



## Revision history

Version	Date	Comments
a	11.09.2017	Updated to Series 4 based on Series 3 document D000030719. Added maximum current data. Updated measurement accuracy. Added power consumption data. Added product safety information. Added extension board 421x. Deleted extension board 046x. Added input, output, extension board and additional power supply information.
b	25.05.2018	Updated maximum current data.

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## Design

E650 is the most proven platform for industrial and commercial meters with more than 2 million meters installed in over 80 countries.

E650 is the result of a century Landis+Gyr experience in metering field combined with high quality requirements.

## Range

E650 meters are the answer to a wide range of specific needs: from the reliable commercial meter to the complex measuring device with comprehensive additional functionality for sophisticated data acquisition and flexible tariff control at large industrial customers.

## Application

E650 offers high flexibility to connect to different power system distributions from low up to high voltage levels thanks to various voltage and current settings.

Covering most of the energy measurement and calculation use cases, E650 meters record active and reactive energy consumption in all three-phase four-wire and three-phase three-wire networks with powerful recording capabilities.

For instance, 32 energy rate registers can be combined in many different ways through 17 measured quantities, per quadrants or per phases. Those registers can be controlled by various sources (Control inputs, time switch or communication signals). 24 max demand rate registers and 2 lowest power factor registers with time stamp are available as well.

8 operating time registers settable with various control signals could be used in various situations from fraud tentatives up to operation follow up.

All registers can be stored in stored value profiles that allows the storage of 84 values for one year with a weekly reset.

One out of 2 load profiles available can be used to record energy registers, last average demand, average power factor for billing purposes in the case of dynamic tariffs, for instance, with an integration period programmable according to real needs.

E650 has various options to detect fraud attempts from energy calculation modes up to hardware options as DC – strong field detection or integrated terminal cover detection switch with time stamped records in the event logbook and optional local signalisation over a special LED or arrows on the LCD display.

In the Time of Use part the utility can define up to 12 different week/season tables, 100 special days and 12 day tables that are controlled by 16 time switch control signals. Programmable passive tables and emergency settings allow to manage unexpected or future situations without any additional workload.

A comprehensive logbook offers the possibility to record more than 70 different events with time stamp in a circular table of 500 events.

E650 can be used for network monitoring with key average measurement RMS recordings (U, I, P, Q, PF, THD).

Up to 26 channels can be recorded in a second load profile with a different integration period programmable from 1 minute up to 60 minutes which allows an excellent network monitoring.

Most power quality events (over-/undervoltages, power failures) are logged in the event logs with number of event, timestamp and phase allowing an easy calculation of SAIDI (System Average Interruption Duration Index) parameters. Up to 30 events for power failures can be recorded in a dedicated event log.

All information (stored data profile, load profiles, logbook, dedicated event log) are stored in non-volatile memory, which prevents any losses of critical data information.

Through a control table, it is possible to combine various signal sources to control signals with Boolean operators.

E650 is able to achieve simple automatism without any additional components.

Such control capabilities could be used not only to control registers but outputs locally or remotely as well.

E650 have extended digitals input and outputs (static and relays) from 3 inputs/2 outputs as basis combined with a variety of option boards offering different capabilities.

## Modular communication

Type AR/CR meters can be equipped with one of the following interface boards for data transmission: RS232, RS422, RS485 or CS.

The E650 can be easily connected through RS485 interface with a data concentrator as DC450.

## Installation support

An indication of phase voltages, phase angles, rotating field and energy direction supports the installation.

## Summary of the main features

	ZMD400	ZFD400
<b>Measured quantities</b>		
Energy (quadrants, ph, direction, reverse stop)		17 <sup>1)</sup>
Summation channels (virtual or digital input)		2 <sup>1)</sup>
Losses (OLA, NLA)		2 <sup>1)</sup>
Losses (I <sup>2</sup> , U <sup>2</sup> )		2 <sup>1)</sup>
Active energy harmonic distortion		2 <sup>1)</sup>
Rotating field direction		•
<b>Energy and demand registers</b>		
Energy rates		32
Total energy		27
Demand rates		24
Power factor (combi-meters only)		2
Last average and current demand		2x10
Memory depth per value (84 values selectable)		53
<b>Other registers</b>		
Operating time		8
Diagnostic registers		41
<b>Tariff module</b>		
Season tables		12
Week tables		12
Day tables		12
Special days (set 26 years ahead)		100
Time of use control signals		16
Emergency settings		•
Active/passive time tables		•
<b>Control table – 7 different control sources combinations to control 16 control signals</b>		
Communication and digital inputs, TOU, voltage, power factor, demand, current monitoring, status, missing voltages		•
<b>Load profiles (integration period from 1 up to 60 minutes)</b>		
Independent load profiles		2 (1 optional)
Maximum number of captured channels		26
<b>Data information storage (stored data profile, 2 load profiles, event log, dedicated event logs)</b>		
Non-volatile memory (Flash memory)		•

<sup>1)</sup> Value recordable in dedicated load profile from 1 up to 60 minutes (typical 15 minutes).

	ZMD400	ZFD400
<b>Instantaneous values</b>		
Voltage phase-neutral or phase-ground	● <sup>2)</sup>	–
Voltage phase-phase	–	● <sup>2)</sup> (U1-2, U2-3 only)
Current	(I1, I2, I3, IN) <sup>2)</sup>	(I1, I3) <sup>2)</sup>
Frequency	● <sup>2)</sup>	● <sup>2)</sup>
Phase angles	● <sup>2)</sup>	–
Active power (+/-)	(P1, P2, P3, P total) <sup>2)</sup>	P total <sup>2)</sup>
Reactive power (+/-)	(Q1, Q2, Q3, Q total) <sup>2)</sup>	Q total <sup>2)</sup>
Power factor	PF1, 2, 3, (PF total) <sup>1)</sup>	PF total <sup>2)</sup>
TTHD of active power	Sum <sup>2)</sup>	Sum <sup>2)</sup>
TTHD of phase voltage	(Phase 1, 2, 3) <sup>2)</sup>	(Phase 1, 3) <sup>2)</sup>
TTHD of phase current	(Phase 1, 2, 3) <sup>2)</sup>	(Phase 1, 3) <sup>2)</sup>
TTHD of voltage	Sum <sup>2)</sup>	Sum <sup>2)</sup>
TTHD of current	Sum <sup>2)</sup>	Sum <sup>2)</sup>
<b>Measurements monitoring with thresholds and records in event log</b>		
Over-/undervoltage phase-neutral	●	–
Over-/undervoltage phase-phase	–	●
Overcurrent (phase and neutral)	●	●
<b>Event logs</b>		
Maximum number of entries time stamped (s)	1000	
<b>Dedicated event log with snapshot</b>		
Maximum number of entries time stamped (s)	30	
<b>Primary or secondary values</b>	●	

<sup>1)</sup> Value recordable in dedicated load profile from 1 up to 60 minutes (typical 15 minutes).

<sup>2)</sup> Value recordable in another load profile from 1 up to 60 minutes (typical 1 minute).

## E650 Series 4 ZxD402AR/CR – Technical Data

### General

#### Voltage

Nominal voltage $U_n$ ZMD402xR	3 x 58/100 to 69/120 V 3 x 110/190 to 133/230 V 3 x 220/380 to 240/415 V
Extended operating voltage range	3 x 58/100 to 240/415 V

#### Nominal Voltage $U_n$ ZFD402xR

	3 x 100 to 120 V 3 x 220 to 240 V
Extended operating voltage range	3 x 100 to 415 V (mid-point earthed)

Voltage range	80 to 115%
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#### Frequency

Nominal frequency $f_n$	50 or 60 Hz
Tolerance	± 2%

### IEC-specific data

#### Current

Nominal current $I_n$	0.3 A, 1 A, 2 A, 5 A, 5  1 A
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#### Maximum current $I_{max}$

Metrological for $I_n = 0.3$ A	1.2 A
Metrological for $I_n = 1$ A	1.2 A, 2 A, 6 A, 10 A
Metrological for $I_n = 5$ A	6 A, 10 A, 15 A, 20 A
Metrological for $I_n = 5  1$ A	6 A
Overload for $I_{max} = 1.2$ A ... 10 A	12 A
Overload for $I_{max} = 15$ A, 20 A	20 A

Short-circuit current	0.5 s with 20 x $I_{max}$
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#### Measurement accuracy

ZxD402xR	
Active energy, to IEC 62053-22	class 0.2 S
Reactive energy, to IEC 62053-24	class 0.5 S

#### Measurement behaviour

Starting current ZxD402xR	
According to IEC	0.1% $I_n$
Typical	0.07% $I_n$
5  1 A	as 1 A meter
The start-up of the meter is controlled by the starting power and not by the starting current.	

Starting power in M-circuit	single-phase
Nominal voltage x starting current	

Starting power in F-circuit	all phases
Nominal voltage x starting current x $\sqrt{3}$	

### General

#### Operating behaviour

Voltage failure (power-down)	
Bridging time	0.5 s
Data storage	after another 0.2 s
Switch off	after approx. 2.5 s

#### Voltage restoration (power-up)

Function standby 3 phases	after 2 s
Function standby 1 phase	after 5 s
Detection of energy direction and phase voltage	after 2 to 3 s

#### Power consumption

Power consumption per phase in voltage circuit	
Without auxiliary supply	
3 x 58/100 to 69/120 V	0.6 W 1.2 VA
3 x 110/190 to 133/230 V	0.7 W 1.5 VA
3 x 220/380 to 240/415 V	0.9 W 2.1 VA
3 x 58/100 to 240/415 V	0.9 W 2.1 VA

#### Total power consumption in voltage circuit

Without auxiliary supply	
3 x 100 to 120 V	1.8 W 3.6 VA
3 x 220 to 240 V	2.0 W 4.5 VA
3 x 100 to 415 V	2.7 W 6.3 VA

#### Power consumption per phase in current circuit

Phase current	1 A	5 A	10 A
Active power (typical)	5 mW	0.125 W	0.5 W
Apparent power (typical)	5 mVA	0.125 VA	0.5 VA

#### Environmental influences

Temperature range	to IEC 62052-11
Metrological	-10 °C to +45 °C
Operation limit	-25 °C to +55 °C
Storage	-40 °C to +85 °C

#### Temperature coefficient

Range	-10 °C to +45 °C
Average value (typical)	± 0.008% per K
at $\cos\varphi=1$ (from 0.05 $I_b$ to $I_{max}$ )	± 0.01% per K
at $\cos\varphi=0.5$ (from 0.1 $I_b$ to $I_{max}$ )	± 0.02% per K

Ingress protection to IEC 60529	IP52
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## Electromagnetic compatibility

Electrostatic discharges	to IEC 61000-4-2
Air discharge	15 kV
Contact discharge	8 kV

Electromagnetic RF fields	to IEC 61000-4-3
80 MHz to 2 GHz	10 and 30 V/m

Radio interference suppression according to IEC/CISPR 22	class B
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Fast transient burst test	to IEC 61000-4-4
Current and voltage circuits under load according to IEC 62053-21/23	4 kV
Auxiliary circuits > 40 V	2 kV

Surge test	to IEC 61000-4-5
Current and voltage circuits	4 kV
Auxiliary circuits > 40 V	1 kV

Immunity to conducted disturbances IEC 61000-4-6	
150 kHz to 80 MHz	10 V

Immunity to conducted disturbances according to CENELEC TR 50579	
	2 to 150 kHz

## Insulation strength

Insulation strength	4 kV at 50 Hz during 1 min.
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Impulse voltage 1.2/50 $\mu$ s	to IEC 62052-11
Current and voltage circuits	8 kV
Auxiliary circuits	6 kV

Protection class II to IEC 62052-11	<input type="checkbox"/>
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## Product safety

Normal environmental conditions	IEC 62052-31
Overvoltage category	III
Pollution degree	2
Max. operating altitude	2000 m

## Calendar clock

Calendar type	Gregorian or Persian (Jalaali)
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Accuracy	< 5 ppm
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Backup time (power reserve) meter	
With supercapacitor	> 20 days
Charging time for max. backup time	300 h
With battery (optional)	10 years
Battery type	CR-P2
Battery temperature range	-40 °C to +55 °C

## Display

Characteristics	
Type	LCD (liquid crystal display)
Digit size in value field	8 mm
Number of digits in value field	up to 8
Digit size in index field	6 mm
Number of digits in index field	up to 8

## Inputs (passive)

HLV, reinforced insulation by optocoupler	
Number on base meter	3
Number on extension board 420x	4
Number on extension board 240x	2
Control voltage $U_S$	100 to 240 $V_{AC}$
Range	80 to 115 %
Input current	< 0.8 mA at 230 $V_{AC}$

SELV, reinforced insulation by optocoupler	
Number on extension board 326x	3
Control voltage $U_S$	12 to 24 $V_{DC}$
Range	80 to 115 %
Input current	< 1.5 mA at 24 $V_{DC}$

## Inputs (active)

SELV, reinforced insulation by optocoupler	
Active inputs, external closing contact required for activation (no control voltage necessary)	
Number on extension board 421x	4
Open circuit voltage (contact open)	< 5 V
Short-circuit current (contact closed)	< 5 mA
Max. contact resistance	< 500 Ohm

## Outputs (solid-state relay)

HLV or SELV, reinforced insulation by solid-state relay	
Voltage	12 to 240 $V_{AC/DC}$
Max. current for each output	100 mA $R_{MS}$
Max. switching frequency (pulse length 20 ms)	25 Hz
Contact resistance (typical)	13–18 Ohm

Base meter	
Number	2
Max. current all outputs together	200 mA $R_{MS}$
Derating above 45 °C ambient	0.8 mA / °C

Extension board 420x	
Number	2
Max. current all outputs together	200 mA $R_{MS}$
Derating above 45 °C ambient	0.8 mA / °C



Extension board 240x	
Number	4
Max. current all outputs together	200 mA <sub>RMS</sub>
Derating above 45 °C ambient	0.8 mA / °C

Extension board 060x	
Number	6
Max. current all outputs together	200 mA <sub>RMS</sub>
Derating above 45 °C ambient	0.8 mA / °C

Extension board 045x	
Number	4
Max. current all outputs together	200 mA <sub>RMS</sub>
Derating above 45 °C ambient	0.8 mA / °C

Extension board 047x	
Number	4
Max. current all outputs together	200 mA <sub>RMS</sub>
Derating above 45 °C ambient	0.8 mA / °C

### Mechanical relay

HLV, reinforced insulation, intended to control auxiliary devices	
Number on extension board 326x	2
Number on extension board 421x	2
Max. voltage	250 V <sub>AC</sub>
Max. current for each relay	8 A
Max. current all relays together	8 A
Max. operations with $\cos\varphi \sim 1$	100 000
Contact resistance (typical)	10 mOhm
Withstand across open contact	1000 V <sub>AC</sub>
Withstand between contacts	1500 V <sub>AC</sub>

### Outputs (optical)

Optical test outputs active and reactive energy	
Type	red LED
Number	2
Meter constant	selectable

### Communication interface

Optical interface to IEC 62056-21	
Type	serial, asynchronous, half-duplex
Max. transmission rate	9600 bps
Protocols	IEC 62056-21 and DLMS

RS232 interface to DIN 61393 / DIN 66259	
Type	serial, asymmetric, asynchr., bidirectional
Operating mode	transparent
Nominal voltage	$\pm 9$ V <sub>DC</sub>
Maximum voltage	$\pm 15$ V <sub>DC</sub>
Minimum voltage	$\pm 5$ V <sub>DC</sub>
Max. transmission rate	9600 bps
Protocols	IEC 62056-21 and DLMS
Max. conductor length depending on environment and connecting cable	30 m
Insulation resistance to meter	4 kV <sub>AC</sub> /50 Hz, 1 min
Creep distance	$\geq 6.3$ mm

RS485 interface to ISO-8482	
Type	serial, symmetrical, half-duplex
Nominal voltage range	-7 to +12 V <sub>DC</sub>
Binary 1 state	difference voltage $< -0.2$ V
Binary 0 state	difference voltage $> 0.2$ V
Max. transmission rate	9600 bps
Max. number of devices	32
Protocols	IEC 62056-21 and DLMS
Max. conductor length depending on environment and connecting cable	$\leq 1000$ m
Insulation resistance to meter	4 kV <sub>AC</sub> /50 Hz, 1 min
Creep distance	$\geq 6.3$ mm

CS interface to IEC 62056-21 / DIN 66258	
Type	serial, bidirectional, current interface
Nominal voltage without load	24 V <sub>DC</sub>
Max. voltage without load	30 V <sub>DC</sub>
Binary 1 state	10–30 mA
Binary 0 state	$\leq 2$ mA
Max. transmission rate	9600 bps
Protocols	IEC 62056-21 and DLMS
Insulation resistance to meter	4 kV <sub>AC</sub> /50 Hz, 1 min
Creep distance	$\geq 6.3$ mm

RS422 interface to ISO-8482	
Type	serial, symmetric, asynchronous, bidirectional
Nominal voltage range	-3 to +3 V <sub>DC</sub>
Binary 1 state	difference voltage $< -0.2$ V
Binary 0 state	difference voltage $> 0.2$ V
Max. transmission rate	9600 bps
Max. number of devices	10
Protocols	IEC 62056-21 and DLMS
Max. conductor length depending on environment and connecting cable	1000 m
Insulation resistance to meter	4 kV <sub>AC</sub> /50 Hz, 1 min
Creep distance	$\geq 6.3$ mm



## Additional power supply (optional)

On extension board 045x	
HLV, reinforced insulation	
Nominal voltage range	100 to 240 V <sub>AC/DC</sub>
Tolerance	80 to 115% U <sub>n</sub>
Frequency	50 or 60 Hz

### V<sub>IN</sub> = 80 V

Max. power consumption <sup>1)</sup>	1.8 W / 3.2 VA
Max. current	40 mA

### V<sub>IN</sub> = 276 V

Max. power consumption <sup>1)</sup>	2.1 W / 5.3 VA
Max. current	20 mA

## On extension board 047x

SELV, reinforced insulation	
Nominal voltage range	12 to 48 V <sub>DC</sub>
Tolerance	80 to 115% U <sub>n</sub>
Max. power consumption <sup>1)</sup>	1.7 W
Max. current (V <sub>IN</sub> = 9.6 V)	170 mA

## On extension board 326x

SELV, reinforced insulation	
Nominal voltage range	12 to 24 V <sub>DC</sub>
Tolerance	80 to 115% U <sub>n</sub>
Max. power consumption <sup>1)</sup>	1.7 W
Max. current (V <sub>IN</sub> = 9.6 V)	170 mA

<sup>1)</sup> Power consumption without mains supply. If auxiliary and mains supply are available, the consumption is shared arbitrarily.

## Weight and dimensions

Weight	approx. 1.5 kg
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### External dimensions

Width	177 mm
Height (with short terminal cover)	244 mm
Height (with standard terminal cover)	281.5 mm
Height (with extended hook)	305.5 mm
Depth	75 mm

### Suspension triangle

Height (with extended hook)	230 mm
Height (suspension eyelet open)	206 mm
Height (suspension eyelet covered)	190 mm
Width	150 mm

### Terminal cover

Short	no free space
Standard (opaque, transparent)	40 mm free space
Long (opaque, transparent)	60 mm free space
GSM	60 mm free space
ZxB type 80 mm	80 mm free space
ZxB type 110 mm	110 mm free space
ADP2 adapter	

## Housing material

Polycarbonate, partly glass-fibre reinforced

## Environmental protection

RoHS compliant design

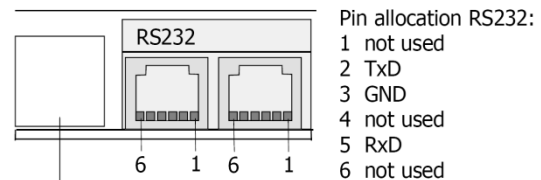
## Connections

### Phase connections

Type	screw type terminals
Diameter	5.2 mm
Recommended conductor cross-section	1.5 to 6 mm <sup>2</sup>
Screw head	Pozidrive Combi No. 2
Screw dimensions	M4 x 8
Screw head diameter	≤ 5.8 mm
Tightening torque (min...max)	1.0...1.7 Nm

### RS232 interface on interface board c1

Type RJ 12

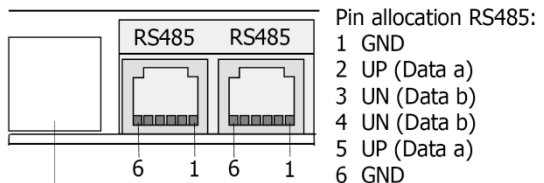


Opening for spring-loaded terminal  
(not fitted on type c1 interface board)

The two RJ12 jacks of the RS232-interface are internally looped. However, only one of them is connected (point-to-point connection).

### RS485 interface on interface board c2

Type RJ 12

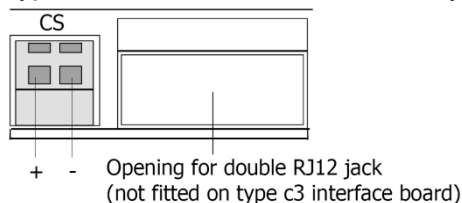


Opening for spring clamp terminal  
(not fitted on type c2 interface board)

The two RJ12 jacks of the RS485 interface are looped internally to permit connection of several meters.

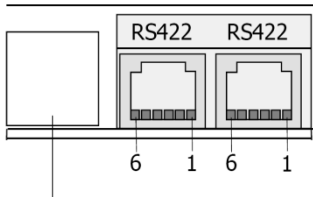
### CS interface on interface board c3

Type screw type terminals



**RS422 interface on interface board c6**

Type **RJ 12**



- Pin allocation RS422:
- 1 GND
  - 2 UP (Data a)
  - 3 UN (Data b)
  - 4 UN (Data z)
  - 5 UP (Data y)
  - 6 GND

Opening for spring clamp terminal  
(not fitted on type c6 interface board)

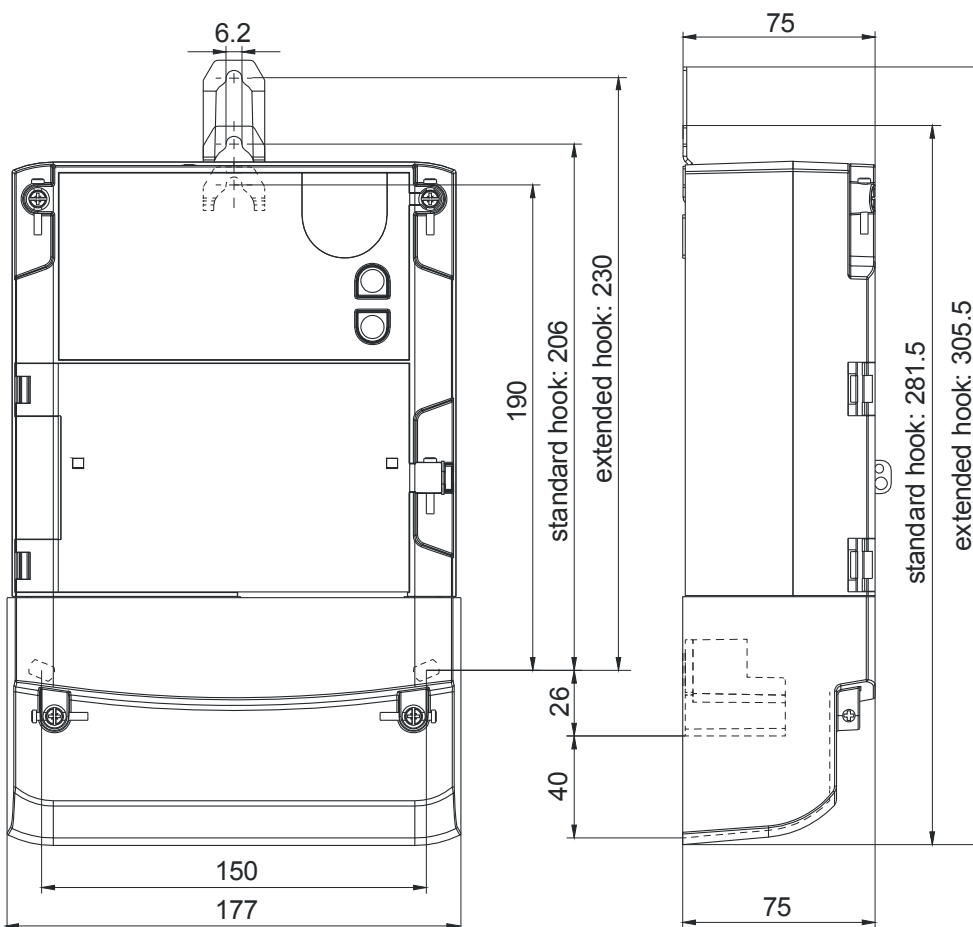
The two RJ12 jacks of the RS422-interface are looped internally to permit a connection of several meters.

**Other connections**

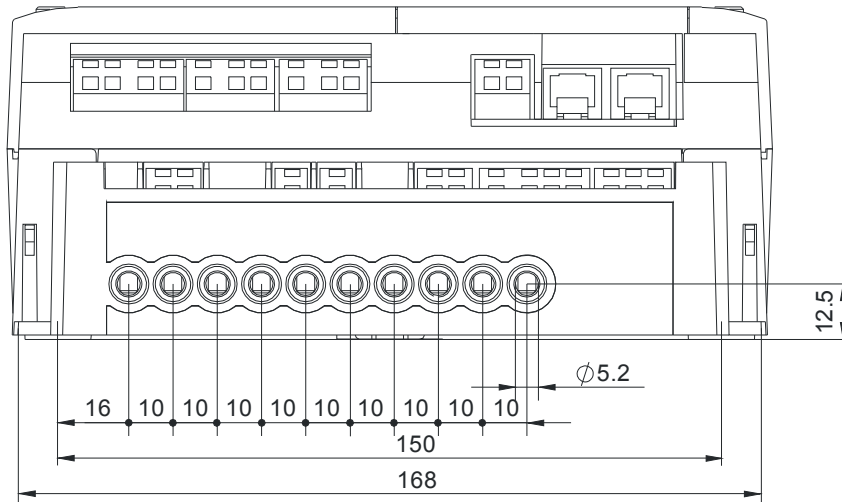
Type **screwless spring-type terminal**

Max. current of voltage outputs **1 A**

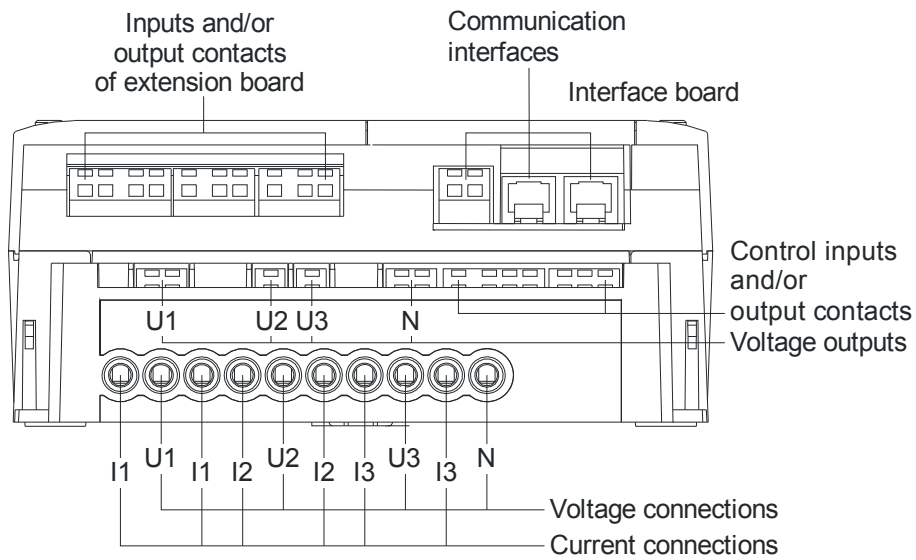
**Meter dimensions (standard terminal cover)**



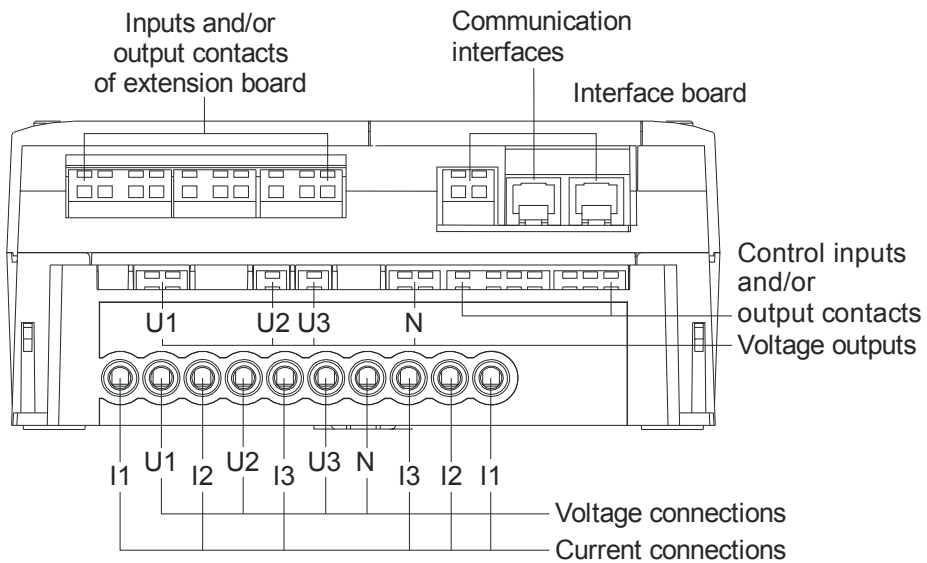
Terminal dimensions



Terminal layout according to DIN



Symmetrical terminal layout (optional, ZMD402 only)



Type designation		ZMD	4	02	C	R	44	4207	.c1	S4
<b>Network type</b>										
ZFD	3-phase 3-wire network (F-circuit)									
ZMD	3-phase 4-wire network (M-circuit)									
<b>Connection type</b>										
4	Transformer operated									
<b>Accuracy class</b>										
02	Active energy class 0.2 S (IEC)									
<b>Measured quantities</b>										
C	Active and reactive energy									
A	Active energy									
<b>Construction</b>										
R	With integrated interface									
<b>Tariffication</b>										
21	Energy rates, external rate control via control inputs									
24	Energy rates, internal rate control via time switch (additionally possible via control inputs)									
41	Energy and demand rates, external rate control via control inputs									
44	Energy and demand rates, internal rate control via time switch (additionally possible via control inputs)									
		All versions with 3 control inputs and 2 output contacts								
<b>Additional functions</b>										
000x	No extension board									
060x	6 outputs									
240x	2 control inputs, 4 outputs									
420x	4 control inputs, 2 outputs									
421x	4 active inputs, 2 relay outputs 8 A									
326x	3 control inputs, 2 relay outputs, auxiliary power supply 12 to 24 V <sub>DC</sub>									
045x	4 outputs, auxiliary power supply 100 to 240 V <sub>AC</sub> /V <sub>DC</sub>									
047x	4 outputs, auxiliary power supply 12 to 48 V <sub>DC</sub>									
xxx0	No additional functions									
xxx7	Load profile									
<b>Integrated interface (R types only), Series 4</b>										
c1	RS232 interface									
c2	RS485 interface									
c3	CS interface									
c6	RS422 interface									



**Contact:**

Landis+Gyr AG  
Theilerstrasse 1  
CH-6301 Zug  
Switzerland  
Phone: +41 41 935 6000  
[www.landisgyr.com](http://www.landisgyr.com)

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| Gyr+  
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