GOSSEN METRAWATT

Operating Instructions

ENERGY**MID**

Electronic Energy Meters
Direct conn. EM2281/EM2289
Transformer conn. EM2381/2387/2389

3-349-868-03
7/8.21

Read and adhere to the complete supplementary product documentation which can be found on the Internet at **www.gossenmetrawatt.com**
> Englisch > Products > Industrial Measurement > Energy Meters > EM2281 ... EM2389

Repair and Replacement Parts Service Recalibration

Recalibration can be conducted at any time by our federally approved test laboratory (EBY-8).

GMC-I Service GmbH
Service Center
Beuthener Straße 41
90471 Nürnberg, Germany
Phone +49-911-817718-0
Fax +49-911-817718-253
e-mail service@gossenmetrawatt.com
www.gmci-service.com

This address is only valid in Germany. Please contact our representatives or subsidiaries for service in other countries.

Industrial Product Support

If required please contact:

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

GOSSEN METRAWATT
Gossen Metrawatt GmbH
Südwestpark 15
90449 Nürnberg, Germany
Phone +49-911-8602-111
Fax +49 911 8602-777
e-mail info@gossenmetrawatt.com
www.gossenmetrawatt.com

1 Scope of Delivery

1 Energy meter
2 Operating instructions (German and English)
1 Calibration certificate (with feature P9 only)

Important information such as technical data, interface descriptions, and operating instructions for features can be found on the Internet. The link can be found on the cover page.

2 Safety Precautions – Symbols

– Check the specified nominal voltage on the serial plate before placing the instrument into service.
– Observe maximum pulse output voltage.
– When wiring the instrument, make sure the connector cables are not damaged, and that they are voltage-free.
– If it can be assumed that safe operation is no longer possible, the instrument must be immediately removed from service (disconnect input voltage!). Safe operation can no longer be relied upon if the instrument demonstrates visible damage.
The device may not be placed back into operation until troubleshooting and repair have been performed, and calibration and dielectric strength have been tested and approved at our factory or an authorized service center.
– Voltage conducting parts may be exposed if the cover is opened.
If balancing, maintenance or repair of a live open instrument is required, this may only be carried out by trained personnel who are familiar with the dangers involved.
– When connecting measuring current, it is important to provide for low-ohmic contact and to select an appropriate conductor diameter.

Meanings of Symbols on the Instrument

DE MTP 17 B 002 MI-003 (EM228x)
DE MTP 16 B 004 MI-003 (EM238x)
DE MTP 20 B 004 (EM228x Z2)
DE MTP 20 B 005 (EM238x Z2)
Prototype test certificate

Total insulation, protection class II device

Warning concerning a point of danger (attention, observe documentation!)

This device may not be disposed of with the trash. Further information can be accessed on the Internet at www.gossenmetrawatt.com by entering the search term “WEEE”.

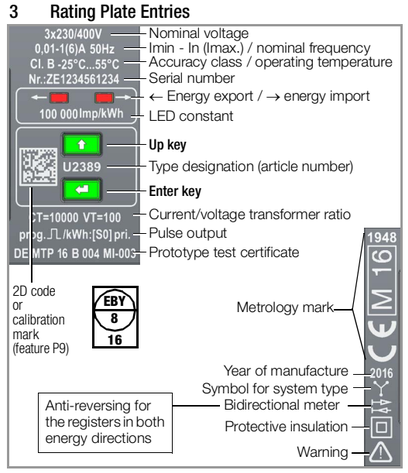
CE M16 1948 Metrology mark with indication of year (M16) and register no. of the notified body for module D, country-specific calibration validity period

EBY 8 16 Marking with stamp of the federally approved test laboratory **(for recalibration only)**

Tamper-Proof Sealing – Opening the Meter / Repairs

Tamper-Proof Calibration Sealing with Manufacturer’s Seal (at the side)
If the manufacturer’s seal is damaged or removed, all guarantee claims are rendered null and void.
The meter may only be opened by authorized, trained personnel in order to ensure flawless operation and to assure that the guarantee is not rendered null and void.
If it can be ascertained that the meter has been opened by unauthorized personnel, no guarantee claims can be honored by the manufacturer with regard to personal safety, measuring accuracy, compliance with applicable safety measures or any consequential damages.
Tamper-proof sealing for the terminal cover may be attached either to the left or the right of the terminal cover.

3 Rating Plate Entries

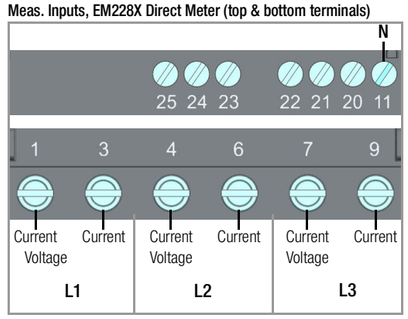


4 Connector Pin Assignments and Wire Gauge

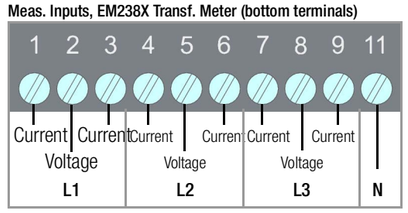
Note: Observe the wiring diagrams in the top and bottom terminal covers.

Connections	Direct, EM228X	Transformer, EM238X
Current input	Solid wire ≤ 16 sq. mm Fine wire ≤ 25 mm² or ≤ 16 mm² with wire end ferrule Tightening torque: 3-4 Nm	Solid wire ≤ 4 sq. mm Tightening torque: 0,5-0,6 Nm
Voltage input	N: solid wire ≤ 2.5 sq. mm Tightening torque: 0,4 Nm	Solid wire ≤ 4 sq. mm Tightening torque: 0,5-0,6 Nm
SØ pulse output Bus output, tariff input (power utility pulse)	Solid wire ≤ 2.5 sq. mm Tightening torque: 0,4 Nm	Solid wire ≤ 2.5 sq. mm Tightening torque: 0,4 Nm
TCP/IP	RJ-45 (8P8C)	

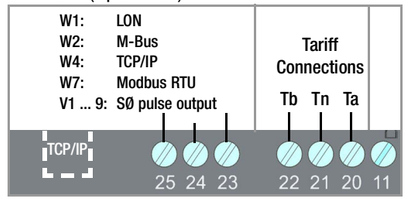
Meas. Inputs, EM228X Direct Meter (top & bottom terminals)



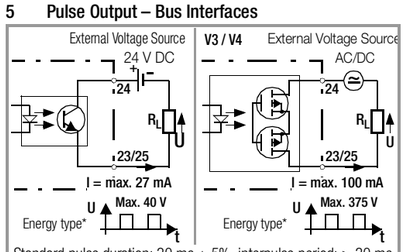
Meas. Inputs, EM238X Transf. Meter (bottom terminals)



Connections (top terminals)



5 Pulse Output – Bus Interfaces



Standard pulse duration: 30 ms + 5%, interpulse period: > 30 ms
V7/V8 pulse duration: 130 ms + 5%, interpulse period: > 130 ms

Default setting: active energy
Terminal 23 (SØ1) import, terminal 25 (SØ2) export
* Type of energy can also be selected with feature V2, V4.

Pulse Rates	V1/V3, fixed	V7	V8	V9, fixed	V2/V4, programmable
	[pulses per kWh]				
Direct	U228x				
	1000	100	—	—	1 … 1000 pls/kWh
Transformer	U2381 / U238x				
	f (secondary)				
				100 ...	
CT x VT = 1 (Q0)	1000	100	1000	50000	1...**1000**...10,000 pls/kWh
CTxVT=1(Q0)U6/7	1000	100	1000	20000	1...**1000**...10,000 pls/kWh
CTxVT=1(Q0) U3	1000	100	1000	50000	1...**1000**...10,000 pls/kWh
CT, VT, progr. (Q1)	1000	100	1000	50000	1...**1000**...50,000 pls/kWh
CT, VT, progr. (Q1)U6/7	1000	100	1000	20000	1...**1000**...50,000 pls/kWh
CT, VT, progr. (Q1)U3	1000	100	1000	50000	1...**1000**...50,000 pls/kWh
CTxVT; CT, VT, fixed (Q9)	f (primary)				f (primary)
2 … 10	1000	100	—	—	1 … 1000 pls/kWh
11 … 100	100	10	—	—	0.1 … 100 pls/kWh
101 … 1000	10	1	—	—	0.01 … 10 pls/kWh
1001 … 10,000	1	100	—	—	1 … 1000 pls/MWh
10,001 … 100,000	0.1	10	—	—	0.1 … 100 pls/MWh
100,001..1,000,000	0.01	1	—	—	0.01 … 10 pls/MWh

Underlined values are default values.

6 Display and Control Panel

6.1 Test LEDs

The **test LEDs** are located above the control keys. The left-hand LED indicates energy export, and the right-hand LED energy import. LED blinking frequency increases along with measured power. If all currents are smaller than starting current, both LEDs light up continuously.

LED Constant

EM228x: 10,000 pls/kWh (direct meter)
EM238x: 100,000 pls/kWh (transformer meter)

6.2 Resolution, Main Display (large characters) Energy Import

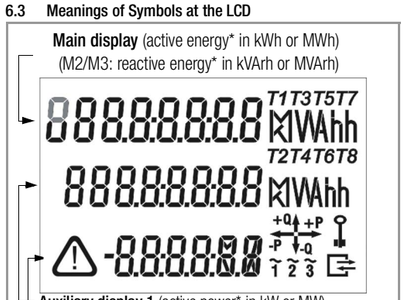
Internally, increased resolution is used for counting. As a result, the total register may be a few digits higher than the sum of the individual registers in the last place when using multi-tariffs.

Meter / Feature		CTxVT min.	CTxVT max.	Normal display	Calibration display *	Unit
U2281, U2289		—	—	123456.78	23456.789	kWh
U238x	Q0	1	1	12345.678	2345.6789	kWh
	Q9	2	4	12345.678	2345.6789	kWh
		5	40	123456.78	3456.7890	kWh
		41	400	1234567.8	34567.890	kWh
		401	4000	12345678	345678.90	kWh
		4001	40000	123456.78	3456.7890	MWh
		40001	400000	1234567.8	34567.890	MWh
		400001	1000000	12345678	345678.90	MWh
	Q1 **	1	4	u12345.67	**	kWh
		5	40	u123456.7	**	kWh
		41	400	u1234567	**	kWh
		401	4000	u12345.67	**	MWh
		4001	40000	u123456.7	**	MWh
		40001	100000	u1234567	**	MWh

* An additional place to the right of the decimal point is included for the calibration display in the case of a main display which can be calibrated (Q0 or Q9). And thus the leading digit is eliminated in the case of an 8-place display.
** In the case of Q1, the secondary display can be calibrated ≙ Q0, for which reason display overflow is based on the secondary display.

The normal display is shifted one place to the left if necessary.

6.3 Meanings of Symbols at the LCD



Main display, not calibrated (feature Q1, programmable CT/VT, see section 6.2).
T1 ... T8: active tariff

Display of instantaneous power in 4 quadrants: positive or negative active power P, positive or negative reactive power Q.

Correct connection:
Continuous illumination of the phase symbols where P ≥ **0**
Phase failure:
Symbol for affected phase is cleared from the display.
Incorrect phase sequence:
Phase symbols blink in following order: 3 - 2 - 1.
The background illumination blinks red.
Negative power:
Respective phase symbol blinks.

For bus connection: appears when the meter transmits a data packet.

Key symbols for parameters configuration (see next column)

Key Symbols for Parameters Configuration

<u>for Feature Q1 and V2, V4:</u>

Key and 2nd key bit blanked:
Parameter CT, VT and SØ configurable according to features, disabling with enable key.

Key displayed with one bit:
Parameter CT, VT and SØ disabled, change after activating the enable key.

<u>Remaining feature combinations:</u>

Key blanked, 2nd key bit displayed:
parameters CT, VT or SØ (which are or can be calibrated) are preset at the factory, can be queried in the display mode, other parameters can be set by the user.

Key displayed with 2nd bit: parameters which are or can be calibrated are preset at the factory; other parameters are disabled with the enable key and must be reset after clearing disabling.

Values which are preset at the factory are printed additionally on the rating plate.

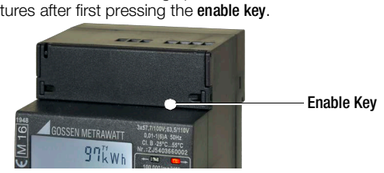
6.4 LCD Background Illumination

Background illumination is activated each time a key is activated. Background illumination goes off after about 2 minutes.
Background illumination colors indicate various display menus:
– White: query menus
– Red: display of firmware version
– Pink: parameters display and setting menu
– Blinking red: in case of error

6.5 Key Operation

Querying Parameter Values

In addition to the LCD test, the **UP** and **ENTER** keys also make it possible to query currently set parameter values, as well as to change parameters for certain features after first pressing the **enable key**.



If no keys are pressed for a period of 1 minute, the meter is returned automatically to its standard display.

Parameters can be changed for the following meters:

Parameters CT and VT for U238x with feature Q1,
Parameter SØ for U228x/U238x with feature V2/V4
Further parameters in accordance with the interface description.

a) Enabling Parameter Changes

The enable key makes it possible to enable or disable parameter changes. It’s located underneath the top terminal cover between terminals 21 and 22 and is activated with a pointed object (e.g. a ballpoint pen).
Pressing the enable key activates the “change parameters” operating mode (key off):

Pressing the enable key again disables the “change parameters” operating mode (key on):

If no keys are pressed for a period of about 2 minutes, the “change parameters” operating mode is exited automatically and disabled (key on).

b) Changing Parameter Values

- Briefly press the enabling key as described in point a) above (this activates the “change parameters” operating mode).
- See the operating overview on the back with regard to changing the parameters.
- Press and hold the ENTER key until the firmware version appears (red background).
- Press the UP key. The display test appears.
Briefly press and hold the ENTER key in order to display two further test patterns.
- Then repeatedly press the UP key until the parameter to be changed appears at the display.
- Briefly press the ENTER key in order to access the setting menu.
- The input cursor blinks at the leftmost entry position. Each tine the ENTER key is pressed the cursor is advanced to the next position to the right. The value of the blinking digit can be increased by pressing the UP key. When the rightmost digit is acknowledged by pressing the ENTER key, the selected value is accepted and SAVinG appears briefly at auxiliary display 2. If no keys are pressed for a period of about one minute, the setting menu is exited.
- Press and hold the ENTER key or wait for one minute in order to change to the normal display.
- Press the enable key once again. This disables the “change parameters” operating mode.
Disabling takes place automatically after 2 minutes.

7 Switching Amongst Tariffs

Hardware Controlled

Tariff Input	Tb	Ta
Tariff 1	0	0
Tariff 2	0	1
Tariff 3	1	0
Tariff 4	1	1

Tariff inputs Ta and Tb are each connected with reference to Tn.
Level 0: < 12 V
Level 1: > 45 V (max. 265 V permissible!)

Software Controlled (not included in MID scope of approval)

In the case of meters with bus (featureW1 … W7), four further tariffs can be selected (software controlled).

8 Overview of Bus Systems

- LON-Bus (feature W1)
- M-Bus (feature W2)
- Modbus TCP (feature W4)
- Modbus RTU (feature W7)

Interface descriptions for energy meters with bus connection can be found on the Internet at www.gossenmetrawatt.com.

9 Error Messages – Reset

Display

If an error occurs, the respective error code and active energy or instantaneous power are displayed alternately.

Error Code	Meaning	Cause / Remedy
⚠ LOVoLt	All phase voltages < 75%	Check connection
⚠ UH1 1	Maximum value for U1 exceeded	Check connection
⚠ UH1 2	Maximum value for U2 exceeded	Check connection
⚠ UH1 3	Maximum value for U3 exceeded	Check connection
⚠ IH1 1	Maximum value for I1 exceeded	Check connection
⚠ IH1 2	Maximum value for I2 exceeded	Check connection
⚠ IH1 3	Maximum value for I3 exceeded	Check connection
⚠ SYnc	Frequency measuring error	Meter connected to direct voltage
⚠ COn	Interface error	Check connection
⚠ EnErGY	Meter defective	Send device to repair service
⚠ CALI b	Balancing required	
⚠ AnALoG	DC offset too high	
⚠ MEMErr	Memory error	Send device to repair service
⚠ CErt	Temper-proof calibration log	Replace device

LOVoLt error

In case of LOVoLt error (phase voltages too low), the background illumination and bus connection are deactivated for meters with feature U3 (100...110 V L-L) with bus connections TCP/IP and Modbus RTU (W4 and W7).The counter reading profile (feature Z1) cannot be viewed as long as the error is pending. The remaining meter function is not affected.

10 Repair and Recalibration

Note for Test Laboratories

Direct measuring meter: Testing is only possible with source which supply currents superimposed on voltages.

Calibration Display

Display of energy values with increased resolution can be selected for testing or calibration purposes.

➪ Press and hold the ENTER key once to this end. The firmware version is displayed with a red background.

➪ Press the UP key twice. The calibration display appears with a pink background.

See section 6.2 with regard to resolution depending on type and feature.
Recalibration can be conducted at any time by our federally approved test laboratory (EB-8) (see repair and service address on the back of the folder).
Calibration capability is valid for 8 years in Germany.

11 Manufacturer's Guarantee

The energy meters are guaranteed for a period of 3 years after shipment. The manufacturer's guarantee covers materials and workmanship. Damages resulting from use for any other than the intended purpose or operating errors, as well as any and all consequential damages, are excluded.

12 Ambient Conditions

Operating temperature range	–25 ... +55 °C
Storage temperature range	–25 ... +70 °C
Relative humidity	< 75% annual average
Elevation	to 2000 m
Deployment	Indoors
mechanical classification	M1
electromagnetic classification	E2
Protection (built-in device)	front panel: IP 51
Protection terminal area	IP20

13 Return and Environmentally Sound Disposal

The instrument is a category 9 product (monitoring and control instrument) in accordance with ElektroG (German electrical and electronic device law). This device is subject to the WEEE directive. Furthermore, we make reference to the fact that the current status in this regard can be accessed on the Internet at www.gossenmetrawatt.com by entering the search term WEEE.

We identify our electrical and electronic devices in accordance with WEEE 2012/19/EU and ElektroG using the symbol shown at the right per DIN EN 50419.
These devices may not be disposed of with the trash.

14 CE Declaration

The instrument fulfills all requirements of applicable EU directives and national regulations.
We confirm this with the CE mark. The CE Declaration of Conformity is available upon request. See cover page for the link.

Key for Controls

Keys

⏎	ENTER key (press briefly)
long ⏎	ENTER key (press and hold)
⇧	UP key (press briefly)

Abbreviations

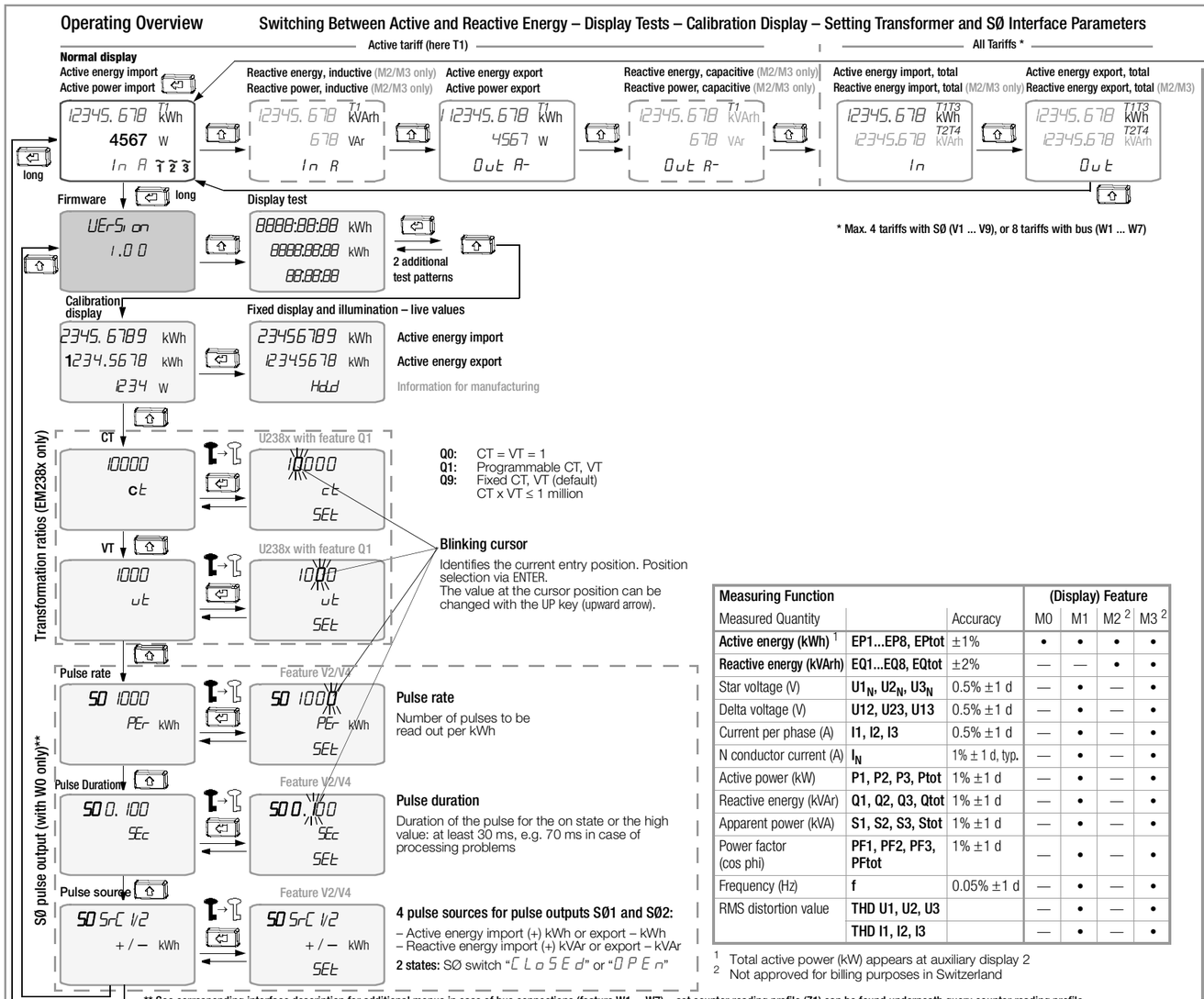
ct	Transformation ratio, current
I_N	N conductor current (calculated)
SØ	SØ pulse output
THD	Distortion component (for voltage and current)
vt	Transformation ratio, voltage

Features

M1	Multifunctional variant: measurement of U, I, P, Q, S, PF, f, THD, In
M2	Measurement of reactive energy
M3	Multifunctional variant: measurement of U, I, P, Q, S, PF, f, THD, In, reactive energy
Q1	Programmable transformation ratios
Q9	Fixed transformation ratios
V2/V4	Programmable SØ
V9	Customer-specific SØ rate
W1 ... 7	Bus connections
Z1	Counter reading profile (only possible with bus)
Z2	Certified meter reading profile

Operating Overview

Switching Between Active and Reactive Energy – Display Tests – Calibration Display – Setting Transformer and SØ Interface Parameters

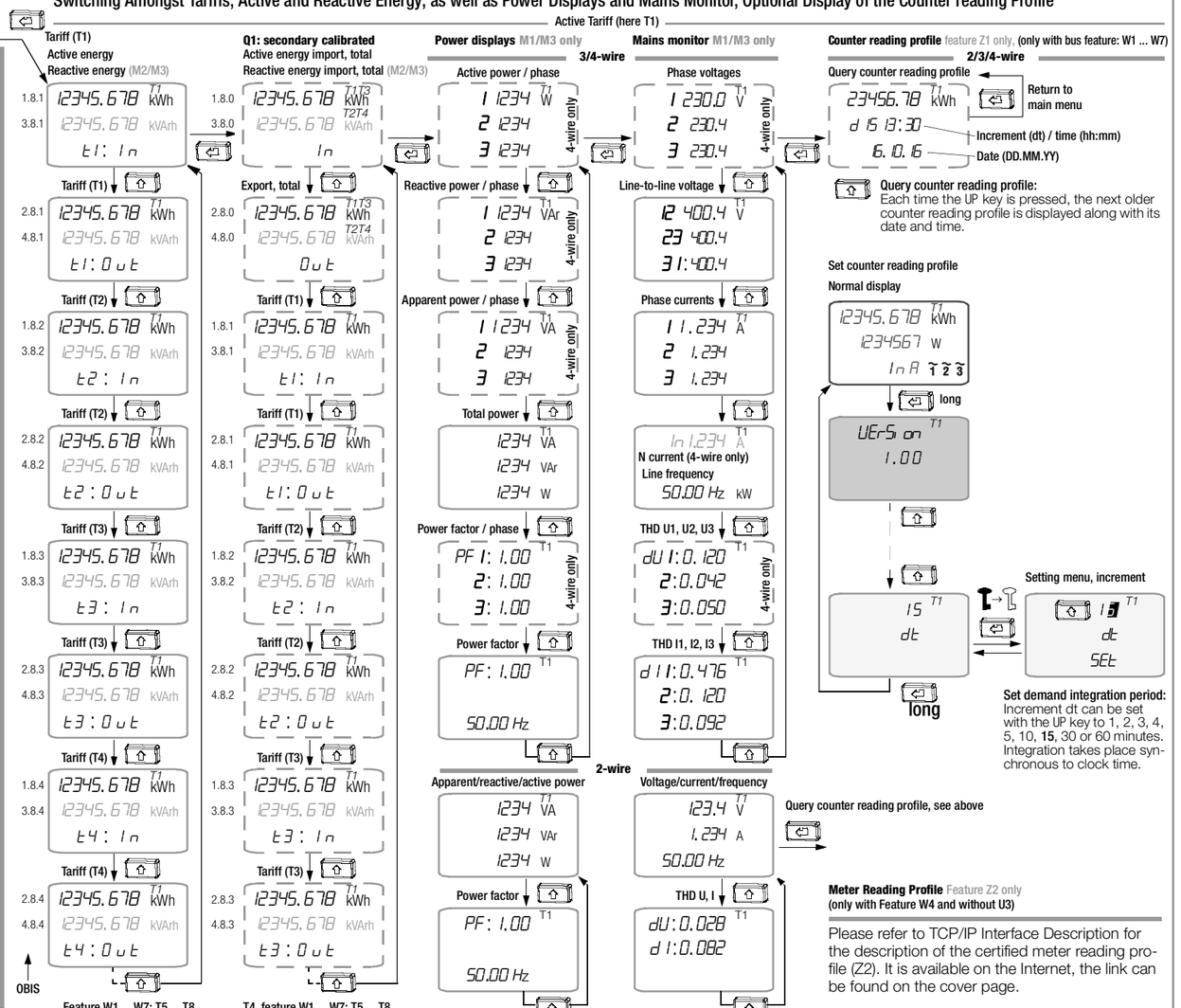


** See corresponding interface description for additional menus in case of bus connections (feature W1 ... W7) – set counter reading profile (Z1) can be found underneath query counter reading profile.

Measuring Function			(Display) Feature			
Measured Quantity		Accuracy	M0	M1	M2 [2]	M3 [2]
Active energy (kWh) [1]	**EP1...EP8, EPtot**	±1%	•	•	•	•
Reactive energy (kVArh)	**EQ1...EQ8, EQtot**	±2%	—	—	•	•
Star voltage (V)	**$U1_N$, $U2_N$, $U3_N$**	0.5% ±1 d	—	•	—	•
Delta voltage (V)	**U12, U23, U13**	0.5% ±1 d	—	•	—	•
Current per phase (A)	**I1, I2, I3**	0.5% ±1 d	—	•	—	•
N conductor current (A)	**I_N**	1% ± 1 d, typ.	—	•	—	•
Active power (kW)	**P1, P2, P3, Ptot**	1% ±1 d	—	•	—	•
Reactive energy (kVAr)	**Q1, Q2, Q3, Qtot**	1% ±1 d	—	•	—	•
Apparent power (kVA)	**S1, S2, S3, Stot**	1% ±1 d	—	•	—	•
Power factor (cos phi)	**PF1, PF2, PF3, PFtot**	1% ±1 d	—	•	—	•
Frequency (Hz)	**f**	0.05% ±1 d	—	•	—	•
RMS distortion value	**THD U1, U2, U3**		—	•	—	•
	THD I1, I2, I3		—	•	—	•

1 Total active power (kW) appears at auxiliary display 2
2 Not approved for billing purposes in Switzerland

Switching Amongst Tariffs, Active and Reactive Energy, as well as Power Displays and Mains Monitor, Optional Display of the Counter reading Profile



Meter Reading Profile Feature Z2 only
(only with Feature W4 and without U3)

Please refer to TCP/IP Interface Description for the description of the certified meter reading profile (Z2). It is available on the Internet, the link can be found on the cover page.