Electricity Meters IEC

HIGH PRECISION METERING

Landis+Gyr Qualigrid

ZMQ202 / ZFQ202

USER MANUAL

H 71 0200 0215 h en

Revision History

Index	Date	Comments
a	20.12.2002	First release, for approbation.
b	07.01.2003	New layout
c	07.03.2003	Chapter 2 updated, various changes: hazard symbols, sealing, LP memory, starting load
d	19.03.2003	Minor changes to paragraph 6.3 Errors
e	30.06.2003	Updates according to the safety review (preliminary edition) and to final review
f	19.12.2003	Updates according to product risk analysis and firmware H00
g	31.03.2004	Updates for firmware H01
h	31.01.2005	Amendments for firmware version H02/H90 (registration of delta values, demand and power factor, stored billing value profile, IEC870 subset, transmitting contact test mode)

subject to technical changes

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About this Document

Range of validity

The present user manual applies to the meters specified on the title page with firmware H01.

Purpose

The user manual contains all the information required for application of the meters for the intended purpose. This includes:

- Provision of knowledge concerning characteristics, construction and function of the meters
- Information about 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, shutting down and disposal)

Target group

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

Conditions

Users of this manual are familiar from their training with the basic principles of electrical engineering, in particular with the principles of energy measurement, including circuitry types, connection technology, etc.

Reference documentation

The following documents complement this user manual:

Functional description:	Explains the functionality of the ZxQ meter and the parameterisation using the MAP tool.
Technical data:	States all technical data of the ZxQ meter.

Type designation

The following conventions are employed in this user manual for representing type designations:

- The lower case letter "x" can be used as an unknown to indicate different versions (e.g. ZxQ202 for the ZMQ202 and ZFQ202 meters).
- The digit pair "00" can be used to indicate accuracy data (e.g. ZxQ200 for the ZxQ202 and ZxQ205 meters).
- The abbreviated type designation ZMQ or ZFQ meters can be used when all three-phase four-wire meters or three-phase three-wire meters are meant.

Table of Contents

1 Safety

This chapter explains the safety information used in this user manual, describes the responsibilities and lists the safety regulations to be obeyed.

1.1 Safety Information

Attention is drawn as follows in the individual chapters of this user manual with classified word symbols and pictographs to the relevant danger level, i.e. the severity and probability of any danger:

Danger

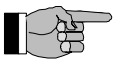
Definition of Danger

For a possibly dangerous situation, which could result in severe physical injury or fatality.

Warning

Definition of Warning

For a possibly dangerous situation, which could result in minor physical injury or material damage.



Note

Definition of Note

For general details and other useful information to simplify the work.

In addition to the danger level, 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 – usually the utility – is responsible that all persons engaged on work with meters:

1. have read and understood the relevant sections of the user manual.
2. are sufficiently qualified for the work to be performed.
3. strictly observe the safety regulations (according to section *1.3 Safety Regulations*) and the operating information in the individual chapters.

In particular, the owner of the meters bears responsibility for

- the protection of persons,
- the 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 Regulations

The following safety regulations must be observed at all times.

Danger

Do not open the meter when energised

When the meter is connected and energised, there are live parts inside the meter. Do not open the meter when energised.

Disconnect the measuring voltage and all auxiliary circuits before opening the meter housing.

Danger

Dangerous voltage on conductors

Dangerous voltage is present on the conductors that the meter is to be connected to.

Contact with the conductors when under voltage will result in severe personal injury or death.

The conductors must not be under voltage when connecting or disconnecting the meter. The relevant preliminary fuses must therefore be removed and kept in a safe place until the work is completed, so that other persons cannot replace them unnoticed.

Danger

Dangerous voltage on transformers

Dangerous voltage is produced by the current transformers when the secondary circuit is broken while current is flowing in the primary.

Contact with the transformers when under voltage will result in severe personal injury or death. The high voltage produced will also destroy the transformers.

The current transformer secondary circuit must be short-circuited before de-installing the meter.

Danger

Missing transformer earthing

Voltage transformers that are not earthed on the secondary may reach dangerously high voltage values on the secondary.

Voltage transformers are usually earthed on the secondary. As an exception for special connections, the earthing can be omitted unless possible otherwise.

If the voltage transformer is not earthed, severe personal injury or death can result if contact is made with the meter and the meter will be damaged beyond repair.

If the voltage transformers are not earthed, special precautions must be taken when working at the meter.

Danger

Galvanic isolation

The measuring circuits and auxiliary circuits (additional power supply, tariff control input, synchronisation input, transmitting contacts, communication interfaces) must be galvanically isolated.

Danger

Voltage paths must be fused

When installing the meter, all auxiliary circuits such as the additional power supply and the tariff control voltage must be fused by max. 6A delay fuses. It is recommended to fuse the measurement voltage, too.

Warning

Damage of dust, water, incorrect cleaning and handling

Damage to the meter could occur if the meter is subjected to running water or even high-pressure devices, e.g. for cleaning purposes. The meter may be cleaned with a damp cloth.

2 Description of Unit

2.1 Application

The ZxQ is a high precision combimeter of class 0.2S designed for energy measurement in the following applications.

- energy production applications
- energy transmission applications
- industrial consumer applications
- in special, high-precision metering applications

2.2 Features

The ZxQ is the answer to customer needs, providing

- More measurement quantities (e.g. single phase, U, I, VA)
- Installation diagnostics for easy commissioning
- Quick network diagnostics on site
- Standard protocols for the communication of the meter with the billing station.

Excellent measurement features for Cl.0.2S

- Landis+Gyr-proven long-term stability and reliability (75,000 Cl.0.2S meters in operation)
- All requirements guaranteed according to IEC 62053-22
- Excellence in measurement from starting load to Pmax in both energy directions
- Negligible influence if power factor is less than 1
- Reactive energy Cl.0.5 possible (IEC definitions only for Cl.2).

Special grid functions

- Measurement system five times faster than for industrial meters, giving sufficient resolution for capture periods less than 15 minutes (1 to 5 minutes) and accurate measurement when at energy direction changes
- Measurement or losses if the billing point and the metering point are not he same
- Easy customer calibration for all-phase corrections
- Transmitting meter with concentrator (extension for existing equipment)
- An additional power supply secures communication even if the measuring voltage fails. In addition, the additional power supply prevents the line between transformer and meter from improper voltage drops.

Communication

- Standard dlms communication protocol with the possibility of other standard protocols for network management
- Use of modular communication units separated from measurement (same solution as ZMD400).

Transmitting contacts

None, or 4 to 8 transmitting contacts, constant impulse frequency up to 40 imps/s, possibility for two contacts with the same value or quadrant splitting.

Broad range of applications

Wall / projection-mounting and rack / flush-mounting with the same printed circuit boards give more flexibility at the place of installation and saves money on spare parts. Plug-in compatible version with ESSAILEC connectors for replacement or extension of system.

2.3 Type Designation

ZMQ 2 02 C.4 r4 f6

Network Type

ZFQ	3-phase 3 wire network (F-circuit)
ZMQ	3-phase 4 wire network (M-circuit)

Accuracy Class

02	class 0.2 S according to IEC

Functional Range

C.2	active and reactive measurement, dlms or IEC870 subset
C.4	active und reactive measurement, dlms protocol
C.6	additionally losses and CT/VT correction, dlms protocol
C.8	all functions incl. demand measurement, dlms protocol

Transmitting Contacts

r3	4 changeover contacts with symmetric mark/space ratio (4 x u)
r4	4 changeover contacts with fixed pulse width (4 x u)
r4a	8 normally open contacts with fixed pulse width (4 x 2a)
r4aa	4 twin normally open contacts with fixed pulse width (2 x 4a)

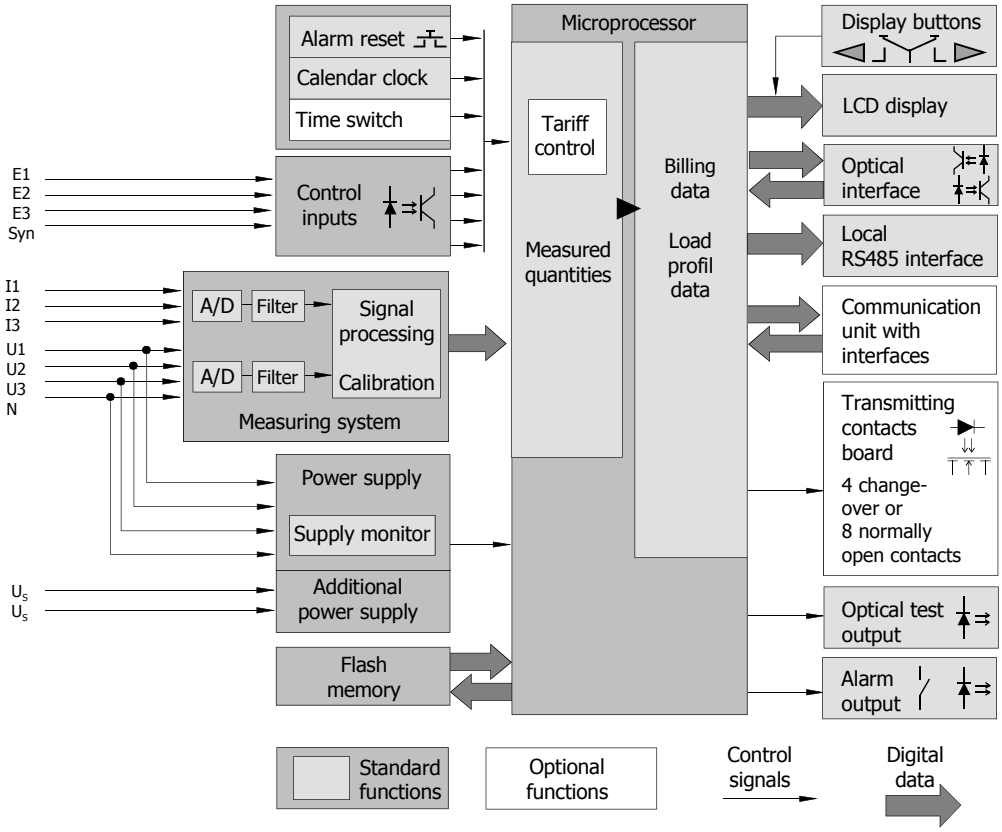
Housing

f6:	wall mounted housing
f9:	rack mounted housing

For more information concerning the meter with the functional range C.2 for the connection to the Landis+Gyr FAG and the communication according to the IEC870 subset please refer to *Chapter 8 on page 97*.

In this user manual, the communication according to the IEC870 subset will be referred to as IEC870 communication hereafter.

2.4 Block Schematic Diagram



Inputs

The main inputs to the meter are:

- Phase voltages U1, U2, U3 and neutral conductor N
  - to be processed in the measuring system
  - to be monitored by the voltage monitor
  - for the three-phase power supply of the meter
- Phase currents I1, I2, I3
  - to be processed in the measuring system
  - to be monitored by the current monitor
- Control inputs used for:
  - selecting of energy tariffs (3 control inputs: E1, E2, E3)
  - synchronising the internal calendar clock (1 control input: Syn)

Opto-couplers provide the galvanic isolation and protect the electronic circuits of the meter from interference, which could otherwise enter via the control inputs.

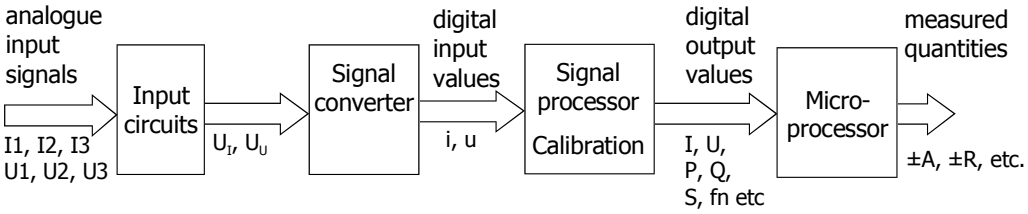
- Additional power supply U_S to ensure the operation of the meter during interruptions of the measurement voltage
- Push buttons
  - for display control (2 buttons)
  - for service functions and alarm reset (1 button)

Outputs

The meter has following outputs:

- Single line, 8-digit liquid crystal display (LCD) with back light for local reading of billing data and load profile data and additional information, such as energy flow, type of energy, presence of phase voltages and identification numbers
- Optical test outputs (green LEDs) for either active and reactive energy or I^2 and U^2
- Alarm output (relay and red LED)
- Up to 8 transmitting contacts with selectable signal assignment on the transmitting contacts board (static relays)
- Optical interface for the download of parameterisation data and for local data acquisition by a suitable data acquisition unit (e.g. lap-top computer)
- Local serial interface RS485 for the daisy-chain connection between the individual meters
- Various communication interfaces (e.g. RS485, RS232, modem) for the transfer of billing data and load profile data to the central station.

2.5 Measuring System



2.5.1 Input Signals

The measuring system of the meter has the analogue current values I1, I2, I3 and the analogue voltage values U1, U2, U3 available as input signals.

2.5.2 Input Circuits

Voltage input

High resistance voltage dividers reduce the voltages U1, U2, U3 applied to the meter (57.7 V to 132.8 V) to a proportional value of a few mV (U_U) for further processing.

Current input

Compensated current transformers similarly reduce the input currents I1, I2, I3 applied to the meter (0 A to 2 A or 0 A to 7.5 A). The secondary currents of these current transformers develop voltages over burden resistors. These voltage values are proportional to the input currents, also of a few mV (U_I).

The meter can be adapted to the required current range (1 A or 5 A) by changing the burden resistors of the current transformers.

2.5.3 Signal Converter

The analogue input signals U_U and U_I are converted to digital values by signal converter.

Digital instantaneous values of voltage (U) and current (I) for all three phases are then available at the output of the signal converter.

2.5.4 Signal Processor

Over an integration interval of 0.2 seconds, the signal processor calculates active, reactive and apparent energy. As a general rule, the measuring system of the ZMQ produces single-phase data while the ZFQ provides data corresponding to its two measuring elements.

The signal processor also provides various instantaneous values such as phase voltages and phase currents as well as diagnostic values (total harmonic distortion, voltage failures etc.).

The values will be available as digital data. They are stored in the output buffer of the signal processor from where they are transferred to the microprocessor by an SPI interface.

2.5.5 Microprocessor

Based on the data of the signal processor the microprocessor calculates the measured quantities.

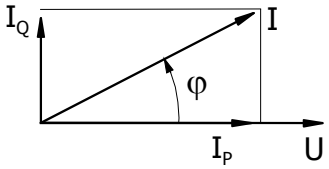
Single phase energy calculation

The calculation of the energy per phase is a two-step procedure:

1. The instantaneous, single-phase values of power are produced by multiplying the instantaneous, single phase values of voltage U and current I.
2. The single-phase values of power are then integrated over the integration period.

Active energy

The active power is the product of the voltage multiplied by the current component parallel to the voltage I_P.



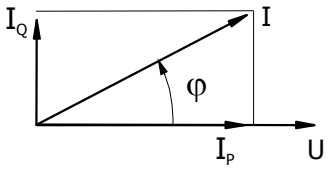
Calculation per phase of
$P = U \cdot I \cdot \cos \varphi$
$P = U \cdot I_P$

The instantaneous value of active power P is then integrated over the integration period of 0.2 seconds to form a digital value of active energy.

Reactive energy

For the instantaneous value of reactive power Q the instantaneous values of voltage U and current I must be rotated by +45° and -45° respectively prior to the multiplication.

The reactive power is the product of the voltage multiplied by the current component vertical to the voltage I_Q.



Calculation per phase of
$Q = U \cdot I \cdot \sin \varphi$
$Q = U \cdot I_Q$

The instantaneous value of reactive power Q is then integrated over the integration period of 0.2 seconds to form a digital value of reactive energy.

2.6 Measured Values

Depending on the functional range of the meter (C.4, C.6 or C.8), different sets of measured quantities are available.

C.4

Meters with the functional range C.4 provide the following measured quantities:

Measured quantity		**ZMQ**	**ZFQ**
Active energy import	+A	Sum	Sum
Active energy export	–A	Sum	Sum
Reactive energy import	+R	Sum	Sum
Reactive energy export	–R	Sum	Sum
Reactive energy in quadrant I	+Ri	Sum	Sum
Reactive energy in quadrant II	+Rc	Sum	Sum
Reactive energy in quadrant III	–Ri	Sum	Sum
Reactive energy in quadrant IV	–Rc	Sum	Sum
Energy direction of active energy	EFA	Sum	Sum
Energy direction of reactive energy	EFR	Sum	Sum

C.6

Meters with the functional range C.6 provide the following measured quantities in addition to the C.4:

Measured quantity		**ZMQ**	**ZFQ**
Active iron losses (transformer)	NLA	Sum	Sum
Active copper losses (line)	OLA	Sum	Sum
Reactive iron losses (transformer) *	NLR	Sum	Sum
Reactive copper losses (line) *	OLR	Sum	Sum
Total active losses in positive direction	+TLA	Sum	Sum
Total active losses in negative direction	-TLA	Sum	Sum
Total reactive losses in positive direction *	+TLR	Sum	Sum
Total reactive losses in negative direction *	-TLR	Sum	Sum
Net/gross active energy in positive direction	+CA	Sum	Sum
Net/gross active energy in negative direction	-CA	Sum	Sum
Net/gross reactive energy in positive direction *	+CR	Sum	Sum
Net/gross reactive energy in negative direction *	-CR	Sum	Sum
Total losses of active energy	TLA	Sum	Sum
Total losses of reactive energy	TLR	Sum	Sum
THD of active energy	THD_A	Sum / Phases	Sum

* Values for reactive losses are available for compatibility reasons with third-party products. However, Landis+Gyr recommend not to measure reactive losses.

C.8

Meters with the functional range C.8 provide the following measured quantities in addition to the C.6 and the C.4:

Measured quantity		ZMQ	ZFQ
Active energy import	+A	single-phase	
Active energy export	–A	single-phase	
Reactive energy import	+R	single-phase	
Reactive energy export	–R	single-phase	
Reactive energy in quadrant I	+Ri	single-phase	
Reactive energy in quadrant II	+Rc	single-phase	
Reactive energy in quadrant III	–Ri	single-phase	
Reactive energy in quadrant IV	–Rc	single-phase	
Apparent energy import	+S	Sum / Phases	Sum *
Apparent energy export	-S	Sum / Phases	Sum *
Apparent energy in quadrant I	+Si	Sum / Phases	Sum *
Apparent energy in quadrant II	+Sc	Sum / Phases	Sum *
Apparent energy in quadrant III	–Si	Sum / Phases	Sum *
Apparent energy in quadrant IV	–Sc	Sum / Phases	Sum *
Current square hours	I^2h	Sum	Sum
Voltage square hours	U^2h	Sum	Sum

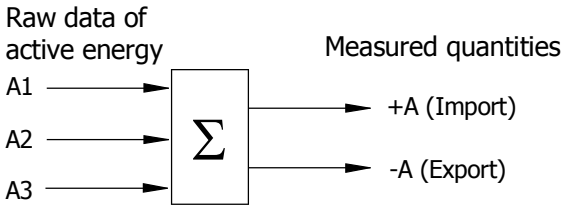
* Due to the different type of measurement of the Aron circuit, data for the individual phases are not provided by the ZFQ.

2.6.1 Calculation of Measured Quantities

By scanning the digital output values of active energy A and reactive energy R every 0.2 seconds, energy components (Ws or vars) with varying energy magnitudes are produced at fixed intervals.

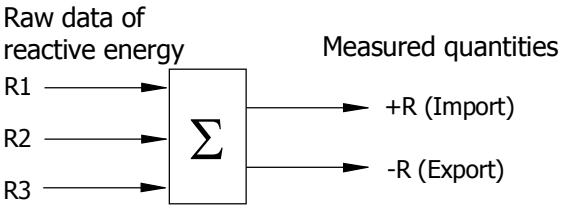
Active energy

The microprocessor calculates the total active energy import +A and the total active energy export -A by summating the raw data of active energy A1, A2 and A3.



Reactive energy

The microprocessor calculates the total reactive energy import +R and the total reactive energy export -R by summating the raw data of reactive energy R1, R2 and R3.

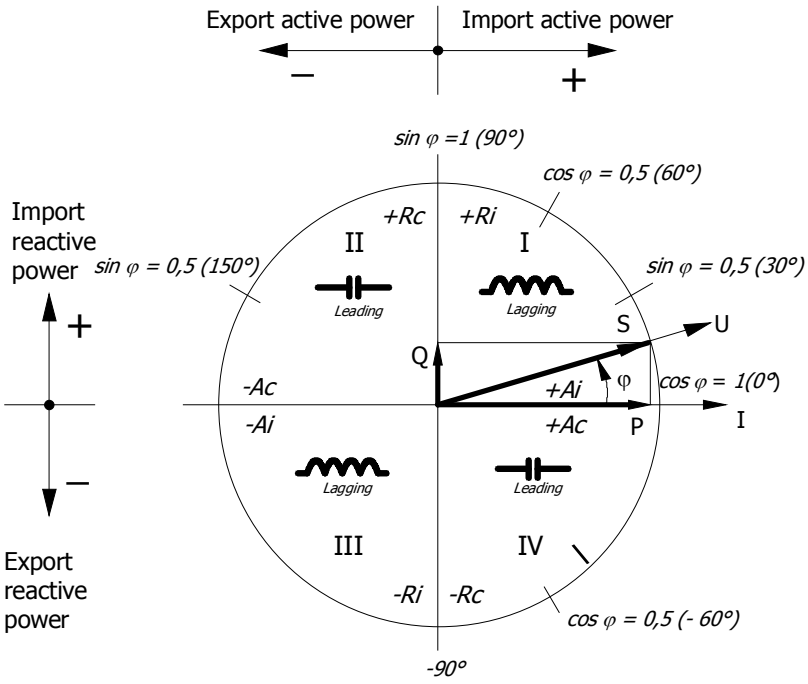


These energy components are scaled by the microprocessor corresponding to the meter constant (primary data) and are then available as measured quantities. The measured quantities can be selected by parameter setting and their measured values are fed directly to the registers to record the energy.

Allocation to the four quadrants

Based on the signs of A and R the microprocessor can allocate the reactive energy to the four quadrants.

- Reactive energy in quadrant I: +Ri
- Reactive energy in quadrant II: +Rc
- Reactive energy in quadrant III: –Ri
- Reactive energy in quadrant IV: –Rc



2.6.2 Demand

The ZxQ meters with the functional range C.8 register the demand of the measured values +a, -A, +S and -S. The meters may register the average demand of the current and the last integration period as well as maximum demand and cumulated maximum demand.

2.6.3 Power Factor

The ZxQ meters with the functional range C.8 register the power factor. The meters may register the instantaneous power factor as well as the average power factor of the current and the last integration period for both energy directions (import and export).

2.6.4 Instantaneous Values

The ZxQ may register the following instantaneous values:

Instantaneous values		**ZMQ**	**ZFQ**
Active power (instantaneous value)		Sum	Sum
Reactive power (instantaneous value)		Sum	Sum
Phase voltages (RMS) Primary and secondary values		U1, U2, U3	U12, U32
Phase currents (RMS)		I1, I2, I3	I1, I3
Network frequency	fn	yes	yes
Phase angle between voltages	φ U	U1-U2 / U1-U3*	U12-U32 **
Phase angle between voltage and current	φ U-I	U1-I1, U1-I2, U1-I3 *	U12-I1, U12-I3 **
Direction of rotating field		yes	yes
Power factor	PF	C.8 only	C.8 only

* Phase angles will only be displayed if voltage L1 is present.
** Phase angles will only be displayed if all voltages are present.

2.6.5 Diagnostic Values

The ZxQ may register the following diagnostic values:

Diagnostic values		**ZMQ**	**ZFQ**
Phase failures		yes	yes
Voltage dip table		Sum	Sum
THD of RMS phase voltages	THD_U	Sum / Phases	Sum
THD of RMS phase currents	THD_I	Sum / Phases	Sum

2.7 Tariff Control

Various signal sources can be used to select the required tariff. Tariff control may be performed:

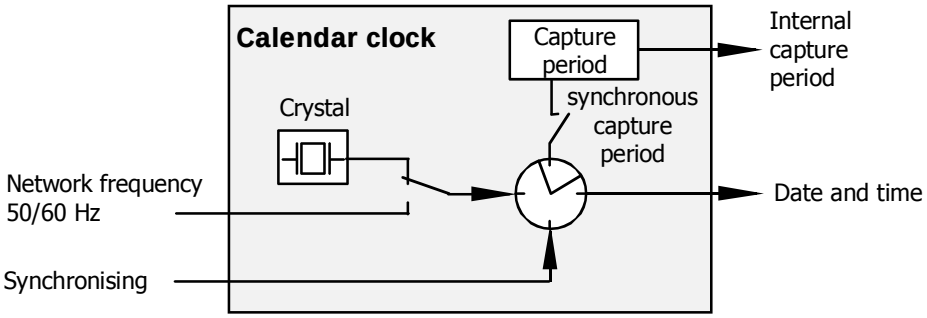
- Externally by the three input control signals E1, E2, E3 (with selectable control voltage ranges: 24 V up to 230 V; the control voltage must be specified by the customer). The control input E1 may also be used to enable the bypass feeder operation mode.
- Internally by the calendar clock and the time switch
- By event signals based on threshold values of the monitoring functions, e.g. frequency, voltage

Signals from the various signal sources can be combined to realise a sophisticated tariff structure.

2.8 Calendar Clock

The internal calendar clock of the ZxQ generates the date and time information, which is used:

- for the date and time information to be displayed
- to control the time switch TOU
- for the time stamps in the load profile, snapshot, stored billing value profile and event log
- for the controlling of the capture period of the load profile



Time base

The calendar clock either uses the internal crystal or the network frequency as time base (depending on parameterisation).

The network frequency (50 Hz or 60 Hz) may be used as time base, provided it is sufficiently accurate. Tuning is then performed after each full wave, i.e. after 20 ms at 50 Hz. If the network frequency happens to vary by more then 5% the calendar clock automatically switches to the crystal time base.

Accuracy

The crystal features a maximum deviation of 0.5 s per day (<6ppm).

Synchronisation

The calendar clock can be synchronised in regular intervals:

- by an external master clock via synchronisation input Syn
- via communication (e.g. by the central station).

Time-setting

The time and date of the calendar clock can be set:

- manually in the set mode in the service menu of the meter
- via communication

Power reserve

A supercap (capacitor of a very large capacity) provides the power reserve for the calendar clock. The power reserve may be extended by the use of a battery.

- Power reserve without battery: 20 days (only after the meter has been connected to the network for at least 300 hours)
- Power reserve with battery: 10 years

2.8.1 Synchronisation and Time-Setting

Synchronisation

We talk about synchronisation when the clock is adjusted to an external reference in regular intervals. The synchronisation signal is sent to the meter within a predefined time window. Synchronisation is performed in order to make sure that all meters within the network show the same time.

Synchronisation of the meter may take place via the control inputs or via communication.

Time-setting

We talk about time-setting when the time is adjusted outside the synchronisation window. This is the case when, for instance, during meter installation the calendar clock is set to the local time.

The time may be set manually in the set mode or via communication.

2.8.2 Synchronising the Calendar Clock via the Synchronisation Input

The calendar clock can be synchronised by an external master clock (e.g. central station), which sends synchronisation pulses at regular intervals.

There are three possibilities of synchronising the calendar clock using the external synchronisation signal:

- The synchronisation takes place several times per day
  - To the minute or
  - To the capture period
- The synchronisation takes place once per day.

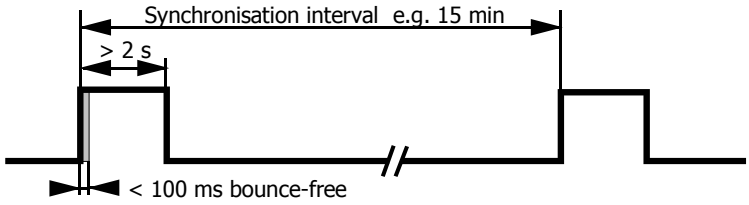
Note

Use only one type of synchronisation

Only one type of synchronisation can be used at a time, either several times per day **or** once per day.

several times per day

The "several times per day" synchronisation takes place at regular intervals. The interval is defined by parameter setting.



Since the synchronisation signal is transmitted at regular intervals (e.g. 00:00h, 00:15h, 00:30h etc) it carries a time information. When, for instance, the meter receives the third synchronisation signal of the day (00:30h) the calendar clock is synchronised to 00:30h. The reaction of the meter to the synchronisation signal depends on the detected deviation (see *2.8.5 Handling the Deviations*).

The meter will accept the synchronisation pulse any time but only once within one synchronisation interval.

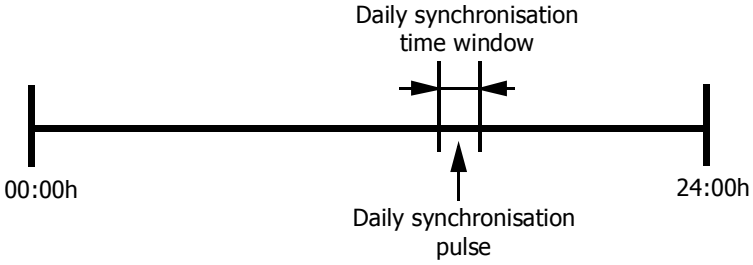
Note

Ignoring second synchronisation pulse

A second synchronisation pulse within the same synchronisation interval will be ignored.

Once per day

With the daily synchronisation, the meter allows one time window per day within which the synchronisation pulse must be sent to the meter. The time of the day (e.g. 22:00h) and the width (e.g. one minute) of the window can be defined by parameter setting.



If the "time of the day" parameter is set to 22:00h and the meter receives a synchronisation signal within the defined window, the calendar clock is synchronised to 22:00h. The reaction of the meter to the synchronisation signal depends on the deviation (see *2.8.5 Handling the Deviations*).

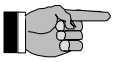
The meter will not accept any synchronisation pulses outside the time window and the signal will therefore have no effect.

2.8.3 Synchronising the Calendar Clock via Communication

The calendar clock can be synchronised by the central station, which sends the time information to the meter via the selected communication interface.

The time information received is compared with the local time of the meter. The reaction of the meter to the time information depends on the deviation (see *2.8.5 Handling the Deviations*).

Via communication, the time may be synchronised only once per synchronisation interval.

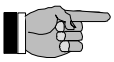


Note

Time synchronisation twice within synchronisation interval

If the time is synchronised a second time within the same synchronisation interval, the capture period is reset no matter how small the deviation.

This is to prevent multiple synchronisation with a small time shift resulting in a large time shift that, if made in one single approach, would have reset the capture period.



Note

Disabling the synchronisation via communication

The synchronisation of the calendar clock via communication may be disabled by setting the parameters of the security system accordingly.

2.8.4 Setting the Time

Date and time of the calendar clock can be set manually in the set mode or via communication (e.g. with a laptop computer).

The time information received is compared with the local time of the meter. The reaction of the meter to the time information depends on the deviation (see *2.8.5 Handling the Deviations*).

Note

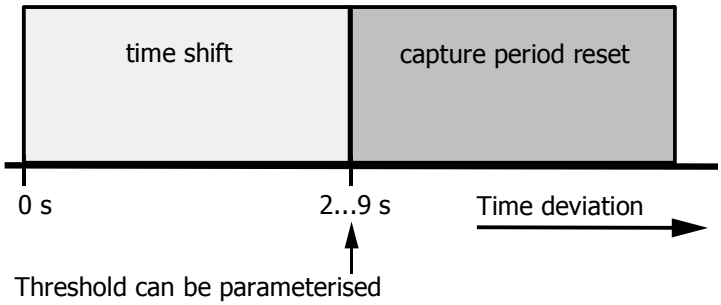
Setting the time twice within capture period

If the time is set a second time within the same capture period, the capture period is reset no matter how small the deviation.

2.8.5 Handling the Deviations

Depending on the time deviation of the internal clock from the external master clock, the adjustment has different effects on the calendar clock. The following two cases are possible:

- the time deviation is smaller than 2 to 9 seconds (depending on parameter setting) => time shift
- the time deviation is longer than 2 to 9 seconds (depending on parameter setting) => capture period reset



Time shift

If the difference between the internal clock and the master clock is between one second and the parameterised threshold, the time is adjusted to the synchronisation time. Advancing or setting back the clock is only allowed once per synchronisation interval. The affected capture period is shortened or elongated by the number of seconds of the time shift.

This time shift is allowed only once per synchronisation interval. Thus further time shifts within the same synchronisation interval will restart the capture period.

Capture period reset

If the difference between the internal clock and the master clock is greater than the parameterised threshold, the time for the calendar clock is set to the synchronisation time. Setting the time always causes the termination of the present capture period and the start of a new period. An entry in the event log will also be made.

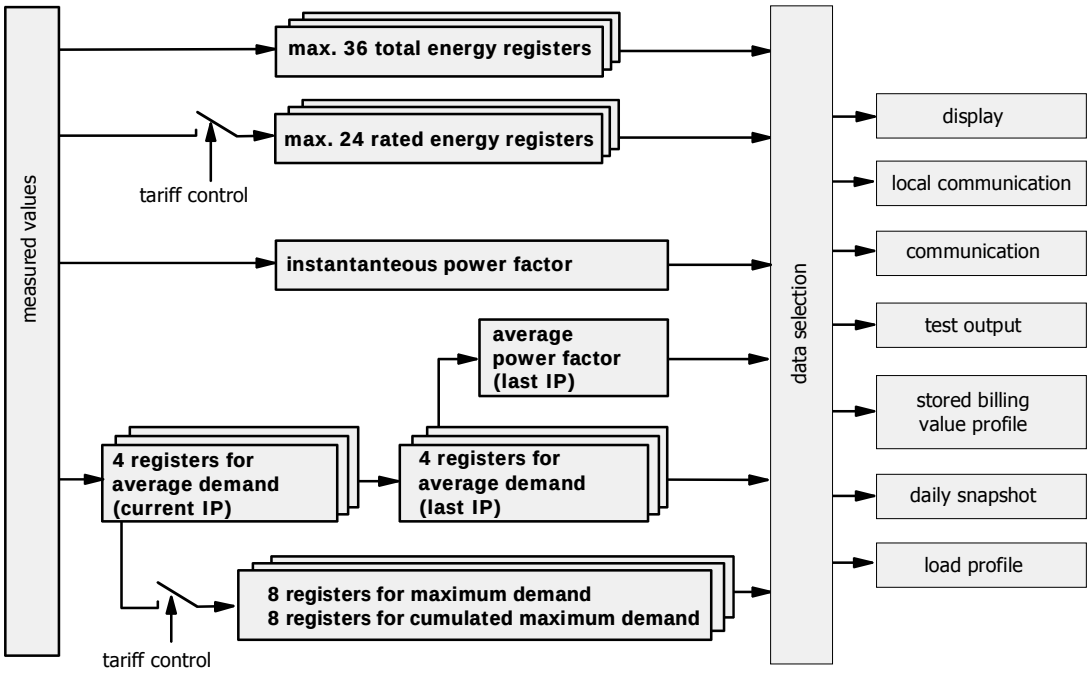
Setting the time to either the begin or the end of the capture period results in one shortened capture period.

Setting the time to a time within the capture period results in at least one shortened capture period. Load profile entries for shortened capture periods are identified by a corresponding status entry and are declared invalid.

2.9 Registers

The following registers are available for the analysis of the individual measured values:

- 36 total energy registers (no tariffs)
- 24 rated energy registers
- 1 register for the instantaneous power factor (C.8 only)
- 2 registers for the average power factor of the last integration period for energy import and export (C.8 only)
- 4 registers for average demand of the current integration period (C.8 only)
- 4 registers for average demand of the last integration period (C.8 only)
- 8 registers for maximum demand (C.8 only)
- 8 registers for cumulated maximum demand (C.8 only)
- other registers for values of voltage and current, network frequency, phase angles etc.



2.10 Memory

A non-volatile memory (FLASH memory) contains the configuration and parameterisation data of the meter. It also contains the load profile, the snapshot, the stored billing value profile and the event log data.

All data stored in the flash memory is prevented from loss caused by voltage failures. No battery is required to do so.

2.10.1 Load Profile

The current statuses of various registers are saved to the load profile at regular intervals.

Load profile memory size

Each load profile entry consists of the measured value itself (energy registers = 8 bytes, diagnostic values = 4 bytes), a time stamp of 8 bytes and a status code of 4 bytes.

The ZxQ meters feature a load profile memory of 1.8 MB. The memory depth of the load profile is calculated with the formula below.

$$\text{memory depth}[\text{days}] = \frac{1'810'000\,\text{byte} \times \text{capture period}[\text{min}]}{\text{used memory per entry}[\text{byte}] \times 24\,\text{h} \times 60\,\text{min}}$$

A minimum of 100 days is guaranteed with 36 captured registers and a capture period of 15 minutes.

The load profile is organised as a circular buffer, i.e. the oldest entry will be overwritten by the most recent entry.

2.10.2 Snapshot

The meter stores the current value of the energy registers to the snapshot profile every day. Which registers are stored to the snapshot profile and at what time of the day the storage takes place can be selected by parameterisation.

The snapshot profile may register a maximum of 36 registers with a maximum of 40 entries each.

2.10.3 Stored Billing Value Profile

At the end of the billing period, the meter stores the current value of the registers to the stored billing value profile. The billing period always corresponds with the capture period of the load profile. Which energy registers and/or demand registers are stored to the stored billing value profile can be selected by parameterisation.

The stored billing value profile is available with meters with the functional range C.8 only. The stored billing value profile may register a maximum of 36 registers with a maximum of 40 entries each.

2.10.4 Event Log

Events that occur sporadically are stored in the event log. The user may select what events trigger an entry in the event log. The event log is used to analyse the behaviour of the network as well as to supervise the correct application of the meter.

Event log memory size

In the event log, a minimum of 256 event entries can be stored, all of which consist of the time stamp and the event number.

The event log is organised as a circular buffer, i.e. the oldest entry will be overwritten by the most recent entry.

2.11 Power Supply

The supply voltages for the meter are obtained from the three-phase network, whereby the phase voltage may vary over the entire voltage range without the power supply having to be adjusted. As the power supply even works with only one phase voltage available, single-phase voltage dips do not affect the operation of the meter.

A voltage monitor ensures correct operation and reliable data recovery in the event of a all-phase voltage interruption and correct restarting when the voltage is restored.

2.12 Additional Power Supply

Because the three-phase network can be switched off in grid metering applications, the meter is equipped with an additional power supply in order to prevent the meter from being switched off.

The additional power supply supplies its voltage in parallel to the normal network supply and it ensures an uninterrupted operation of the meter, so that the meter can be read at any time. In a special mode, the meter may also be powered by the additional power supply only (optional, depending on parameter settings). As a result, there is no load on the line between transformer and meter which prevents the line from voltage drops.

2.13 Transmitting Contacts Module

The transmitting contacts module is fitted inside the meter and is therefore secured by verification seals. It features up to four changeover contacts or up to eight normally open contacts (solid-state relays). The contacts are used to transmit energy pulses and/or energy direction information or status information.

The transmitting contacts either transmit pulses with a defined pulse length (20 ms, 40 ms or 80 ms) or pulses with a mark-to-space-ratio of 1.

There are transmitting contact modules with a pre-defined terminal allocation while the terminal allocation of other modules can be parameterised according to the customer's specification.

2.14 Communication Unit (Option)

The optional communication unit is a complete unit housed in its own case. If mounted, it is situated under the front cover. Therefore, it is secured by a utility seal and can be mounted and replaced in the field if necessary. It contains communication interfaces (e.g. RS232, RS485, modem) as required for remote reading of the meter data. Two different communication units are available.

2.15 Software Tools

There are two software tools available with the meter, which enable easy parameter setting and communication with the meter.

MAP190

The software Landis+Gyr MAP190 is used for setting up complete parameter sets off-line (parameter editor). The prepared parameter sets can then be downloaded to the meter via the optical interface. The software MAP190 is used for the order processing by regional companies.

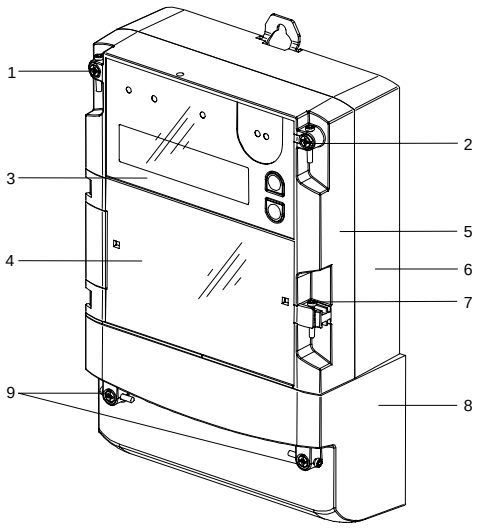
MAP120

The software Landis+Gyr MAP120 is used:

- to communicate with the meter according to dlms
- to perform service tasks
- to set certain parameter ranges such as primary data, the time switch etc.
- to reparameterise the meter and the communication unit

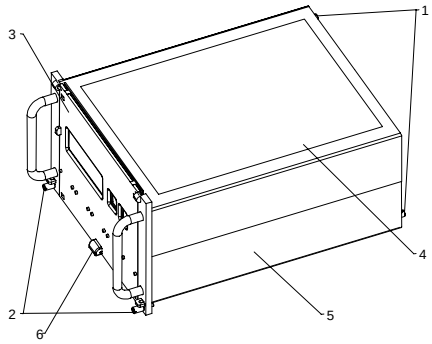
3 Mechanical Description

Wall-mounting f6



1 Manufacturer's seal
2 Manufacturer's or verification seal
3 Front window with face plate
4 Front door with information plate and terminal connection diagram on rear side
5 Cover
6 Base
7 Utility's seal
8 Terminal cover
9 Utility's seal after installation

Rack-mounting f9



1 Manufacturer's or verification seal
2 Utility's seal after installation
3 Front cover with face plate and additional information
4 Connection diagram
5 Housing
6 Utility's seal

Usage of Seals

Wall-mounting f6

	Sealing at manufacturer's site	Sealing at utility's site - no verification necessary	Sealing at utility's site - verification necessary
1	manufacturer's seal	manufacturer's seal	manufacturer's seal
2	manufacturer's seal	manufacturer's seal	verification seal
7	none	utility's seal	verification or utility's seal
9	none	utility's seal	utility's seal

Rack-mounting f9

	Sealing at manufacturer's site	Sealing at utility's site - no verification necessary	Sealing at utility's site - verification necessary
1 (left)	manufacturer's seal	manufacturer's seal	manufacturer's seal
1 (right)	manufacturer's seal	manufacturer's seal	verification seal
2	none	utility's seal	verification seal
6	binder	utility's seal	verification seal

3.1 Manufacturer's Seal

The manufacturer's seal is secured after the meter has been assembled, tested, and calibrated.

Wall-mounting f6

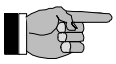
For the f6, the manufacturer's seal secures the meter cover so that the front window can not be opened without removing the seal. The ZxQ is delivered with two manufacturer's seal; one at the upper left side of the front window and one on the upper right side. Once certified, the manufacturer's seal on the upper right side of the front window is replaced with the verification seal.

Rack-mounting f9

For the f9, the manufacturer's seal secures the meter base so that it can not be opened without removing the seal. The ZxQ is delivered with two manufacturer's seals at the back of the base; one at the upper right side and one at the lower left side. Once certified, one or both of the manufacturer's seals is replaced with the verification seal.

3.2 Verification Seal

The verification seal is secured after the meter's measuring capability has been verified.



Note

Damaging the verification seal

In countries with an obligatory verification, the verification seal is awarded by the verification body and guarantees the correct measurement performance of the meter according to the local regulations.

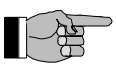
Breaking a verification seal renders the official verification invalid. Breaking a verification seal also renders the guarantee invalid, as defined in the general delivery conditions.

Wall-mounting f6

Once certified, the manufacturer’s seal on the upper right side of the front window is replaced with the verification seal.

Rack-mounting f9

Once certified, one or both of the manufacturer's seal at the back of the meter case is replaced with the verification seal.



Note

Removal of communication unit on rack mounted version f9

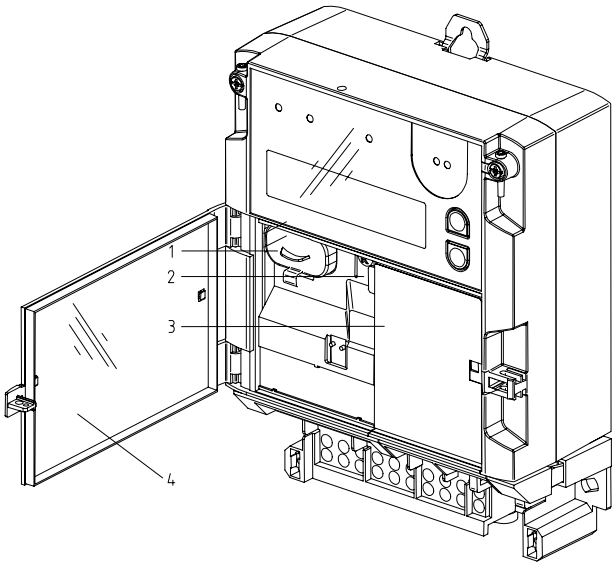
For f9, the **communication unit** can only be removed or exchanged for another communication unit or dummy by opening the meter case and breaking the verification seal.

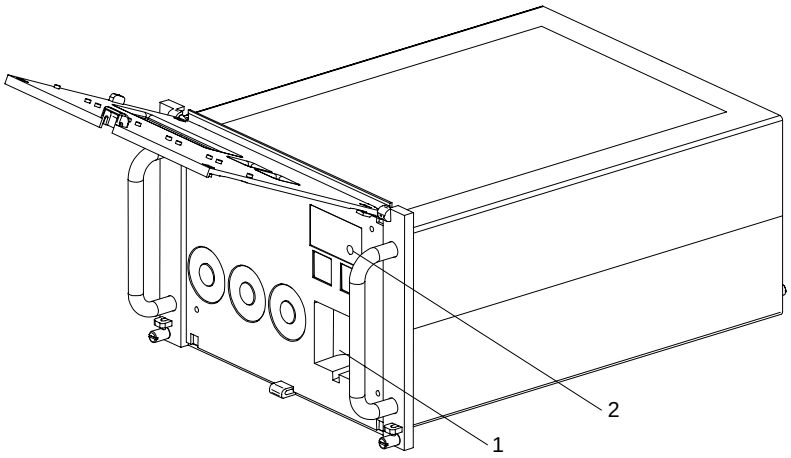
3.3 Utility's Seals

The utility's seals are secured after the meter is prepared for use and commissioning.

Wall-mounting f6 For the f6, the utility's seal secures the hinged front door, which allows access to the battery compartment, the alarm reset button and the communication unit. The information plate with the connection diagram on the rear side is also located in the front door.

Rack-mounting f9 For the f9, the utility's seal secures the hinged front cover, which allows access to the battery compartment and the alarm reset button.





1 Battery compartment

2 Alarm reset button

3 Communication unit or dummy

4 Information plate with connection diagram

A 6 V lithium battery can be inserted in the **battery compartment** to provide power to the calendar clock and display.

The **alarm reset button** has three functions:

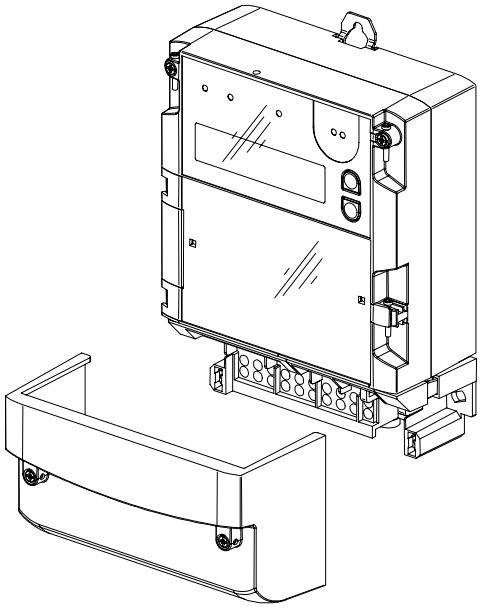
1. Reset an alarm.
2. Select the service menu from the display check.
3. Perform the cursor function in the set mode.

A **communication unit** is installed when the meter is used in a system where remote meter reading is employed. Remote meter reading requires communication between the meter and the **central station**, which the communication unit provides via a serial interface or modem.

Remote meter reading, time synchronisation with the central station time, meter check to ensure the meter is functioning correctly, and parameter setting can be performed using the communication unit.

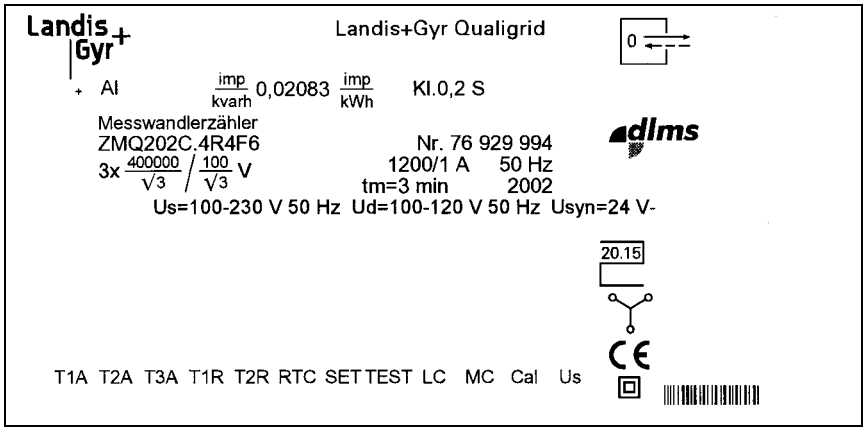
If a communication unit is not required, a dummy is inserted.

For f6, the terminal cover protects the meter terminal connecters. The terminal cover is secured with two utility's seals to prevent unauthorised access, both for safety and anti-tampering reasons.



3.4 Face Plate f6

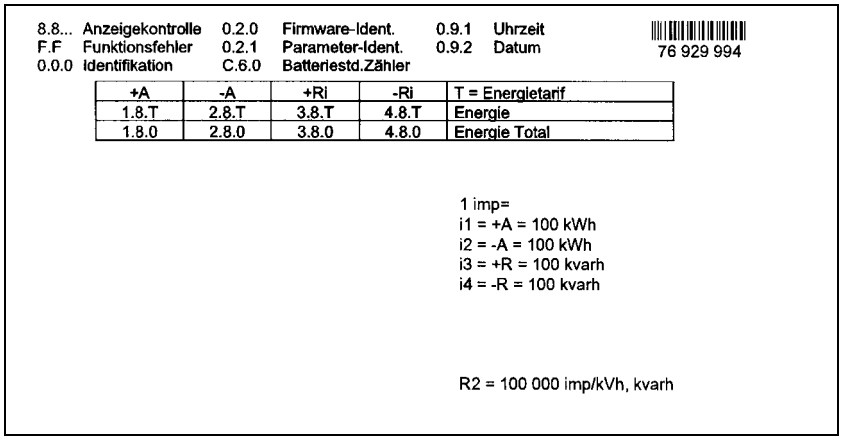
The face plate is located behind the front window, which is secured by a manufacturer's or verification seal. The face plate is designed to customer specifications. It contains all relevant data about the meter.



Recesses in the front window permit operation of the display buttons "up" and "down" for control of the liquid crystal display.

3.5 Information Plate f6

The information plate is located in the hinged front door. It contains all relevant data about the meter. The front door is secured by the utility's seal after the meter has been connected according to the terminal connection diagram which is located on the back of the face plate. The terminal connection diagram is only visible with the door open.

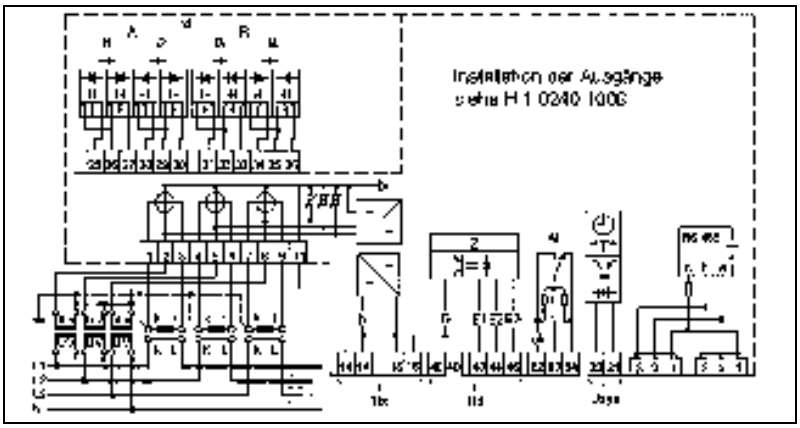


On the information plate you will find:

- explanations to the display
- the pulse values of the transmitting contacts
- the hint "U_S < 0.1 VA" if the meter is supplied via additional power supply only (max. load of 0.1 VA on the measurement voltage, optional)
- the meter constant R2 for testing meters with primary data on the testing station (this is to avoid roundoff errors when calculating the secondary meter constant).

3.6 Terminal Connection Diagram f6

The terminal connection diagram is located on the back of the face plate and specifies how the meter is to be connected. It is only visible with the front door open. After the connections have been made, the front door is secured by the utility's seal.



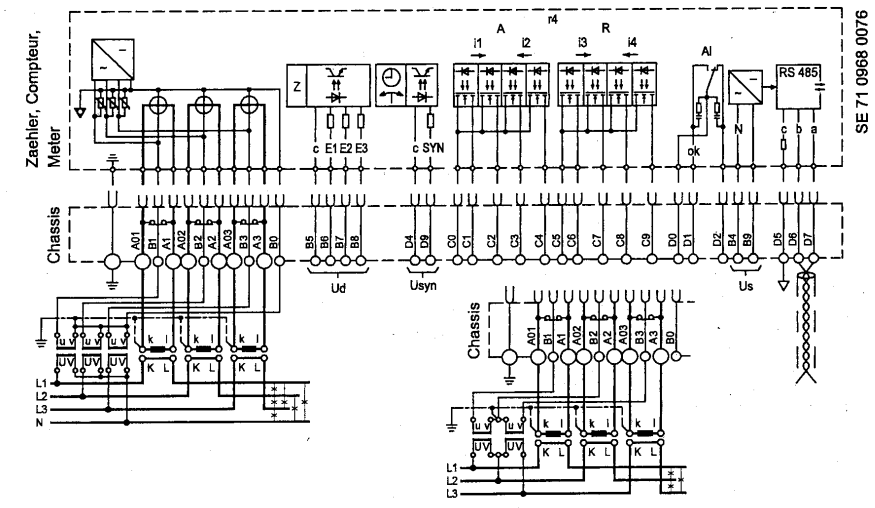
3.7 Face Plate and Information Plate f9

The f9 face plate and information plate is located in the front cover, which is secured by the utility's seal. When the utility's seal is broken, the front cover can be opened. The face plate and information plate is designed to customer specifications. It contains all relevant data about the meter.

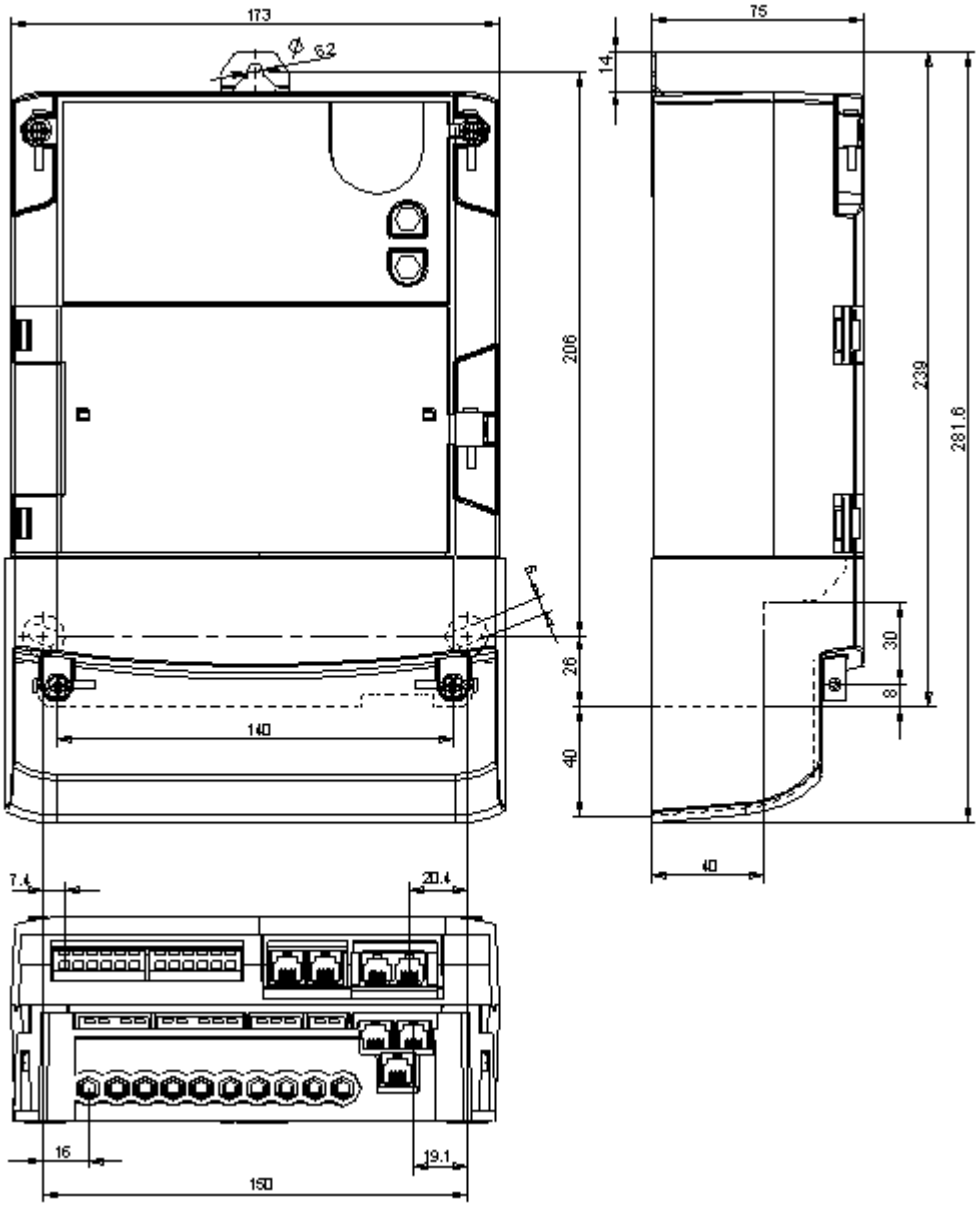
Recesses in the front cover permit operation of the display buttons "up" and "down" for control of the liquid crystal display.

3.8 Connection Diagram f9

The connection diagram is located on the top of the case and specifies how the meter is to be connected. The connection diagram is visible when the meter is drawn out of the rack.

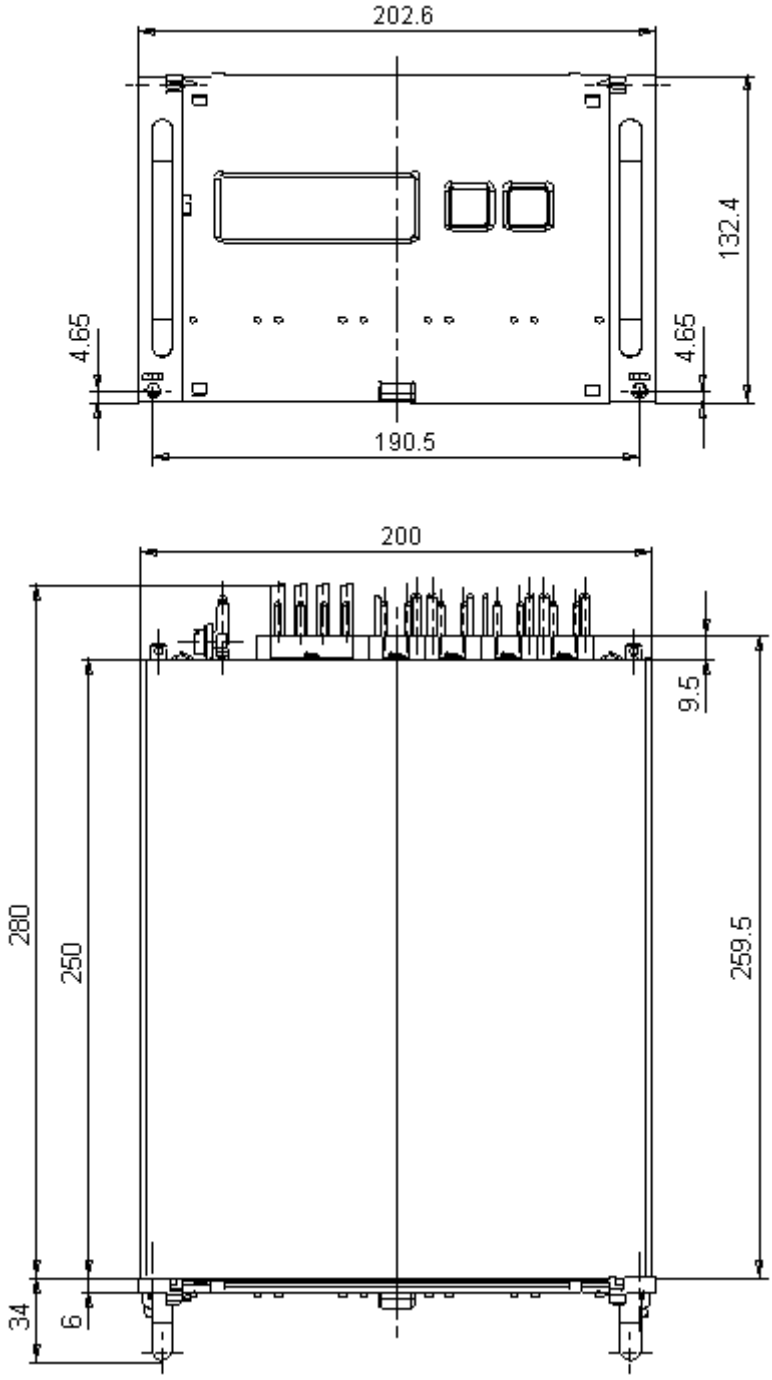


3.9 Dimension Diagrams f6



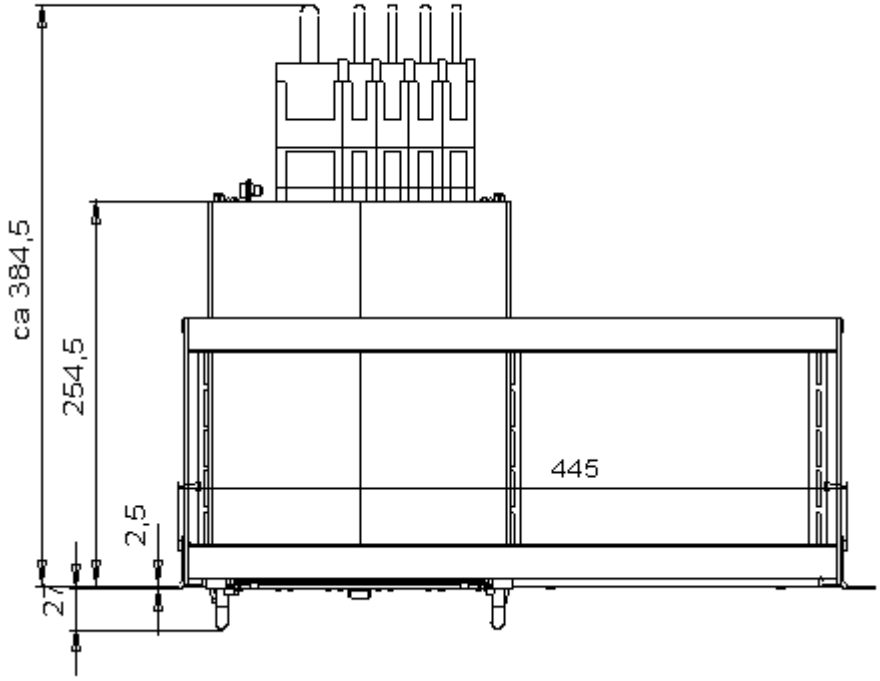
3.10 Dimension Diagrams f9

3.10.1 Rack Mounting

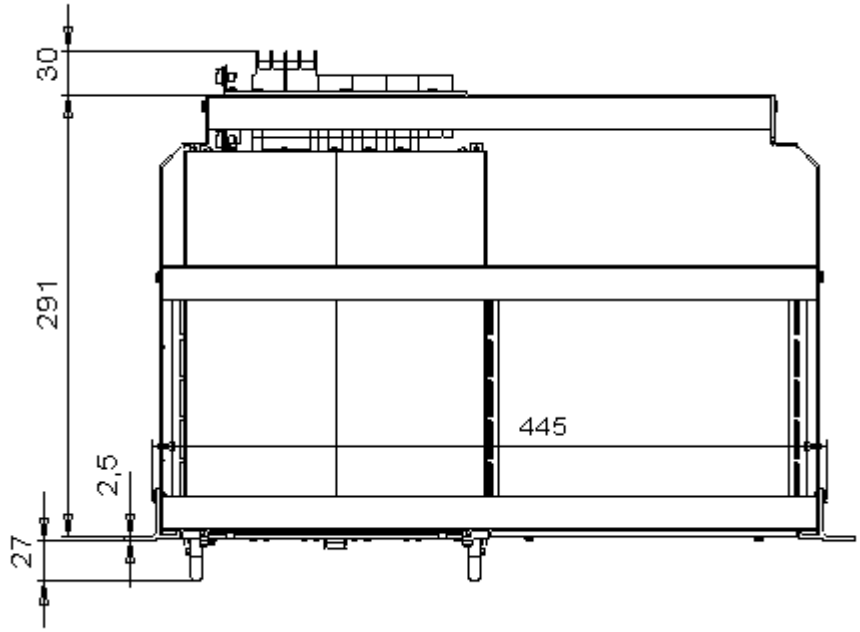


3.10.2 Racks

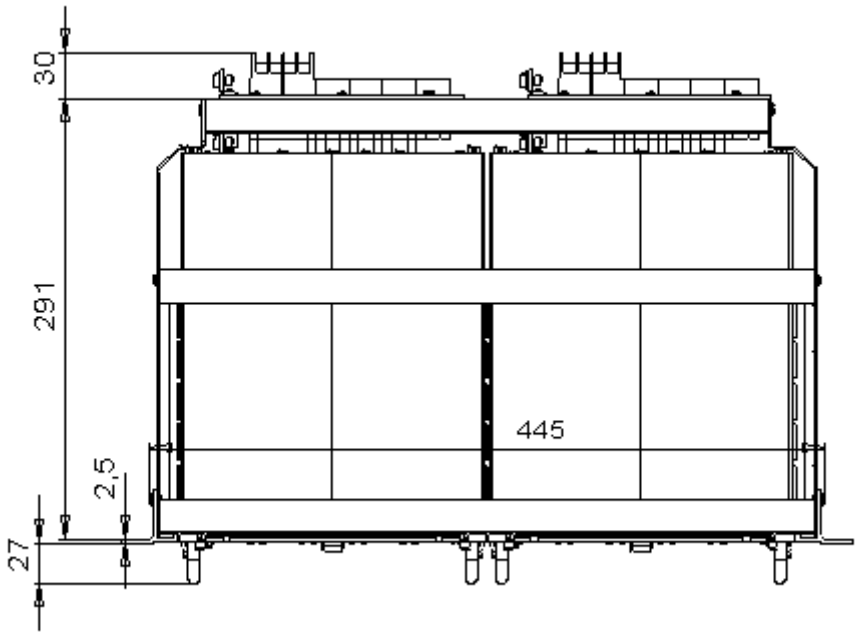
f9.10 for meters with cable connection



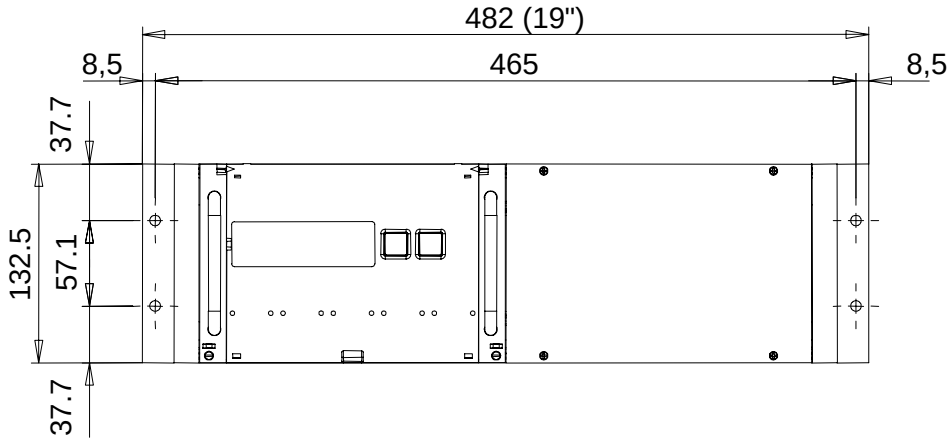
f9.11 for one meter with direct connection



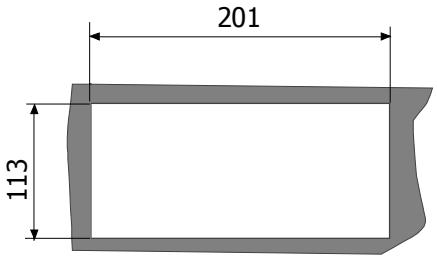
f9.12 for two meters with direct connection

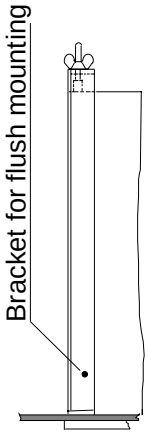


Front view

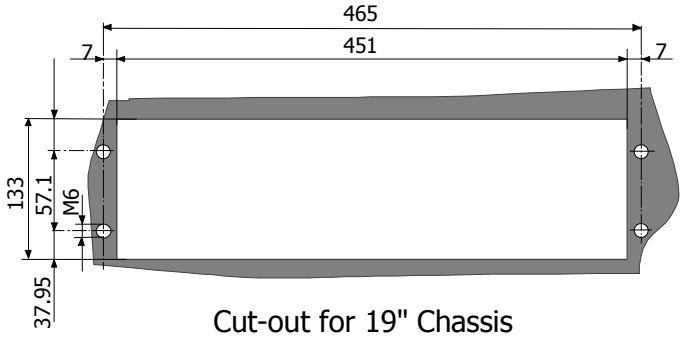


3.10.3 Flush Mounting





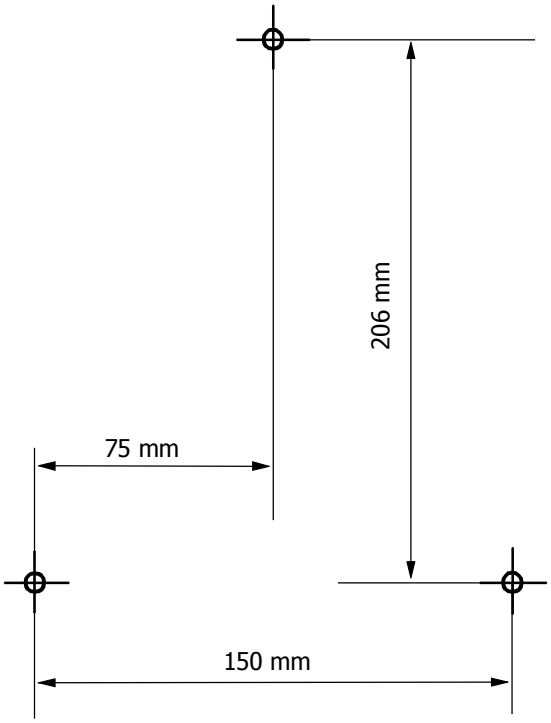
Cut-out for panel-flush mounting



Cut-out for 19" Chassis

3.11 Mounting f6

1. Select the position for mounting the meter.
2. Mark the three fixing points (suspension triangle) on the mounting surface:
   horizontal base of suspension triangle = 150 mm
   height of suspension triangle for open mounting = 206 mm



3. Drill the three holes for the fixing screws.
4. Unscrew the meter terminal cover.
5. Fix the meter with the three fixing screws on the mounting surface.

Warning

Dropping meters

The meters can cause injuries if dropped.

They must be held securely during installation.

Meters which have dropped must not be installed, even if no damage is apparent. They 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.

4 Installation / De-installation

4.1 Prerequisites

Danger

Galvanic isolation

The measuring circuits and auxiliary circuits (additional power supply, tariff control input, synchronisation input, transmitting contacts, communication interfaces) must be galvanically isolated.

Danger

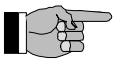
Voltage paths must be fused

When installing the meter, all voltage paths (measurement voltage and all auxiliary circuits such as the auxiliary power supply and the tariff control voltage) must be fused by max. 6 A delay fuses.

Warning

Separation of voltage connections and communication lines

The voltage connections must be physically separated from the communication lines in accordance with local laws and regulations.



Note

Recommendation

We recommend that twisted and shielded cables are used for the communication lines. One end of the cable shield should be connected to the ground.

4.2 Connect the f6 Meter

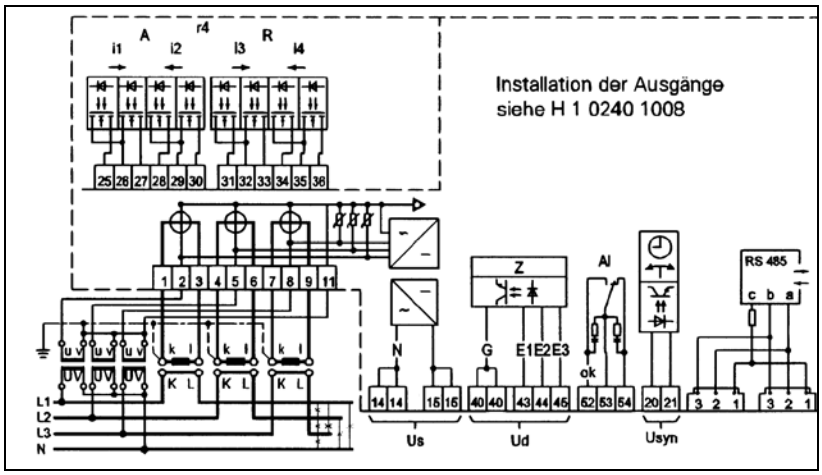
Note

Assumption of mounted meter

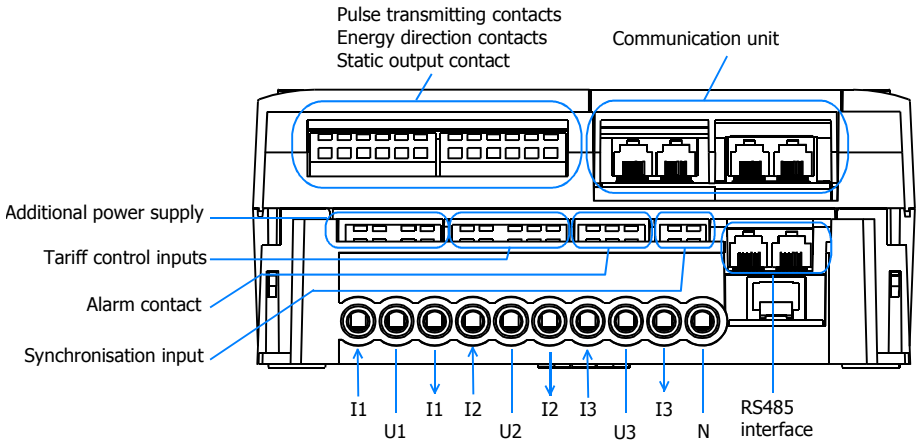
It is assumed that the meter is already mounted. How to mount the meter is described in section *3.11 Mounting f6*.

4.2.1 Connection Diagram

The f6 is connected according to the terminal connection diagram located in the front door. The following is an example.



4.2.2 Terminal Layout



Transmitting contacts

The 12 spring clamp connectors are located on the transmitting module and transmit measured values as pulses to telemetering instruments. They are passive output contacts, i.e. energised by the receiver.

The function of each output depends on the connected PCB. Assigning the functions to the corresponding connector is determined in the software. The connector numbers remain the same, whichever PCB is connected.

Communication interface

Depending on the communication unit type, the number of RJ-12 connectors can vary. When spring clamp connectors are available (e.g. at B4 and M4) they are not used. The RJ-12 connectors are located on the communication unit. Communication between the meter and the central station can be achieved via a PSTN modem, RS485 interface, or RS232 interface.

Additional power supply

The four spring clamp connectors on the left provide connection for the **additional power supply**.

Inputs and outputs

The five spring clamp connectors on the right of the additional power supply provide connection for **tariff control inputs**. If the meter is shipped without external tariff control, these terminals will not be labelled.

The three spring clamp connectors on the right of the tariff control inputs is the **synchronisation input**.

The two spring clamp connectors on the right of the synchronisation input is the **alarm contact**.

Serial interface

The two RJ-12 connectors are located on the power supply board, and provide local serial RS485 connection of other meters (daisy chain). They are connected in parallel so that the use of a T-piece is not necessary.

4.2.3 Procedure

Danger

Dangerous voltage on conductors

Dangerous voltage is present on the conductors that the meter is to be connected to.

Contact with the conductors when under voltage will result in severe personal injury or death.

The conductors must not be under voltage when connecting or disconnecting the meter.

Installation and de-installation of the meter must only be performed by qualified meter installers, with strict adherence to the utility's safety regulations.

Danger

Dangerous voltage on current transformers

Dangerous voltage is produced by the current transformers when the secondary circuit is broken while current is flowing in the primary.

Contact with the transformers when under voltage will result in severe personal injury or death. The high voltage produced will destroy the transformers.

The current transformer secondary circuit must be short-circuited before de-installing the meter. Installation and de-installation of the meter must only be performed by qualified meter installers, with strict adherence to the utility's safety regulations.

Danger

Missing transformer earthing

Voltage transformers in medium and high voltage systems that are not earthed on the secondary may reach dangerously high voltage values on the secondary.

Voltage transformers are usually earthed on the secondary. If the voltage transformer is not earthed, severe personal injury or death can result if contact is made with the meter and the meter will be damaged beyond repair.

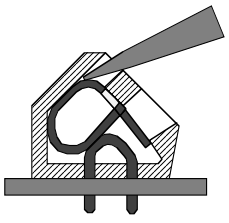
If the voltage transformers are not earthed, special precautions must be taken when working at the meter. Installation and de-installation of the meter must only be performed by qualified meter installers, with strict adherence to the utility's safety regulations.

Connect Current and Voltage Connectors

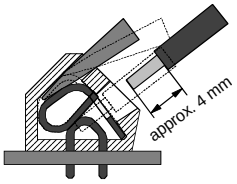
1. Shorten the current and voltage connecting wires to the required length and then strip them to fit the connectors.
2. Insert the current and voltage connecting wires to the terminal numbers as shown in the connection diagram.
3. Tighten (torque up to 1.7 Nm) the terminal screws using the torque screwdriver size 2.

Connect Control Inputs and Outputs and Transmitting Contacts

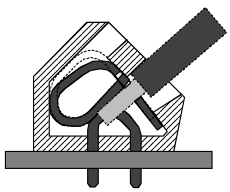
4. Shorten the connecting wires of the control inputs and outputs to the required length and strip them for approx. 4 mm (wires and strands up to 2.5 mm^2 can be connected).
5. If stranded wire is used, it is recommended to fit it with ferrules for connection.
6. Connect the connecting wires of the control inputs and outputs as shown on the terminal connection diagram to the spring clamp connectors as follows:



Insert a size 1 screwdriver, turning it slightly upwards, in the upper opening.



Place the stripped connecting wire in the lower opening and hold it there securely.



Withdraw the screwdriver. The connecting wire is now firmly fixed.

Danger

Avoid bare parts of wire

When voltage is applied, any bare part of the wire will become live. Ensure no bare wire is visible above the terminal edge.

If this is not the case, the stripped part of the wire must be shortened as necessary.

Connect Communication and Serial Interfaces

7. Plug in the ready-made telephone cables as shown on the terminal connection diagram.

Warning

Power on

Incorrect connections could damage the meter or result in the meter measuring incorrectly.

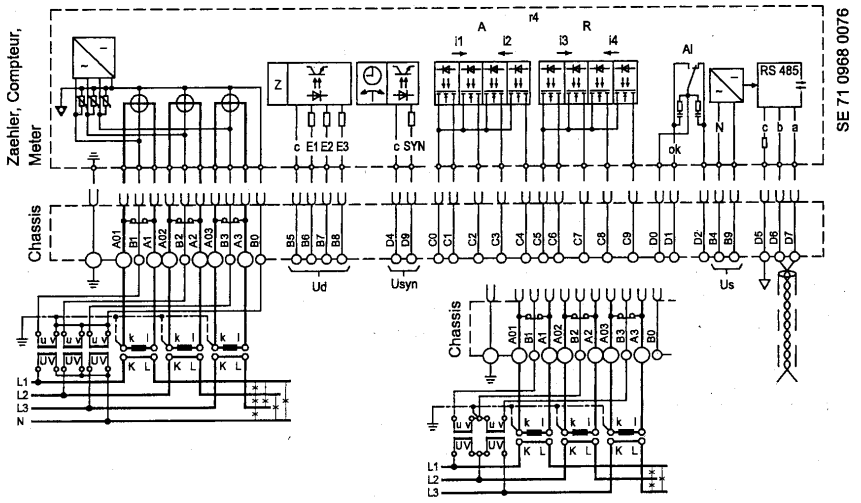
We recommend all connections be checked before applying power.

8. Open circuit the current transformer secondary circuit using the provided assembly.
9. Switch on the voltage and current.

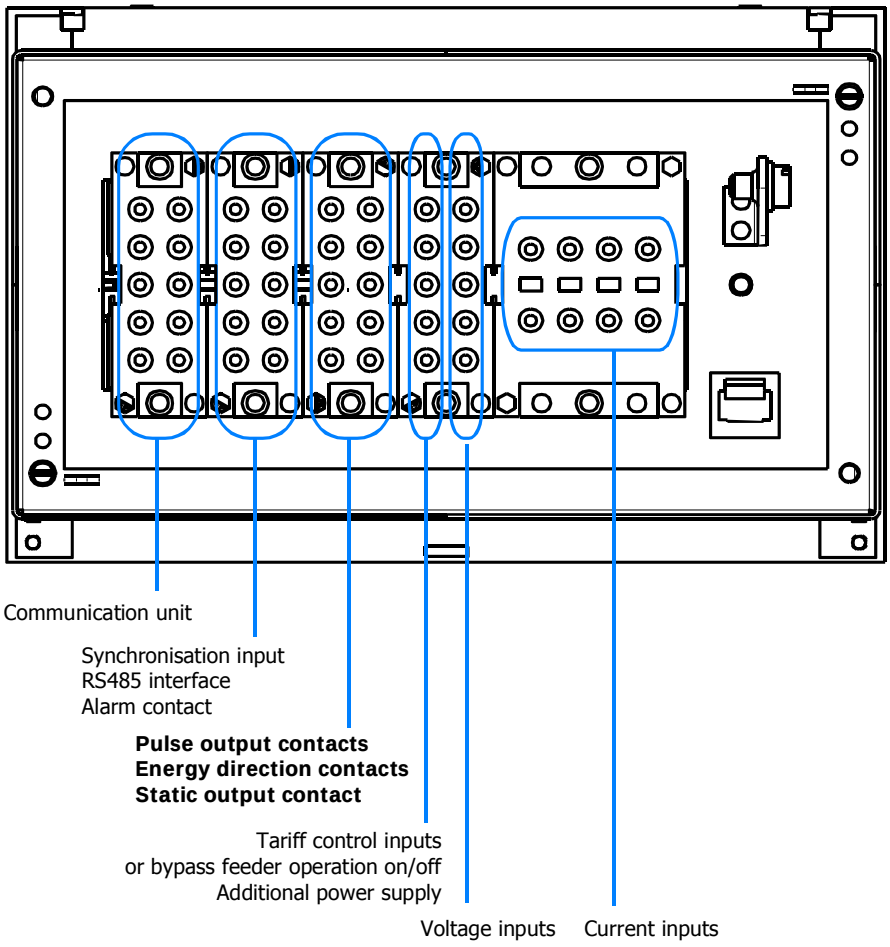
4.3 Connect the f9 Meter

4.3.1 Connection Diagram

The f9 is connected according to the connection diagram located on the top of the case. The following is an example.



4.3.2 Terminal Layout



The f9 is equipped with Essailec connectors for direct plug-in into a pre-wired rack. The rack is pre-wired according to the plug connection diagram.

4.3.3 Procedure

Danger

High voltage on transformer

High voltage is produced by the current transformers when the secondary circuit is broken while current is flowing in the primary.

Contact with the transformers when under voltage will result in severe personal injury or death. In addition, the high voltage produced will destroy the transformers.

The current transformer secondary circuit must be short-circuited before de-installing the meter. Connecting and disconnecting the meter must only be performed by qualified meter installers, with strict adherence to the utility's safety regulations.

Warning

Power on

Incorrect connections could damage the meter or result in the meter measuring incorrectly.

We recommend all connections be checked before applying power.

Warning

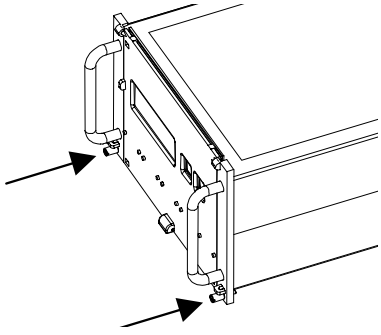
Dropping meters

The meters can cause injuries if dropped.

They must be held securely during installation.

Meters which have dropped must not be installed, even if no damage is apparent. They 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.

1. Open-circuit the current transformer secondary circuit using the provided assembly. (The detailed procedure depends on the transformers being used.)
2. Plug the f9 into the pre-wired rack.
3. Tighten both meter fixing screws.



4. Switch on the voltage and current.

4.4 Installation Check

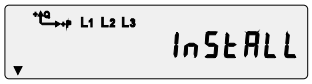
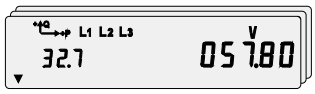
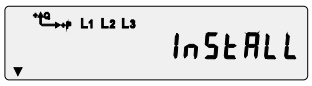
The power must be connected and all 3 phases under load. If the phase voltages are present only, the optical test outputs are continuously lit.

Key:

▽	Short press down display button (<2s)
▼	Long press down display button (>2s)
△	Short press up display button (<2s)
▲	Long press up display button (>2s)
▽▼	Short press down display button until "End" is displayed then long press down display button
(R)	Alarm reset button (under utility's seal)

4.4.1 Check Procedure

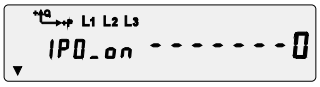
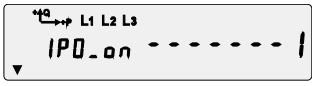
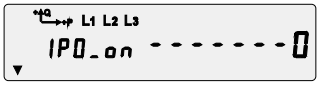
1.		Check whether the operating display is shown. An 'FF' indicates fatal errors or alarms.		Operating display
2.		Check phases L1, L2, and L3 are present and in the correct phase sequence, i.e. L1-L2-L3. If one phase is not present or the voltage is < 45% Un, the relevant symbol is absent. With the normal phase sequence the symbols are displayed continuously. If the meter is connected with reversed phase sequence (e.g. L2-L1-L3) the symbols flash.		Phase check
3.		The energy direction arrows indicate whether energy is being imported (+) or exported (-). P = active energy, Q = reactive energy.		Energy direction indicator
4.	▽	All segments of the display are illuminated		Display check
5.	(R)	Enter service menu		Set mode

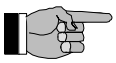
6.	▽	Select menu item		Installation diagnostic
7.	▼	Enter installation diagnostic list		
8.	▽	Check the phase voltages:		
		Voltage L1: Code 32.7 Voltage L2: Code 52.7 Voltage L3: Code 72.7		
	▽	Check the phase currents:		
		Current L1: Code 31.7 Current L2: Code 51.7 Current L3: Code 71.7		
	▽	Check the phase angles:		Note: Current must be flowing to show the phase angles
		Phase angle U(L1) Code 81.7.0 Phase angle U(L2) Code 81.7.1 Phase angle U(L3) Code 81.7.2 Phase angle I (L1) Code 81.7.4 Phase angle I (L2) Code 81.7.5 Phase angle I (L3) Code 81.7.6		
9.	▽	Advance display until **End**.		End of installation diagnostic
10.	▼	Back to the service menu.		Service menu
11.	▽	Advance display until **End**.		End of service menu
12.	▼	Exit service menu.		Operating display

4.4.2 Testing the Transmitting Contacts

In order to check the wiring of the transmitting contact the meter is switched to transmitting contact test mode. While in the test mode the meter send pulses with a frequency of 1 Hz to the pulse receiver.

The transmitting contact test mode is only available with meters with the functional range C.4, C.6 and C.8.

				Operating display
1.	▽	All segments of the display are illuminated		Display check
2.	Ⓡ	Enter service menu		Set mode
3.	▽	Select required setting		Transmitting contact test mode display
4.	▼	Switch on transmitting contact test mode 1 = transmitting contact test mode switched on 0 = transmitting contact test mode switched off		
5.		Check whether the 1 Hz pulses of the transmitting contacts are received by the transcoder and whether they are allocated to the correct registers.		
6.	▼	Switch off transmitting contact test mode		
7.	▽	Advance display until **End**		End of transmitting contact test mode display
8.	▼	Exit service menu		Operating display



Note

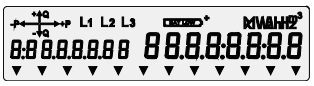
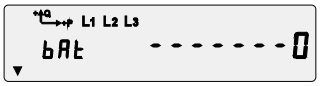
Availability

The transmitting contact test mode is not available in some countries. In these countries it cannot be activated.

4.4.3 Set Date and Time

				Operating display
1.	▽	All segments of the display are illuminated		Display check
2.	Ⓡ	Enter service menu		Set mode
3.	▼	Enter set mode		Identification number
4.	▽	Select required setting		Date, old value
5.	Ⓡ	Select next digit to be changed		Digit flashes
6.	▽	Change digit value		Digit flashes
7.	Ⓡ	Select digit to be changed		Next digit flashes
8.		Repeat steps 5 - 7 for all digits to be changed		All digits flash
9.	Ⓡ	Confirm new setting		Date, new value
10.		Repeat steps 4 - 9 for all settings to be changed		
11.	▽	Advance display until **End**		End of set mode
12.	▼	Back to service menu		Service menu
13.	▽	Advance display until **End**		End of service menu
14.	▼	Exit service menu		Operating display

4.4.4 Set Battery Low Indicator

				Operating display
1.	▽	All segments of the display are illuminated		Display check
2.	Ⓡ	Enter service menu		Set mode
3.	▽	Select menu item		Battery on / off display
4.	▼	Change setting: 1 = battery low indicator on 0 = battery low indicator off		
5.	▽	Advance display until **End**		End of battery on / off display
6.	▼	Exit service menu		Operating display

4.5 Sealing

When the installation check is complete, the utility's seals may be applied.

1. Screw on the terminal cover (f6 only).
2. Apply utility seals using the sealing pliers.

4.6 Disconnect the f6 Meter

4.6.1 Procedure

Danger

Dangerous voltage on conductors

Dangerous voltage is present on the conductors that the meter is connected to.

Contact with the conductors when under voltage will result in severe personal injury or death.

The conductors must not be under voltage when connecting or disconnecting the meter.

Installation and de-installation of the meter must only be performed by qualified meter installers, with strict adherence to the utility's safety regulations.

Danger

Dangerous voltage produced by current transformers

Dangerous voltage is produced by the current transformers when the secondary circuit is broken while current is flowing in the primary.

Contact with the transformers when under voltage will result in severe personal injury or death. The high voltage produced will destroy the transformers.

The current transformer secondary circuit must be short-circuited before de-installing the meter. Installation and de-installation of the meter must only be performed by qualified meter installers, with strict adherence to the utility's safety regulations.

Power off

1. Short-circuit the current transformers using the provided assembly.
2. Switch off the voltage. The phase voltage display (L1 L2 L3) disappears.
3. Switch off tariff inputs and synchronisation input. Check if the corresponding indicators disappear from the display.
4. Switch off the voltage for the additional power supply.
5. Check that all connections are free from voltage.
6. Remove the two utility's seals on the terminal cover, release the two screws and remove the terminal cover.

Disconnect Voltage and Current

7. Loosen the terminal screws and remove the wires of the measuring voltage and current.

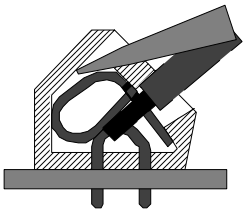
Disconnect Control Inputs and Outputs

8. Disconnect the connecting wires of the supply inputs and outputs from the spring clamp connectors as follows:

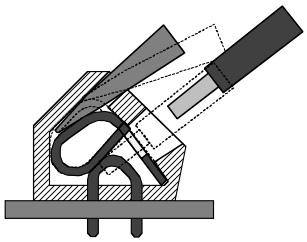
Note

Withdrawing the wire

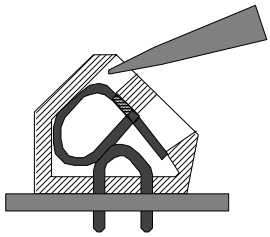
Withdrawing the wire with the terminal closed can damage the terminal.



Insert a size 1 screwdriver, turning it slightly upwards, into the upper opening



Withdraw the wire from the connector.



Withdraw the screwdriver.

Note

Precautions on disconnected wires

The disconnected wires should be isolated and may also be numbered for convenience when reconnecting.

Disconnect Communication Interfaces

9. Unplug the ready-made telephone cables from modems and serial interfaces.

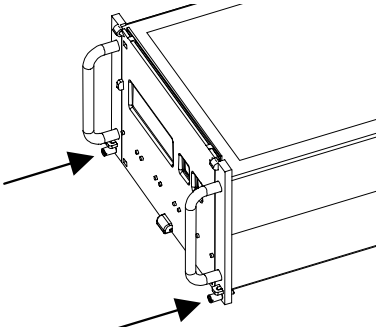
4.7 Disconnect the f9 Meter

4.7.1 Procedure

The f9 can be directly connected or cable connected.

Direct connection

1. Loosen both meter fixing screws.



2. Carefully withdraw the meter from the rack.

Cable connection

Danger

Dangerous voltage on current transformers

Dangerous voltage is produced by the current transformers when the secondary circuit is broken while current is flowing in the primary.

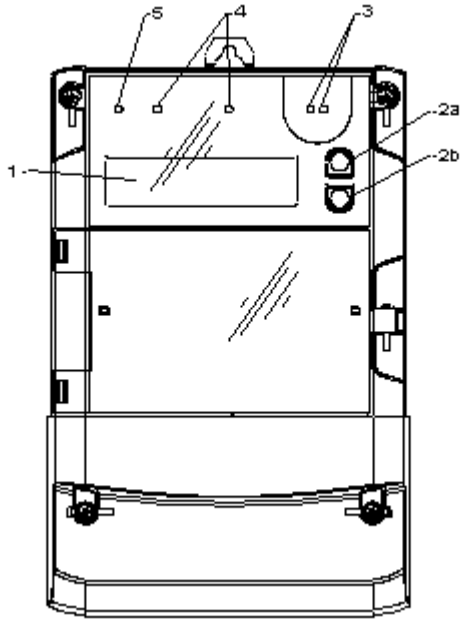
Contact with the transformers when under voltage will result in severe personal injury or death. The high voltage produced will also destroy the transformers.

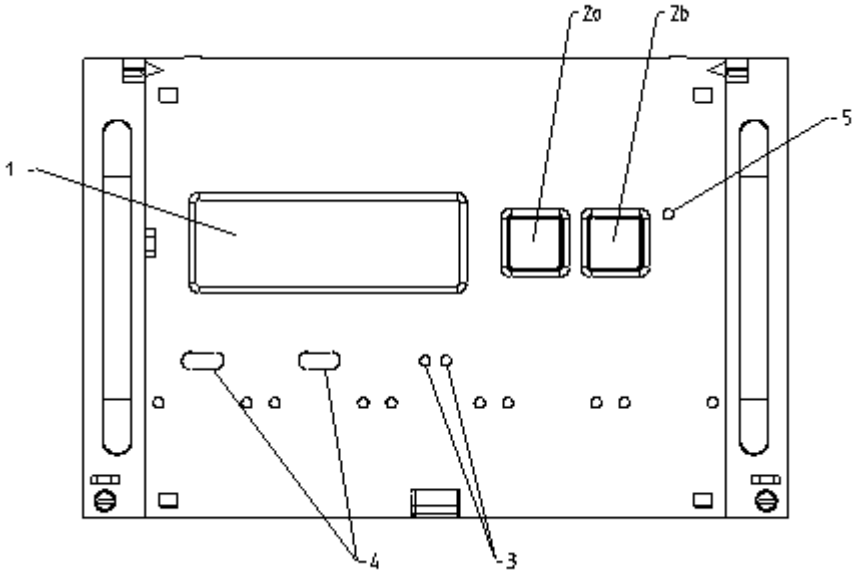
The current transformer secondary circuit must be short-circuited before de-installing the meter. Installation and de-installation of the meter must only be performed by qualified meter installers, with strict adherence to the utility's safety regulations.

1. Short-circuit the current transformers using the provided assembly. (the detailed procedure depends on the transformers being used.)
2. Switch off the voltage. The phase voltage display (L1 L2 L3) disappears.
3. Switch off the voltage for the tariff inputs and the synchronisation input. Check if the corresponding indicators disappear from the display.
4. Switch off the voltage for the additional power supply.
5. Loosen both meter fixing screws.
6. Carefully withdraw the meter from the rack.

5 Operation

5.1 Operating Elements



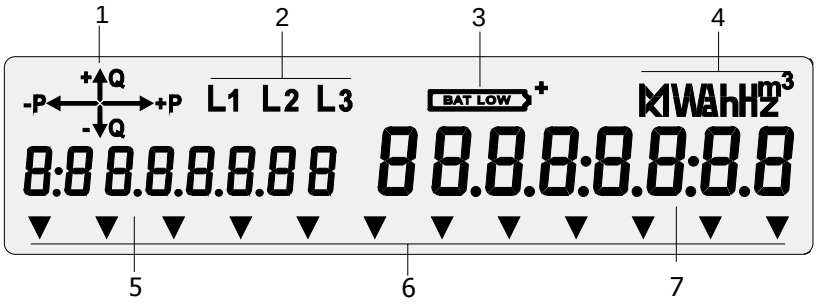


1	Display
2a	Display button up
2b	Display button down
3	Optical interface
4	Optical test outputs
5	Alarm LED

5.1.1 Display

The LCD (liquid crystal display) is provided with background lighting for easier reading.

When a display check is made, all segments of the display are illuminated.



1 Energy direction indicator

P = Active energy (A) Q = Reactive energy (R)

+ = import - = export

2 Phase voltage display (flashes if phase sequence is reversed)

3 Battery low indicator

4 Unit field (W, var, VA, k…, M…, …h, V, A, h, Hz)

5 Display code (8 digits). A code identifying the values in the value field. The code is according to the Object Identification System, described below

6 Arrow symbols for status information according to face plate

7 Value field (8 digits)

Object Identification System

The **B:C.D.E.F** structure applies to Object Identification System (OBIS)

B Defines the channel number, i.e. the number of the input of a metering equipment having several inputs for the measurement of energy of the same or different types (e.g. in data concentrators, registration units). This enables data from different sources to be identified.

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

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

E Defines the further processing of measurement results to tariff registers, according to the tariffs in use. For abstract data or for measurement results for which tariffs are not relevant, this value group can be used for further classification.

F Defines the storage of data according to different billing periods. Where this is not relevant, this value group can be used for further classification.

To simplify the reading of the display code, individual parts of the OBIS code can be omitted. The abstract or physical data C and type of data D must be shown.

Examples

1.8.0 1 = all-phase active power in positive direction
8 = cumulative value (meter reading)
0 = total energy (no tariffs)

0.9.1 Local time

Note

Display code

The display codes are parameterisable for all measured quantities. Therefore, they may differ from the OBIS code.

The most important display codes are annotated on the face plate.

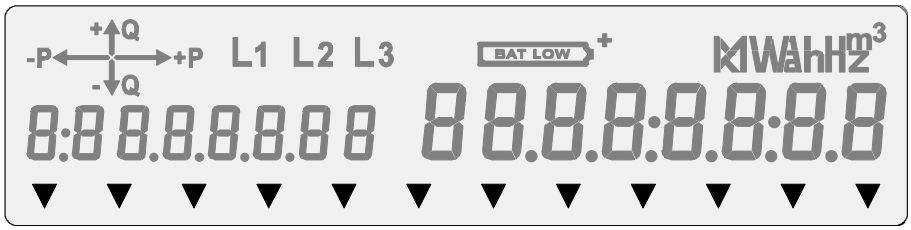
5.1.2 Arrows in Display

The arrow symbols in the display are used to give status information according to the face plate.

Example

The twelve arrows my be used to indicate the following statuses:

Currently active tariff for active energy	T1A, T2A, T3A
Currently active tariff for reactive energy	T1R, T2R
Time/date is invalid	RTC
The meter is in the set mode	SET
The meter is in the test mode	TEST
The meter communicates locally	LC
The meter communicates with the master station	MC
A customer calibration has been made	Cal
The additional power supply U_S is present	U_S



5.1.3 Display Buttons

Up display button

Down display button

The display is controlled using the up and down display buttons.

A **short** press of either button (< 2 seconds):

- Changes the operating display to display check
- Opens the display menu from the display check
- Runs sequentially through menus from item to item, and in lists from value to value (either forwards or backwards).

A **long** press of either button (> 2 seconds):

- Opens a selected sub-menu
- Returns to the next higher level when **End** is displayed
- Browses through lists from main value to main value (either forwards or backwards).

Simultaneously pressing both buttons cancels the function in use and returns to the operating display.

5.1.4 Optical Interface

The optical interface enables:

- Read out of meter data
- Parameter setting using MAP 120 service tool.

These functions are performed via a magnetically attached optical reading head.

The optical interface also functions as an optical switch. A light beam, e.g. from a torch, has the same function as the down display button. This enables reading to be made from a distance, e.g. through a protective glass screen in front of the meter.

5.1.5 Optical Test Outputs

The two green optical test outputs, one for **active energy** and one for **reactive energy** are used to test the meter. They transmit pulses corresponding to the power applied.

In a no load state, when no current is flowing, the optical test outputs are continuously illuminated.

5.1.6 Alarm LED

The red alarm LED indicates that the meter is not functioning correctly.

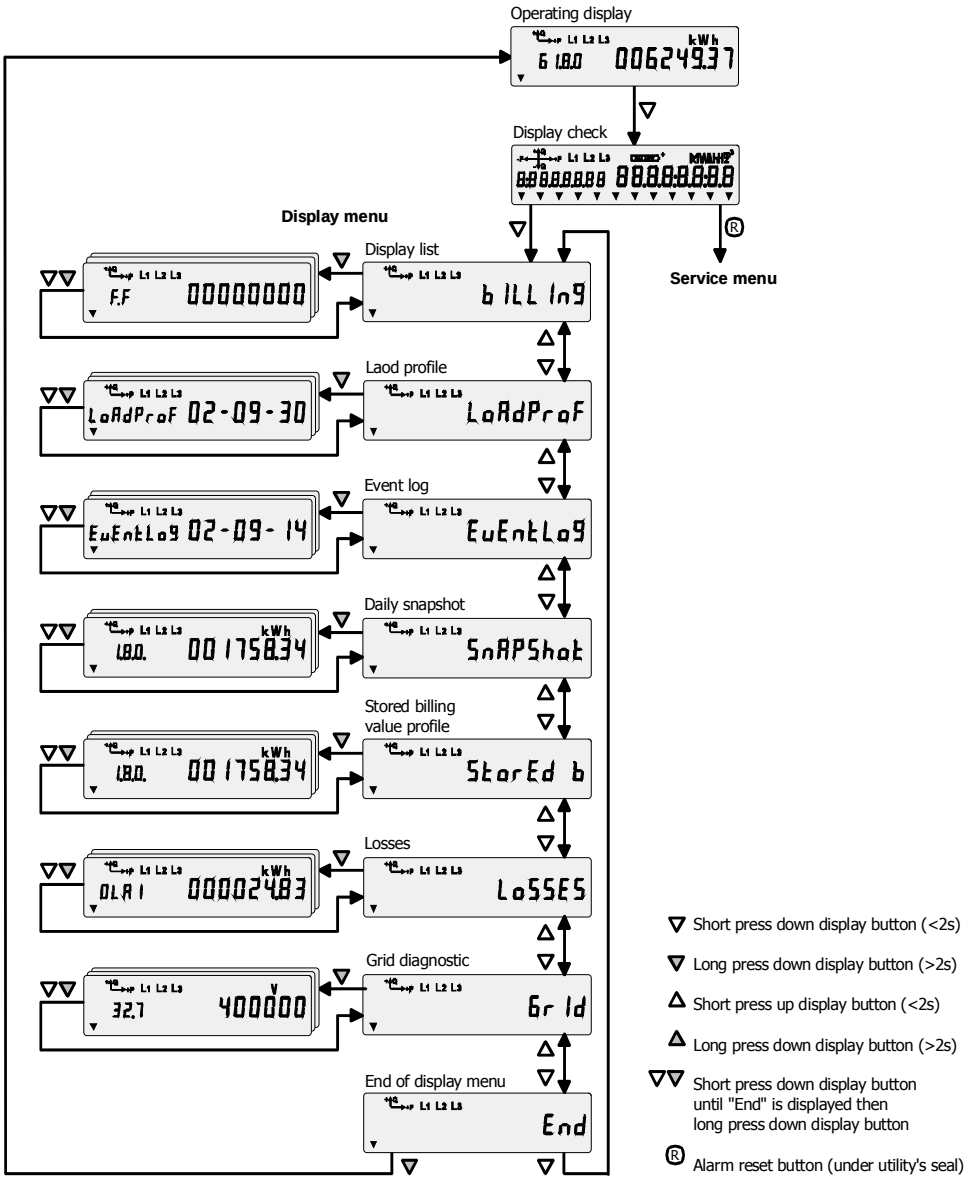
- A **constantly lit** alarm LED indicates that an alarm has been issued. An alarm indicates an internal meter error that prevents the meter from measuring correctly.

  For more details about alarms please refer to *6.3.2 Alarms on page 84*.

- A **blinking** alarm LED indicates that an operational indication has been issued. An operational indication can indicate an internal condition such as a low battery voltage or an external condition such as a missing phase voltage.

  For more details about operational indications please refer to *6.3.3 Operational Indications on page 85*.

5.2 Display Menu

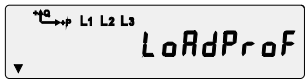
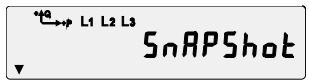
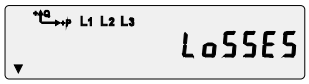


The **operating display** is shown when the display buttons have not been operated. It can be fixed, showing only one value or rolling, showing several values alternately.

The **display menu** is accessed using the display buttons.

The above allocation of displays to the display menu is an example.

5.2.1 Select Display Menu

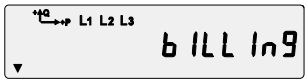
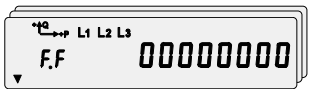
				Operating display
1.	▽	All segments of the display are illuminated		Display check
2.	▽	Display first menu item		Display list
3.	▽	Select menu item		Load profile
				Event log
				Daily snapshot
				Stored billing value profile
				Losses
				Grid diagnostic
4.	▽	Back to operating display		End of display menu

5.2.2 Display List

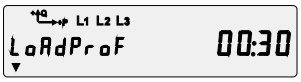
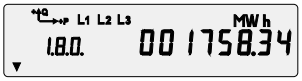
Note

For Germany

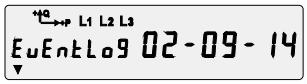
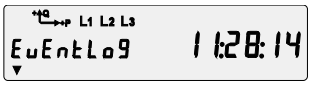
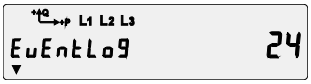
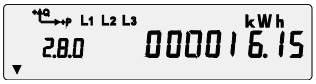
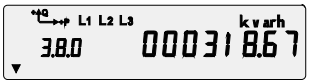
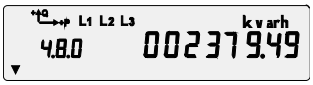
In Germany, this list may only contain certified values.

1.	▽	Select display list		Display list
2.	▽	Enter display list		First main value
3.	▽	Select main value		Other main values
4.	▽	Select required value (main value or stored value)		Main value or stored value
5.		Repeat steps 3 and 4 for all required readouts Long press: display main values only Short press: display main values or stored values		
6.	▽	Advance display until **End**		End of display list
7.	▽	Exit display list		

5.2.3 Load Profile

1.	▽	Select load profile		Load profile
2.	▼	Enter load profile		Date of last entry
3.	▽	Select required entry		Date x
4.	▼	Enter related load profile value list		Time of first entry
5.	▽	Select entry		Time of next entry
6.		Automatic display of all entries (max. 36) AutoScroll changes every 2 seconds	 	Status code Active energy import
7.		Repeat steps 5 and 6 for all entries to be checked		
8.	▼	Back to date selection		End of value list
9.	▽	Select the next date, open list as step 4		Next date
10.		Advance display until **End** (at the end of date list)		End of load profile
11.	▼	Exit load profile		

5.2.4 Event Log

1.	▽	Select event log		Event log
2.	▼	Enter event log		Date of last entry
3.	▽	Select required entry		Time
	▽			Event number
	▽			+A energy register
	▽			-A energy register
	▽			+R energy register
	▽			-R energy register
	▽			Date of next entry
4.		Repeat step 3 for all entries to be checked		
5.	▼	Jump to end of event log		End of event log
6.	▼	Exit event log		

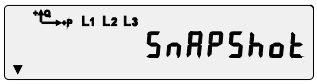
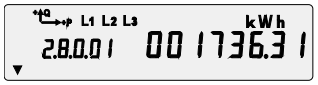
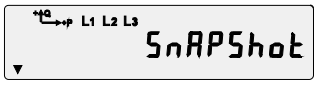
Which events are recorded in the event log is determined by the parameter settings. The time and date of the event is recorded together with a code determining the cause of the event. The most important events are:

Number	Event
1	Parameters influencing the measurement data changed
2	All rated energy registers cleared
3	Load profile and/or energy profile cleared
4	Event log cleared
5	Battery voltage low
7	Battery voltage OK
9	Summer time changeover
10	Clock adjusted (old date/time)
11	Clock adjusted (new date/time)
13	Status of control inputs changed
17 - 22	Measuring voltage (undervoltage, overvoltage L1, L2, L3)

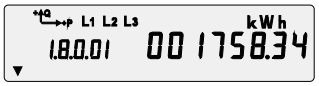
23	Power down
24	Power up
25 - 27	Measuring current (overcurrent L1, L2, L3)
47	Bypass feeder operation mode active
55 - 57	Current without phase voltage L1, L2, L3
58	Missing additional power supply
59	All registers cleared
61	Active power too high (depending on parameter setting)
62	Reactive power too high (depending on parameter setting)
66 - 96	Event log entries resulting from error messages
108	Phase failure (all-phase)
121-123	Phase voltage without current L1, L2, L3
125-127	Phase failures L1, L2, L3

Further information on events is given in the Functional Description, H71 0200 0216.

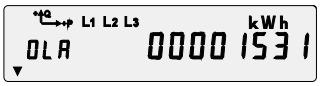
5.2.5 Daily Snapshot

1.	▽	Select daily snapshot		Daily snapshot
2.	▼	Enter daily snapshot		Most recent snapshot of the first register
3.	▽	Select required entry		Most recent snapshot of the second register
4.		Repeat step 3 for all required snapshots	After displaying the most recent snapshots of all registers, the meter displays the penultimate snapshots of all registers and so on.	
5.	▼	Jump to end of daily snapshot		End of daily snapshot
6.	▼	Exit daily snapshot		

5.2.6 Stored Billing Value Profile

1.	▽	Select stored billing value profile		Stored billing value profile
2.	▽	Open stored billing value profile		Most recent stored value of the first register
3.	▽	Select required value		Most recent stored value of the second register
4.		Repeat step 3 all required readings	After displaying the most recent stored value of all registers, the meter displays the penultimate stored value of all registers and so on.	
5.	▽	Advance display until **End**		End of energy profile
6.	▽	Exit stored billing value profile		

5.2.7 Losses

1.	▽	Select losses		Losses
2.	▽	Open losses		First losses value
3.	▽	Select required value		Selected value
4.		Repeat step 3 all required readings		
5.	▽	Advance display until **End**		End of losses
6.	▽	Exit losses		

5.2.8 Grid Diagnostic

1.	▽	Select grid diagnostics		Grid diagnostics
2.	▽	Open grid diagnostics		First grid diagnostic value
3.	▽	Select required value		Selected value
4.		Repeat steps 3 all required readings		
5.	▽	Advance display until **End**		End of grid diagnostic values
6.	▽	Exit grid diagnostics		

5.3 Meter Operation in Systems

5.3.1 Remote Meter Reading in Energy Production Applications

The ZxQ is most suitably employed in production and transmission networks and by large industrial consumers. Such networks and consumers seldom read their meters manually on-site but employ automatic **remote meter reading**.

dlms Protocol

The communication with meter takes place using the dlms protocol according to the IEC62056 series.

Remote meter reading requires communication between the meter and the **central station**. This is achieved using a communication unit via a serial interface or modem. Normally the central station is scheduled to call each meter in the system and to acquire the required data. The following functions can be performed:

- Meter reading; acquisition of meter reading and status information of the meter
- Time synchronisation; with the central station time

Communication with the meter can be established using the standard dlms protocol according to IEC62056 series.

IEC870 Protocol

Meters with the functional range C.2 can communicate using the protocol according to the IEC870 subset.

The meter is connected to a **transcoder** (e.g. Landis+Gyr FAG) via the local RS485 interface. The transcoder requests the meter every minute to send the current data. Every measured value that is transmitted to the transcoder carries a unique identification number.

For more detailed information please refer to *Chapter 8 on page 97*.

5.3.2 Types of Communication

Communication between the central station and the meter can be performed using any of the following types of communication:

- Dedicated (leased) lines
- Permanently installed connections, bus systems, etc.
- Public telephone network using PSTN modems
- Public mobile telephone network using GSM modems
- Others such as ISDN and TCP/IP.

5.3.3 Communication Units

The following types of communication units (CU) are specially designed for use with the ZxQ:

Communication units B4
with RS485 and RS232 interfaces (dlms)

Communication units M22/V34b
with PSTN modem and RS485 interfaces (dlms)

Communication units G22 (for f6 only)
with GSM modem and RS485 interfaces (dlms)

Communication units E22
for TCP/IP and RS485 interfaces (dlms)

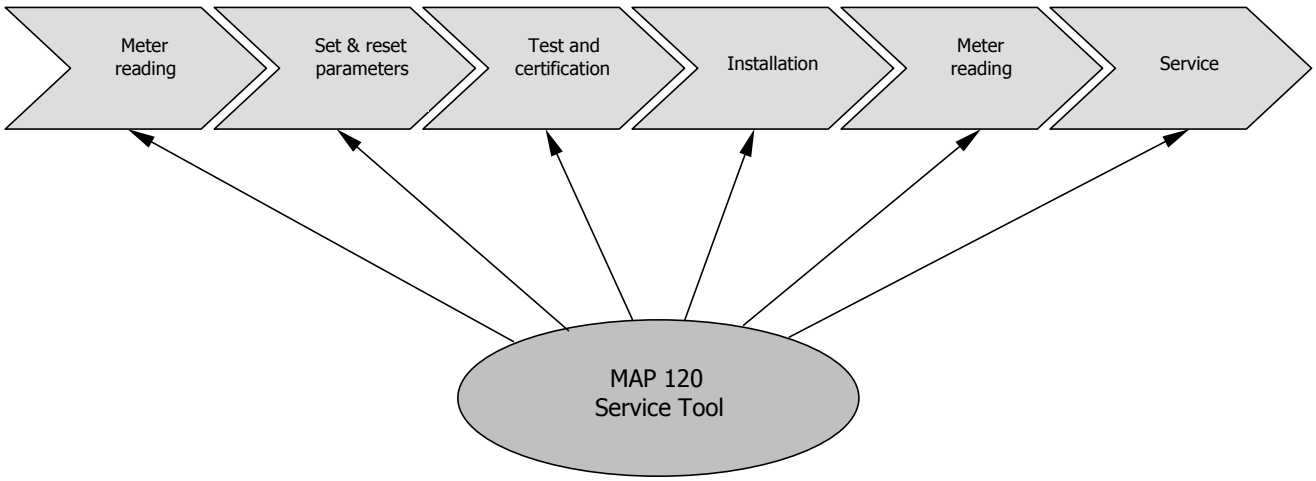
Communication units Q22
for RS485 interfaces (IEC870-5-102 and/or dlms)

For further information about communication units refer to document H71 0200 0144, Survey of Communication Applications.

5.3.4 MAP 120 Service Tool

The MAP 120 Service Tool supports both the meter and communication unit during all phases of their life cycle. It is used to:

- Initial setting of application-specific parameters
- Testing and verification on site
- Register read-out on site
- Change parameters on site; functions, switching tables, tariffs, etc. can be altered by changing parameters.
- Installation and service on site.



6 Service

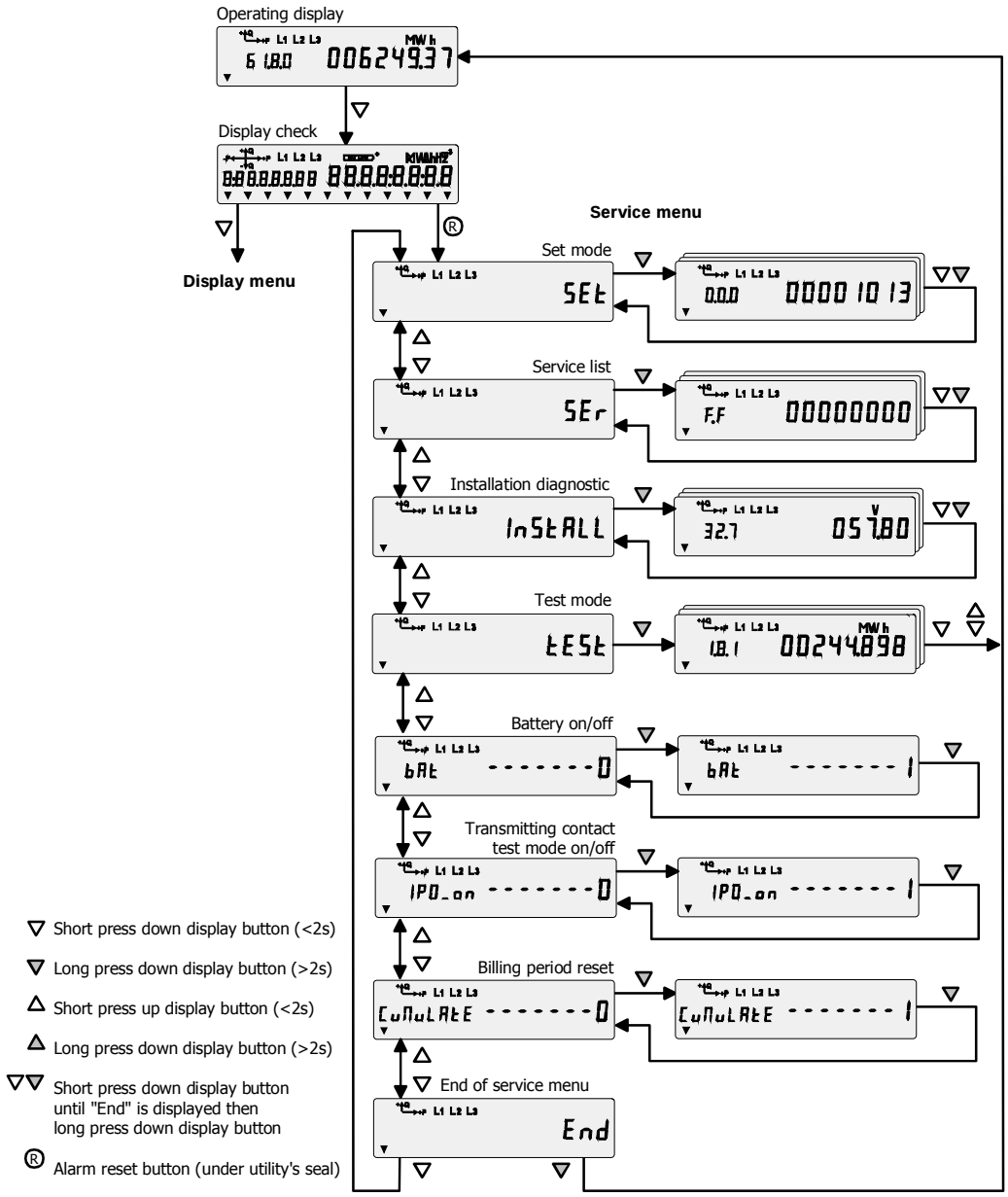
6.1 Alarm Reset Button

Access to the alarm reset button is protected by the verification seal or by the utility's seal. The button is located behind the front door of the wall-mounted f6 and behind the front cover of the rack-mounted f9.

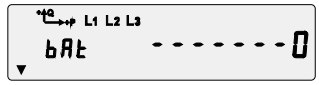
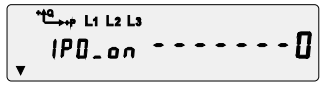
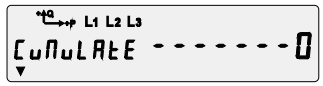
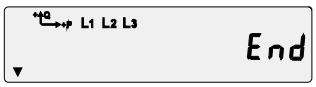
The alarm reset button has three functions:

1. Reset an alarm. Meter failure alarms are cleared by pressing the alarm reset button.
2. Select the service menu from the display check.
3. Perform the cursor function in the set mode.

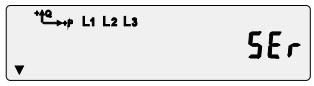
6.2 Service Menu



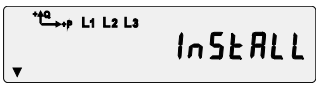
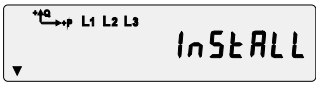
6.2.1 Select Service Menu

				Operating display
1.	▽	All segments of the display are illuminated		Display check
2.	Ⓡ	Display first menu item		Set mode
3.	▽	Select menu item		Service list
				Installation diagnostic list
				Test mode
				Battery on/off display
				Transmitting contact test mode on/off
				Billing period reset
4.	▽	Back to operating display		End of service menu

6.2.2 Service List

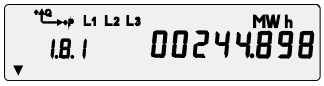
1.	▽	Select service list		Service list
2.	▽	Enter service list		Error code
3.	▽	Select the required main value		Main values
4.	▽	Select required value (main value or stored value)		Main value or stored value
5.		Repeat steps 3 and 4 for all values to be checked. Long press: display main values only Short press: display main values and stored value		
6.	▽	Advance display until **End**		End of service list
7.	▽	Exit service menu		

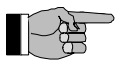
6.2.3 Installation Diagnostic List

1.	▽	Select installation diagnostic list		Installation diagnostic list
2.	▼	Enter installation diagnostic list		First value
3.	▽	Select required value		Value x
4.		Repeat step 3 for all values to be checked		
5.	▽	Advance display until **End**		End of diagnostic list
6.	▼	Exit installation diagnostic list		

6.2.4 Test Mode

Test mode enables you to select which measuring quantity (active, reactive, I^2, U^2) is output to the optical test output. Depending on parameter setting, the resolution of the display register can be increased for faster testing, using the time-power-method.

				Operating display
1.	▽	All segments of the display are illuminated		Display check
2.	Ⓡ	Enter service menu		Set mode
3.	▽	Select test mode		Test mode
4.	▼	Enter test mode		First value
5.	▽	Select required value		Value x
6.		Repeat step 5 for all values to be tested.		
7.	△ ▽	Exit test mode		Operating display



Note

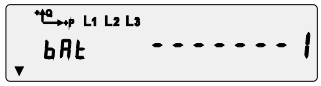
Example

The first value and value x are examples. The real values are defined in the parameter settings and are the same as the operating display.

The measured values are displayed at the optical test outputs as shown in the following table:

Mode	Register on Display	Test output reactive	Test output active
Normal mode	Some sort of register	|R|	|A|
Test mode	NLA register (Transformer losses per phase NLA1,NLA2,NLA3; Total Transformer Losses NLA)	I^2 with $R_{CU}=1\Omega$	U^2 with $R_{FE}=1M\Omega$
	OLA register (Line losses per phase OLA1, OLA2, OLA3; Total line losses OLA)	U^2 with $R_{FE}=1M\Omega$	I^2 with $R_{CU}=1\Omega$
	Reactive energy register	|A|	|R|
	Active energy register or one of not mentioned registers in this table.	|R|	|A|

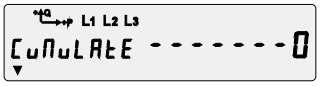
6.2.5 Set Battery Low Indicator

				Operating display
1.	▽	All segments of the display are illuminated		Display check
2.	Ⓡ	Enter service menu		Set mode
3.	▽	Select menu item		Battery on / off display
4.	▼	Change setting: 1 = battery low indicator on 0 = battery low indicator off		
5.	▽	Advance display until **End**		End of battery on / off display
6.	▼	Exit service menu		Operating display

6.2.6 Billing Period Reset

At the end of the billing period the reset signal triggers the entry of the current values into the stored billing value profile (C.8 only). Control of the billing period is usually automatic and synchronous to the capture period of the load profile.

Using the following the procedure you can trigger a billing period reset manually.

				Operating display
1.	▽	All segments of the display are illuminated		Display check
2.	Ⓡ	Enter service menu		Set mode
3.	▽	Select required entry		Billing period reset
4.	▽	Perform a billing period reset Change from 0 to 1 = billing period reset Change from 1 to 0 = billing period reset		
5.	▽	Advance display until **End**.		End of service menu
6.	▽	Exit service menu		Operating display

6.3 Errors

Errors are graded according to their severity and are classified as fatal errors, alarms and operational indications. The type of error that has occurred can be established from the error information on the meter as follows:

Error type	Term according to IEC870-5	Display	Alarm LED	Alarm contact
Fatal error	**----**	FF and error code (display locked)	Off	Closed (OK = contact open)
Alarm	Error indication	FF and error code (More registers can be displayed by pressing the display buttons.) Entry in event log (if activated by parameter setting)	On	Closed (for 1..9 seconds or until the alarm is cleared, depending on parameter setting)
Operational indication	Warning message	FF and error code in rolling display (with some operational indications) Entry in event log (if activated by parameter setting)	Blinking (if activated by parameter setting)	Closed, while the event is present (if activated by parameter setting)

When two or more errors occur simultaneously, the hexadecimal code values will be added.

6.3.1 Fatal Errors

Errors that prevent the meter from performing the measuring function are classified as fatal errors.

When a fatal error occurs, the meter must be changed. Refer to chapter 4 for how to install / de-install a meter, *page 45*.

Fatal errors are shown on the display as follows:

Display	Description
FF 00010000	Main memory error (RAM)
FF 00020000	FLASH memory error
FF 00000100	ROM checksum error
FF 00000200	Back-up data checksum error (FLASH)
FF 00000400	Parameter data checksum error (FLASH)
FF 00000040	FLASH ID does not match

6.3.2 Alarms

Internal meter errors that can prevent the meter from measuring correctly and can cause the measured data to be incorrect are classified as alarms. An FF and error code on the display, constantly lit alarm LED, and possibly a closed alarm contact (depending on parameter settings) signifies an alarm. Normally the alarm contact remains closed until the alarm is cleared but it may also be cancelled after a defined period depending on the parameter settings.

When an alarm occurs, contact the service engineer. Depending on parameter settings, it may be possible to clear the alarm by pressing the alarm reset button.

Alarms are shown on the display and in the event log (depending on parameter settings) as follows:

Read/Write Access Errors:

Display	Description	Event number
FF 00040000	Measuring system access error	75
FF 00080000	Time base error (CTS)	76
FF 00100000	Data profile memory error (FLASH)	77
FF 00400000	Communication unit error	79

Checksum Errors:

Display	Description	Event number
FF 00000400	Parameter data checksum error (FLASH)	83
FF 00000800	Load profile data checksum error (FLASH)	84

Other Errors:

Display	Description	Event number
FF 00000001	Start-up sequence invalid	89
FF 00000010	General system error	93

6.3.3 Operational Indications

There are two types of operational indications:

Internal conditions

Internal conditions that remain until the condition is rectified, e.g. battery voltage low. An FF and error code on the display, blinking alarm LED, a closed alarm contact, and possibly an entry in the event log (depending on parameter settings) signifies an internally generated operational indication.

These operational indications are shown on the display and in the event log as follows (examples, depending on parameter settings):

Display	Description	Event number
FF 01000000	Battery voltage low	65
FF 02000000	Invalid time or date	66
FF 00000080	Transmitting contact ID not valid (If this error occurs no pulses will be transmitted.)	96

Operational indications due to internal conditions are cancelled when the appropriate steps have been taken to remedy the condition, e.g. the battery is replaced.

External operating conditions

External operating conditions that clear automatically when the condition no longer exists, e.g. missing phase voltage L1. A blinking alarm LED, a closed alarm contact, and possibly an entry in the event log (depending on parameter settings) signifies an externally generated operational indication.

Because no error code is apparent on the display the cause for these operational indications must be viewed in the event log.

Operational indications due to external operating conditions are cancelled when the warning condition no longer exists, e.g. additional power supply has returned.

6.4 Repair

When a fatal error or an alarm occurs that cannot be cleared (see previous paragraph Errors), the meter must be repaired by the authorised service and repair centre.

1. If installed, de-install the meter as described in *chapter 4*.
2. Describe the error clearly and state the name and telephone number of the person responsible in case of inquiries.
   Whenever possible, fill out the supplied form and attach to the meter.
3. Pack the meter using the original packing. Do not enclose any loose components.
4. Send the meter to the responsible service and repair centre.
5. Quote the meter serial number from the face plate in all communication!

Warning

Shipment of the meter

The meter may only be shipped in its original packing.

Warning

Do not repair f9 meters with fire damage

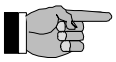
Meters with an f9 housing contain isolation material made of polyvinyl chloride (PVC).

In the unlikely event of a fire, this isolation material may be burned and deposited on the PCBs.

No attempts must be made to repair f9 meters with fire damage. The meters must be disposed of in accordance with local laws and / or regulations. For details please refer to *chapter 9*.

7 Maintenance

Based on our experience as long-term meter manufacturers, electronic meters require no maintenance.



Note

Meter modification

No conversion, modification or retrofitting of the meter is allowed unless stated in this chapter!

7.1 Meter Tests

A meter accuracy check should be performed periodically according to national regulations, usually every 8 years.

When testing the meter, the measuring conditions and the measuring points must follow the IEC meter standards.

Use test equipment according to regulations for Cl.0.2S.

7.1.1 Measuring Times

	Metering Point	Measuring Time
all-phase	1%In cosφ = 1	90 s
	2%In cosφ = 0.5	90 s
	100%In cosφ = 1	10 s
single phase	100%In cosφ = 0.5	40 s

7.1.2 Optical Test Outputs

The green optical test outputs supply pulses at a frequency dependent on the load applied and the meter constant R. The pulse's rising edge is always decisive for the test.

After switch on of voltage and current, wait 1 second for measurement to be started.

The impulse frequency at nominal load Pn is between 4 and 6 Hz.

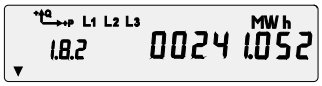
7.1.3 Test via Transmitting Contacts

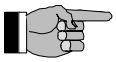
For the accuracy test of the transmitting contacts the same test is performed as for the optical test outputs.

7.1.4 Test Mode

The test mode enables you to select which measuring value (active, reactive, I^2, U^2) is output to the optical test output.

In the display, values for active, reactive and apparent energy are available. Depending on parameter setting, the resolution of the display register can be increased for faster testing. In the test mode, the resolution is increased by one decimal point compared with the normal mode. A maximum of 5 decimal points are possible.

1.	▽	Select test mode		Test mode
2.	▽	Enter test mode		First value
3.	▽	Select required value		Value x
4.		Repeat step 3 for all values to be tested		
5.	△ ▽	Exit test mode		Operating display



Note

Examples

First value and value x are examples. The real values are defined in the parameter settings and are the same as the operating display.

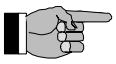
The measured values are displayed at the optical test outputs as shown in the following table:

Mode	Register on Display	Test output reactive	Test output active
Normal mode	Some sort of register	|R|	|A|
Test mode	NLA register (Transformer losses per phase NLA1,NLA2,NLA3; Total Transformer Losses NLA)	I^2 with $R_{CU}=1\Omega$	U^2 with $R_{FE}=1M\Omega$
	OLA register (Line losses per phase OLA1, OLA2, OLA3; Total line losses OLA)	U^2 with $R_{FE}=1M\Omega$	I^2 with $R_{CU}=1\Omega$
	Reactive energy register	|A|	|R|
	Active energy register or one of not mentioned registers in this table.	|R|	|A|

7.1.5 No Load Test

Test voltage Up =	1.15 x nominal voltage Un
Test current Ip =	0.3 x starting load

1. Switch off the current for at least 10 seconds.
2. Switch on the test voltage Up and current Ip (0.3 x starting load). The green optical test outputs must be permanently lit.
3. Run the test for 5 minutes. The meter must not deliver more than one pulse during the test. Check the energy reading for changes in test mode. The last digit of the display must not increase by more than 1.



Note

Local regulations

In some countries, the observation time must be longer than 5 minutes. Follow the local the local regulations.

7.1.6 Starting Load for Active Energy

Apply a load current of **0.05%** of the nominal current In (other values may be selected in the parameter setting) and the voltage Un (three-phase in each case) at **cosφ= 1**. The meter must start registering. The green optical test output must start blinking.

7.1.7 Starting Load for Reactive Energy

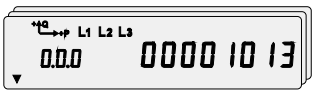
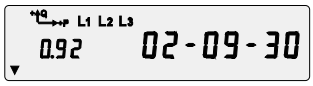
Apply a load current of **0.1%** of the nominal current In (other values may be selected in the parameter setting) and the voltage Un (three-phase in each case) at **sinφ = 1**. The meter must start registering. The green optical test output must start blinking.

7.2 Set Time & Date, ID Numbers, Battery Time

The following values can be changed at any time from the service menu (set mode):

- Date and time
- Identification numbers
- Operating time of battery

Below is an example of how to set the date and time.

				Operating display
1.	▽	All segments of the display are illuminated		Display check
2.	Ⓡ	Enter service menu		Set mode
3.	▼	Enter set mode		Identification number
4.	▽	Select required setting		Date, old value
5.	Ⓡ	Select digit to be changed		Digit flashes
6.	▽	Change digit value		Digit flashes
7.	Ⓡ	Select digit to be changed		Next digit flashes
8.		Repeat steps 5 - 7 for all digits to be changed.		All digits flash
9.	Ⓡ	Confirm new setting		Date, new value
10.		Repeat steps 4 - 9 for all settings to be changed.		
11.	▽	Advance display until **End**		End of set mode
12.	▼	Back to service menu		Service menu
13.	▽	Advance display until **End**		End of service menu
14.	▼	Back to operating display		Operating display

7.3 Change Battery

7.3.1 When to Change Battery

If the meter is provided with a battery, this must be changed if one of the following events occurs:

- The BAT LOW symbol appears in the liquid crystal display.
- During the normal calibration cycle of the meter.
- The battery charge indicates less than 4.8 V (can be read under code C.6.1 in service list).

Note

Indication of symbol "BAT LOW"

Only meters with the parameter set to allow the battery symbol BAT LOW will display it at a low battery condition.

The meter functions perfectly well without a battery.

7.3.2 How to Change Battery

Danger

Presence of dangerous voltage

Dangerous voltage may be present on the battery and battery contacts in the battery compartment.

Touching the battery or battery contacts could result in severe personal injury or death.

Only remove and replace the battery with the existing battery holder without touching the contacts.

Warning

Wrong battery type

Replacing the battery with the wrong type or voltage rating could result in damage to the meter.

Only use a lithium battery with a rated voltage of 6 V and the same construction as the original battery (type CR-P2) as a replacement.

Warning

Battery replacement after a long period of non-use

If the meter has been disconnected from the supply for a long time, the power reserve is exhausted. Replacing the battery when the power reserve is exhausted may lead to an invalid time/date information without the corresponding error message.

Reconnect the meter to the measurement voltage or additional power supply before replacing the battery.

Replacing the Battery in f6 Meters

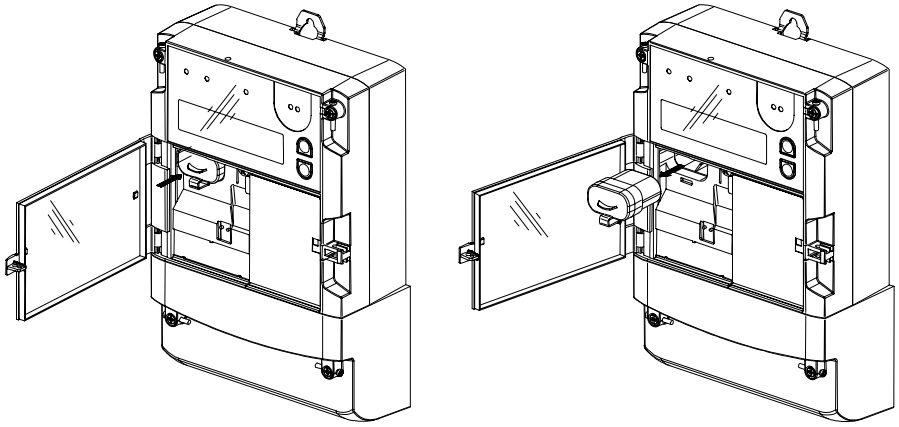
1. Remove the front door seal and open the front door.

Danger

Presence of dangerous voltage

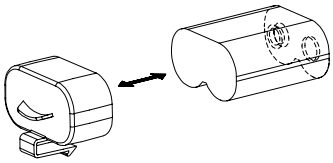
Only remove the battery with the existing battery holder without touching the contacts.

2. Lightly press down the latch of the plastic battery holder until it releases and then withdraw the battery holder with the old battery.



3. Mark the current date on the new battery.

4. Draw the old battery from the holder and insert the new 6 Volt rated lithium battery.



Danger

Presence of dangerous voltage

Only replace the battery with the existing battery holder without touching the contacts.

5. Push the battery holder with battery in the battery compartment until the latch engages.

6. In the set mode, reset the operating time of the battery to zero and change the time and date if necessary as described earlier in this chapter.

7. Close and re-seal the front door.

8. Dispose of old battery as hazardous waste in accordance with local regulations.

Replacing the Battery in f9 Meters

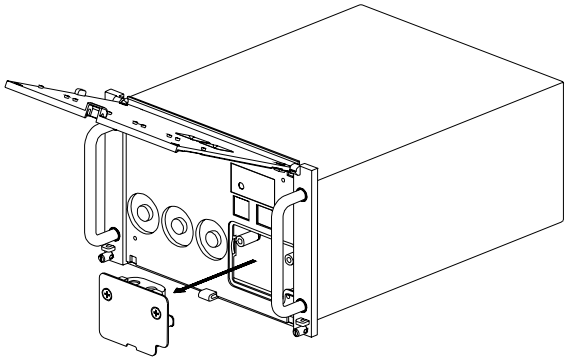
1. Remove the front cover seal and open the front cover.

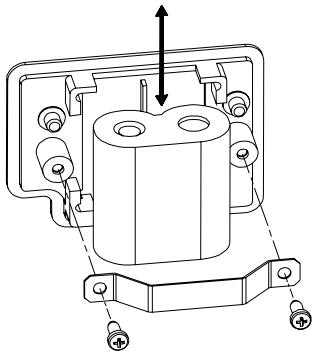
Danger

Presence of dangerous voltage

Only remove the battery with the existing battery holder without touching the contacts.

2. Loosen and remove the two battery holder fixing screws. Withdraw the battery holder from the meter.
3. Mark the current date on the new battery.
4. At the rear of the battery holder loosen the clamp fixing screws and take off the battery.





5. Insert the new battery into the battery holder. Tighten the screws so that the clamp holds the battery.

Danger

Presence of dangerous voltage

Only replace the battery with the existing battery holder without touching the contacts.

6. Insert the battery holder into the meter. Tighten the two fixing screws.
7. In the set mode, reset the operating time of the battery to zero and change the time and date if necessary as described in earlier in this chapter.
8. Close and re-seal the front cover.
9. Dispose of old battery as hazardous waste in accordance with local regulations.

7.4 Change Communication Unit

7.4.1 When to Change Communication Unit

The communication unit can be changed, if for example, different communication requirements are needed.

7.4.2 How to Change Communication Unit

Danger

Dangerous voltage on conductors

Dangerous voltage is present on the conductors that the meter is to be connected to.

Contact with the conductors when under voltage will result in severe personal injury or death.

The conductors must not be under voltage when connecting or disconnecting the meter.

Installation and de-installation of the meter must only be performed by qualified meter installers, with strict adherence to the utility's safety regulations.

Danger

Dangerous voltage when connecting communication unit

Dangerous voltage is present on the meter connections to the communication unit.

Contact with the connections will result in severe personal injury or death.

Voltage must not be present on the meter connections when changing / installing the communication unit.

Changing / installing the communication unit must only be performed by qualified meter installers, with strict adherence to the utility's safety regulations.

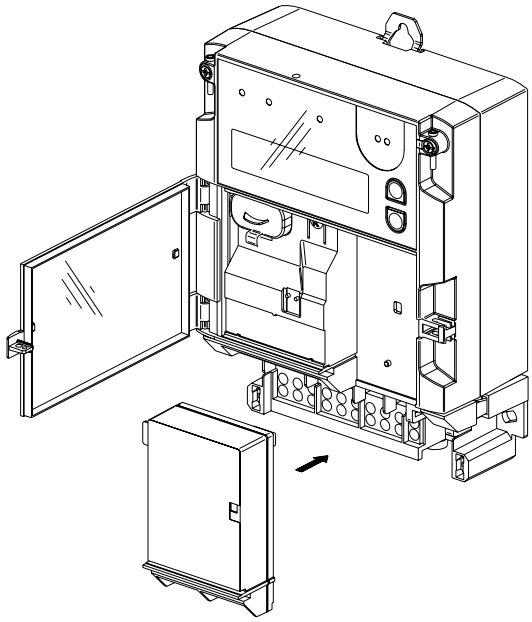
Warning

Do not use communication unit CU-M./V22B

Do not connect any of the communication units of the type CU-M./V22B to the ZxQ meter. Using a communication unit of the type CU-M./V22B may lead to an instable communication.

Changing the Communication Unit in f6 Meters

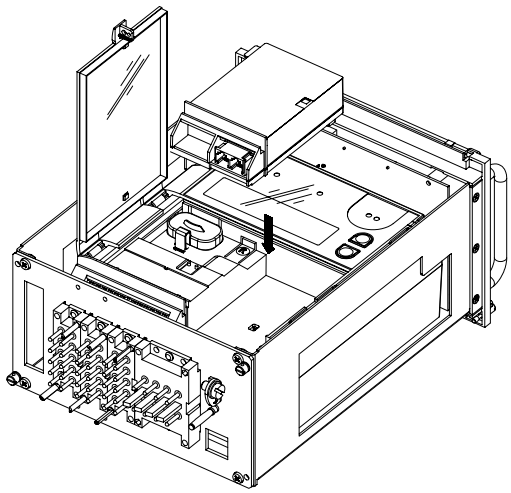
1. Switch off the voltage. The phase voltage indicator (L1 L2 L3) disappears.
2. Switch off tariff inputs and synchronisation input. Check if the corresponding indicators disappear from the display.
3. Switch off the voltage for the additional power supply.
4. Check that all connections are free from voltage.
5. Remove the two utility's seals on the terminal cover, release the two screws and remove the terminal cover.
6. Remove the communication unit (or dummy).
7. Carefully insert the new communication unit ensuring that plug and socket are properly engaged.



8. Connect the connecting wires to the terminals of the communication unit.
9. Carry out functional tests as described in the relevant communication unit manual to ensure it is functioning correctly.
10. Replace the terminal cover, close the front door, and re-seal.

Changing the Communication Unit in f9 Meters

1. De-install the meter (*see page 59*).
2. Switch off the voltage. The phase voltage indicator (L1 L2 L3) disappears.
3. Switch off tariff inputs and synchronisation input. Check if the corresponding indicators disappear from the display.
4. Switch off the voltage for the additional power supply.
5. Withdraw the meter from the rack.
6. Remove the seals at the back of the housing and remove the housing.
7. Remove the communication unit (or dummy).
8. Carefully insert the new communication unit ensuring that plug and socket are properly engaged.



9. Connect the connecting wires to the terminals of the communication unit.
10. Carry out functional tests as described in the relevant communication unit manual to ensure it is functioning correctly.
11. Replace the housing and re-seal.
12. Install the meter (*see page 50*).

8 ZxQ200C.2

This chapter describes the characteristics of the ZxQ200C.2.

Functional range

Unlike the dlms meters ZxQ200C.4, ZxQ200C.6 and ZxQ200C.8 the ZxQ200C.2 can communicate via the protocol according to the IEC870 subset.

The C.2 meter has been designed for the communication according to the IEC870 subset and therefore, it features:

- no tariff control
  - no tariff control inputs
  - no energy tariff registers
  - no time switch (time of use)
- no synchronisation input

8.1 Communication According to the IEC870 Subset

The ZxQ meters with the functional range C.2 are capable of communicating according to the IEC870 subset. These meters are particularly suited for the replacement of previous IEC870 meters such as the Landis+Gyr ZMU. As a result, the ZxQ C.2 is predestined to be used in existing telemetering systems with transcoders such as the Landis+Gyr FAG.

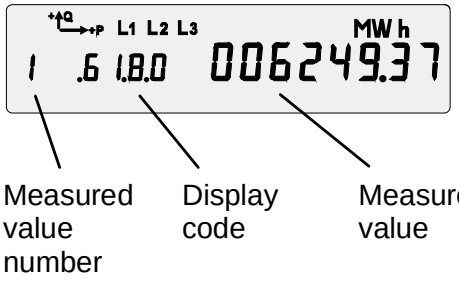
The meter is connected to a transcoder via the local RS485 interface. The transcoder requests the meter every minute to send the current data.

Meter Address

Every meter has got its own meter address (Com No)with which it is clearly identified by the transcoder. All meters that are connected to the same transcoder must have a unique meter address. The meter address may be a number between 1 and 127.

Measured Value Number

In addition to the display code the measured values (energy/loss) also feature a number (MV No) between 1 and 255 with which the value is clearly identified by the transcoder. All measured values of the various meters that are connected to the same transcoder must have a unique measured value number.



When setting the parameters a meter address must be defined for every meter and a measured value number must be defined for every measured value.

8.2 Measured Quantities

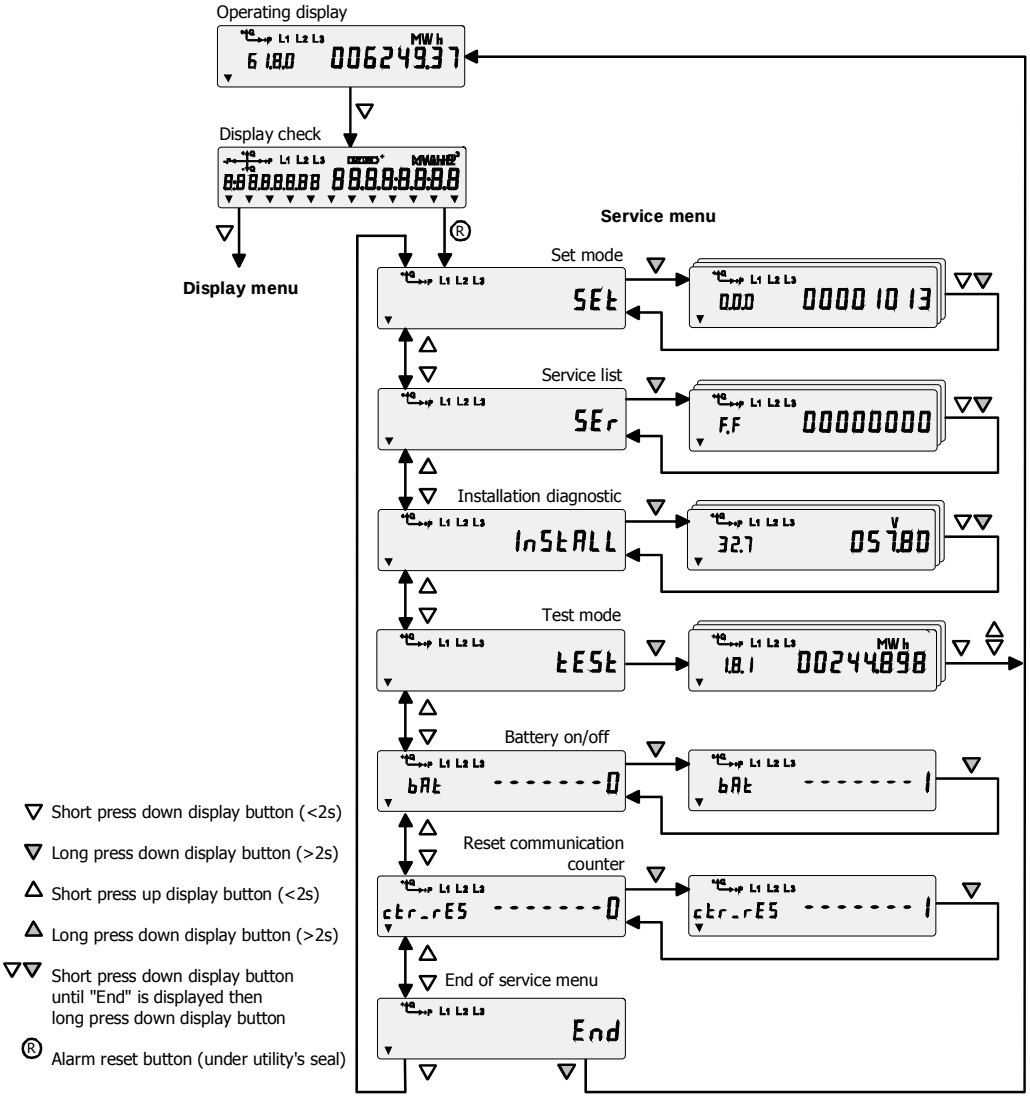
Meters with the functional range C.2 provide the following measured quantities.

Meters with quadrant splitting provide the measured quantities +Ri, +Rc, -Ri and -Rc instead of +R and -R.

Measured Quantities		**ZMQ**	**ZFQ**
Active energy import	+A	Sum	Sum
Active energy export	–A	Sum	Sum
Reactive energy import	+R	Sum	Sum
Reactive energy export	–R	Sum	Sum
Reactive energy in quadrant I	+Ri	Sum	Sum
Reactive energy in quadrant III	–Ri	Sum	Sum
Reactive energy in quadrant II	+Rc	Sum	Sum
Reactive energy in quadrant IV	–Rc	Sum	Sum
Active iron losses (transformer)	NLA	Sum	Sum
Active copper losses, (line)	OLA	Sum	Sum
Total active losses in positive direction	+TLA	Sum	Sum
Total active losses in negative direction	-TLA	Sum	Sum
Energy flow of active energy	EFA	Sum	Sum
Energy flow of reactive energy	EFR	Sum	Sum

8.3 Service Menu

The service menu of the ZxQ200C.2 is expanded by the functions for the communication according to the IEC870 subset.

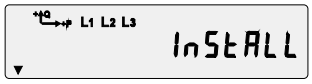


8.4 Installation Check

If the C.2 meter communicates according to the IEC870 subset the following steps must be carried out during the installation check in addition to the steps described in section *4.4 Installation Check on page 52.*

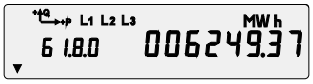
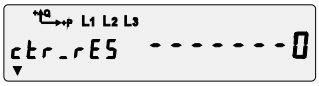
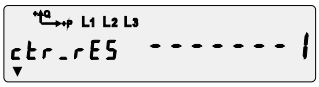
8.4.1 Check Meter Address

Check whether all meters that are connected to the same transcoder have a unique meter address.

1.				Operating display
2.	▽	All segments of the display are illuminated		Display check
3.	Ⓡ	Enter service menu		Set mode
4.	▽	Select required menu item		Installation diagnostic
5.	▼	Enter installation diagnostic		Check meter address
6.	▽	Advance display until **End**		End of installation diagnostic
7.	▼	Return to service menu		Service menu
8.	▽	Advance display until **End**		End of service menu
9.	▼	Exit service menu		Operating display

8.4.2 Reset Communication Counter

Set the counter of the three communication commands freeze, send and respond to "0".

				Operating display
1.	▽	All segments of the display are illuminated		Display check
2.	Ⓡ	Enter service menu		Set mode
3.	▽	Select required menu item		Communication counter reset
4.	▼	Reset communi-cation counter		
		Change from 0 to 1 = reset communication counter Change from 1 to 0 = reset communication counter		
5.	▽	Advance display until **End**		End of display communication counter reset
6.	▼	Exit service menu		Operating display

8.4.3 Check Communication

The communication according to the IEC870 subset has got the sequence of commands:

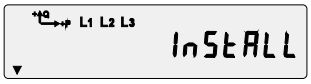
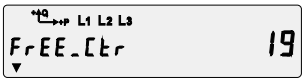
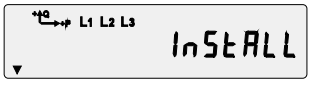
1) Freeze
2) Send
3) Respond

The communication between the meter and the transcoder is only completed successfully if all three commands have been carried out. In order to be able to check the communication the meter features a counter for every command. These counters are always incremented by 1 after the command has been carried out.

Varying counter readings indicate communication problems.

Checking the communication counters

Check whether the counters for the communication commands freeze, send and respond show identical readings.

1.				Operating display
2.	▽	All segments of the display are illuminated		Display check
3.	Ⓡ	Enter service menu		Set mode
4.	▽	Select required menu item		Installation diagnostic
5.	▼	Enter installation diagnostic		Meter address
6.	▽	Select freeze counter		Check freeze counter
7.	▽	Select send counter		Check send counter
8.	▽	Select respond counter		Check respond counter
9.	▽	Advance display until **End**		End of installations diagnostic
10.	▼	Return to the service menu		Service menu
11.	▽	Advance display until **End**		End of service menu
12.	▼	Exit service menu		Operating display

8.5 Error Messages

If the protocol according to the IEC870 subset is used to communicate between meter and transcoder all meter types that can communicate using this protocol can be utilized (e.g. ZxU, ZxV, ZxQ200C.2).

These different meter types generate different operational indications and alarms.

The table below provides a cross-reference of the error messages of the ZxU/ZxV and the ZxQ.

Message ZxU/ZxV	**Message ZxQ**	**Event No ZxQ**
System restart	Energy register cleared	128
Coldstart	General system error	93
Program error	ROM checksum error	(81, fatal error)
Parameter error	Parameter data checksum error (FLASH)	83
Parameter error M, D	Measuring system access error	75
Data error	Main memory error (RAM)	(73, fatal error)
Current without voltage phase Lx	Current without voltage Lx	55-57
Outage Phase Lx	Single-phase failure Lx	125-127
Parameter change [1)]	Parameterisation changed	1
Bypass feeder operation [1)]	Bypass feeder operation	47
Power outage [1)]	Power down	23
Set register value[1)]	[2)]	[2)]
Register overflow [1)]	[2)]	[2)]

1) These messages do not appear in the display of the ZxU/ZxV. However, they will be transmitted to the transcoder using the protocol according to the IEC870 subset.
2) These events do not trigger an event log entry at the ZxQ. However, the events will be transmitted to the transcoder using the protocol according to the IEC870 subset.

9 Disposal

9.1 Components

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.

Warning

Hazardous waste in case of disposal

The ZxQ contains opto-electronic components and possibly a lithium battery, which are regarded as hazardous waste.

Incorrect disposal of these parts could cause ground pollution or emission of poisonous gases, which could lead to environmental damage and personal injury.

Disposal of these parts must be performed by a qualified person in accordance with local laws and/or regulations.

The separable components are graded as follows:

Component	Disposal
LEDs and LCD	Hazardous waste: disposal according to local regulations.
Lithium battery	Hazardous waste: disposal according to local regulations.
PVC isolation material	Hazardous waste: sorted and taken to recycling (regranulation) plant or disposal according to local regulations.
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.

9.2 Meters

For the disposal of meters as a complete unit, observe the local disposal and environmental protection regulations in effect.

Warning

Hazardous waste in case of disposal

The ZxQ contains LCD, LEDs, and lithium battery, which are regarded as hazardous waste.

Incorrect disposal of the meter could cause ground pollution or emission of poisonous gases, which could lead to environmental damage and personal injury.

Disposal of the meter must be performed by a qualified person in accordance with local laws and/or regulations.

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