**Electricity Meters IEC/MID**

Residential

ZxF100Ax/Cx

# E350 Series 2, 3-Phase

User Manual


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# Revision History

| Version | Date | Comments |
|---|---|---|
| a | 24.07.2009 | First edition. |
| b | 18.01.2010 | Example absolute value summation corrected, channel configuration table updated with OBIS codes and remarks, instantaneous power accuracy added, new section 2.4 "Radio Interference", description of power-up display corrected, range of CDS and NDS display durations corrected, description of error display changed, meter display list updated (without display text), description of optical interface enhanced, description of manufacturer specific mode C-C added, description of optical test outputs enhanced, minor formatting and text improvements. |
| c | 05.05.2010 | New display list items, Combined sum integrated in channel configuration (section 1.6); Summation modes updated, FW version presentation updated, supply control switch tamper added, More detailed explanation of supply control switch icon, table of required measuring times updated, display status messages added, error code and status flag explanations extended, addressability added, advice (restriction) for FW version <= M23 added, availability for supply control switch added. |
| d | 24.08.2010 | "Meter display list" corrected (voltage, current, frequency, power items); Explanation efficiency registers updated; Table Instantaneous Values updated; Display status messages updated; Meter tools added. |
| e, f | 06.09.2010 | Minor formatting and text improvements. |
| g | 16.10.2010 | Updating 1.8. Instantaneous values. |
| h | 09.12.2010 | Section 5.2.5 Display sequence entirely updated (main and service display). Declaration of conformity replaced. |
| k | 17.03.2011 | Note about restrictions for meters with firmware versions M21 to M23 added in section 1.2 "Purpose of use". Section 1.3 "Advice" deleted (integrated into note in section 1.2). |
| m | 01.06.2011 | Section 1.4 "Characteristic" expanded with remark about ZFF100 meters phase fail behaviour; Section 2.3 "Safety Instructions" expanded with remark, that PE must not be switched with supply control switch and only "useful" tool have to be used; Section 5.2.7 "Error Display" modified; Remark about module data added in section 5.2.9; Content of section 5.2.12 "Error descriptions E350 Series 1 and Series 2" moved partly into functional description and partly to section 6.2 "Error Codes": Safety information about cleaning added in section 6.1 and modified in section 7.2.; Terminology changes: breaker → disconnector, baud rate → transmission rate, baud → bps (bits per second); Minor formatting and text improvements. |
| n | 20.12.2011 | Section 1.6.3: Adapted to firmware version M25 (8 measurement channels)<br>Section 5.2.9: New display item: Supply control switch tamper counter. |
| p | 24.10.2012 | Adapted to firmware version M26 (DSMR 4.0):<br>“Introduction” updated.<br>Section 5.2.2 “Explanation of LCD Elements” updated.<br>Section 5.2.4 “Display Definitions” updated.<br>Section 5.2.5 “Display Sequence” entering and exiting “Service Display” updated.<br>Section 5.2.6 “Display Check” updated.<br>Section 5.2.9 “Meter Display List – Available Items with OBIS Codes” updated.<br>Section 5.4 “Optical Interface” updated (added blocking).<br>Section 5.5.5 “Readout Status Flag (C.5.0)” updated.<br>New section 5.5.4 “Display Status Flag (C.5.0)” added.<br>New section 5.6 “Password Lock-out” added.<br>Section 7.1.1 “Higher Register Resolution” updated. |
| q | 20.12.2012 | Section 7.1.2: Note about test time for register test for meters with firmware version M25.<br>Section 1.2: Note about restriction for meters with firmware version M25. |
| r | 31.01.2016 | Added “For indoor use only” notification in section *4.1 “Mounting the Meter”*. |

| | | |
|---|---|---|
| s | 05.07.2016 | Moved section *1 "Safety"* to the beginning of the document.<br>Updates section *2.7 "Instantaneous Values"*.<br>Updated section *5.2.9 "Meter Display List – Available Items with OBIS Codes"*.<br>Moved sections *5.5.3 "Readout Status Code (C.5.0)"* and *5.5.4 "Display Status Code (C.5.0)"* to the Functional Description.<br>Updated terminology (e.g. software changed to firmware; disconnector changed to supply control switch). |
| t | 23.08.2106 | Updated section *2.6.3 "Signal Processing"*. |

# Table of Contents

# Introduction

**Range of validity**

The present manual applies to the following E350 Series 2 meter versions:

**Three-phase four-wire network**

- **ZMF100AC** and **ZMF100AB** for active energy (import and export)
- **ZMF100CC** and **ZMF100CB** for active and reactive energy (import and export)

**Three-phase three-wire network**

- **ZFF100AC** and **ZFF100AB** for active energy (import and export)
- **ZFF100CC** and **ZFF100CB** for active and reactive energy (import and export).

For a detailed explanation of the type designation, see section 2.5.

Some features of the meter are only available in specific firmware versions. The firmware version can be seen during the start-up of the meter, or, if configured accordingly, on the display or by readout. In customer documentation, these items are marked with the numbers of the respective FW versions as a superscript note, e.g. for the number of channels: “10 (or 8 $^{[M24…M28]}$ or $^{[M21…M23]}$)”.

**Purpose**

The user manual contains all information required for meter applications for the intended purpose. This includes:

- Provision of knowledge concerning characteristics, construction and knowledge of meters
- Information regarding possible dangers, their consequences and measures to prevent any danger
- Details concerning the performance of all work throughout the service life of the meters (parameterisation, installation, commissioning, operation, maintenance, decommissioning and disposal)

**Target group**

The content of this user manual is intended for technically qualified personnel of energy supply companies, responsible for system planning, installation and commissioning, operation, maintenance, decommissioning and disposal of meters.

**Reference documents**

The technical data and functional description of the meters can be found in separate documents:

- D000027981 "E350 Series 2 ZxF100Ax/Cx 3-phase Technical Data"
- D000028645 "E350 Series 2 ZxF100Ax/Cx 3-phase Functional Description"

# 1 Safety

This section describes the safety information used in this manual, outlines the responsibilities and lists the safety instructions to be observed.

## 1.1 Safety Information

Attention is drawn to dangers and their level (severity and probability) in this user manual in the following way:

**Warning**
Used to indicate a dangerous situation that could cause bodily injury or death.

**Caution**
Used to indicate a situation/ action that could result in material damage or loss of data.

**Note**
Used to indicate general guidelines and other useful information.

All safety information also describes the type and source of the danger, its possible consequences and measures to counteract the danger.

## 1.2 Responsibilities

The owner of the meters is responsible that all persons engaged on work with meters:

1. Are competent and qualified in accordance with national regulations (see ISSA "Guideline for Assessing the Competence of Electrically Skilled Persons").
2. Have read and understood the relevant sections of the user manual.
3. Strictly observe the safety instructions (according to section *1.3*) and the operating information in the individual sections.

In particular, the owner of the meters bears responsibility

- for the protection of persons,
- prevention of material damage
- and the training of personnel.

Landis+Gyr AG provides training courses for this purpose on specific equipment; please contact the relevant agent, if interested.

## 1.3 Safety Instructions

The following safety instructions must be observed at all times:

- The meter connections must not be under voltage during installation or when opening. Contact with live parts is dangerous to life. The relevant main fuses should therefore be removed and kept in a safe place until the work is completed, so that other persons cannot replace them unnoticed.
- Local safety regulations must be observed.
- Protection earth connection must not be switched with the supply control switch.
- Only appropriate tools may be used. This means a screw driver has to have the correct size for the screws and the metallic part of a screw driver has to be insulated.
- The meters must be held securely during installation. They can cause injuries if dropped.
- Meters which have fallen, must not be installed, even if no damage is apparent, but must be returned for testing to the service and repair department responsible (or the manufacturer). Internal damage can result in functional disorders or short-circuits.
- The meters must on no account be cleaned with running water or with compressed air devices. Water penetrating can cause short-circuits.

## 1.4 Radio Interference

**Possible radio interference in residential environments**
This meter is normally a class B product. In combination with some communication modules, it can become a Class A product. In a domestic environment, this may then cause radio interference, in which case the user may be required to take adequate measures.

# 2 Description of Unit

## 2.1 General View

*Fig. 1.1 General view of meter (with GSM/GPRS Module)*

## 2.2 Purpose of Use

**Restrictions for meters with firmware versions M21 to M23:**
The meters may not be used in networks with significant disturbances in the frequency range of 2 kHz to 150 kHz since the intended operating conditions of the meters according to the harmonised standards EN50470-1 and EN50470-3 assume no significant noise currents and voltages in this frequency range.
Such significant disturbances occur for instance in large photovoltaic systems (influence of the inverters with high emissions of extreme harmonics) and can cause additional errors in the meters, even though the meters meet all applicable standards and regulations.

**Restrictions for meters with firmware versions M25:**

Please follow the required test times for the meter constant or dial test, mentioned in section 7.1.2. At switching on or off the load (between <0.5A and >1A) regularly every 20 minutes, an additional error of about 0.1% can occur. The deviation can be higher, if the load is switched more often. The meter complies with all specifications. It fulfils all the valid standards and regulations.

E350 Series 2 ZMF100 meters record active and reactive energy consumption in all 3-phase 4-wire networks. They are directly installed in the supply line by the energy supply company and are read regularly for billing purposes.

ZFF100 meters differ from ZMF meters in the type of measurement (Aron circuit for three-phase three-wire networks). Therefore, they are only equipped with 2 instead of 3 measuring elements.

The data is displayed on an LCD and is also available via optical interface and with a communication module via CS, PLC modem, GSM/GPRS modem or Ethernet. When provided with transmission contacts, the meters can also be used as transmission contact meters for telemetering. The rates can be controlled externally with control inputs (on the communication module).

With a communication module, the meters can also be used to record counting pulses of other physical media (e. g. water or gas volumes) or to directly transmit values recorded by other measuring devices.

Any other application of these meters is regarded as abuse.

## 2.3 Field of Application

**Basic series**

The basic version provides energy registers for tariffication, red pulse output LEDs for active and reactive energy, an optical interface for meter reading and an interface for various communication forms. This interface is protected against fraud and is independent of the module suppliers. The exchangeable communication module is situated outside the calibration liability. The functionality of this meter is suitable for smaller consumers, e.g. for households.

**Supply control switch (ZxF100xB only)**

The function of the supply control switch is customer specific and is defined by the communication module. Possible uses: anti-tampering (e.g. disconnection in case of tampering with magnets), load limitation (fuse control), remote disconnect (e.g. in case of change of tenant), prepayment. The status of the supply control switch is displayed on the meter, but the supply control switch is controlled by the communication module. If you need detailed information on the functionality of your supply control switch, please consult the user manual of the communication module installed.

**Extensions**

The basic series can be extended with various communication modules for additional functions and communications:

- Multi-rate import/export with external rate control
- S0 pulse output
- Communication via PLC, GSM/GPRS, or other media.

The meter functions which can be used in the system are defined by the module (e.g. a 2 rate module is not able to control 6 rates in the meter).

Therefore, meter and module together define the functionality range which can be used.

As the meter has a wide range of configuration possibilities, a specific behaviour can in some cases differ from the description below.

**Parameterisation**

The meters can be parameterised, i.e. specific parameters can be set with software, so that the meters can be supplied according to the specific wishes of the relevant utility.

Retroactive modification of the parameters is not possible.

The parameters stored in the meter are protected against unauthorised overwriting.

Details about parameter settings can be found in the functional description.

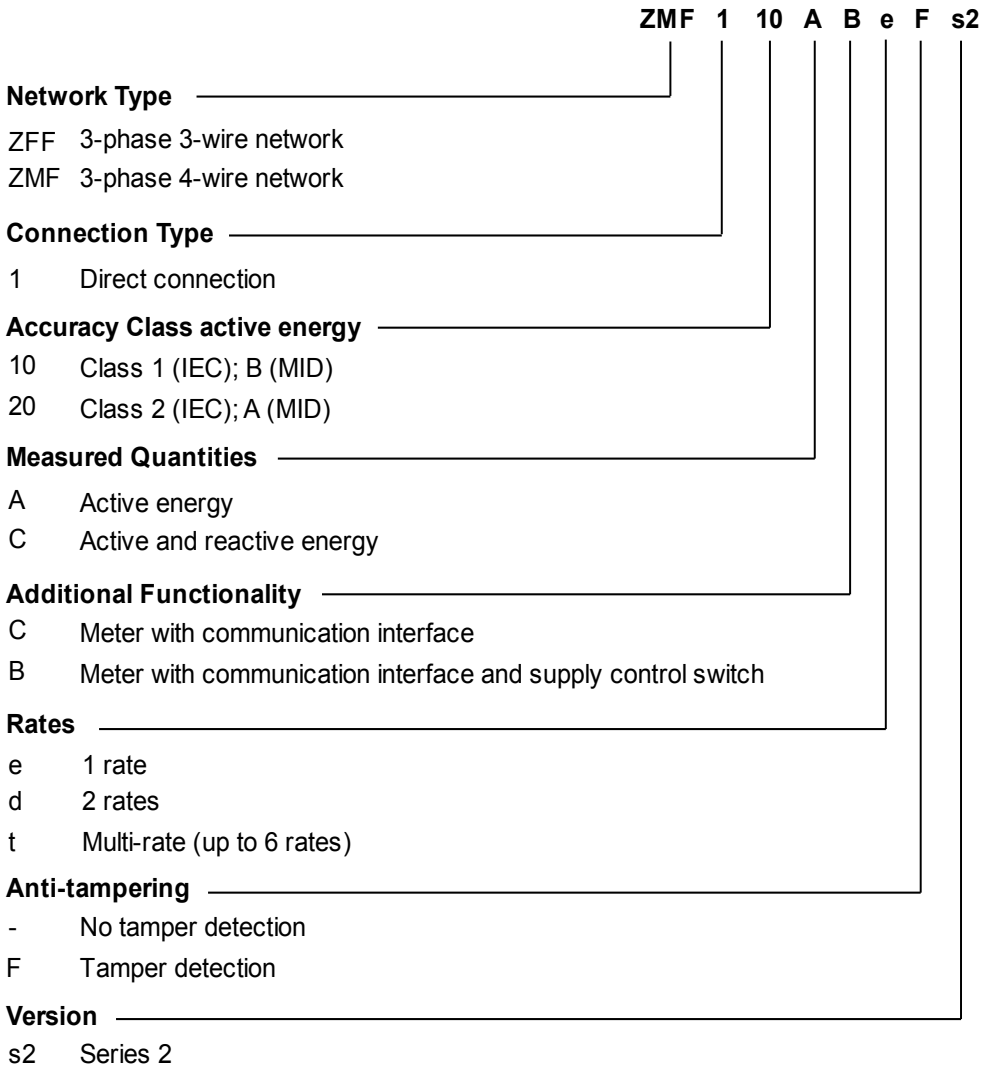
## 2.4 Characteristics

The meters have the following characteristics:

- Recording of active and reactive energy in all 4 quadrants (ZMF100Cx) or recording of active energy imported and exported (ZxF100Ax) with up to 6 rates
- Rate control performed via communication module
- Data display on LCD
- Measuring elements in DFS (Direct Field Sensor) technology with excellent measuring characteristics, including flat load curve, high stability and good protection against interference.
- Active energy measurement accuracy: Classes 1 and 2 (IEC62053-21) and MID accuracy classes A and B (EN50470-3)
- Reactive energy measurement accuracy: Class 2 (IEC62053-23)
- Correct measurement even with only one or two phases (for ZFF100 meters the correct measurement is only granted with missing phases L1 or L3, since L2 is the internal reference point, which must always be present)
- Wide range measurement from starting current to maximum current
- Serial interface with optical input/output for automatic readout of data on the spot and for service functions
- AMR interface (connection to communication module) for meter reading and tariff control according to IEC 62056-21
- Storage of event information (e.g. power outages)
- Installation aids (e.g. phase voltages and direction of energy)
  - Presence of phase voltages (voltage values are displayed)
  - Visual output (no-load indicator) on LCD
  - Display of energy direction
  - Power indication

## 2.5 Type Designation




The "e" for the 1-rate version can be skipped in some versions.

The communication module is not part of this type designation, since it is a complete unit in itself. Users can change it without opening the calibration seal.

## 2.6 Measuring Principle

### 2.6.1 Overview

**Inputs**

The main meter inputs are:

- Phase connection (L1, L2, L3) and neutral for
  - energy measurement
  - three-phase power supply of the meter
  - PLC communication with communication modules (all phases prepared)
- Display button
- Supply control switch button (only if meter equipped with supply control switch)

**Outputs**

The main meter outputs (partly also inputs) are:

- LCD to display measured values and the corresponding OBIS code
- Pulse output LEDs (red, one for active and one for reactive energy)
- Optical interface for automatic data readout on site by means of a suitable PDA (also input)
- Secured AMR Interface for automatic data readout through a communication module, e.g. E35C module, with a PLC, GSM/GPRS, Ethernet or other medium (also input).

**Power supply**

The supply voltage for the meter electronics is taken from the three-phase system. A voltage monitor guarantees a safety data storage in the event of a mains voltage failure and a correct start-up after the return of the voltage.

**Memory**

A non-volatile memory (EEPROM) contains the parameter set of the meter and secures the stored measurements against loss due to power failure.

### 2.6.2 Signal Generation

The three measuring elements, DFS (Direct Field Sensor), register the phase currents with the magnetic field of the current loops and the phase voltages over a resistor divider. The analog/digital converters transform both signals into digital voltage and current data. This data is then multiplied by a digital multiplier to produce an energy proportional value. The resulting value is fed into the microprocessor, which adds the value to the corresponding values of the other phases and the sum is then transferred into the corresponding energy registers (rate-dependent).

The microprocessor generates pulses for the pulse output LEDs from the digital sum to the meter constant R.

### 2.6.3 Signal Processing

The meter records active and reactive energy and can distinguish between energy import and export in up to 6 rates (depending on configuration).

**Calibration**

Calibration data is stored during the final testing of the meter.

**Start detection**

The microprocessor compares the measured power with the minimum starting power. The signals are only passed on for summation if the minimum starting power is exceeded.

**Measured quantities**

The following energy values can be measured and stored in the registers:

- Active energy A
- Reactive energy R
- Apparent energy S

The signals +A and +R are formed by summation for *imported* measured active and reactive energy. The signals –A and –R are formed by summation for *exported* measured active and reactive energy. The combined totals are the sum of the absolute values of +A and –A or +R and –R.

| | |
|---|---|
| Energy type: | kWh, kvarh or kvah |
| Direction: | Import, export, ± reactive |
| Source: | Individual phase, summed, etc. |
| Instantaneous Values: | Voltage, current, frequency, power factor, etc. |

**Measurement channels**

There are 10 (or 8 [M24…M28] or 6 [M21…M23]) independent measurement channels. One of the measured quantities can be assigned to each of this register.

**Energy registers**

In firmware version M29, the measurement channels 1 to 6 have 6 rated registers and 1 total each, channels 7 and 8 have 4 rated registers and 1 total each, channels 9 and 10 have only 1 total register. 54 registers are therefore available in total.

In firmware version M27, the measurement channels 1 to 8 have 4 rated registers and 1 total each, channel 9 and 10 have only 1 total register. 34 registers are therefore available in total.

All registers work internally with 9 digits. The internal magnitude is Wh (Watt-Hours). They cannot be reset. At 999999999, a rollover to 0 takes place. The display and readout formats vary from the internal format.

**Rates**

The meter is designed for up to 6 rates. The assignment of the rate registers is done by means of parameterisation and is shown on the faceplate.

Rate control is performed by the external module.

**Rate control**

With up to 2 rates, the rate switching is operated by the communication module directly or by control inputs. The rate switching for more than 2 rates can be operated only by the communication module.

**Summation methods**

Summation can take place in different ways:

**Summation by vectors +A/–A**

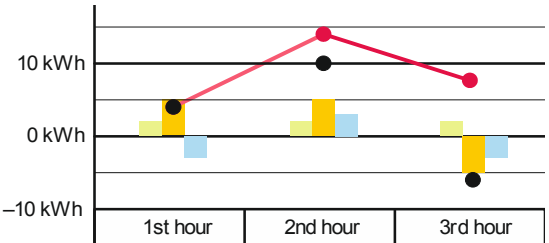
"Ferraris mode":
As in Ferraris meters, the meter summates the values of the individual phases taking the sign into account. With differing signs (energy directions)

the sum corresponds to the difference between the positive and negative values as shown in the figure below.

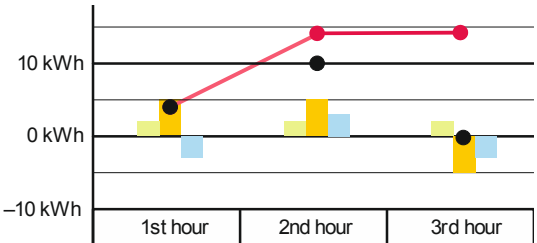
If the vectorial sum of the three vectors $A_{L1}$, $A_{L2}$, $A_{L3}$ is positive, then active energy is imported (+A).

If the vectorial summation of all three vectors $A_{L1}$, $A_{L2}$, $A_{L3}$ is negative, then active energy is exported (–A). See following figure.

The same applies to reactive energy. A distinction of the different quadrants is also possible.




| | 1st hour | 2nd hour | 3rd hour |
|---|---|---|---|
| L1 | 2 kWh | 2 kWh | 2 kWh |
| L2 | 5 kWh | 5 kWh | -5 kWh |
| L3 | -3 kWh | 3 kWh | -3 kWh |
| Sum | 4 kWh | 10 kWh | -6 kWh |
| Cum sum | 4 kWh | 14 kWh | 8 kWh |




| | 1st hour | 2nd hour | 3rd hour |
|---|---|---|---|
| L1 | 2 kWh | 2 kWh | 2 kWh |
| L2 | 5 kWh | 5 kWh | -5 kWh |
| L3 | -3 kWh | 3 kWh | -3 kWh |
| Sum | 4 kWh | 10 kWh | 0 kWh |
| Cum sum | 4 kWh | 14 kWh | 14 kWh |

*Fig. 1.2 Example vectorial summation active energy (left ±A, right: only +A)*

**Summation by quantity (magnitude) Σ+A/Σ–A**

Summation by quantity separates the positive from the negative values of the individual phases. Measured quantity Σ+A therefore only includes the positive values (+$A_1$ and +$A_3$ in example 1), measured quantity Σ–A only the negative values (–$A_2$ in example 1), provided any are present.

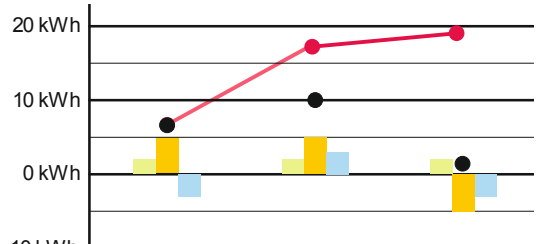
In case of a connection error, the meter measures correctly the real energy consumption. It also measures a real export in the correct way.

For active energy import (+A) only positive magnitudes of $A_{L1}$, $A_{L2}$, $A_{L3}$ are counted. Negative magnitudes of $A_{L1}$, $A_{L2}$, $A_{L3}$ are discarded.

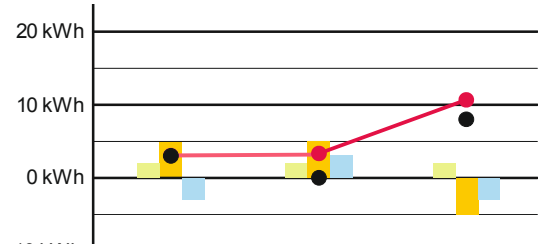
For active energy export (–A) only negative magnitudes of $A_{L1}$, $A_{L2}$, $A_{L3}$ are counted. Positive magnitudes of $A_{L1}$, $A_{L2}$, $A_{L3}$ are discarded.

The same applies to reactive energy. A distinction of the different quadrants is also possible.

The following examples show the magnitude summation for active energy import (left) and for active energy export (right).




| | 1st hour | 2nd hour | 3rd hour |
|---|---|---|---|
| L1 | 2 kWh | 2 kWh | 2 kWh |
| L2 | 5 kWh | 5 kWh | -5 kWh |
| L3 | -3 kWh | 3 kWh | -3 kWh |
| Sum | 7 kWh | 10 kWh | 2 kWh |
| Cum sum | 7 kWh | 17 kWh | 19 kWh |




| | 1st hour | 2nd hour | 3rd hour |
|---|---|---|---|
| L1 | 2 kWh | 2 kWh | 2 kWh |
| L2 | 5 kWh | 5 kWh | -5 kWh |
| L3 | -3 kWh | 3 kWh | -3 kWh |
| Sum | 3 kWh | 0 kWh | 8 kWh |
| Cum sum | 3 kWh | 3 kWh | 11 kWh |

*Fig. 1.3 Example magnitude summation active energy (left: +A, right –A)*

**Summation by single quantities Σ |A Lx|**

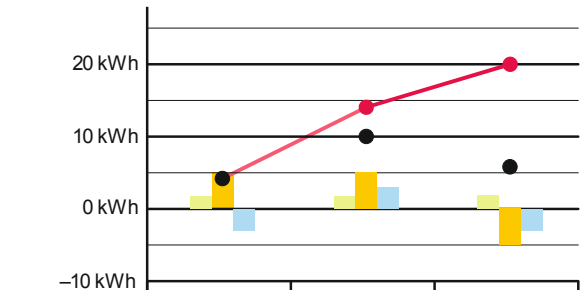
This method summates the quantity of the individual phases independent of the energy direction. A connection error – however – has no effect on the result of measurement.

But if there is a real export in one phase, this method leads to incorrect measurement results.

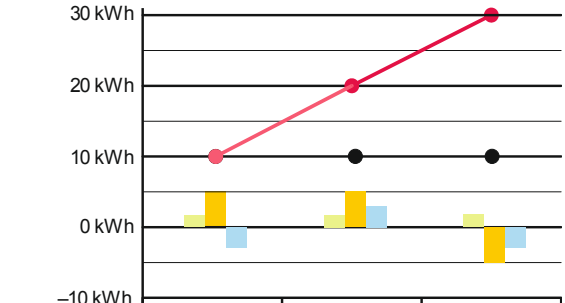
**Summation by Absolute value |+A| + |–A|**

With this method the meter adds exported and imported energy. This method only makes sense if the utility is sure there is no energy export. This method is available in vectorial and magnitude summation mode.

The absolute magnitude summation can be used as an anti-tampering measure. Here negative magnitudes of $A_{L1}$, $A_{L2}$, $A_{L3}$ are added to the positive magnitudes of $A_{L1}$, $A_{L2}$, $A_{L3}$. See example below.




| | 1st hour | 2nd hour | 3rd hour |
|---|---|---|---|
| L1 | 2 kWh | 2 kWh | 2 kWh |
| L2 | 5 kWh | 5 kWh | -5 kWh |
| L3 | -3 kWh | 3 kWh | -3 kWh |
| Sum | 4 kWh | 10 kWh | 6 kWh |
| Cum sum | 4 kWh | 14 kWh | 20 kWh |




| | 1st hour | 2nd hour | 3rd hour |
|---|---|---|---|
| L1 | 2 kWh | 2 kWh | 2 kWh |
| L2 | 5 kWh | 5 kWh | -5 kWh |
| L3 | -3 kWh | 3 kWh | -3 kWh |
| Sum | 10 kWh | 10 kWh | 10 kWh |
| Cum sum | 10 kWh | 20 kWh | 30 kWh |

*Fig. 1.4 Example absolute value summation active energy (left: combined sum, vectorial, always positive; right: combined sum, magnitude, always positive per phase)*

**Subtraction |+A| – |–A|**

With this method the meter subtracts an exported energy from the imported. It cannot detect a connection error.

**Use of vectorial and magnitude mode**
ZFF meters must work in vectorial mode – we do not have energy values for each phase (3 phases and only 2 measurement systems).
For ZMF, most of the customers, use vectorial mode too. Only some customers use magnitude mode, mainly for tamper prevention.

**F-circuit**
With F-circuit (Aron connection), only the sums of +R and -R are calculated.

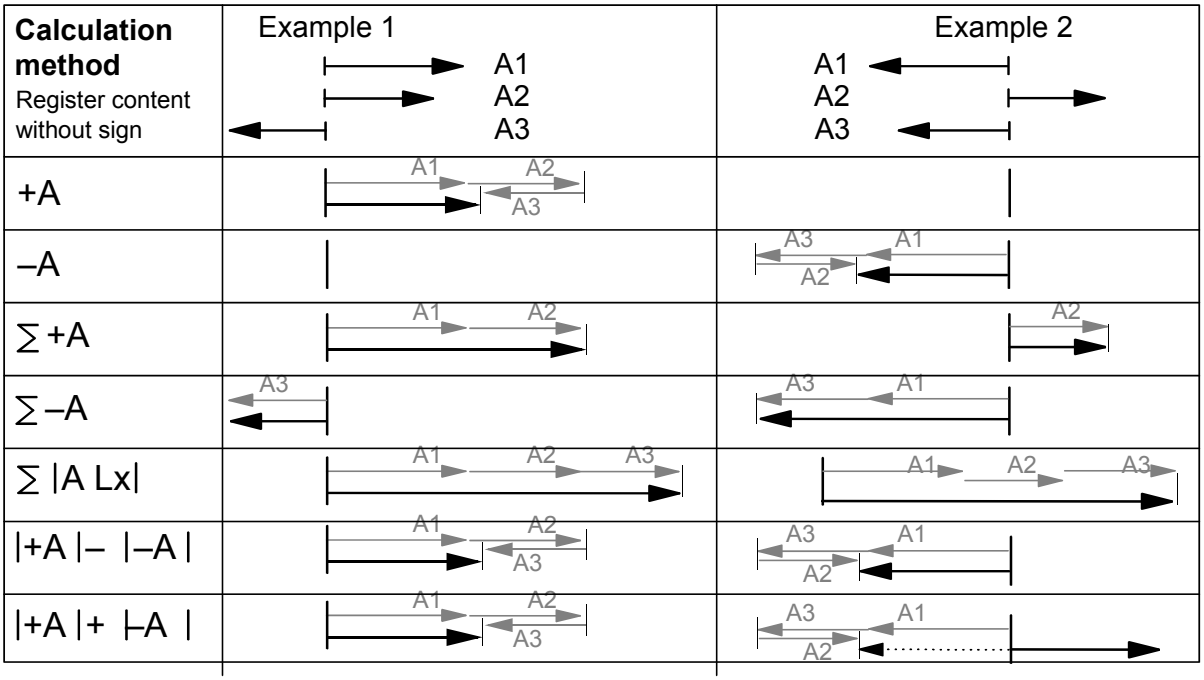



*Fig. 1.5 E350 – Phase summation samples*

**Further measurement quantities**

In addition to the usual quantities, the measured quantities active, reactive and apparent energy have further possibilities such as:

| | |
|---|---|
| Subtraction of reactive energy | \|+R\| – \|–R\| |
| Addition of reactive energy | \|+R\| + \|–R\| |
| Quadrants | +Ai, +Ac, –Ai, –Ac |
| etc. | |

**Further samples**

More samples and applications are shown in the functional description.

**4-quadrant measurement**

The reactive energy (±Rc, ±Ri) is allocated to the 4 quadrants as follows:

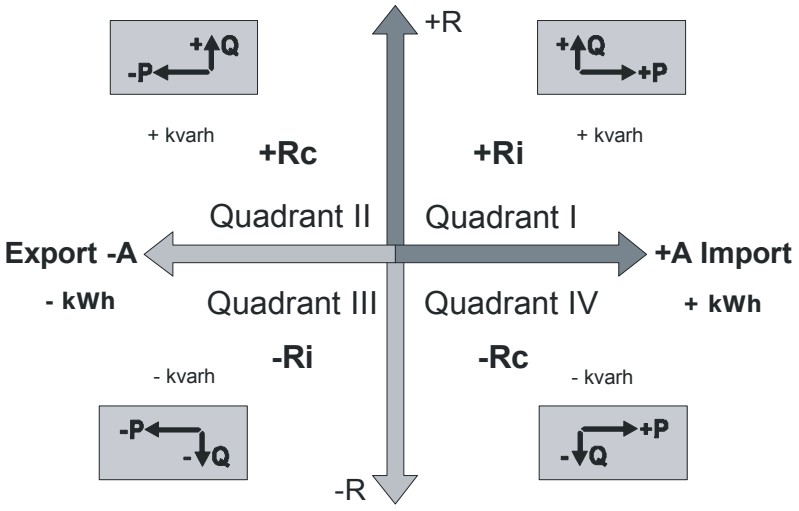



*Fig. 1.6 4-quadrant measurement (only inZxF100**C**x meters)*

The reactive energies of the individual phases can be allocated to the 4 quadrants in the same way.

**Channel configuration** A measured quantity can be assigned by parameterisation to each of the 10 (8 [M57])available channels. The following table shows some of the most common measured quantities used:

| Value | OBIS | Direction | Quadrant(s) | Phase | Unit | Remarks |
|---|---|---|---|---|---|---|
| +A | 1.8.0 | Import | I + IV | Sum | kWh | 1 |
| +A | 1.8.0 | Import | I + IV | L1 + L2 + L3 | kWh | 2 |
| –A | 2.8.0 | Export | II + III | Sum | kWh | |
| \|+A\| + \|–A\| | 15.8.0 | Combined sum | I + II + III + IV | Sum | kWh | 3 |
| +R | 3.8.0 | Import | I + II | Sum | kvarh | |
| +R | 5.8.0 | Import | I | Sum | kvarh | |
| +R | 6.8.0 | Import | II | Sum | kvarh | |
| –R | 4.8.0 | Export | III + IV | Sum | kvarh | |

Remark 1: by vector (Ferraris mode)
Remark 2: by signal values (magnitude summation)
Remark 3: always positive registration (anti-tampering measure)
Sum = vectorial sum of $A_{Li}$ or $R_{Li}$
L1 + L2 + L3 = magnitude sum
More configuration possibilities can be found in the functional description.

## 2.7 Instantaneous Values

Instantaneous values are updated every second.

The following instantaneous values are available:

| Measured value | Resolution | Start value | Max. value |
|---|---|---|---|
| Voltages L1, L2, L3 | 1 V | 170 V | 440 V |
| Currents I1, I2, I3 | 0.01 A | 0.2 A | 120 A |
| Frequency | 0.1 Hz | 47 Hz | 53 Hz |
| Power Factor | 0.1 | -1 | 1 |
| Power | 0.01 kW or 0.001 kW [1)] | I > 0.075 $I_b$ | $I_{max}$ |
| Signed Instantaneous Reactive Power QI+QII+QIII+QIV [2)] | | | |
| Instantaneous Reactive Import Power +R QI+QII [2)] | | | |
| Instantaneous Reactive Export Power –R QIII+QIV [2)] | | | |

| Measured value | Resolution | Start value | Max. value |
|---|---|---|---|
| Instantaneous Apparent Import Power +VA [2)] | | | |
| Instantaneous Apparent Export Power -VA [2)] | | | |
| Instantaneous Neutral Current [2) 3)] | | | |
| Instantaneous Current ~ Sum of I1, I2, I3 [2) 3)] | | | |
| Instantaneous U1-I1 angle [2)] | 1° for angles between U - I | | |
| Instantaneous U2-I2 angle [2) 3)] | 1° for angles between U - I | | |
| Instantaneous U3-I3 angle [2)] | 1° for angles between U - I | | |
| Instantaneous U1-U2 angle [2)] | 30° for angles between U – U | | |
| Instantaneous U1-U3 angle [2) 3)] | 30° for angles between U – U | | |
| Instantaneous U2-U3 angle [2)] | 30° for angles between U – U | | |

[1)] *Depending on meter configuration (from FW version M27 onwards).*
[2)] *From FW version M29 onwards.*
[3)] *Not applicable to ZFF 3-phase 3-wire meters.*

If no value is available, "---" can be shown (e.g. if in no-load or value below start value).

## 2.8 Anti-Tampering and Tamper Prevention

E350 meters feature four optional anti-tampering functions:

- Detection of terminal cover opening
- Detection of DC magnetic field
- Sealable access lock to voltage connections
- Detection of supply control switch tampering (supply control switch meters only)

## 2.9 Supply Control Switch

The ZxF100xB version of the E350 meter is equipped with a supply control switch, which is controlled via the communication module. Various functions can be implemented:

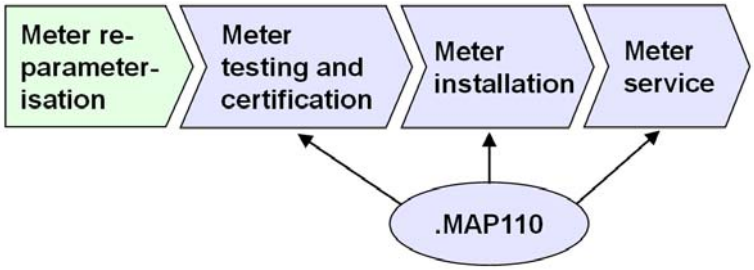
- disconnection if credit has been used up
- change to minimum power mode if credit has been used up
- disconnection, if maximum power has been exceeded over a specified time
- others

The supply control switch can either be controlled via the communication module or manually with the supply control switch button on the meter's terminal cover (if parameterised accordingly, see also section 5.1.2 "Supply Control Switch Button").

## 2.10 Software Tools

Landis+Gyr meters are provided with optimum support by suitable software tools during all phases of their life cycle:

- The Landis+Gyr .MAP110 service tool for customers is used for the test and installation of meters and for servicing work on the spot.




For the list of functions of .MAP110, please see .MAP documentation and the E350 Series 2 Functional Description.

# 3 Mechanical Description

## 3.1 Housing

The internal construction of the meter will not be described here, as the meter is sealed after calibration and verification.

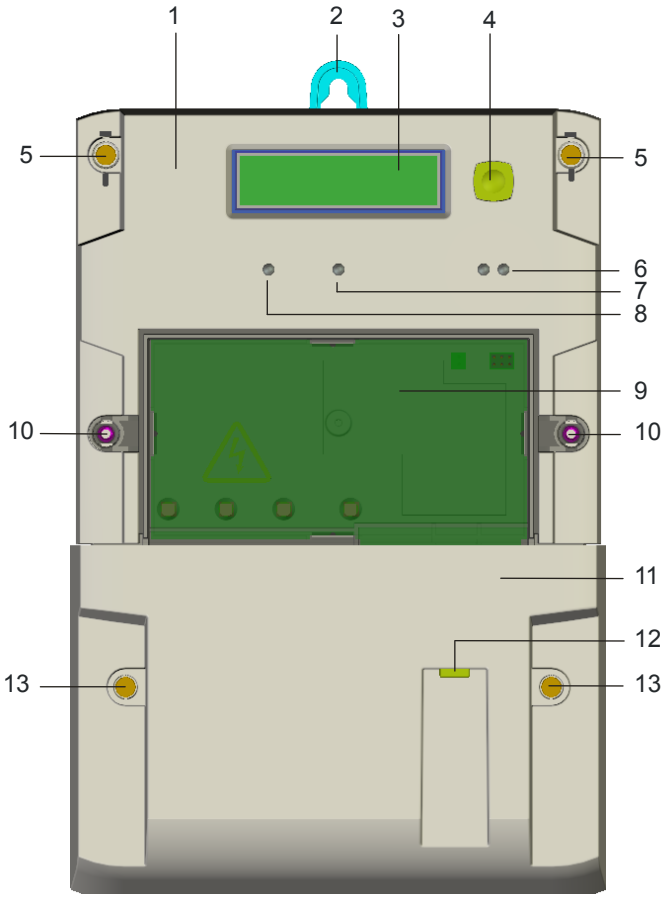



*Fig. 3.1 Front view of meter*

*1 Front cover (faceplate with laser marking, for details see Fig. 3.2)*
*2 Suspension hanger (not inserted for covered mounting)*
*3 LCD*
*4 Display button*
*5 Screw with sealing point (manufacturer or verification seal)*
*6 Optical interface*
*7 Pulse output LED active energy (red)*
*8 Pulse output LED reactive energy (red)*
*9 Communication module compartment*
*10 Screw with sealing point (manufacturer or utility seal)*
*11 Terminal cover*
*12 Supply control switch button*
*13 Screw with sealing point (utility seal)*

A terminal block with all connecting terminals is located under the terminal cover. On the terminal cover, two sealing points for utility seals prevent unauthorised access to the phase connections and therefore help to avoid unrecorded power consumption.

## 3.2 Faceplate

The faceplate (laser marking on front cover) shows customer specific meter information.

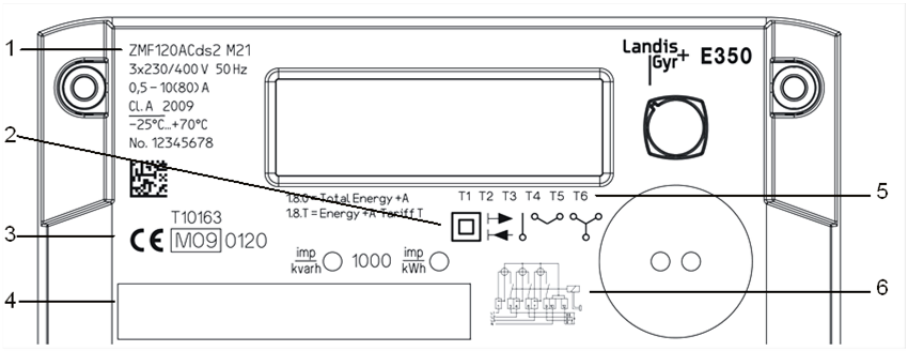



*Fig. 3.2 Basic layout of faceplate*

*1 Meter data*
*2 Double protection insulation symbol*
*3 Approval symbol, CE conformity symbol*
*4 Customer No. / Barcode / Ownership designation*
*5 Active rate*
*6 Connection diagram*

The display button and the display are fully described in section 5.

## 3.3 Connection Diagrams (examples)

**Where to find relevant diagrams**
The diagrams relevant for the installation are shown on the meter's faceplate or specified otherwise (e.g. inserted in the terminal cover).

**ZMF100AC/CC, ZMF100AB/CB**

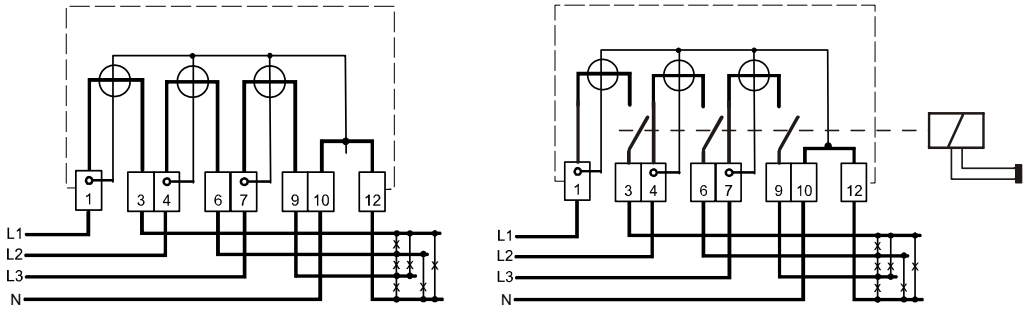



*Fig. 3.3 Connection diagram ZMF100xC (left, M-Connection) and ZMF100xB (right, with supply control switch)*

**ZFF100AC/CC, ZFF100AB/CB**

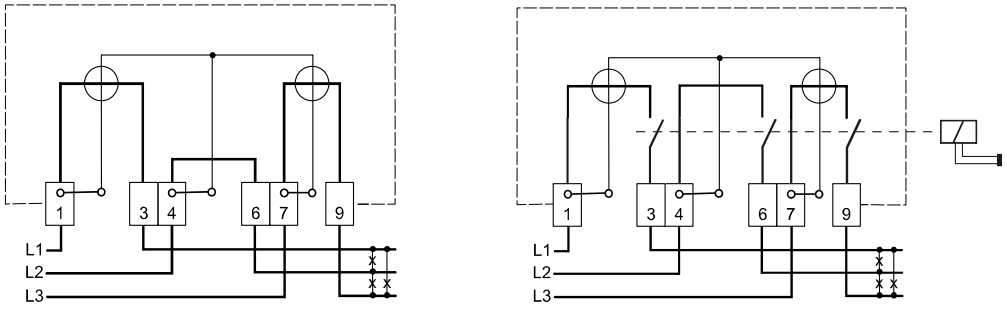



*Fig. 3.4 Connection diagram ZFF100xC (left, Aron connection), ZFF100xB (right, with supply control switch)*

## 3.4 Dimensions

The meter is either available with a standard terminal cover (see Fig. 3.5) or with an extended terminal cover (see Fig. 3.6).

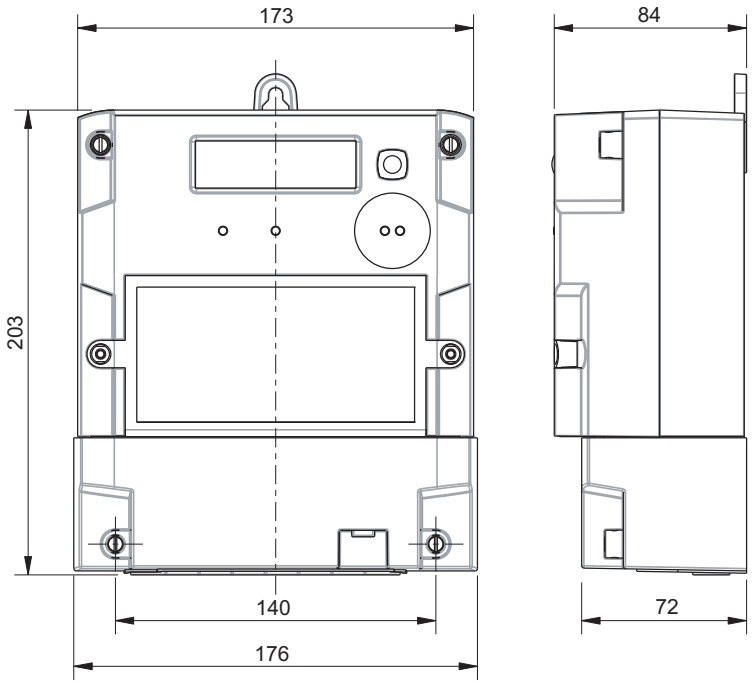



*Fig. 3.5 Meter dimensions (version with short terminal cover)*

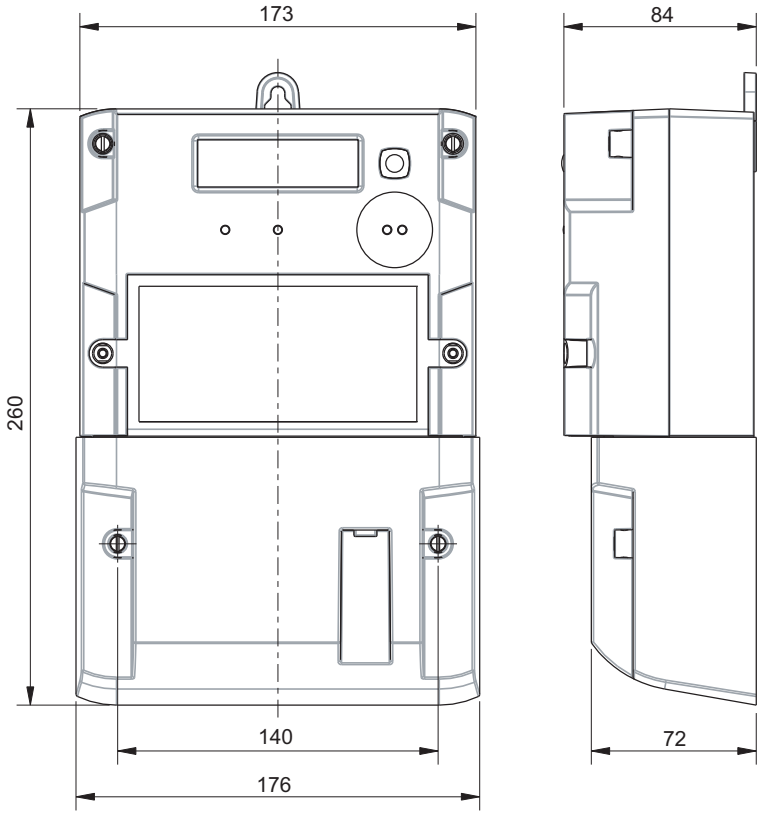



*Fig. 3.6 Meter dimensions (version with 60 mm terminal cover)*

The meter with extended terminal cover offers increased safety since the phase connecting wires are protected under the terminal cover.

The suspension triangles are identical in both terminal covers. They comply with DIN standards.

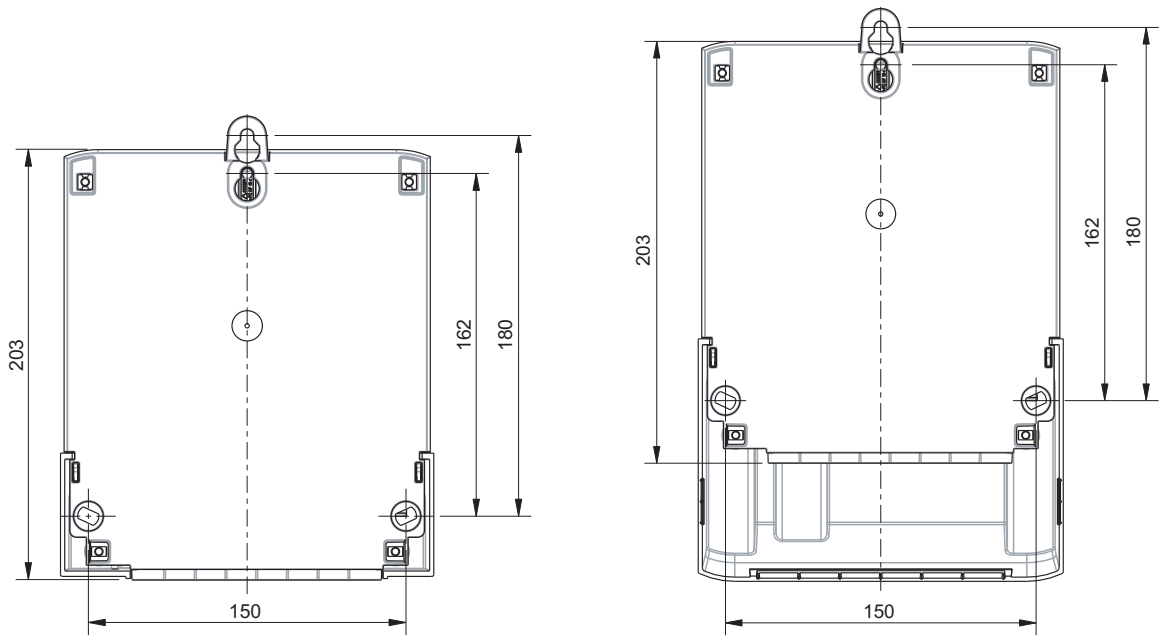



*Fig. 3.7 Meter rear view (left with standard terminal cover, right with extended terminal cover)*

Terminals are available with an opening diameter of 8.5 mm and 9.5 mm.

Terminals with opening diameter of 8.5 mm and 9.5 mm have the same position on the terminal block.

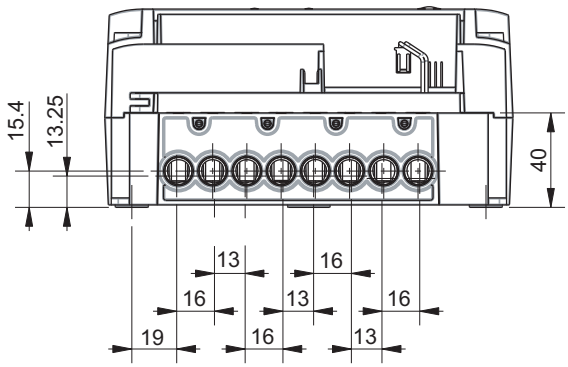



*Fig. 3.8 Terminal layout and dimensions*

# 4 Installation/Uninstallation

## 4.1 Mounting the Meter

**This meter is intended for indoor use only**

In cases where an outdoor installation is unavoidable, care must be taken to ensure the meter is installed within a suitable enclosure to maintain the operating environment in accordance with the meter specification. Such enclosures must be securely sealed to avoid the risk of meter damage as a consequence of exposure to the external environment including (but not limited to) extreme temperatures, humidity and insect ingress.

The meter should be mounted as follows on the meter board or similar device provided for this purpose (see also section 3.4 "Dimensions"):

1. Find the correct position for the meter. Ensure there are no wires underneath the holes to be drilled.
2. Define the desired form of fixing (open or covered meter mounting).
3. Ensure with a phase tester or universal measuring instrument that the connecting wires are not live.

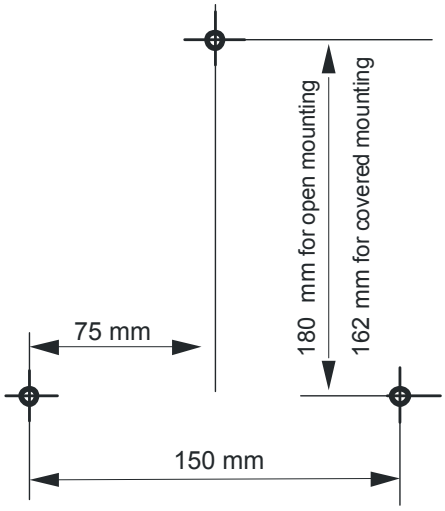



*Fig. 4.1 Drilling plan*

4. Mark the three fixing points (suspension triangle as shown in the drilling plan Fig. 4.1) on the mounting surface provided.
5. Drill the three holes.
6. Unscrew the meter terminal cover.
7. For open meter mounting insert the meter suspension eyelet – this is supplied in the terminal cover – into the corresponding opening at the rear side of the meter until the suspension eyelet engages (see Fig. 4.2).

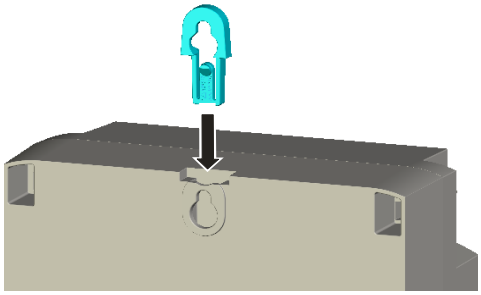


*Fig. 4.2 Meter suspension eyelet*

8. Fit the meter with 3 fixing screws on the mounting surface provided.

## 4.2 Connecting the Meter

**Remove main fuses before connecting**
The connecting wires at the place of installation must not be live when fitting the meter. Touching live parts is dangerous to life. Remove the corresponding main fuses and keep them in a safe place until work is completed, so that they cannot be replaced by anyone unnoticed.

**Provide overcurrent protection**
For ZxF100xB meters: As the supply control switch is not equipped with a thermal and/or short circuit protection device, it needs to be protected with an external fuse or overload switch.
For ZxF100xC meters: As the meter has no internal overcurrent protection and no method of disconnection from the mains, this must be provided by the end installation.

### Connecting the phase connection lines

1. Shorten the phase connecting wires to the required length and then strip them.
2. Insert the phase connecting wires into the corresponding terminals (the terminals are numbered as shown in the connection diagram) and tighten the terminal screws firmly (max. torque 3 Nm).

It is recommended to identify the beginning and end of the relevant conductors with a suitable test unit (e.g. buzzer) to ensure that the right consumer is connected to the meter output.

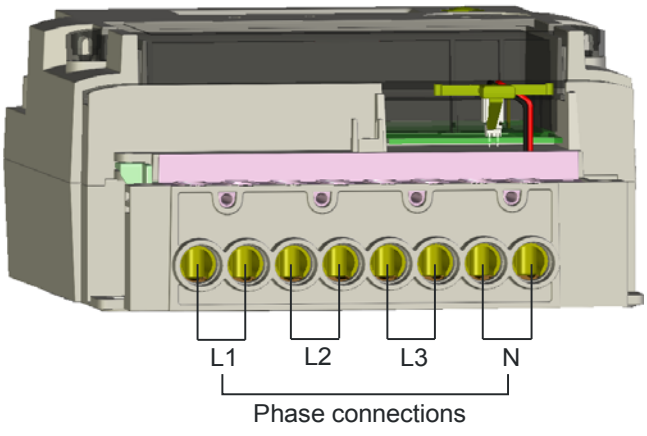



*Fig. 4.3 Meter connections*

With small conductor cross-sections (e.g. 4 $mm^2$), the connecting line must be placed in the indentation (stamping) of the current loops so that it cannot shift sideways when tightening the terminal screws. Ensure that the connecting line remains in the indentation when tightening.

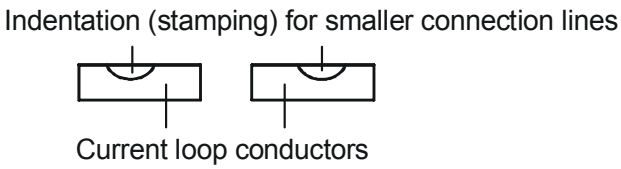



*Fig. 4.4 Cross-section through current loop conductor*

**Insufficiently tightened screws**
Insufficiently tightened screws of the connections can lead to increased power losses at the terminals and therefore to undesirable heating. A contact resistance of 1 mΩ causes a power loss of 6.4 W at 80 A!

**Insulate to correct length**
Touching live parts is dangerous to life. Shorten the stripped part of the connecting wire, if bare wire is visible above the terminal edge.

**Do not withdraw connecting wires with closed terminals**
Never withdraw connecting wires with the terminal closed, since this could damage the terminal.

## 4.3 Checking the Connections

Before putting the meter into operation check (and correct, if necessary) the following points to ensure a correct connection:

1. Has the correct meter (identification number) been installed at the measuring point of the relevant consumer?
2. Is the calibration connection closed (sealable sliding piece inserted and sealed)?
3. Are all screws for the phase and neutral connections tightened well?
4. Are all inputs and outputs connected correctly? The house connection or consumer fuse wires must be present at the input (terminals 1, 4, 7), those of the meter to the consumer at the output (terminals 3, 6, 9).
5. Is the neutral conductor connected to terminals 10 and 12 (not applicable to Aron connected ZFF meters)? Interchanging of a phase with the neutral could destroy the meter.

Mount the terminal cover after a successful check of the connections, tighten its screws and seal it.

## 4.4 Commissioning and Functional Check

**Do not touch live parts**
The main fuses must be inserted to put the meter into operation and for the functional check. Without terminal cover there is a danger of contact with the terminals. Touching live parts is a danger to life.

The installed meter should be put into service and checked as follows:

1. Insert the corresponding main fuses. The meter is on.
2. Check whether the display appears correctly (no error message) and with no load connected that the no-load indicators are constantly on.
3. Connect a load and check whether the no-load indicator for active energy disappears.
4. Check whether the supply control switch (if present) works according to the functionality specified for your application.

## 4.5 Disconnecting the Meter

**Remove main fuses before disconnecting**
The connecting wires at the place of installation must not be live when removing the meter. Touching live parts is dangerous to life. The corresponding main fuses should be removed and kept in a safe place until work is completed, so that they cannot be replaced by anyone unnoticed.

For ZxF100xB: **Do not use the supply control switch as a main switch for disconnecting purposes!** The meter remains connected to the mains!

Remove the meter from the network as follows:

1. Switch off the voltage. The display goes off.
2. Remove the seal at the terminal cover.
3. Release and remove the terminal cover.
4. Ensure with a phase checker that the connecting wires have no voltage. If there is voltage, remove the main fuses.
5. Remove the connecting wires of the communication module, if available.
6. Loosen the terminal screws of the phase and neutral connecting wires with a suitable screwdriver and withdraw the wires from the terminals.
7. Fit a substitute meter as described in section 4.2 "Connecting the Meter" and the following sections, if necessary.

# 5 Operation

## 5.1 Control Elements

E350 meters have a display button on the front cover and a supply control switch button on the terminal cover, if the meter is equipped with a supply control switch.

Data acquisition is either made by reading the display or automatic readout via the optical interface. For this purpose, the optical head is placed on the marked position on the front cover of the meter and readout is performed with a PDA (refer to section 5.5 "Data Readout").

### 5.1.1 Display Button

The display button is located on the front cover on the right of the LCD.

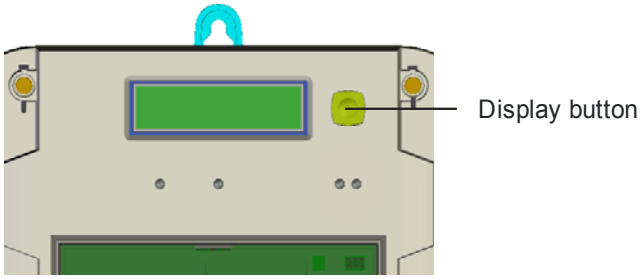



*Fig. 5.1 Display button*

By pressing the display button, the display mode or the displayed value can be changed (see section 5.2.4 "Display Definitions").

### 5.1.2 Supply Control Switch Button

The supply control switch button (option) is located on the terminal cover.

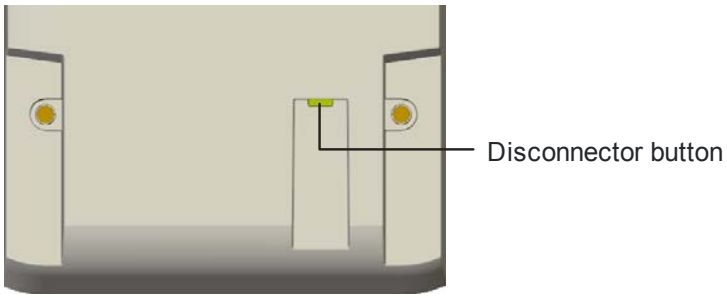



*Fig. 5.2 Supply control switch button*

If the supply control switch button is pressed, the supply control switch opens and/or closes depending on parameterisation, i.e. a closed supply control switch can always be opened with the supply control switch button whereas closing an open supply control switch needs an additional permission from the meter.

## 5.2 Liquid Crystal Display (LCD)

### 5.2.1 Basic Layout

The basic layout shows all indication possibilities of the LCD.

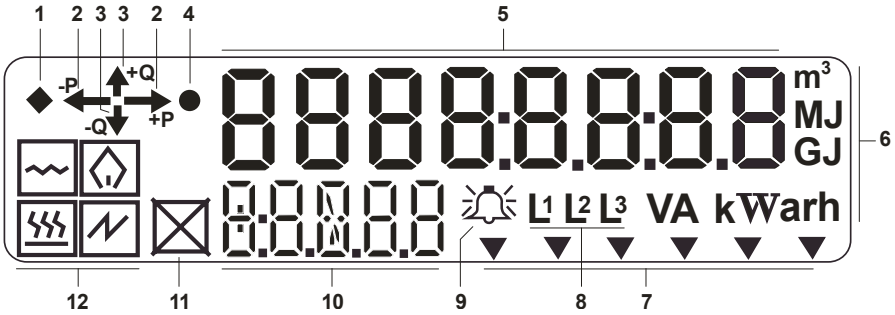



*Fig. 5.3 Basic layout of LCD*

*1 Reactive no-load indication*
*2 Active energy direction indication (+P: import, -P: export)*
*3 Reactive energy direction indication (+Q: import, -Q: export)*
*4 Active no-load indication*
*5 Value field (eight 7 segment digits)*
*6 Unit indications*
*7 6 arrow symbols for rate indication*
*8 Phase voltage indications (flashing if rotating field reversed)*
*9 Tamper alert indicator*
*10 Index field (five digits with 7, 8 or 11 segments)*
*11 Disconnect icon*
*12 Media icons (water, heating, gas, electricity)*

### 5.2.2 Explanation of LCD Elements

For the purpose of this document, flashing LCD segments will be shown in grey colour.

**Value field**

Up to 8-digit values can be displayed in the value field. The 7 segment digits are able to display numeric data or limited alpha numeric text. Additional decimal points and colons enhance the 7 segment digits. This allows the representation of values with decimal places as well as date and time formats.

**Unit indications**

VA kWarh $m^3$ MJ GJ

With the unit indications below and on the right side of the value field the following units can be displayed: V, A, kWh, kvah, kvarh, kW, kva, kvar, $m^3$, MJ, GJ. The unit displayed indicates which register is being viewed.

**Active energy direction indication**

Always indicates the sum of the three phases:

| | |
|---|---|
|  | positive active energy direction (imported from power company) |
|  | negative active energy direction (exported to power company) |
|  | positive active energy direction, but negative active energy direction of individual phases (arrow -P flashes); only in three-phase four-wire circuit (only with magnitude summation). |
|  | negative active energy direction, but positive active energy direction of individual phases (arrow +P flashes); only in three-phase four-wire circuit (only with magnitude summation) |

**Reactive energy direction indication**

Always indicates the sum of the three phases:

| | |
|---|---|
|  | positive reactive energy direction |
|  | negative reactive energy direction |
|  | positive reactive energy direction, but negative reactive energy direction of individual phases (arrow -Q flashes); only in three-phase four-wire circuit (only with magnitude summation) |
|  | negative reactive energy direction, but positive reactive energy direction of individual phases (arrow +Q flashes); only in three-phase four-wire circuit (only with magnitude summation) |

**Quadrant**

Indicates in which quadrant the present measurement is made:

| | | | |
|---|---|---|---|
|  | 1st quadrant |  | 3rd quadrant |
|  | 2nd quadrant |  | 4th quadrant |

**Reactive no-load indication**

◆

The reactive no-load indication (a diamond) shows that the kvarh registers have entered anti-creep mode. No energy is flowing through the meter (no reactive energy direction indicator displayed).

**Active no-load indication**

●

The active no-load indication (a circle) shows that the kWh registers have entered anti-creep mode. No energy is flowing through the meter (no active energy direction indicator displayed).

**Media icons**

The media icons represent the medium measured (from left to right water, gas, heating and electricity). The media icon displayed corresponds to group A of the OBIS identification code (see also section 5.2.3).

The electricity media icon is either ***on***, if data from the internal meter is displayed, or ***flashing***, if data from an external meter is displayed (automatically controlled). The water, gas and heating media icons are also flashing, if data from an external source is displayed.

**Disconnect icon**

This icon indicates that the respective media (represented by the displayed media icon) is disconnected by the supply control switch.

| | |
|---|---|
| Icon ON: | Supply control switch open (circuit interrupted) |
| Icon OFF: | Supply control switch closed (circuit closed, current can flow) |
| Icon flashing: | Supply control switch open, can be closed locally (push button) |

This operation is the preset. The operation will be controlled by the installed module. Please refer to the manual of the module for valid operation mode. Alternatively to this indication, a display of the supply control switch status can be in the installed module and the display on the LCD can be disabled.

**Tamper alert indicator**

This icon is switched on when the meter has detected the parameterised tamper event (either terminal cover, supply control switch or strong magnetic field).

**Phase voltage indications**

L1 L2 L3

The phase voltage indications are switched on, if the respective phase voltages are present. It can be selected by parameterisation whether all the phase voltage indications are flashing if the rotating field goes in the wrong direction and/or whether they are flashing if the energy flow is reverse in the corresponding phase. The meter can also be configured so that it will flash in service mode only.

**Arrow symbols**

▼ ▼ ▼ ▼ ▼ ▼

The 6 arrow symbols indicate the active rate as marked on the faceplate. It can be parameterised whether the arrow symbol for the active rate is on or flashing.

**Index field**

Up to 5-digit indices that define the value in the value field with groups **C, D and E** (and partly group **B**) of the OBIS identification code (see following section) are displayed in this field.

**Examples:**

**1.8.0** indicates that the status (group D = 8) of total (group E = 0) active energy import of all phases (group C = 1) is displayed in the value field.

**0.9.1** indicates that the local time is displayed in the value field.

### 5.2.3 Displaying OBIS Codes

For OBIS (Object Identification System), the structure **A-B:C.D.E.F** applies. The individual groups have the following significance:

**A** Defines the medium, e.g. electricity, gas, heat or water-related data. **Group A is represented with the media icons.**

**B** Group B is not shown on E350 meters (only channel 1 available). From firmware version M26 upwards, group B can be displayed using a formatted command, if necessary, for external M-Bus multi-energy devices connected to module. The first digit of the four-digit OBIS code displays the channel used by the M-Bus device, e.g. a device with the four-digit OBIS code “4.1.8.0” uses channel “4”.

**C** Defines the measured quantity, the abstract or physical data items related to the information source concerned, e.g. active power, reactive power, apparent power, power factor, current or voltage.

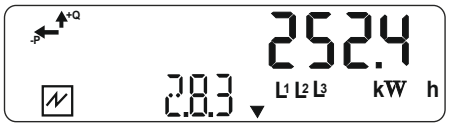
**D** Defines types, or the result of the processing of physical quantities according to various algorithms. The algorithms can deliver energy and demand quantities as well as other physical quantities.

**E** Defines the rates in use. For abstract data or for measurement results without rates, this value group can be used for further classification.

**F** Group F is not shown on E350 meters.

**Representation example**

OBIS identification code **1-1:2.8.3.0** (Active energy export, Rate 3) is represented as follows on the display:




Group A of the OBIS identification code is represented by the media icon for electricity, groups B and F are not displayed and groups C to E are represented as index value 2.8.3.

Active energy export for rate 3 is indicated by 252.4 kWh.

The active energy direction arrow -P, the phase voltage indications L1, L2 and L3 and the arrow symbol of the current rate are also displayed.

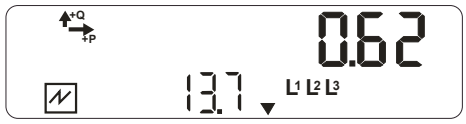
### 5.2.4 Display Definitions

The meter can show various displays. Here are some examples.

**Note**
The number of digits and decimal places displayed can be parameterised (also whether leading zeros are to be displayed).

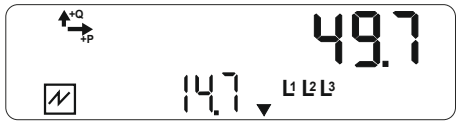
**Total active energy import**


**Total power factor**



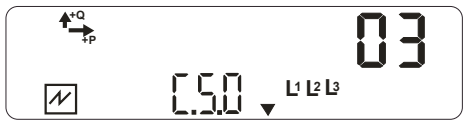

**Total reactive energy import**


**Mains frequency**



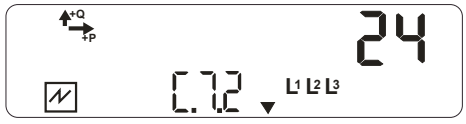

**Active energy import rate 1**


**Status flag**

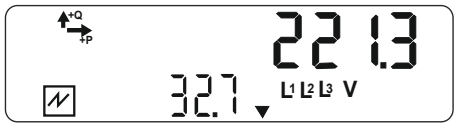



**Active energy export rate 2**


**Phase fail counter L2**

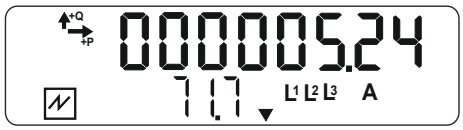



**Line voltage L1**




**Manufacturer identification number**


**Line current L3**

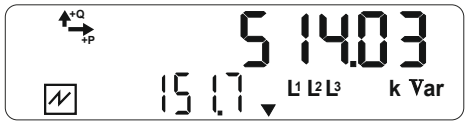



**Water consumption**


**Total active power**


**Heat consumption**


**Reactive energy L1**




**Gas consumption**

### 5.2.5 Display Sequence

The previous section showed in detail the possible displays. The display sequences shown on any specific customer's product are set through parameterisation at the factory.

There are two display sequences:

- **Main display** (with an auto-scroll list and a recall list)
- **Service display** (with the service list)

The main display can include up to 31 displays, the service display up to 63 displays (defined by parameterisation).

The parameters which have an influence on the display sequence must be defined in the configuration process.

These items are:

- Leading zeros can be enabled/disabled for registers
- Energy register displays can be defined with an integer part of 6 digits (in exceptional cases 5) and with 0, 1, 2 or 3 decimal places. Max. 6 significant digits (left of the decimal point) are allowed. Max. 8 digits including decimal places are available.
- Only 6 integer digits are allowed for meters according to MID.
- Active rate indication can be enabled or disabled
- Flashing decimal point in the energy register displays to indicate that the meter is in the service or certification display sequence

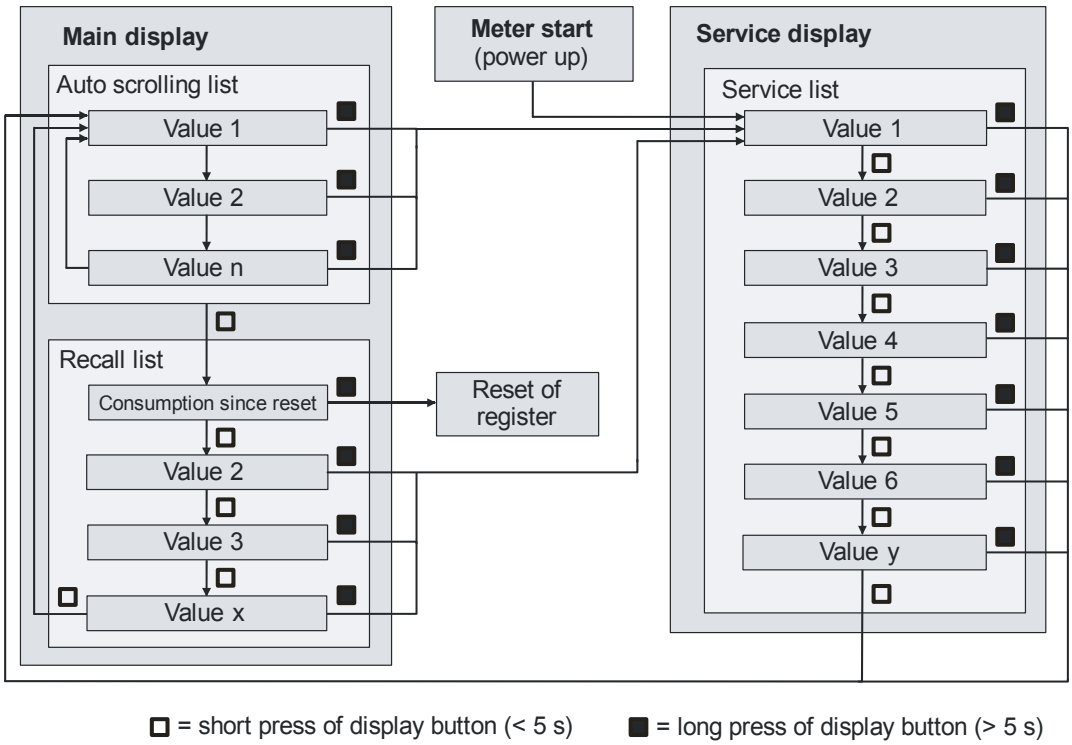
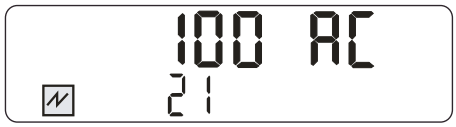



*Fig. 5.4 Overview display sequences*

**Power-up**

During power-up, the type and firmware version of the meter is displayed for 10 seconds.




The display contains:

- In the main field, "100" and the characters to define whether it is an active or a combimeter respectively a meter with or without supply control switch, e.g. 100 Ab, 100 AC, 100 bC, 100 bb.
- In the index field, the firmware version,
  e.g. **21** for version M21 or with alternative format: **2300** for M23.0.0.

Firmware version M26 and upwards:

Depending on the execution, a checksum describing the exact firmware version is shown in addition or instead of the firmware version.

Then the service display appears for the parameterised start-up time. If the start-up time for the service display is zero, the display starts directly with the main display.

**Service display**

The service display allows tests to be carried out by allowing registers to be displayed at higher resolutions. It provides information to assist the installer during installation or during subsequent testing of the network status. The service display may also include data, which can give information about the state of the meter during work in the field or in the test facility.

The service display may be accessed

- when the meter is first powered up,
- on a **long press** (more than 5 seconds) of the display button in the main display, or
- when the terminal cover is removed.

Exception: If the display button is pressed for a long time while the consumption since last reset is displayed, the register is reset instead.

The way in which the service display is accessed is determined by parameterisation.

The items on the service display (maximum 63) can be scrolled through with **short presses** (less than 5 seconds) of the display button.

The meter exits the display list when either

- the end of the service list is reached.
- the terminal cover is replaced, or
- a defined time after power-up has expired [configurable between 1 and 255 minutes].

Removal of the terminal cover will override all of the above and the meter will not exit service mode until the terminal cover is replaced.

Exiting the service mode depends on how you entered:

- Long button press – exit at the end of list.
- Terminal cover removal – exit when the cover replaced.
- Power-up – exit after a time period.

**Main display**

The number of displays (max. 31), their sequence, whether they are contained in the auto-scroll list or only in the recall list (all displays of the auto-scroll list appear also in the first part of the recall list) and the display duration for the items (between 1 and 15 seconds) can be parameterised. Up to 12 displays under the control of the communication module can be included in the main display.

The **auto-scroll list** of the main display is displayed

- If the end of the service display or the recall list of the main display is reached,
- If the display button is not pressed for a period, configurable at manufacturing, of between 5 and 60 minutes (default 30 minutes), or
- After a long press of the display button (more than 5 seconds) in the service display.

It shows the end-user the main consumption data, e.g. the status of rated registers and total registers, current instantaneous demand, etc. After the last display in the auto-scroll list it starts again. If the number of displays in the auto-scroll list is set to 1, auto-scroll is switched off and the first display of the recall list is displayed continuously.

The **recall list** of the main display is accessed by a **short press** (less than 5 seconds) of the display button while the auto-scroll list is running.

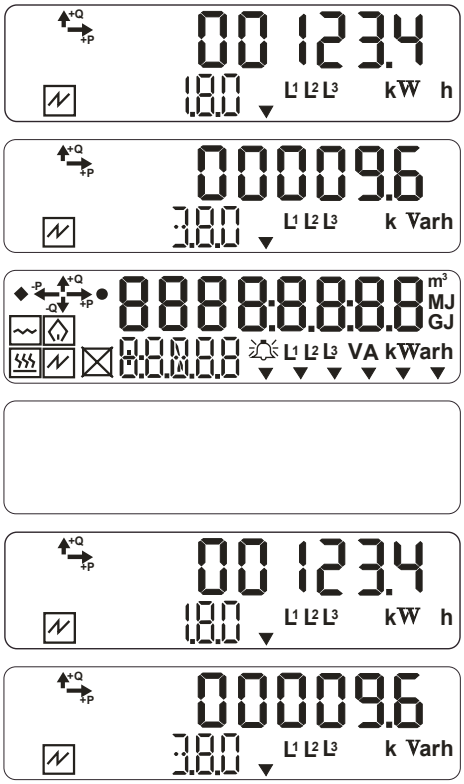
A **short press** moves the display to the next item in the recall list. Repeated short presses will scroll through to the end of the recall list, then "End" is displayed after which auto-scroll is resumed.

A **long press** (more than 5 seconds) in the main display will access the service display (if parameterised to do so). Exception: If the display button is pressed for a long time while the consumption since last reset is displayed, the register is reset instead.

**Example**

The following table shows a simple meter main display. The value of the total active energy import register is assumed to be 000123456 Wh and that of the total reactive energy import register 000009876 varh. The registers are set to show 6 digits with 1 decimal place. The leading zeros are not suppressed.

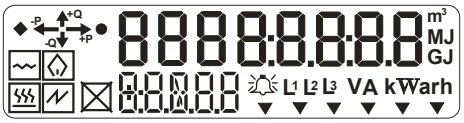
| Displayed value |
|---|
| Total active energy import |
| Total reactive energy import |
| Display check (all segments on) |
| Empty display (all segments off) |




The meter first shows the total active energy import register as 00123.4 kWh, followed by the reactive energy import register as 00009.6 kvarh and all segments on and then all off. The display duration for each display can be set between 1 and 15 seconds, but not individually. This sequence is repeated until the meter is switched off or the recall list (short press of the display button) or the service display (long press of the display button) is entered.

### 5.2.6 Display Check

During the display check, the first test item shows the display with all segments switched on. Especially the index and value fields should be checked for missing segments. The second display test item shows the display with all segments switched off.




Third display test item: The display check may also be configured to flash the display on and off at a rate of one cycle per second.

### 5.2.7 Error Display

An error display can be included in a display sequence, but it also automatically turns up in case of a malfunction. The error code is based on a 32 bit value in which each bit, if set, indicates a particular error condition. In the following error display the error code "00002002" is composed of the two errors "00000002" and "00002000".


The error codes are described in section 6.2.2 "Error Code Descriptions".

### 5.2.8 Text Messages on Display

It is possible for the module to show information on the meter display. Possible items include Ids of connected devices, time. For this, the value and the index fields can be used. This information is available in the module documentation.

The following characters can be used in text messages:

| Character | LCD |
|---|---|
| <SPACE> | |
| – (minus) | - |
| _ (underscore) | _ |
| 0 | 0 |
| 1 | 1 |
| 2 | 2 |
| 3 | 3 |
| 4 | 4 |
| 5 | 5 |
| 6 | 6 |
| 7 | 7 |
| 8 | 8 |
| 9 | 9 |

| Character | LCD |
|---|---|
| A | A |
| B | b |
| C | C |
| D | d |
| E | E |
| F | F |
| G | G |
| H | h |
| I | i |
| J | J |
| K | - |
| L | L |
| M | M |

| Character | LCD |
|---|---|
| N | n |
| O | o |
| P | P |
| Q | q |
| R | r |
| S | S |
| T | t |
| U | u |
| V | U |
| W | U |
| X | - |
| Y | y |
| Z | 2 |

**Display variations**
Some characters might be displayed differently, depending on module and meter version.
Characters which cannot be represented with the 7-segment display will be replaced by an underscore (there are also meter versions with a slightly different character set. E.g. the characters that cannot be shown are represented with a lower "o").

### 5.2.9 Meter Display List – Available Items with OBIS Codes

| Index value (OBIS code) | Item | Meter firmware version |
|---|---|---|
| F.F | Error code (always first in the list) | |
| 32.7 | VRMS Phase L1 (L12 in ZFFxxx meters) | |
| 52.7 | VRMS Phase L2 (not for 3-wire ZFFxxx meters) | |
| 72.7 | VRMS Phase L3 (L32 in ZFFxxx meters) | |
| 31.7 | IRMS Phase L1 | |
| 51.7 | IRMS Phase L2 (not for 3-wire ZFFxxx meters) | |
| 71.7 | IRMS Phase L3 | |
| 33.7 | Power factor phase L1 (4-wire ZMF1xx meters only) | |
| 53.7 | Power factor phase L2 (4-wire ZMF1xx meters only) | |
| 73.7 | Power factor phase L3 (4-wire ZMF1xx meters only) | |
| 13.7 | Power Factor Phase Summation | |
| 14.7 | Mains frequency | |
| C.1.0 | ID1.1 Meter ID (8 characters) | |
| 0.0 | Customer identification (16 character string) (Readout) | |
| 0.0.1 | ID1.2 Customer ID_1 (characters 1-8) | |
| 0.0.2 | ID1.3 Customer ID_2 (characters 9-16) | |
| C.1.1 | ID1.4 Manufacturing ID (8 characters) | |
| 1.8.0 | Total active energy import | |
| 1.8.X | Active energy import rate X (X = 1…6) | |
| 2.8.0 | Total active energy export | |
| 2.8.X | Active energy export rate X (X = 1…6) | |
| 3.8.0 | Total reactive energy import | |
| 3.8.X | Reactive energy import rate X (X = 1…6) | |
| 4.8.0 | Total reactive energy export | |
| 4.8.X | Reactive energy export rate X (X = 1…6) | |
| 0.2.0 | Firmware Version | |
| 0.2.1 | Scheme / Parameter ID | |
| OFF | Blank Display - All segs OFF | |
| ON | All Segments On - All segs ON | |
| FLASH | All Segments Flash - All segs FLASH | [M26…] |

| Index value (OBIS code) | Item | Meter firmware version |
|---|---|---|
| 130.8.0 | Reactive Energy - Absolute Value [\|+R\|+\|-R\|] {+kvarh} | |
| 131.8.0 | Reactive Energy - Absolute Value [\|+R\|-\|-R\|] {+/-kvarh} | |
| 16.7 | Active Power kW ➔ combined \|QI+QIV\| - \|QII+QIII\| (signed/unsigned) | |
| 15.7 | Active Power kW ➔ combined \|QI+QIV\| + \|QII+QIII\| | |
| 36.7 | Active Power Ph.L1 kW (4-wire ZMF1xx meters only) (signed/unsigned) | |
| 56.7 | Active Power Ph.L2 kW (4-wire ZMF1xx meters only) (signed/unsigned) | |
| 76.7 | Active Power Ph.L3 kW (4-wire ZMF1xx meters only) (signed/unsigned) | |
| 35.7 | Active Power Ph. L1 kW (4-wire ZMF1xx meters only) (unsigned) | [M26…] |
| 55.7 | Active Power Ph. L2 kW (4-wire ZMF1xx meters only) (unsigned) | [M26…] |
| 75.7 | Active Power Ph. L3 kW (4-wire ZMF1xx meters only) (unsigned) | [M26…] |
| 21.7 | Active import power phase L1 (4-wire ZMF1xx meters only) | |
| 41.7 | Active import power phase L2 (4-wire ZMF1xx meters only) | |
| 61.7 | Active import power phase L3 (4-wire ZMF1xx meters only) | |
| 22.7 | Active export power phase L1 (4-wire ZMF1xx meters only) | |
| 42.7 | Active export power phase L2 (4-wire ZMF1xx meters only) | |
| 62.7 | Active export power phase L3 (4-wire ZMF1xx meters only) | |
| C.5.0 | Status Flag (Readout: “Miniflex /E350s2 status”) (see Functional Description for more details) | |
| C.5.1 | Status flag (see E350 Series 2 Functional Description for more details) | [M29…] |
| 82.8.1 | Terminal cover removal counter | |
| 82.8.2 | DC Field Count | |
| 82.8.3 | Supply control switch tamper counter (only in readout) | [M25…] |
| C.7.0 | Power Fail Count | |
| C.7.1 | Phase L1 (R) Fail Count | |

| Index value (OBIS code) | Item | Meter firmware version |
|---|---|---|
| C.7.2 | Phase L2 (S) Fail Count (not for 3-wire ZFFxxx meters) | |
| C.7.3 | Phase L3 (T) Fail Count | |
| 130.7.0 | Signed Instantaneous Reactive Power QI+QII+QIII+QIV | [M29…] |
| 3.7.0 | Instantaneous Reactive Import Power +R QI+QII | [M29…] |
| 4.7.0 | Instantaneous Reactive Export Power –R QIII+QIV | [M29…] |
| 9.7.0 | Instantaneous Apparent Import Power +VA | [M29…] |
| 10.7.0 | Instantaneous Apparent Export Power -VA | [M29…] |
| 91.7.0 | Instantaneous Neutral Current (4-wire ZMF1xx meters only) | [M29…] |
| 90.7.0 | Instantaneous Current ~ Sum of I1, I2, I3 (4-wire ZMF1xx meters only) | [M29…] |
| 81.7.40 | Instantaneous U1-I1 angle | [M29…] |
| 81.7.51 | Instantaneous U2-I2 angle (4-wire ZMF1xx meters only) | [M29…] |
| 81.7.62 | Instantaneous U3-I3 angle | [M29…] |
| 81.7.10 | Instantaneous U1-U2 angle | [M29…] |
| 81.7.20 | Instantaneous U1-U3 angle (4-wire ZMF1xx meters only) | [M29…] |
| 81.7.21 | Instantaneous U2-U3 angle | [M29…] |
| | 4 Energy efficiency items (see section 5.2.11) | [M23…] |
| | Module data 1 - 12 (value and OBIS code will be sent by module) | |
| | End of list | |

### 5.2.10 Display Status Messages

Depending from configuration the following messages can appear at the end of a display list:

| Message | Meaning |
|---|---|
| FF 00000000 | Error detected (if error value FF > 0) |
| rEd | Reverse energy detected |
| td | Terminal cover removal detected |
| mFd | Strong magnet field tamper detected |
| btd | Supply control switch (breaker) tamper detected |

| | |
|---|---|
| VoltAGE Low | Voltage is lower than the configured threshold (standard value: 170 V) |


*Fig. 5.5 Sample: Message for magnet tamper detected*

### 5.2.11 Energy Efficiency Items in the Meter Display

If configured appropriately, the display can list 4 new (Firmware ≥ M23) items intended to allow the consumer to easily monitor energy flow:

| Item | Display | Content | Remarks |
|---|---|---|---|
| Import Energy Meter | St1 | Import Energy 1.8.0 | Resettable |
| Export Energy Meter | St2 | Export Energy 2.8.0 | Resettable |
| 24 Hour Energy Consumption | 24 h | Import Energy 1.8.0 over last 24 h | Refresh every 5 min |
| 1 Week Energy Consumption | 1 w | Import Energy 1.8.0 over last week | Refresh every 1 hour |

The resolution of these 4 displays is 1 W.

**Import and Export Energy meter display:**

These registers (St1 and St2) are counting energy permanently. The Import and the Export energy Meter values can be reset by applying a long button press whilst the register value is being displayed on the meter (working like a trip recorder in a car).

During power outage registers St1 and St2 are reset. These both registers start after recover of power with the values of the energy registers of import or export energy (St1: import, value register 1.8.0; St2: export, value register 2.8.0).

**24 hour and 1 week consumption registers:**

These registers show the energy consumed during the last period of 1 week (24 h register: period of 1 day).The meter counts the time duration continuously but does not synchronise with a calendar clock.

Time during power outages is not included in the elapsed time measurements of the registers "24 Hour Energy Consumption" and "1 Week Energy Consumption".

E.g. for the 24 h register assume registration for 5 hours followed by 1 hour power outage. Then completion of the 24 h registration will complete 19 hours following the end of the outage (5 h + 19 h = 24 h).

After resumption of power following an outage, the registers "24 Hour Energy Consumption" and "1 Week Energy Consumption" will display "0" until the first refresh occurs (i.e. after 5 min and 1 hour respectively).

## 5.3 Pulse Output LEDs

Pulse output LEDs – one for active and one for reactive energy – are used for meter testing. They transmit visible red pulses equivalent to the

currently measured value. The number of pulses per time unit depends on the meter constant (as stated on the faceplate). When registering energy, the pulse output LEDs will flash at a rate of 1 pulse per Wh or varh of energy recorded. The pulse width is 10 ms.

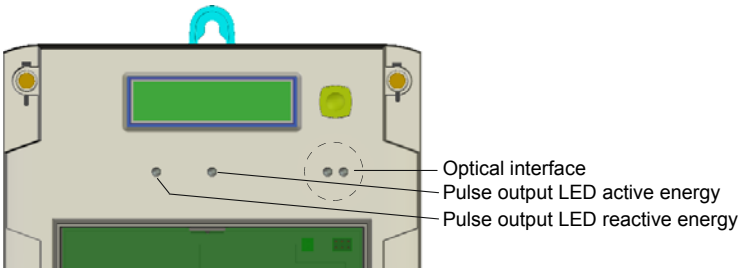



*Fig. 5.6 Pulse output LEDs and optical interface*

## 5.4 Optical Interface

All meters have an optical communications interface (see Fig. 5.6). If the communication module supports this function, both meter and module can be accessed via optical interface. In this case, the communication module has to be addressed.

The optical interface allows reading the meter's registers and identity in the field using a suitable device (PDA or laptop computer). The readout list is in full accordance with the provisions of IEC62056-21. The optical interface is normally closed, a wake-up string is sent to the meter, which activates the readout list.

With this communication channel, firmware can be downloaded to the module. Additionally, an external user can send commands to the module and upload data from the module via the optical interface. All communication is half-duplex, i.e. data can either be transmitted or received at any point in time.

If the module communicates with the optical interface, the meter will not accept sign-ons from either the optical interface or the AMR interface. If the module wants to read the meter, it must terminate the optical interface ⇔ module communication.

The module communicates normally via dlms.

**Access to module over optical interface**

Access to module over the optical interface of the meter is possible with meters whose serial number is 11117214 or higher.

Open communications with 7 bit, even parity, 1 stop bit, 4800 bps.

This can be used to read out the module over the optical meter interface or to set the TOU table of the module.

**Blocking**

The optical interface can be blocked using a formatted command issued from the communication module or the optical interface. This is to improve security be blocking any local access to the meter.

## 5.5 Data Readout

The power supplier can read the meter data, particularly the energy consumption, locally in two ways:

- Reading the meter's LCD. Only the data shown in the display list can be recorded.
- Automatic data readout via the optical interface with the aid of, e.g., a PDA or laptop. Further data are then accessible depending on the parameterisation (total registers etc.). Log corresponds to the provisions of IEC62056-21, a communication standard for meters.

### 5.5.1 IEC 62056-21 Mode C

The meter supports IEC 62056-21 mode C-a. This enables the reading of data from the meter in the data readout mode. After an initial sign-on sequence, the meter transmits its data to the PDA. This consists of a number of items which are set in the configuration. Each item is sent in ASCII with OBIS (IEC 62056-61) identifiers. Each identifier is on a separate line (separated by carriage return and line feed characters CRLF) and follows the format Identifier (value*units).

The maximum transmission rate is 9600 bps. The response message identifies the firmware version and the IEC 62056-21 transmission rate mode used.

The meter provides also a manufacturer specific mode C-C, which delivers only a part of the read out list (start and end item are configurable during production). This can be used for fast read out for frequently required values.

### 5.5.2 Readout Configuration

The readout items, their order in the list, along with the number of decimal places for the registers, are specified in the configuration. The register sizes can have up to 6 integer digits and up to 3 decimal places. This is independent on the display configuration.

The readout list (similar to the display list) consists of a number of specified items. The customer specifies the readout sequence. This sequence is set at the factory. All items are identified with OBIS codes when read out.

**Readout and display items**

The items that can be placed in the readout list (in any order except for "Error code" which is always first in the list) are listed in section 5.2.9 "Meter Display List – Available Items with OBIS Codes" on page 40. Most of these items can be included in the readout list.

**Readout error code (F.F)**

The error code consists of 8 bits and describes the following:

| Bit number | Allocation |
|---|---|
| 0 | Not used |
| 1 | MMI initialisation or communications failure |
| 2 | Error accessing EEPROM |
| 3 | Calibration data is corrupted |
| 4 | Not used |
| 5 | Error restoring energy registers |
| 6 | Data saved to EEPROM on power fail is corrupted |
| 7 | Not used |

Valid for readout with E35C modules! For other modules, other codes may be delivered, e.g. equal to error display values.

### 5.5.3 Data Readout Procedure via Optical Interface or Communication Module

1. Start the communication module (according to the associated user manuals).
2. Connect the cable of the reader head to the PDA.
3. Place the reader head in the marked position on the faceplate of the meter. The reader head is held magnetically.
4. Start the data readout with the PDA.
5. Remove the reader head from the meter again after readout.

**Readout list (example)**

The data read out are recorded in the form shown below. The scope and sequence of values in the readout list is determined by parameterisation.

| Info flow | Readout list | Significance |
|---|---|---|
| → | /?!$^{C}_{R}{}^{L}_{F}$ | Opening string (initial sign on) |
| ← | /LGZ0ZMF100AC.MXX $^{C}_{R}{}^{L}_{F}$ | Unit recognition for the specific manufacturer (no identification of data; MXX: FW version) |
| → | <ACK>0Z0$^{C}_{R}{}^{L}_{F}$ | Acknowledgement; Z: Transmission rate |
| ← | <STX> F.F(00)$^{C}_{R}{}^{L}_{F}$ | Start of text, Error message (readout flag)* |
| ← | C.1.1(0000000074892473)$^{C}_{R}{}^{L}_{F}$ | Meter identification number 1 |
| ← | 1.8.0(000065.3*kWh)$^{C}_{R}{}^{L}_{F}$ | Total active energy import |
| ← | 2.8.0(000003.5*kWh)$^{C}_{R}{}^{L}_{F}$ | Total active energy export |
| ← | 1.8.1(000021.5*kWh)$^{C}_{R}{}^{L}_{F}$ | Active energy import rate 1 |
| ← | 1.8.2(00043.8*kWh)$^{C}_{R}{}^{L}_{F}$ | Active energy import rate 2 |
| ← | 2.8.1(000001.5*kWh)$^{C}_{R}{}^{L}_{F}$ | Active energy export rate 1 |
| ← | 2.8.2(00000.0*kWh)$^{C}_{R}{}^{L}_{F}$ | Active energy export rate 2 |
| ← | C.5.0(03)$^{C}_{R}{}^{L}_{F}$ | Status flag (L2 phase fail flag) |
| ← | !$^{C}_{R}{}^{L}_{F}$<ETX><BCC> | End of text, Checksum |

*Fig. 5.7 Example of readout list*

** Valid for readout with E35C modules! For other modules other codes may be delivered, e.g. equal to error display values.*

<ACK>, <CR>, <LF>, <STX>, <ETX>, <BCC> ASCII character not visualised in the data readout list.

Code Z in the data readout acknowledge string identifies the required transmission rate for the data to follow:

| Code Z | Transmission rate |
|---|---|
| 0 | 300 bps |
| 1 | 600 bps |
| 2 | 1200 bps |
| 3 | 2400 bps |
| 4 | 4800 bps |
| 5 | 9600 bps |

### 5.5.4 Addressability of Meter

The meter monitors every communication request received over the optical interface or the AMR interface. The AMR interface can be controlled by various inputs from the module (e.g. CS interface input).

With FW versions M23 or higher, the meter will react to the communication request only under either of the following conditions:

- If the request contains no address,
- If the address matches with the address of the meter.

The address of the meter is preset to the serial number of the meter.

For FW versions prior to M23, the meters react only, if the request contains no address.

If the meter is connected to a communication bus with several meters, the communication request must be started **with** an address. Otherwise a communication conflict between the meters will occur.

## 5.6 Password Lock-out

The meter can be configured to lock-out the optical interface for a period of up to 255 seconds in 1 second increments. Default lock-out time is 60 seconds.

When a communication event is invoked with an incorrect password, access is denied. The denial of access continues for the period of the timeout (i.e. the meter remains signed on for the invalid password timeout period). Even if the password is corrected, the invalid password timeout has to expire before retrying is allowed.

# 6 Service

## 6.1 Operating Faults

If the LCD is not readable or the data readout does not work, the following points should be checked first:

1. Is the mains voltage present (main fuses intact)?
2. Is the maximum permissible ambient temperature not exceeded?
3. Is the optical interface and/or the liquid crystal display clean (not scratched, painted over, misted over or soiled in any way)?

**Danger of short-circuits**
Never clean soiled meters under running water or with high pressure devices. Water penetration can cause short-circuits. To remove normal dirt like dust a damp cloth is sufficient. If the meter is heavily soiled, it should be dismantled if necessary and sent to an authorised service centre, so that a new plastic viewing window can be fitted.

If none of the points listed is the cause of the fault, the meter should be disconnected, removed and sent to the responsible Landis+Gyr service centre (according to section 6.3 "Repairing Meters").

## 6.2 Error Codes

There are two kinds of errors: persistent and transient errors. Transient error codes are automatically reset at the next readout. The errors can also be cleared either using the formatted write command C150 or by power cycling the meter.

Persistent error codes cannot be reset in the field. If the reason for the error persists, for example in the case of a component failure, power cycling will not clear the error. A meter showing a persistent error code must be considered unsafe for further use. Contact a Landis+Gyr Service Centre for support.

### 6.2.1 Structure of an Error Code

An error code is an eight digit value. Each digit of the error code represents four errors (i.e. four bits of the error register). The status of the four bits is shown in hexadecimal code, i.e. the single digits may show values between 0 (no error code set) and F (all four error codes set).

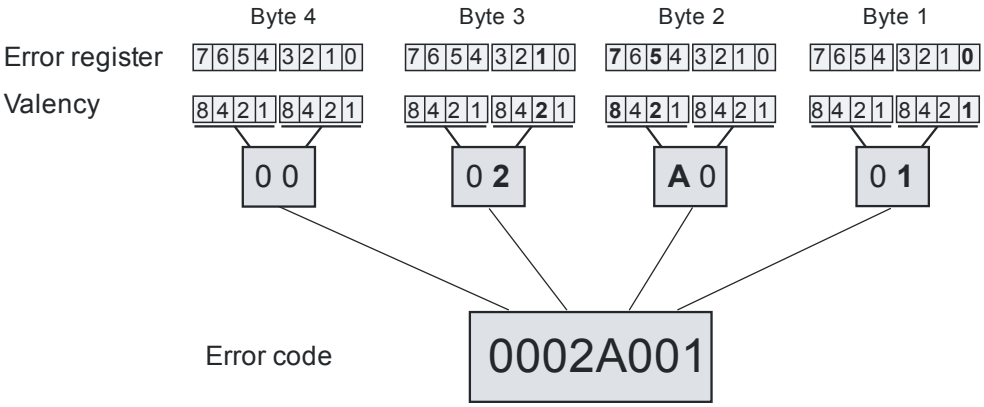
**Error codes are added**
As all errors are shown in hexadecimal code, a single error can appear in various ways depending on the presence of other errors.

**Example:**

Two errors are shown as: F.F 0000**2**00**1**

Another two errors occur: F.F 000**28**000

The displayed error code reads: F.F 000**2A**00**1**




### 6.2.2 Error Code Descriptions

The following error code descriptions apply for E350 Series 2 meters.

Error code descriptions for E350 Series 1 meters can be found in the functional description D000028645.

The allocation of the defined errors to the individual bits of the error register and the error code of the single errors is as follows:

| Byte | Bit | Valency | Error code | Error code description |
|---|---|---|---|---|
| 1 | | 1 | 00 00 00 01 | Insufficient time to complete power failure |
| | 1 | 2 | 00 00 00 02 | More than 32 consecutive attempts to communicate with, or initialise the MMI devices have failed |
| | 2 | 4 | – | Not used |
| | 3 | 8 | 00 00 00 08 | Reserved |
| | 4 | 1 | – | Not used |
| | 5 | 2 | – | Not used |
| | 6 | 4 | – | Not used |
| | 7 | 8 | 00 00 00 80 | Reserved |
| 2 | 0 | 1 | – | Not used |
| | 1 | 2 | – | Not used |
| | 2 | 4 | – | Not used |
| | 3 | 8 | – | Not used |
| | 4 | 1 | – | Not used |
| | 5 | 2 | 00 00 20 00 | Calibration value failed checksum* |
| | 6 | 4 | 00 00 40 00 | Power fail data failed checksum |
| | 7 | 8 | 00 00 80 00 | Failed checksum when restoring registers from EEPROM* |

| Byte | Bit | Valency | Error code | Error code description |
|---|---|---|---|---|
| 3 | 0 | 1 | – | Not used |
| | 1 | 2 | 00 02 00 00 | Error accessing EEPROM |
| | 2 | 4 | – | Not used |
| | 3 | 8 | 00 08 00 00 | Reserved |
| | 4 | 1 | – | Not used |
| | 5 | 2 | 00 20 00 00 | Reserved |
| | 6 | 4 | 00 40 00 00 | Error restoring energy registers |
| | 7 | 8 | 00 80 00 00 | Error saving energy registers |
| 4 | 0 | 1 | – | Not used |
| | 1 | 2 | – | Not used |
| | 2 | 4 | – | Not used |
| | 3 | 8 | – | Not used |
| | 4 | 1 | – | Not used |
| | 5 | 2 | – | Not used |
| | 6 | 4 | – | Not used |
| | 7 | 8 | 80 00 00 00 | Reserved |

* *These errors cannot be cleared using the formatted write command C150 or by power cycling the meter. Contact a Landis+Gyr Service Centre for support.*

## 6.3 Repairing Meters

The following procedure should be adopted if a meter repair is necessary:

1. If installed, remove the meter (see section 4.5) and fit a substitute meter.
2. Describe the error found as exactly as possible and state the name and telephone number of the person responsible in case of inquiries. Please also state serial no. and complete type designation no.
3. Pack the meter to ensure it is not damaged during transport. Use the original packing, if available. Do not enclose any loose components.
4. Send the meter to an authorised service centre.

# 7 Maintenance

The meter is maintenance-free. The following points should be regularly checked:

- Is the meter dry and clean (particularly display and optical interface)?
- Is the meter in operation and serviceable (displayed data reasonable)?
- Are all seals undamaged?
- Is there an error recorded based on periodical internal self-tests since the previous check (check on the display or readout list)?
- Have the values of the energy registers changed within reasonable limits since the last data readout (no unauthorised manipulations)?

Continue with section 6.3 "Repairing Meters" in case of irregularities.

## 7.1 Meter Testing

The meters are calibrated during manufacturing. A later recalibration is not possible. Meter tests should be performed at periodic intervals according to the valid national regulations (either on all meters or on specific random samples). For this purpose, the meters must be removed as described in section 4.5 "Disconnecting the Meter" and replaced by a substitute meter for the duration of the test.

### 7.1.1 Higher Register Resolution

The meter features a *service or certification display sequence,* which allows registers to be displayed with 3 decimal places. See 5.2.5 "Display Sequence"*.*

This sequence is entered by pressing the display button for more than 5 s. It is exited again if the display button is not pressed for a time between 0 and 60 minutes (default 30 minutes) determined by parameterisation.

**Display example**


This mode is used for controlling whether a change in a register value accords with the number of impulses at the pulse output LED, which can now be done with 0.5 kW in about 5 minutes. It is indicated by a flashing decimal point.

### 7.1.2 Measuring Times

For technical reasons higher measuring deviations can occur during short-term measurements. It is therefore recommended to use sufficiently long measuring times in order to achieve the required accuracy.

**Table of required measuring times:**

**ZMF**
$U_n$=230 V

| | **Measuring uncertainty 0.2%** | | | **Measuring uncertainty 0.1%** | | |
|---|---|---|---|---|---|---|
| **Current [A]** | 3 P cosφ=1 | 1 P 1 | 3 P 0.5 | 3 P cosφ=1 | 1 P 1 | 3 P 0.5 |
| **0.2** | 25 s | 70 s | 90 s | 90 s | 4.5 min | 6 min |
| **0.5** | 20 s | 20 s | 20 s | 20 s | 45 s | 60 s |
| **≥ 1** | 20 s | 20 s | 20 s | 20 s | 20 s | 20 s |

3 P = universal
1 P = single-phase

**ZFF**
$U_n$ =230 V

| | **Measuring uncertainty 0.2%** | | | **Measuring uncertainty 0.1%** | | |
|---|---|---|---|---|---|---|
| **Current [A]** | 3 P cosφ=1 | 1 P 1 | 3 P 0.5 | 3 P cosφ=1 | 1 P 1 | 3 P 0.5 |
| **0.2** | 42 s | 3 min | 3 min | 3 min | 12 min | 11 min |
| **0.5** | 20 s | 30 s | 27 s | 30 s | 2 min | 2 min |
| **1** | 20 s | 20 s | 20 s | 20 s | 30 s | 30 s |
| **≥ 2** | 20 s | 20 s | 20 s | 20 s | 20 s | 20 s |
| | | | | - | - | - |

**For meters with firmware version M25:**

If the so called register test (test of the meter constant or the gear transmission error) is carried out not at a constant load point, but with a constant injected amount of energy, a test time of 15 min is recommended (minimum 10 min).

### 7.1.3 Pulse Output LEDs

The pulse output LEDs are positioned on the faceplate.

LED for active energy: It supplies pulses with a value of 1 Wh of the import or export energy measured. This corresponds to a meter constant of 1000 imp/kWh. For meter testing purposes, only the rising edge is decisive.

LED for reactive energy: The LED for reactive energy works similarly, but with values of 1 varh and a meter constant of 1000 imp/kvarh.

### 7.1.4 Connection to a Meter Testing Device

To test the meter, connect it to a dedicated testing device.

The meter uses a voltage jumper whereby a spring contact connects the voltage circuit of the meter to the phase terminal. By inserting a contact pin of 2.5 mm diameter, the voltage and current circuits of the meter are separated and the test voltage is connected via the contact pin. See Fig. 7.1.

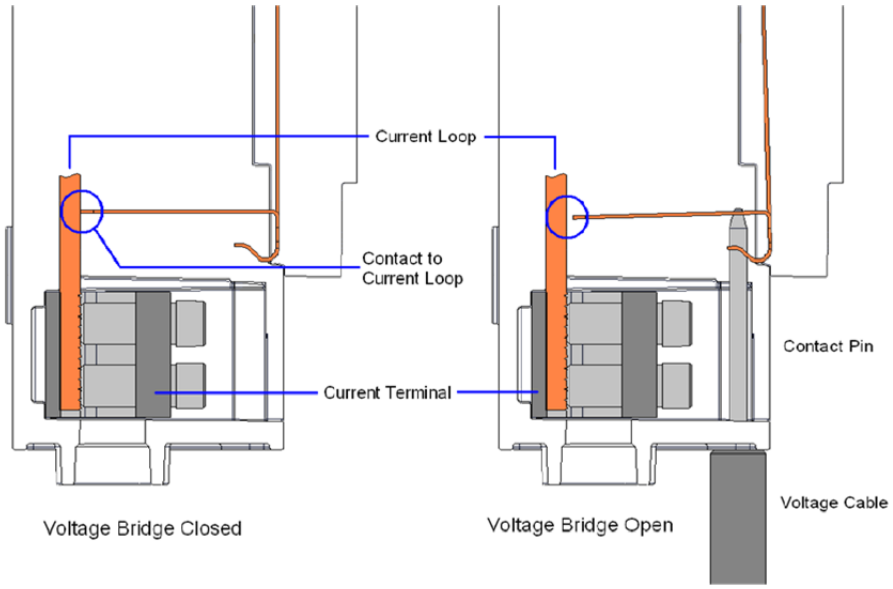



*Fig. 7.1 Voltage jumper with test voltage connection*

**Procedure:**

1. Connect the meter to the terminals of the testing device as shown in the meter connection diagram and according to the usual testing methods. Remove the access lock sliding piece, if present.
2. To connect the test voltage, use a connecting cable with a contact pin of 2.5 mm diameter and 40 mm length (± 1 mm). Insert this pin in the opening provided on the front of the terminal block, right above the measuring terminals.

**Keep voltage cables free from voltage when inserting**
Touching live contact pins can be fatal.

3. After testing, remove the cable (voltage-free!) from the terminal cover. The spring closes the contact and the voltage is connected again. Insert the access lock sliding piece again, if necessary, and seal it.

### 7.1.5 No-Load Test

A test voltage $U_p$ of 1.15 $U_n$ is used for the no-load test (creep test) according to IEC 62053-21 (e.g. $U_p$ = 265 V with $U_n$ = 230 V).

**Procedure:**

1. Disconnect the meter from the mains for at least 10 seconds.
2. Switch on the test voltage $U_p$ and wait approx. 10 seconds. Both the active (circle) and the reactive (diamond) no-load indication must now be permanently on. The energy direction indicators are off.


### 7.1.6 Starting Test

**Procedure:**

1. Apply a load current of 0.1% of the base current $I_b$ or, for MID meters, of the reference current $I_{ref}$, e.g. 10 mA with $I_b$=$I_{ref}$=10 A, and the voltage $U_n$ (three-phase in each case). The meter must remain in no-load.


2. Increase the load current to 0.5% $I_b$ (for MID: to 0.5% $I_{ref}$) (i.e. 50 mA with $I_b$ = $I_{ref}$ = 10 A). The energy direction arrow must appear within 10 seconds and both no-load indications must disappear. The optical test output for active energy must start to flash.


## 7.2 Cleaning

**Danger of short-circuits**
Never clean soiled meters under running water or with high pressure devices. Water penetration can cause short-circuits. To remove normal dirt like dust a damp cloth is sufficient. If the meter is heavily soiled, it should be dismantled, if necessary, and sent to an authorised service centre, so that a new plastic viewing window can be fitted.

# 8 Decommissioning and Disposal

This section explains the disconnection of the meter from the system and its correct disposal.

## 8.1 Decommissioning

The procedure for disconnecting and removing the meter from the mains is described in section 4.5.

## 8.2 Disposal

Based on the data specified in environmental certificate ISO 14001, the components used in meters are largely separable and can therefore be taken to the relevant disposal or recycling point.

**Disposal and environmental protection regulations**
For the disposal of meters observe the local disposal and environmental protection regulations in effect without fail.

| Components | Disposal |
|---|---|
| Printed circuit boards | Electronic waste: disposal according to local regulations. |
| Metal parts | Sorted and taken to collective materials disposal point. |
| Plastic components | Sorted and taken to recycling (regranulation) plant or if no other possibility to refuse incineration. |

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