Electricity Meters IEC

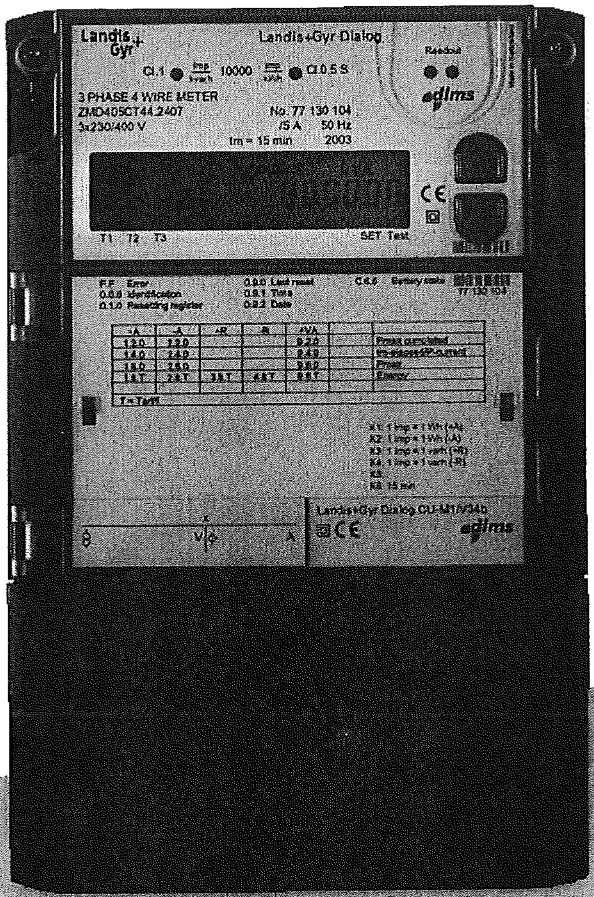
INDUSTRIAL AND COMMERCIAL

Landis+Gyr Dialog

ZMD400 AT / CT - ZFD400 AT / CT

USER MANUAL

Landis+Gyr



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Revision History

Index	Date	Comments
–	26.07.1999	First edition
a	11.02.2000	Changes in related sections
b	28.09.2000	Changes in related sections
c	18.06.2001	Changes in related sections
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subject to technical changes

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Introduction

Range of validity

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

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 (parameterization, 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.

Reference documents

The technical data and functional description of the meters are explained in separate documents:

- H 71 0200 0062 "Technical Data ZMD400AT/CT - ZFD400AT/CT"
- H 71 0200 0331 "Technical Data ZMD402CT - ZFD402CT"
- H 71 0200 0266 "Functional Description ZMD300 / ZMD400 / ZFD400"

Conventions

The structure and significance of meter type designations are described in chapter 2.3. 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. ZxD410xT for the ZFD410AT, ZMD410AT, ZFD410CT and ZMD410CT meters).
- The digit pair "00" can be used to indicate accuracy data (e.g. ZxD400xT for the ZxD405xT and ZxD410xT meters).
- The abbreviated type designation ZMD or ZFD meters can be used when all three-phase four-wire meters or three-phase three-wire meters are meant.
- The following collective terms are also sometimes used instead of the type designation:
  - "Active energy meters" for the ZxD400AT meters
  - "Combimeters" for the ZxD400CT meters
- Of the four digit extension board designation (e.g. 2400) only the first 3 digits represent the function of the board; the fourth digit is an unknown (the first 3 digits in the type designation, e.g. 240, are used for details of additional functions, while the fourth digit indicates whether a load profile is present or not).

Table of Contents

1 Safety

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

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 – normally the power supply company – 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) and the operating information in the individual chapters.

In particular, the owner of the meters bears responsibility

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

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

1.3 Safety Regulations

The following safety regulations must be observed at all times:

- The conductors to which the meter will be connected must not be under voltage during installation or change of the meter. Contact with live parts is dangerous to life. The relevant preliminary fuses should therefore be removed and kept in a safe place until the work is completed, so that other persons cannot replace them unnoticed.
- Local safety regulations must be observed. Installation of the meters must be performed exclusively by technically qualified and suitably trained personnel.
- Secondary circuits of current transformers must be short-circuited (at the test terminal block) without fail before opening. The high voltage produced by the interrupted current transformer is dangerous to life and destroys the transformer.
- Transformers in medium or high voltage systems must be earthed on one side or at the neutral point on the secondary side. Otherwise they can be statically charged to a voltage which exceeds the insulation strength of the meter and is also dangerous to life.
- The meters must be held securely during installation. They can cause injuries if dropped.
- Meters which have fallen must not be installed, even if no damage is apparent. 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.
- The meters must on no account be cleaned with running water or with high pressure devices. Water penetrating can cause short-circuits.

2 Description of Unit

This chapter provides you with a brief overview of design and function of the meters ZxD400xT.

2.1 Field of Application

ZxD400xT meters can be used for transformer connection at all three voltage levels, namely on low, medium and high voltage. They are primarily used by medium and large consumers and in the field of energy generation and exchange.

The ZMD400xT meter is specially suitable for applications at the low voltage level, while the ZFD400xT meter is generally used more at the medium and high voltage levels.

ZxD400xT meters have a comprehensive tariff structure. This extends from seasonal tariffs to multiple energy and demand tariffs.
The ZMD400xT and ZFD400xT meters are designed for connection to current transformers with 5 A or 1 A rated current or as special version for both applications (5//1).

The combimeters ZMD400CT and ZFD400CT record active and reactive energy consumption, the ZMD400AT and ZFD400AT active energy meters only the active energy in three-phase four-wire or three-phase three-wire networks (low, medium and high voltage) and from this determine the required electrical measured quantities. For this purpose they are connected to the measuring point via current and possibly voltage transformers:

- **Low voltage:** ZMD400xT with current transformers
- **Medium voltage:** ZFD400xT (in part also ZMD400xT) with current and voltage transformers
- **High voltage:** ZMD400xT (in part also ZFD400xT) with current and voltage transformers

The data determined are displayed (LCD) and are also available at the optical interface for data acquisition, with communication unit also as required via CS, RS232, RS485, modem, etc.

When provided with transmission contacts, the meters can also be used as transmission contact meters for telemetering. The tariffs can be controlled internally or externally.

With communication unit the meters can also be used for recording counting pulses for other physical media (e.g. water or gas volumes).

2.2 Characteristics

ZxD400xT meters have the following basic characteristics:

- Recording of active, reactive and apparent energy in all four quadrants (ZxD400CT) or recording of active energy imported and exported (ZxD 400AT)
- Tariff system with energy and demand tariffs, stored values, load profiles etc.

- Extended functions such as monitoring functions, sliding maximum demand, etc. (for ZxD400CT additionally power factor cosφ)
- Tariff control
  - External via control inputs (ZxD400xT21 and ZxD400xT41)
  - Internal
    - by integral time switch (ZxD400xT24 and ZxD400xT44)
    - by event signals based on monitored values as voltage, current demand etc.
    or
    - by integrated ripple control receiver (extension board 0030/0430)
- Display of data with a liquid crystal display (LCD)
- Active and reactive power per phase and true RMS values of voltages and currents by means of digital signal processing (DSP) chips
- Compliance with IEC accuracy class 1 or 0.5 S for active energy consumption and class 1 for reactive energy (ZxD400CT) or class 1, respectively (ZxD400AT)
- Flexible measuring system through parameterization (definition of different variables by software)
- Correct measurement even with failure of individual phases or when used in two or single-phase networks
- Wide range of measurement from starting current to maximum current
- Optical interface according to IEC 62056-21 and dlms
  - for direct readout of meter data
  - for service functions of meter, extension board and communication unit (e.g. parameterization)
- Inputs for recording fixed valency pulses (communication unit)
- Output contacts (solid-state relays) for fixed valency pulses, control signals and status messages
- Installation aids
  - Indication of phase voltages, phase angles, rotating field and direction of energy
- Storage of event information, e.g. voltage failures, exceeding of thresholds or error messages. Event information can be read out via the available interfaces. Important events can be communicated to the power supply company as operating messages (sending of SMS messages, control of an arrow in the display, drive for an output contact, etc.).
- Interfaces such as CS, RS232, RS485, modem, etc. for remote transmission of data (communication unit)
- Supplementary power supply for communication with the meter if no measuring voltage is present

2.3 Type Designation

ZMD 410 CT 44.4207

Type of circuit

- ZFD Three-phase three-wire network (F circuit, Aron circuit)
- ZMD Three-phase four-wire network (M circuit)

Type of connection

- 3 Direct connection with digital measuring system
- 4 Transformer connection with digital measuring system

Accuracy class

- 10 1 to IEC
- 05 0.5 to IEC

Measured quantities

- C Active and reactive energy
- A Active energy

Design

- T Complex tariff functions, modular communication
- R Complex tariff functions, integrated interface

Version

- 21 Energy tariffs; external tariff control via control inputs
- 24 Energy tariffs; internal tariff control via time switch (additionally possible via control inputs)
- 41 Energy and demand tariffs; external tariff control via control inputs
- 44 Energy and demand tariffs; internal tariff control via time switch (additionally possible via control inputs)

All versions with 3 control inputs and 2 output contacts.

Additional functions

Additional control inputs on extension board

- 0 No additional control inputs
- 2 2 additional control inputs
- 4 4 additional control inputs

Additional output contacts on extension board

- 0 No additional output contacts
- 2 2 additional output contacts
- 4 4 additional output contacts
- 6 6 additional output contacts

Hardware functions on extension board

- 0 No additional hardware
- 3 Integrated ripple control receiver
- 5 Supplementary power supply

Profile

- 0 No load profile
- 7 Load profile

The codes for version, additional functions and communication unit are not normally specified in the type designation in this user manual, unless necessary for understanding.

The communication unit is not a part of this type designation, since it is a complete unit in itself. Users can change it at any time without opening the verification seal. Every communication unit has its own user manual.

Series designation

The hardware version is distinguished by the series designation. The 1st hardware generation (series 1) has no series designation, while for the 2nd hardware generation (series 2) the series designation S2 is printed on the nameplate directly after the type designation.

Software version

The software version stored in the meter cannot be recognised externally. It can, however, be determined by reading out the meter identification (see section 5.5 "Data Readout"). Specific meter characteristics are present or not depending on the software version. For example by parameterization from software version B20 the form of phase angle representation can be selected or from software version B21 operating messages for the occurrence of important events can be signalled to the power supply company as SMS messages.

Class 0.2

Some types of ZxD400CT meters are also availabe as class 0.2 meters (not contained in the above type designation survey). These meter comply with IEC accuracy class 0.2S for active energy consumption and class 0.5 for reactive energy consumption. Details can be found in the corresponding data sheet.

2.4 Block Schematic Diagram

This chapter provides a survey of the function of ZxD400xT meters based on a block schematic diagram.

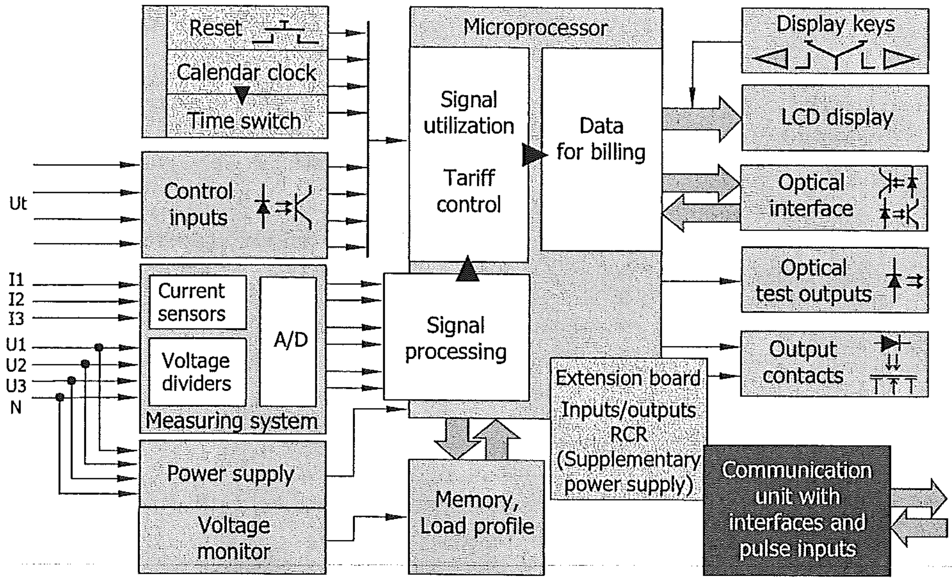


Fig. 2.1 Block schematic diagram ZMD400xT

Note

ZMD and ZFD meters

The following explanations refer exclusively to meters in M circuit for three-phase three-wire networks (ZMD meters).

ZFD meters differs from ZMD meters firstly in the number of measuring elements (2 instead of 3) and secondly in the type of measurement (Aron circuit for three-phase three-wire networks). These are not specially mentioned here.

The ZxD400AT active energy meters record the active energy consumption imported and exported, while the ZxD400CT combimeters record the active and reactive energy consumption in all four quadrants.

The ZxD400xT meters can be fitted with modular communication interfaces in a communication unit, which can be exchanged or used in the field as required.

Inputs

The main inputs to the meter are:

- Connections of phase voltages (U1, U2, U3), phase currents (I1, I2, I3) and neutral conductor N
  - for processing in the measuring system
  - for the three-phase power supply to the meter and voltage monitor
- Control inputs Ut (3 fixed, plus up to 4 others on extension board) for:
  - Changeover of energy and demand tariffs
  - Resetting
  - Demand inhibition
  - Synchronizing

  Opto-couplers protect the following circuit from interference, which could otherwise enter via the control inputs.
- Keys
  - for display control (display keys, optical interface)
  - for resetting or service functions (reset key)
- Pulse inputs for external pulse transmitters (only for meters equipped with a communication unit)

Outputs

The meter has the following outputs:

- LCD liquid crystal display with display keys for local reading of billing data (single 8-digit display with additional information, such as energy direction, type of energy, presence of phase voltages and identification number)
- Optical test outputs (red, 1 in active energy meters, 2 in combimeters)
- Static relay with freely parameterized signal assignment (2 fixed, plus up to 6 others on the extension board)
- Optical interface for automatic local data acquisition by suitable acquisition unit (handheld terminal)
- Communication interfaces of various kinds in the communication unit (see also section 2.8)

Measuring system

The input circuits (voltage dividers and current transformers) record voltage and current in the individual phases. Analogue-digital transformers digitize these values and feed them as instantaneous digital values via calibration stages to a signal processor.

Signal processing

The signal processor determines the following measured quantities from the instantaneous digital values of voltage and current for each phase and forms their mean value over one second:

- Active power per phase
- Reactive power per phase (combimeters ZxD400CT only)
- Phase voltages
- Phase currents
- Mains frequency
- Phase angles

Signal utilization

For signal utilization in the various registers the microprocessor scans the measured quantities every second to determine the following measured values:

- Active energy (sum and individual phases, separated according to energy direction, if required in the combimeters ZxD400CT also assigned to the 4 quadrants)
- Reactive energy (only for combimeters ZxD400CT, sum and individual phases, separated according to energy direction, assigned to the 4 quadrants)
- Apparent energy (only for combimeters ZxD400CT, sum and individual phases, separated according to energy direction)
- Power factors cosφ (only for combimeters ZxD400CT, individual phases and mean value)
- Phase voltages
- Phase currents and neutral current
- Direction of rotating field

Tariff control

Tariff control is performed:

- Externally via control inputs (3 fixed, plus up to 4 others on the extension board)
- Internally by time switch and calendar clock
- Internally by the ripple control receiver for integration with the extension board
- By event signals based on threshold values of the monitoring functions

Data preparation for billing

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

- 24 for energy tariffs
- 8 for total energy
- 8 for running mean demand values
- 24 for demand tariffs
- 2 for power factors cosφ (combimeters ZxD400CT only)
- others for values of voltage and current, mains frequency and phase angles

Memory

A non-volatile flash memory serves to record a load profile and also contains the configuration and parameterization data of the meter and secures the billing data against loss from voltage failures.

Power supply

The supply voltages for the meter electronics are obtained from the three-phase network, whereby the phase voltage can vary over the entire voltage range without the supply voltage having to be adjusted. A voltage monitor ensures correct operation and reliable data recovery in the event of a voltage interruption and correct restarting when the voltage is restored.

Supplementary power supply

For medium or high-voltage applications in particular the measuring voltage can be switched off. Since the meter normally obtains its supply from the measuring voltage, it is similarly switched off and cannot be read. The supplementary power supply connected in parallel with the normal power supply ensures operation of the meter free from interruption, so that it can be read at any time. The supplementary power supply is situated on an extension board.

Extension board

The extension board is fitted inside the meter and is therefore secured by the verification seals. It cannot be exchanged. It can contain the following components:

- up to 4 control inputs in combination with
- up to 6 output contacts (solid-state relays)
- a ripple control receiver
- a supplementary power supply

Communication unit

The communication unit for fitting only in the ZxD400xT meters is a complete unit in its own case. If present, it is situated under the front door, is therefore secured by an utility seal and can be exchanged or inserted in the field if necessary. It contains:

- Communication interfaces as required for remote scanning of the meter (e.g. CS, RS232, RS485, modem)
- 2 signal inputs (S0 interfaces) for processing external pulse transmitters

2.5 Measuring Unit

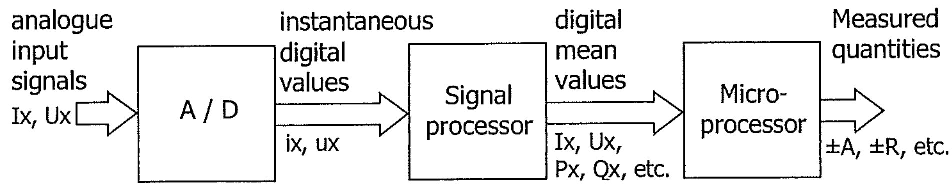


Fig. 2.2 Block schematic diagram of measuring unit

Input signals

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

Signal conversion

The meter measuring system generates calibrated instantaneous digital values of voltage and current for each phase from the analogue input signals.

Signal preparation

The signal processor of the meter determines the following digital mean values (averaged for one second in each case) from the instantaneous values of voltage and current in each phase:

- Active powers P1, P2 and P3 (with sign for direction of energy)
- Reactive powers Q1, Q2 and Q3 (with sign for direction of energy, only in combimeters ZxD400CT)
- Phase voltages U1, U2, U3
- Phase currents I1, I2, I3, neutral current I0
- Phase angles between voltages U1 and U2 as well as U1 and U3

- Phase angles between voltage U1 and currents I1, I2 and I3
- Mains frequency fn

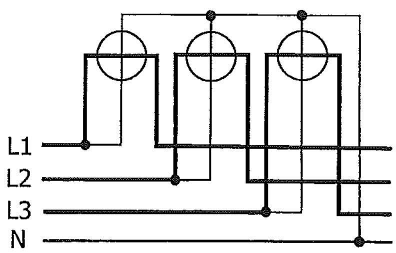
Signal processing

The microprocessor calculates the following measured quantities from the mean values provided by the signal processor:

Measured quantity		ZMD400CT	ZFD400CT	ZMD400AT	ZFD400AT
Active power import	+A	Sum / Phases	Sum	Sum / Phases	Sum
Active power export	–A	Sum / Phases	Sum	Sum / Phases	Sum
Reactive power positive	+R	Sum / Phases	Sum	–	–
Reactive power negative	–R	Sum / Phases	Sum	–	–
Reactive power 1st quadrant	+Ri	Sum / Phases	Sum	–	–
Reactive power 2nd quadrant	–Rc	Sum / Phases	Sum	–	–
Reactive power 3rd quadrant	–Ri	Sum / Phases	Sum	–	–
Reactive power 4th quadrant	+Rc	Sum / Phases	Sum	–	–
Apparent power import	+VA	Sum / Phases	Sum	–	–
Apparent power export	–VA	Sum / Phases	Sum	–	–
Power factor	cosφ	Phases / mean value	Mean value	–	–
Phase voltages		U1 - U2 - U3	U12 - U32	U1 - U2 - U3	U12 - U32
Phase currents		I1 - I2 - I3	I1 - I3	I1 - I2 - I3	I1 - I3
Neutral current		I0	–	I0	–
Mains frequency	fn	yes	yes	yes	yes
Phase angle voltages	φ U	U1 - U2 / U1 - U3	–	U1 - U2 / U1 - U3	–
Phase angle voltage-current	φ U-I	yes	–	yes	–
Direction of rotating field		yes	yes	yes	yes

Owing to the different type of measurement of the Aron circuit, data for the individual phases in the ZFD400xT are specifically not provided. The following diagrams show the differences between the ZMD400xT and the ZFD400xT.

ZMD400xT



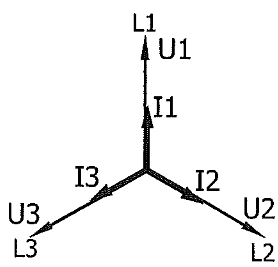


Fig. 2.3 Type of measurement ZMD400xT

Since the ZMD400xT measures the individual phases mutually independently with one measuring element each, it can record the sum of the three phases, the individual phases themselves, the phase angle between voltage and current as well as the angle between voltages U1 - U2 and U1 - U3.

ZFD400xT

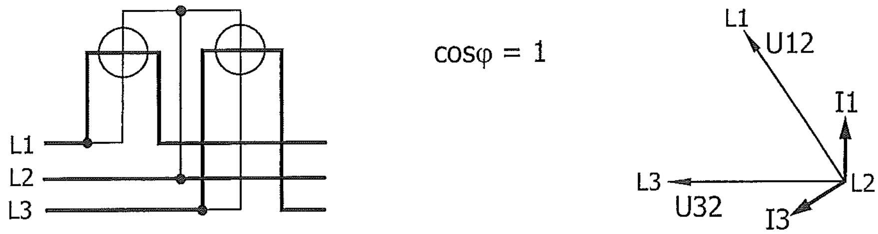


Fig. 2.4 Type of measurement ZFD400xT

The ZFD400xT with Aron circuit records with its two measuring elements a phase current I1 or I3 each, together with the corresponding linked voltage U12 or U32. It cannot therefore form any actual single-phase values. In addition, the phase angles between voltage and current always have an additional angle of 30° and are therefore not representative.

2.6 Signal Conversion and Processing

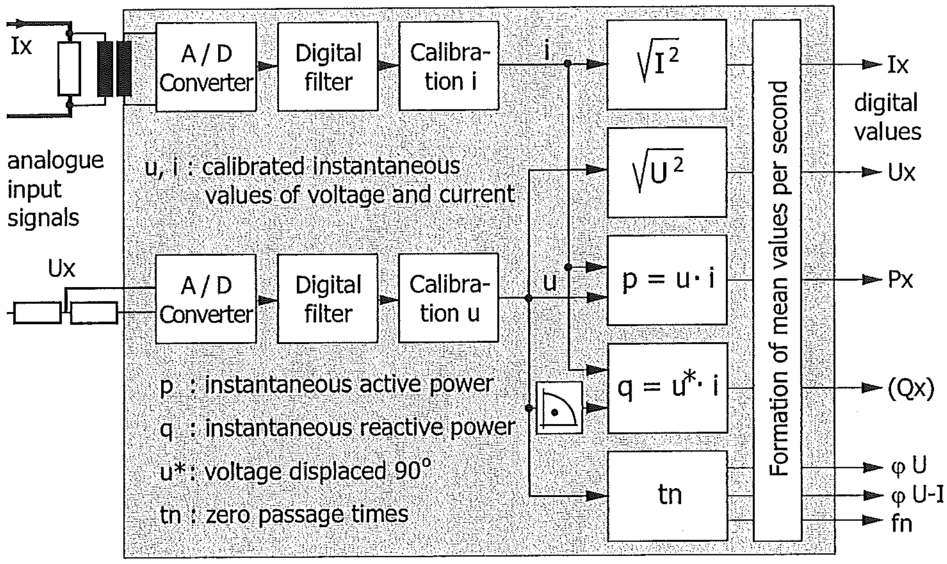


Fig. 2.5 Principle of signal processor

There is no calculation of reactive power Q by the ZxD400AT active energy meters.

Input circuits

High resistance voltage dividers reduce the voltages U1, U2 and U3 (58 to 240 V) applied to the meter to a proportionate amount of a few mV (U_U) for further processing.

Internal current transformers reduce the input currents I1, I2 and I3 to the meter (0 to 10 A) for further processing. The secondary currents of these current transformers develop voltages proportional to the input currents across resistors, also of a few mV (U_I).

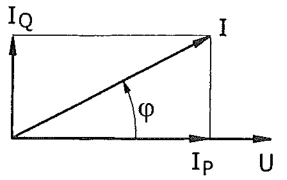
Digitizing

The analogue signals U_U and U_I are digitized in Sigma-Delta converters (analogue-digital converters with highest resolution) with a sample rate of 1.6 kHz and then filtered. A following calibration stage compensates for the natural errors of the voltage divider or current transformer, so that no further adjustment is necessary in the subsequent processing.

Calibrated digital instantaneous values of voltage (u) and current (i) for all three phases are then available as intermediate values for the formation of the required values in the signal processor.

Power calculation

The instantaneous value of active power p is produced by multiplying the instantaneous values of voltage u and current i (the active component corresponds to the product of voltage component with the current component parallel to the voltage). Thereby the harmonics up to 1 kHz are measured correctly.



Calculation per phase of

$$P = U \cdot I \cdot \cos\varphi$$

$$Q = U \cdot I \cdot \sin\varphi$$

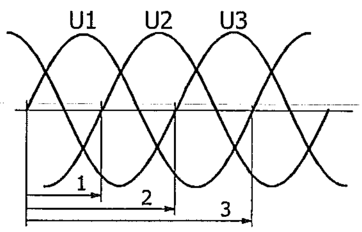
Fig. 2.6 Power calculation

For the instantaneous value of reactive power q (only formed by the ZxD400CT combimeters) the instantaneous value of voltage u must be rotated through 90° before multiplication (the reactive component is the product of the voltage component with the current component vertical to the voltage). Thereby no harmonics are measured since only the fundamental wave is rotated through 90°.

The squares of voltage and current are obtained by multiplying the instantaneous values of voltage and current by themselves. The values U and I are obtained from these by extracting the root.

Time measurement

The mains frequency can be calculated from the time measured between two zero passages (change from negative to positive value of voltage U1). The times between zero passage of the phase voltage U1 and those of the other phase voltages U2 and U3 serves to determine the phase angle between the voltages and of the rotating field.



Time measurement
for rotating field,
frequency, phase angle

1 : T_{U1-U2}

2 : T_{U1-U3}

3 : T_{U1-U1} (fn)

Fig. 2.7 Time measurement

The phase angle between voltage and current is determined by the times between zero passage of the phase voltage U1 and those of the phase currents I1, I2 and I3.

Mean value formation

For further processing of the individual signal the signal processor generates mean values over one second, which the following microprocessor scans at intervals of one second.

2.7 Formation of Measured Quantities

By scanning the mean values of active P and in combimeters also reactive Q powers every second, energy components are produced (Ws or vars) at fixed intervals (every second) and with varying energy magnitudes or demand. These energy components are scaled by the microprocessor corresponding to the meter constant and are then available as measured quantities for selection of measured value. The measured values are fed directly to the following registers to record the energy and the maximum demand (in combimeters also of minimum power factor).

Active power

The active powers in the individual phases ±A1, ±A2 and ±A3 are formed directly from the mean values of active power P1, P2 and P3.

By summating the mean values of active power P1, P2 and P3 the microprocessor calculates the total active power import +A or the total active power export -A.

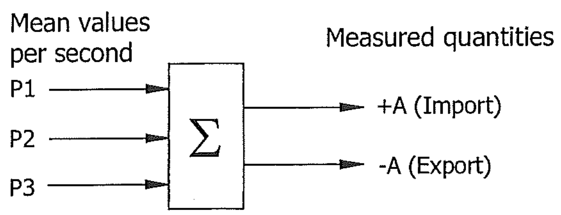


Fig. 2.8 Total active power

Reactive power

The reactive power values of the individual phases ±R1, ±R2 and ±R3 are obtained in the combimeters directly from the mean values of reactive power Q1, Q2 and Q3.

By summating the mean values of reactive power Q1, Q2 and Q3, the microprocessor calculates the total positive reactive power +R or the total negative reactive power -R.

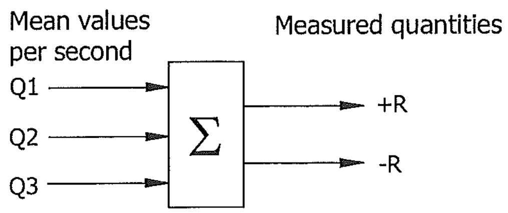


Fig. 2.9 Total reactive power

The microprocessor can allocate the reactive power to the 4 quadrants in the combimeters from the signs of R and A:

- Reactive power in 1st quadrant: +Ri
- Reactive power in 2nd quadrant: +Rc
- Reactive power in 3rd quadrant: -Ri
- Reactive power in 4th quadrant: -Rc

In the same way he can allocate the reactive powers of the individual phases to the 4 quadrants.

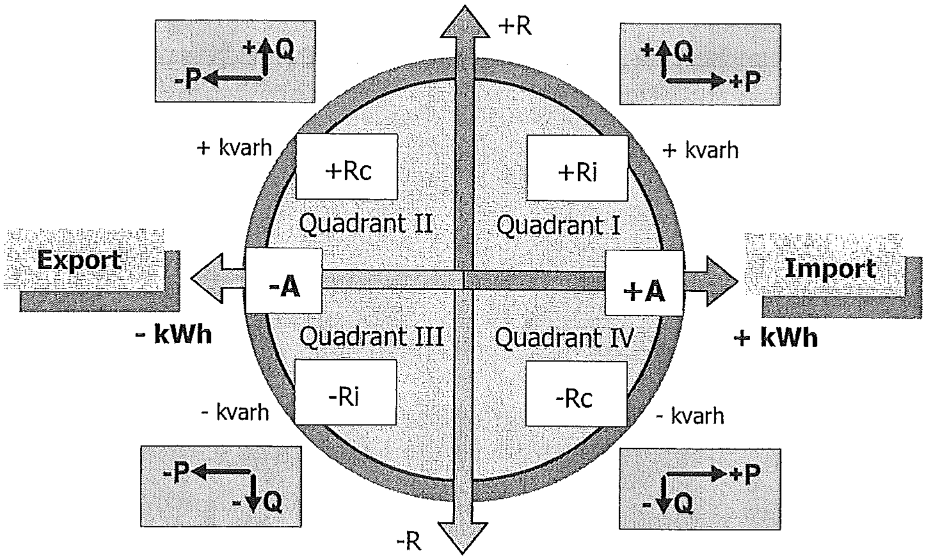


Fig. 2.10 4-quadrant measurement

The quadrants are numbered from top right as 1st quadrant (+A/+Ri) anti-clockwise to the 4th quadrant (+A/-Rc) at bottom right.

Apparent power

The apparent power is calculated in the combimeters in two ways:

- by geometric addition of the active and reactive power of the individual phases
- by multiplying the rms values of voltage and current of the individual phases

The method of calculation can be parameterized (only one possible in each case).

Calculation method 1 (vectorial addition)

From the mean values P1, P2 and P3 and Q1, Q2 and Q3 the microprocessor calculates the apparent power of the individual phases ±VA1, ±VA2 and ±VA3 as well as the total apparent power ±VA.

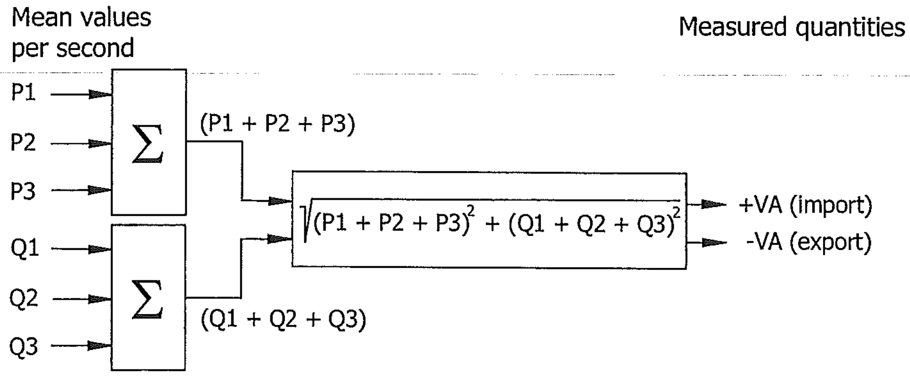


Fig. 2.11 Total apparent power according to calculation type 1

Calculation method 2 (from rms values)

From the mean values $U1_{rms}$, $U2_{rms}$, $U3_{rms}$ and $I1_{rms}$, $I2_{rms}$, $I3_{rms}$ the microprocessor calculates by multiplication the apparent power of the individual phases ±VA1, ±VA2 and ±VA3 and summates these for the total apparent power ±VA.

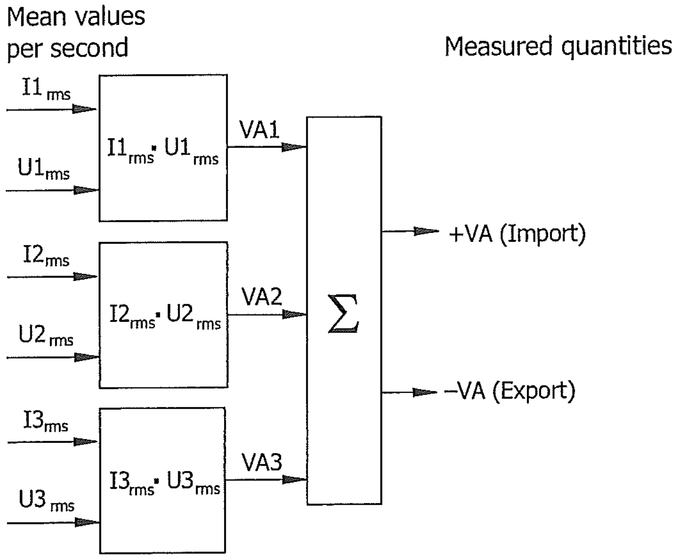


Fig. 2.12 Total apparent power according to calculation type 2 (ZMD300Cx / ZxD400Cx only)

Power factor cosφ

The power factor cosφ is calculated in combimeters as follows:

$$\cos\varphi = \frac{P}{S}$$

The meter uses the method of calculation employed for calculating the apparent power.

Phase voltages

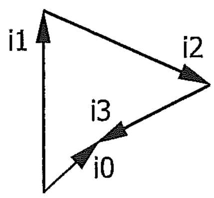
The rms values of the voltages $U1_{rms}$, $U2_{rms}$ and $U3_{rms}$ are obtained from the mean values of the squares of the voltages by extracting the root and directly from these the phase voltages U1, U2 and U3.

Phase currents

The rms values of the currents $I1_{rms}$, $I2_{rms}$ and $I3_{rms}$ are obtained from the mean values of the squares of the currents by extracting the root and directly from these the phase currents I1, I2 and I3.

Neutral current

The signal processor calculates the instantaneous neutral current i0 by adding the instantaneous phase currents i1, i2 and i3.



i0 = i1 + i2 + i3
(geometrical addition)

Fig. 2.13 Neutral current I0

Mains frequency

The signal processor calculates the mains frequency fn by forming the reciprocal from the time $t_{U1\text{-}U1}$ between two zero passages of voltage U1.

Phase angles

The signal processor calculates the phase angles between voltages U1-U2 and U1-U3 from the times $t_{U1\text{-}U1}$, $t_{U1\text{-}U2}$ and $t_{U1\text{-}U3}$ between zero passages of the various voltages.

The signal processor calculates the phase angle between voltage U1 and current per phase from the times $t_{U1\text{-}I1}$, $t_{U1\text{-}I2}$ and $t_{U1\text{-}I3}$ between zero passages of the voltage U1 and the phase currents.

2 forms of representation are available for displaying the phase angle. These can be selected by parameterization.

Case 1: All voltage and current angles are displayed clockwise with reference to the voltage in phase 1. The values of the angles are always positive and can be from 0 to 360°.

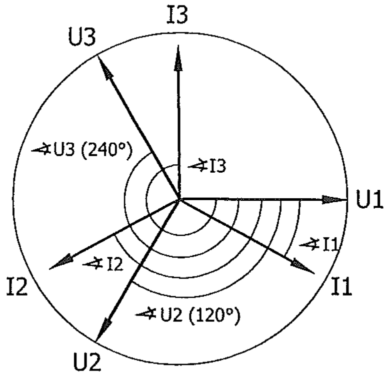


Fig. 2.14 Phase angle case 1

Case 2: The voltage angles are displayed as in case 1. The angles of the currents are displayed, however, with reference to the associated phase voltage and can have values between -180° and +180°.

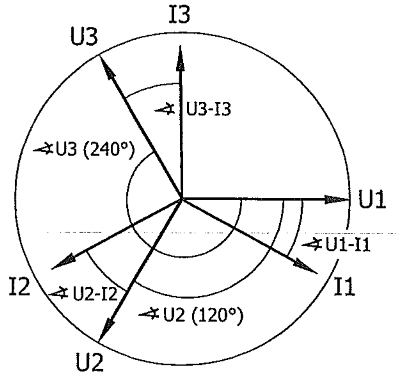


Fig. 2.15 Phase angle case 2

Direction of rotating field

The direction of the rotating field is calculated by the microprocessor based on the phase angle of the 3 voltages. If the direction of rotation corresponds to that specified by the parameterization, the phase voltage indications L1, L2 and L3 are continuously lit. Otherwise they flash every second.

2.8 Communication

The ZxD400xT meters have an optical interface for communication on the spot via a read head using a wide range of communication interfaces.

- for **remote scanning** of meters (RS232, RS485, CS, M-Bus, PSTN modem, GSM modem etc.) or
- for **recording metering pulses** for other physical media, such as water, gas or heat (S0 interface).

The communication devices are accommodated in an easily exchanged communication unit, which is plugged in under the front door of the meter and secured by a factory seal (see also section 3 "Mechanical Construction"). It can be fitted and removed at any time in the field without touching the verification seal.

An initial fitting as well as retrofitting without re-parameterization of the meters is possible with any version of communication unit. For fitting and removal of the already parameterized communication units the installation personnel do not require any special knowledge of communications. Modern plug connections ensure a rapid and faultless connection of the communication units.

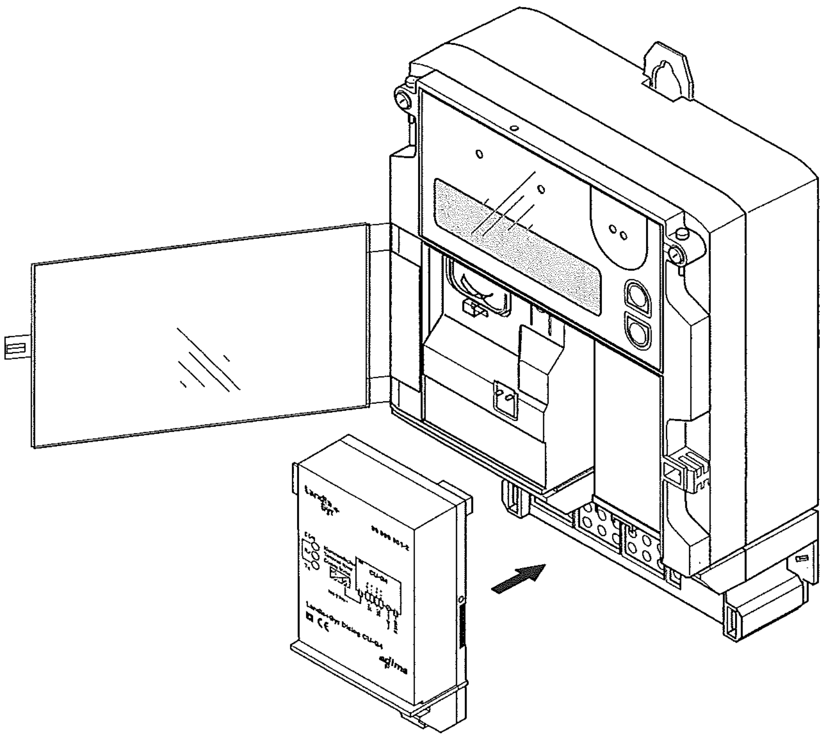


Fig. 2.16 Simple fitting of the communication unit

Versions of communication units

The following versions of communication units (CU) of the 1st and 2nd generation are available in various basic versions:

- Communication units **CU-Ax** (1st generation) with RS232, CS and S0 interfaces
- Communication units **CU-Bx** (1st generation) with RS485, RS232 and S0 interfaces

- Communication units **CU-Mx** (1st generation)
  with PSTN modem (V.22b or V.34b), RS485 and S0 interfaces
- Communication units **CU-M2x** (2nd generation)
  with PSTN modem (V.22b or V.34b), CS interface and RS232 or RS485 interface
- Communication units **CU-Gx** (1st generation)
  with GSM modem, RS232-, RS485- and S0 interfaces
- Communication units **CU-G2x** (2nd generation)
  with GSM modem, CS interface and RS232 or RS485 interface
- Communication units **CU-Dx** (1st generation)
  with M-Bus interface
- Communication units **CU-P2x** (2nd generation)
  with GSM/GPRS modem, CS interface and RS232 or RS485 interface
- Communication units **CU-E2x** (2nd generation)
  with Ethernet interface, CS interface and RS232 or RS485 interface

The relevant version is designated with a number inserted instead of "x" (e.g. CU-A1, CU-B2, CU-M22, CU-P21).

Communication units of the 2nd generation can be recognised by the **2** inserted after the basic version letter (e.g. CU-M**2**0, CU-M**2**1, CU-M**2**2).

Each version is fitted with the number of interfaces required for the relevant purpose of application according to the following table.

The 1st generation types marked grey in the table are superseded by corresponding types of the 2nd generation (e.g. M2 by M20 and M4 by M22).

Type	2 S0	CS passive	CS+ active/ passive	RS232	RS485	PSTN Modem	GSM Modem	GSM/ GPRS Modem	M-Bus *	Ethernet
CU-A1	×	×		×						
CU-A2		×		×						
CU-A4		×								
CU-A5				×						
CU-B1	×			×	×					
CU-B2					×					
CU-B4				×	×					
CU-D2									×	
CU-M1	×				×	×				
CU-M2						×				
CU-M4					×	×				
CU-M20						×				
CU-M21			×	×		×				
CU-M22			×		×	×				
CU-G1					×		×			
CU-G2							×			

Type	2 S0	CS passive	CS+ active/ passive	RS232	RS485	PSTN Modem	GSM Modem	GSM/ GPRS Modem	M-Bus *	Ethernet
CU-G3				×			×			
CU-G4	×				×		×			
CU-G5	×			×			×			
CU-G20							×			
CU-G21			×	×			×			
CU-G22			×		×		×			
CU-P20								×		
CU-P21			×	×				×		
CU-P22			×		×			×		
CU-E20										×
CU-E21			×	×						×
CU-E22			×		×					×

* Only the physical M-Bus layer, but not the M-Bus protocol, is used with the M-Bus interface.

Optical interface

The optical interface to IEC 62056-21 is a serial, bi-directional interface. It is situated at top right on the main face plate (see also chapter 3 "Mechanical Construction") and serves:

- for automatic data recording on the spot by means of suitable acquisition unit (hand-held terminal) (see section 5.5 "Data Readout")
- for performing service functions, e.g. to input formatted commands (see section 5.6)
- as "optical key", i.e. as receiver of a light signal, e.g. generated by a flashlight acting like the "down" display key (see also section 5.1.2 "Control of Display via Optical Interface")
- for communication with a Landis+Gyr MAP120 service tool or a Landis+Gyr MAP190 parameter editor.

S0 interface

The S0 interface is standardized to IEC 62053-31 or DIN 43864. The pulse inputs serve to accept external pulse transmitters (e.g. other meters with transmit contact for fixed valency pulses) for processing in the meter.

RS232 interface

The RS232 interface is an asymmetric, serial, asynchronous, bi-directional interface to DIN 66259. This interface serves for the connection of an external modem or a computer.

The RS232 interface of the communication units of the 1st generation is available in 2 different versions:

- as **basic version without control lines** for the connection of an external modem with sufficient intelligence of its own or
- as **extended version with control lines** for the connection of a transparent external modem.

The use of the extended version with control lines has the following advantages:

- Application of commercially available modem possible without difficulty.
- Maximum possible baud rate can be used without danger of buffer overflow.
- Limiting of maximum connection and idle time possible.
- Optimum behaviour with poor connections. Support of time-windows.

Communication units of the 2nd generation exclusively contain RS232 interfaces without control lines.

RS485 interface

The serial bi-directional RS485 interface is standardized to ISO-8482. It is basically intended for the connection of several meters (up to 31) via a master to a communication path (multiple connections).

CS interface

The serial bi-directional CS interface is standardized to IEC 62056-21 or DIN 66258. It supports both the communication protocol to IEC 62056-21 as well as communication according to dlms and can be operated both actively and passively. Limitation: the CS interfaces in communication units of the 1st generation can only be operated passively.

PSTN modem

The PSTN modem (PSTN = Public Switched Telephone Network) is approved according to TBR21. This is a standard modem (Modulator-Demodulator) for the modulated remote transmission of data via the analogue telephone line of the public telecommunications fixed network. It is licensed throughout Europe by decision 98/482/Ec of the council as output device for the public telecommunications fixed network. The PSTN modem is available for V22b or V34b transmission standards.

GSM modem

The GSM modem (GSM = Global System for Mobile Communication) is approved according to various standards such as ETS 300 607-1, EN 301 419-1 etc. It is a radio modem (Modulator-Demodulator) for the modulated remote transmission of data via the public mobile telephone network. The GSM modem uses the 900 MHz and 1800 MHz GSM frequency bands.

GPRS modem

The GPRS modem (GPRS = General Packet Radio Service) uses the GSM network for data transmission, but sends and receives the data in packets via the GSM channels free at the time. The packet-oriented data transmission permits tariff control according to data volumes transmitted instead of connection time, so that the GPRS modem can be permanently online. GPRS permits a wireless connection to the Internet by means of transmission protocol TCP/IP (Transmission Control Protocol).

M-Bus interface

The serial M-Bus interface is standardized to EN 1434-3. It is intended for the connection of up to 250 devices (electricity, water, gas or heat meters) via a repeater (level converter) to a communication path in order to read out the meter data or perform service functions. The use of the M-Bus physical layers (the M-Bus protocol is not used) has compared with the customary use of a RS485 bus the advantage, that an already existing M-Bus infrastructure can be further used, i.e. no new cabling is necessary.

Ethernet interface

The Ethernet interface is standardised to IEEE 802.3. This is a standard for data transmission in packet form in LAN networks (Local Area Network). The Ethernet interface permits connection to the LAN by means of the transmission control protocol TCP/IP (Transmission Control Protocol/Internet Protocol). The maximum transmission speed is 10 Mbps.

Further information sources

More detailed information about Landis+Gyr Dialog communication solutions can be found in the following documents.

- **Technical data** for the various communication units
- **User manuals** for the various communication units
- **Basic information** for communication applications
- Detailed **application notes** for numerous reference applications with various communication units for different transmission media

All these documents as well as advisory services are available from the competent representative of Landis+Gyr Ltd.

2.9 Software Tools

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

- The **Landis+Gyr MAP110** service tool for customers is used for testing, certifying and installation of meters and for servicing work on the spot.
- The **Landis+Gyr MAP120** service and programming tool for customers is used for re-parameterization meters on the spot. It also includes the entire functional application of the Landis+Gyr MAP110 service tool.

Since these software tools support both the meters as well as the communication units, no expenditure is required for instruction and maintenance of additional parameterization and service tools for these communication units compared with the use of communication devices from other manufacturers.

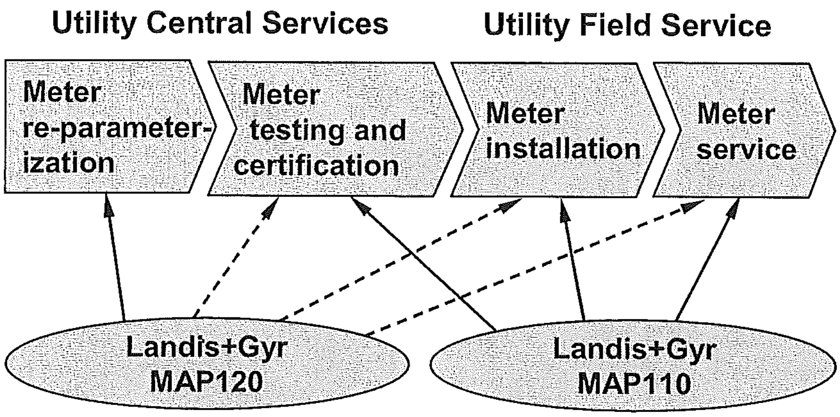


Fig. 2.17 Application of MAP software tools

3 Mechanical Construction

This section describes the mechanical construction of the ZxD400xT meter and shows the most common connection diagrams.

3.1 Sealing

The internal construction of the meters is not described here, since they are protected following verification and official certification on delivery by a manufacturer and verification seal. It is not permitted to open the meters after delivery. The front door is only secured with an utility seal and can be opened to operate the reset key, to change the battery, to exchange the tariff face plate with connection diagram or to fit or remove a communication unit (see Fig. 3.2 and separate user manuals for the communication units available).

The following drawing shows the meter components visible from outside.

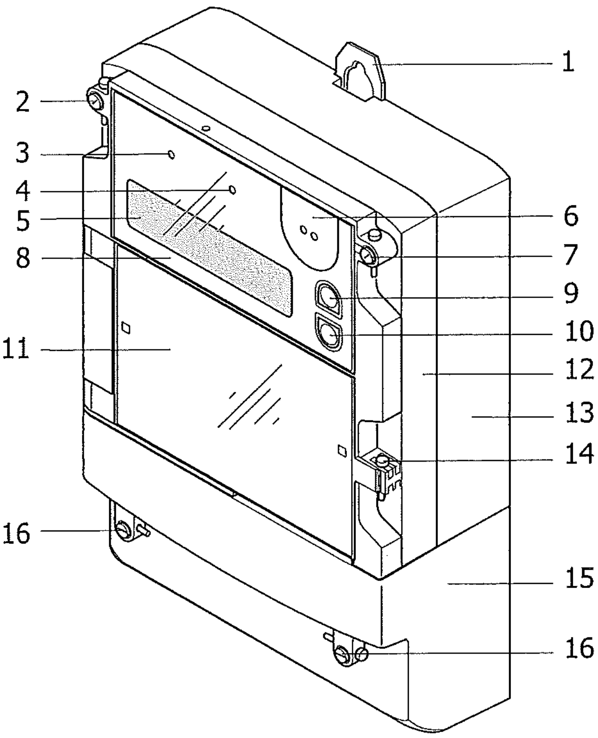


Fig. 3.1 Meter ZxD400xT

1 Combined suspension hanger (open or concealed)
2 Screw with manufacturer seal
3 Optical test output reactive energy consumption (red), ZxD400CT only
4 Optical test output active energy consumption (red)
5 Liquid crystal display (LCD)
6 Optical interface
7 Screw with verification seal
8 Front section with main face plate
9 Display key "up"
10 Display key "down"
11 Front door with tariff face plate
12 Upper part of case
13 Lower part of case
14 Utility seal for front door
15 Terminal cover
16 Terminal cover screws with utility seals

Case

The meter case is made of antistatic plastic (polycarbonate). The upper part of the case is provided with two transparent plastic viewing windows, affording a view of the main face plate (top) and the tariff face plate (bottom). The lower part of the case is additionally glass-fibre reinforced. For further details refer to material list no. H 71 0264 1007.

Viewing window

The upper viewing window with the main face plate is secured on the upper right side with a verification seal, while the upper part of the case is secured on the upper left side with a manufacturer seal (warranty) or a second verification seal.

The lower viewing window is in the form of a hinged front door, secured with an utility seal. The tariff face plate with the connection diagram on the rear side, the battery compartment, the reset key and (if present) the communication unit are situated under this front door.

Terminal cover

The terminal cover is available in various lengths in order to ensure the required free space for the connections.

Front door

The front door must be opened to give access to the battery compartment, reset key and tariff face plate. To fit or remove the communication unit the terminal cover must also be removed.

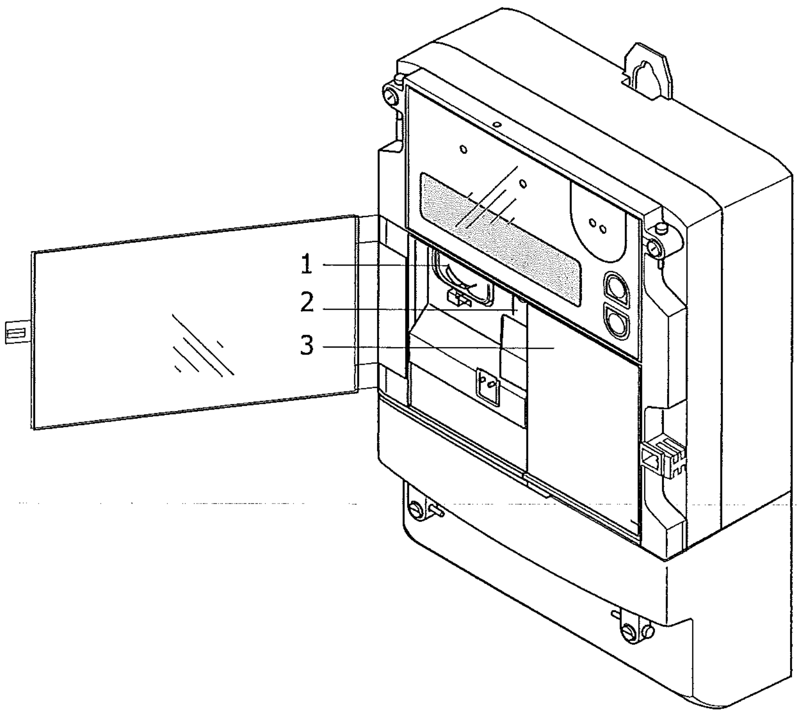


Fig. 3.2 Meter with front door open
1 Battery compartment
2 Reset key R
3 Communication unit or dummy

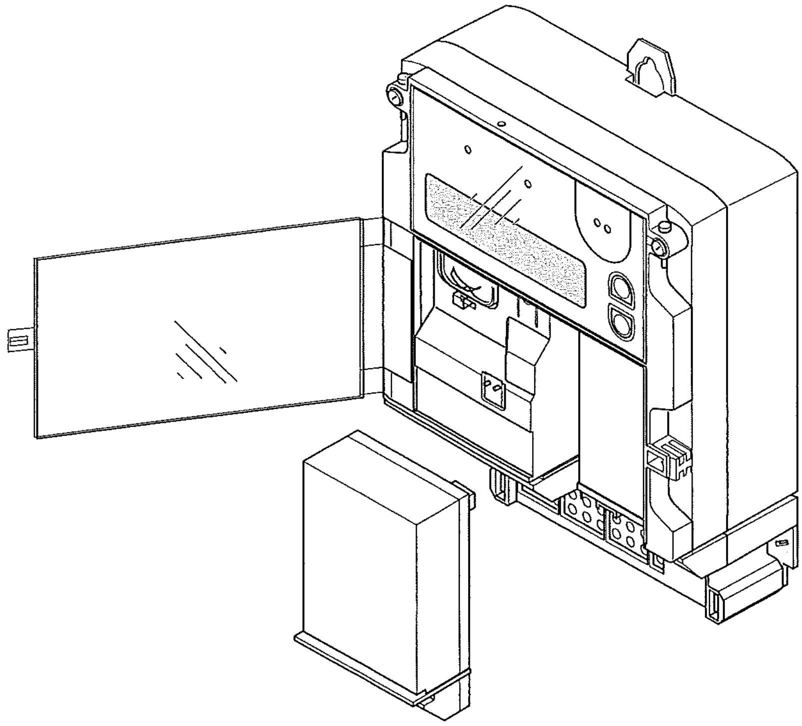


Fig. 3.3 Meter with communication unit withdrawn

If the meter has no communication unit, this is replaced by a dummy case.

Seal component

An additional component, which is easy to install, allows the use of a standard padlock instead of an utility seal.

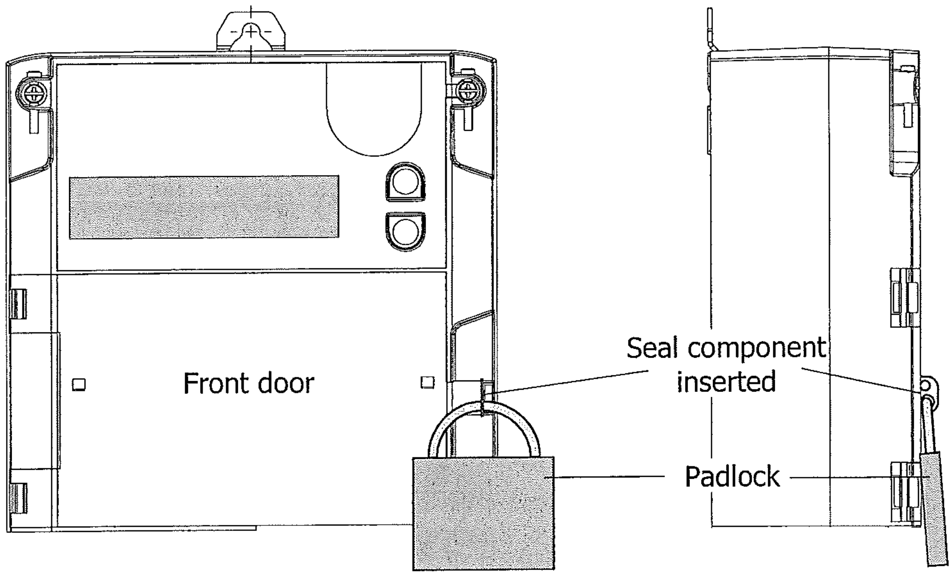


Fig. 3.4 Front door sealing using a padlock

The seal component is stowed away in a holder under the front door when not in use.

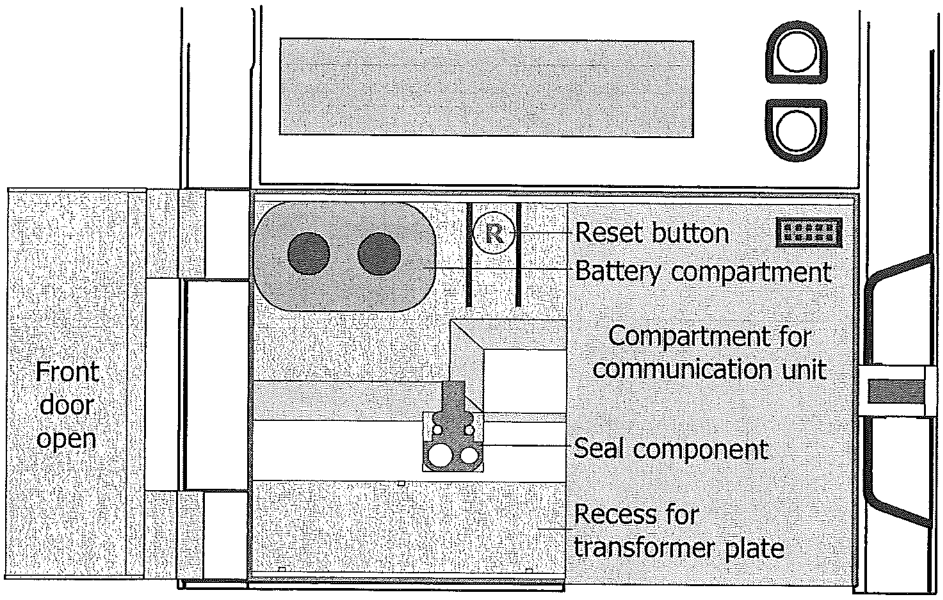


Fig. 3.5 Stowage of seal component when not in use

The seal component is installed as follows:

- Slide the seal component into the vertical slot at an angle, as shown, (position 1) until it contacts the rear wall.
- Now turn the seal component until it is horizontal and slide it down into position 2 as illustrated. The two bulges firmly fix the seal component into the lateral grooves.

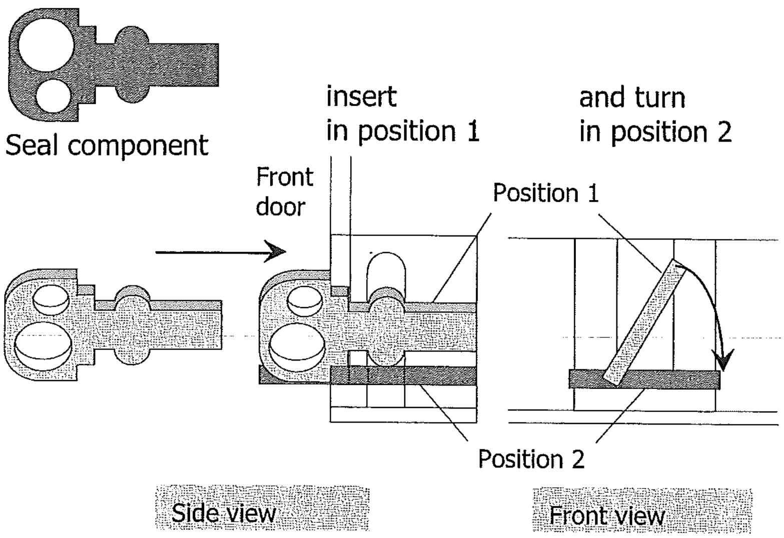


Fig. 3.6 Seal component for use with padlock

3.2 Face Plates

All relevant data for the meter are provided on the face plates inscribed in utility specific form.

Main face plate

The main face plate is situated under the plastic viewing window, which is secured by a verification seal. Recesses permit operation of the display keys "down" and "up" for control of the liquid crystal display.

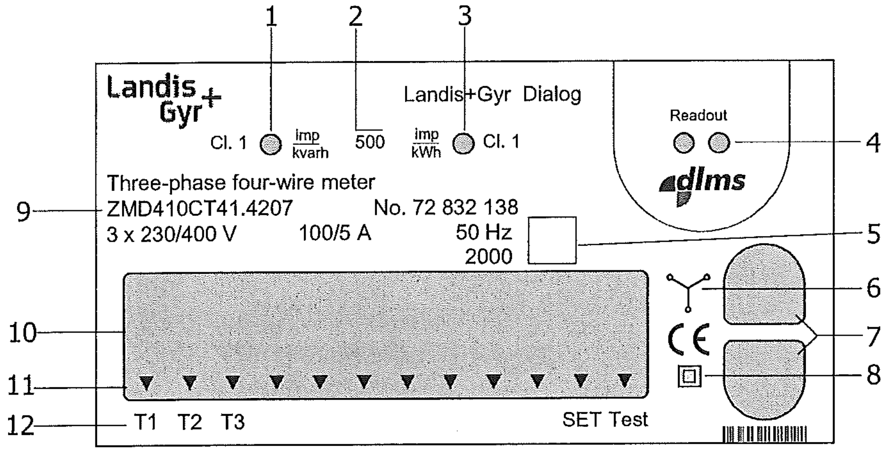


Fig. 3.7 Main face plate (example ZMD410CT)

1. *Optical test output reactive energy (with accuracy class – ZxD400CT only)*
2. *Meter constant R1 (referred to primary values) or R2*
3. *Optical test output active energy (with accuracy class)*
4. *Optical interface*
5. *Approval symbol*
6. *Type of connection*
7. *Display key "up" / Display key "down"*
8. *Symbol for dual protective insulation*
9. *Meter data (type designation, serial number, rated values, year of construction)*
10. *Liquid crystal display (LCD)*
11. *Arrows for present status indication*
12. *Status indication*

The operating elements and displays are described more fully in section 5 "Operation".

Tariff face plate

The tariff face plate is placed in the front door, which can be swung out sideways to the left and is secured by an utility seal. The connection diagram of the meter is shown on the back of the face plate and is therefore visible with the front door open.

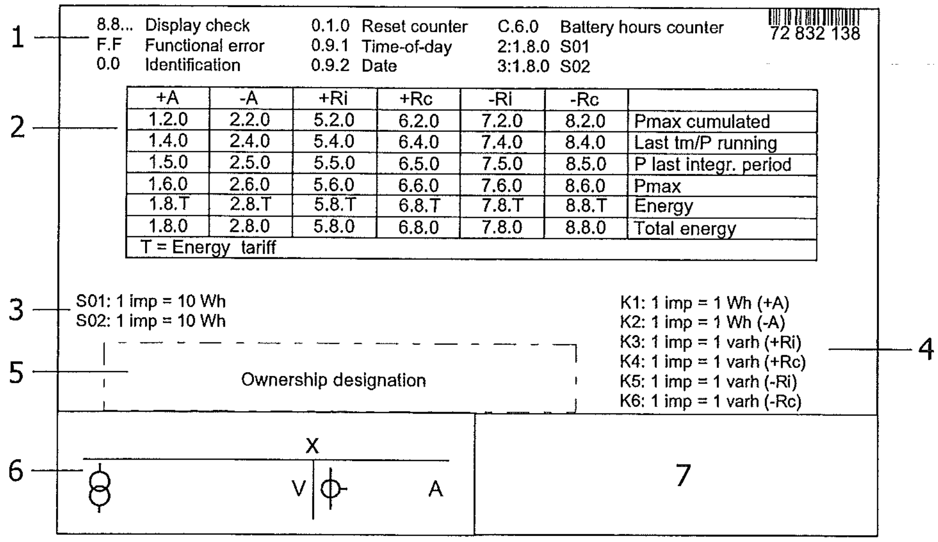


Fig. 3.8 Tariff face plate (example ZxD400CT)

1 *General data appearing in the display*
2 *Measured quantities*
3 *Pulse input data*
4 *Output contact data*
5 *Ownership designation*
6 *Transformer data and readout factor*
7 *Communication unit data (if present)*

3.3 Connections

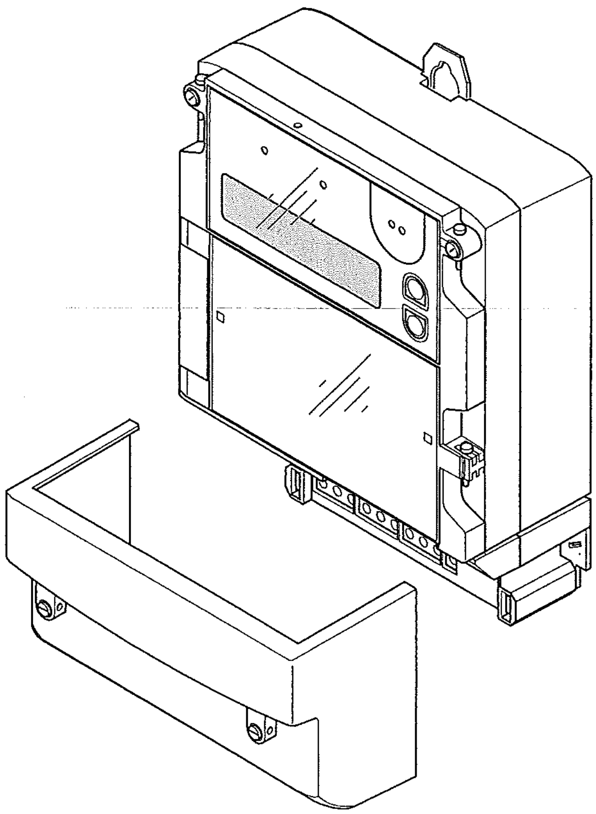


Fig. 3.9 Meter with terminal cover removed (example ZxD400CT)

The terminal block with all meter connections is situated under the terminal cover. Two utility seals in the fixing screws of the terminal cover prevent unauthorized access to the phase connections and therefore to unrecorded current consumption.

Terminal layout (example ZMD400xT)

The top row of terminals (level 1) consists of spring-loaded terminals and comprises

- Extension board terminals on the left
  depending on version up to 4 control inputs or 6 output contacts or a combination of these with maximum 6 inputs and outputs, voltage connections for a separate supply or test input of the ripple control receiver
- Communication unit terminals on the right

The center row of terminals (level 0) likewise consists of spring-loaded terminals and comprises

- Voltage outputs U1, U2, U3 and N, tapped from the relevant phase input
- 3 fixed control inputs with a common return line G (electrically isolated)
- 2 output contacts for transferring fixed valency pulses or control signals (electrically isolated)

The lower row of terminals comprises the phase connections with input and output of the circuit for each phase with the voltage connection in between and neutral conductor at far right.

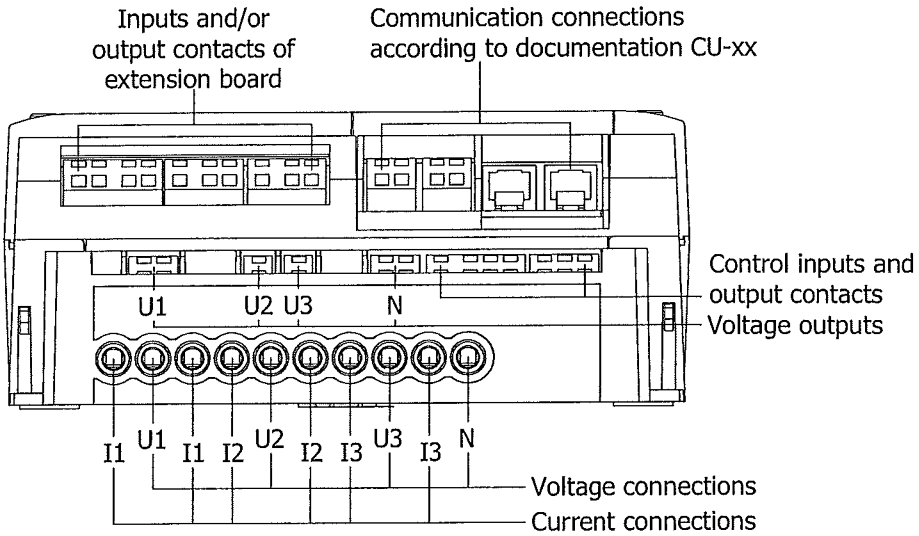


Fig. 3.10 Terminal layout ZMD400xT

3.4 Connection Diagrams

Note

Binding connection diagrams

The following connection diagrams should be considered examples. The connection diagrams provided at the rear of the front door and visible when the door is open are always binding for the installation.

ZFD400xT for three-phase three-wire networks

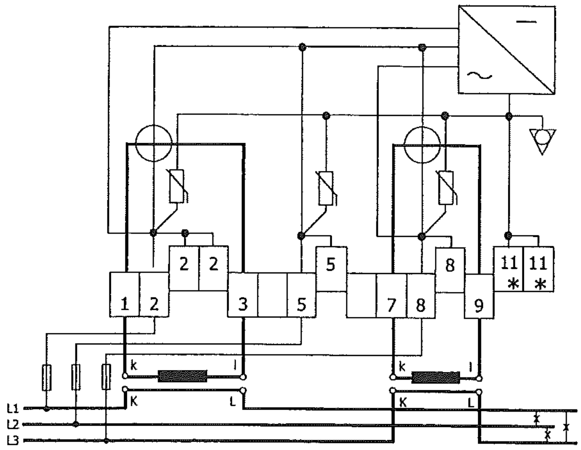


Fig. 3.11 Connection diagram of measuring unit ZFD400xT with current transformer

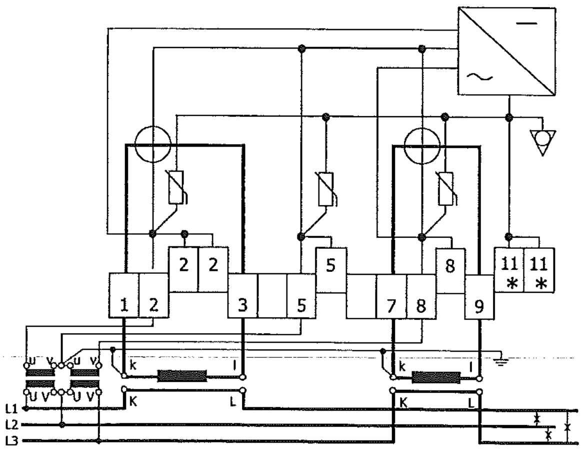


Fig. 3.12 Connection diagram of measuring unit ZFD400xT with current and voltage transformers

Note

Artificial star point

* With the three-wire circuit the artificial star point (terminal 11) must not be externally wired.

ZMD400xT for three-phase four-wire networks

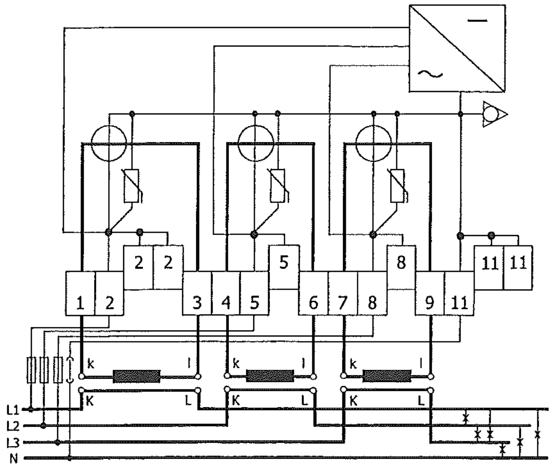


Fig. 3.13 Connection diagram of measuring unit ZMD400xT with current transformer

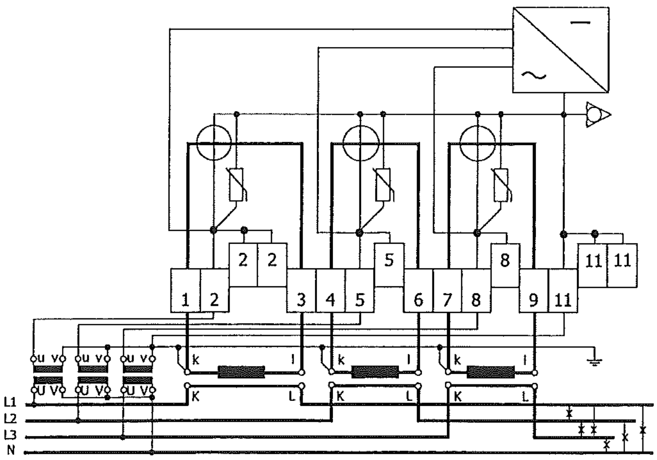
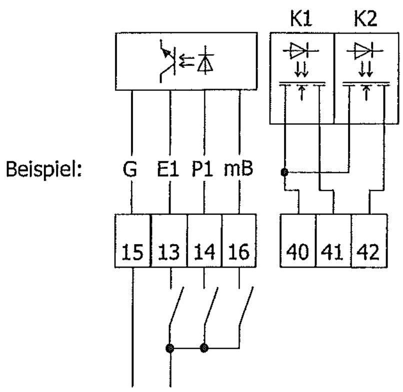


Fig. 3.14 Connection diagram of measuring unit ZMD400xT with current and voltage transformers

Control inputs / output contacts



Basic version:

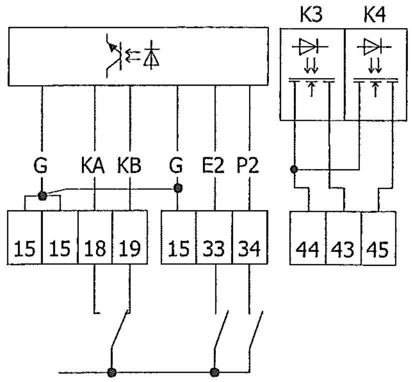
3 control inputs

2 output contacts
(solid-state relays)

Signal assignment and numbering of terminals for free parametrization

Fig. 3.15 Connection diagram fixed control inputs / output contacts (example)

Extension board 4200



Extension board 4200

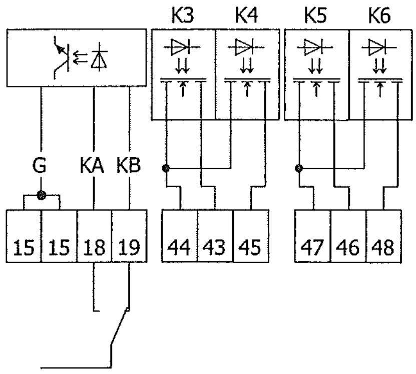
4 control inputs

2 output contacts
(solid-state relays)

Signal assignment and numbering
of terminals for free parametrization

Fig. 3.16 Connection diagram extension board with 4 control inputs and 2 output contacts (example)

Extension board 2400



Extension board 2400

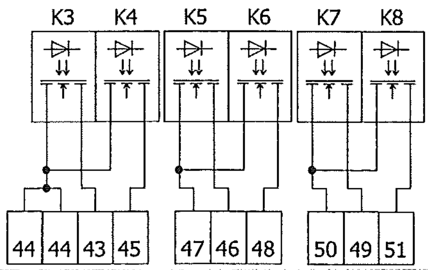
2 control inputs

4 output contacts
(solid-state relays)

Signal allocation and numbering
of terminals for free parametrization

Fig. 3.17 Connection diagram extension board with 2 control inputs and 4 output contacts (example)

Extension board 0600



Extension board 0600

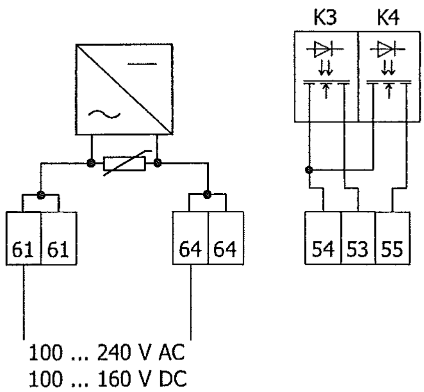
no control inputs

6 output contacts
(solid-state relays)

Signal allocation and numbering
of terminals for free parametrization

Fig. 3.18 Connection diagram extension board with 6 output contacts (example)

Extension board 0250



Extension board 0250

with supplementary power supply

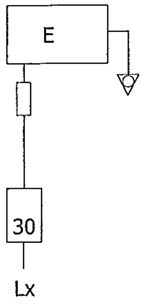
no control inputs

2 output contacts
(solid-state relays)

Signal allocation and numbering
of terminals for free parametrization

Fig. 3.19 Connection diagram extension board with supplementary power supply (example)

Extension board 0030



Extension board 0030

with ripple control receiver

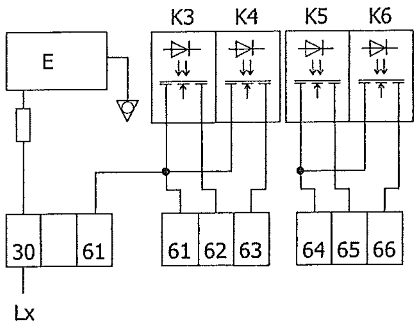
no control inputs

no output contacts

Signal allocation for free parametrization

Fig. 3.20 Connection diagram extension board with ripple control receiver (example)

Extension board 0430



Extension board 0430

with ripple control receiver

no control inputs

4 output contacts (solid-state relays)

Signal allocation for free parametrization

Fig. 3.21 Connection diagram extension board with ripple control receiver and 4 output contacts (example)

3.5 Dimensions

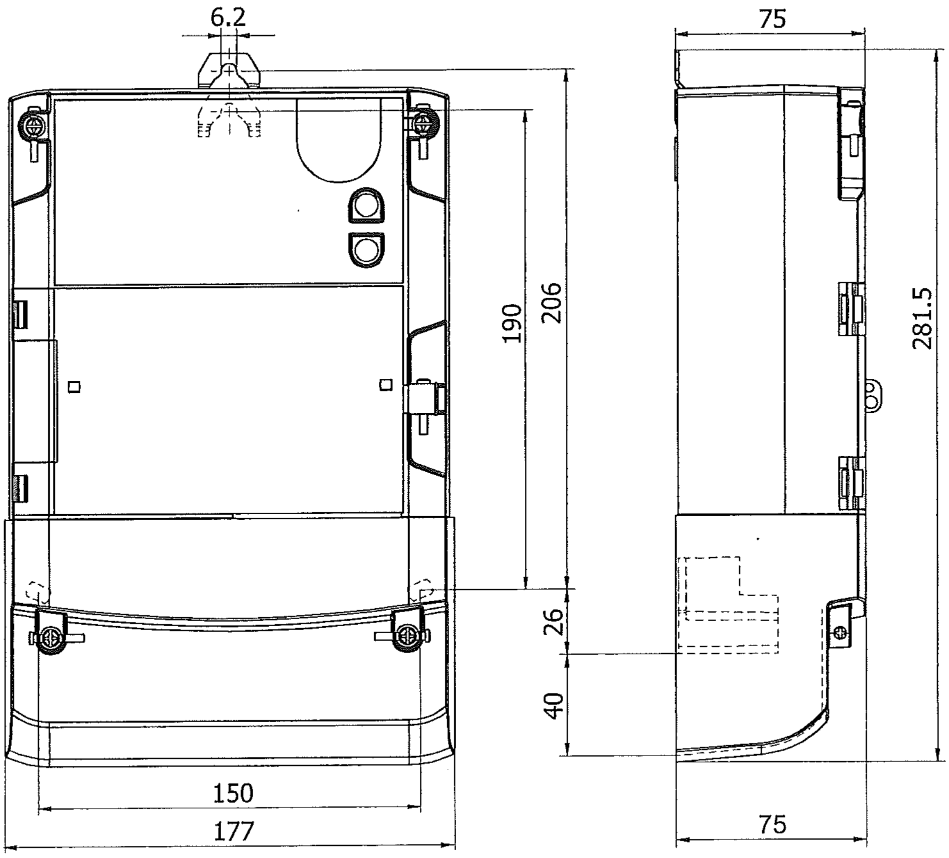
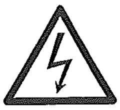


Fig. 3.22 Meter dimensions (Standard terminal cover)

4 Installation and De-Installation

This chapter describes the installation and connection of meters for transformer connection. In addition, the necessary steps for checking the connections, commissioning of the meter and the final functional check are described as well as the de-installation.



Danger

Dangerous voltage

Dangers can arise from live electrical installations to which the meters are connected. Touching live parts is dangerous to life. All safety information should therefore be strictly observed without fail.

4.1 Basic Information for Connecting Meter

It is recommended to use the following circuits whenever possible for connecting the meter to the various voltage levels.

4.1.1 Connection to Low Voltage with Current Transformers

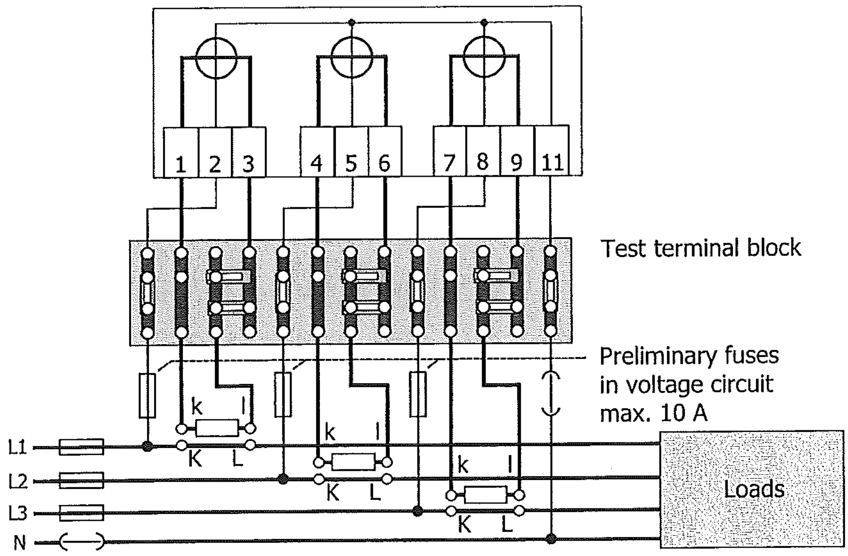


Fig. 4.1 Connection to low voltage with current transformers

Test terminal block

The secondary circuit of a current transformer must always be closed when current is flowing in the primary. Opening of the secondary circuit can destroy the transformer. The test terminal block shown in Fig. 4.1 allows the secondary circuits to be short-circuited and the voltage circuits to be opened in order to change the meter without interrupting operation.

Preliminary fuses

The preliminary fuses in the voltage circuit (max. 10 A) protect against short-circuits in the measuring circuit. The voltage circuits are connected directly to the primary and would only be protected by the main fuses of 100 A or more if the preliminary fuses were not fitted. A short-circuit would certainly destroy the measuring device.

4.1.2 Connection to Medium and High Voltage (Aron Circuit)

This circuit is used above all in the medium voltage range (3 to 30 kV) and rarely with high voltage (from 30 kV).

It is also recommended here to insert a test terminal block between transformer and measuring device (meters and others). This permits simple exchange without interrupting operation. On the other hand, no preliminary fuses are necessary in the voltage circuits, since the voltage transformers cannot produce a high short-circuit capacity on the secondary side.

Earthing

On medium and high voltage the secondary side potential of all transformers should be earthed for safety reasons. Otherwise potentials could develop, which could result in dangerous contact voltages.

Three-phase three-wire meter

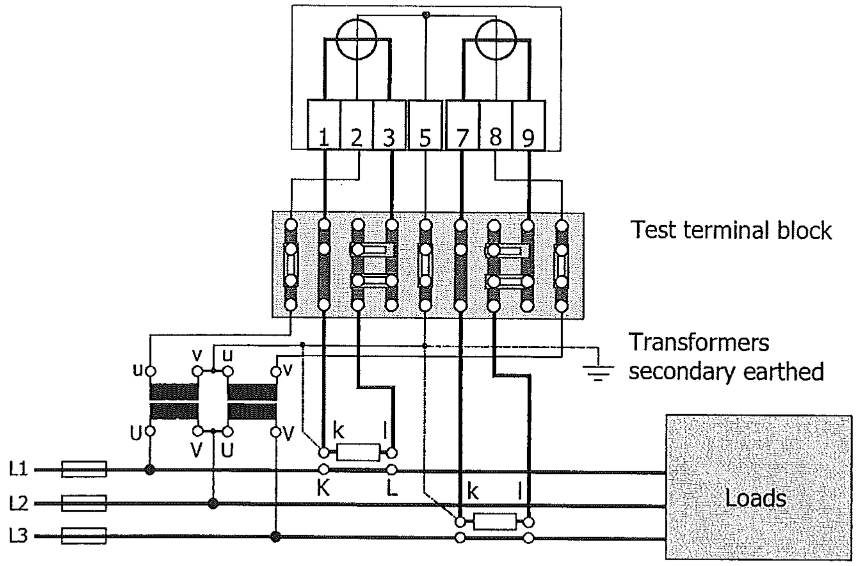


Fig. 4.2 Connection to medium and high voltage (Aron circuit)

Instead of the three-phase three-wire meter ZFD400 the power supply company can also use a three-phase four-wire meter ZMD400. The following two connections are then possible:

- with 2 voltage transformers and open star point at the meter
- with 3 voltage transformers and star point connected at the meter

Three-phase four-wire meter (with open star point at meter)

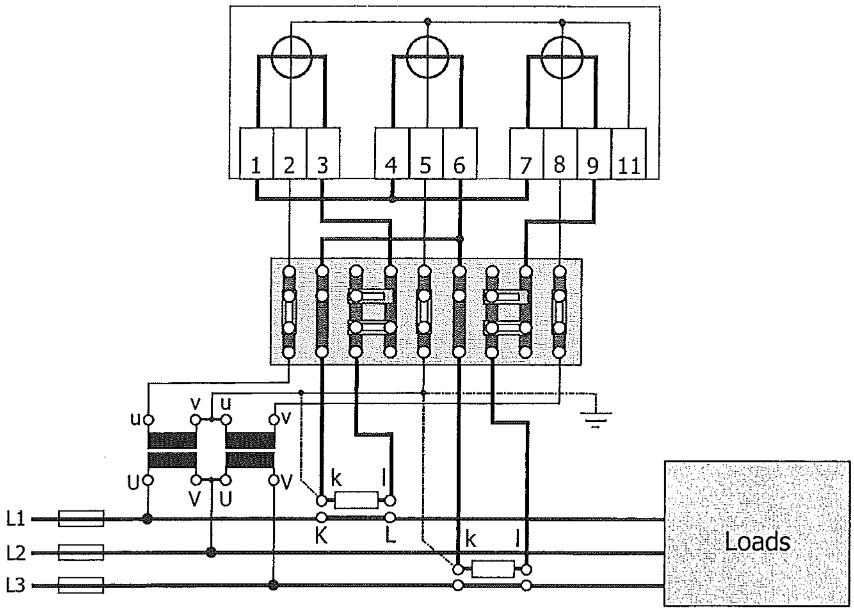


Fig. 4.3 Connection to medium and high voltage four-wire meter with open star point

Three-phase four-wire meter (with star point connected at meter)

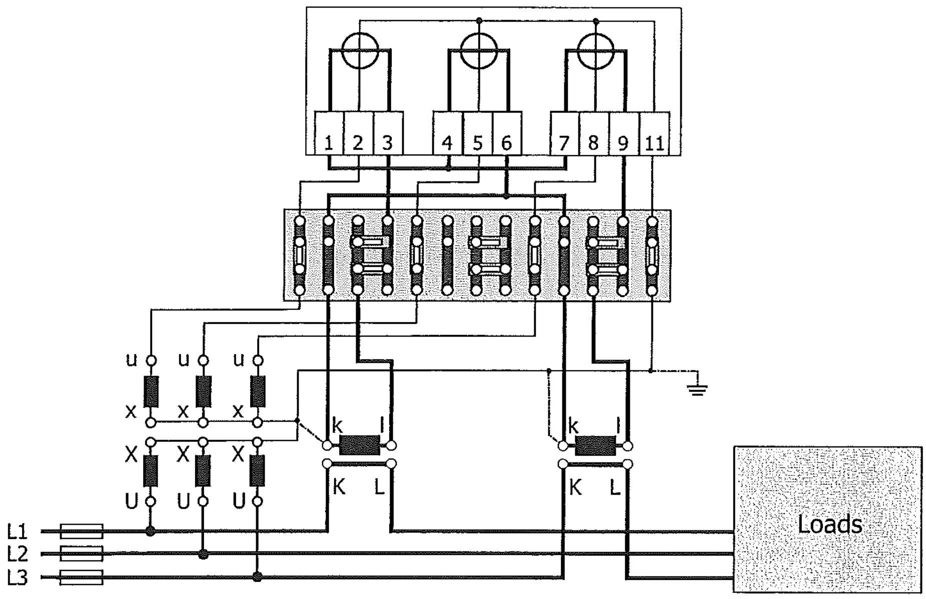


Fig. 4.4 Connection to medium and high voltage four-wire meter with star point connected

4.1.3 Connection to Medium and High Voltage (Three-Phase Four-Wire Circuit)

This circuit is mainly used with high voltage (from 30 kV). The same conditions then apply as for the Aron circuit.

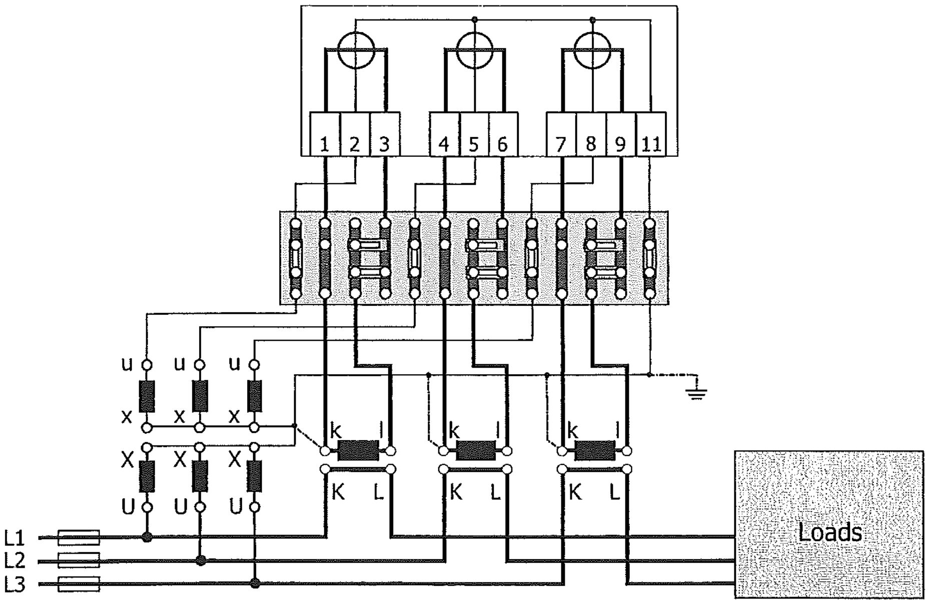


Fig. 4.5 *Connection to medium and high voltage (three-phase four-wire circuit)*

4.2 Mounting the Meter

Danger

Dangerous voltage on conductors

The connecting conductors at the point of installation must be voltage-free for installation of the meter. Contact with live components is dangerous to life. The relevant preliminary fuses should therefore be removed and kept in a safe place until finishing work, so that they cannot be re-inserted by other persons unnoticed.

The jumpers in the voltage connections must also be opened at the test terminal block (e.g. TVS14). For this purpose release the screw of the relevant jumper with an insulated screwdriver, move the jumper away from the terminal on the meter side and then re-tighten the screw.

If no test terminal block is available, the primary voltage must be interrupted, i.e. the system switched off.

Danger

Dangerous voltage on current transformers

The current transformer secondary circuits must not be opened when current is flowing in the primary. This would produce a dangerous voltage at the terminals of several thousand volts and the insulation of the transformer would be destroyed.

To install the meter short-circuit the secondary of the current transformer to the test terminal block (e.g. TVS14). For this purpose release the screw of the relevant short-circuiting jumper with an insulated screwdriver, move the jumper away over the terminals on the meter side and then re-tighten the screw. The circuit on the meter side can then be opened without danger.

If no test terminal block is available, the primary voltage must be interrupted, i.e. the system switched off.

The meter should be mounted as follows on the meter board or similar device provided for this purpose:

1. Find the correct meter position for mounting the meter.
2. Determine the desired form of fixing (open or covered meter mounting).
3. Set the meter suspension eyelet in the relevant position. This can be moved up or down over the stop as illustrated in Fig. 4.6.
4. Check with a phase tester or universal measuring instrument whether the connecting wires are live. If so, remove the corresponding preliminary fuses and keep them in a safe place until installation is completed, so that they cannot be replaced by anyone unnoticed. Open the voltage connections at the test terminal block with an insulated screwdriver and check whether the short-circuit jumpers of the circuit are closed.

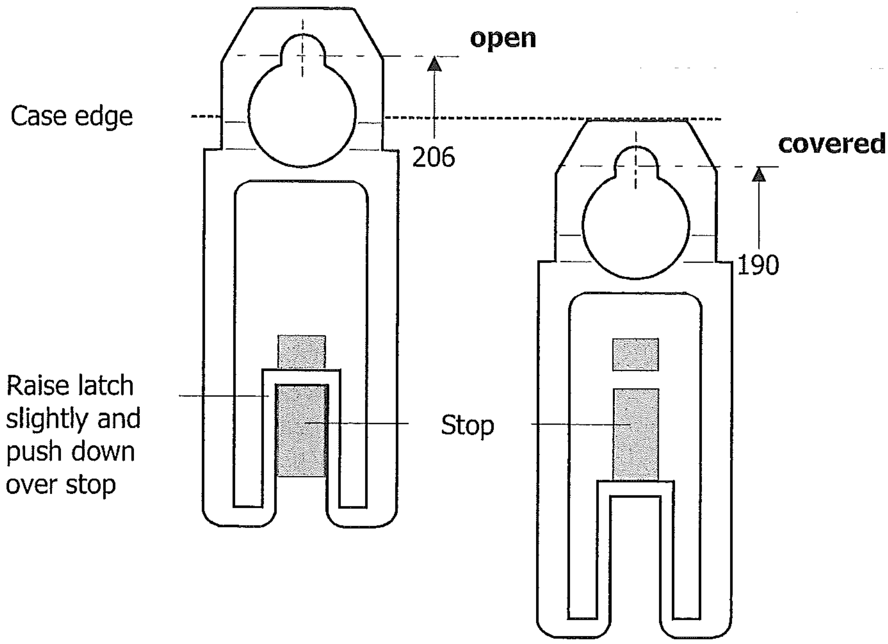


Fig. 4.6 Meter suspension eyelet

5. Mark the three fixing points (suspension triangle as in following illustration) on the mounting surface provided:
   - horizontal base of suspension triangle = 150 mm
   - height of suspension triangle for open mounting = 206 mm
   - height of suspension triangle for covered mounting = 190 mm

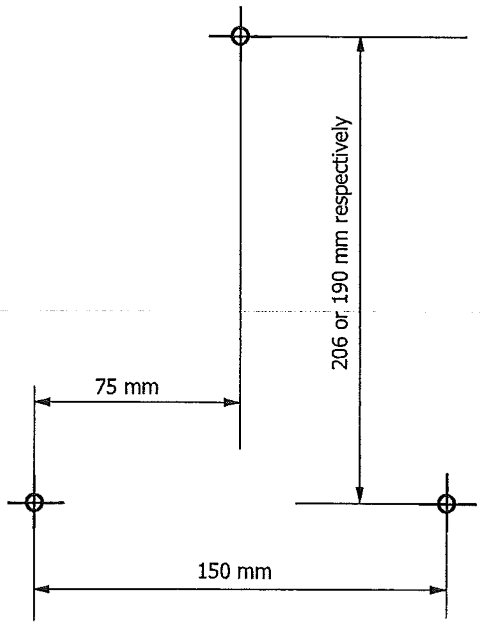


Fig. 4.7 Drilling plan

6. Drill the three holes for the fixing screws.
7. Unscrew the meter terminal cover.
8. Fit the meter with the three fixing screws on the mounting surface provided.

4.3 Connecting Meter

Danger

Dangerous voltage on conductors

The connecting conductors at the point of installation must be voltage-free for installation of the meter. Contact with live components is dangerous to life. The relevant preliminary fuses should therefore be removed and kept in a safe place until finishing work, so that they cannot be re-inserted by other persons unnoticed.

The jumpers in the voltage connections must also be opened at the test terminal block (e.g. TVS14). For this purpose release the screw of the relevant jumper with an insulated screwdriver, move the jumper away from the terminal on the meter side and then re-tighten the screw.

If no test terminal block is available, the primary voltage must be interrupted, i.e. the system switched off.

Danger

Dangerous voltage on current transformers

The current transformer secondary circuits must not be opened when current is flowing in the primary. This would produce a dangerous voltage at the terminals of several thousand volts and the insulation of the transformer would be destroyed.

To install the meter short-circuit the secondary of the current transformer to the test terminal block (e.g. TVS14). For this purpose release the screw of the relevant short-circuiting jumper with an insulated screwdriver, move the jumper away over the terminals on the meter side and then re-tighten the screw. The circuit on the meter side can then be opened without danger.

If no test terminal block is available, the primary voltage must be interrupted, i.e. the system switched off.

Preliminary work

It is assumed that the transformers and test terminal blocks have already been correctly fitted, the current transformers are short-circuited and the voltage connections opened.

Note

Earthing

When using voltage transformers the secondary star-point (or centre point in Aron circuit) of the transformer is earthed. The secondary circuits of the current transformers are also earthed one side (connection k).

Preliminary fuses must be used with direct voltage connection. The current transformers must not be earthed on the secondary side in this case, see connection diagram.

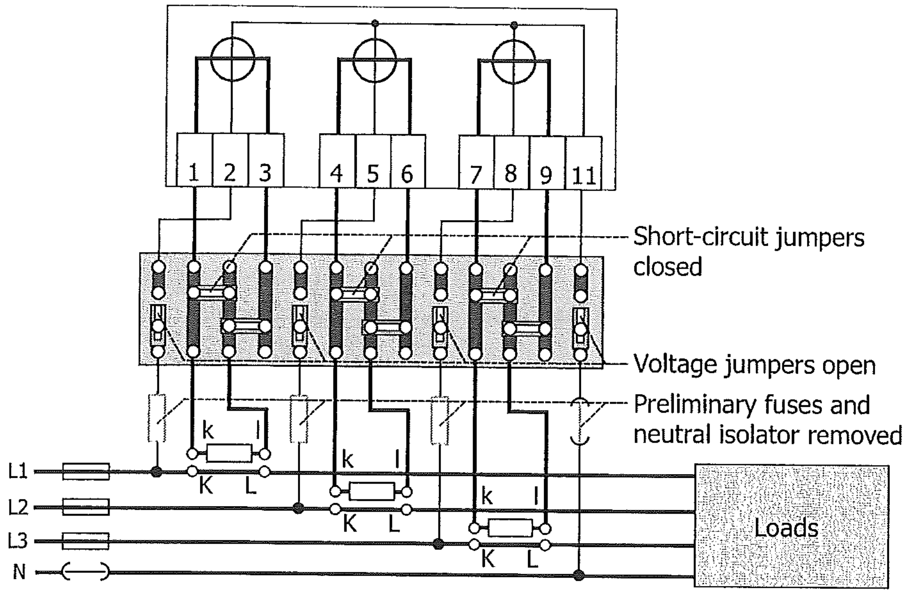


Fig. 4.8 Test terminal block status before installing the meter

Connecting

The electrical connections to the meter should be made as follows according to the connection diagram:

1. Check whether the preliminary work described above has been performed. If not, complete this work (test terminal blocks should only be touched with an insulated screwdriver).
2. Check with a phase tester or universal measuring instrument whether the connecting wires are live. If so, remove the corresponding preliminary fuses and keep them in a safe place until installation is completed, so that they cannot be replaced by anyone unnoticed.

Connecting the phase connection lines

3. Shorten the phase connecting wires to the required length and then strip them.
4. Insert the phase connecting wires in the relevant terminals (the terminals are numbered as shown in the connection diagram) and tighten the terminal screws firmly (torque 1.7 Nm).

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

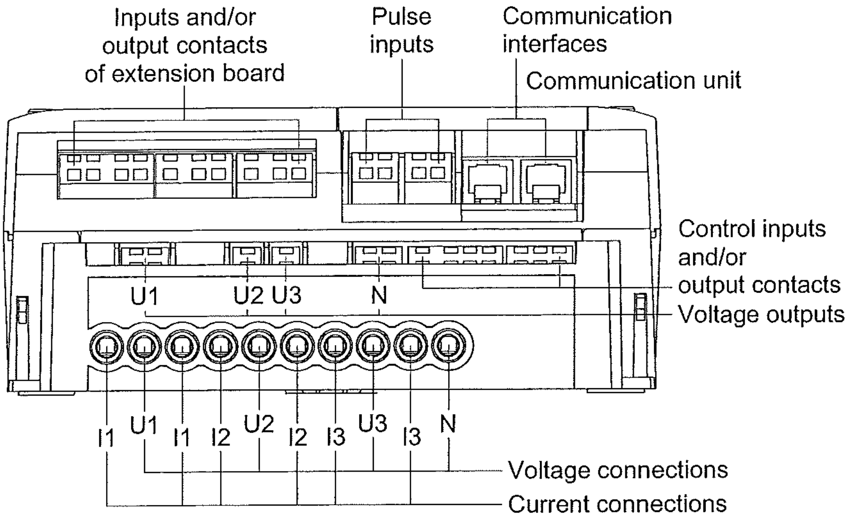


Fig. 4.9 Meter connections (example ZMD400xT)

Note

Artificial star point

With the three-wire circuit the artificial star point (terminal 11) must not be externally wired.

Connecting the signal inputs and outputs

5. Shorten the connecting wires of the signal 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).
6. If stranded wire is used, it is recommended to provide it with ferrules for connection.
7. Connect the connecting wires of the signal inputs and outputs as follows to the screwless spring-loaded terminals (the terminals are numbered as shown on the connection diagram):
   - Insert a size 1 screwdriver in the upper opening and insert it turning slightly upwards (Fig. 4.10 A).
   - Now place the stripped connecting wire in the lower opening and hold it there securely (Fig. 4.10 B).
   - Withdraw the screwdriver. The connecting wire is then firmly fixed (Fig. 4.10 C).

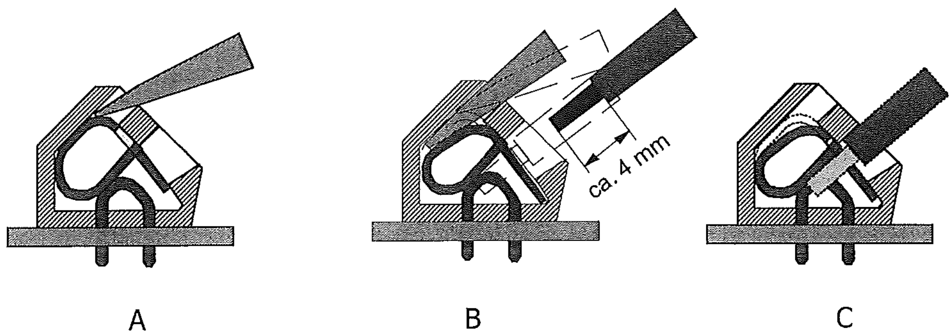


Fig. 4.10 Connection in screwless spring-loaded terminals

Danger

Bare end of connecting wire must not be too long

The insulation of the connecting line must extend as far as the terminal indentation, i.e. there must be no further bare part of the connecting line visible above the terminal edge (as shown in Fig. 4.10 C). Touching live parts is dangerous to life. The stripped part of the connecting wire should be shortened if necessary.

Warning

Only one wire or ferrule per terminal

Only one wire or ferrule with strand(s) may be connected in screwless spring-loaded terminals. The terminal could be damaged or the contact could not properly made.

If a connecting wire must be disconnected again for any reason, this is performed in the reverse sequence:

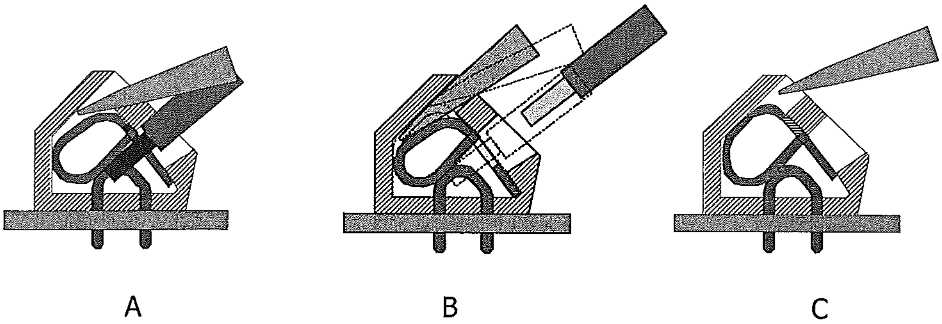


Fig. 4.11 Releasing connection from spring-loaded terminal

Warning

Damage to terminals

Never withdraw connecting wires with the terminal closed, since this could damage the terminal.

4.4 Check of Connections

Note

Effects of connection errors

Only a properly connected meter measures correctly !
Every connection error results in a financial loss for the power company !

Before putting into operation check again whether all meter connections are connected correctly according to the connection diagram.

4.5 Commissioning, Functional Check and Sealing

Danger

Dangerous voltage on conductors

The preliminary fuses must be re-inserted or the jumpers of the voltage circuits in the test terminal block re-closed before commissioning and functional check of the meter.

If the terminal cover is not screwed tight, there is a danger of contact with the connection terminals. Contact with live components is dangerous to life.

The relevant preliminary fuses should therefore be removed before making any modifications to the installation and these kept in a safe place until completing the work to prevent anyone re-inserting them unnoticed. The jumpers in the test terminal block of the voltage circuits should again be opened and secured.

Danger

Dangerous voltage on current transformers

The current transformer circuits must be closed before commissioning and functional check of the meter. Opening the jumpers short-circuiting the secondary sides of the transformers permit the transformer current to flow through the meter. The opening of the short-circuit jumper must never interrupt the circuit.

Note

Prerequisites for commissioning and functional check

The functional check requires voltage to be applied and load applied to all phases. If export is possible, determine first the energy direction present.

If no mains voltage is present, commissioning and functional check must be performed at a later date.

Via the test terminal blocks you can also supply the meter from suitable auxiliary sources on the secondary side with the system switched off. Repeat the functional check later with the system switched on.

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

1. Close the jumpers of the voltage paths in the test terminal block with an insulated screwdriver and re-insert the preliminary fuses.
2. Check on the display whether all three phases L1, L2 and L3 are indicated and show the right phase sequence.
   - If one phase is not present, the relevant symbol is absent. This is also the case if the voltage is less than 20 V.
   - With the normal phase sequence L1-L2-L3 the symbols are displayed continuously.
   - If, however, the meter is connected with reversed phase sequence (e.g. L2-L1-L3) the symbols flash. The direction of field rotation (clockwise or anticlockwise) is determined by the parameterization. This has no influence, however, on the measuring behaviour of the meter.

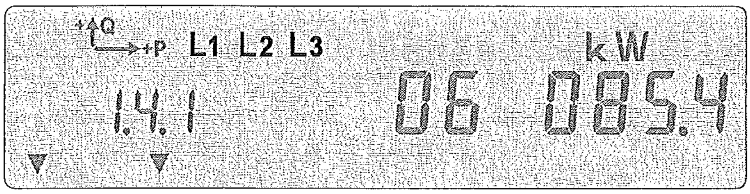


Fig. 4.12 Phase sequence indication

3. Open the short-circuit jumper of phase 1 in the test terminal block with an insulated screwdriver.
4. Check the display of the energy direction: +P to right, +Q up with inductive load.
5. Close the short-circuit jumper of phase 1 in the test terminal block again with an insulated screwdriver.
6. Repeat the same test for the other phases as in points 3 to 5.
7. Then open the short-circuit jumpers of all phases in the test terminal block with an insulated screwdriver.

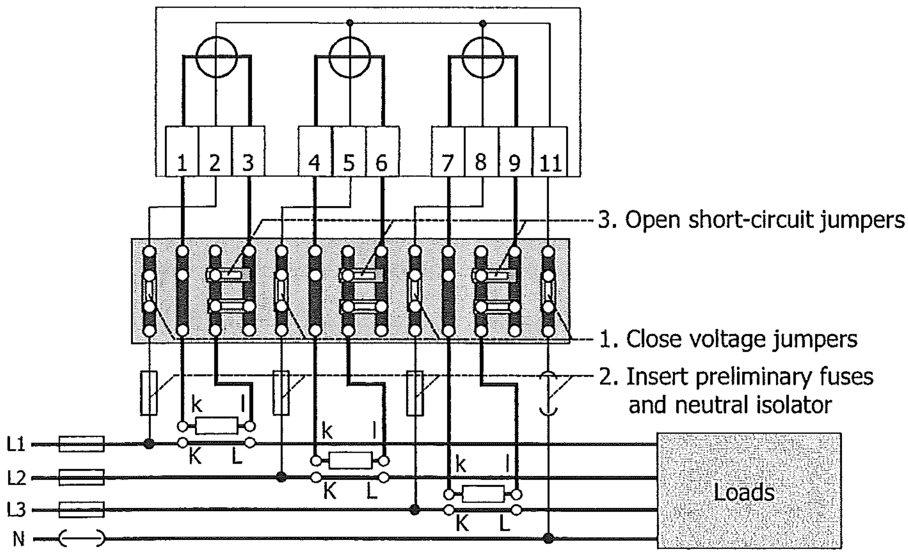


Fig. 4.13 Test terminal blocks status after commissioning

8. Check whether the operating display appears correctly (no error message).
9. Further values can be checked in the service list obtained via the service menu if parameterized: phase voltages, angles, currents, etc.
10. Check the tariff displays and switch the control voltages to the tariff inputs on and off. The arrow symbols of the tariff display must change.
11. If the meter is connected to a meter readout system via the electrical interface, a check should be made of correct functioning of the data transmission.
12. If a GSM modem is connected to the meter, the SMS transmission function should be checked by sending a test SMS message, e.g. to your own mobile telephone.
13. Screw on the terminal cover if the meter is operating correctly. Otherwise first locate and eliminate the error.

14. Seal the terminal cover with two utility seals.
15. Set the current date and time with the relevant formatted command (see section 5.6) or in the set mode (see section 5.7).
16. Close the front door.
17. Re-seal the front door.

4.6 De-Installation

Danger

Dangerous voltage on conductors

The connecting conductors must be free from voltage when the meter is removed. It is dangerous to life to touch live parts. Remove the corresponding pre-fuses and ensure that they cannot be re-inserted by anyone unnoticed before completing the work.

If the meter is connected via voltage transformers, it must be possible to open the test terminal (e.g. TVS14). For this purpose release the screw of the relevant jumper with an insulated screwdriver, push the jumper away from the terminal and then re-tighten the screw.

If there is no test terminal block, the primary voltage must be interrupted, i.e. the system switched off.

Danger

Dangerous voltage on current transformers

The secondary sides of the current transformer circuits must not be opened if a current is flowing in the primary. This would produce an extremely high voltage of several thousand volts dangerous to life at the terminals and the insulation would be destroyed.

Short-circuit the current transformer at the test terminal block (e.g. TVS14) to remove the meter. For this purpose release the screw of the relevant short-circuit jumper with an insulated screwdriver, push the short-circuit jumper over the terminals on the current transformer side and then re-tighten the screw. The circuit on the meter side can then be opened without danger.

If there is no test terminal block, the primary voltage must be interrupted, i.e. the system switched off.

The meter should be removed as follows:

1. Short-circuit the current transformer with the short-circuit jumpers in the test terminal block using an insulated screwdriver and interrupt the voltage connections with the jumpers in the test terminal block.
2. Remove the two factory seals at the screws of the terminal cover.
3. Release the two screws of the terminal cover and remove it.
4. Check that the connecting wires are not live using a phase tester or universal measuring instrument. If not, check the condition of the test terminals again according to Fig. 4.8. Remove the relevant pre-fuses if necessary and ensure that they cannot be re-inserted by anyone unnoticed before completing the installation.

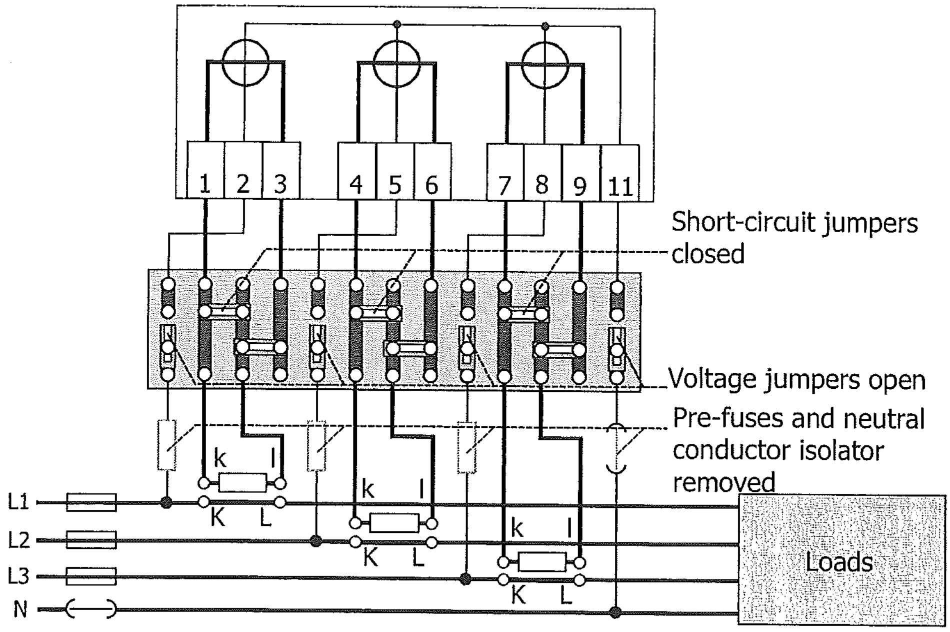


Fig. 4.14 Condition of test terminal block before removing meter

5. Remove the connecting wires of the signal inputs and outputs from the screwless spring-loaded terminals as follows:
   - Place a size 1 screwdriver in the upper opening and insert it turning slightly upwards (Fig. 4.15 A).
   - Then draw the wire from the lower opening (Fig. 4.15 B).
   - Withdraw the screwdriver (Fig. 4.15 C).

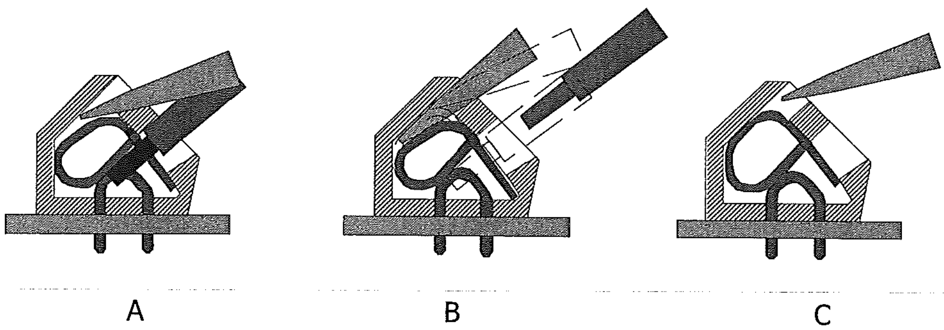


Fig. 4.15 Removing connections in screwless spring-loaded terminals

Warning

Damage to terminals

Never withdraw connecting wires from closed terminals. The terminals could be damaged.

6. Release the terminal screws 1 to 11 of the phase connecting wires with a suitable screwdriver and withdraw the phase connecting wires from the terminals.
7. Fit a substitute meter as described in section 4.3 "Connecting Meter" and the following chapters.

5 Operation

This chapter describes the appearance, layout and function of all operating elements and displays of the meters ZxD400xT as well as operating sequences.

Note

Illustrations

The illustrations of the face plate and display in this section always show the ZxD400CT combimeter (with additional optical test output for reactive energy, together with direction of reactive power and quadrant display).

5.1 Control Elements

The ZxD400xT meters have the two display keys "down" and "up" and a reset key as conventional operating elements. The display can also be controlled with the aid of a light source via the optical interface.

5.1.1 Display Keys

The two display keys "down" and "up" are placed on the main face plate (top) on the right of the liquid crystal display.

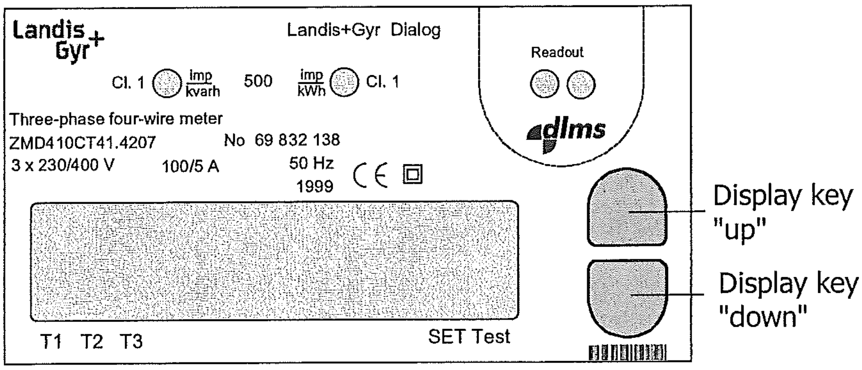


Fig. 5.1 Display keys

By pressing the lower display key "down", the display changes to the next value in the list. By pressing the upper display key "up", the display changes to the previous value (refer also to 5.3.2 "Display Menu").

5.1.2 Control of Display via Optical Interface

All meters of the ZxD series have an "optical key" in addition to the "up" and "down" display keys. The optical interface serves to receive a light signal, e.g. generated by a torch. The light signal acts like the "down" display key and controls the display in one direction from one value to the next. This type of display control only functions when voltage is supplied to the meter.

The reader can also control the display at a distance from the meter depending on the light intensity from the source, e.g. through a protective glass disc in front of the meter.

5.1.3 Reset Key

The reset key is situated to the right of the battery compartment under the front door. To permit operation of the reset key the front door must be opened and therefore the factory seal removed.

The reset key is normally used to perform a manual reset. If the display check is displayed, however, pressing of the reset key produces the service menu (refer also to 5.3.3 "Service Menu").

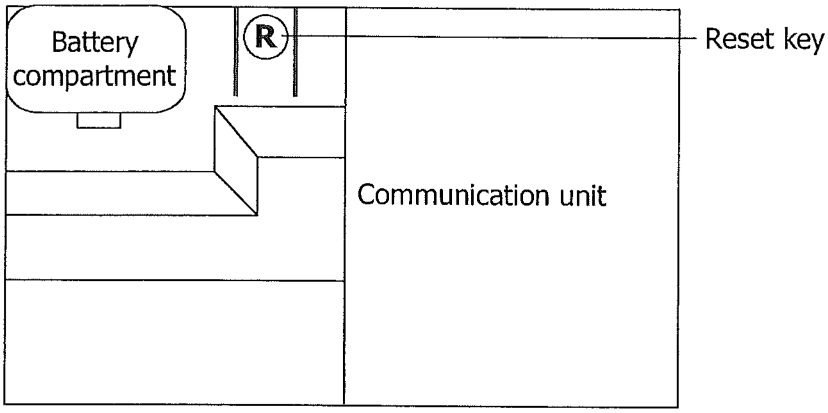


Fig. 5.2 Reset key under front door

5.2 Display

5.2.1 Introduction

The meters ZxD400xT are provided with a liquid crystal display (LCD).

The display can be provided with background lighting for easier reading (optional). This is switched on by pressing one of the display keys and is extinguished automatically after a short time if no further key is pressed.

5.2.2 Basic Layout

The basic layout shows all the indication possibilities of the liquid crystal display.

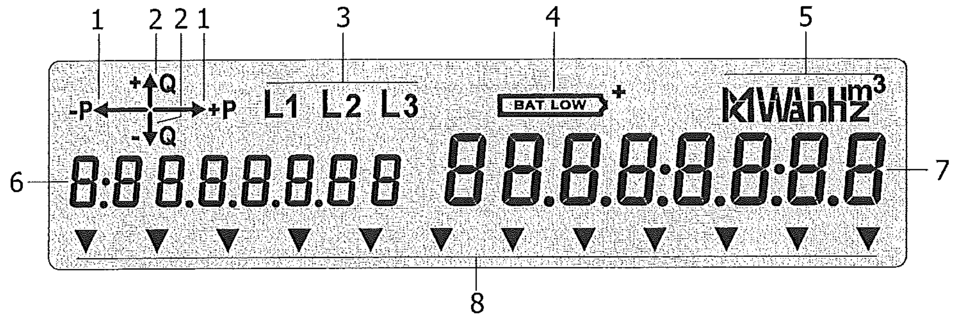


Fig. 5.3 Basic layout of the liquid crystal display (LCD)

1. *Active power direction (+P: import, -P: export)*
2. *Reactive power direction (not used with ZxD400AT)*
3. *Phase voltages (flash if rotating field reversed)*
4. *Battery status (charge voltage)*
5. *Units field*
6. *Index field (8 digits)*
7. *Value field (8 digits)*
8. *12 arrow symbols for status information (e.g. tariffs)*

Active power direction

Shows always the sum of the three phases:

→+P	positive active energy direction (imported from power company)
-P←	negative active energy direction (exported to power company)
-P←→+P	negative active energy direction of individual phases (second arrow flashes), but only in the M circuit (ZMD400xT).

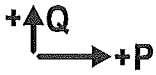
Reactive power direction

Indicates for combimeters ZxD400CT always the sum of the three phases (not used for active energy meters ZxD400AT).

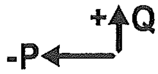
+↑Q	positive reactive energy direction
-↓Q	negative reactive energy direction

Quadrant display

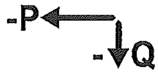
Indicates for combimeters ZxD400CT in which quadrants the present measurement is made (not used for active energy meters ZxD400AT):



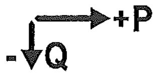
1. Quadrant



2. Quadrant



3. Quadrant



4. Quadrant

Phase voltages

L1 L2 L3

Indication of presence of phase voltages.
If the rotating field corresponds to that given by the parameterization, symbols L1, L2 and L3 are continuously lit. Otherwise they flash every second.

Battery condition

The symbol appears if the charge voltage of the battery fitted is too low (provided the meter is parameterized as "fitted with battery").

Units field

The following units are shown:
W, var, VA, k..., M..., ...h, V, A, h, Hz, m³
(var and VA only for combimeters)

Index field

8:8 8.8.8.8.8 8

Up to 8-digit indices are displayed, which define the value in the value field.

Value field

8 8.8.8:8.8:8.8

Up to 8-digit values are displayed.

Arrow symbols

▼ ▼ ▼ ▼

An arrow symbol is an additional status indication for tariffs, reset block, test mode, etc. The arrow points to a status description on the face plate.

5.2.3 Index System

The information concerning which data are shown in the display is made with an index system and is supported by the unit over the value field.

The 8-digit index field permits all previously known index systems such as DIN, LG, VEOe, OBIS, etc.

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

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 in the index field, 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 = Active energy import (all phases)
8 = Status
0 = Total

0.9.1 Local time

Reference is made for examples to the following display list and the readout log (refer to chapter 5.5 "Data Readout").

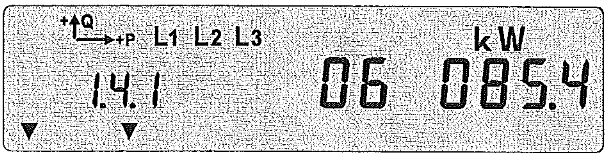
5.3 Types of Display

The ZxD400xT has the following three types of display:

- **Operating display**
  The values specified by the parameterization are shown as a rolling display in the operating display. The display is always in operating mode when the display keys are not operated. The meter returns automatically from the display list to the operating display after a defined time. This can consists of one or more values.
- **Display menu**
  By pressing the display key the display check is activated and from there the user reaches the display menu by again pressing the display key. From the display menu values of the display list, the load profile, the event log etc. can be accessed. The display list for example comprises all values, which appear in the display after pressing a key. The values themselves and also the sequence can be parameterized. The display keys permit scrolling up and down in the list.
- **Service menu**
  The user reaches the service menu by pressing the reset key starting from the display check. From the service menu values of the service list, the set mode etc. can be accessed. The service list for example is an extended display list with additional values.

5.3.1 Operating Display

The values always displayed are considered the operating display. This can be parameterized as fixed display (only one value present, e.g. the present tariff) or as rolling display (several values alternate at a fixed rate, e.g. every 15 seconds).



running mean value with status of integrating period

Fig. 5.4 Example of a fixed display

Note

Limiting to active values in rolling operating display

In meters with software version B21 or higher it is possible by parameterization to limit the rolling display to active values. This helps to keep the rolling display clear, e.g. in meters with numerous energy and demand registers.

Error message

The meter can generate an error message on the basis of self-tests. According to parameterization, this can be permanently included in the operating display. In the event of a fatal error, it replaces the normal operating display and the meter no longer operates.

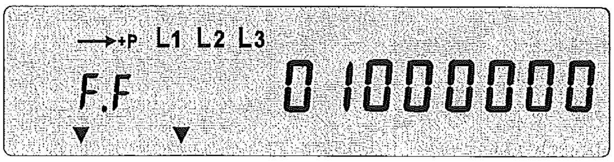
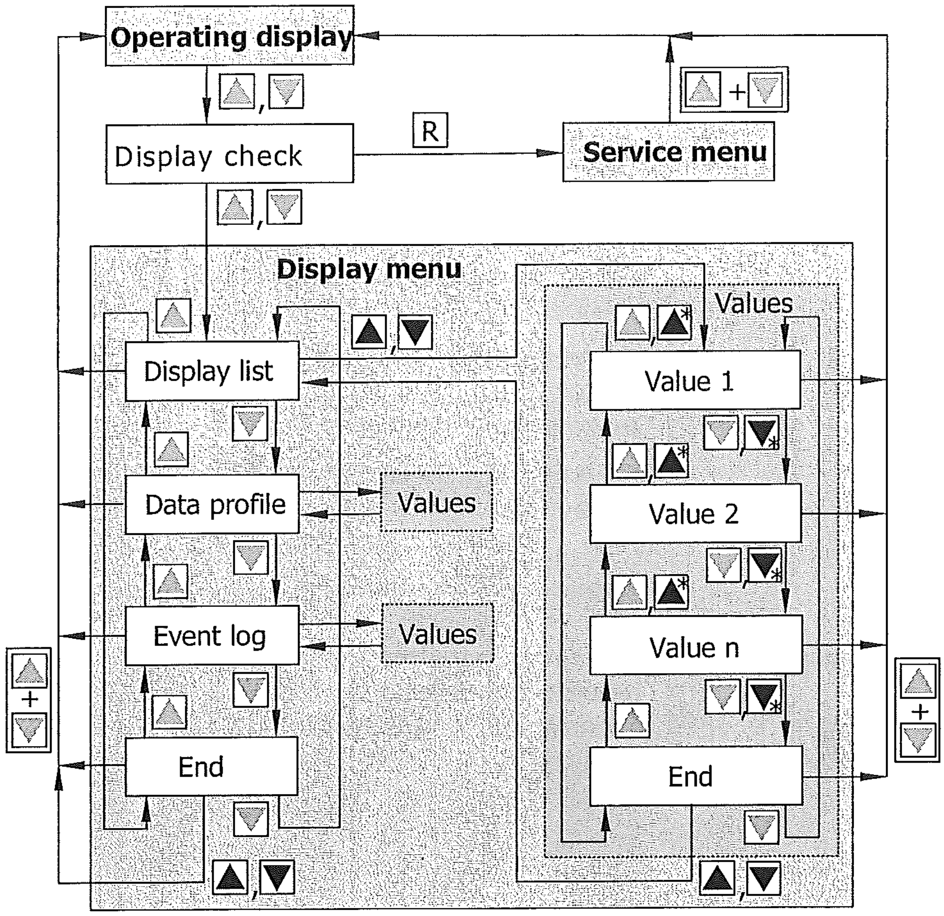


Fig. 5.5 Example of an error message (unsufficent battery voltage)

In case of an error message the procedure described in chapter 6.2 should be followed.

5.3.2 Display Menu



△ = press "up" key briefly (< 2 s) | R = press reset key

▽ = press "down" key briefly (< 2 s) | △+▽ = together

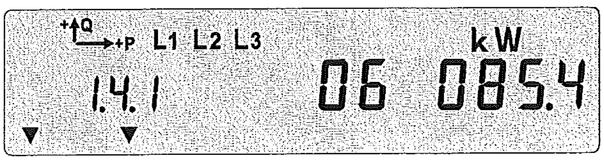
▲ = press "up" key longer (> 2 s) | △,▲ = as required (or)

▼ = press "down" key longer (> 2 s) | * = main values only

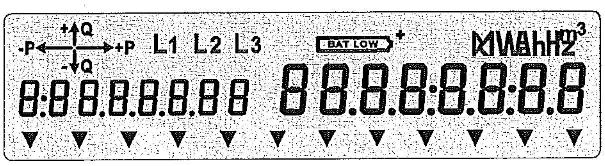
Fig. 5.6 Display menu survey

Display check

Brief operation (< 2s) of the display key "down" or "up" causes change of the operating display, e.g.:



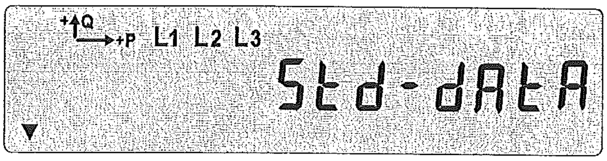
to the display check:



All segments of the display are operated here. The index and value fields should be checked each time for missing segments. This can prevent incorrect readings.

Display menu

Pressing the display key "down" or "up" again **briefly** changes to the display menu or directly to the display list. The first menu item appears, e.g. "Display list" (standard data):



The menu item only appears when several menu items exist. Otherwise direct entry is made to the display list.

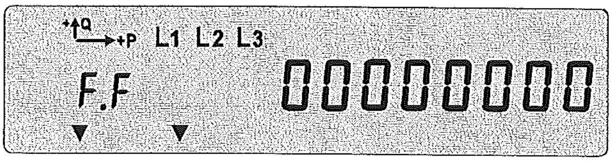
The next menu item appears for every further **brief** operation of the "down" display key, e.g. "Data profile", "Event log" etc. The first menu item appears again after the last item.

The preceding menu item is displayed again by **briefly** pressing the "up" display key.

Both display keys ("down" and "up") must be pressed **simultaneously** to return to the operating display from the display menu.

Value display

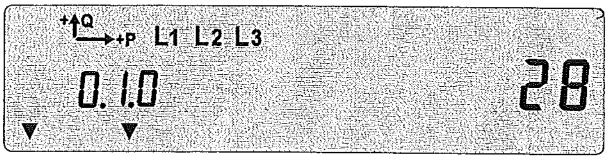
The first value of the list associated with the present menu is displayed by pressing the display key "down" or "up" for **longer** (at least 2 seconds), normally the error message:



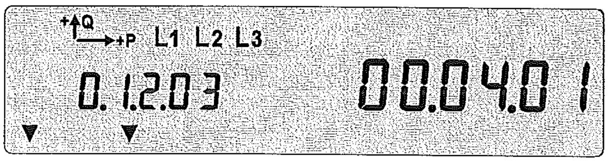
The next list value appears for every further **brief** operation of the "down" display key. **Brief** operation of the "up" key again displays the preceding value. The sequence of values in the list is determined by the parameterization.

A rapid run is started by holding down the display key "down" or "up" (at least 2 seconds). The main values of the list are then displayed while the key remains pressed, but no stored values.

Examples of values in a display list:

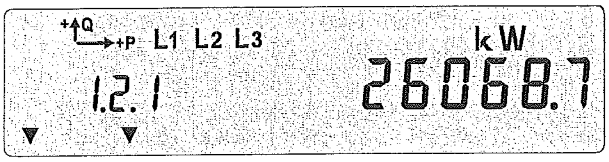


Reset counter



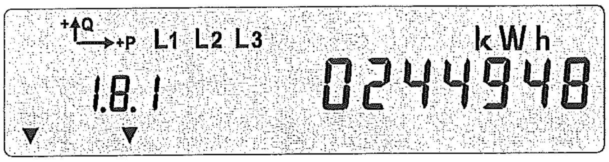
Date of resetting

stored value 03 (March)



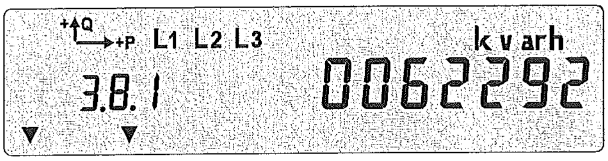
Cumulated maximum demand

active power



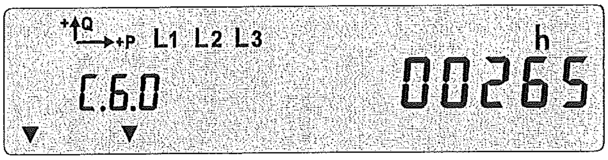
Active energy

present status

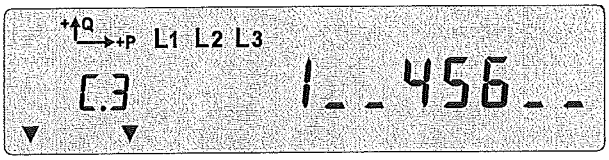


Reactive energy

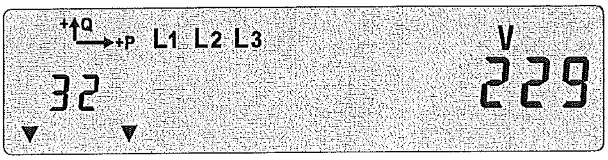
present status



Battery hours counter

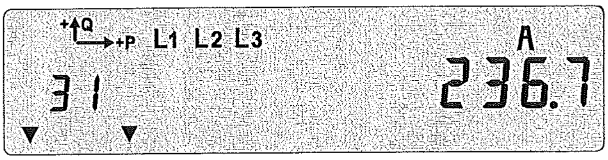


Status of signals at control terminals



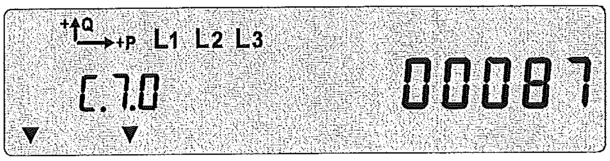
Present voltage

phase 1



Present current

phase 1



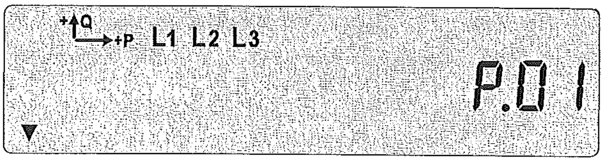
Number of total voltage failures

To return to the menu level from the list at the end of the display list press the display key "down" or "up" for **longer** (at least 2 seconds).

Both display keys ("down" and "up") must be pressed **simultaneously** to return to the operating display from the list.

Load profile

The "Load profile" menu item for selection in the display menu (denoted P.01) is shown as follows:



The first value of the load profile is displayed by pressing the display key "down" or "up" for **longer** (at least 2 seconds).

5.3.3 Service Menu

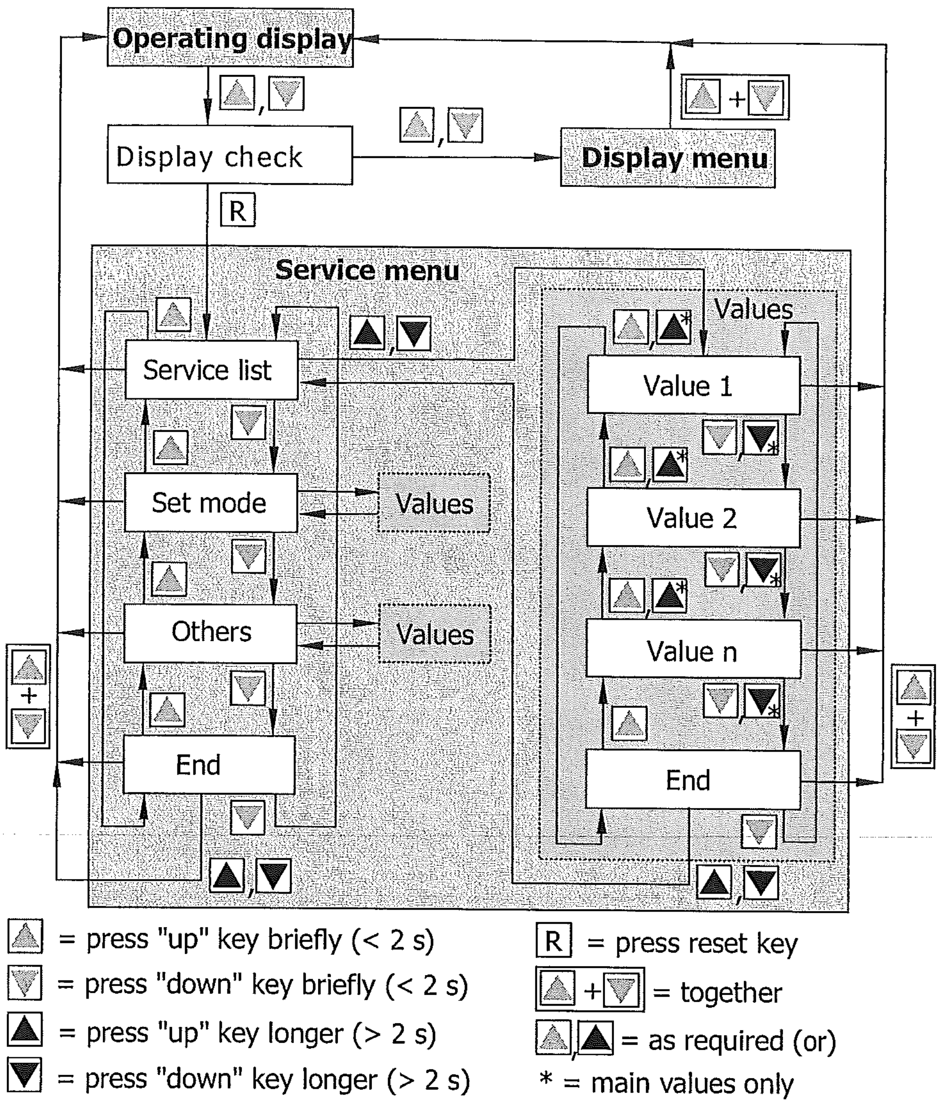
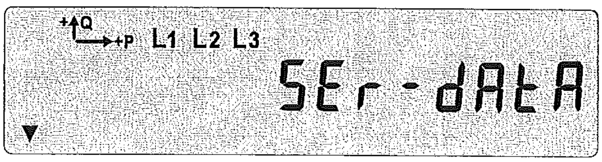


Fig. 5.7 Service menu survey

Service menu

Pressing the reset key during the display check changes the display to the service menu or directly to the service list. The first menu item appears, e.g. "Service list" (service data):



The menu item only appears if there are several items present. Otherwise direct entry is made to the service list.

The next menu item appears for every further **brief** operation of the "down" display key, e.g. "Set mode", "Test mode on/off", etc. The first item appears again following the last menu item "End".

The preceding menu item appears again by pressing the "up" key **briefly.**

Both display keys ("down" and "up") must be pressed **simultaneously** to return to the operating display from the service menu.

Value display

The first value of the list associated with the present menu is displayed by pressing the display key "down" or "up" for **longer** (at least 2 seconds) (as for the display list)

The next list value appears for every further **brief** operation of the "down" display key. **Brief** operation of the "up" key again displays the preceding value. The sequence of values in the list is determined by the parameterization.

A rapid run is started by holding down the display key "down" or "up" (at least 2 seconds). The main values of the list are then displayed while the key remains pressed, but no stored values.

To return to the menu level from the list at the end of the display list press the display key "down" or "up" for **longer** (at least 2 seconds).

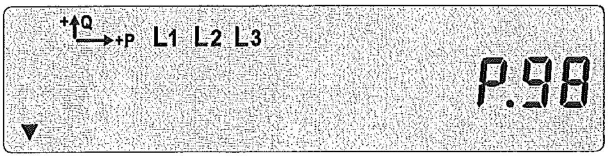
Both display keys ("down" and "up") must be pressed **simultaneously** to return to the operating display from the list.

Set mode

Values can be changed in the value display of the set mode with the aid of the reset key and display keys (for setting time and date, identification numbers, battery hours counter, etc.). The procedure is described under "Changing Values in Set Mode" in chapter 5.7.

Event log

The "Event profile" menu item for selection in the service or display menu (denoted P.98) is shown as follows:



The first value of the load profile is displayed by pressing the display key "down" or "up" for **longer** (at least 2 seconds).

5.4 Optical Test Output

The optical test outputs – one for active energy in all meters and a second for reactive energy in combimeters – are fitted in the main face plate above the liquid crystal display.

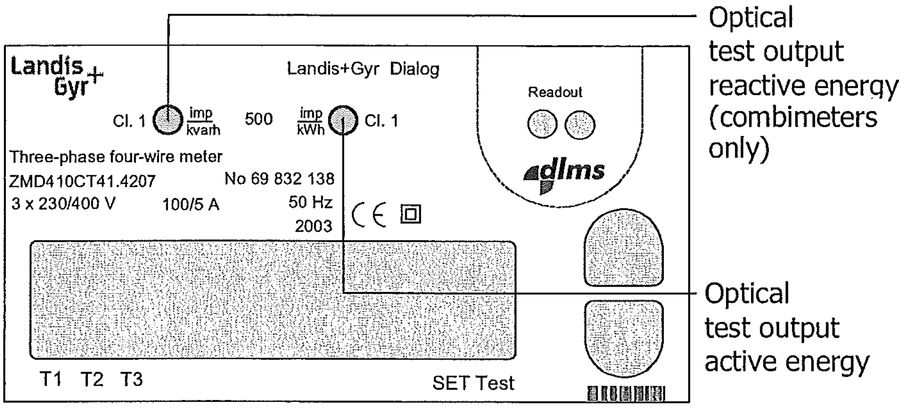


Fig. 5.8 Optical test outputs

The optical test outputs are used for testing the meter (see also chapter 7.1). They transmit visible red pulses corresponding to the current measured values (active and reactive energy).

5.5 Data Readout

The power supply company can record the data stored in the meter on the spot at any time in two ways:

- Reading the liquid crystal display of the meter. Only those data can be recorded which appear in the rolling operating display or can be selected with the display key.
- Automatic data readout via the optical interface with the aid of a hand held terminal) or other readout device (e.g. laptop). Further data are then accessible depending on the parameterization.

Note

Readout data

For readout to IEC 62056-21 all data determined by the parameterization are read out in the specified sequence.

For readout according to dlms (Device Language Message Specification) the data requested by the readout unit are read out.

If the meter is fitted with the appropriate communication unit (see associated separate operating instruction) remote scanning of the meter data is also possible.

Procedure for data readout via optical interface

1. Start the hand held terminal (according to the details in the associated operating instructions).
2. Connect the cable of the reading head to the hand held terminal.
3. Place the reading head in the "Readout" indentation on the plastic viewing window of the meter. The reading head cable must point towards the terminal cover (when mounted vertically downwards). The reading head is held magnetically.
4. Start the data readout on the hand held terminal (according to the details in the associated operating instructions).
5. Remove the reading head from the meter again after completing the readout.

5.5.1 Readout to IEC 62056-21

The data read out according to IEC 62056-21 are recorded in the form shown below. The scope and sequence of values in the log is determined by the parameterization.

Log example	Significance	
/LGZ4\2ZMD4104100	Designation of meter (reply on transmit request)	
F.F (00000000)	Error message	
0.0.1 (417242)	1st identification number	
0.1.0 (28)	Number of resets	
0.1.2.04 (98-05-01 00:00)	Time of last reset	
1.2.1 (26068.7*kW)	P max cumulated	Tariff 1
1.2.2 (15534.8*kW)	P max cumulated	Tariff 2
1.6.1 (192.4*kW)(00-05-06 10:45)	P max present	Tariff 1
1.6.1*04 (202.4)(00-04-22 09:30)	with April stored value	Tariff 1
1.6.2 (086.7*kW)(00-05-04 22:30)	P max present	Tariff 2
1.6.2*04 (100.9)(00-04-14 23:00)	with April stored value	Tariff 2
1.8.1 (0244948*kWh)	Active energy (import)	Tariff 1
1.8.1*04 (0234520)	with April stored value	Tariff 1
1.8.2 (0082520*kWh)	Active energy (import)	Tariff 2
1.8.2*04 (0078197)	with April stored value	Tariff 2
5.8.1 (0106103*kvarh)	Reactive energy (inductive)	Tariff 1
5.8.1*04 (0100734)	with April stored value	Tariff 1
5.8.2 (0039591*kvarh)	Reactive energy (inductive)	Tariff 2
5.8.2*04 (0036152)	with April stored value	Tariff 2
1.8.0 (0327468*kWh)	Total active energy	
5.8.0 (0145694*kvarh)	Total reactive energy (inductive)	
8.8.0 (0001452*kvarh)	Total reactive energy (capacitive)	
0.9.1 (14:18:06)	Time-of-day of readout	
0.9.2 (00-05-20)	Date of readout	
C.7.0 (00087)	No. of voltage failures of all phases	
C.72.0 (00157)	Number of undervoltages	
C.73.0 (00000)	Number of overvoltages	
C.74.0 (00306)	Number of overloads (overcurrent)	
C.3.0 (500)	Active pulse constant	
C.3.1 (500)	Reactive pulse constant	
C.2.1 (00-03-26)	Date of last parameterization	
!	End of log	

Notes

The power supply company can select by parameterization between a standard identification or its own identification. The standard identification has the following structure:

/**LGZ**...	Manufacturer	(Landis+Gyr)
/LGZ **4**...	Baud rate	4 = 4800 Baud
/LGZ4 **\2**...	Extended communication possibility	2 = DLMS-compatible meter
/LGZ4\2 **ZMD410**...	Meter	Type of measuring unit
/LGZ4\2ZMD410 **41**...		Basic version tariff section
/LGZ4\2ZMD41041 **00**...		Additional functions (RCR, supplementary power supply)
/LGZ4\2ZMD4104100 **.B14**		Software version
Stored values	The hyphen following the identification number and the tariff (1.6.1) denotes the type of resetting:	
e.g. 1.6.1*04	*04	Resetting made internally or remote controlled
e.g. 1.6.1&04	&04	Resetting performed manually or with reset key R

Identification by the power supply company itself uses an identification number. ID1.1 (designation of ownership by the power supply company), ID1.2 (any desired number) or ID2.1 (serial number) are available. The identification is comprised as follows in this case:

/**LGZ**...	Manufacturer	(Landis+Gyr)
/LGZ **4**...	Baud rate	4 = 4800 Baud
/LGZ4 **\2**...	Extended communication possibility	2 = DLMS-compatible meter
/LGZ4\2 **\B14**...	Meter	Software version
/LGZ4\2\B14 **12345678**		Identification number specified by parameterization (maximum 8 characters)

5.5.2 Readout to dlms

While the readout according to IEC 62056-21 uses a protocol determined in advance, readout to dlms enables the power supply company to configure the values to be read out individually. The company therefore has systematic access to specific values without being influenced by other values not required.

dlms specification

Various meter manufacturers – including Landis+Gyr – together with related organizations, have compiled the language specification dlms (Device Language Message Specification) and undertaken to use this in their equipment (meters, tariff units, systems, etc.).

Objective

The objective of dlms is to use a common language for data exchange in the energy measurement and other sectors. In addition to end units such as meters, tariff units, etc. dlms also concerns the interfaces, transmission channels and system software.

Principle

dlms can be compared to sending a letter: the sender writes the address of the recipient on the letter and hands it to the post office for transport. The way in which the postal department transports the letter is of no consequence to the sender and receiver. The only important thing is that the address of the recipient is clearly shown and that the letter is received, read and it can be seen from whom the letter originates.

Units with dlms operate in a similar way. They provide the values - termed items - required by the receiver (e.g. control centre) and pass them via interface to the transport medium (channel). How the values reach the recipient is again immaterial for both parties.

dlms items

dlms is an item-oriented language. The dlms items

- have an unmistakable name in the form of the EDIS identification number
- contain the value in an exactly defined form and
- are configured in a similarly exactly defined format.

Items of this kind are number of resets with date and time, cumulative maxima, rolling mean values, maxima, energy statuses, associated stored values, etc.

The sender feeds these items to a transport medium, e.g. the telephone network. This transmits them to the receiver, so that the items are received in the same form as supplied by the sender.

5.6 Input of Formatted Commands

The following operating data or meter characteristics can be modified by the input of formatted commands. The user of formatted commands, however, must have the necessary access authorization according to the security system.

The following commands can be used both according to IEC 62056-21 and also with dlms:

- Set time / date
- Set identification numbers for the power supply company and for the manufacturer (by line).
- Initiation of reset via interface
- Neutralize reset inputs KA/KB
- Set / reset reset counter
- Set / reset energy registers
- Set / reset total energy registers
- Set / reset demand maximum registers
- Set / reset power factor registers
- Reset stored values
- Reset battery hours counter
- Reset voltage failures registers
- Switch on / off increased resolution (test mode) of energy registers
- Delete error messages
- Change passwords P1,P2 and W5
- Reset load profile
- Reset event profile

The following commands can only be executed with dlms:

- Reset event register
  - Under- and overvoltages
  - Demand messages
  - Current messages
  - Power factor messages
- Set thresholds for messages

Formatted commands are transferred to the meter with a suitable aid (hand held terminal or laptop) via the optical interface or via an interface circuit of the communication unit.

5.7 Changing Values in Set Mode

In set mode some values (date and time, identification numbers and battery hours counter) can be changed with the aid of the reset key and display keys, without the use of auxiliary aids such as hand-held terminal or laptop.

Procedure:

1. Remove the front door seal.
2. Open the front door, so that the reset key is accessible.
3. Press the "up" or "down" display key briefly. The display changes from operating display to display check.
4. Press the reset key. The display changes to the service menu with the first menu item.
5. Press the "down" display key as many times briefly, until the menu item "Set mode" (SEt) is displayed.
6. Press the "up" or "down" display key for **longer** (at least 2 seconds), until the first value for setting is displayed.
7. Select the value to be changed with the "up" or "down" display key.
8. Press the reset key. The first digit of the value to be changed flashes.
9. Change the digit by pressing the "up" (increase) or "down" (decrease) display key as required.
10. Press the reset key. The next digit of the value to be changed flashes, if it was not previously the last digit. Otherwise all digits flash together.
11. Repeat steps **9** and **10** for all digits of the value to be changed, until all digits of the changed value flash together.
12. Press the reset key to confirm the new value (the value set can be rejected and the previous value retained by pressing the "up" or "down" display key). After pressing the reset key the new value is given a plausibility test and stored if the test result is positive. The next value for setting is displayed. In the event of an error (e.g. invalid date or time) all digits continue flashing and the input must be repeated.
13. If required, further values can be changed as described in steps **7** to **12**.
14. If you press the "up" and "down" display keys **simultaneously**, the operating display appears again.
15. Close the front door.
16. Re-seal the front door.

6 Service

This chapter describes the necessary servicing work after the appearance of operating faults or error messages.

6.1 Operating Faults

If the liquid crystal display is illegible or the data readout does not function, the following points should first be checked:

1. Is the mains voltage present (pre-fuses intact and test terminals closed) ?
2. Is the maximum permissible ambient temperature not exceeded ?
3. Is the plastic viewing window over the face plate clean (not scratched, painted over, misted over or soiled in any way) ?

Warning

Danger of short-circuits

Never clean soiled meters under running water or with high pressure devices. Penetrating water can cause short-circuits. A damp cleaning cloth is sufficient to remove normal dirt such as dust. If the meter is more heavily soiled, it should be dismantled if necessary and sent to the responsible service and repair centre, so that a new plastic viewing window can be fitted.

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

6.2 Error Messages

The meters regularly perform an internal self-test. This checks the correct function of all important parts.

In the event of a serious error detected, the meters display an error code. This error code appears as an eight-digit figure together with "F.F" or "FF" in the display, depending on the parameterization and significance of the error. The error code is always included in the readout log (error code F.F(00000000) = no error).

If nothing else is specified in the following description of the error groups, the error messages can only be deleted with formatted commands (see 5.6 "Input of Formatted Commands"). If the error occurs again, the meter should be removed and sent to the responsible service and repair center (according to 6.3 "Repairing Meters").

6.2.1 Structure of an Error Message

An error message has the following form:

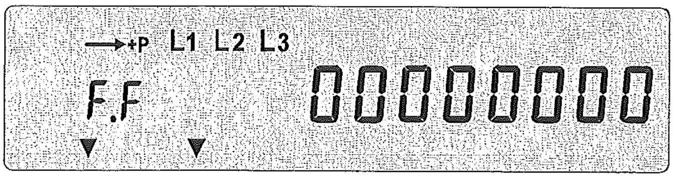


Fig. 6.1 Error message from meters of the ZxD series

Meters of the ZxD series all use the same format for error messages. This consists of four groups of 2 digits each, whereby the groups have the following significance:

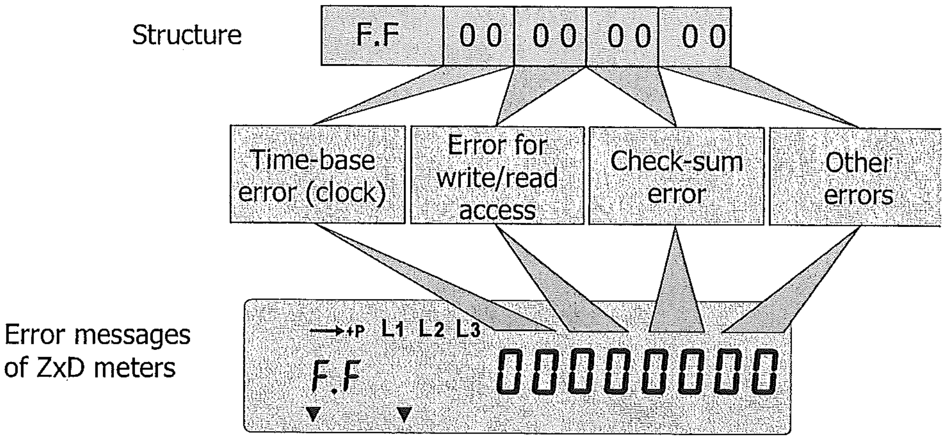


Fig. 6.2 Significance of error message

Each group has two digits written in hexadecimal notation and can therefore have the values 0 to 9 and letters A to F. Both digits each form the sum of the individual values of 4 possible types of error as shown in the following diagrams.

6.2.2 Error Groups

Time-base errors (clock)

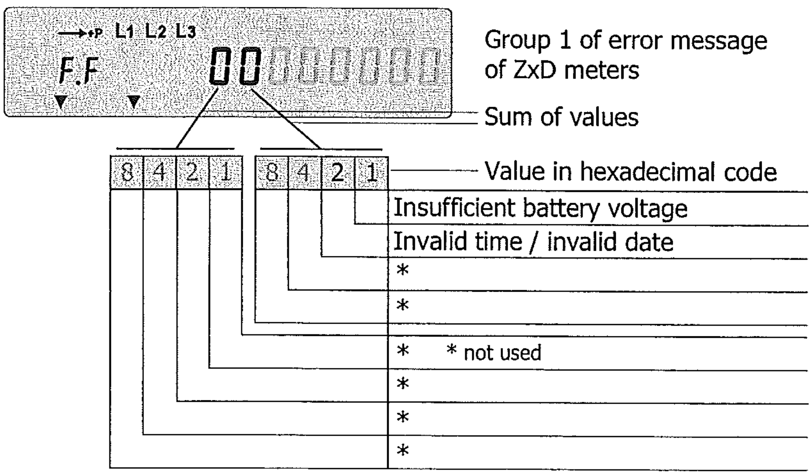


Fig. 6.3 Group 1 of error message

The first digit in the first group has no significance, since no error messages are assigned to it.

The second digit can have values between 0 (no error message) and 3 (both error messages set). Significance:

F.F **01** 00 00 00

Insufficient battery voltage

Battery missing or discharged. The calendar clock will stop when the Supercap is discharged following separation from the mains.

The error is deleted automatically when the battery voltage has again reached a sufficient value (e.g. after inserting a new battery as described in 7.2 "Changing the Battery").

This error message only appears if the meter is parameterized as "fitted with battery". Otherwise there is no check of the battery condition.

F.F **02** 00 00 00

Invalid time / invalid date

The meter has found that the calendar clock has stopped at some time. The clock is running, but shows the wrong time or date.

The error is deleted automatically when the time and date have been set correctly by the relevant formatted command or manually in the set mode (see 5.6 "Input of Formatted Commands" or 5.7 "Changing Values in Set Mode").

Errors for write/read access

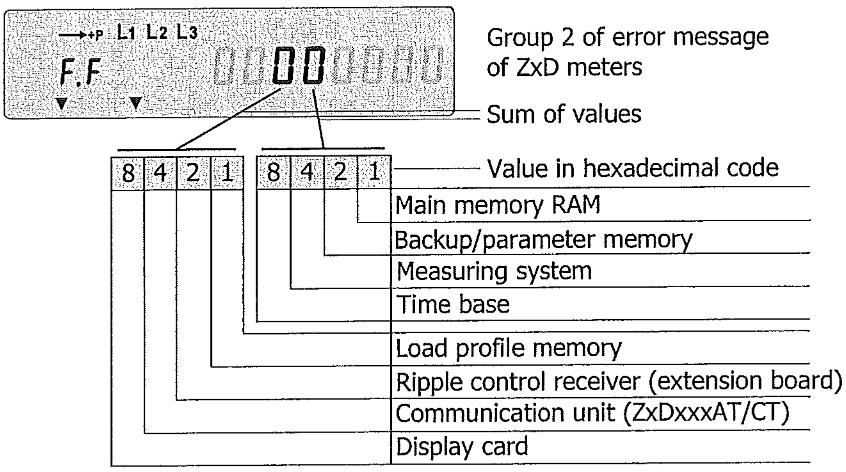


Fig. 6.4 Group 2 of error message

In the second group both digits can have values between 0 (no error message) and F (all four error messages set). Significance:

F.F 00 **x1** 00 00

Error in RAM main memory

This appears in the display as a so-called **Fatal Error** when starting the meter if the RAM test fails.

The meter does not operate and must be changed.

The same applies to messages: F.F .. x3 / x5 / x7 / x9 / xB / xD / xF

F.F 00 **x2** 00 00

Error in backup/parameter memory

The meter supplies this message in the event of a repeated memory test failure. The meter can contain faulty data or fail.

F.F 00 **x4** 00 00 — Error in the measuring system

The meter supplies this message for repeated failure of the measuring system test. The meter can contain faulty data or fail.

F.F 00 **x8** 00 00 — Error in time base

The meter sets this message for repeated failure of the time base test. The calendar clock can display an invalid time or date.

F.F 00 **1x** 00 00 — Error in load profile memory (EEPROM)

The meter sets this message for repeated failure of a memory test. The meter can contain incorrect data.

F.F 00 **2x** 00 00 — Error in the ripple control receiver (extension board)

The meter sets this message for repeated failure of a test of the ripple control receiver on the extension board. The meter uses the default configuration.

F.F 00 **4x** 00 00 — Error in the communication unit (ZxDxxxAT/CT only)

The meter sets this message for repeated failure of a test of the communication unit. Communication fails.

F.F 00 **8x** 00 00 — Error in the display card

The meter sets this message for repeated failure of a display card test. The liquid crystal display shows incorrect data.

Check-sum errors

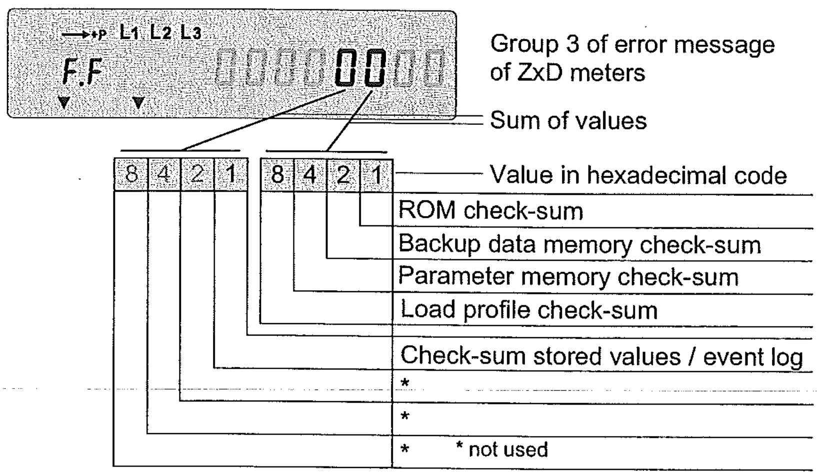


Fig. 6.5 Group 3 of error message

The first digit in the third group can have the value 0 (no error message) or 1 (error message set).

The second digit can have values between 0 (no error message) and F (all four error messages set). Significance:

F.F 00 00 **01** 00 — Check-sum error in ROM of microprocessor

This appears in the display as a so-called **Fatal Error** when the relevant ROM test fails.

F.F 00 00 **02** 00 — Check-sum error in memory for backup data

This also appears on the display as so-called **Fatal Error** if the relevant memory test fails.

F.F 00 00 **04** 00 — Check-sum error in memory for parameters

This also appears on the display as so-called **Fatal Error** if the relevant EEPROM test fails.

In all 3 cases mentioned the meter does not operate and should be changed.

The same applies to messages F.F .. .. 03 / 05 / 06 / 07 / 09 / 0A up to 0F.

F.F 00 00 **08** 00 — Check-sum error in memory of load profile

The meter sets this message for repeated failure of a load profile test. The meter can contain incorrect data.

F.F 00 00 **1x** 00 — Check-sum test for the stored values or event log

The meter sets this message for repeated failure of a check-sum test for the stored values or event log. The meter can contain incorrect data.

Other errors

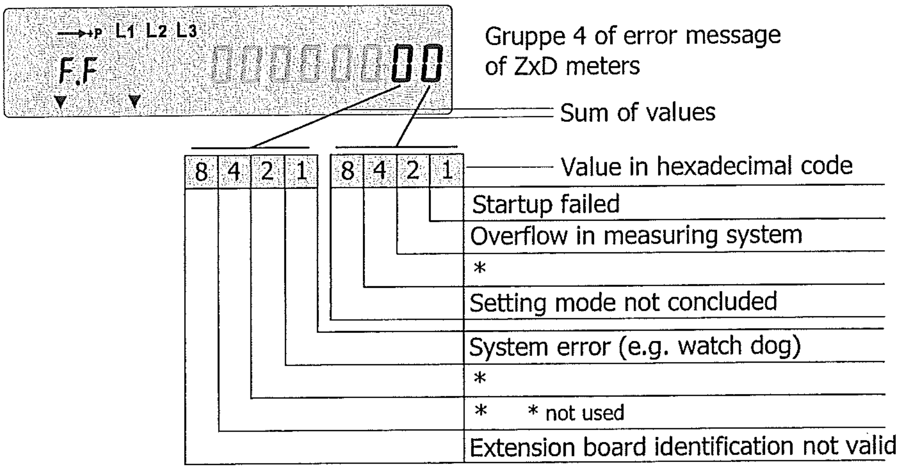


Fig. 6.6 Group 4 of error message

The first digit in the fourth group can have the values 0 to 3 and 8 to B.

The second digit can have values between 0 (no error message) and F (all four error messages set). Significance:

F.F 00 00 00 **x1** — Invalid startup owing to incorrect data storage

The meter has detected that the last data storage was not performed correctly. The meter can contain incorrect data.

F.F 00 00 00 **x2** — Overflow or no activity of measuring system

The meter has detected an error in the data processing. It may not have measured part of the energy.

F.F 00 00 00 **x8** — Setting mode not concluded

A setting command has not been concluded correctly. The meter can contain incorrect data.

The error is deleted automatically when the next similar setting command is correctly concluded.

F.F 00 00 00 **1x** — System error in microprocessor

The meter loses all data determined since the last storage, i.e. for 24 hours maximum.

F.F 00 00 00 **8x** Identification of extension board differs from that parameterized in the meter.

The meter possibly does not have functions required such as data profile, control inputs or output signals.

6.3 Repairing Meters

Meters must only be repaired by the responsible service and repair centre (or manufacturer).

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

1. If installed, remove the meter as described in section 4.6 and fit a substitute meter.
2. Describe the error found as exactly as possible and state the name and telephone number of the person responsible in case of inquiries.
3. Pack the meter to ensure it can suffer no further damage during transport. Preferably use the original packing if available. Do not enclose any loose components.
4. Send the meter to the responsible service and repair centre.

7 Maintenance

This chapter describes the necessary maintenance work.

7.1 Meter Testing

Meter tests should be performed at periodic intervals according to the valid national regulations (either on all meters or on specific random samples). In principle the meters should be dismantled for this purpose according to the instructions in section 4.6 "De-Installation" and replaced by a substitute meter. The meter test can also be performed on the spot in certain circumstances.

7.1.1 Test Mode

The test mode permits increasing the resolution of the energy registers by 1 to 3 digits. This allows the power supply company to carry out the so called measuring unit test in sufficiently short time.

In test mode the same registers shown as rolling display in the operating display are always displayed, but with high resolution and not rolling.

The energy registers comprise a total of 12 digits. A maximum of 8 digits, however, is shown on the display. The effective number of digits shown and the number of decimal places are determined by the parameterization. For the test mode more decimal places are normally parameterized (maximum 4) to permit a quicker test of the transmission to the energy registers.

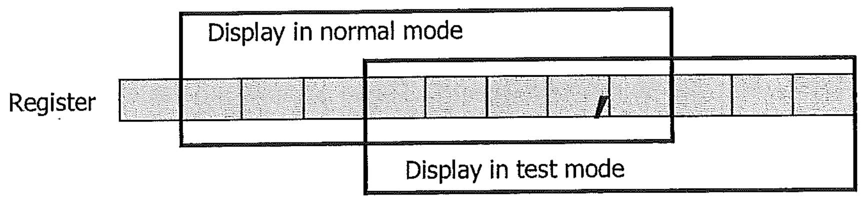


Fig. 7.1 Display changeover normal mode – test mode

Changeover from normal to test mode and back is made by formatted commands (see chapter 5.6 "Input of Formatted Commands") or manually in the service menu.

In test mode the optical test output for active energy can also provide reactive energy pulses depending on the parameterization. Reactive energy pulses are supplied to this test output if the register shown on the display represents a reactive energy register. Active energy pulses are supplied for all other measured values shown as in normal operating mode.

7.1.2 Measuring Times

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

Table of measuring times required:

ZMD400xT
ZFD400xT

Un = 58 to 230 V
In= 1 A, 5 A

	Measuring uncertainty 0.1 %			Measuring uncertainty 0.05 %		
Current [% In]	3 P cosφ=1	1 P 1	3 P 0.5	3 P cosφ=1	1 P 1	3 P 0.5
1	40 s	40 s	90 s	80 s	80 s	160 s
2	20 s	20 s	40 s	40 s	40 s	80 s
5	10 s	10 s	15 s	16 s	16 s	32 s
10	8 s	8 s	10 s	14 s	14 s	18 s
20	6 s	6 s	8 s	12 s	12 s	14 s
50	6 s	6 s	6 s	12 s	12 s	12 s
100	6 s	6 s	6 s	12 s	12 s	12 s
200	6 s	6 s	6 s	12 s	12 s	12 s

3 P = universal
1 P = single-phase

7.1.3 Optical Test Output

The red optical test outputs on the meter above the LCD should be used for meter testing. These supply pulses at a frequency dependent on the meter constant R, whereby the rising edge is always decisive for the test.

Note that the digital signal processing provides a delay of 2 seconds between the instantaneous power at the meter and the appearance of the pulses at the optical test outputs. No pulses are lost.

The number of pulses per second for the desired power is obtained by multiplying the meter constant R by the power in kW divided by 3600.

Example: Meter constant R = 1000
Power P = 35 kW
f-test output = R x P / 3600 = 1000 x 35 / 3600 = 10 imp/s

The optical test outputs are continuously lit at creep.

7.1.4 Creep Test

A test voltage Up of 1.15 Un is used for the creep test (no-load test) to IEC 61036 (e.g. Up = 265 V with Un = 230 V).

Procedure:

1. Disconnect the meter from the mains for at least 10 seconds.
2. Then switch on the test voltage Up and wait approx. 10 seconds. After this time the energy direction arrows must disappear. The red optical test outputs are permanently "lit".
3. Switch on test mode (high resolution).
4. The meter must not deliver more than one pulse during the creep test. Check the energy levels for changes in test mode. They must not increase by more than the value of one pulse (see face plate).

7.1.5 Starting Test Active Part

Procedure:

1. Apply a load current of 0.02 % of the nominal current In (e.g. 1 mA with In = 5 A) and the voltage Un (three-phase in each case) and **cosφ = 1**. The meter must remain in creep.
2. Increase the load current to 0.1 % In for the ZxD405xT or 0.2 % In for the ZxD410xx (i.e. 10 mA with In = 5 A). The energy direction arrow "P" must appear within 10 seconds. The optical test output for active energy consumption is no longer permanently "lit".

7.1.6 Starting Test Reactive Part

Procedure:

1. Apply a load current of 0.02 % of the nominal current In (e.g. 1 mA with In = 5 A) and the voltage Un (three-phase in each case) and **sinφ = 1**. The meter must remain in creep.
2. Increase the load current to 0.2 % In (i.e. 10 mA with In = 5 A). The energy direction arrow "Q" must appear within 10 seconds. The optical test output for reactive energy consumption is no longer permanently "lit".

7.2 Changing the 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.
- The battery has been in the meter for more than 10 years (preventive servicing). It is recommended to note the date of insertion on the battery. The 10 years depend on the product and on the age of the battery when inserting it into the meter.
- The battery operating hours counter indicates over 80,000 hours (can be read under code C.6.0 in service mode).

- The battery charge indicates less than 4.8 V (can be read under code C.6.1 in service mode).

Note

Meters with or without battery

Only meters parameterized as "fitted with battery" have the BAT LOW + symbol and the battery operating hours counter.

Danger

Dangerous voltage on contacts in the battery compartment

The contacts in the battery compartment may have mains voltage applied (F circuit). Therefore only remove the battery with the existing battery holder and insert the new battery only with the battery holder. Ensure that the contacts are never touched.

Note

Replacement battery

Only use a lithium battery with a rated voltage of 6 V and the same construction as the original battery as a replacement.

Procedure:

1. Remove the front door seal.
2. Open the front door.
   The battery compartment is on the left below the liquid crystal display.

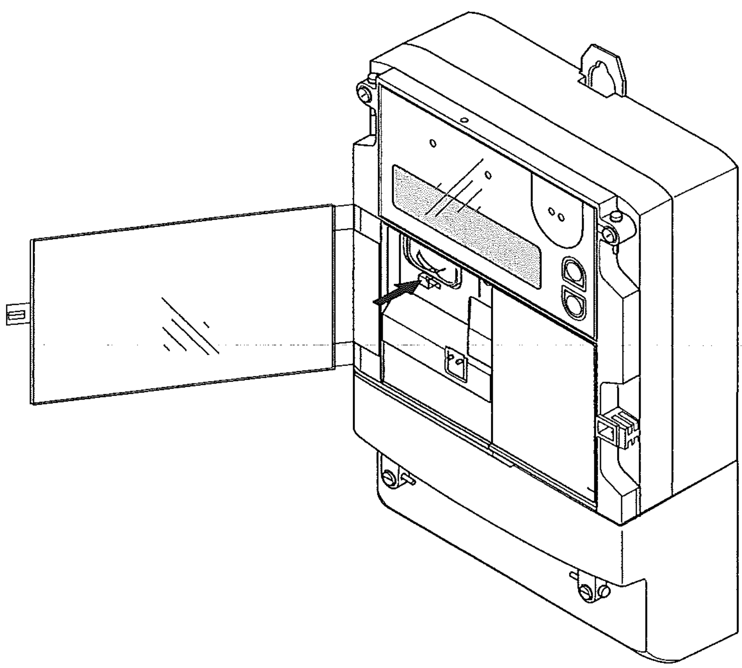


Fig. 7.2 Battery compartment

3. Press on the latch of the plastic battery holder until it releases and then withdraw the battery holder with the old battery.

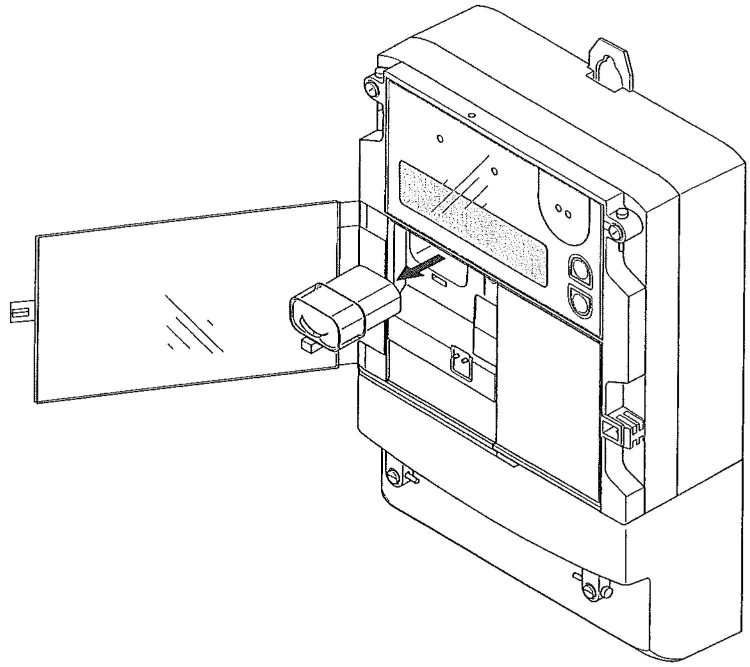


Fig. 7.3 Removing the battery

4. Mark the current date on the new battery.
5. Draw the old battery from the holder and insert the new battery.

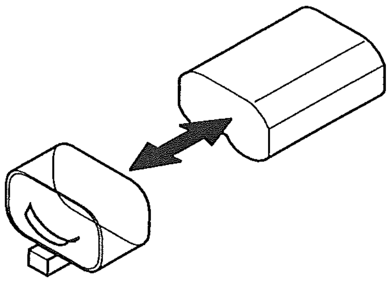


Fig. 7.4 Battery holder and battery

6. Push the battery holder with battery in the battery compartment until the latch engages.
7. Reset the battery hours counter to zero with the relevant formatted command (see 5.6) or in the set mode (see 5.7).
8. Close the front door.
9. Re-seal the front door.
10. Dispose of old battery as hazardous waste in accordance with local regulations.

Note

Checking time-of-day and date

After inserting the battery, check the time-of-day and date without power applied and set these values again if necessary.

8 Disposal

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

Note

Disposal and environmental protection regulations

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

Components	Disposal
Printed circuit boards	Electronic waste: disposal according to local regulations.
Battery	Hazardous waste: disposal according to local regulations.
LEDs, LCD-Display	Hazardous 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 Index

This chapter contains an overall index of the user manual ZxD400xT.