kamstrup

Data sheet

Kamstrup OMNIA® e-meter CT

- Integrated LTE-M and NB-IoT for high bandwidth and excellent coverage
- Standardised interface for Smart Building applications
- Grid Snapshot when events occur
- Last Gasp functionality
- Integrated load control relays
- Low power consumption
- Remote firmware update
- Power quality measurements according to EN 50160
- Type approved according to:
  - Active energy
    EN 50470-1, -3 (MID)
  - Active energy and reactive energy
    IEC 62052-11
    IEC 62053-21, -22, -23, -24
  - Safety
    IEC 62052-31

Combine OMNIA® e-meter with data analytics software to prevent grid overload and enable data-based grid planning

Contents

Application

Kamstrup OMNIA® e-meter is a family of smart electricity meters.

The OMNIA® e-meter CT is a current transformer connected electricity meter for registration of electrical energy. The meters are fully electronic without movable parts. Thus, energy registration is not affected by shock or impact during transport and mounting. Furthermore, measurements are correct no matter the physical mounting direction.

The shunt measuring principle secures good linearity and a considerable dynamic range. At the same time, the shunt measuring principle is immune to magnetism and DC currents.

Kamstrup OMNIA® e-meter contains a dual technology modem capable of using both NB-IoT and LTE-M. Unlike previous LTE technologies, LTE-M and NB-IoT are tailored to suit the needs of smart metering. This means that you get high bandwidth and a much better coverage than with other LTE technologies such as 4G.

And, as the infrastructure is already in place, cellular communication eases the transfer to next generation metering and saves you the trouble of having to deal with maintaining a communication infrastructure.

Combine NB-IoT and LTE-M to achieve:

- High data rates and low latencies for most of the meters using LTE-M
- High coverage for hard-to-reach locations using NB-IoT

The OMNIA® e-meter is designed to save you time and trouble during rollout. Cellular IoT communication eases rollout planning by simply eliminating it. Since the communication infrastructure is already in place, you decide when and where the next meter should be installed.

The user-friendly design of the OMNIA® e-meter supports the installer in first-time-right installations. Connectivity is verified instantly so that the installer doesn't have to wait around or leave prematurely at the risk of having to revisit the installation.

Power outages and other grid incidents can be prevented by looking for early warnings such as frequency variations, voltage variations, and harmonic content. But locating the root cause of a voltage quality incident can be difficult and time-consuming.

The OMNIA® e-meter builds on a ground-breaking EPU architecture that analyses each single period of voltage and current and frequency and harmonic content with unprecedented precision. This helps utilities locate the root cause of voltage quality problems quickly without unnecessary field visits.

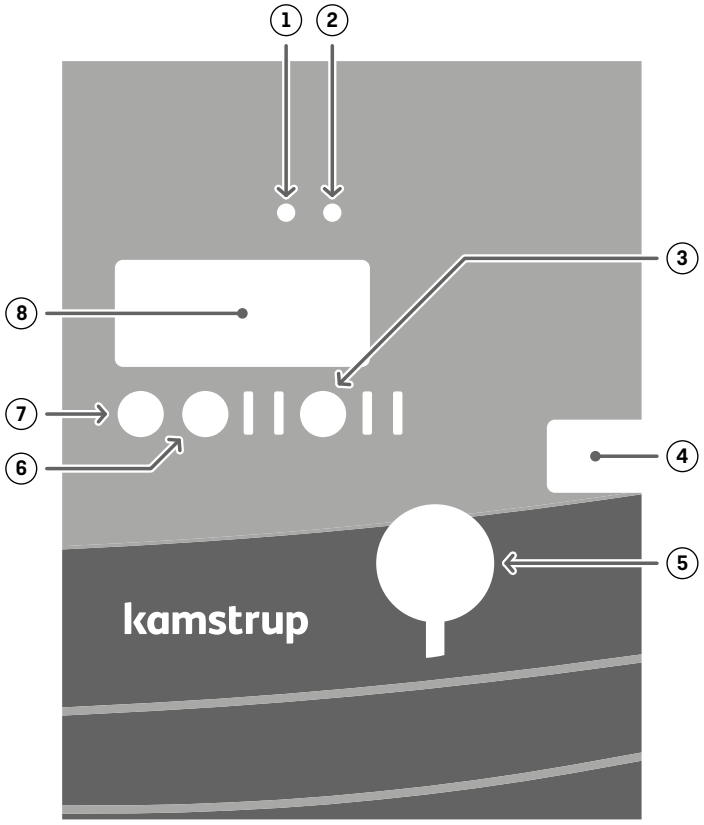
The above-industry-standard range of measurements and their pinpoint accuracy means that the OMNIA® e-meter provides a solid foundation for advanced analysis and grid optimisation in the analytics application of your choice.

The use of cellular IoT technologies enables the transfer of larger amounts of data to support enhanced customer service, targeted grid maintenance, and fact-based grid planning.

Functions

Meter buttons and interfaces

Below you see an overview and descriptions of the meter buttons and interfaces.



1 – Meter constant LED:	Blinks (yellow) at a rate reflecting the consumption of active energy.
2 – Reserved	Not used for OMNIA e-meter CT
3 – Optical interface:	Connect an infra-red optical head in order to read out data and change configuration parameters in the meter.
4 – HAN interface:	Connect compatible smart building equipment. (HAN = Home Area Network)
5 – Sealing wheel:	Lock and unlock the terminal cover, secure that the cover is in place and seal the meter.
6 – Control push button:	(Reserved for future use).
7 – Menu push button:	Cycle the information shown in the meter display.
8 – Meter display:	For descriptions of the meter display, see the table below.

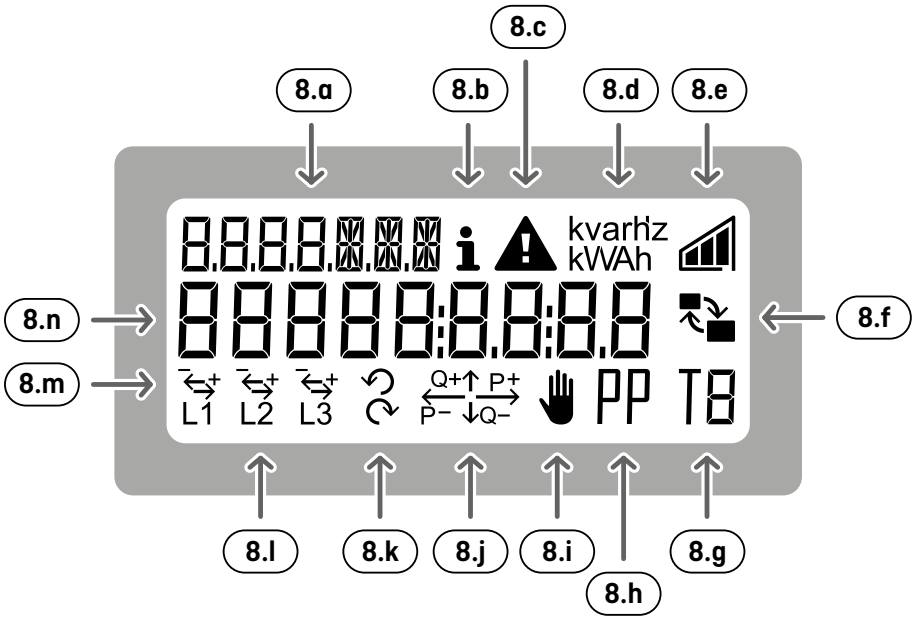
Functions

Display

Kamstrup OMNIA® e-meter is provided with a Liquid Crystal Display (LCD). The registers that can be read from the display depend on the chosen configuration. It is also possible to remotely configure the display.

The display configuration is constructed as two independent display lists: One for automatic shift function and one for manual shift function.

The display is constructed of segments as shown in the figure below.



8.a – Object ID field:	OBIS code identification of the value in the value field.
8.b – Info:	Indicates that the Value field shows data of an informative nature, i.e. not legally relevant data.
8.c – Error:	Indicates that an internal error has occurred in the meter.
8.d – Unit field:	Shows the unit of the measurand shown in the Value field.
8.e – Network symbol:	Shows the connection quality to the communication network.
8.f – System symbol:	Indicates that there is a verified data connection to the head-end system.
8.g – Tariff:	Indicates the tariff that is currently active.
8.h – Prepayment:	(Reserved for future use).
8.i – Tamper:	Indicates if the meter has been exposed to attempts of physical or magnetic tampering.
8.j – Quadrant indicator:	Indicates the current net load type.
8.k – Phase sequence:	Indicates the sequence of the connected phases.
	= L1-L2-L3 = L1-L3-L2
8.l – Supply voltage:	Indicates that voltage is above the minimum threshold (160 V).
8.m – Phase current:	Indicates the direction of the current for each phase.
	+ = Energy import – = Energy export
8.n – Value field:	Shows the consumption data value of the measurand.

Functions

Display lists
The automatic display list (scroll) changes between the selected readings every 10 seconds. The manual display list changes through activation of the left push button.

The meter automatically returns from manual to automatic display list two minutes after the last activation of the left push button.

Select from the range of pre-set display lists and find the match to your specific needs, whether they call for a basic, intermediate or advanced display list. The pre-set display lists are listed in the OMNIA® e-meter order form.

Permanent memory
Measured and calculated data are stored in the meter's permanent memory. Data are stored by every change of energy register values.

Tamper proof
Apart from the mechanical sealing, the meter also reveals tampering. In case of attempts of tampering (mechanical or magnetic), an event is activated which is time and date stamped and saved to the permanent memory. Events can be sent automatically as alarms via the communication infrastructure and, in some cases, indicated on the display. Magnetic influence does not affect the measuring accuracy, which is unique for a CT meter.

Data security
Kamstrup OMNIA® e-meter is protected by encryption on all communication interfaces. The security architecture is built around role-based access with each role having a separate level of privilege. The encryption method is AES-GCM 128 and it is implemented according to DLMS/COSEM security suite 0.

The encryption covers readout of all consumption/production data, read and write possibilities of configuration parameters and control commands like disconnect/reconnect of the internal supply control switch.

Kamstrup OMNIA® e-meter can be ordered with an option for digital signature support for supply control switch (SCS) state change commands. The head-end system (HES) then needs to digitally sign all SCS state change commands using its HES signing certificate in addition to encrypt the commands using the meter specific

Load profile
Kamstrup OMNIA® e-meter has two load profile loggers, each configurable to 5, 10, 15, 30 or 60 min. integration periods.

The captured registers are selectable to match the energy types of interest.

Load profile 1 always includes either average powers or energy totals corresponding to the measuring accuracy verification printed on the meter front.

Logging depth in days: – Load profile 1	**5 min.**	**15 min.**	**30 min.**	**60 min.**
A+/A-/R+/R-	60	180	361	722
A+/A-/R1/R2/R3/R4	48	146	292	585
A+/A-/R+/R-/R1/R2/R3/R4	40	122	245	491

Analysis logger
Kamstrup OMNIA® e-meter is provided with a configurable analysis logger. The logging depth will be depending on the configuration of the meter as well as the number of registers. The analysis logger can register data from up to 48 different registers at a time (36 registers when using selective access)..

Power quality assessment
Kamstrup OMNIA® e-meter is equipped with a power quality assessment tool. It is based on the requirements in EN 50160 regarding power quality delivered from utilities.

The power quality assessment in Kamstrup OMNIA® e-meter is based on events, i.e. information is only registered if a parameter exceeds its limits. Power quality events are logged with a timestamp in the Power quality event logger .

Additionally, the Occurrence counter logger captures a set of counter registers, which are incremented when the limits of EN 50160 are exceeded.

Supported parameters are:
- Power frequency
- Over- and undervoltage
- Supply voltage interruption
- Rapid voltage change
- Supply voltage unbalance
- Total harmonic distortion
- Supply voltage sags and swells

Grid events
Kamstrup OMNIA® e-meter detects events in the electric distribution grid. A grid event is characterised by (and differs from power quality monitoring in that) the root cause typically being a disconnected or broken conductor.

The meter detects when a neutral wire in the low voltage distribution grid is disconnected or broken and can also indicate when a phase wire in the medium voltage grid is disconnected.

Note This feature only applies to multi-phase meters and works as intended only when all three phases and neutral are connected.

Functions

Harmonic content

Kamstrup OMNIA® e-meter measures harmonic content of voltage and current at individual harmonic frequencies. This feature complements the total harmonic distortion (THD) by providing additional details of which harmonic frequencies are dominating and their levels. The meter records individual harmonic content of both voltage and current. A selected set is presented in individual harmonics registers. All individual harmonics registers operate per phase and are available as instantaneous values and as mean values and can be added to the analysis logger.

Additionally, the meter calculates the total harmonic distortion of both voltage (THDU) and current (THDI). The calculations of THDU and THDI include each harmonic frequency up to the 50th harmonic.

Grid snapshot

Kamstrup OMNIA® e-meter can push a snapshot of instantaneous values when triggered by an event.

When a trigger event occurs, a snapshot is taken of the selected registers, revealing the state of the grid at the time the event occurred. A new snapshots can be pushed to the head-end system.

Grid snapshot can capture up to 24 registers when triggered.

Events and alarms

Kamstrup OMNIA® e-meter continuously monitors the electrical grid as well as its own state of operation. Deviations from normal, trigger an event in one of the event loggers. Most events can trigger alarm notifications pushed to the head-end system. The alarm is pushed from the meter immediately after the event is registered in one of the event loggers.

Refer to OMNIA® e-meter user guide for a full list of event loggers and alarms.

Alarms are transmitted through the communication network with priority before conventional data push.

Last gasp

Kamstrup OMNIA® e-meter is available with a last gasp feature. A last gasp capable meter can push a message to the head-end system when an all-phase supply voltage interruption occurs.

The last gasp message is pushed immediately after detection and contains a time stamp of the beginning of the all-phase supply voltage interruption. Important Not all meters are last gasp capable. The feature requires additional energy storage in the meter, which must be selected at order time.

Optical reading

An optical interface is placed on the front of the meter. This optical connection can be used to read data or configure e.g. display set-up, meter number and other settings.

Changes via the optical connection can be made by using the software program METERTOOL OMNIA® e-meter.

It is not possible to change the meter's legal data.

S0 pulse output

Emits pulses of active energy at 10000 pulses per kWh. The pulses are emitted synchronously with the LED. The maximum voltage, which may be connected to the S0 output, is 27 V DC (at 1 kΩ), and the maximum current, which can be drawn through the output, is 27 mA. The pulse time is 30 ms.

Load control

Kamstrup OMNIA® e-meter is available with one or two integrated load control switches for managing (on/off) external electrical loads. Each load control relay can be individually controlled.

Load control relays can be operated in several modes and one relay can operate in one mode while the other operates in a different mode.

Modes of operation include on-demand, activity calendar mode and following the active tariff.

Approvals

Kamstrup OMNIA® e-meter CT is type approved according to the Measuring Instruments Directive (MID) for active energy and according to the national requirements for other energy types, where required.

Approval	Norm
Type test according to:	
–Active energy	EN 50470-1 EN 50470-3
–Reactive energy and active energy	IEC 62052-11 IEC 62053-21 IEC 62053-22 IEC 62053-23 IEC 62053-24
–Safety	IEC 62052-31

Various	Norm
Optical interface	IEC 62056-21
S0 pulse output (optional)	IEC 62053-31

Technical data

Measuring principle	
– Current	Single-phased current measurements by current shunt
– Voltage	Single-phased voltage measurements by voltage divider
Nominal voltage U_n	
– CT meter	3 x 230/400 V or 240/415 V
Extended operating voltage range	80% – 115% Un
Nominal frequency, fn	50 Hz ± 5%
Phase displacement	Unlimited
Current rating, I_{min} - I_n (I_{max})	0.01 1(6)A or 0.01 1(10)A 0.05 5(6)A or 0.05 5(10)A
Accuracy class	
– Active energy	Class B or C (MID) Class 0.5 s or 1 (IEC)
– Reactive energy	Class 1 or 2 (IEC)
Meter constant	10000 imp/kWh
Protective class	II
Overvoltage category	III
Rated impulse voltage	
– Acc. IEC 62052-31	6 kV
– Acc. SP-method 1618	12 kV
Short circuit current	200 A

Technical data

Ingress protection	IP54
Application area	Indoors or outdoors in suitable cabinet
Load control switches (LCS) (optional)	
– Relay type	Non-latching, normally open
– Rated operating voltage	230/240 V
– Rated operating current	Up to 5 A
Display	
– Digit size value field	7 mm
– Digit size OBIS field	5 mm
Optical interface	Max. 9600 bps
Data storage	EEPROM, > 10 years without voltage
Pulse output (S0) (optional)	10000 imp/kWh or /kvarh
RTC accuracy	< 0.5s/day at 23 °C
Supercap	3 days or 7 days (selectable)
Internal battery (optional)	> 10 years without power
Lifetime of supercap/battery	> 10 years at nominal conditions
Power consumption	
– Voltage circuit, three phases total	Typ. 1.5 W, 1.8 VA (excl. communication)
– Add'l from LTE communication	Typ. +0.2 W (typical communication setup of meter in moderate coverage, pushing billing data every 15 minutes and analysis data every 4 hours)
– Current circuit, per phase	< 0.01 VA @ 1A load
Operating temperature	-40 °C - +70 °C
Storage temperature	-40 °C - +85 °C
Relative humidity, non-condensing	< 75 % year's average at 21 °C < 95 % less than 30 days/year, at 25 °C
Materials	
– Meter case	Glass reinforced polycarbonate
– Terminal cover	Polycarbonate
Weight	
– CT meter	< 0.9 kg

Communication

Kamstrup OMNIA® e-meter is available with an integrated cellular communication interface acting as the primary communication interface towards a head-end system (HES).

The meter contains a dual technology modem capable of using both NB-IoT and LTE-M. The optimum access technology for a particular environment (coverage, network capability, etc.) is autonomously selected by the meter.

Protocol	DLMS/COSEM, CoAP transport layer
Access technologies	LTE Cat. M1 and NB-IoT
LTE frequency bands	B3 (1800MHz), B8 (900MHz), B20 (800MHz) and B28 (700MHz)
SIM types	Embedded SIM (MFF2)
Antenna types	Internal or external (optional via MCX)

The read out of conventional meter data, consisting of both interval loggers and event loggers, is based on a reliable push schedule from the meter to the head-end system. It means that the meter is responsible for pushing all conventional data at regular intervals, which is handled by push setups. Reception of each data packet is acknowledged from the HES ensuring that no data is lost.

In case the connection between meter and HES is interrupted, the meter is responsible for storing the push data in a "queuing" system, waiting for network connection to be reestablished. When the network connection is restored, the meter ensures "catch-up" by pushing data in "queue" until acknowledgement is received from the HES.

Connection to the HES is automatically established, and Kamstrup OMNIA® e-meter initiates data transfer with no need for interaction from the installer. All it takes is a preloaded configuration (entered at order time) specifying the address of the relevant servers.

Embedded SIM cards are installed inside the meter from Kamstrup's factory for plug & play operation. A data subscription package is selected when ordering the meter. Kamstrup has partnered up with several multi-national mobile network operators to offer the best coverage and subscriptions for our customers' needs.

Home area network (HAN)

Kamstrup OMNIA® e-meter is available with a home area network (HAN) interface accessible on the meter front.

The HAN interface connector type is RJ12 and the meter holds a female connector; the external device connects via standard RJ12 male plug. The external device is power supplied from the meter (+5V).

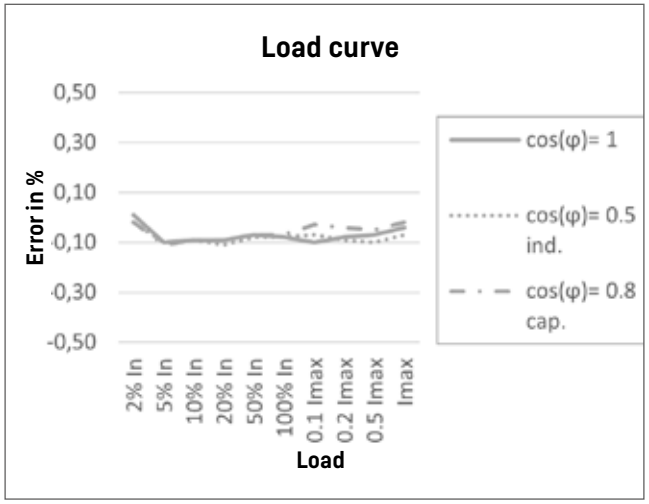
This physical interface conforms to the properties defined in DSMR v. 5.0.2 P1 companion standard, with the following exception:

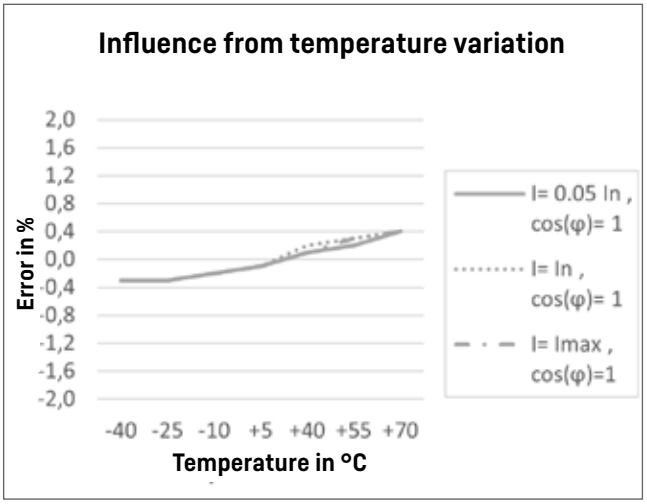
- The HAN interface fulfills the electrical requirements of overvoltage category III, which is the level generally applicable to electricity smart meters.

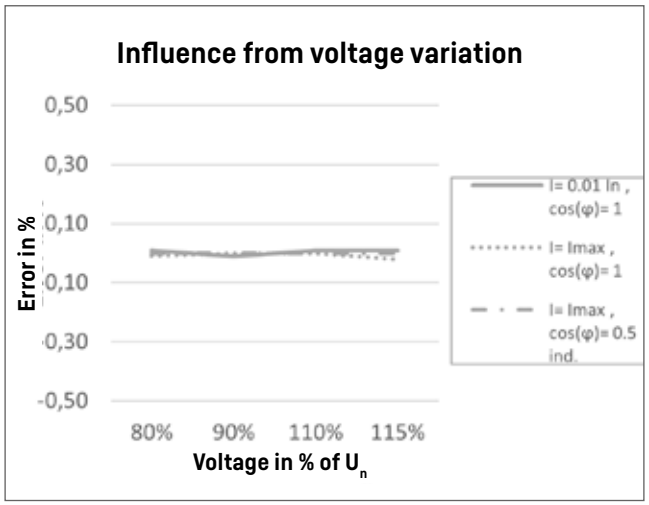
Some functionality described in the DSMR P1 companion standard might not be available. Please refer to the OMNIA® e-meter user guide for details on available functionality.

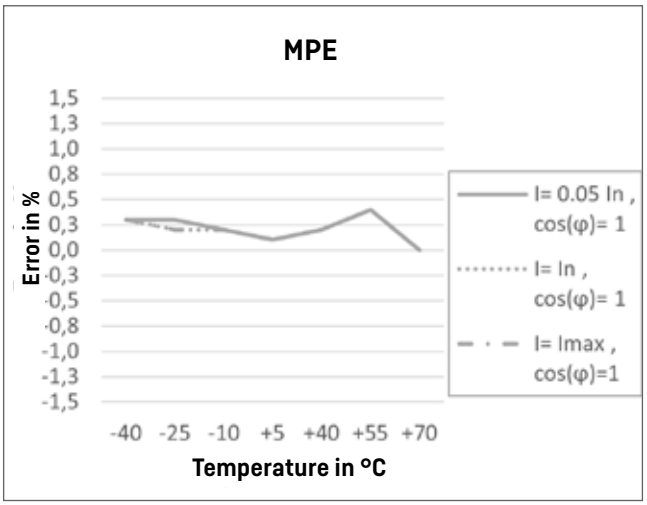
Due to the typical use cases and processes of distribution system operators (DSOs), the HAN interface is unencrypted.

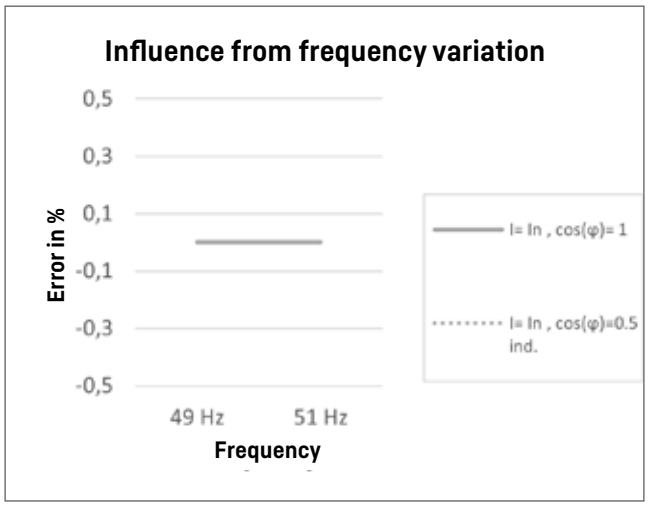
Typical accuracy charts











MPE (Maximum Permissible Error)

Error composed of:

- current load
- voltage variation
- frequency variation
- temperature variation

Configuration – hardware

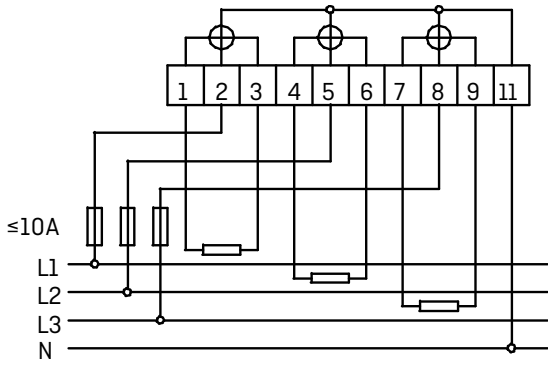
68	X_1	-	X_2	-	X_3	X_4	X_5	-	X_6	X_7	X_8	X_9	X_{10} X_{11}	X_{12}	X_{13}	-	X_{14}	X_{15} X_{16}	X_{17}	X_{18} X_{19} X_{20}
X_1 – Meter type																				
CT meter	5																			
X_2 – Type number revision																				
Revision 2			2																	
X_3 – Housing																				
CT meter layout, elevation clamps					3															
X_4 – Integrated breaker																				
None						0														
X_5 – Generation																				
OMNIA® e-meter							P													
X_6 – Variant																				
Variant 1									1											
X_7 – Measuring systems																				
3 systems										3										
X_8 – Integrated communication																				
None											0									
LTE cat. M1/NB2											4									
X_9 – HAN interface																				
None												0								
HAN: P1												2								
X_{10} X_{11} – FLEX interfaces																				
None													00							
2x load ctrl + 1x pulse out													AB							
1x pulse out													AD							
X_{12} – Supply backup																				
Supercap, 7 days capacity														7						
Battery														B						
Supercap, 7 days capacity and last gasp														D						
Battery and last gasp														E						
X_{13} – HOT SWAP interface																				
None															0					
Yes															1					
X_{14} – Current range																				
1(6)A																	2			
5(6)A																	3			
1(10)A																	-			
5(10)A																	-			
X_{15} X_{16} – Accuracy class																				
Active 1 / reactive 1 (IEC)																		11		
Active 1 / reactive 2 (IEC)																		12		
Active 0.5s / reactive 1 (IEC)																		51		
Active 0.5s / reactive 2 (IEC)																		52		
Active B / reactive 1 (MID)																		B1		
Active B / reactive 2 (MID)																		B2		
Active C / reactive 1 (MID)																		C1		
Active C / reactive 2 (MID)																		C2		
X_{17} – Energy type																				
A+/A-/R+/R-																			4	
X_{18} X_{19} X_{20} – Country code																				
Country code																				XXX

Installation

Connection diagrams

The relevant connection diagram is printed under the terminal cover of each meter.

Three-phase, four-wire meter (3P4W)
for current transformer connection



Terminal specificions

Cable dimensions – Single-core (solid) cable – Multi-core cable	 2.5 mm² – 10 mm² 2.5 mm² – 10 mm²
Screw slot	PZ2 or straight slot
Torque	1.6 Nm – 2.0 Nm
Stripping	15 mm – 22 mm

Safety and installation guidelines

The meter must be unpowered when working on it.

It can be potentially fatal to touch conductive meter parts when the meter is powered. Hence, the relevant safety fuse must be removed and kept in a place where it cannot be inserted by unauthorised persons.

Only authorised persons are permitted to install electricity meters or to remove the terminal cover or any other covers on the meter.

Current local standards , guidelines, regulations and instructions must be observed.

Meters for direct or CT connection must be protected against short circuit by a safety fuse in accordance with the maximum current stated on the meter.

It is the responsibility of the installer to coordinate the safety fuse with the maximum current rating of the meter and to ensure coordination with the UC rating of the meter.

The meter is only to be used for measuring electrical energy and shall operate within the specified voltage, current and frequency ranges only.

The meter is only to be used:

- in the ambient temperature range -40 °C to 70 °C and the specified relative humidity.
- in an pollution degree 1 or 2 environment.
- below 2000 m altitude

Do not touch:

- the hot swap interface, i.e. the 8-pin header located under the terminal cover.
- the external antenna connector or the tamper switch.

The meter must only be cleaned using a dry cloth.

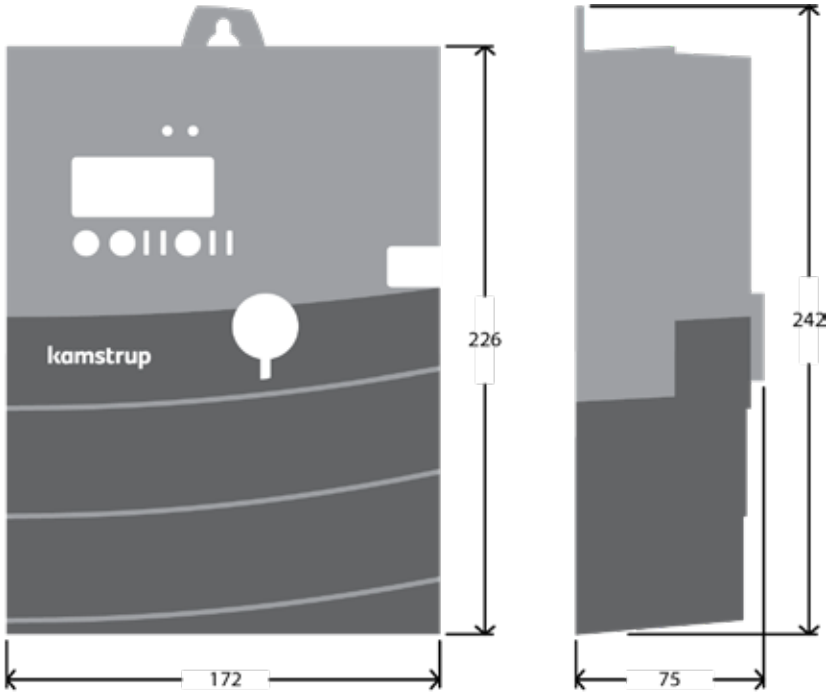
When installing a CT meter with current transformers being part of a live installation, never leave the secondary winding of the current transformer open.

A current transformer can produce very high voltages, which can cause electrical shock or insulation breakdown.

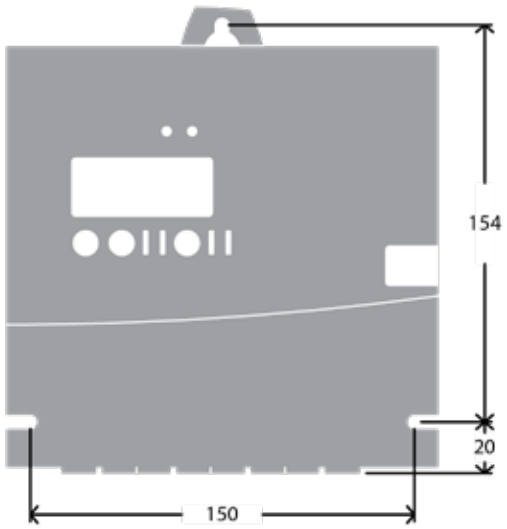
Make sure to short the secondary winding according to the current transformer specification until the secondary winding has been connected to the associated transformer inputs of the meter

Dimensions

Kamstrup OMNIA® e-meter CT has the following dimensions (in millimeters).



CT meter with 60 mm terminal cover



CT meter without terminal cover

Accessories

External antenna

Box with 10 pcs. OMNIA e-meter antenna adapter to MCX (required for connecting external antenna)	66 99 727
Mini triangle antenna with MCX and 2.5 m cable for 2/3/4G, NB-IoT/LTE-M and wM-Bus	66 99 448

Data acquisition and configuration

Infra-red optical head with 1.5 m cable and USB connector	66 99 099
Bluetooth optical head, including charger and brackets, EU	66 96 0110
Mounting adapter for infra-red optical head (required for mounting optical head)	30 26 909

Covers

Terminal cover 00 mm for OMNIA e-meter three-phase and CT	59 60 756
Terminal cover 60 mm for OMNIA e-meter three-phase and CT	59 60 787

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