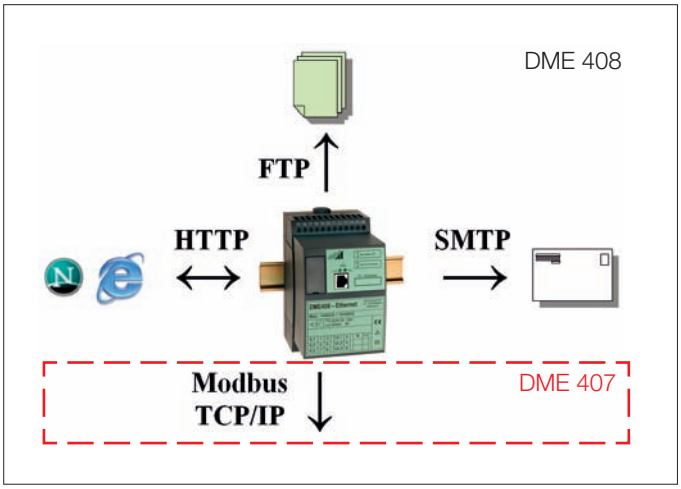
CAMILLE BAUER

SINEAX DME 407 / 408
Energy Management in 3-phase Systems

Application

The devices may be used for any remote application to record state informations and billing data for power feeders, distributions or specific loads in electrical systems. They can be connected via intranet or internet. For an on-site display the devices can be used along with the display unit A200, which visualizes all state information via high-contrast LED displays.

All described functions are combined in a DME 408. To use it in superior systems using the “Modbus over TCP/IP” protocol not all functions are really needed. The DME 407 therefore doesn’t supports mail and file transfer and provides no measurand a acquisition via browser.

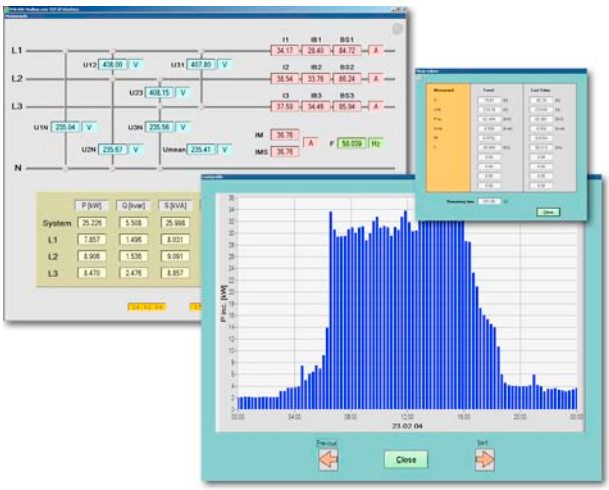


Main features

- Accurate reporting (class 0.2) of the present system state
- Recording energy consumption and billing data (load profiles, meters)
- Remote acquisition of measurement data via Ethernet using WEB-Browser (http), file-transfer (ftp) or Modbus over TCP/IP protocol
- Acquisition of mean values for any desired measurand with trend calculation and logging of their progression
- Monitoring alarm limits: Alarming via E-Mail (smtp)
- Periodical transmission of measurement data via E-Mail
- Functionally separated configuration of the installation bound measuring task and the analysis of measurement data via Ethernet
- Built-in, synchronizable realtime clock for time stamping of measurands

Ethernet Demos

Visit the ethernet demos on our homepage. A DME 408 is arranged in the mains input of our factory and delivers online energy consumption data via WEB browser. Additionally a downloadable application software shows the capabilities of measurement acquisition and analysis using the Modbus over TCP/IP interface.



Accuracy

State measurands:	Class 0.2
Active energy meters:	Class 1 (IEC 1036)
Reactive energy meters:	Class 2 (IEC 1268)

Technical Data

Ethernet connector:	RJ45
Physical Layer:	10/100 Base-T
Power supply:	AC/DC 85 … 230 V

SINEAX DME 407 / 408
Energy Management in 3-phase Systems

Symbols

Symbols	Meaning
X	Measured variable
U	Input voltage
Ur	Rated value of the input voltage
U 12	Phase-to-phase voltage L1 – L2
U 23	Phase-to-phase voltage L2 – L3
U 31	Phase-to-phase voltage L3 – L1
U1N	Phase-to-neutral voltage L1 – N
U2N	Phase-to-neutral voltage L2 – N
U3N	Phase-to-neutral voltage L3 – N
UM	Average value of the voltages (U1N + U2N + U3N) / 3
I	Input current
I1	AC current L1
I2	AC current L2
I3	AC current L3
Ir	Rated value of the input current
IM	Average value of the currents (I1 + I2 + I3) / 3
IMS	Average value of the currents and sign of the active power (P)
IB	RMS value of the current with wire setting range (bimetal measuring function)
BS	Slave pointer function for the measurement of the RMS value IB
φ	Phase-shift between current and voltage
F	Frequency of the input variable
P	Active power of the system P = P1 + P2 + P3
P1	Active power phase 1 (phase-to-neutral L1 – N)
P2	Active power phase 2 (phase-to-neutral L2 – N)
P3	Active power phase 3 (phase-to-neutral L3 – N)

Symbols	Meaning
Q	Reactive power of the system Q = Q1 + Q2 + Q3
Q1	Reactive power phase 1 (phase-to-neutral L1 – N)
Q2	Reactive power phase 2 (phase-to-neutral L2 – N)
Q3	Reactive power phase 3 (phase-to-neutral L3 – N)
S	Apparent power of the system $S = \sqrt{I_1^2 + I_2^2 + I_3^2} \cdot \sqrt{U_1^2 + U_2^2 + U_3^2}$
S1	Apparent power phase 1 (phase-to-neutral L1 – N)
S2	Apparent power phase 2 (phase-to-neutral L2 – N)
S3	Apparent power phase 3 (phase-to-neutral L3 – N)
Sr	Rated value of the apparent power of the system
PF	Active power factor $\cos\varphi = P/S$
PF1	Active power factor phase 1 P1/S1
PF2	Active power factor phase 2 P2/S2
PF3	Active power factor phase 3 P3/S3
QF	Reactive power factor $\sin\varphi = Q/S$
QF1	Reactive power factor phase 1 Q1/S1
QF2	Reactive power factor phase 2 Q2/S2
QF3	Reactive power factor phase 3 Q3/S3
LF	Power factor of the system $LF = sgnQ \cdot (1 - \lvert PF \rvert)$
LF1	Power factor phase 1 $sgnQ1 \cdot (1 - \lvert PF1 \rvert)$
LF2	Power factor phase 2 $sgnQ2 \cdot (1 - \lvert PF2 \rvert)$
LF3	Power factor phase 3 $sgnQ3 \cdot (1 - \lvert PF3 \rvert)$
H	Power supply
Hn	Rated value of the power supply

Applicable standards and regulations

IEC 688 resp. EN 60 688	Electrical measuring transducers for converting AC electrical variables into analog and digital signals
IEC 1010 resp. EN 61 010	Safety regulations for electrical measuring control and laboratory equipment
IEC 529 resp. EN 60 529	Protection types by case (code IP)
IEC 255-4 Part. E5	High-frequency disturbance test (static relays only)
IEC 1000-4-2/-3/-4/-6	Electromagnetic compatibility for industrial-process measurement and control equipment
EN 55 011	Electromagnetic compatibility of data processing and telecommunication equipment Limits and measuring principles for radio interference and information equipment
IEC 68-2-1/-2/-3/-6/-27 resp. EN 60 068-2-1/-2/-3/-6/-27	Ambient tests -1 Cold, -2 Dry heat, -3 Damp heat, -6 Vibration, -27 Shock
DIN 40 110	AC quantities
DIN 43 807	Terminal markings
IEC 1036	Alternating current static watt-hour meters for active energy (classes 1 and 2)
UL 94	Tests for flammability of plastic materials for parts in devices and appliances

Technical Data

Measuring input

Rated frequency:	50, 60 or 16 2/3 Hz
Nominal input voltage:	57 to 400 V (phase-to-neutral) resp. 100 to 693 V (phase-to-phase)
Nominal input current:	1 to 6 A
Consumption [VA]:	Voltage circuit: U^2 / 400 k Current circuit: ≤ I^2 · 0.01
Overload capacity:	Current circuit 10 A 400 V at single-phase AC system resp. 693 V at three-phase system Voltage circuit 480 V at single-phase AC system resp. 831 V at three-phase system

Continuous thermal ratings of inputs

Current circuit	10 A	400 V single-phase AC system 693 V three-phase system
Voltage circuit	480 V 831 V	single-phase AC system three-phase system

Short-time thermal rating of inputs

Input variable	Number of inputs	Duration of overload	Interval between two overloads
Current circuit	400 V single-phase AC system 693 V three-phase system		
100 A	5	3 s	5 min.
250 A	1	1 s	1 hour
Voltage circuit	1 A, 2 A, 5 A		
Single-phase AC system 600 V H_{intern}: 1.5 Ur	10	10 s	10 s
Three-phase system 1040 V H_{intern}: 1.5 Ur	10	10 s	10 s

Ethernet Interface

Bus connections:	RJ45
Physical Layer:	10/100 Base-T
IP address:	192.168.57.240, settable via browser
Max. length of bus:	2500 m
Interface:	Electrically insulated (500 V)
Configuration possibilities:	Locally from a PC, or via ethernet

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Table 1: Measurands available via Ethernet Interface

Sym-bols	Meaning	Application		
		A11 … A16	A34	A24/ A44
U	Input voltage	●	—	—
U12	Phase-to-phase voltage L1 – L2	—	●	●
U23	Phase-to-phase voltage L2 – L3	—	●	●
U31	Phase-to-phase voltage L3 – L1	—	●	●
U1N	Phase-to-neutral voltage L1 – N	—	—	●
U2N	Phase-to-neutral voltage L2 – N	—	—	●
U3N	Phase-to-neutral voltage L3 – N	—	—	●
UM	Average value of the voltages	—	—	●
I	Input current	●	—	—
I1	AC current L1	—	●	●
I2	AC current L2	—	●	●
I3	AC current L3	—	●	●
IM	Average value of the currents	—	●	●
IMS	Average value of the currents and sign of the active power	—	●	●
IB	RMS value of the current with wire setting range (bimetal measuring function)	●	—	—
IB1	RMS value of the current with wire setting range (bimetal measuring function), phase 1	—	●	●
IB2	RMS value of the current with wire setting range (bimetal measuring function), phase 2	—	●	●
IB3	RMS value of the current with wire setting range (bimetal measuring function), phase 3	—	●	●
BS	Slave pointer function for the measurement of the RMS value IB	●	—	—
BS1	Slave pointer function for the measurement of the RMS value IB, phase 1	—	●	●
BS2	Slave pointer function for the measurement of the RMS value IB, phase 2	—	●	●
BS3	Slave pointer function for the measurement of the RMS value IB, phase 3	—	●	●
F	Frequency of the input variable	●	●	●
P	Active power of the system	●	●	●
P1	Active power, phase 1 (phase-to-neutral L1 – N)	—	—	●
P2	Active power, phase 2 (phase-to-neutral L2 – N)	—	—	●
P3	Active power, phase 3 (phase-to-neutral L3 – N)	—	—	●
PF	Active power factor $\cos\varphi$ = P/S	●	●	●
PF1	Active power factor, phase 1, P1/S1	—	—	●
PF2	Active power factor, phase 2, P2/S2	—	—	●
PF3	Active power factor, phase 3, P3/S3	—	—	●
Q	Reactive power of the system	●	●	●
Q1	Reactive power, phase 1 (phase-to-neutral L1 – N)	—	—	●
Q2	Reactive power, phase 2 (phase-to-neutral L2 – N)	—	—	●
Q3	Reactive power, phase 3 (phase-to-neutral L3 – N)	—	—	●
S	Apparent power of the system	●	●	●
S1	Apparent power, phase 1 (phase-to-neutral L1 – N)	—	—	●
S2	Apparent power, phase 2 (phase-to-neutral L2 – N)	—	—	●
S3	Apparent power, phase 3 (phase-to-neutral L3 – N)	—	—	●
LF	Power factor of the system	●	●	●
LF1	Power factor, phase 1	—	—	●
LF2	Power factor, phase 2	—	—	●
LF3	Power factor, phase 3	—	—	●

Continuation of Table 1 see on next page!

Continuation of Table 1:

Sym-bols	Meaning	Application		
		A11 … A16	A34	A24/ A44
QF	Reactive power factor sinφ = Q/S	●	●	●
QF1	Reactive power factor, phase 1, Q1/S1	—	—	●
QF2	Reactive power factor, phase 2, Q2/S2	—	—	●
QF3	Reactive power factor, phase 3, Q3/S3	—	—	●
	Power meter 1 … 4	●	●	●
	Average values 1 … 10	●	●	●

For the average values 1…10 their progression and trend is also available.

Where c.t's and/or v.t's are used for measurement, the values are referred to the primaries of the transformers.

Reference conditions

Ambient temperature:	15 … 30 °C
Input variable:	Rated useful range
Power supply:	H = Hn ± 1%
Active/reactive factor:	cosφ = 1 resp. sinφ = 1
Frequency:	50 … 60 Hz, 16 2/3 Hz
Waveform:	Sinusoidal, form factor 1.1107
Miscellaneous:	EN 60 688

System response

Accuracy class:	0.2 resp. 0.4 (phase shift applications) Active energy meters class 1, acc. to IEC 1036 (0.1 Ir ≤ I ≤ 1.5 Ir) Reactive energy meters class 2, acc. to IEC 1268 (0,1 Ir ≤ I ≤ 1,5 Ir)
Measurement cycle:	Depending on application
Response time:	Approx. 1 … 2 times measurement cycle

Influencing quantities and permissible variations

According to EN 60 688

Electrical safety

Protection class:	II
Enclosure protection:	IP 40, housing IP 20, terminals
Overvoltage category:	III

Insulation test:	Input voltage:	AC 400 V
	Input current:	AC 400 V
	Output:	DC 40 V
	Power supply:	AC 400 V DC 230 V
Surge test:	5 kV; 1.2/50 µs; 0.5 Ws	
Test voltage:	50 Hz, 1 min. acc. to EN 61 010-1	
	5550 V, inputs versus all other circuits as well as outer surface	
	3250 V, input circuits versus each other	
	3700 V, power supply versus outputs and SCI as well as outer surface	
	490 V, outputs and SCI versus each other and versus outer surface	

Power supply →○

DC, AC power pack (DC or 50 … 60 Hz)

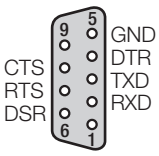
Rated voltage U_N	Tolerance
85 … 230 V DC, AC	DC – 15 … + 33% AC ± 10%

Consumption: ≤ 9 W resp. ≤ 10 VA

Programming connector on transducer

Interface: RS 232 C

DSUB socket: 9-pin



The interface is electrically insulated from all other circuits.

Installation data

Housing:	Housing **T24** See Section “Dimensioned drawings”
Housing material:	Lexan 940 (polycarbonate), flammability class V-0 acc. to UL 94, self-extinguishing, non-dripping, free of halogen
Mounting:	For snapping onto top-hat rail (35 ×15 mm or 35 ×7,5 mm) acc. to EN 50 022 or directly onto a wall or panel using the pull-out screw hole brackets
Orientation:	Any
Weight:	Approx. 0.7 kg

Terminals

Type:	Screw terminals with wire guards
Max. wire gauge:	≤ 4.0 mm² single wire or 2 ×2.5 mm² fine wire

Ambient tests

EN 60 068-2-6:	Vibration
Acceleration:	± 2 g
Frequency range:	10 … 150 … 10 Hz, rate of frequency sweep: 1 octabe/minute
Number of cycles:	10, in each of the three axes
EN 60 068-2-27:	Shock
Acceleration:	3 ×50 g 3 shocks each in 6 directions
EN 60 068-2-1/-2/-3:	Cold, dry heat, damp heat

Ambient conditions

Variations due to ambient temperature:	± 0.2% / 10 K
Nominal range of use for temperature:	0…15…30…45 °C (usage group II)
Operating temperature:	– 10 to + 55 °C
Storage temperature:	– 40 to + 85 °C
Annual mean relative humidity:	≤ 75%
Altitude:	2000 m max.
Indoor use statement!	

Table 2: Ordering information

The following device versions are available as standard versions. It is only necessary to quote the Order No.:

DESCRIPTION	Order No.
Mechanical design	
Housing T24 for rail and wall mounting	
Rated frequency	
50/60 Hz	
Power supply	
85 … 230 V DC/AC	
Device type	
DME 407, german/english	154 930
DME 407, french/englisch	154 948
DME 408, german/english	152 843
DME 408, french/english	149 329

The language versions apply to the available languages for the configuration interface via internet browser.

Electrical connections

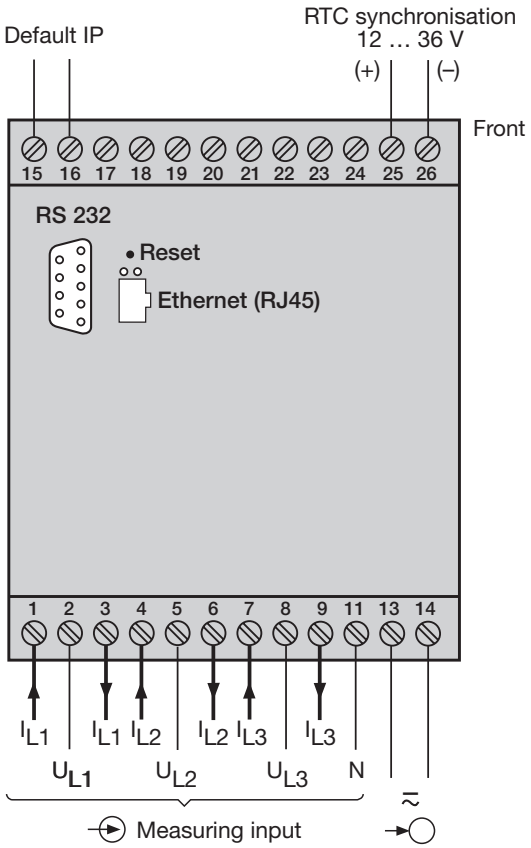
Function			Connection
Measuring input	AC current	IL1	1 / 3
		IL2	4 / 6
		IL3	7 / 9
	AC voltage	UL1	2
		UL2	5
		UL3	8
		N	11
Default IP			15
			16
Power supply	AC	~	13
		~	14
	DC	+	13
		–	14

If power supply is taken from the measured voltage internal connections are as follows:

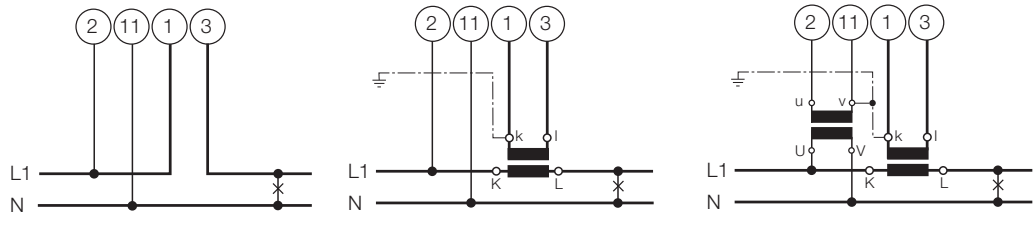
Application (system)	Internal connection Terminal / System
Single-phase AC current	2 / 11 (L1 – N)
4-wire 3-phase symmetric load	2 / 11 (L1 – N)
All other (apart from A15 / A16 / A24)	2 / 5 (L1 – L2)

Default-IP
If terminals 15 and 16 are short-circuited during power-on the device will use the IP address 192.168.57.240.

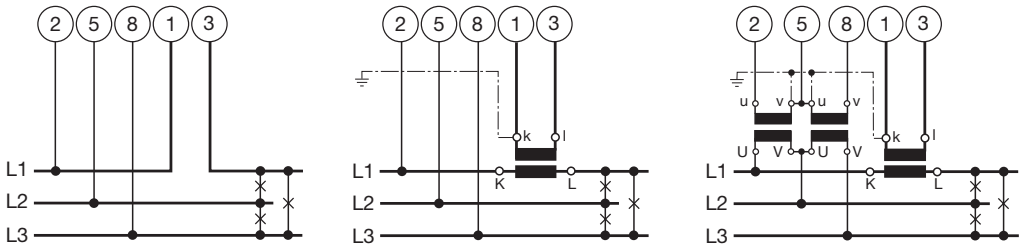
RTC synchronization
The system time can be synchronized to the network frequency by applying an optional voltage (12…36 V~) on terminals 25 and 26.
The synchronization may also be performed by means of minute-pulses (12…36 V=).



Reset
If i.e. the network parameters set no longer allow to access the device a reset of all parameters will be necessary. To do so you have to break through the foil of the label at the market position. To press the underlying reset button you need a pin of at least 10 mm length and max. 1.2 mm diameter. The button must be pressed on power-up for about 3 s. Because all adjusted options and configuration settings are lost during reset perform this step only if absolutely necessary.

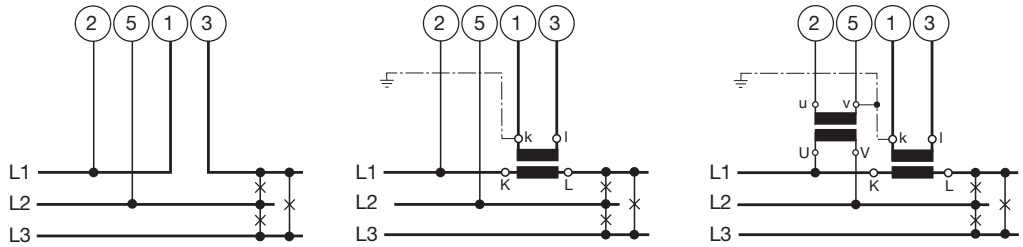
	Measuring inputs
System / application	Terminals
Single-phase AC system A11	

Measuring inputs

System / application	Terminals
3-wire 3-phase **symmetric load** I: L1 A13	

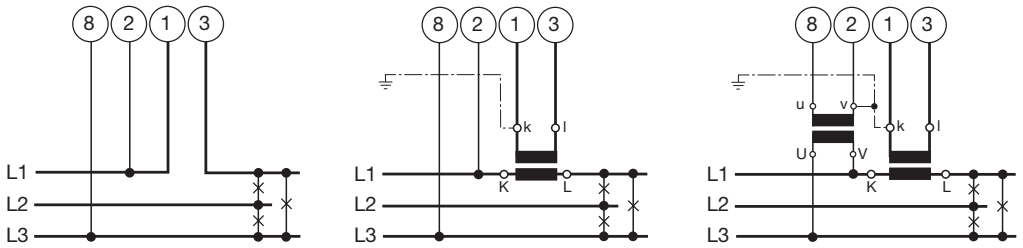
Connect the voltage according to the following table for current measurement in L2 or L3:

Current transf.	Terminals		2	5	8
L2	1	3	L2	L3	L1
L3	1	3	L3	L1	L2

System / application	Terminals
3-wire 3-phase **symmetric load** phase-shift U: L1 – L2 I: L1 A12	

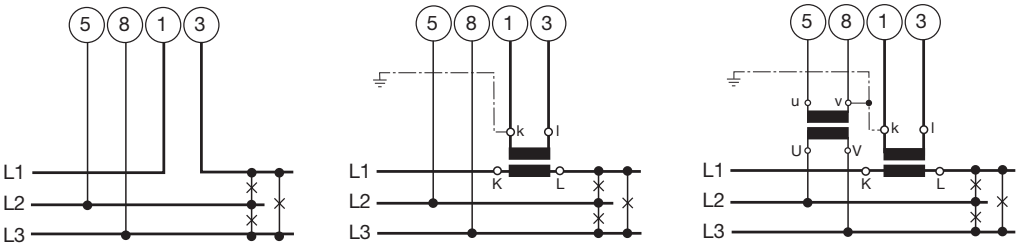
Connect the voltage according to the following table for current measurement in L2 or L3:

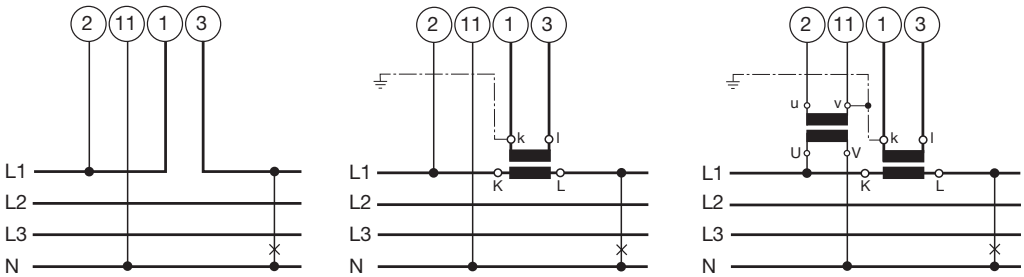
Current transf.	Terminals		2	5
L2	1	3	L2	L3
L3	1	3	L3	L1

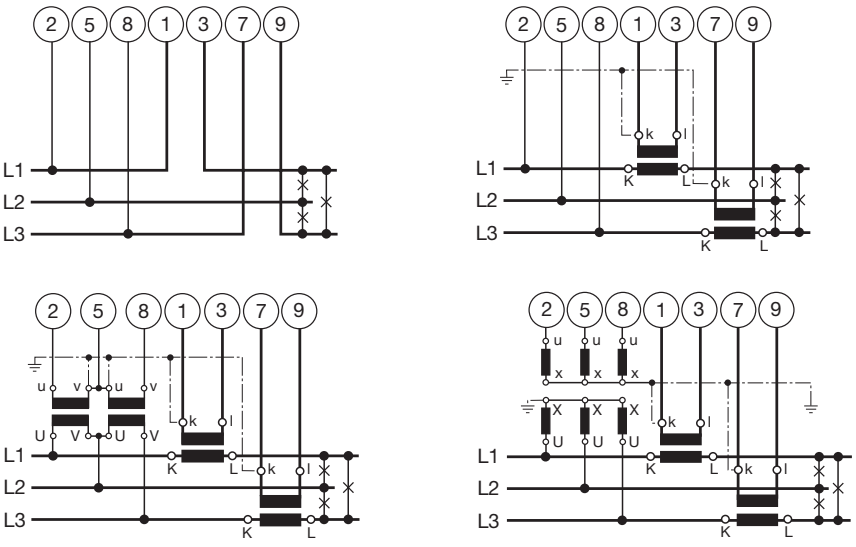
System / application	Terminals
3-wire 3-phase **symmetric load** phase-shift U: L3 – L1 I: L1 A15	

Connect the voltage according to the following table for current measurement in L2 or L3:

Current transf.	Terminals		8	2
L2	1	3	L1	L2
L3	1	3	L2	L3

<table>
<tr><th colspan="2">Measuring input</th></tr>
<tr><td>System / application</td><td>Terminals</td></tr>
<tr><td>3-wire
3-phase
symmetric load
phase-shift
U: L2 – L3
I: L1
A16</td><td>


Connect the voltage according to the following table for current measurement in L2 or L3:
<table>
<tr><td>Current transf.</td><td colspan="2">Terminals</td><td>5</td><td>8</td></tr>
<tr><td>L2</td><td>1</td><td>3</td><td>L3</td><td>L1</td></tr>
<tr><td>L3</td><td>1</td><td>3</td><td>L1</td><td>L2</td></tr>
</table>
</td></tr>
<tr><td>4-wire
3-phase
symmetric load
I: L1
A14</td><td>


Connect the voltage according to the following table for current measurement in L2 or L3:
<table>
<tr><td>Current transf.</td><td colspan="2">Terminals</td><td>2</td><td>11</td></tr>
<tr><td>L2</td><td>1</td><td>3</td><td>L2</td><td>N</td></tr>
<tr><td>L3</td><td>1</td><td>3</td><td>L3</td><td>N</td></tr>
</table>
</td></tr>
<tr><td>3-wire
3-phase
asymmetric load
A34</td><td>


</td></tr>
</table>

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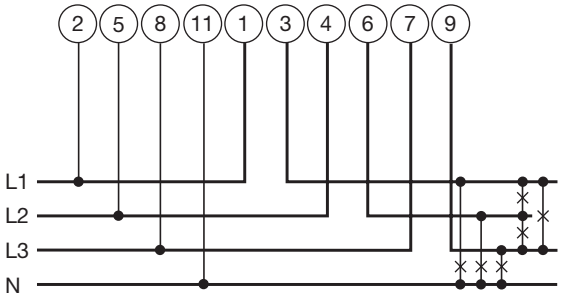
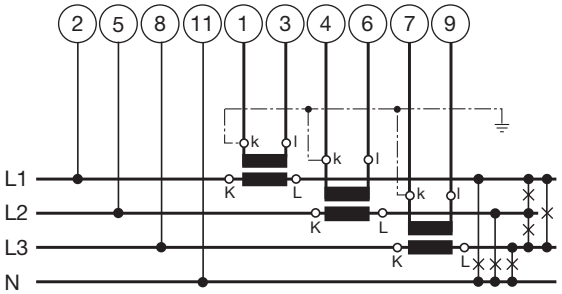
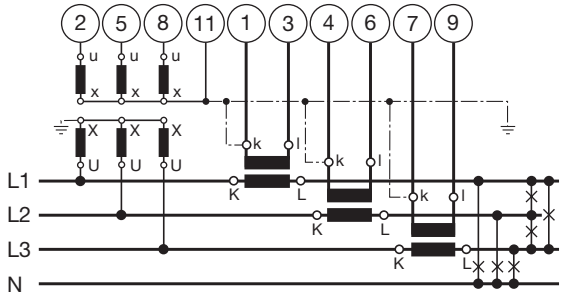
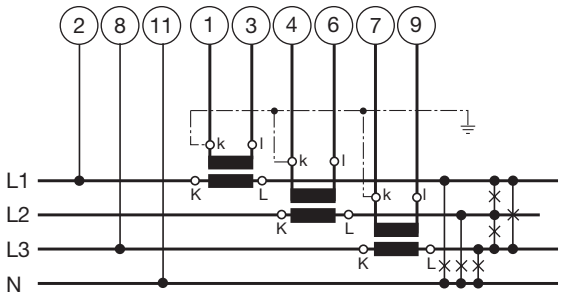
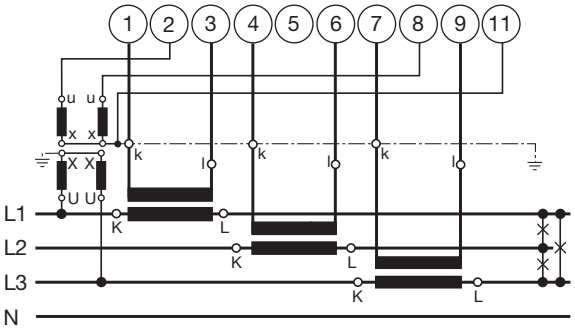
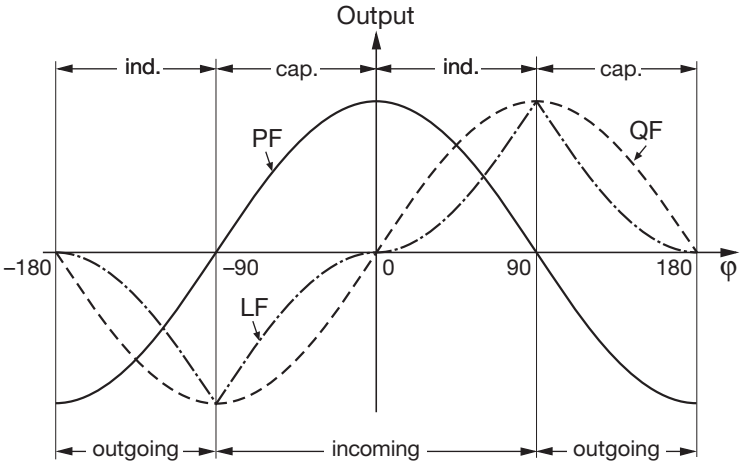
Measuring inputs	
System / application	Terminals
4-wire 3-phase **asymmetric load** A44	   3 single-pole insulated voltage transformers in high-voltage system
4-wire 3-phase **asymmetric load,** Open Y connection A24	 Low-voltage system  2 single-pole insulated voltage transformers in high-voltage system

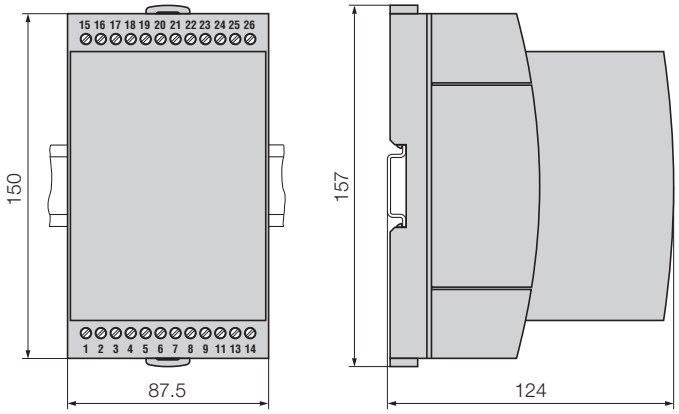
Difference between PF, QF and LF



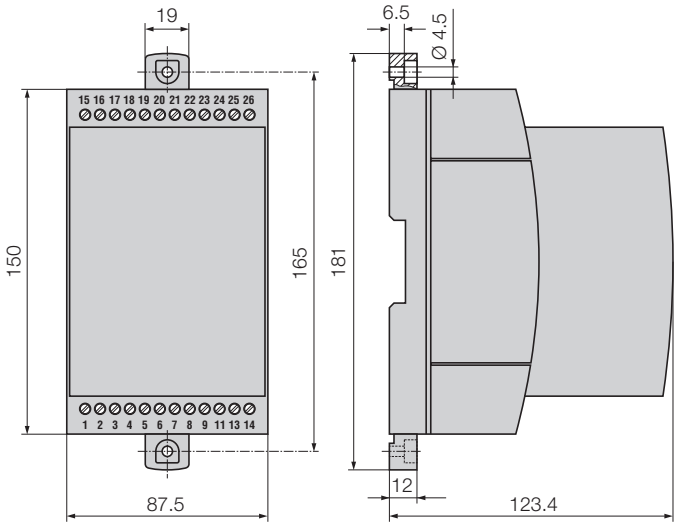
Active power PF ——, reactive power QF -----,
power factor LF – · – · – .

SINEAX DME 407 / 408
Energy Management in 3-phase Systems

Dimensioned drawings



*SINEAX DME 4 in housing **T24** clipped onto a top-hat rail (35 × 15 mm or 35×7.5 mm, acc. to EN 50 022).*



*SINEAX DME 4 in housing **T24**, screw hole mounting brackets pulled out.*

Table 3: Accessories

Description	Order No.
Programming cable	980 179
Configuration software DME 4 for SINEAX/EURAX DME 424, 440, 442, SINEAX DME 400, 401, 406 and 407/408 Windows 3.1x, 95, 98, NT, 2000 and XP on CD in German, English, French, Italian and Dutch **(Download free of charge under http://www.camillebauer.com)** In addition, the CD contains all configuration programmes presently available for Camille Bauer products.	146 557
Operating Instructions DME 407/408 Bd-e	154 956
Operating Instructions DME 407/408 Bf-e	154 964

Description	Order No.
SINEAX A 200	154 063
Interconnecting cable sub D 9 pol. male/male 1.8 m	154 071

Camille Bauer LTD
Aargauerstrasse 7
CH-5610 Wohlen/Switzerland
Phone +41 56 618 21 11
Fax +41 56 618 35 35
e-mail: info@camillebauer.com
http://www.camillebauer.com

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