correctly synchronised?
      NB: Time-dependent tariffs and interval metering increasingly used in EV applications

  → **Need to check on-site**

  - **Subsequent verification and statistical surveying**

Legal metrology framework in the EU

Fundamental principle: Legal metrology is competence of the Member states

Harmonised requirements for new instruments
- Allows non-bureaucratic access to the Union market
- Stable framework supports innovative solutions: Solid basis for business cases
- Stable framework allows consumers to gain confidence

Functional definition of measuring instrument in MID
- Allows market to optimise without compromising on metrological quality, including trustworthiness
- No double certification of the same function after integration: Avoids high administrative burden with small benefit
- Access to Union market for entire product: Article 7 MID and Regulation (EU) 2019/515 (Mutual recognition)

Use of instrument regulated without harmonisation
- No impact on union market – no need for harmonisation
- Member states check correctness of use
  - Example: Measurement refers to transferred good?
- Member states check stability after *x* years

Measurements in lab: Aim

Aim: Make sure measurement function of product is good.

Aim relevant for

- **Making available on the market** (MID harmonised)
  → Prevent obstacles to free circulation of goods related to active electrical energy measurement function

- **In use** (subsequent verification, statistical surveying)
  → Ensure stability (“Still as good as on day one”) efficiently

Measurements in lab: Challenges

DUT: Active electrical energy meter in isolation

- Energy measurement under rated operating conditions: No problem
- Energy measurement with disturbances: Different from traditional applications
- NB: MID defines critical change values explicitly, but not test levels

- Need generators for disturbances
- Need references for measurement with disturbances

- Result is to be indicated, but display not part of the definition of an active electrical energy meter
- If not utility metering application: No display required at all: Industry may choose hard copy only (printout or record)
- Protocol not the same as for traditional applications
- Need automatic communication with test system

Measurements on site: Aim

Aim: Make sure measurements at good in real life

- **Relevant in use** (during the lifetime of the instrument)
- **Complements** measurements in lab of the active electrical energy meter

Measurements on site: Challenges

- Many little details to look at
- Some need metrological R&D, most don’t
- Slides included for the most important ones
- During talk: Look at the top 2 only

Measurements on site: Challenges

Is the meter conformity assessed?

Practical problem:

- Need access to the meter
  → Similar to traditional applications
- Need to have the documentation (declaration of conformity and manuals)
  → Identical to traditional applications

No need for metrological R&D

Measurements on site: Challenges

Is the meter (still) legal to use? Is the verification (still) valid?

- Option A: Verify verification marks (stickers) or inscribed year of affixing the conformity mark
  → Practical problem: Need access to the meter – Similar to traditional applications

- Option B, Step 1: Read out digitally stored identification and year of affixing the conformity mark
  → MID Module D or F or H1 must check correctness of stored information
  → Information must be read out and made available to consumer

- Option B, Step 2: Verify identification of instrument against digital verification mark
  → Digital verification mark must exist, e.g. in a data base
  National, non-harmonised matter

- **Verification mark is key to confidence.**
- **Must go with time and meet consumer expectations.**
- **No mistake permissible!?**

Measurements on site: Challenges

Is the meter used as intended by the manufacturer and specified in the manual?

Practical problem:

- Need access to the meter
  → Similar to traditional applications

- Need to have the documentation (declaration of conformity and manuals)
  → Identical to traditional applications

No need for metrological R&D

Measurements on site: Challenges

Is the result indicated to the consumer?

- Availability, integrity and authenticity
- If based on a hardware display in the meter:
  Is the hardware display visible?
  Are the hardware seals visible?
- If based on a hardware display attached to the meter:
  Can the consumers trace the result to the meter?
- If based on a printer attached to the meter:
  Can the consumers trace the result to the printout?
  Is there always paper?
- If based on a remote display hardware:
  Can the consumers trace the result (data) to the meter?
  Is the cryptographic key available for verification of the data by the consumer (if applicable)?
- If based on a remote printer:
  Is the printout available to the consumer without complication?
  Can the consumers trace the result (data) to the meter?

No need for metrological R&D

→ General inspection does not need tools: Consumers don't have them either.

Measurements on site: Challenges

Is the result indicated to the E-mobility service provider (EMSP)?

- Availability, integrity and authenticity
- If based on a hardware display in the meter:
  → Doesn't work
- If based on a hardware display attached to the meter:
  → Doesn't work
- If based on a printer attached to the meter:
  → Doesn't work
- If based on a remote display hardware:
  Can the affected parties trace the result (data) to the meter?
  Is the cryptographic key available for verification of the data by the affected parties (if applicable)?
- If based on a remote printer:
  Is the printout available to the affected parties without complication?
  Can the affected parties trace the result (data) to the meter?

No need for metrological R&D

→ General inspection need to check, e.g.,
at the EMSP, the charge point operator (CPO) or the consumer (if data transits through CPO/EMSP to consumer)

→ Use tools used by EMSP

Measurements on site: Challenges

Is the measurement correct at the property boundary?

- Is the cabling correct?
  - Option A: Check cabling from meter to property boundary
    → Need access
  - Option B: Measure energy provided at property boundary
    → Need reference equipment
- Is the configuration correct? (Transformer ratio, cable losses etc.)
  - Option A: Check configuration of meter and compare to transformer/cable/…
    → Need access
    → Need knowledge about transformer/cable/… → Standardisation can help (*)
  - Option B: Measure energy provided at property boundary
    → Need reference equipment

Ideal solution: Option A for manufacturer, Option B for users and authorities

→ General inspection: Need reference equipment for on-site use

→ CPOs: Need reference equipment for on-site use to make sure general inspection doesn't find any problem

→ Both: Need calibration service for reference equipment

Standardisation

History:

- Annex MI-003, Part 2 (Measurement transformers) of 2000/0233(COD): Removed.
- Reasoning in WELMEC WG 8 subgroup MI-003:
  Subgroup chairman: “My impression is that we now largely agree on leaving ITs out of MID. If we do that we avoided the tricky subassembly discussion completely […]. On the other hand, it is clear to me that we cannot cover the light industry sector completely without ITs. However, I regard it a reasonable price to pay for this compromise. ITs are very well standardized products. That is why I believe that the internal market will operate reasonably well without serious technical barriers to trade.” (subgroup chairman, 21 March 2001)
- Main reasons:
  - Excessive cost of conformity assessment of combination of meter and measurement transformer
  - Meter manufacturer ≠ Measurement transformer manufacturer ≠ System manufacturer
  - Meter is conformity assessed according to MID
  - Measurement transformers:
    Mostly instrument transformers at the time: Well standardised, no technical differences on the Union market
    → Little benefit of harmonisation
- No calls to re-add measurement transformers in recent years

→ Standardisation (and use of standards) affect need for harmonisation (risk and cost-benefit analyses)

Measurements on site: Challenges

If synchronisation is relevant: Is the meter correctly synchronised?
NB: Time-dependent tariffs and interval metering for local increasingly used in EV applications

- Option A: Check real-time (no latency) clock display
  → Need such a display
  → Need a portable reference clock (state-of-the-art)
- Option B: Cause a time-stamped event and check time stamp
  → Time stamp must be made available (e.g.: Beginning or end of transaction)
  → Resolution of time stamp must be sufficient
  → Need a portable reference clock (state-of-the-art)

- Both can be done
- Option B is probably cheaper to implement for the industry
- Option B includes the full system
- Option B is relevant to billing

→ Perhaps some degree of automatisation could be helpful (e.g. automatic timestamping reference)

Measurements on site: Side benefit

Is the billing correct?

- Outside legal metrology in most Member States
- NB: Payment functionality consciously removed from MID draft before 2002
- Price declaration is regulated in most Member States

→ Not the focus, but problems would show to general inspection.

→ General inspection does not need tools: Consumers don't have them either.

No need for metrological R&D

Measurements on site: Side benefit

EV charging stations are much easier to check than other applications since consumers regularly disconnect
→ Nobody is disturbed
→ Checks are easy and efficient

Metrological problem is identical to other uses of active electrical energy meters
→ If something is acceptable for all other uses, it is also acceptable for EV charging applications

Principle of proportionality applies also to general inspection
→ Risk analysis

→ Target problems better: Tools for risk analysis based on past observations

Summary

Measurements in lab

- Aim:
  Make sure measurement function of product is good.

- Highly automated

- New metrology related needs:
  - Generator for disturbances
  - Reference for measurement with disturbances
  - Automatic reading (especially if no display)

Measurements on site

- Aim:
  Make sure measurements are good in real life.

- Relatively manual

- New metrology related needs:
  - Digital verification mark
  - Reference equipment
  - Calibration services of reference equipment
  - Standardisation for external devices (indirect measurement technique)
  - Automatic reference timestamping
  - Data analysis (target general inspection better)

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