GOSSEN METRAWATT

TCP/IP

Interface for Multi-Tariff Meters U228X-W4 and U238X-W4

3-349-937-03
11/9.21

Modbus

ASHRAE BACnet™

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1 General

1.1 Scope of Functions of the TCP/IP Interface

U2x8x series meters with TCP/IP interface include the following functions:

- Integrated webserver for configuration and troubleshooting, can be deactivated (as of firmware version V1.13)
- Meter reading profile function (with order feature Z1)
- Certified meter reading profile for acquiring 3rd party quantities per PTB-A 50.7 and PTB-A 50.7-1 (with order feature Z2, not available in combination with order feature U3)
- NTP time synchronization (as of TCP/IP firmware version 1.05)
- Support for BACnet IP protocol (as of TCP/IP firmware version 1.00):
  - Read out current measurement data
- Support for the Modbus TCP protocol:
  - Support for up to quadruple simultaneous access via Modbus TCP (as of TCP/IP firmware version 1.18)
  - Configuration of the meter
  - Read out current measurement data
  - Read out meter reading profile values (with order feature Z1)
  - Read out certified meter reading profile values for acquiring 3rd party quantities (with order feature Z2)
  - Cutoff date meter
  - Resettable meter
  - Use of 8 tariffs for tariff changes

1.2 Electrical Connection

The meter is connected to the communications network by means of a commercially available network cable with RJ 45 plug (Ethernet cable). The other end of the network cable is connected to an Ethernet switch which establishes the connection to the rest of the network.

2 Application Notes

2.1 General Notes on Initial Start-Up

In the case of type U238x U3 meters (4-wire meters with phase voltage of 57.7/63.5 V), the device's interface function, meter reading profile logging and background illumination do **not** work during single-phase operation! None of the other meter functions are impaired as a result.

The certified meter reading profile (order feature Z2) is thus not available in combination with order feature U3.

If the tariff change will be triggered via the interface, the enable key must first of all be pressed once in order to enable tariff changing via the interface (see section 2.8 for details).

Please note:
Up through and including TCP firmware version V1.13, it's not possible to simultaneously establish more than one TCP connection with the meter! And thus, for example, it's not possible to connect the meter to the EnergyMID tool and a backend at the same time in the case of meters with the above specified or older TCP firmware versions. If more than one connection is nevertheless established at the same time, the interface may crash.

As of TCP firmware version V1.18,**up to** 4 connections can be established at the same time via port 502. These include connections to the EnergyMID tool or a backend system, as well as accessing the meter's website via a browser.
If the maximum number of possible connections has been reached and an attempt is made to start an additional connection, the connection which has been inactive for the longest period of time is terminated by the meter and the additional connection is established.

Please note that excessive data traffic on the webserver can interfere with Modbus TCP connections. If this is the case, deactivate the webserver function if necessary.

2.2 Physical Characteristics

The meter supports 10 and 100 MBit/s in full and half-duplex. The corresponding setting is entered automatically. In a 1 GBit/s network, the corresponding port at the switch is configured automatically to 10 or 100 MBit/s.
The TCP/IP connection supports HP Auto-MDIX, which means that crossover network cables are unnecessary – the meter can be connected to a switch as well as to a PC with normal patch cables.

2.3 Display at the LCD

Figure 1 provides an overview of TCP parameter settings as they appear at the meter's display (excerpt from operating instructions 3-349-868-01, expanded to include TCP/IP parameter settings):

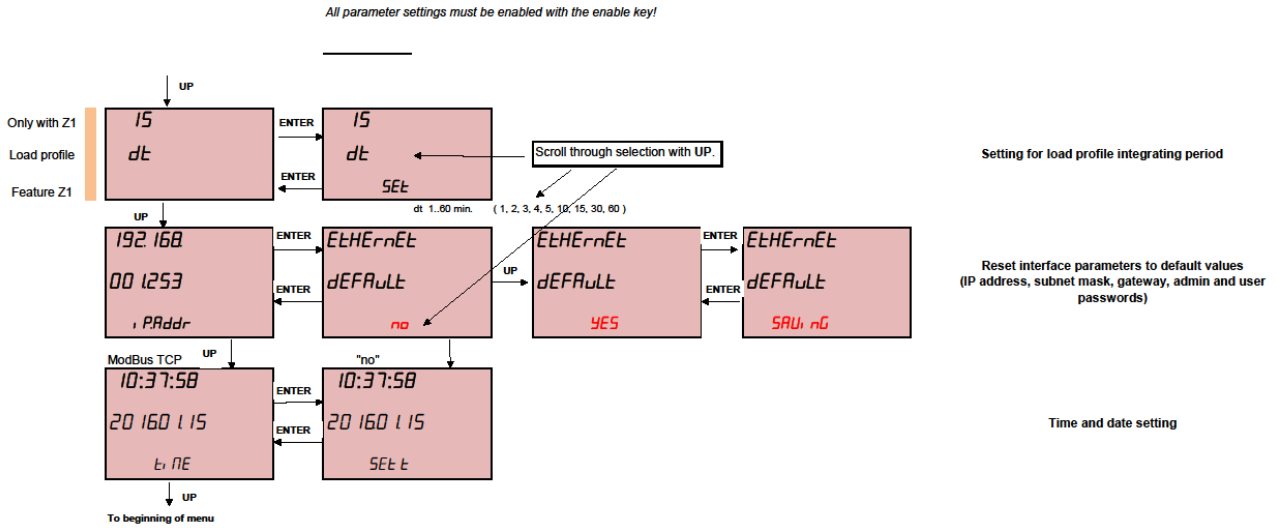

Figure 1: Display, U2x8x TCP Parameters

Note:
A detailed illustration of menu navigation with order feature Z2 (certified meter reading profile) can be found in section 2.11.

2.4 TCP/IP Meter Configuration

The default settings for the device's network configuration are as follows:

- IP address: 192.168.1.253
- Subnet mask: 255.255.255.0
- Gateway: 0.0.0.0
- DNS server 0.0.0.0
- Webserver: activated (enable)
- User name: admin
- Password: admin

The IP address can be selected as described below via either the EnergyMID tool or the meter's web interface.
If your network also uses IP address 192.168.1.x, you don't have to make any changes at your PC. However, you'll have to rule out the possibility that any other device is already using this IP address. You can check this, for example, with the ping command. Don't connect the meter to your network yet – open a command line first. Enter the following command:

"Ping 192.168.1.253"

Then press the enter key. If the following response appears 4 times, this means that there's no device in the network with the corresponding address and the IP address is thus available:

"Request Timeout"

If this is the case, you can connect the meter and continue. If, on the other hand, the following message appears, temporarily disconnect the device with this IP address from your network and execute the ping command once again to see whether or not the response indicates a timeout:

"Reply from 192.168.1.253: Bytes = ..."

If the respective device cannot be disconnected or if you don't know which device is using this IP address, disconnect the PC from the network and connect it directly to the meter. You can then change the IP address at the meter and connect it to the network.
If your network uses an address range other than 192.168.1.x, the address range must be adapted in the meter. The address range of your configuration PC must first of all be changed to the range shown above to

this end. The procedure depends upon your operating system. Instructions can be found on the Internet, for example by searching for “change Win 10 IP address”.

When the above listed conditions have been fulfilled and the meter is being supplied with electrical power, connect the meter to your network or PC by means of a network cable (see above).

Then start your Internet browser at the PC and enter the following address: 192.168.1.253. After pressing the enter key, you’ll first have to log on to the meter. User name and password are both initially set to “admin” (default setting). After entering the password and clicking “OK”, the following page should appear:

Figure 2: U2x8x Webserver – Measurement

This display shows current measured values, the tariff, date and time, and error flags.
Click “Setup” in order to access the dialog for setting the IP address.
The following page appears:

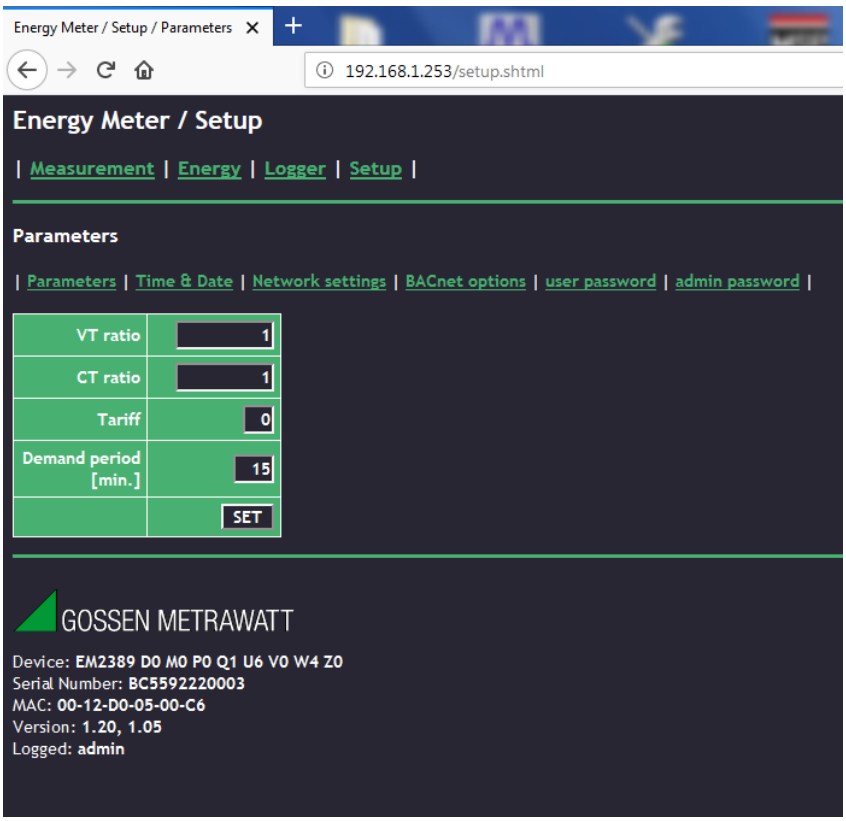

Figure 3: U2x8x Webserver – Setup

Depending on the meter variant, various meter parameters can be changed here, time can be set, access passwords can be changed and the IP address can be changed as described above. Click “Network Settings” in order to change the IP address. The following page then appears, in which the IP address can now be changed:

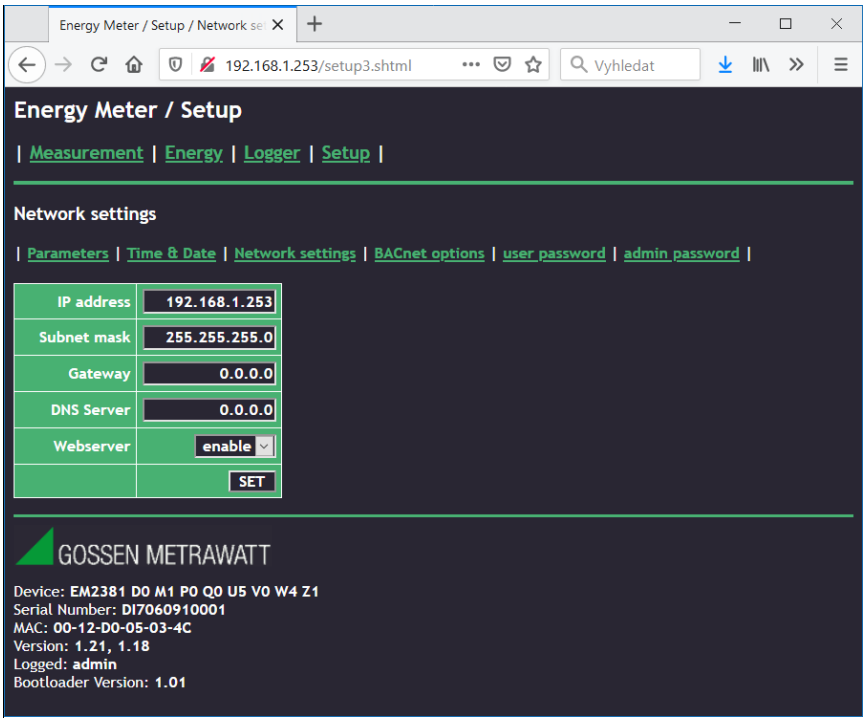

Figure 4: U2x8x Webserver – Network Settings

Click into the “IP address” field and change the address to an address included in your network’s IP address range. Then click “SET” in order to save the change.

Attention: After clicking “SET”, the meter’s TCP/IP module is automatically restarted and the new address becomes immediately active. This means that you immediately have to use the newly selected address. If another IP address range is used, the range also has to be changed at your PC again in order to gain access to the meter.
And thus if you want to use more than one meter, it makes good sense to configure all of the meters correspondingly as a first step.

Note: Within any given network, each IP address may only be assigned once!

If, instead, you want to reset the IP address to the default setting, this can be done directly at the device via the menu (see Figure 1: Display, U2x8x TCP Parameters).

The gateway and DNS settings are required for NTP functionality and can also be changed as shown in Figure 4.

2.5 NTP Network and Server

The NTP function is a protocol for synchronizing the real-time clocks (RTCs) in the meters.
NTP time is checked during the first five minutes after switching the meter on, and then once every 6 hours. If the time difference is less than 3% of the integrating period (5 to 30 seconds), time is synchronized without triggering a logger entry. If the time difference exceeds this limit value, the time change event is recorded in the logbook (event 41). If there’s no connection to the NTP server, event 0D is saved to the logger. As soon as connection has been reestablished, event 8D is displayed at the logger. Time synchronization has an accuracy of ±2 seconds.

NTP functionality is available as of TCP firmware version V1.05.

Please note:
Differentiation between Central European daylight savings time and winter time is not supported.

2.5.1 Setting up the Network for NTP

The energy meter’s network settings have to be adapted to your local network.
The following settings are required:

- IP address: Assign an IP address (DHCP is not supported).
- Subnet mask: Set the subnet mask.
- Gateway: Enter your local router address.
- DNS server: Use your local DNS server or a public DNS server.

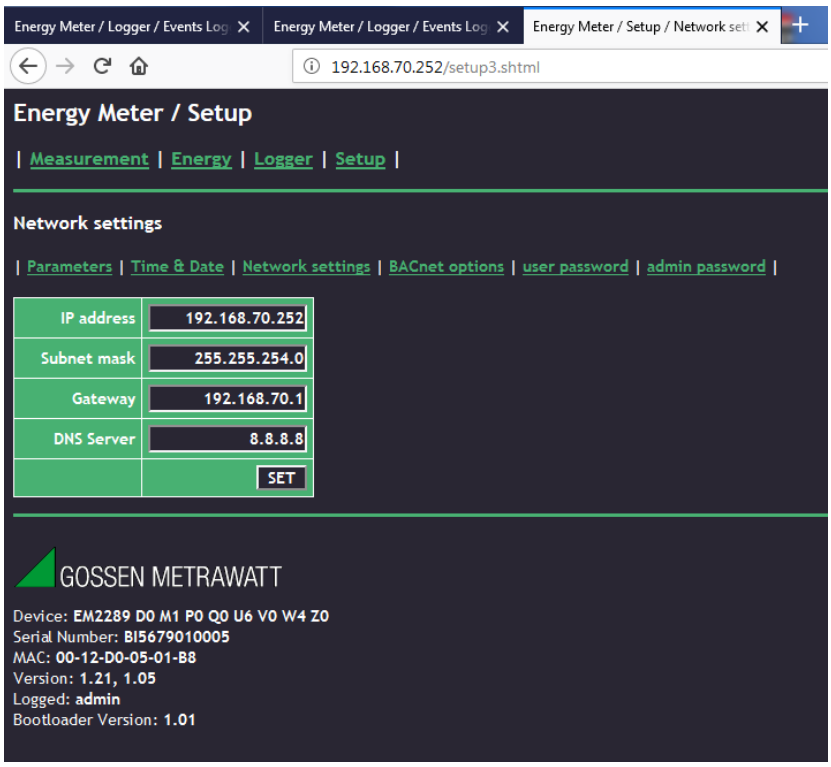

Figure 5: U2x8x – Network Settings

2.5.2 Setting up the NTP Server

Time and date can be set manually in the top part of the window (see Figure 6).
NTP functionality can be activated in the bottom part.

The following fields must be completed in order to use NTP time synchronization:

Use Time Server	Yes
Time Server	Address of an NTP time server, for example: pool.ntp.org
Time Zone	GMT +1:00

Table 1: NTP Time Synchronization Settings

The change is activated after setting these parameters and acknowledging by clicking “SET”.

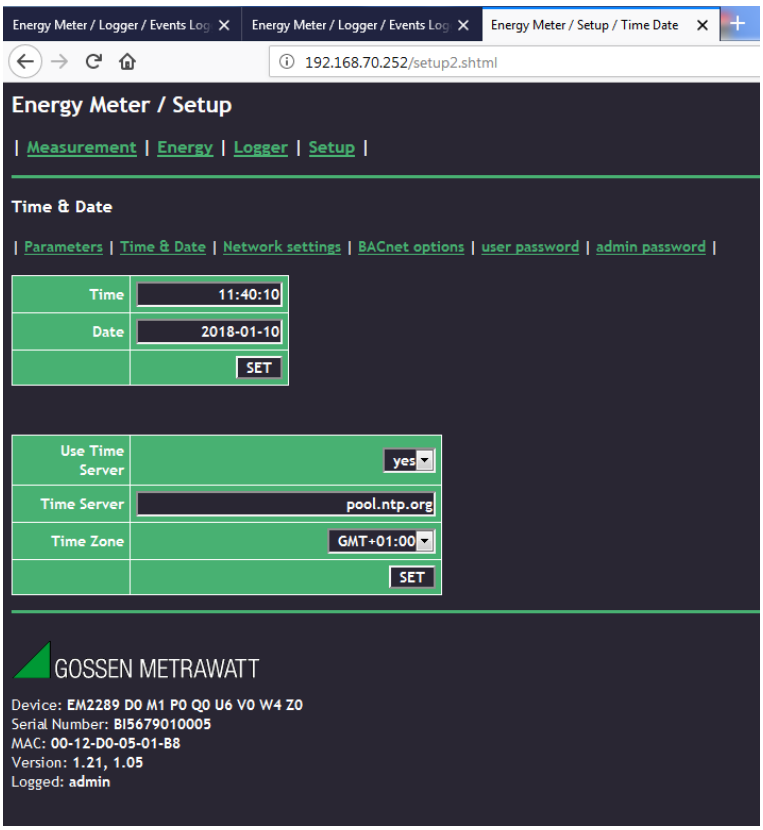

Figure 6: U2x8x Time and Time Server Settings

2.6 Webserver Deactivation

As of TCP/IP firmware version 1.13, it's possible to deactivate and reactivate the meter's webserver. Malfunctioning of the Modbus TCP interface in the event of excessive data traffic can be avoided in this way. Deactivation is possible via the webserver itself, as well as via the EnergyMID tool or directly via the Modbus TCP interface.

However, if the webserver has been deactivated, it can only be reactivated via the interface or the EnergyMID tool.

The following procedure is used to deactivate the webserver via the EnergyMID tool:

- Connect the meter to the tool.
- Then click "Command" in the drop-down list under "Settings" at the right-hand side of the window.
- From there, click "Set Webserver"(see Figure 7):

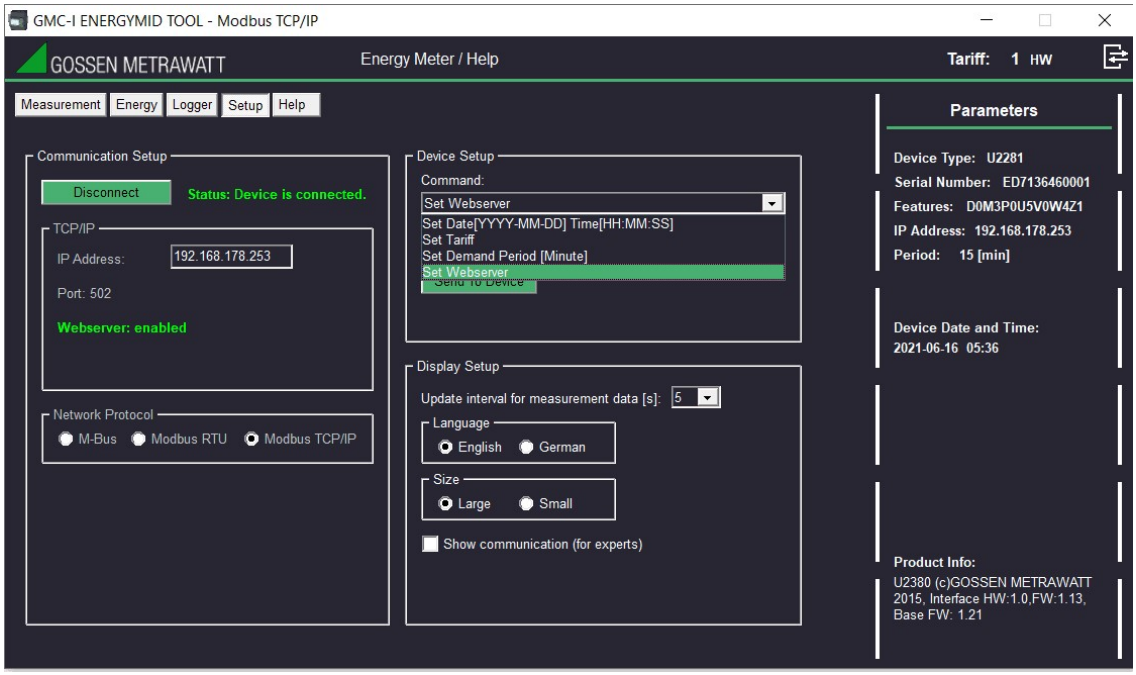

Figure 7: Setting the Webserver

- Select the corresponding item depending on whether you want to activate or deactivate the webserver. The webserver is deactivated in the following example:

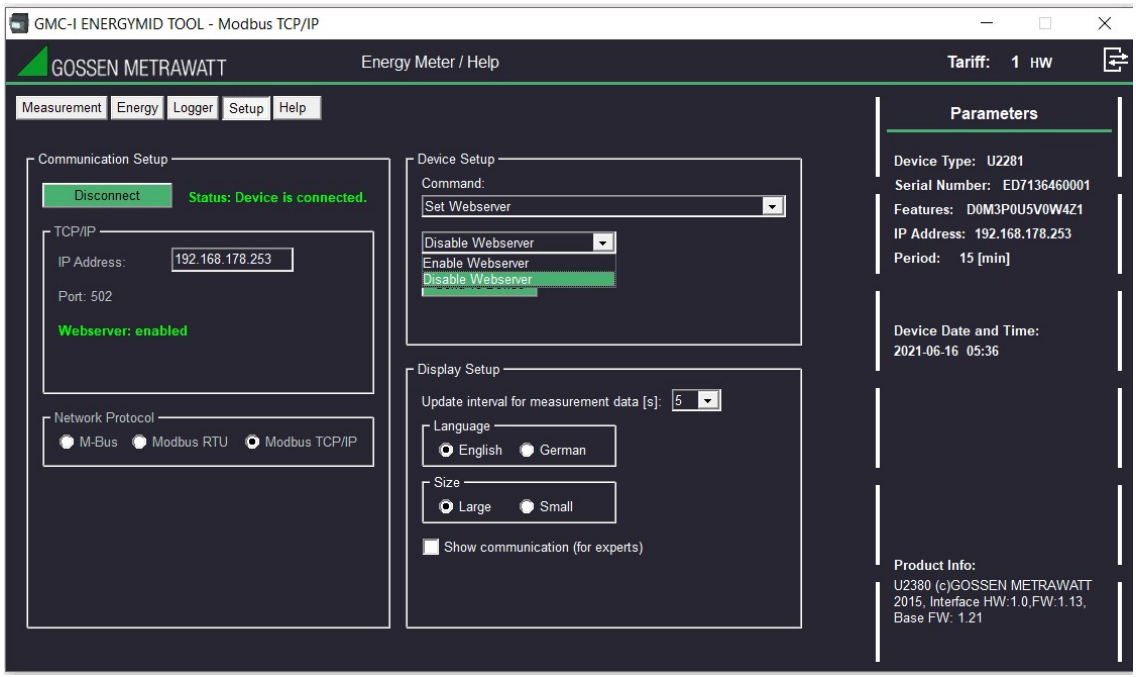

Figure 8: Deactivating the Webserver

- Then, immediately after clicking “Send to Device”, the command is transmitted to the meter and the selected webserver setting is activated. A corresponding message appears:

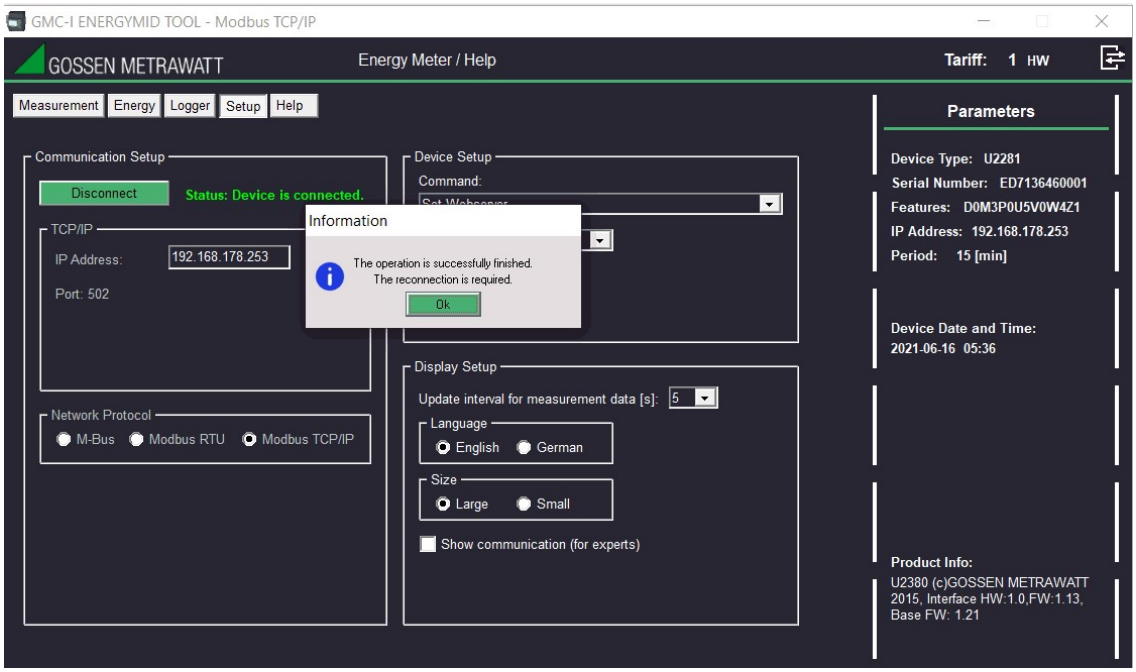

Figure 9: Webserver Deactivation – Settings Accepted

Please note:
The meter's interface is restarted after this procedure has been completed. As a result, the meter is disconnected from the EnergyMID tool, your PC or the backend, and must then be reconnected.

2.7 Firmware Update

In the case of energy meters with TCP/IP interface, it's possible to update the interface's firmware via an Ethernet loader. This is useful, for example, if the new firmware version contains bug fixes or new functions which are of interest to you.
For instance, BACnet functionality is available for energy meters as of version V1.0.
In order to be able to use BACnet on older devices, the firmware has to be updated.

Download the GMC-I update tool with the designation "TCP/IP Firmware (Ethernet Loader)" from our website to this end:

https://www.gmc-instruments.de/produkte/industrielle-messtechnik/energiemanagement/energiezaehler/mid-zertifizierte-energiezaehler/em2281em2389/

Connect the meter to the PC via an Ethernet cable and fill out the following fields:
- **IP address:** Enter the current device IP address (can be changed via webserver, see section 2.4).
- **admin password:** Your administrator password (default: admin).
- Click the **FIRMWARE UPDATE** button.

Please wait until the update procedure has been completed and do not interrupt communication!

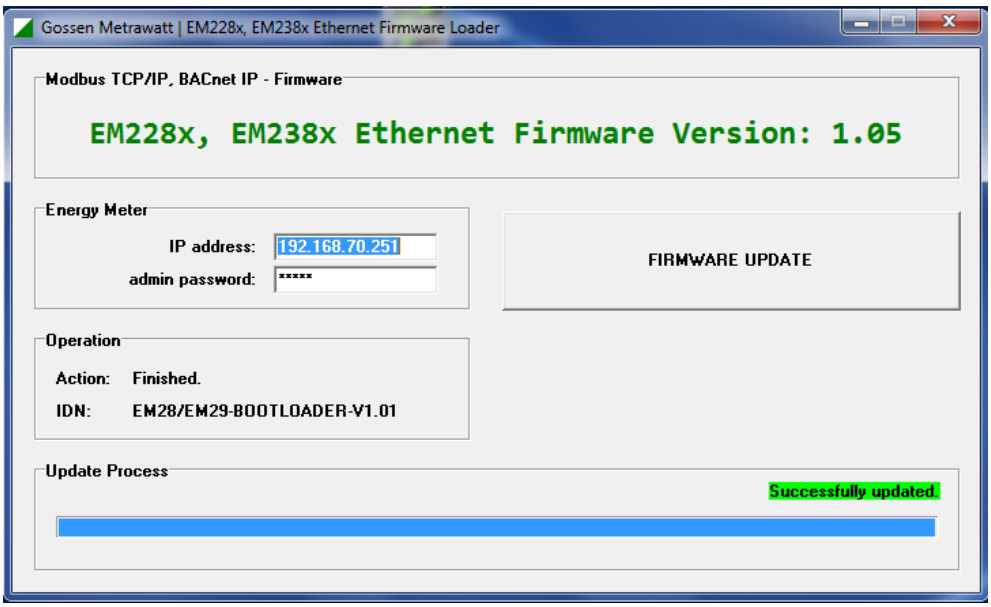

Figure 10: Ethernet Firmware Loader

If the update doesn't start, please check the following:
- An incorrect password is indicated by means of a corresponding message.
- Other errors can usually be traced back to an incorrectly entered IP address.
- The PC must be in the same subnet.
- On some computers, the required connection type is obstructed by a parallel WiFi connection: if applicable, try another computer or deactivate the adapter.

Please note: As is the case with all firmware updates, this procedure is not entirely without risk. During the update, there's no valid interface firmware. The devices' energy metering function is not impaired, but in extreme cases the interface function may be lost. Please contact our technical support department with any questions or in the event that problems should occur.

Please also note:
In the case of meters with order feature Z2 (certified meter reading profile), TCP/IP interface firmware **cannot** be updated via the Ethernet loader due to regulatory requirements!

2.8 Tariff Change via Interface

The currently selected energy metering tariff can be viewed in register 412. The interface can specify a tariff by writing a value of 1 to 8 to register 10500, in which case the hardware tariff input is ignored.
If a value of 0 (default value) is written to register 10500, the meter's tariff is specified via the device's tariff input.

The procedure for specifying the tariff via the interface must include the following steps:

- In order to initially specify the tariff via the interface (value of 1 to 8 at address 10500) after previous hardware control (indicated by a value of 0 at register address 10500), the enable key on the device must first be pressed. The key shown in the device display must disappear and may no longer be visible. Otherwise the setting is ignored by the device and hardware control remains active!
- As long as a fixed tariff is selected in register 10500 (a value of 1 to 8), the tariff can always be changed via the interface.
- Entering a value of 0 to the register address makes it possible to switch back to hardware control.

Please note:
In the case of meters with order feature Z2 (certified meter reading profile), initialization of the next meter reading profile period is decisive for switching the tariff.
This means that if a new tariff is selected during any given meter reading profile period, the old tariff remains active until the beginning of the next period. The new tariff is then activated at the beginning of the next meter reading profile period.
The selected tariff for the next meter reading profile period can be viewed in register 10510.

2.9 Operating Logbook

The operating logbook is read out sequentially from the newest to the oldest entry. The procedure is as follows:

- By reading exactly 16 words from register address 3100, the last (newest) entry is read in its entirety.
- Subsequently, the next older entry is always retrieved by reading exactly 16 words from address 3200.
- Previously retrieved values can be read out once again by reading exactly 16 words from address 3300, for example in the case of transmission problems etc.

Contents of the operating logbook include:

- Events recorded with a timestamped event
- Events are logged once again when they disappear and their disappearance is indicated.
- Parameters: Relevant parameters are also logged depending on the event.

2.10 Meter Reading Profile (order feature Z1)

Stored values from the load profile are read out sequentially from the newest to the oldest entry. The procedure is as follows:

- By reading exactly 32 words from register address 3400, the last (newest) entry is read in its entirety.
- Subsequently, the next older entry is always retrieved by reading exactly 32 words from address 3500.
- Previously retrieved values can be read out once again by reading exactly 32 words from address 3600, for example in the case of transmission problems etc.

Please note:
In the case of meters with feature Z1, the byte order of the meter reading profile values during read-out is not the same as the byte order used by many read-out tools. The meter reading profile package, with a length of 32 words, has its own byte order which is explained below.

The values are read out from the meter in format types 11, 11a and 11b, and must be correspondingly interpreted. A detailed definition of these format types can be found in section 0**Fehler! Verweisquelle konnte nicht gefunden werden.**.

Example:
If data stored to the meter as of address 3400 are read via the TCP interface, the meter responds with the following byte sequence, for example:

00 04 40 28 03 01 00 FE 00 00 00 3D 00 00 00 00 00 00 80 00 00 00 80 43 24 00 00 00 04 03 00 00 2D 11 1F 03 E4 07 0F 0A 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00

The data are interpreted as follows:

Register Address	Date Read	Interpreted as
NA	000440h	Modbus TCP protocol bytes
3400 As of address 3400, exactly 32 words must be read as a block.	2803h	Index: 0328h = 808
	01h	Tariff: 01h = 1
	00h	Energy exponent: 00h = 0 → U/M is [Wh]
	FE 00 00 00h	Active energy import: 00 00 00 FEh = 254 [Wh]
	3D 00 00 00h	Active energy export: 00 00 00 3Dh = 61 [Wh]
	00 00 00 80h	Reactive energy import: 80 00 00 00h → has not been measured (only available with M2 and M3)
	00 00 00 80h	Reactive energy export: 80 00 00 00h → has not been measured (only available with M2 and M3)
	43h	2 additional places after the decimal point for increased accuracy in the case of active energy import: 43h = 67 [1/100Wh] → 254.67 Wh
	24h	2 additional places after the decimal point for increased accuracy in the case of active energy export: 24h = 36 [1/100Wh] → 61.36 Wh
	00h	2 additional places after the decimal point for increased accuracy in the case of reactive energy import:

Register Address	Date Read	Interpreted as
		00h → has not been measured (only available with M2 and M3)
	00h	2 additional places after the decimal point for increased accuracy in the case of reactive energy export: 00h → has not been measured (only available with M2 and M3)
	00 04h	Status field 1: 0400h = 0000 0100 0000 0000 (bin) → Bit 10 is set → Unknown phase sequence
	03 00h	Status field 2: 0003h = 0000 0000 0000 0011 (bin) → Bits 0 and 1 are set → Shortened integrating period after a reset
	00h	Timestamp for seconds: 00h = 0
	2Dh	Timestamp for minutes: 2Dh = 45
	11h	Timestamp for hours: 11h = 17
	1Fh	Timestamp for the day: 1Fh = 31
	03h	Timestamp for the month: 03h = 2
	E4 07h	Timestamp for the year: 07 E4h = 2020
	0Fh	Integrating period: 0Fh = 15 [min]
	0A 00h	Reserved
	00 00h	Reserved
	00 00h	Reserved
	00 00h	Reserved
	00 00h	Reserved
	00 00h	Reserved
	00 00h	Reserved
	00 00h	Reserved
	00 00h	Reserved
	00 00h	Reserved
	00 00h	Reserved
	00 00h	Reserved
	00 00h	Reserved
	00 00h	Reserved
	00 00h	Reserved

Table 2: Interpretation of the Byte Sequence with Feature Z1

2.11 Certified Meter Reading Profile (order feature Z2)

For meters with ordering feature Z2 (certified meter reading profile), the meter reading profile values are recorded and processed in the meter in accordance with PTB-A 50.7 and PTB-A 50.7-1.
Consequently, the values can also be used for billing and acquiring 3rd party quantities. Up to 168,000 meter reading profile values can be stored in energy meter memory. After the maximum number of meter reading profile values has been reached, additional values are written to memory in a rolling manner. The oldest meter reading profile value is always replaced by the newly generated meter reading profile value.
Meter reading profile values can be queried via the interface, and can be viewed on the integrated webserver and at the meter's display panel.

A meter reading profile value which cannot be used for billing is identified in the display by means of a warning symbol (triangle with exclamation mark). This corresponds to bit 15 of certified meter reading profile status 2 of the respective entry (format type 12b), and is caused by certain statuses of certified meter reading profile statuses 1 and 2. A meter reading profile value is not valid for billing if any of the following errors or states occurs during the meter reading profile period:

- Overvoltage or overcurrent (certified meter reading profile status 1, bits 0 to 5)
- The meter is not calibrated (certified meter reading profile status 1, bit 11)
- Excessively large DC offset (certified meter reading profile status 1, bit 12)
- Erroneous energy reading (certified meter reading profile status 1, bit 13)
- Internal communication error (certified meter reading profile status 1, bit 14)
- The energy value has been reconstructed from cyclical backups (certified meter reading profile status 1, bit 15)
- Shortened integrating period (certified meter reading profile status 2, bit 0)
- A reset has occurred (certified meter reading profile status 2, bit 1)
- End of period due to clock time change (certified meter reading profile status 2, bit 3)
- Clock has not been synchronized during the last 36 hours (certified meter reading profile status 2, bit 5)
- The calibration logbook is full (certified meter reading profile status 2, bit 6)

After a power failure, the last integrating period is reconstructed when power is restored. This is the case if failure duration is longer than the remaining time of the last integrating period. It's generated on the basis of the energy value after voltage has been restored and is identified accordingly in the associated meter reading profile statuses. Because it's highly unlikely that the new integrating period will start exactly at the point in time of an integrating period change after voltage is restored, the newly initiated integrating period is shortened. This means that associated bit 0 is set for this entry in meter reading profile status 2. After synchronization of the integrating period, standard 15-minute interval operation is restored.
If failure duration is shorter than remaining time since the last integrating period, the period continues and the voltage failure is identified in the meter reading profile status associated with the entry.

Due to the fact that the meter stores meter reading profile values for more than 4 years (up to 168,000 entries), a period of time can be specified via the keys on the meter or via the interface, for which the meter will return stored meter reading profile values.

Please refer to Figure 11 for a detailed description of the menu for meters with certified meter reading profile.
Details regarding read-out via interface can be found in the description of format types 12, 12a and 12b in section 3.10.12.
The address range is described in more detail in section 3.9.

Please note:
The calibrated primary values are recorded for U238x transformer meters with features Q0 and Q9 in the certified meter reading profile.
In contrast, the calibrated secondary values for transformer meters with feature Q1 are stored in the certified meter reading profile as meter reading profile values.

Please note:
In the case of meters with feature Z2, the byte order of the meter reading profile values during read-out is the same as the byte order used by many read-out tools. The values can thus be interpreted directly after the read-out without first changing the byte sequence.

Please also note that calibration-relevant events are recorded to a separate calibration logbook (see section 2.12).

Please note:
If the meter readings from the certified meter reading profile are to be used for billing, legal time must be used for time synchronization. This means that for the purpose of synchronization, either the NTP time server of the German Federal Institute of Physics and Metrology (PTB) or the time server of another official body must be used.

The addresses of the PTB's time servers, as well as further detailed information, can be found on the PTB's website at:

https://www.ptb.de/cms/en/ptb/fachabteilungen/abtq/gruppe-q4/ref-q42/time-synchronization-of-computers-using-the-network-time-protocol-ntp.html

See section 2.5 for details on using the NTP server in U2x8x meters.

Figure 11 shows menu navigation with the Modbus TCP interface for feature Z2. Please note that the enable key must first be pressed for all parameter settings!

Please note that the following instructions for measuring correctness must be complied with:

Obligations of the User in the Spirit of § 23 of the German Measuring and Verification Act (MessEG)

The measuring and verification act stipulates that users of measuring instruments, as defined by the measuring and verification act, are required to measure and handle measuring instruments in such a way that the correctness of the measurement is assured.
Users, as defined by the measuring and verification act and taking into account regulation of market roles by the German metering point operation act (MsbG), are:

- Users of Measuring Instruments
  Users of measuring instruments are metering point operators in the spirit of the metering point operation act.
- Measured Value Users
  Measured value users are persons who perform measurements for, and transfer measured values to, authorized third parties as defined by the measuring point operation act, and who are responsible for the billing of network usage and energy supply.

Users of measuring instruments are responsible for providing measured value users with the opportunity of informing themselves about the requirements explained below.

Transparency of Use

The origin of the invoiced work and, if applicable, power values must be rendered transparent by the measured value user for the electrical power customers for whom the instruments are used. "Render transparent" means providing information which enables electrical power customers to understand how the items in their electric power bills are arrived at with the help of displays of the utilized equipment, which complies with calibration legislation. In particular, information must be provided which indicates:

- Which of the values displayed by the instruments may be used for billing purposes
- That values which are not displayed cannot be used for billing purposes and that displayed values which result from functions which are not relevant under calibration law are of a purely informative nature and, likewise, cannot be used for billing purposes

Furthermore, the measuring instruments must be used in such a way that readability of the measurement results which are relevant for billing, as well as any error messages, is also assured for electrical power customers.

Tariffing

No tariffs are permitted for the use of meter reading profiles in compliance with calibration law. Only the summation registers may be used.

Error Messages / Time Adjustments

- Error Messages
  The accompanying documents describe the instrument malfunctions which can be self-diagnosed and displayed by the meters referred to here. If one or more error messages with relevance to calibration law are displayed, use in compliance with calibration law is no longer assured and the stored measurement results must be regarded as questionable. The instruments must be removed, repaired if necessary and calibrated if they will still be used for billing purposes.
- Time Adjustments
  In the case of meters with internal clocks that can be adjusted by remote control, technical measures must be implemented in order to ensure that it's possible to check whether the clock has been adjusted during a billing period in a manner that affects measurement and billing accuracy by means of displays that comply with calibration law. This is accomplished as follows for the meters referred to here:
  A command used to adjust the meter's clock via the interface always results in an entry to the calibration logbook. The integrating period after the point in time of clock adjustment is flagged as invalid. The new integrating period, which begins when time is adjusted, ends at the next integer multiple of the integrating period's duration (at x o'clock: 15, 30, 45 or 00) based on the newly set meter time.

Using the Communication Interfaces

The meters' communication interfaces do not comply with calibration law. Measured values obtained via the interfaces from the meters to be approved here can only be used for billing purposes to the extent that they're an unchanged replication of the measurement results shown in the display of the meters to be approved here in accordance with appendix 2, section 8.1 of the German measuring and verification act.

Time Synchronization

The meters referred to here are synchronized via the included TCP/IP interface. In order for the meter reading profiles to be used in compliance with calibration law, the user must ensure that meter time is synchronized to legal time on a regular basis at least every 36 hours.

Measurement Results which May Not be Used for Billing Purposes

Measured values other than the measured quantities specified in the prototype test certificate may not be used for billing purposes.

Logbook Function

The meters referred to here are always equipped with a calibration logbook, which can only be deleted by violating the access protection measures implemented by the manufacturer.

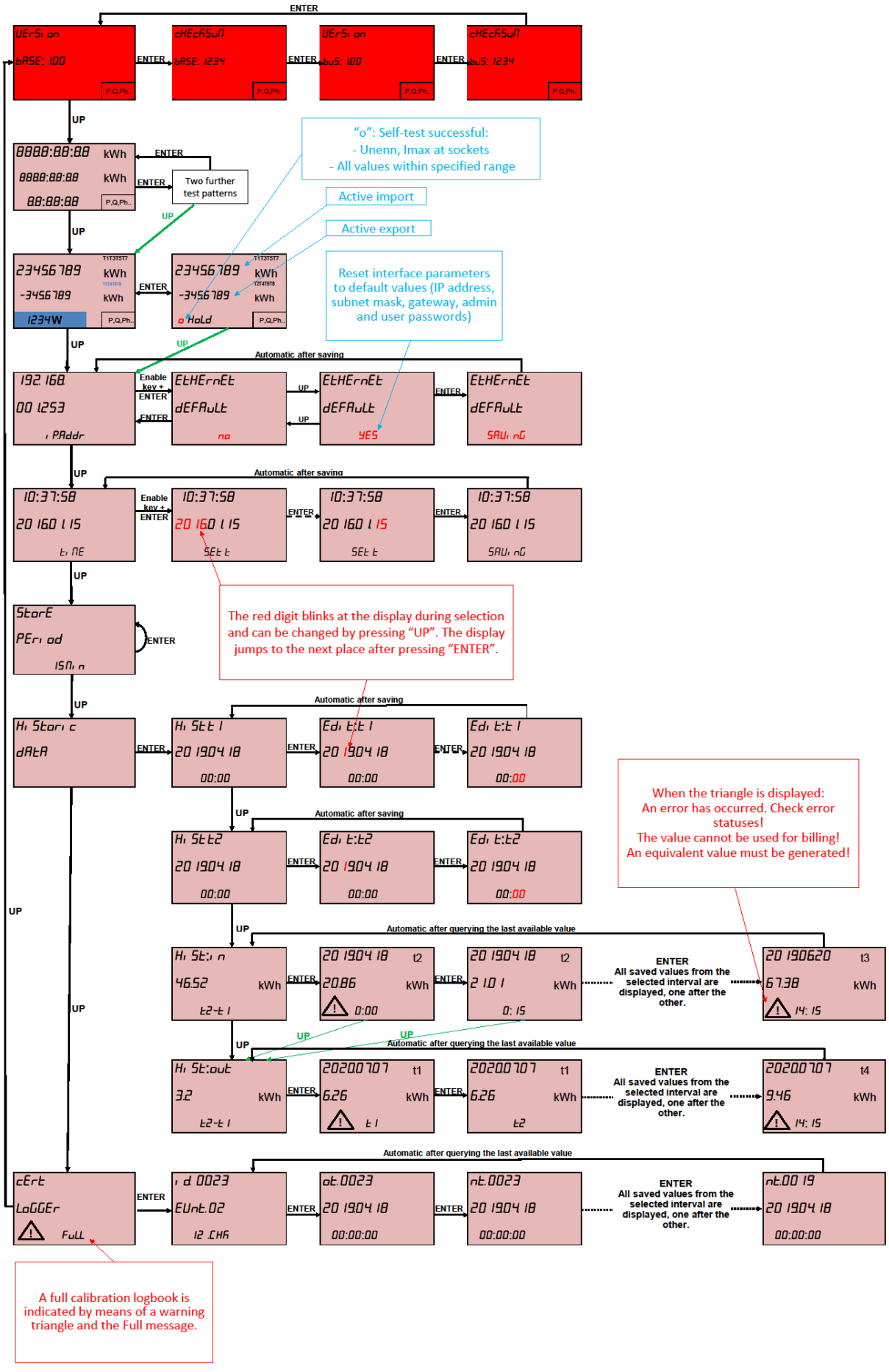

Figure 11: Menu Navigation, Certified Meter Reading Profile

2.12 Calibration Logbook (order feature Z2)

In order to be able to uninterruptedly verify the time parameter under calibration law, the meter with order feature Z2 (certified meter reading profile) is equipped with a calibration logbook in accordance with PTB-A 50.7 and PTB-A 50.7-1. Any time adjustment that goes beyond time synchronization, and thus corresponds to a parameter setting which will be saved, is documented in this logbook.
A time change of more than 9 seconds is considered an adjustment.

The calibration logbook can store up to 4000 entries and cannot be deleted. When the maximum number of entries is reached, time can no longer be adjusted. This means that as of this point in time, meter reading profile values from the certified meter reading profile in accordance with PTB-A 50.7 can no longer be used for billing. This status is indicated by an error message which appears at the display and by the error bit set in the error status 2 register. Likewise, the following entries from the certified meter reading profile are identified as unusable for billing.
Depending on how the calibration logbook is used, a maximum period of use of up to 16 years is possible before the calibration logbook is entirely filled.

The display can be used to read out the calibration logbook. Detailed menu navigation is shown in Figure 11. Furthermore, the logbook can be accessed via the integrated webserver and the Modbus TCP interface. A request can be made to this end via register 11400, and the corresponding entry can be read out from register 3900. Further information concerning the registers can be found in the details regarding the address space in subsection 3.9.1.2, and regarding format types 12c and 12d in section 3.10. The event codes visible in the display and via the interfaces (shown as “Evnt.02” in Figure 11) are uniform and can also be taken from format type 12c.

2.13 Cutoff Date Meter

The date and time at which the meter readings will be “frozen” can be preselected by writing an entry to register address 10800, i.e. the momentary energy value status is copied to a special data range and can be read out later (cutoff date energy values).
The point in time at which cutoff date energy values were recorded can be found at addresses 503 to 506, and the energy values for tariffs 1 to 8 can be found in resisters 1400 to 2111 (see Table 3).
The following rules apply to the specification of a cutoff date:

- Future point in time: Cutoff date energy values are updated at this point in time.
- Point in time in the past: no updating of cutoff date energy values.
- Current date, time of day in the past: current device time and cutoff date energy values are saved to memory.
- A 0 entered for the day, the month or the year functions as a placeholder: the cutoff date energy values are updated on each corresponding date.
- Everything set to 0 (placeholders) in date and time: Cutoff date via device clock, every day at midnight, initial transfer immediately.

2.14 Resettable Meter

Similar to the cutoff date meter, meter readings are saved and the respective differential value (= momentary value – value at the time of resetting) is determined.
The date and time at which the meter readings will be reset can be preselected by writing a value to register address 10700.
The point in time at which resetting has occurred can be found at addresses 507 to 510, and the energy values for tariffs 1 to 8 can be found in resisters 2200 to 2911 (see sections 3.9.1.1 and 3.9.2.1).
The following rules apply to the specification of a reset time point:

- Future point in time: Reset to this point in time
- Point in time in the past: no resetting of energy values
- Current date, time of day in the past: immediate reset with current device clock time.
- A 0 entered for the day, the month or the year functions as a placeholder: energy values are reset on each corresponding date.
- Everything set to 0 (placeholders) in date and time: Reset via device clock, every day at midnight, initial reset time immediately.

2.15 Clock Internal Power Reserve

The internal clock’s reserve power bridges a period of at least 2 days in the de-energized state. This is made possible by means of buffering with a Gold Cap Charging time for the Gold Cap is at least 2 minutes. After this charging time has expired, the specified power reserve is available for at least 2 days. Depending on ambient conditions, typical power reserve is roughly one week.

3 Modbus TCP

3.1 Introduction

Modbus TCP is a variant of Modbus RTU. Basically it's a Modbus RTU package packed into a TCP/IP sequence. The Modbus RTU frame is rendered routable on the Internet through the use of the TCP/IP standard. And thus with suitable configuration, it's no longer necessary to have all Modbus clients in the same subnet. In contrast, all clients are physically connected to a single bus in the case of Modbus RTU.

Definition of terms:
The Modbus server is the meter because it stores the data.
The Modbus client is the PC or a summator because it receives the data.

3.2 OSI Model

The OSI model is a reference model for network protocols. It defines 7 layers within which all data transmission takes place. Each layer has precisely defined interfaces to the next higher and next lower layers (except for layers 1 and 7 because there's no further layer below 1 or above 7). The higher level doesn't see how the lower levels are transmitting data.

Order of the layers (the highest level is at the top):

7 Application layer
6 Presentation layer
5 Session layer
4 Transport layer
3 Network layer
2 Data link layer
1 Physical layer

Layer 1 defines the physical interface, for example the utilized plugs and cables and how the bits to be transmitted are coded.

Layer 2 is the data link layer. The data stream is subdivided into blocks within this layer and a checksum is added for the detection of faulty blocks. A globally unique MAC address is used in order to address the recipient.

As the utilized interface, the Ethernet standard defines exactly how layers 1 and 2 must be laid out.

Layer 3 is the network layer. It regulates routing of the data packets through the various subnets. The Internet protocol (IP) is used for addressing – the so-called IP address is added.

Layer 4 is the transport layer. It's used for segmentation of the data stream, and in order to prevent network congestion. Addressing takes place here as well – port addresses are added. Port 80 is especially well known due to its use on the Internet ("surfing"). Modbus TCP is executed via port 502, which is reserved to this end.

Layers 5 and 6 are not used for Modbus TCP.

Layer 7 is the application layer. The Modbus RTU packets are transported within this layer.

3.3 Modbus TCP Protocol Layout

As a result of the mode of operation defined in the OSI model, the recipient's application layer directly sees the Modbus commands transmitted by the sender – layers further down are quasi-transparent and Modbus TCP doesn't have to deal with them.

A Modbus TCP packet is laid out as follows:
The following are added to the MBAP header (Modbus application protocol):

- The "transaction identifier" (2 bytes) which is generated by the TCP client (master) and returned unchanged
- The "protocol identifier" (2 bytes) – always 0 in the Modbus TCP protocol
- The length, i.e. the number of bytes which follow (2 bytes)
- The unit identifier (1 byte): address field for RTU to TCP converter which is ignored by the meter

And thus a complete Modbus TCP packet is laid out as follows:

MBAP				**PDU**	
Transaction Identifier (2 bytes)	**Protocol Identifier (2 bytes)**	**Length (2 bytes)**	**Unit Identifier (1 byte)**	**Function Code (1 byte)**	**Data (x bytes)**

Example 1: Request the selected current transformer ratio (CT) at register address 10000 of the device with address 18 (in the example: 1000:1):

Request:

MBAP				**PDU**	
Transaction Identifier	**Protocol Identifier**	**Length**	**Unit Identifier**	**Function code**	**Data**
00 02	00 00	00 06	01	03	27 10 00 01

Response:

MBAP				**PDU**	
Transaction Identifier	**Protocol Identifier**	**Length**	**Unit Identifier**	**Function code**	**Data**
00 02	00 00	00 05	01	03	02 **03 E8**

Example 2: Request THD values for phase voltages L1 ... L3 at register addresses 8 … 10 of the device with address 24:

Request:

MBAP				**PDU**	
Transaction Identifier	**Protocol Identifier**	**Length**	**Unit Identifier**	**Function code**	**Data**
00 02	00 00	00 06	01	04	00 08 00 03

Response:

MBAP				**PDU**	
Transaction Identifier	**Protocol Identifier**	**Length**	**Unit Identifier**	**Function code**	**Data**
00 02	00 00	00 09	01	03	**00 15 00 80 00 25**

The THD values for the voltages are thus:
THD (L1) = (0x0015) = 0.021
THD (L2) = (0x0080) = 0.128
THD (L3) = (0x0025) = 0.037

Example 3: Set the voltage transformer ratio at register address 10100 of the device with address 17 to 500:1.

Command:

MBAP				**PDU**	
Transaction Identifier	**Protocol Identifier**	**Length**	**Unit Identifier**	**Function code**	**Data**
00 02	00 00	00 09	01	10	27 74 00 01 02 **01 F4**

Response:

MBAP				**PDU**	
Transaction Identifier	**Protocol Identifier**	**Length**	**Unit Identifier**	**Function code**	**Data**
00 02	00 00	00 06	01	10	27 74 00 01

3.4 Protocol Data Unit (PDU)

According to the specification, Modbus TCP frames always have the same layout:
(All numbers are decimal numbers unless otherwise specified.)

Function Code	**Data**
8-bit	n x 8-bit (n = 0 ... 252)

The Modbus specification defines various function codes (FC). The following three function codes are used for Modbus TCP by the U228x, U238x meter range:

Function Code (decimal)	**Meaning**	**Used to**
3	Read words (read holding registers)	Read parameters
4	Read values (read input register)	Read measured values
16	Write words (write multiple registers)	Write parameters

The function code is followed by the data to be transmitted. In requests from the client to the server, the data are always 16-bit words and the high byte is always transmitted first.

3.5 Data Content of the Various Function Codes

3.5.1 Function Code 3 – Read Parameters:

Request

Function Code	Data			
	Start Address		Number of Registers	
03	High byte	Low byte	High byte	Low byte

Client>>Server

Response

Function Code	Data	
	Number of Data Bits	Information
03	N (8-bit)	N/2 register

Server>>Client

3.5.2 Function Code 4 – Read Measured Values

Request

Function Code	Data			
	Start Address		Number of Registers	
04	High byte	Low byte	High byte	Low byte

Client>>Server

Response

Function Code	Data	
	Number of Data Bits	Information
04	N (8-bit)	N/2 register

Server>>Client

3.5.3 Function Code 16 – Write Parameters

Request

Function Code (hex)	Data					
	Start Address		Number of Registers		Number of Bytes	Information
10h	Hi	Lo	Hi	Lo	N	N bytes

Client>>Server

Response

Function Code (hex)	Data			
	Start Address		Number of Registers	
10h	Hi	Lo	Hi	Lo

Server>>Client

3.6 Error Handling

When the recipient of a frame detects an error, a corresponding error frame is sent to the master.

Function Code	Data
FC + 80h	Error Code

The received function code is returned with set MSB (**m**ost **s**ignificant **b**it). This corresponds to an addition of 80h. The error code indicates an operating or program error. The following error codes are supported:

Error Code	Description
01	The utilized function code is not supported.
02	The utilized register address is impermissible. The register is invalid or write protected.
03	Some of the utilized data values are not within the permissible range, e.g. invalid number of registers.

3.7 TCP Address Space

Please note:
Depending on order feature Z, “meter reading profile”, the TCP address space differs with regard to the individual register lengths, as well as the byte sequence of the data within the registers.

In the case of order feature Z1 (meter reading profile), the byte sequence doesn’t correspond to the sequence expected by many read-out tools. Consequently, the data bytes must first be rearranged when reading out the meter reading profile values, and can only then be interpreted. Detailed information can be found in section 2.10.

In contrast, the byte sequence has been changed for feature Z2 (certified meter reading profile) and is thus Modbus-compliant. The data can therefore be read out and processed directly.

3.8 Overview of Modbus TCP Address Space

Note:
This section provides a rough overview of the Modbus TCP address space for U2x8x meters.
Section 3.9 deals with the various address space ranges and the associated variables in greater detail.

All register addresses in this document are zero-based, and are thus transmitted directly via the interface as they're listed in the tables. Conversion is consequently unnecessary.

Address (decimal)	Number of Registers	Description	Access
0-14	15	Voltage	R
100-110	11	Current	R
200-216	17	Power	R
300-313	14	Total energy (all tariffs)	R
400-414	15	Energy, active tariff	R
500-510	11	Operating hours, date and time of the last reset and the last cutoff date	R
600-613	14	Energy, tariff 1	R
700-713	14	Energy, tariff 2	R
800-813	14	Energy, tariff 3	R
900-913	14	Energy, tariff 4	R
1000-1013	14	Energy, tariff 5	R
1100-1113	14	Energy, tariff 6	R
1200-1213	14	Energy, tariff 7	R
1300-1313	14	Energy, tariff 8	R
1400-1411	12	Energy, tariff 1, on cutoff date	R
1500-1511	12	Energy, tariff 2, on cutoff date	R
1600-1611	12	Energy, tariff 3, on cutoff date	R
1700-1711	12	Energy, tariff 4, on cutoff date	R
1800-1811	12	Energy, tariff 5, on cutoff date	R
1900-1911	12	Energy, tariff 6, on cutoff date	R
2000-2011	12	Energy, tariff 7, on cutoff date	R
2100-2111	12	Energy, tariff 8, on cutoff date	R
2200-2211	12	Resettable energy, tariff 1	R
2300-2311	12	Resettable energy, tariff 2	R
2400-2411	12	Resettable energy, tariff 3	R
2500-2511	12	Resettable energy, tariff 4	R
2600-2611	12	Resettable energy, tariff 5	R
2700-2711	12	Resettable energy, tariff 6	R
2800-2811	12	Resettable energy, tariff 7	R
2900-2911	12	Resettable energy, tariff 8	R
2920-2936	17	Meter reading profile response (with order feature Z2)	R
3000-3035 1	36	Features	R
3100-3115 2	*16*	*Operating logbook, last entry*	*R*
3200-3215 2	*16*	*Operating logbook, previous entry*	*R*
3300-3315 2	*16*	*Operating logbook, next entry*	*R*
For order feature Z1 (see details in section *3.9)*			
3400-3431 2	*32*	*Meter reading profile, last entry*	*R*
3500-3531 2	*32*	*Meter reading profile, previous entry*	*R*
3600-3631 2	*32*	*Meter reading profile, next entry*	*R*
For order feature Z2 (see details in section *3.9)*			
3400-3416 2	*17*	*Meter reading profile, last entry*	*R*
3500-3516 2	*17*	*Meter reading profile, previous entry*	*R*
3600-3616 2	*17*	*Meter reading profile, next entry*	*R*
3700-3701 2	2	*Version*	*R*
3800-3835 2	*36*	*Meter reading interval response*	*R*
4000-4005 1, 3	6	Meter clock read-out	R

1 Only with Z2: Registers can be read/written register by register, but only block by block access is available with other order features.
2 Register with fixed block length: can only be read and written as a block with all variants

Address (decimal)	Number of Registers	Description	Access
4100-4105 3	6	Read-out data and time index of the next reset	R
4200-4205 3	6	Read-out data and time index of the next cutoff date	R
10000 4	1	CT	R/W
10100 4	1	VT	R/W
10400 4	1	Meter reading profile integrating period	R/W
10500 4	1	Tariff	R/W
10510 7	1	Tariff of the next meter reading profile period	R
10600-10603 4	*4*	*Device clock*	*R/W*
10700-10703 4	*4*	*Date and time of next reset*	*R/W*
10800-10803 4	*4*	*Date and time of next cutoff date*	*R/W*
11000 5	1	(De)activation of the webserver	R/W
11100 5		Restores interface parameters to default settings	R/W
11200-11209 4	1	*Request meter reading profile interval*	*R/W*
11300-11302 7	*10* 3	Response to request for meter reading profile interval	R/W
14000-14005 6,7	6	Set device clock	R/W
14100-14105 6,7	6	Set date and time of the next reset	R/W
14200-14205 6,7	6	Set date and time of the next cutoff date	R/W

Table 3: Modbus TCP Address Range

Access: R = **r**ead, W = **w**rite

Note:
The following address ranges can only be read and written block by block with fixed length:

- 3100 to 3835
- 10600 to 10803
- 11200 to 11209

This is a device-specific restriction for the assurance of the data consistency of the parameters and the data within this address range. All other registers can also be read proportionately in accordance with the Modbus specification.
With order feature Z2, some registers can be read or written registered by register. The restriction does not apply in this case. Data consistency is nevertheless assured.
Please observe the footnotes on pages 26 and 27 in this regard.

3 Only available with order feature Z2
4 Register with fixed block length: can only be read and written as a block with all variants
5 Only available as of TCP interface version 1.13
6 Only with order feature Z2: Registers can be read/written register by register.
7 Only available with order feature Z2

3.9 Details Concerning Address Space and Variables

All register addresses in this document are zero-based, and are thus transmitted directly via the interface as they're listed in the tables. No conversion is required.

Please note:
Order features Z0/Z1 and Z2 differ with regard to access to the TCP address space. With order feature Z2, some address ranges can be read and written register by register, but the address ranges can only be read and written as an entire block with order features Z0 and Z1. The descriptions of the address spaces in sections 3.9.1 and 3.9.1.2 are thus broken down in accordance with order feature Z.

3.9.1 Address Space with Flexible Addressing (Modbus standard)

The following is a description of the address range within which the register can be addressed flexibly, i.e. register by register in accordance with the Modbus standard.
Please note that this address range as included with order features Z0 and Z1 differs from the Z2 address range. The address range specified in section 3.9.1.1 is thus only valid for meters with order feature Z0 and Z1, and the address range in section 3.9.1.2 is only valid for order feature Z2.

3.9.1.1 Address Space with Flexible Addressing for Order Features Z0 and Z1

Register Address (decimal)	Name	Length (words)	Format Type	FC	Description	OBIS
0	Voltage on the primary side between phases L1 and L2	1	1	4	Mantissa, exponent at address 12	
1	Voltage on the primary side between phases L2 and L3	1	1	4	Mantissa, exponent at address 12	
2	Voltage on the primary side between phases L3 and L1	1	1	4	Mantissa, exponent at address 12	
3	Mean value of voltage between phases on the primary side	1	1	4	Mantissa, exponent at address 12	
4	Primary phase voltage L1 to N	1	1	4	Mantissa, exponent at address 12	
5	Primary phase voltage L2 to N	1	1	4	Mantissa, exponent at address 12	
6	Primary phase voltage L3 to N	1	1	4	Mantissa, exponent at address 12	
7	Mean value of phase voltages on the primary side	1	1	4	Mantissa, exponent at address 12	
8	Primary phase voltage THD, L1 to N	1	5	4		
9	Primary phase voltage THD, L2 to N	1	5	4		
10	Primary phase voltage THD, L3 to N	1	5	4		
11	Frequency	1	3	4		
12	Voltage exponent	1	SINT16	4	Exponent	
13	Error status flags 1	1	6	4		
14	Error status flags 2	1	7	4		
100	L1 phase current on the primary side	1	1	4	Mantissa, exponent at address 108	
101	L2 phase current on the primary side	1	1	4	Mantissa, exponent at address 108	
102	L3 phase current on the primary side	1	1	4	Mantissa, exponent at address 108	

Register Address (decimal)	Name	Length (words)	Format Type	FC	Description	OBIS
103	Mean value of phase currents on the primary side	1	1	4	Mantissa, exponent at address 108	
104	Current in the N conductor on the primary side	1	1	4	Mantissa, exponent at address 108	
105	Phase L1 current THD	1	5	4		
106	Phase L2 current THD	1	5	4		
107	Phase L3 current THD	1	5	4		
108	Current exponent	1	SINT16	4	Exponent	
109	Error status flags 1	1	6	4		
110	Error status flags 2	1	7	4		
200	Active power P1 on the primary side	1	1	4	Mantissa, exponent at address 212	
201	Active power P2 on the primary side	1	1	4	Mantissa, exponent at address 212	
202	Active power P3 on the primary side	1	1	4	Mantissa, exponent at address 212	
203	Active power Ptot on the primary side	1	1	4	Mantissa, exponent at address 212	
204	Reactive power Q1 on the primary side	1	1	4	Mantissa, exponent at address 212	
205	Reactive power Q2 on the primary side	1	1	4	Mantissa, exponent at address 212	
206	Reactive power Q3 on the primary side	1	1	4	Mantissa, exponent at address 212	
207	Reactive power Qtot on the primary side	1	1	4	Mantissa, exponent at address 212	
208	Phase 1 power factor	1	4	4		
209	Phase 2 power factor	1	4	4		
210	Phase 3 power factor	1	4	4		
211	Total power factor	1	4	4		
212	Power exponent on the primary side	1	SINT16	4	Exponent	
213	Secondary active power, all phases	1	1	4	Mantissa, exponent at address 214	
214	Secondary power exponent	1	SINT16	4	Exponent	
215	Error status flags 1	1	6	4		
216	Error status flags 2	1	7	4		
300	Active energy import, total (all tariffs)	2	2	4	Mantissa (see format type 2)	1.8.0
302	Active energy export, total (all tariffs)	2	2	4	Mantissa (see format type 2)	2.8.0
304	Reactive energy import, total (all tariffs)	2	2	4	Mantissa (see format type 2)	3.8.0
306	Reactive energy export, total (all tariffs)	2	2	4	Mantissa (see format type 2)	4.8.0
308	Primary energy factor	2	UINT32	4	Primary energy [Wh/varh] = mantissa * factor	
310	Energy exponent	1	SINT16	4	Secondary or primary depending on energy type	
311	Energy type	1	UINT16	4	Energy value types: 0 = secondary, 1 = primary	

Register Address (decimal)	Name	Length (words)	Format Type	FC	Description	OBIS
312	Error status flags 1	1	6	4		
313	Error status flags 2	1	7	4		
400	Active energy import of the active tariff	2	2	4	Mantissa (see format type 2)	
402	Active energy export of the active tariff	2	2	4	Mantissa (see format type 2)	
404	Reactive energy import of the active tariff	2	2	4	Mantissa (see format type 2)	
406	Reactive energy export of the active tariff	2	2	4	Mantissa (see format type 2)	
408	Primary energy factor	2	UINT32	4	Primary energy [Wh/varh] = mantissa * factor	
410	Energy exponent	1	SINT16	4	Secondary or primary depending on energy type	
411	Energy type	1	UINT16	4	Energy value types: 0 = secondary, 1 = primary	
412	Active tariff	1	UINT16	4	Active tariff (1 ... 8)	
413	Error status flags 1	1	6	4		
414	Error status flags 2	1	7	4		
500	Operating hours	2	UINT32	4		
502	Operating hours since last reset	1	UINT16	4		
503	Point in time of last cutoff date	4	8	4		
507	Point in time of last reset	4	8	4		
600	Tariff 1, active energy import	2	2	4	Mantissa (see format type 2)	1.8.1
602	Tariff 1, active energy export	2	2	4	Mantissa (see format type 2)	2.8.1
604	Tariff 1, reactive energy import	2	2	4	Mantissa (see format type 2)	3.8.1
606	Tariff 1, reactive energy export	2	2	4	Mantissa (see format type 2)	4.8.1
608	Primary energy factor	2	UINT32	4	Primary energy [Wh/varh] = mantissa * factor	
610	Energy exponent	1	SINT16	4	Exponent	
611	Energy type	1	5	4	Energy value types: 0 = secondary, 1 = primary	
612	Error status flags 1	1	6	4		
613	Error status flags 2	1	7	4		
700	Tariff 2, active energy import	2	2	4	Mantissa (see format type 2)	1.8.2
702	Tariff 2, active energy export	2	2	4	Mantissa (see format type 2)	2.8.2
704	Tariff 2, reactive energy import	2	2	4	Mantissa (see format type 2)	3.8.2
706	Tariff 2, reactive energy export	2	2	4	Mantissa (see format type 2)	4.8.2

Register Address (decimal)	Name	Length (words)	Format Type	FC	Description	OBIS
708	Primary energy factor	2	UINT32	4	Primary energy [Wh/varh] = mantissa * factor	
710	Energy exponent	1	SINT16	4	Secondary or primary depending on energy type	
711	Energy type	1	5	4	Energy value types: 0 = secondary, 1 = primary	
712	Error status flags 1	1	6	4		
713	Error status flags 2	1	7	4		
800	Tariff 3, active energy import	2	2	4	Mantissa (see format type 2)	1.8.3
802	Tariff 3, active energy export	2	2	4	Mantissa (see format type 2)	2.8.3
804	Tariff 3, reactive energy import	2	2	4	Mantissa (see format type 2)	3.8.3
806	Tariff 3, reactive energy export	2	2	4	Mantissa (see format type 2)	4.8.3
808	Primary energy factor	2	UINT32	4	Primary energy [Wh/varh] = mantissa * factor	
810	Energy exponent	1	SINT16	4	Secondary or primary depending on energy type	
811	Energy type	1	5	4	Energy value types: 0 = secondary, 1 = primary	
812	Error status flags 1	1	6	4		
813	Error status flags 2	1	7	4		
900	Tariff 4, active energy import	2	2	4	Mantissa (see format type 2)	1.8.4
902	Tariff 4, active energy export	2	2	4	Mantissa (see format type 2)	2.8.4
904	Tariff 4, reactive energy import	2	2	4	Mantissa (see format type 2)	3.8.4
906	Tariff 4, reactive energy export	2	2	4	Mantissa (see format type 2)	4.8.4
908	Primary energy factor	2	UINT32	4	Primary energy [Wh/varh] = mantissa * factor	
910	Energy exponent	1	SINT16	4	Secondary or primary depending on energy type	
911	Energy type	1	5	4	Energy value types: 0 = secondary, 1 = primary	
912	Error status flags 1	1	6	4		
913	Error status flags 2	1	7	4		

Register Address (decimal)	Name	Length (words)	Format Type	FC	Description	OBIS
1000	Tariff 5, active energy import	2	2	4	Mantissa (see format type 2)	1.8.5
1002	Tariff 5, active energy export	2	2	4	Mantissa (see format type 2)	2.8.5
1004	Tariff 5, reactive energy import	2	2	4	Mantissa (see format type 2)	3.8.5
1006	Tariff 5, reactive energy export	2	2	4	Mantissa (see format type 2)	4.8.5
1008	Primary energy factor	2	UINT32	4	Primary energy [Wh/varh] = mantissa * factor	
1010	Energy exponent	1	SINT16	4	Secondary or primary depending on energy type	
1011	Energy type	1	5	4	Energy value types: 0 = secondary, 1 = primary	
1012	Error status flags 1	1	6	4		
1013	Error status flags 2	1	7	4		
1100	Tariff 6, active energy import	2	2	4	Mantissa (see format type 2)	1.8.6
1102	Tariff 6, active energy export	2	2	4	Mantissa (see format type 2)	2.8.6
1104	Tariff 6, reactive energy import	2	2	4	Mantissa (see format type 2)	3.8.6
1106	Tariff 6, reactive energy export	2	2	4	Mantissa (see format type 2)	4.8.6
1108	Primary energy factor	2	UINT32	4	Primary energy [Wh/varh] = mantissa * factor	
1110	Energy exponent	1	SINT16	4	Secondary or primary depending on energy type	
1111	Energy type	1	5	4	Energy value types: 0 = secondary, 1 = primary	
1112	Error status flags 1	1	6	4		
1113	Error status flags 2	1	7	4		
1200	Tariff 7, active energy import	2	2	4	Mantissa (see format type 2)	1.8.7
1202	Tariff 7, active energy export	2	2	4	Mantissa (see format type 2)	2.8.7
1204	Tariff 7, reactive energy import	2	2	4	Mantissa (see format type 2)	3.8.7
1206	Tariff 7, reactive energy export	2	2	4	Mantissa (see format type 2)	4.8.7
1208	Primary energy factor	2	UINT32	4	Primary energy [Wh/varh] = mantissa * factor	
1210	Energy exponent	1	SINT16	4	Secondary or primary depending on energy type	
1211	Energy type	1	5	4	Energy value types: 0 = secondary, 1 = primary	
1212	Error status flags 1	1	6	4		
1213	Error status flags 2	1	7	4		

Register Address (decimal)	Name	Length (words)	Format Type	FC	Description	OBIS
1300	Tariff 8, active energy import	2	2	4	Mantissa (see format type 2)	1.8.8
1302	Tariff 8, active energy export	2	2	4	Mantissa (see format type 2)	2.8.8
1304	Tariff 8, reactive energy import	2	2	4	Mantissa (see format type 2)	3.8.8
1306	Tariff 8, reactive energy export	2	2	4	Mantissa (see format type 2)	4.8.8
1308	Primary energy factor	2	UINT32	4	Primary energy [Wh/varh] = mantissa * factor	
1310	Energy exponent	1	SINT16	4	Secondary or primary depending on energy type	
1311	Energy type	1	5	4	Energy value types: 0 = secondary, 1 = primary	
1312	Error status flags 1	1	6	4		
1313	Error status flags 2	1	7	4		
1400	Active energy import, tariff 1, on cutoff date	2	2	4	Mantissa (see format type 2)	
1402	Active energy export, tariff 1, on cutoff date	2	2	4	Mantissa (see format type 2)	
1404	Reactive energy import, tariff 1, on cutoff date	2	2	4	Mantissa (see format type 2)	
1406	Reactive energy export, tariff 1, on cutoff date	2	2	4	Mantissa (see format type 2)	
1408	Primary energy factor	2	UINT32	4	Primary energy [Wh/varh] = mantissa * factor	
1410	Energy exponent	1	SINT16	4	Secondary or primary depending on energy type	
1411	Energy type	1	5	4	Energy value types: 0 = secondary, 1 = primary	
1500	Active energy import, tariff 2, on cutoff date	2	2	4	Mantissa (see format type 2)	
1502	Active energy export, tariff 2, on cutoff date	2	2	4	Mantissa (see format type 2)	
1504	Reactive energy import, tariff 2, on cutoff date	2	2	4	Mantissa (see format type 2)	
1506	Reactive energy export, tariff 2, on cutoff date	2	2	4	Mantissa (see format type 2)	
1508	Primary energy factor	2	UINT32	4	Primary energy [Wh/varh] = mantissa * factor	
1510	Energy exponent	1	SINT16	4	Secondary or primary depending on energy type	
1511	Energy type	1	5	4	Energy value types: 0 = secondary, 1 = primary	

Register Address (decimal)	Name	Length (words)	Format Type	FC	Description	OBIS
1600	Active energy import, tariff 3, on cutoff date	2	2	4	Mantissa (see format type 2)	
1602	Active energy export, tariff 3, on cutoff date	2	2	4	Mantissa (see format type 2)	
1604	Reactive energy import, tariff 3, on cutoff date	2	2	4	Mantissa (see format type 2)	
1606	Reactive energy export, tariff 3, on cutoff date	2	2	4	Mantissa (see format type 2)	
1608	Primary energy factor	2	UINT32	4	Primary energy [Wh/varh] = mantissa * factor	
1610	Energy exponent	1	SINT16	4	Secondary or primary depending on energy type	
1611	Energy type	1	5	4	Energy value types: 0 = secondary, 1 = primary	
1700	Active energy import, tariff 4, on cutoff date	2	2	4	Mantissa (see format type 2)	
1702	Active energy export, tariff 4, on cutoff date	2	2	4	Mantissa (see format type 2)	
1704	Reactive energy import, tariff 4, on cutoff date	2	2	4	Mantissa (see format type 2)	
1706	Reactive energy export, tariff 4, on cutoff date	2	2	4	Mantissa (see format type 2)	
1708	Primary energy factor	2	UINT32	4	Primary energy [Wh/varh] = mantissa * factor	
1710	Energy exponent	1	SINT16	4	Secondary or primary depending on energy type	
1711	Energy type	1	5	4	Energy value types: 0 = secondary, 1 = primary	
1800	Active energy import, tariff 5, on cutoff date	2	2	4	Mantissa (see format type 2)	
1802	Active energy export, tariff 5, on cutoff date	2	2	4	Mantissa (see format type 2)	
1804	Reactive energy import, tariff 5, on cutoff date	2	2	4	Mantissa (see format type 2)	
1806	Reactive energy export, tariff 5, on cutoff date	2	2	4	Mantissa (see format type 2)	
1808	Primary energy factor	2	UINT32	4	Primary energy [Wh/varh] = mantissa * factor	
1810	Energy exponent	1	SINT16	4	Secondary or primary depending on energy type	
1811	Energy type	1	5	4	Energy value types: 0 = secondary, 1 = primary	

Register Address (decimal)	Name	Length (words)	Format Type	FC	Description	OBIS
1900	Active energy import, tariff 6, on cutoff date	2	2	4	Mantissa (see format type 2)	
1902	Active energy export, tariff 6, on cutoff date	2	2	4	Mantissa (see format type 2)	
1904	Reactive energy import, tariff 6, on cutoff date	2	2	4	Mantissa (see format type 2)	
1906	Reactive energy export, tariff 6, on cutoff date	2	2	4	Mantissa (see format type 2)	
1908	Primary energy factor	2	UINT32	4	Primary energy [Wh/varh] = mantissa * factor	
1910	Energy exponent	1	SINT16	4	Secondary or primary depending on energy type	
1911	Energy type	1	5	4	Energy value types: 0 = secondary, 1 = primary	
2000	Active energy import, tariff 7, on cutoff date	2	2	4	Mantissa (see format type 2)	
2002	Active energy export, tariff 7, on cutoff date	2	2	4	Mantissa (see format type 2)	
2004	Reactive energy import, tariff 7, on cutoff date	2	2	4	Mantissa (see format type 2)	
2006	Reactive energy export, tariff 7, on cutoff date	2	2	4	Mantissa (see format type 2)	
2008	Primary energy factor	2	UINT32	4	Primary energy [Wh/varh] = mantissa * factor	
2010	Energy exponent	1	SINT16	4	Secondary or primary depending on energy type	
2011	Energy type	1	5	4	Energy value types: 0 = secondary, 1 = primary	
2100	Active energy import, tariff 8, on cutoff date	2	2	4	Mantissa (see format type 2)	
2102	Active energy export, tariff 8, on cutoff date	2	2	4	Mantissa (see format type 2)	
2104	Reactive energy import, tariff 8, on cutoff date	2	2	4	Mantissa (see format type 2)	
2106	Reactive energy export, tariff 8, on cutoff date	2	2	4	Mantissa (see format type 2)	
2108	Primary energy factor	2	UINT32	4	Primary energy [Wh/varh] = mantissa * factor	
2110	Energy exponent	1	SINT16	4	Secondary or primary depending on energy type	
2111	Energy type	1	5	4	Energy value types: 0 = secondary, 1 = primary	
2200	Resettable active energy import, tariff 1	2	2	4	Mantissa (see format type 2)	
2202	Resettable active energy export, tariff 1	2	2	4	Mantissa (see format type 2)	
2204	Resettable reactive energy	2	2	4	Mantissa (see	

Register Address (decimal)	Name	Length (words)	Format Type	FC	Description	OBIS
	import, tariff 1				format type 2)	
2206	Resettable reactive energy export, tariff 1	2	2	4	Mantissa (see format type 2)	
2208	Primary energy factor	2	UINT32	4	Primary energy [Wh/varh] = mantissa * factor	
2210	Energy exponent	1	SINT16	4	Secondary or primary depending on energy type	
2211	Energy type	1	5	4	Energy value types: 0 = secondary, 1 = primary	
2300	Resettable active energy import, tariff 2	2	2	4	Mantissa (see format type 2)	
2302	Resettable active energy export, tariff 2	2	2	4	Mantissa (see format type 2)	
2304	Resettable reactive energy import, tariff 2	2	2	4	Mantissa (see format type 2)	
2306	Resettable reactive energy export, tariff 2	2	2	4	Mantissa (see format type 2)	
2308	Primary energy factor	2	UINT32	4	Primary energy [Wh/varh] = mantissa * factor	
2310	Energy exponent	1	SINT16	4	Secondary or primary depending on energy type	
2311	Energy type	1	5	4	Energy value types: 0 = secondary, 1 = primary	
2400	Resettable active energy import, tariff 3	2	2	4	Mantissa (see format type 2)	
2402	Resettable active energy export, tariff 3	2	2	4	Mantissa (see format type 2)	
2404	Resettable reactive energy import, tariff 3	2	2	4	Mantissa (see format type 2)	
2406	Resettable reactive energy export, tariff 3	2	2	4	Mantissa (see format type 2)	
2408	Primary energy factor	2	UINT32	4	Primary energy [Wh/varh] = mantissa * factor	
2410	Energy exponent	1	SINT16	4	Secondary or primary depending on energy type	
2411	Energy type	1	5	4	Energy value types: 0 = secondary, 1 = primary	
2500	Resettable active energy import, tariff 4	2	2	4	Mantissa (see format type 2)	
2502	Resettable active energy export, tariff 4	2	2	4	Mantissa (see format type 2)	
2504	Resettable reactive energy import, tariff 4	2	2	4	Mantissa (see format type 2)	
2506	Resettable reactive energy export, tariff 4	2	2	4	Mantissa (see format type 2)	
2508	Primary energy factor	2	UINT32	4	Primary energy [Wh/varh] =	

Register Address (decimal)	Name	Length (words)	Format Type	FC	Description	OBIS
					mantissa * factor	
2510	Energy exponent	1	SINT16	4	Secondary or primary depending on energy type	
2511	Energy type	1	5	4	Energy value types: 0 = secondary, 1 = primary	
2600	Resettable active energy import, tariff 5	2	2	4	Mantissa (see format type 2)	
2602	Resettable active energy export, tariff 5	2	2	4	Mantissa (see format type 2)	
2604	Resettable reactive energy import, tariff 5	2	2	4	Mantissa (see format type 2)	
2606	Resettable reactive energy export, tariff 5	2	2	4	Mantissa (see format type 2)	
2608	Primary energy factor	2	UINT32	4	Primary energy [Wh/varh] = mantissa * factor	
2610	Energy exponent	1	SINT16	4	Secondary or primary depending on energy type	
2611	Energy type	1	5	4	Energy value types: 0 = secondary, 1 = primary	
2700	Resettable active energy import, tariff 6	2	2	4	Mantissa (see format type 2)	
2702	Resettable active energy export, tariff 6	2	2	4	Mantissa (see format type 2)	
2704	Resettable reactive energy import, tariff 6	2	2	4	Mantissa (see format type 2)	
2706	Resettable reactive energy export, tariff 6	2	2	4	Mantissa (see format type 2)	
2708	Primary energy factor	2	UINT32	4	Primary energy [Wh/varh] = mantissa * factor	
2710	Energy exponent	1	SINT16	4	Secondary or primary depending on energy type	
2711	Energy type	1	5	4	Energy value types: 0 = secondary, 1 = primary	
2800	Resettable active energy import, tariff 7	2	2	4	Mantissa (see format type 2)	
2802	Resettable active energy export, tariff 7	2	2	4	Mantissa (see format type 2)	
2804	Resettable reactive energy import, tariff 7	2	2	4	Mantissa (see format type 2)	
2806	Resettable reactive energy export, tariff 7	2	2	4	Mantissa (see format type 2)	
2808	Primary energy factor	2	UINT32	4	Primary energy [Wh/varh] = mantissa * factor	
2810	Energy exponent	1	SINT16	4	Secondary or primary depending on energy type	

Register Address (decimal)	Name	Length (words)	Format Type	FC	Description	OBIS
2811	Energy type	1	5	4	Energy value types: 0 = secondary, 1 = primary	
2900	Resettable active energy import, tariff 8	2	2	4	Mantissa (see format type 2)	
2902	Resettable active energy export, tariff 8	2	2	4	Mantissa (see format type 2)	
2904	Resettable reactive energy import, tariff 8	2	2	4	Mantissa (see format type 2)	
2906	Resettable reactive energy export, tariff 8	2	2	4	Mantissa (see format type 2)	
2908	Primary energy factor	2	UINT32	4	Primary energy [Wh/varh] = mantissa * factor	
2910	Energy exponent	1	SINT16	4	Secondary or primary depending on energy type	
2911	Energy type	1	5	4	Energy value types: 0 = secondary, 1 = primary	
3000	Features	36	13	4	Device options and information	
10000	Current transformer ratio (CT)	1	UINT16	03/16	Limit values exist for CT x VT	
10100	Voltage transformer ratio (VT)	1	UINT16	03/16	Limit values exist for CT x VT	
10400	Meter reading profile integrating period	1	UINT16	03/16	Selectable settings: 1, 2, 3, 4, 5, 10, 15, 30, 60 (minutes)	
10500	Tariff	1	UINT16	03/16	Tariff selection: 1 … 8 or 0 0 means that hardware tariff selection is active. **See also section 2.8.**	
11000	Webserver de/activation	1	UINT16	03/16	0 = deactivated 1 = activated	
11100	Default settings for Ethernet and BACnet	1	UINT16	03/16	This register initializes default settings for Ethernet and BACnet and restarts the interface controller with the value 0EDF hex.	

Table 4: Address Space with Flexible Addressing for Order Features Z0 and Z1

3.9.1.2 Address Space with Flexible Addressing for Order Feature Z2

Register Address (decimal)	Name	Length (words)	Format Type	FC	Description	OBIS
0	Voltage on the primary side between phases L1 and L2	1	1	4	Mantissa, exponent at address 12	
1	Voltage on the primary side between phases L2 and L3	1	1	4	Mantissa, exponent at address 12	
2	Voltage on the primary side between phases L3 and L1	1	1	4	Mantissa, exponent at address 12	
3	Mean value of voltage between phases on the primary side	1	1	4	Mantissa, exponent at address 12	
4	Primary phase voltage L1 to N	1	1	4	Mantissa, exponent at address 12	
5	Primary phase voltage L2 to N	1	1	4	Mantissa, exponent at address 12	
6	Primary phase voltage L3 to N	1	1	4	Mantissa, exponent at address 12	
7	Mean value of phase voltages on the primary side	1	1	4	Mantissa, exponent at address 12	
8	Primary phase voltage THD, L1 to N	1	5	4		
9	Primary phase voltage THD, L2 to N	1	5	4		
10	Primary phase voltage THD, L3 to N	1	5	4		
11	Frequency	1	3	4		
12	Voltage exponent	1	SINT16	4	Exponent	
13	Error status flags 1	1	6	4		
14	Error status flags 2	1	7	4		
100	L1 phase current on the primary side	1	1	4	Mantissa, exponent at address 108	
101	L2 phase current on the primary side	1	1	4	Mantissa, exponent at address 108	
102	L3 phase current on the primary side	1	1	4	Mantissa, exponent at address 108	
103	Mean value of phase currents on the primary side	1	1	4	Mantissa, exponent at address 108	
104	Current in the N conductor on the primary side	1	1	4	Mantissa, exponent at address 108	
105	Phase L1 current THD	1	5	4		
106	Phase L2 current THD	1	5	4		
107	Phase L3 current THD	1	5	4		
108	Current exponent	1	SINT16	4	Exponent	
109	Error status flags 1	1	6	4		
110	Error status flags 2	1	7	4		
200	Active power P1 on the primary side	1	1	4	Mantissa, exponent at address 212	
201	Active power P2 on the primary side	1	1	4	Mantissa, exponent at address 212	
202	Active power P3 on the primary side	1	1	4	Mantissa, exponent at address 212	

Register Address (decimal)	Name	Length (words)	Format Type	FC	Description	OBIS
203	Active power Ptot on the primary side	1	1	4	Mantissa, exponent at address 212	
204	Reactive power Q1 on the primary side	1	1	4	Mantissa, exponent at address 212	
205	Reactive power Q2 on the primary side	1	1	4	Mantissa, exponent at address 212	
206	Reactive power Q3 on the primary side	1	1	4	Mantissa, exponent at address 212	
207	Reactive power Q_{tot} on the primary side	1	1	4	Mantissa, exponent at address 212	
208	Phase 1 power factor	1	4	4		
209	Phase 2 power factor	1	4	4		
210	Phase 3 power factor	1	4	4		
211	Total power factor	1	4	4		
212	Power exponent on the primary side	1	SINT16	4	Exponent	
213	Secondary active power, all phases	1	1	4	Mantissa, exponent at address 214	
214	Secondary power exponent	1	SINT16	4	Exponent	
215	Error status flags 1	1	6	4		
216	Error status flags 2	1	7	4		
300	Active energy import, total (all tariffs)	2	2	4	Mantissa (see format type 2)	1.8.0
302	Active energy export, total (all tariffs)	2	2	4	Mantissa (see format type 2)	2.8.0
304	Reactive energy import, total (all tariffs)	2	2	4	Mantissa (see format type 2)	3.8.0
306	Reactive energy export, total (all tariffs)	2	2	4	Mantissa (see format type 2)	4.8.0
308	Primary energy factor	2	UINT32	4	Primary energy [Wh/varh] = mantissa * factor	
310	Energy exponent	1	SINT16	4	Secondary or primary depending on energy type	
311	Energy type	1	UINT16	4	Energy value types: 0 = secondary, 1 = primary	
312	Error status flags 1	1	6	4		
313	Error status flags 2	1	7	4		
400	Active energy import of the active tariff	2	2	4	Mantissa (see format type 2)	
402	Active energy export of the active tariff	2	2	4	Mantissa (see format type 2)	
404	Reactive energy import of the active tariff	2	2	4	Mantissa (see format type 2)	
406	Reactive energy export of the active tariff	2	2	4	Mantissa (see format type 2)	
408	Primary energy factor	2	UINT32	4	Primary energy [Wh/varh] = mantissa * factor	
410	Energy exponent	1	SINT16	4	Secondary or primary depending on energy type	
411	Energy type	1	UINT16	4	Energy value types:	

Register Address (decimal)	Name	Length (words)	Format Type	FC	Description	OBIS
					0 = secondary, 1 = primary	
412	Active tariff	1	UINT16	4	Active tariff (1 ... 8)	
413	Error status flags 1	1	6	4		
414	Error status flags 2	1	7	4		
500	Operating hours	2	UINT32	4		
502	Operating hours since last reset	1	UINT16	4		
503	Point in time of last cutoff date	4	8	4		
507	Point in time of last reset	4	8	4		
600	Tariff 1, active energy import	2	2	4	Mantissa (see format type 2)	1.8.1
602	Tariff 1, active energy export	2	2	4	Mantissa (see format type 2)	2.8.1
604	Tariff 1, reactive energy import	2	2	4	Mantissa (see format type 2)	3.8.1
606	Tariff 1, reactive energy export	2	2	4	Mantissa (see format type 2)	4.8.1
608	Primary energy factor	2	UINT32	4	Primary energy [Wh/varh] = mantissa * factor	
610	Energy exponent	1	SINT16	4	Exponent	
611	Energy type	1	5	4	Energy value types: 0 = secondary, 1 = primary	
612	Error status flags 1	1	6	4		
613	Error status flags 2	1	7	4		
700	Tariff 2, active energy import	2	2	4	Mantissa (see format type 2)	1.8.2
702	Tariff 2, active energy export	2	2	4	Mantissa (see format type 2)	2.8.2
704	Tariff 2, reactive energy import	2	2	4	Mantissa (see format type 2)	3.8.2
706	Tariff 2, reactive energy export	2	2	4	Mantissa (see format type 2)	4.8.2
708	Primary energy factor	2	UINT32	4	Primary energy [Wh/varh] = mantissa * factor	
710	Energy exponent	1	SINT16	4	Secondary or primary depending on energy type	
711	Energy type	1	5	4	Energy value types: 0 = secondary, 1 = primary	
712	Error status flags 1	1	6	4		
713	Error status flags 2	1	7	4		
800	Tariff 3, active energy import	2	2	4	Mantissa (see format type 2)	1.8.3
802	Tariff 3, active energy export	2	2	4	Mantissa (see format type 2)	2.8.3
804	Tariff 3, reactive energy import	2	2	4	Mantissa (see format type 2)	3.8.3
806	Tariff 3, reactive energy	2	2	4	Mantissa (see format	4.8.3

Register Address (decimal)	Name	Length (words)	Format Type	FC	Description	OBIS
	export				type 2)	
808	Primary energy factor	2	UINT32	4	Primary energy [Wh/varh] = mantissa * factor	
810	Energy exponent	1	SINT16	4	Secondary or primary depending on energy type	
811	Energy type	1	5	4	Energy value types: 0 = secondary, 1 = primary	
812	Error status flags 1	1	6	4		
813	Error status flags 2	1	7	4		
900	Tariff 4, active energy import	2	2	4	Mantissa (see format type 2)	1.8.4
902	Tariff 4, active energy export	2	2	4	Mantissa (see format type 2)	2.8.4
904	Tariff 4, reactive energy import	2	2	4	Mantissa (see format type 2)	3.8.4
906	Tariff 4, reactive energy export	2	2	4	Mantissa (see format type 2)	4.8.4
908	Primary energy factor	2	UINT32	4	Primary energy [Wh/varh] = mantissa * factor	
910	Energy exponent	1	SINT16	4	Secondary or primary depending on energy type	
911	Energy type	1	5	4	Energy value types: 0 = secondary, 1 = primary	
912	Error status flags 1	1	6	4		
913	Error status flags 2	1	7	4		
1000	Tariff 5, active energy import	2	2	4	Mantissa (see format type 2)	1.8.5
1002	Tariff 5, active energy export	2	2	4	Mantissa (see format type 2)	2.8.5
1004	Tariff 5, reactive energy import	2	2	4	Mantissa (see format type 2)	3.8.5
1006	Tariff 5, reactive energy export	2	2	4	Mantissa (see format type 2)	4.8.5
1008	Primary energy factor	2	UINT32	4	Primary energy [Wh/varh] = mantissa * factor	
1010	Energy exponent	1	SINT16	4	Secondary or primary depending on energy type	
1011	Energy type	1	5	4	Energy value types: 0 = secondary, 1 = primary	
1012	Error status flags 1	1	6	4		
1013	Error status flags 2	1	7	4		
1100	Tariff 6, active energy import	2	2	4	Mantissa (see format type 2)	1.8.6
1102	Tariff 6, active energy export	2	2	4	Mantissa (see format type 2)	2.8.6
1104	Tariff 6, reactive energy	2	2	4	Mantissa (see format	3.8.6

Register Address (decimal)	Name	Length (words)	Format Type	FC	Description	OBIS
	import				type 2)	
1106	Tariff 6, reactive energy export	2	2	4	Mantissa (see format type 2)	4.8.6
1108	Primary energy factor	2	UINT32	4	Primary energy [Wh/varh] = mantissa * factor	
1110	Energy exponent	1	SINT16	4	Secondary or primary depending on energy type	
1111	Energy type	1	5	4	Energy value types: 0 = secondary, 1 = primary	
1112	Error status flags 1	1	6	4		
1113	Error status flags 2	1	7	4		
1200	Tariff 7, active energy import	2	2	4	Mantissa (see format type 2)	1.8.7
1202	Tariff 7, active energy export	2	2	4	Mantissa (see format type 2)	2.8.7
1204	Tariff 7, reactive energy import	2	2	4	Mantissa (see format type 2)	3.8.7
1206	Tariff 7, reactive energy export	2	2	4	Mantissa (see format type 2)	4.8.7
1208	Primary energy factor	2	UINT32	4	Primary energy [Wh/varh] = mantissa * factor	
1210	Energy exponent	1	SINT16	4	Secondary or primary depending on energy type	
1211	Energy type	1	5	4	Energy value types: 0 = secondary, 1 = primary	
1212	Error status flags 1	1	6	4		
1213	Error status flags 2	1	7	4		
1300	Tariff 8, active energy import	2	2	4	Mantissa (see format type 2)	1.8.8
1302	Tariff 8, active energy export	2	2	4	Mantissa (see format type 2)	2.8.8
1304	Tariff 8, reactive energy import	2	2	4	Mantissa (see format type 2)	3.8.8
1306	Tariff 8, reactive energy export	2	2	4	Mantissa (see format type 2)	4.8.8
1308	Primary energy factor	2	UINT32	4	Primary energy [Wh/varh] = mantissa * factor	
1310	Energy exponent	1	SINT16	4	Secondary or primary depending on energy type	
1311	Energy type	1	5	4	Energy value types: 0 = secondary, 1 = primary	
1312	Error status flags 1	1	6	4		
1313	Error status flags 2	1	7	4		
1400	Active energy import, tariff 1, on cutoff date	2	2	4	Mantissa (see format type 2)	
1402	Active energy export, tariff	2	2	4	Mantissa (see format	

Register Address (decimal)	Name	Length (words)	Format Type	FC	Description	OBIS
	1, on cutoff date				type 2)	
1404	Reactive energy import, tariff 1, on cutoff date	2	2	4	Mantissa (see format type 2)	
1406	Reactive energy export, tariff 1, on cutoff date	2	2	4	Mantissa (see format type 2)	
1408	Primary energy factor	2	UINT32	4	Primary energy [Wh/varh] = mantissa * factor	
1410	Energy exponent	1	SINT16	4	Secondary or primary depending on energy type	
1411	Energy type	1	5	4	Energy value types: 0 = secondary, 1 = primary	
1500	Active energy import, tariff 2, on cutoff date	2	2	4	Mantissa (see format type 2)	
1502	Active energy export, tariff 2, on cutoff date	2	2	4	Mantissa (see format type 2)	
1504	Reactive energy import, tariff 2, on cutoff date	2	2	4	Mantissa (see format type 2)	
1506	Reactive energy export, tariff 2, on cutoff date	2	2	4	Mantissa (see format type 2)	
1508	Primary energy factor	2	UINT32	4	Primary energy [Wh/varh] = mantissa * factor	
1510	Energy exponent	1	SINT16	4	Secondary or primary depending on energy type	
1511	Energy type	1	5	4	Energy value types: 0 = secondary, 1 = primary	
600	Active energy import, tariff 3, on cutoff date	2	2	4	Mantissa (see format type 2)	
1602	Active energy export, tariff 3, on cutoff date	2	2	4	Mantissa (see format type 2)	
1604	Reactive energy import, tariff 3, on cutoff date	2	2	4	Mantissa (see format type 2)	
1606	Reactive energy export, tariff 3, on cutoff date	2	2	4	Mantissa (see format type 2)	
1608	Primary energy factor	2	UINT32	4	Primary energy [Wh/varh] = mantissa * factor	
1610	Energy exponent	1	SINT16	4	Secondary or primary depending on energy type	
1611	Energy type	1	5	4	Energy value types: 0 = secondary, 1 = primary	
1700	Active energy import, tariff 4, on cutoff date	2	2	4	Mantissa (see format type 2)	
1702	Active energy export, tariff 4, on cutoff date	2	2	4	Mantissa (see format type 2)	
1704	Reactive energy import, tariff 4, on cutoff date	2	2	4	Mantissa (see format type 2)	
1706	Reactive energy export, tariff 4, on cutoff date	2	2	4	Mantissa (see format type 2)	

Register Address (decimal)	Name	Length (words)	Format Type	FC	Description	OBIS
1708	Primary energy factor	2	UINT32	4	Primary energy [Wh/varh] = mantissa * factor	
1710	Energy exponent	1	SINT16	4	Secondary or primary depending on energy type	
1711	Energy type	1	5	4	Energy value types: 0 = secondary, 1 = primary	
1800	Active energy import, tariff 5, on cutoff date	2	2	4	Mantissa (see format type 2)	
1802	Active energy export, tariff 5, on cutoff date	2	2	4	Mantissa (see format type 2)	
1804	Reactive energy import, tariff 5, on cutoff date	2	2	4	Mantissa (see format type 2)	
1806	Reactive energy export, tariff 5, on cutoff date	2	2	4	Mantissa (see format type 2)	
1808	Primary energy factor	2	UINT32	4	Primary energy [Wh/varh] = mantissa * factor	
1810	Energy exponent	1	SINT16	4	Secondary or primary depending on energy type	
1811	Energy type	1	5	4	Energy value types: 0 = secondary, 1 = primary	
1900	Active energy import, tariff 6, on cutoff date	2	2	4	Mantissa (see format type 2)	
1902	Active energy export, tariff 6, on cutoff date	2	2	4	Mantissa (see format type 2)	
1904	Reactive energy import, tariff 6, on cutoff date	2	2	4	Mantissa (see format type 2)	
1906	Reactive energy export, tariff 6, on cutoff date	2	2	4	Mantissa (see format type 2)	
1908	Primary energy factor	2	UINT32	4	Primary energy [Wh/varh] = mantissa * factor	
1910	Energy exponent	1	SINT16	4	Secondary or primary depending on energy type	
1911	Energy type	1	5	4	Energy value types: 0 = secondary, 1 = primary	
2000	Active energy import, tariff 7, on cutoff date	2	2	4	Mantissa (see format type 2)	
2002	Active energy export, tariff 7, on cutoff date	2	2	4	Mantissa (see format type 2)	
2004	Reactive energy import, tariff 7, on cutoff date	2	2	4	Mantissa (see format type 2)	
2006	Reactive energy export, tariff 7, on cutoff date	2	2	4	Mantissa (see format type 2)	
2008	Primary energy factor	2	UINT32	4	Primary energy [Wh/varh] = mantissa * factor	

Register Address (decimal)	Name	Length (words)	Format Type	FC	Description	OBIS
2010	Energy exponent	1	SINT16	4	Secondary or primary depending on energy type	
2011	Energy type	1	5	4	Energy value types: 0 = secondary, 1 = primary	
2100	Active energy import, tariff 8, on cutoff date	2	2	4	Mantissa (see format type 2)	
2102	Active energy export, tariff 8, on cutoff date	2	2	4	Mantissa (see format type 2)	
2104	Reactive energy import, tariff 8, on cutoff date	2	2	4	Mantissa (see format type 2)	
2106	Reactive energy export, tariff 8, on cutoff date	2	2	4	Mantissa (see format type 2)	
2108	Primary energy factor	2	UINT32	4	Primary energy [Wh/varh] = mantissa * factor	
2110	Energy exponent	1	SINT16	4	Secondary or primary depending on energy type	
2111	Energy type	1	5	4	Energy value types: 0 = secondary, 1 = primary	
2200	Resettable active energy import, tariff 1	2	2	4	Mantissa (see format type 2)	
2202	Resettable active energy export, tariff 1	2	2	4	Mantissa (see format type 2)	
2204	Resettable reactive energy import, tariff 1	2	2	4	Mantissa (see format type 2)	
2206	Resettable reactive energy export, tariff 1	2	2	4	Mantissa (see format type 2)	
2208	Primary energy factor	2	UINT32	4	Primary energy [Wh/varh] = mantissa * factor	
2210	Energy exponent	1	SINT16	4	Secondary or primary depending on energy type	
2211	Energy type	1	5	4	Energy value types: 0 = secondary, 1 = primary	
2300	Resettable active energy import, tariff 2	2	2	4	Mantissa (see format type 2)	
2302	Resettable active energy export, tariff 2	2	2	4	Mantissa (see format type 2)	
2304	Resettable reactive energy import, tariff 2	2	2	4	Mantissa (see format type 2)	
2306	Resettable reactive energy export, tariff 2	2	2	4	Mantissa (see format type 2)	
2308	Primary energy factor	2	UINT32	4	Primary energy [Wh/varh] = mantissa * factor	
2310	Energy exponent	1	SINT16	4	Secondary or primary depending on energy type	

Register Address (decimal)	Name	Length (words)	Format Type	FC	Description	OBIS
2311	Energy type	1	5	4	Energy value types: 0 = secondary, 1 = primary	
2400	Resettable active energy import, tariff 3	2	2	4	Mantissa (see format type 2)	
2402	Resettable active energy export, tariff 3	2	2	4	Mantissa (see format type 2)	
2404	Resettable reactive energy import, tariff 3	2	2	4	Mantissa (see format type 2)	
2406	Resettable reactive energy export, tariff 3	2	2	4	Mantissa (see format type 2)	
2408	Primary energy factor	2	UINT32	4	Primary energy [Wh/varh] = mantissa * factor	
2410	Energy exponent	1	SINT16	4	Secondary or primary depending on energy type	
2411	Energy type	1	5	4	Energy value types: 0 = secondary, 1 = primary	
2500	Resettable active energy import, tariff 4	2	2	4	Mantissa (see format type 2)	
2502	Resettable active energy export, tariff 4	2	2	4	Mantissa (see format type 2)	
2504	Resettable reactive energy import, tariff 4	2	2	4	Mantissa (see format type 2)	
2506	Resettable reactive energy export, tariff 4	2	2	4	Mantissa (see format type 2)	
2508	Primary energy factor	2	UINT32	4	Primary energy [Wh/varh] = mantissa * factor	
2510	Energy exponent	1	SINT16	4	Secondary or primary depending on energy type	
2511	Energy type	1	5	4	Energy value types: 0 = secondary, 1 = primary	
2600	Resettable active energy import, tariff 5	2	2	4	Mantissa (see format type 2)	
2602	Resettable active energy export, tariff 5	2	2	4	Mantissa (see format type 2)	
2604	Resettable reactive energy import, tariff 5	2	2	4	Mantissa (see format type 2)	
2606	Resettable reactive energy export, tariff 5	2	2	4	Mantissa (see format type 2)	
2608	Primary energy factor	2	UINT32	4	Primary energy [Wh/varh] = mantissa * factor	
2610	Energy exponent	1	SINT16	4	Secondary or primary depending on energy type	
2611	Energy type	1	5	4	Energy value types: 0 = secondary, 1 = primary	

Register Address (decimal)	Name	Length (words)	Format Type	FC	Description	OBIS
2700	Resettable active energy import, tariff 6	2	2	4	Mantissa (see format type 2)	
2702	Resettable active energy export, tariff 6	2	2	4	Mantissa (see format type 2)	
2704	Resettable reactive energy import, tariff 6	2	2	4	Mantissa (see format type 2)	
2706	Resettable reactive energy export, tariff 6	2	2	4	Mantissa (see format type 2)	
2708	Primary energy factor	2	UINT32	4	Primary energy [Wh/varh] = mantissa * factor	
2710	Energy exponent	1	SINT16	4	Secondary or primary depending on energy type	
2711	Energy type	1	5	4	Energy value types: 0 = secondary, 1 = primary	
2800	Resettable active energy import, tariff 7	2	2	4	Mantissa (see format type 2)	
2802	Resettable active energy export, tariff 7	2	2	4	Mantissa (see format type 2)	
2804	Resettable reactive energy import, tariff 7	2	2	4	Mantissa (see format type 2)	
2806	Resettable reactive energy export, tariff 7	2	2	4	Mantissa (see format type 2)	
2808	Primary energy factor	2	UINT32	4	Primary energy [Wh/varh] = mantissa * factor	
2810	Energy exponent	1	SINT16	4	Secondary or primary depending on energy type	
2811	Energy type	1	5	4	Energy value types: 0 = secondary, 1 = primary	
2900	Resettable active energy import, tariff 8	2	2	4	Mantissa (see format type 2)	
2902	Resettable active energy export, tariff 8	2	2	4	Mantissa (see format type 2)	
2904	Resettable reactive energy import, tariff 8	2	2	4	Mantissa (see format type 2)	
2906	Resettable reactive energy export, tariff 8	2	2	4	Mantissa (see format type 2)	
2908	Primary energy factor	2	UINT32	4	Primary energy [Wh/varh] = mantissa * factor	
2910	Energy exponent	1	SINT16	4	Secondary or primary depending on energy type	
2911	Energy type	1	5	4	Energy value types: 0 = secondary, 1 = primary	
2920	Response: meter reading profile entry	17	12	4	Contains the meter reading profile value that was requested via register 11300.	

Register Address (decimal)	Name	Length (words)	Format Type	FC	Description	OBIS
3000	Features	36	13	4	Read our device	
3900	Response: calibration logbook entry	15	12c	4	Contains the entry requested from the calibration logbook via register 11400.	
4000	Device clock	6	8	4	Device clock	
4100	Date and time of next reset	6	UINT8	4	Read out date and time of next reset	
4200	Date and time of next cutoff date	6	UINT8	4	Read out date and time of next cutoff date	
10000	Current transformer ratio (CT)	1	UINT16	03/16	Limit values exist for CT x VT	
10100	Voltage transformer ratio (VT)	1	UINT16	03/16	Limit values exist for CT x VT	
10400	Meter reading profile integrating period	1	UINT16	03	Read out meter reading profile period (permanently set to 15 minutes)	
10500	Tariff	1	UINT16	03/16	Tariff selection: 1 … 8 or 0 0 means that hardware tariff selection is active. **See also section 2.8.**	
10510	Tariff of the next meter reading profile period	1	UINT16	03	Read out tariff of the next meter reading profile period **See also section 2.8.**	
11000	Webserver de/activation	1	UINT16	03/16	0 = deactivated 1 = activated	
11100	Default settings for Ethernet and BACnet	1	UINT16	03/16	This register initializes default settings for Ethernet and BACnet and restarts the interface controller with the value 0EDF hex.	
11300	Query certified meter reading profile	3	15	03/16	Response can be read from register 2920	
11400	Request calibration logbook entry	2	12d	03/16	Response can be read from register 3900	

Register Address (decimal)	Name	Length (words)	Format Type	FC	Description	OBIS
14000	Set device clock	6	16	03/16	Writing to this register is no longer possible when the calibration log book is full.	
14100	Set date and time of the next reset	6	16	03/16		
14200	Set date and time of the next cutoff date	6	16	03/16		

Table 4: Address Space with Flexible Addressing for Order Feature Z2

3.9.2 Address Space with Fixed Block Size

Address spaces with fixed block sizes differ for order features Z0 / Z1 (no meter reading profile / with non-certified meter reading profile) and order feature Z2 (with certified meter reading profile), and are described in sections 3.9.2.1 and 3.9.2.2 below.

3.9.2.1 Address Space with Fixed Block Size for Order Features Z0 and Z1

Register Address (decimal)	Name	Fixed Length (words)	Format Type	FC	Description
3100	Operating logbook, last entry	16	10	4	
3200	Operating logbook, previous entry	16	10	4	
3300	Operating logbook, next entry	16	10	4	
3400	Meter reading profile, last entry	32	11	4	
3500	Meter reading profile, previous entry	32	11	4	
3600	Meter reading profile, next entry	32	11	4	
3700	HW and FW versions	2	9	4	Interface HW and FW versions
10600	Device clock time at the meter	4	8	16 / 3	
10700	Date and time for resetting	4	8	16 / 3	
10800	Date and time of the cutoff date	4	8	16 / 3	

Table 5: Address Space with Fixed Block Size for Order Features Z0 and Z1

3.9.2.2 Address Space with Fixed Block Size for Order Feature Z2

Register Address (decimal)	Name	Fixed Length (words)	Format Type	FC	Description
3100	Operating logbook, last entry	16	10	4	
3200	Operating logbook, previous entry	16	10	4	
3300	Operating logbook, next entry	16	10	4	
3400	Meter reading profile, last entry	17	11c	4	
3500	Meter reading profile, previous entry	17	11c	4	
3600	Meter reading profile, next entry	17	11c	4	
3700	HW and FW versions	2	9	4	Interface HW and FW versions
3800	Meter reading interval response	36	14	4	
10600	Device clock time at the meter	4	8	16 / 3	Writing to this register is no longer possible when the calibration log book is full.
10700	Date and time for resetting	4	8	16 / 3	
10800	Date and time of the cutoff date	4	8	16 / 3	
11200	Request meter reading profile interval	10	13	16 / 3	

Table 6: Address Space with Fixed Block Size for Order Feature Z2

3.9.3 Variable Types

Standard Variable Types	UINT8 8-bit integer, no leading sign SINT8 8-bit integer, with leading sign UINT16 16-bit integer, no leading sign SINT16 16-bit integer, with leading sign UINT32 32-bit integer, no leading sign SINT32 32-bit integer, with leading sign

Table 7: U2x8x Variable Types

3.10 Format Types

3.10.1 Format Type 1 (voltage, current, power)

This format consists of two components:

- Mantissa (SINT16)
- Exponent (SINT16): The exponent is saved in the exponent register.

The value of the measured quantity is calculated as follows:

$$Variable\ value = mantissa * 10^{exponent}$$

U/M of the variables:

- Voltage V
- Current A
- Power W or VA or VAr depending on the type of power

Example:
A voltage exponent of -1 and a voltage value of 2309 are read as:

Mantissa register:	09h	05h
Exponent register:	FFh	FFh

And thus measured voltage amounts to:

$2309 * 10^{(-1)} = 230.9$ V

Note: If the mantissa has a value of 8000h, this means that the variable is undefined.

3.10.2 Format Type 2 (energy)

Calibratable energy values are saved as UINT32 values.

- Mantissa: UINT32

The primary energy value is always transmitted.

- Primary energy factor: UINT32
- Exponent: SINT16

Primary energy in watt hours is calculated as follows for all meter types (regardless of energy type):

$$Primary\ energy\ [Wh/VArh] = mantissa * primary\ energy\ factor$$

Or:

$$Primary\ energy\ [Wh/VArh] = mantissa * (10^{exponent})$$

Example:
Calculation of primary active energy (import and export) of the active tariff:

Active energy import [Wh] = mantissa (address 400, UINT32) * factor (address 408, UINT32)
Active energy export [Wh] = mantissa (address 402, UINT32) * factor (address 408, UINT32)

3.10.3 Format Type 3 (frequency)

Is used for frequency and is defined as follows:

- Mantissa (UINT16)

Frequency is calculated as follows:

*Variable value = mantissa * 0.01 [Hz]*

Example:
A frequency mantissa of 5002 is read as

Frequency register: **13h** | **8Ah**

$$5002 * 0{,}01 = 50{,}02 \text{ Hz}$$

3.10.4 Format Type 4 (power factor)

Is used for power factor and is defined as follows:

- Mantissa (SINT16)

Power factor is calculated as follows:

$$\textit{Variable value} = \frac{Mantisse}{1000}$$

Example:
A power factor mantissa of 985 is read as

Power factor register: **03h** | **D9h**

$$\frac{985}{1000} = 0.985$$

3.10.5 Format Type 5 (total harmonic distortion – THD)

Is used for THD and is defined as follows:

- Mantissa (UINT16)

THD is calculated as follows:

$$\textit{Variable value} = \frac{Mantisse}{1000}$$

3.10.6 Format Type 6 (error status flags 1)

This register contains the following error bits:

MSB														LSB
NoCal		I3Hi	I2Hi	I1Hi	U3Hi	U2Hi	U1Hi		DCerr	I3Lo	I2Lo	I1Lo	U3Lo	U2Lo	U1Lo

Bit Position	Error Bit	Description
0	U1Lo	U1 < 75% Un
1	U2Lo	U2 < 75% Un
2	U3Lo	U3 < 75% Un
3	I1Lo	I1 < start-up
4	I2Lo	I2 < start-up
5	I3Lo	I3 < start-up
6	DC err	DC offset too high
7		Unused
8	U1Hi	U1 > 120% Un
9	U2Hi	U2 > 120% Un
10	U3Hi	U3 > 120% Un
11	I1Hi	Maximum value for I1 exceeded
12	I2Hi	Maximum value for I2 exceeded
13	I3Hi	Maximum value for I3 exceeded
14		Unused
15	NoCal	Device not calibrated

Table 8: Error Status Flags 1

3.10.7 Format Type 7 (error status flags 2)

This register contains the following error bits:

MSB														LSB
Mem Err	NCOM	KEY		Res		CLK36	CLK18	CLK_CHG	CERT_FULL	NRUM	FRUM		FHi	FLo	FNo

Bit Position	Error Bit	Description
0	FNo	No frequency synchronization
1	FLo	Frequency < 40 Hz
2	FHi	Frequency > 70 Hz
3		Unused
4	FRUM	Incorrect direction of rotation
5	NRUM	No direction of rotation detected
6	CERT_FULL	Calibration logbook is full. Clock time can no longer be changed. Meter reading profile is invalid as of this point in time.
7	CLK_CHG	Clock time was set during the current meter reading profile period.
8	N_CLK_18H	Clock time synchronized 18 hours ago
9	N_CLK_36H	Clock time synchronized 36 hours ago
10		Unused
11	Res	Reserved
12		Unused
13	Key_Unlocked	Enable active
14	N_COM	Problems with internal communication
15	MemErr	Memory error in EEPROM

Table 9: Error Status Flags 2

3.10.8 Format Type 8 (RTC structure)

Structure of the Modbus frame (date and time):

MSB							LSB
Seconds	Minutes	Hours	Day	Month	Year low	Year high	0
Data bytes							

Variable	Format
Seconds	UINT8
Minutes	UINT8
Hours	UINT8
Day	UINT8
Month	UINT8
Year	UINT16

Table 10: RTC Structure

Example:
The query for requesting date and time is as follows:

MBAP				PDU	
Transaction Identifier	**Protocol Identifier**	**Length**	**Unit Identifier**	**Function Code**	**Data**
00 02	00 00	00 06	01	03	29 68 00 04

The response is as follows:

MBAP				PDU	
Transaction Identifier	**Protocol Identifier**	**Length**	**Unit Identifier**	**Function Code**	**Data**
00 02	00 00	00 0B	01	03	08 **02 06 0C 0B 07 E0 07 00**

This corresponds to 12:06:02 p.m. on 11 July 2016.

The clock should subsequently be set to 12:15:00 p.m. on 11 July 2016:

The corresponding command is as follows:

MBAP				PDU	
Transaction Identifier	**Protocol Identifier**	**Length**	**Unit Identifier**	**Function Code**	**Data**
00 02	00 00	00 0F	01	10	29 68 00 04 08 **00 0F 0C 0B 07 E0 07 00**

Response:

MBAP				PDU	
Transaction Identifier	**Protocol Identifier**	**Length**	**Unit Identifier**	**Function Code**	**Data**
00 02	00 00	00 06	01	10	29 68 00 04

3.10.9 Format Type 9 (interface hardware and firmware versions)

Format for hardware (HW) and firmware (FW) versions of the Modbus interface:

HW-MSB	HW-LSB	FW-MSB	FW-LSB

Variable	Format
HW-MSB	UINT8
HW-LSB	UINT8
FW-MSB	UINT8
FW-LSB	UINT8

Example: HW version = 1.30, FW version = 1.45

Variable	Value
HW-MSB	1
HW-LSB	30
FW-MSB	1
FW-LSB	45

3.10.10 Format Type 10 (operating logbook entry)

The structure consists of 32 bytes.

Logger Structure Definition

Byte Index	Variable	Format
0	Index entry	UINT16
2	Event code	UINT8
3	Parameter (1)	UINT8
4	Parameter (2)	UINT8
5	Parameter (3)	UINT8
6	Parameter (4)	UINT8
7	Parameter (5)	UINT8
8	Parameter (6)	UINT8
9	Parameter (7)	UINT8
10	Operating hours	UINT32
14	Event timestamp	Format type 8
22 … 31	Reserve	------

Table 11: Operating Logbook Entry

Event Codes:

Event Code Beginning	Event Code End	Description	Parameter
00h		Status OK	
01h	81h	Current overload	Phase number (parameter 1)
02h	82h	Phase voltage too high	Phase number (parameter 1)
03h	83h	No frequency synchronization	
04h	84h	Frequency too low	
05h	85h	Frequency too high	
06h	86h	Incorrect phase sequence	
07h	87h	Unknown phase sequence	
08h	88h	Meter not calibrated	
j09h	89h	Phase voltage too low	Phase number (parameter 1)
0Ah	8Ah	Analog error: DC offset too high	
0Bh	8Bh	Energy error: Erroneous energy reading	

Event Code Beginning	Event Code End	Description	Parameter
0Ch	8Ch	Internal communication error	
40h		Date/time changed (only with Z2) date/time changed via the display	New time saved (format type 8 in parameters 1 ... 7)
41h		(only with Z2) date/time changed via NTP	New time saved (format type 8 in parameters 1 ... 7)
42h		(only with Z2) date/time changed via webserver	New time saved (format type 8 in parameters 1 ... 7)
43h		(only with Z2) date/time changed via Modbus TCP/IP	New time saved (format type 8 in parameters 1 ... 7)
44h		(only with Z2) date/time changed via BACnet	New time saved (format type 8 in parameters 1 ... 7)
45h		(only with Z2) date/time reset due to depleted RTC power reserve	New time saved (format type 8 in parameters 1 ... 7)
48h		CT changed	New CT value saved (parameter 1)
49h		VT changed	New VT value saved (parameter 1)
60h		Reset has occurred, date and time have **not** been saved.	
61h		Supply power to meter was interrupted.	
68h		The energy value has been reconstructed from cyclical backups.	

Table 12: Event Codes

3.10.11 Format Types for Meter Reading Profile (Z1)

Please note:
The registers specified here are only valid for meters with order feature Z1. The meter reading profile entry values for the certified meter reading profile (order feature Z2) are specified in section 3.10.12.3.

3.10.11.1 Format Type 11 (meter reading profile entry)

The structure consists of 64 bytes.

Byte Index	Variable	Format	Word Index	Modbus Word Register	
				High Byte	Low Byte
0 1	Index entry	UINT16	0	Bit 7:0	Bit 15:8
2	Active tariff	UINT8	1	Tariff	
3	Exponent for energy	SINT8			Exponent
4 5	Active energy import, all phases (mantissa)	UINT32	2	Bit 7:0	Bit 15:8
6 7			3	Bit 23:16	Bit 31:24
8 9	Active energy export, all phases (mantissa)	UINT32	4	Bit 7:0	Bit 15:8
10 11			5	Bit 23:16	Bit 31:24
12 13	Reactive energy import, all phases (mantissa)	UINT32	6	Bit 7:0	Bit 15:8
14 15			7	Bit 23:16	Bit 31:24
16 17	Reactive energy export, all phases (mantissa)	UINT32	8	Bit 7:0	Bit 15:8
18 19			9	Bit 23:16	Bit 31:24
20	Two additional places for active energy import (mantissa 2)	UINT8	10	… import	
21	Two additional places for active energy export (mantissa 2)	UINT8			… export
22	Two additional places for reactive energy import (mantissa 2)	UINT8	11	… import	
23	Two additional places for reactive energy export (mantissa 2)	UINT8			… export
24 25	Meter reading profile status 1	Format 11a	12	Bit 7:0	Bit 15:8
26 27	Meter reading profile status 2	Format 11b	13	Bit 7:0	Bit 15:8
28 29	Timestamp	Format 8	14	Second	Minute
30 31			15	Hour	Day
32 33 34			16	Month	Year (bit 7:0)
			17	Year (bit 15:8)	Interval
35	Meter reading interval (1, 2, 3, 4, 5, 10, 15, 30, 60 min.)	UINT8			
36-63	Reserve		18-31	0	0

Table 13: Meter Reading Profile Entry for Order Feature Z1

3.10.11.2 Format Type 11a (meter reading profile status 1)

This bit field identifies which events occurred during the integrating period:

MSB **LSB**

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Bit	Description
0	Current 1 has exceeded the maximum value
1	Current 2 has exceeded the maximum value
2	Current 3 has exceeded the maximum value
3	Maximum value for U1 exceeded
4	Maximum value for U2 exceeded
5	Maximum value for U3 exceeded
6	No frequency synchronization possible
7	Frequency too low
8	Frequency too high
9	Incorrect phase sequence
10	Phase sequence unknown
11	Device is not calibrated
12	Analog error: DC offset too high
13	Energy error: Erroneous energy reading
14	Internal communication error
15	The energy value has been reconstructed from cyclical backups.

Table 14: Meter Reading Profile Status 1 for Order Feature Z1

Meter reading profile status 1: bits 0 ... 15 come from the operating logbook and identify events which have occurred during the meter reading profile interval.

3.10.11.3 Format Type 11b (meter reading profile status 2)

This bit field identifies which events occurred during the integrating period:

MSB **LSB**

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Status Bit	*Description*
0	Shortened integrating period (not started/ended synchronous to clock time)
1	Reset occurred (start after a reset)
2	Tariff change (end of period due to tariff change)
3	Clock time change (end of period due to clock time change)
4	-
5	-
6	-
7	-
8	-
9	-
10	-
11	-
12	-
13	-
14	-
15	-

Table 15: Meter Reading Profile Status 2 for Order Feature Z1

If the logger entry for the meter reading profile is incomplete (after reset, tariff change or time change), this is indicated by the “shortened integrating period” status bit.

If a reset has occurred, for example in the case of a restart after a power failure, this is indicated in the first meter reading profile entry by means of the “reset occurred” status bit (“shortened integrating period”). If the tariff is changed, the momentary logger value for the meter reading profile (asynchronous entry) at the point in time of the tariff change is saved with the comment “tariff change”. A new meter reading profile interval is then started with the new tariff. As a result, no energy values can be lost (the entry after the tariff change and the next entry are flagged with the “shortened integrating period” status bit.

If time is changed, the momentary logger value for the meter reading profile (asynchronous entry) is saved with the “time change” status bit along with the previous timestamp, after which a new logger period for the meter reading profile is started with the new time. As a result, no energy values can be lost (the entry after the clock time change and the next entry are flagged with the “shortened integrating period” status bit).

3.10.12 Format Types for Certified Meter Reading Profile (Z2)

Please note:
The registers specified here are only valid for meters with order feature Z2. The Format types for the **non-**certified meter reading profile (order feature Z1) are specified in section 0.

3.10.12.1 Format Type 12 (certified meter reading profile entry)

The structure consists of 34 bytes.

Byte Index	Variable	Format	Word Index	Modbus Word Register	
				High Byte	Low Byte
0 1 2 3	Entry number (0 = no valid data in structure)	UINT32	0	Bit 31:24	Bit 23:16
			1	Bit 15:8	Bit 7:0
4 5	Timestamp – year	UINT16	2	Bit 15:8	Bit 7:0
6 7	Timestamp – month	UINT16	3	Bit 15:8	Bit 7:0
8 9	Timestamp – day	UINT16	4	Bit 15:8	Bit 7:0
10 11	Timestamp – hour	UINT16	5	Bit 15:8	Bit 7:0
12 13	Timestamp – minute	UINT16	6	Bit 15:8	Bit 7:0
14 15 16 17	Active energy import, all tariffs (mantissa)	UINT32	7	Bit 31:24	Bit 23:16
			8	Bit 15:8	Bit 7:0
18 19	Two additional decimal places for active energy import (mantissa 2)	UINT16	9	Bit 15:8	Bit 7:0
20 21 22 23	Active energy export, all tariffs (mantissa)	UINT32	10	Bit 31:24	Bit 23:16
			11	Bit 15:8	Bit 7:0
24 25	Two additional decimal places for active energy export (mantissa 2)	UINT16	12	Bit 15:8	Bit 7:0
26 27	Exponent	SINT16	13	Bit 15:8	Bit 7:0
28 29	Meter reading profile status 1	Format 12a	14	Bit 15:8	Bit 7:0
30 31	Meter reading profile status 2	Format 12b	15	Bit 15:8	Bit 7:0
32 33	Active tariff	UINT16	16	Bit 15:8	Bit 7:0

Table 16: Meter Reading Profile Entry for Order Feature Z2

Note:
All energy values are calculated as follows:

Display accuracy:

$$Energy = Mantisse * 10^{Exponent}$$ [Wh] or [VArh]

Increased accuracy:

$$Energy = Mantisse * 10^{Exponent} + Mantisse2 * 10^{Exponent-2}$$ [Wh] or [VArh]

Calibratable energy is always saved to memory: the CT and VT values must be subsequently multiplied in the case of feature Q1 (adjustable CT and VT values, calibratable secondary energy).

Example:

Mantissa 1 of 4561 and mantissa 2 of 24 and exponent +3 is read as:

Mantissa 1 register:	00h	00h	11h	D5h
Mantissa 2 register:	00h	18h		
Exponent register:	03h			

This results in the following with regard to energy:

$$Energy = 4561 * 10^3 + 24 * 10^1 = 4561240\ Wh$$

3.10.12.2 Format Type 12a (certified meter reading profile status 1)

Note:
The “meter reading profile status 1” bit field for the certified meter reading profile is identical to that for the non-certified meter reading profile and thus corresponds to format type 11 (see section 3.10.11.2).

This bit field identifies which events occurred during the integrating period:

MSB **LSB**

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Bit	Description
0	Current 1 has exceeded the maximum value
1	Current 2 has exceeded the maximum value
2	Current 3 has exceeded the maximum value
3	Maximum value for U1 exceeded
4	Maximum value for U2 exceeded
5	Maximum value for U3 exceeded
6	No frequency synchronization possible
7	Frequency too low
8	Frequency too high
9	Incorrect phase sequence
10	Phase sequence unknown
11	Device is not calibrated
12	Analog error: DC offset too high
13	Energy error: Erroneous energy reading
14	Internal communication error
15	The energy value has been reconstructed from cyclical backups.

Table 17: Meter Reading Profile Status 1 for Order Feature Z2

Meter reading profile status 1: bits 0 ... 15 come from the operating logbook and identify events which have occurred during the meter reading profile interval.

3.10.12.3 Format Type 12b (certified meter reading profile status 2)

This bit field identifies which events occurred during the integrating period:

MSB **LSB**

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Status Bit	*Description*
0	Shortened integrating period (not started synchronous to clock time)
1	Reset occurred (start after a reset)
2	Tariff change (end of period due to tariff change)
3	Clock time change (end of period due to clock time change)
4	Clock has not been synchronized during the last 18 hours
5	Clock has not been synchronized during the last 36 hours
6	Calibration logbook full – not valid for billing purposes
7	Clock time was set during the meter reading profile period.
8	
9	-
10	-
11	-
12	-
13	-
14	-
15	Energy value can be used for billing.

Table 18: Meter Reading Profile Status 2 for Order Feature Z2

If the logger entry for the meter reading profile is incomplete (after reset, tariff change or time change), this is indicated by the “shortened integrating period” status bit.

If a reset has occurred, for example in the case of a restart after a power failure, this is indicated in the first meter reading profile entry by means of the “reset occurred” status bit (and “shortened integrating period”).

3.10.12.4 Format Type 12c (calibration logbook entry)

The structure consists of 28 bytes.

Byte Index	**Variable**	**Format**	**Word Index**	**Modbus Word Register**	
				High Byte	**Low Byte**
0 1	Entry numbers (1 to 4000, 0 = no valid data in structure)	UINT16	0	Bit 15:8	Bit 7:0
0 2	Event code	UINT16	1	Bit 15:8	Bit 7:0
3 4	Old timestamp – year	UINT16	2	Bit 15:8	Bit 7:0
5 6	Old timestamp – month	UINT16	3	Bit 15:8	Bit 7:0
7 8	Old timestamp – day	UINT16	4	Bit 15:8	Bit 7:0
9 10	Old timestamp – hour	UINT16	5	Bit 15:8	Bit 7:0
11 12	Old timestamp – minute	UINT16	6	Bit 15:8	Bit 7:0
13 14	Old timestamp – seconds	UINT16	7	Bit 15:8	Bit 7:0
15 16	New timestamp – year	UINT16	8	Bit 15:8	Bit 7:0
17 18	New timestamp – month	UINT16	9	Bit 15:8	Bit 7:0

19 20	New timestamp – day	UINT16	10	Bit 15:8	Bit 7:0
21 22	New timestamp – hour	UINT16	11	Bit 15:8	Bit 7:0
23 24	New timestamp – minute	UINT16	12	Bit 15:8	Bit 7:0
25 26	New timestamp – seconds	UINT16	13	Bit 15:8	Bit 7:0
27 28	Checksum	UINT8	14	Bit 15:8	Bit 7:0

Table 19: Calibration Logbook Entry

Event Codes:

Event Code	Description
01	Time change via display
02	Time change via Modbus TCP
03	Time change via website
04	Time change via SNTP
05	Time change via BACnet
06	Reset time (power reserve depleted); default: 1/1/2016

3.10.12.5 Format Type 12d (request calibration logbook entry)

The structure consists of 4 bytes.

Byte Index	Variable	Format	Word Index	Modbus Word Register	
				High Byte	Low Byte
0 1	Requested type (1 = newest entry, 2 = next entry, 3 = entry number)	UINT16	0	Bit 15:8	Bit 7:0
2 3	Requested entry number (only used where requested type = 3)	UINT16	1	Bit 15:8	Bit 7:0

Table 20: Calibration Logbook Request

3.10.13 Format Type 13 (request certified meter reading profile interval)

The structure consists of 20 bytes.

Byte Index	Variable	Format	Word Index	Modbus Word Register	
				High Byte	Low Byte
0 1	Beginning timestamp – year	UINT16	0	Bit 15:8	Bit 7:0
2 3	Beginning timestamp – month	UINT16	1	Bit 15:8	Bit 7:0
4 5	Beginning timestamp – day	UINT16	2	Bit 15:8	Bit 7:0
6 7	Beginning timestamp – hour	UINT16	3	Bit 15:8	Bit 7:0
8 9	Beginning timestamp – minute	UINT16	4	Bit 15:8	Bit 7:0
10 11	Ending timestamp – year	UINT16	5	Bit 15:8	Bit 7:0
12 13	Ending timestamp – month	UINT16	6	Bit 15:8	Bit 7:0
14 15	Ending timestamp – day	UINT16	7	Bit 15:8	Bit 7:0
16 17	Ending timestamp – hour	UINT16	8	Bit 15:8	Bit 7:0
18 19	Ending timestamp – minute	UINT16	9	Bit 15:8	Bit 7:0

Table 21: Meter Reading Profile Interval Request for Order Feature Z2

Please note:
If all beginning timestamps are set to 0, the meter responds with the first and last stored meter reading profile values.

3.10.14 Format Type 14 (certified meter reading profile interval response)

The structure consists of 72 bytes.

Byte Index	Variable	Format	Word Index	Modbus Word Register	
				High Byte	Low Byte
0 1	Response valid (1 = valid, 0 = not ready)	UINT16	0	Bit 15:8	Bit 7:0
2 3	Values valid (1 = valid, 0 = no data within the interval)	UINT16	1	Bit 15:8	Bit 7:0
4 … 37	Initial value	Format 12	2 … 18		
38 … 71	Final value	Format 12	19 … 35		

Table 22: Response to Meter Reading Profile Interval Request for Order Feature Z2

3.10.15 Format Type 15 (request certified meter reading profile value)

The structure consists of 6 bytes.

Byte Index	Variable	Format	Word Index	Modbus Word Register	
				High Byte	Low Byte
0 1	Requested type (1 = newest entry, 2 = next entry, 3 = entry number)	UINT16	0	Bit 15:8	Bit 7:0
2 3	Requested entry number (only used where requested type = 3)	UINT32	1	Bit 31:24	Bit 23:16
4 5			2	Bit 15:8	Bit 7:0

Table 23: Request Meter Reading Profile Value with Order Feature Z2

3.10.16 Format Type 16 (set and read time)

The structure consists of 12 bytes.

Byte Index	Variable	Format	Word Index	Modbus Word Register	
				High Byte	Low Byte
0 1	Year	UINT16	0	Bit 15:8	Bit 7:0
2 3	Month	UINT16	1	Bit 15:8	Bit 7:0
4 5	Day	UINT16	2	Bit 15:8	Bit 7:0
6 7	Hour	UINT16	3	Bit 15:8	Bit 7:0
8 9	Minute	UINT16	4	Bit 15:8	Bit 7:0
10 11	Second	UINT16	5	Bit 15:8	Bit 7:0

Table 24: Setting and Reading Time

Note:
The trigger for writing the data to the device is the second.

3.10.17 Format Type 17 (device information)

The structure consists of 72 bytes.

Byte Index	Variable	Format
0 … 10	Features	UINT8 [11]
11 … 18	Device serial number	UINT8 [8]
19	Calibration date	UINT8
20	Calibration month	UINT8
21	Calibration year	UINT16
23 … 24	Reserve	
25	Firmware Version	UINT16
27 … 31	Reserve	
32 … 63	Product information	UINT8[32]
64 … 70	M-Bus reserve	UINT8[7]
71	Unused	

Table 25: Device Information

Features:

Byte Index	Feature	
0	Type	0: U2281 direct, 2-wire 2: U2289 direct, 4-wire 3: U2381 transformer, 2-wire 4: U2387 transformer, 3-wire 5: U2389 transformer, 4-wire
1	D	0: Gossen Metrawatt
2	H	Auxiliary voltage, not for meters with 4 standard width units (0 = none)
3	M	Multifunctional variant: 0: none 1: with U, I, P, Q, S, PF, f, THD, IN 2: with reactive energy 3: with U, I, P, Q, S, PF, f, THD, IN and reactive energy
4	P	Calibration 0: with MID 9: with MID + calibration certificate
5	Q	CT / VT 0: 1 1: adjustable 9: CT / VT fixed in the purchase order
6	U	Operating voltage 3: 100 V / 110 V (not available in combination with Z2) 5: 2-wire, 230 V 6: 400 V 7: 500 V
7	V	Pulse output 0: none 1: 1000 pulses/kWh, 24 V, pulse width: 30 ms, interpulse period: > 30 ms 2: S0 programmable, 24 V, pulse width: 30 ms, interpulse period: > 30 ms 3: 1000 pulses/kWh, 230 V, pulse width: 30 ms, interpulse period: > 30 ms 4: S0 programmable, 230 V, pulse width: 30 ms, interpulse period: > 30 ms 7: 100 pulses/kWh, 24 V, pulse width: 130 ms, interpulse period: > 130 ms 8: 1000 pulses/kWh, 24 V, pulse width: 130 ms, interpulse period: > 130 ms 9: customer-specific order, 24 V
8	W	Bus interface 0: none 1: LON 2: MBus 4: TCP/IP 7: MODBus RTU
9	Z	Meter reading profile 0: without meter reading profile 1: with meter reading profile 2: with certified meter reading profile
10	S	Special variant (always 0)

Table 26: Features

Serial number:

0th Byte	1st Byte	2nd Byte	3rd Byte		4th Byte		5th Byte		6th Byte		7th Byte	
CHAR	CHAR	BCD	BCD	BCD	BCD	BCD	BCD	BCD	BCD	BCD	BCD	Reserve
“Z”	“B”	1	2	3	4	5	0	0	0	0	1	

The serial number consists of two letters and 10 digits (BCD format).

In the above example: ZB1234500001

Firmware version:

The version of the energy meter's basic firmware is read out as a UINT16 register.

A value of 130 corresponds to firmware version 1.30.

Product information:

Text-based information with 32 characters – defined by the manufacturer.

4 BACnet IP

4.1 General

BACnet (**b**uilding automation and **c**ontrol **n**etworks) is a network protocol for building automation.

Insofar as the specified standards (defined BIBBs) are adhered to within the BACnet, compatibility can be assured for communication amongst devices from various manufacturers.

Which services and procedures have to be supported at the server and client sides in order to fulfill a given system requirement is defined in the so-called BIBB (**B**ACnet **i**nteroperability **b**uilding **b**lock).

Energy meters included in the EM228x and EM238x series support the BACnet Smart Sensor (B-SS) device type with the following BIBBs: DS-RP-B, DM-DDB-B and DM-DOB-B. The following BIBBs are also supported: DS-WP-B, DS-RPM-B and DM-TS-B.

- Vendor name: Gossen Metrawatt GmbH
- Vendor ID: 881
- Product name: ENERGYMID Energy Meter
- Product model number: EM2281, EM2289, EM2381, EM2387, EM2389

The following parameters can be set via the web interface:

- BACnet port
- Device ID
- Device name
- Device description
- Device location

4.2 Device Object

Property	R/W	NV	Value Returned	Additional Information
Object_Identifier	R/W	NV	Device <n>	n is the BACnet device ID. It corresponds to a decimal number within a range of 1 to 4,193,999. This can be changed via the interface or the webserver. The default value upon shipment from the factory is the number 881,000 + the 16-bit part of the MAC address, in order to reduce the possibility of conflicts when several devices are installed.
Object_Type	R	NV	8 : Object Device	
Object_Name	R/W	NV	<Object_Name>	The object name can be changed and is limited to 64 characters. The default value is “Energy Meter – <BACnet Device ID>”.
System_Status	R	NV	0 : Operational	
Vendor_Name	R	NV	GMC-I Messtechnik GmbH Gossen Metrawatt GmbH	The Vendor_Name is different for order features Z0/Z1 and Z2: • Z0/Z1: GMC-I Messtechnik GmbH • Z2: Gossen Metrawatt GmbH
Vendor_Identifier	R	NV	881	
Model_Name	R	NV	EM2389 Energy Meter W4 U6 Q1 M3 Z1	EM2281, EM2289, EM2381, EM2387, EM2389
Serial_Number	R	NV	U5555555555	
Firmware_Revision	R	NV	<Current interface firmware version>	“x.yy” is the firmware version of the TCP/BACnet interface card.
Application_Software_Version	R	NV	<Current main firmware version>	“x.yy” is the firmware version of the meter’s PCB.
Location	R/W	NV	<Location>	The location description field is limited to 64 characters. The default value is “”.
Description	R/W	NV	<Description>	The description field is limited to 64 characters. The default value is “Energy Meter”.
Protocol_Version	R	NV	1	
Protocol_Revision	R	NV	12	
Protocol_Services_Supported	R	NV	I Am, Who Is, I Have, Who Has, Read Property, Read Property Multiple, Write Property, Time Synchronization	
Protocol_Object_Types_Supported	R	NV	Device, Analog Input	
Object_List	R	NV	Device, AI0, AI1, AI2, AI3, AI4, ... AI78	
Max_APDU_Length_Supported	R	NV	1476	
Segmentation_Supported	R	NV	3 : None	
Local Date	R			Is set via BACnet time synchronization
Local Time	R			Is set via BACnet time synchronization
APDU_Timeout	R	NV	3000	
Number_Of_APDU_Retries	R	NV	3	

Property	R/W	NV	Value Returned	Additional Information
Device_Address_Binding	R	NV	None	
Database_Revision	R	NV	0	Is increased by 1 each time the device configuration is changed

Table 27: BACnet Device Object

Key:

R/W R = read only (read access only), R/W = read or write (read or write access)
NV Value is stored in non-volatile memory.
The value is still available even if meter supply power fails.
Units Lists the units of measure included in a register.

4.3 Analog Input Objects

Property	R/W	NV	Value Returned	Additional Information
Object_Identifier	R	NV	Analog_Input <AI>	AI is the index of the analog input object (0, 1, 2 ...)
Object_Type	R	NV	0 : Object Analog Input	
Object_Name	R	NV	Name of the register	Example: “U1N”
Present_Value	R		Value of the register	Example: “230.0”
Units	R		U/M of the register	Example: “Volts”
Description	R	NV	Description of the register	Example: “Primary phase voltage L1 to N”
Status_Flags	R		In_Alarm, Fault, Overridden, Out_Of_Service	
Out_Of_Service	R		False, True	False = Present_Value is valid True = Present_Value is invalid
Event_State	R	NV	Normal	

Table 28: BACnet Analog Input Objects – 1

Object	Object_Name	Description	Units	Additional Information
		Voltmeter		
AI0	U12	Voltage on the primary side between phases L1 and L2	V	
AI1	U23	Voltage on the primary side between phases L2 and L3	V	
AI2	U31	Voltage on the primary side between phases L3 and L1	V	
AI3	Uavg	Mean value of voltage between phases on the primary side	V	
AI4	U1N	Primary phase voltage L1 to N	V	
AI5	U2N	Primary phase voltage L1 to N	V	
AI6	U3N	Primary phase voltage L1 to N	V	
AI7	UavgN	Mean value of phase voltages on the primary side	V	
AI8	ThdU1	Primary phase voltage THD, L1 to N	%	
AI9	ThdU2	Primary phase voltage THD, L1 to N	%	
AI10	ThdU3	Primary phase voltage THD, L1 to N	%	
AI11	Freq	Frequency	Hz	
		Ammeter		
AI12	I1	L1 phase current on the primary side	A	
AI13	I2	L2 phase current on the primary side	A	
AI14	I3	L3 phase current on the primary side	A	
AI15	IAvg	Mean value of phase currents on the primary side	A	
AI16	IN	N conductor current on the primary side (calculated)	A	
AI17	ThdI1	Phase L1 current THD	%	

Object	Object_Name	Description	Units	Additional Information
AI18	ThdI2	Phase L2 current THD	%	
AI19	ThdI3	Phase L3 current THD	%	
		Power Meter		
AI20	Wat1	Active power P1 on the primary side	W	
AI21	Wat2	Active power P2 on the primary side	W	
AI22	Wat3	Active power P3 on the primary side	W	
AI23	WatTot	Active power Ptot on the primary side	W	
AI24	VAr1	Reactive power Q1 on the primary side	VAr	
AI25	VAr2	Reactive power Q2 on the primary side	VAr	
AI26	VAr3	Reactive power Q3 on the primary side	VAr	
AI27	VArTot	Reactive power Qtot on the primary side	VAr	
AI28	PwrFact1	Phase L1 power factor	Power factor	
AI29	PwrFact2	Phase L2 power factor	Power factor	
AI30	PwrFact3	Phase L3 power factor	Power factor	
AI31	PwrFactTot	Total power factor	Power factor	
		Energy Meter		
AI32	WhPosTot	Active energy import, total (all tariffs)	Wh	
AI33	WhNegTot	Active energy export, total (all tariffs)	Wh	
AI34	VArhPosTot	Reactive energy import, total (all tariffs)	VArh	
AI35	VArhNegTot	Reactive energy export, total (all tariffs)	VArh	
AI36	WhPosActTariff	Active energy import of the active tariff	Wh	
AI37	WhNegActTariff	Active energy export of the active tariff	Wh	
AI38	VArhPosActTariff	Reactive energy import of the active tariff	VArh	
AI39	VArhNegActTariff	Reactive energy export of the active tariff	VArh	
AI40	ActiveTariff	Active tariff		
AI41	EnergyFlowHours	Operating hours	Hour	
AI42	PowerUpHours	Operating hours since last reset	Hour	
AI43	WhPosT1	Tariff 1, active energy import	Wh	
AI44	WhNegT1	Tariff 1, active energy export	Wh	
AI45	VArhPosT1	Tariff 1, reactive energy import	VArh	
AI46	VArhNegT1	Tariff 1, reactive energy export	VArh	
AI47	WhPosT2	Tariff 2, active energy import	Wh	
AI48	WhNegT2	Tariff 2, active energy export	Wh	
AI49	VArhPosT2	Tariff 2, reactive energy import	VArh	
AI50	VArhNegT2	Tariff 2, reactive energy export	VArh	
AI51	WhPosT3	Tariff 3, active energy import	Wh	
AI52	WhNegT3	Tariff 3, active energy export	Wh	
AI53	VArhPosT3	Tariff 3, reactive energy import	VArh	
AI54	VArhNegT3	Tariff 3, reactive energy export	VArh	
AI55	WhPosT4	Tariff 4, active energy import	Wh	
AI56	WhNegT4	Tariff 4, active energy export	Wh	
AI57	VArhPosT4	Tariff 4, reactive energy import	VArh	
AI58	VArhNegT4	Tariff 4, reactive energy export	VArh	
AI59	WhPosT5	Tariff 5, active energy import	Wh	
AI60	WhNegT5	Tariff 5, active energy export	Wh	
AI61	VArhPosT5	Tariff 5, reactive energy import	VArh	
AI62	VArhNegT5	Tariff 5, reactive energy export	VArh	
AI63	WhPosT6	Tariff 6, active energy import	Wh	
AI64	WhNegT6	Tariff 6, active energy export	Wh	
AI65	VArhPosT6	Tariff 6, reactive energy import	VArh	
AI66	VArhNegT6	Tariff 6, reactive energy export	VArh	
AI67	WhPosT7	Tariff 7, active energy import	Wh	
AI68	WhNegT7	Tariff 7, active energy export	Wh	
AI69	VArhPosT7	Tariff 7, reactive energy import	VArh	
AI70	VArhNegT7	Tariff 7, reactive energy export	VArh	
AI71	WhPosT8	Tariff 8, active energy import	Wh	

Object	Object_Name	Description	Units	Additional Information
AI72	WhNegT8	Tariff 8, active energy export	Wh	
AI73	VArhPosT8	Tariff 8, reactive energy import	VArh	
AI74	VArhNegT8	Tariff 8, reactive energy export	VArh	
AI75	CT	Current transformer ratio (CT)		
AI76	VT	Voltage transformer ratio (VT)		
AI77	Status1	Status 1 Flags		See section 3.3.6, “Format Type 6”
AI78	Status2	Status 2 Flags		See section 3.3.7, “Format Type 7”

Table 29: BACnet Analog Input Objects – 2

5 Product Support

If required please contact:

Gossen Metrawatt GmbH
Industry Product Support Hotline
Phone: +49 911 8602-500
Fax: +49 911 8602-340
e-mail: support.industrie@gossenmetrawatt.com

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