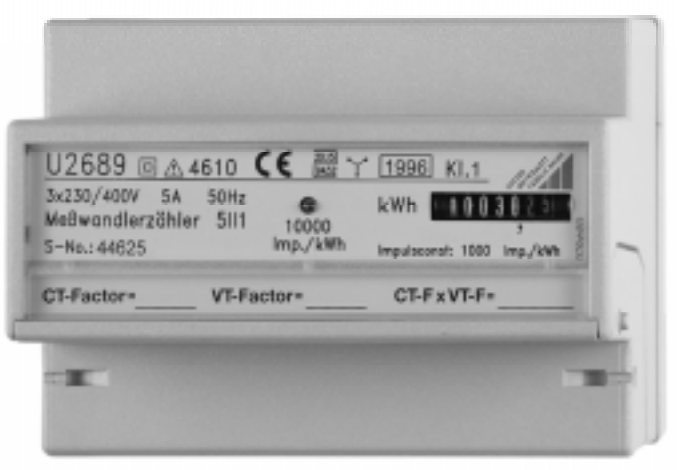
U2681 ... U2690
Energy meter for active and reactive energy

Applications

The electronic energy meter serves to acquire the energy consumption in AC and three-phase systems. The compact and rugged design permits applications at any site, e.g. in industrial plants, at construction sites, in offices and recreational facilities. When installing an energy meter near a consumer, pin-point control of its energy cost is possible. In addition, each energy meter has a pulse output for remote transmission of the measured values.

- Acquisition of active and reactive energy (Active energy: also in distorted systems)
- Remote transmission of pulses
- Applications in industry and trade



Essential features

Focus field sensor for distorted current and voltage curves

DC measurements possible from 10 Hz to 10 kHz

Self-securing screw terminals

Optionally class 2 and class 1 (for active energy meters)

Direct connection or connection by transformer

Position-independent mounting on a top-hat rail according to EN 50 022 or wall mounting with screw fasteners

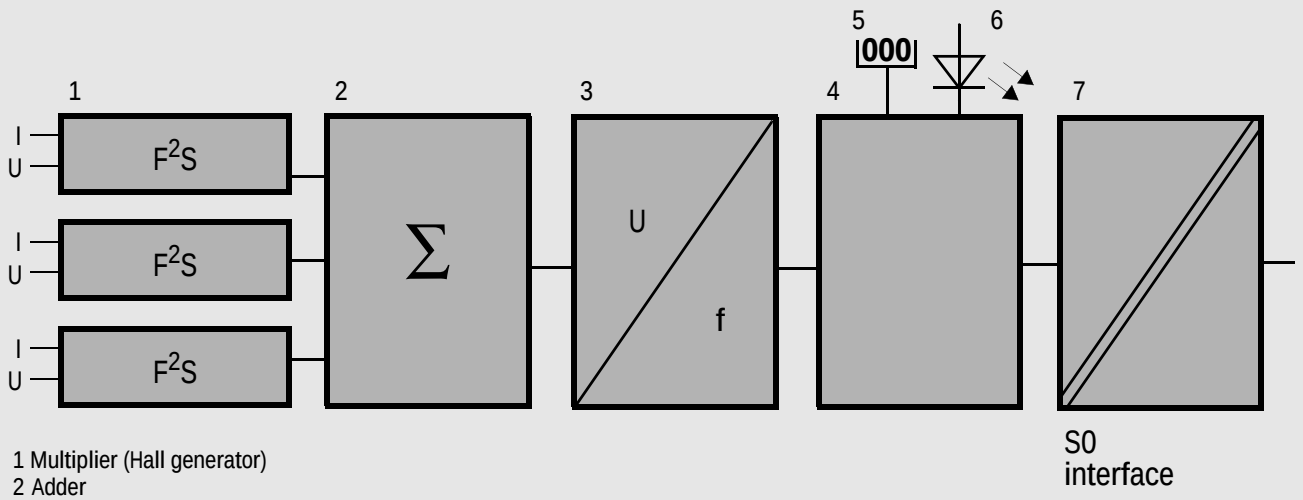
Description

Energy meters on Hall generator basis (focus field sensor F^2S) are particularly well suited for measurements in heavily distorted low-voltage systems. Moreover, F^2S meters are suited for all applications that previously were a domain of the Ferraris meters or AC-coupled static energy metering systems.
The especially fine frequency response of the meters considerably widens the application possibilities towards distorted systems.

Block circuit diagram (ex. U2689 and/or 2690), see figure 1:

In the 3 Hall generators (1), the partial power in proper phase relation is continuously formed as products of the instantaneous values of the input voltages and input currents.
The partial power is added (2) and passed to a voltage/frequency converter (3).
The output frequency is a directly proportional image of the power conditions on the primary side. The power-proportional pulse train is then passed to a counter (5), a LED (6) and an optocoupler (7).
The output signal of the optocoupler is potential-free and complies with the S0 standard according to DIN 43 864.

U2681 ... U2690
Energy meter for active and reactive energy



1 Multiplier (Hall generator)
2 Adder
3 Voltage/Frequency converter
4 Driver for counter
5 Counter
6 LED
7 Pulse output (S0 interface)

Figure 1: Block circuit diagram U2689 / U2690

Applied rules and standards

DIN 43 880	Built-in equipment for electrical installations; overall dimensions and related mounting dimensions
DIN 43 856	Electricity meters; tariff time switches and ripple control receivers; connection diagrams, terminal marking, circuit diagrams
DIN 43 857	Watthour meters in moulded insulation case without instrument transformers, up to 60 A rated maximum current
DIN 43 864	Current interface for the pulse transmission between the pulse generator counter and the tariff meter
IEC 65	Safety requirements for mains operated electronic and related apparatus for household and similar general use
IEC 68	Environmental testing
IEC 521	Classes 0.5 and 2 alternating current watt-hour meters
IEC 1036	Alternating current static watt hour-meters for active energy (classes 1 and 2)
IEC 255-4	High-frequency disturbance test (static relays only)
IEC 801-3	Electromagnetic compatibility for industrial-process measurement and control equipment
VDE 0418	Classes 0.5, 1 and 2 alternating current watthour meters

Symbols and their meaning

Symbol	Meaning
CT factor	Ratio of current transformer
CT-F x VT-F	CT factor x VT factor
F	Error
F^2S	Focus field sensor (Hall generator)
f	Frequency
I	Root-mean-square value of the current
U	Root-mean-square value of the voltage
Un	AC voltage between outer conductor and star point
Ur	Rated value of the input voltage
VT factor	Ratio of voltage transformer
I_B	Nominal current (basic current)
I_{max}	Maximum current

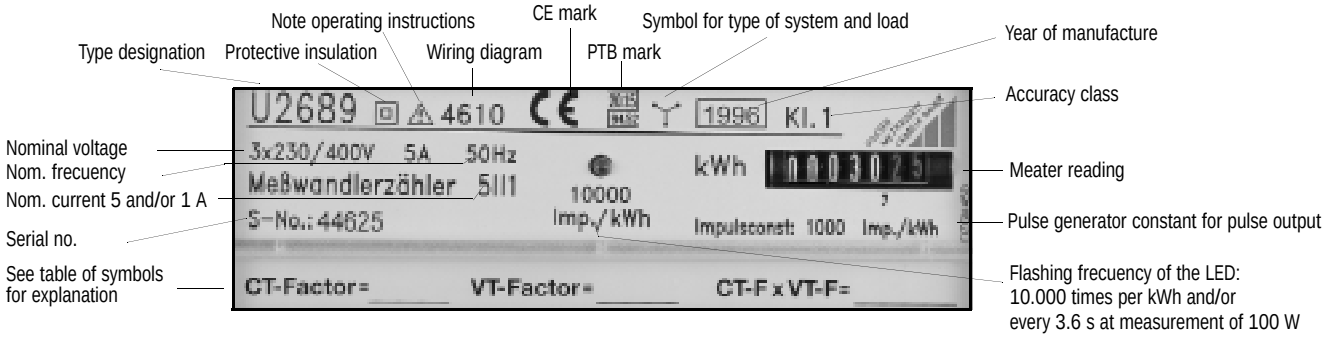


Figure 2: Inscription of the nameplate

Technical data

Measuring ranges active consumption meter

Voltages

See order code	

Currents

Directly measuring I_B	10 A	
Starting current	Class 2: 0.5 % I_B	Class 1: 0.4 % I_B
Directly measuring I_{max}	63 A	
Curr. instrument transformer I_B	1 A (suited for instrument transformer 1 A and 5 A)	
Starting current	Class 2: 0.5 % I_B	Class 1: 0.4 % I_B
Curr. instrument transformer I_{max}	6 A	

Frequency range

Nominal frequency	15 Hz ... 75 Hz
Maximum frequency	10 Hz ... 10 kHz

Accuracy class

Standard	1 or 2 acc. to IEC 1036, depending upon order code

Measuring ranges reactive consumption meters

Voltages

See order code	

Currents

Directly measuring I_B	10 A	
Starting current	Class 2: 0.5 % I_B	Class 1: 0.4 % I_B
Directly measuring I_{max}	63 A	
Curr. instrument transformer I_B	1 A (suited for instrument transformer 1 A and 5 A)	
Starting current	Class 2: 0.5 % I_B	Class 1: 0.4 % I_B
Curr. instrument transformer I_{max}	6 A	

Frequency range

Nominal frequency	15 ... 75 Hz (U2688, U2690)
Maximum frequency	10 Hz ... 10 kHz

Accuracy class

Standard	2 acc. to VDE 0418 part 20 (draft)

Overload capacity

All meters	Unlimited 1.15 U_n and I_{max}
Direct connection	5x 3 s U_n and 100 A (interval: 5 min)
Direct connection	1x 1 s U_n and 250 A
Connection to current transf.	0.5 s 20 x I_{max}

Pulse output

All energy meters are provided with a pulse output as standard feature, see figure 3. The pulse output is electrically isolated from the measuring circuit via an optocoupler.

Electrical values

Pulse generator const., direct	1, 10, 100, 1,000, 5,000, 10,000 pulses/kWh
Pulse generator constants Instrument transformer counter	10, 100, 1,000 pulses/kWh 10,000, 50,000, 100,000 pulses/kWh
Pulse width	100 ms +50 %
Pulse interval	> 50 ms
U_{ext}	max. 40 V
Switching current	max. 27 mA
Dissipation power	max. 0.2 W

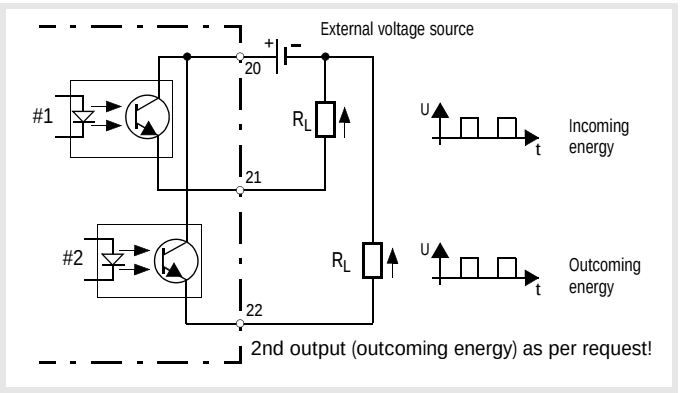


Figure 3: Pulse output

Indication

Counter (secondary counter, kWh or kVarh)

Direct connection	Step-by-step switch, 6+1 places
Connection to instr. transformer	Step-by-step switch, 5+2 places

LEDs

Direct connection counter	Red LED, 1,000 pulses/kWh
Instrument transformer counter	Red LED, 10,000 pulses/kWh

Auxiliary voltage

All required auxiliary voltages are generated by the measuring voltage.

Internal losses

Voltage circuit

Two-wire meter	< 5 VA
Three- and four-wire meter	< 3 VA per phase

Current circuit

at I_{max}	< 1 VA
at I_B = 1 A	< 0.02 VA
at I_B = 5 A	< 0.5 VA
at I_B = 10 A	< 0.02 VA

Potential isolation

Nominal insulation voltage

Inputs	AC 600 V
Output	DC 50 V

Insulation test voltage

Input <-> output/case	DC 5.6 kV (AC 4 kV)
Output <-> case	2 kV

U2681 ... U2690
Energy meter for active and reactive energy

Electrical safety

Protection class	II VDE 0160
Overvoltage category	III VDE 0160
Permissible degree of pollution	2

Electromagnetic compatibility according to IEC 1036

Impulse voltage	6 kV, 1.2/50 µs 10+/10– impulses (IEC 801-5)
Burst	2 kV (IEC 801-4)
Electromagnetic fields	10 V/m (IEC 801-3)
Electrostatic discharge	15 kV (IEC 801-2)

Environmental conditions

Nominal operating temperature	–10 ... +45 °C
Maximum operating temperature	–20 ... +55 °C
Storage temperature	–25 ... +85 °C
Relative humidity	< 75 % mean annual RH

Mechanical data

Case

Material	Polycarbonate LEXAN acc. to UL94 class V0
Dimensions	Height ≤ 90 mm Depth ≤ 70 mm Width 125.5 mm +0.5 mm
Weight	< 0.5 kg
Mounting	To top-hat rail acc. to DIN EN 50 022 or wall mounting
Protection type	IP 51

Connections

Current, direct	≤ 16 mm^2 solid wire, marking A1x
Current instrument transformer	≤ 4 mm^2 solid wire, marking A2x
Voltage	≤ 4 mm^2 solid wire
Pulse output	≤ 2.5 mm^2 solid wire
Protection type	IP 20

Dimensional drawing

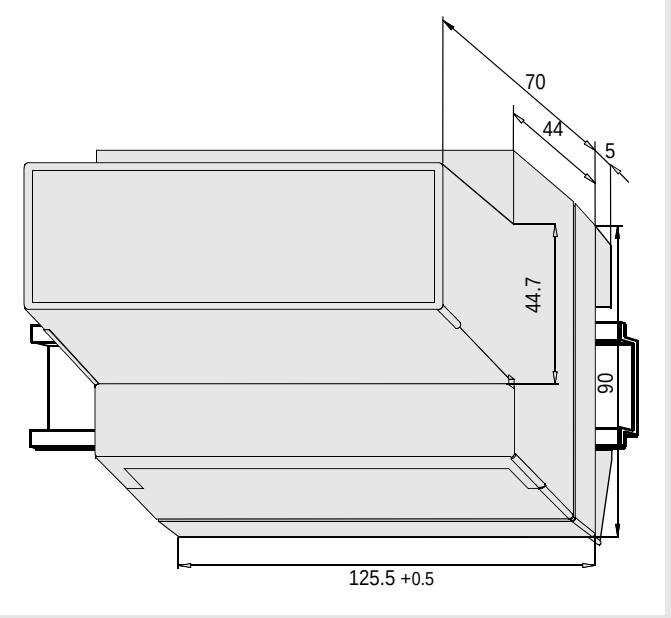


Figure 4: Dimensional drawing of front and side view

Mounting

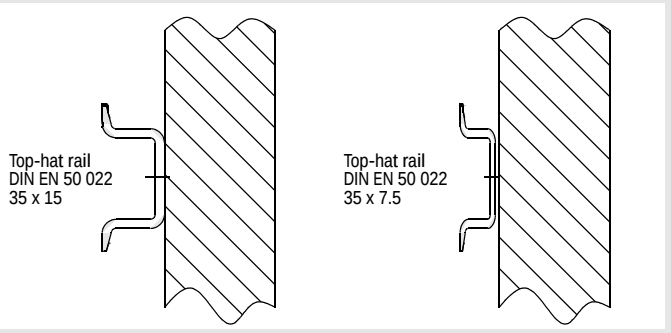


Figure 5: Mounting to top-hat rail

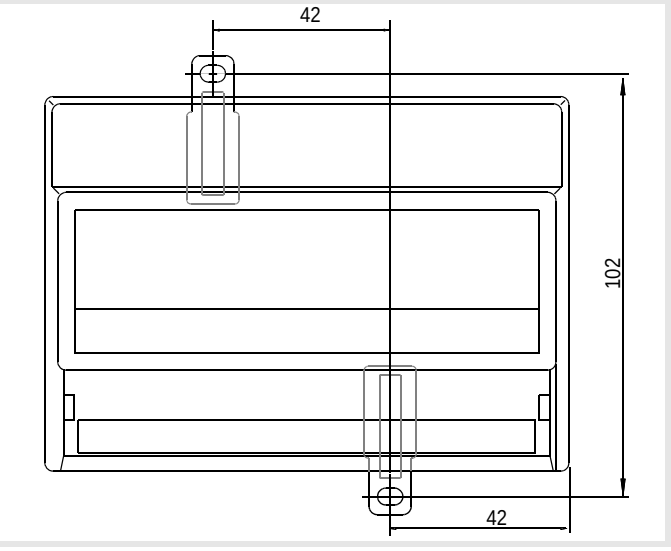


Figure 6: Dimensional drawing for wall mounting (front view)

Terminal covers

Seleable terminal covers are used for contact protection.

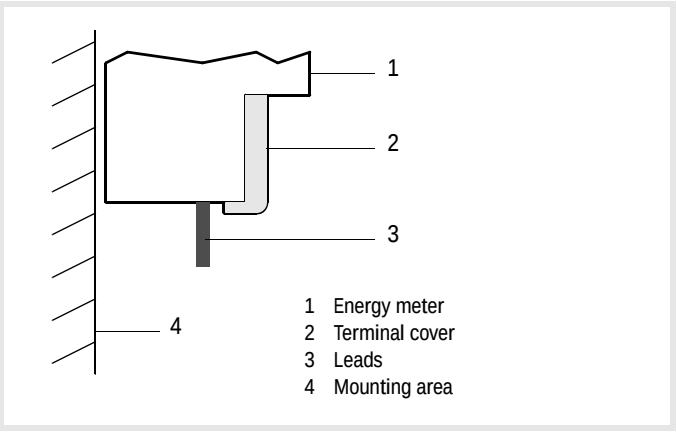


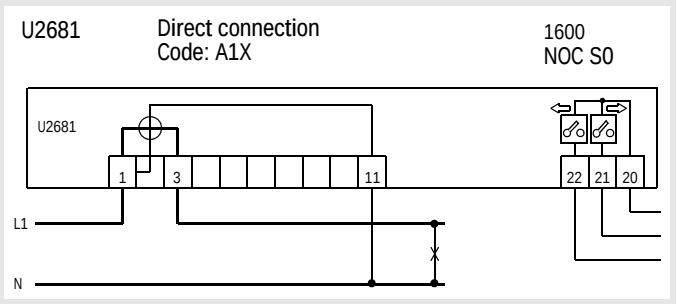
Figure 7: Terminal covers

Pin assignment

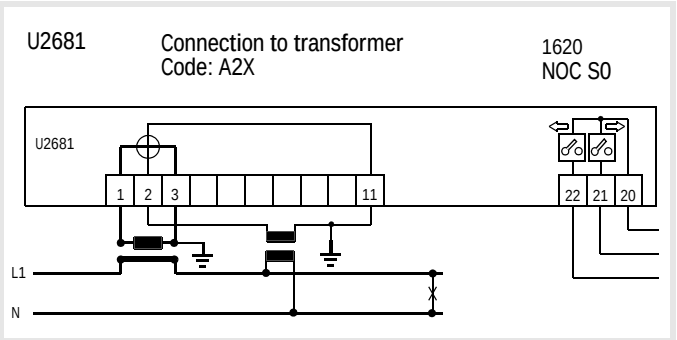
The connection elements are self-securing screw terminals and are protected with a sealable covers as standard.

Energy meter for active energy

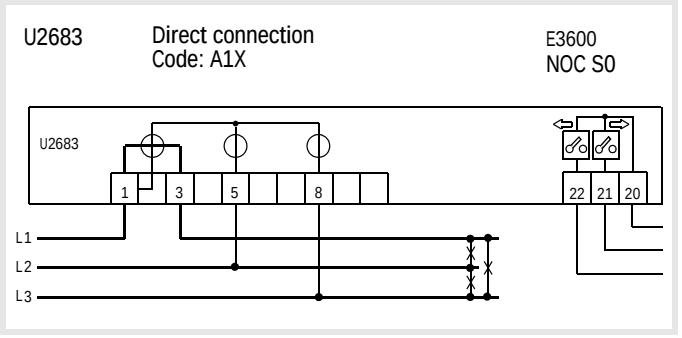
Two-wire AC system (without current transformer)



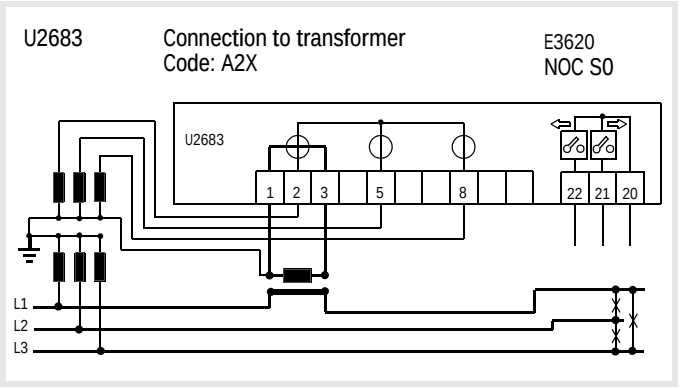
Two-wire AC system (with current transformer)



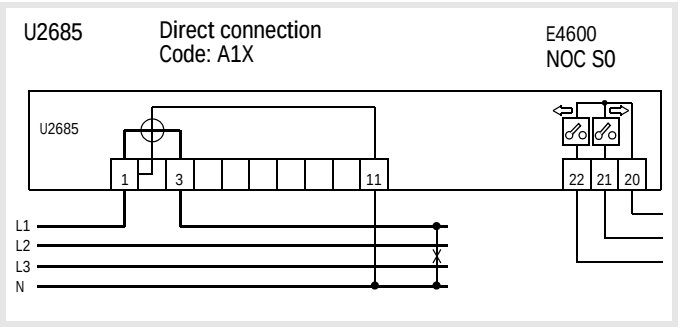
Three-wire, three-phase system balanced load (w/o current transformer)



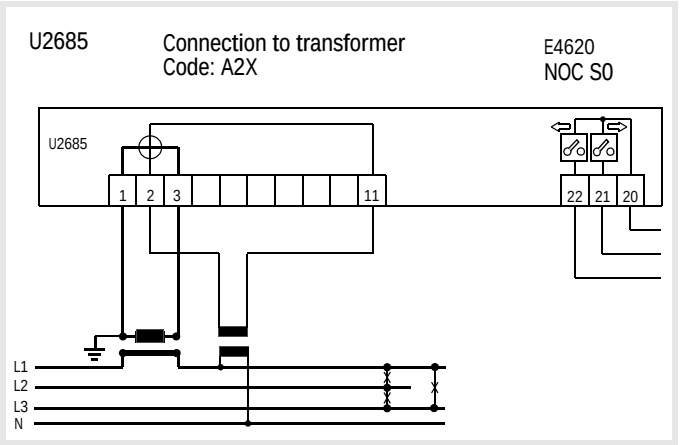
Three-wire, three-phase system balanced load (with current transformer)



Four-wire, three-phase system balanced load (w/o current transformer)



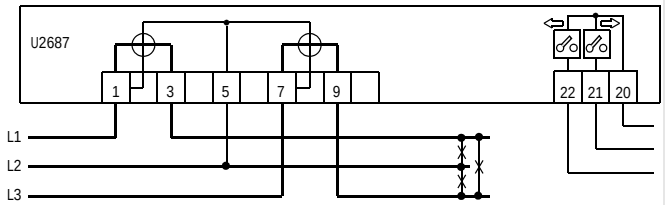
Four-wire, three-phase system balanced load (with current transformer)



U2681 ... U2690
Energy meter for active and reactive energy

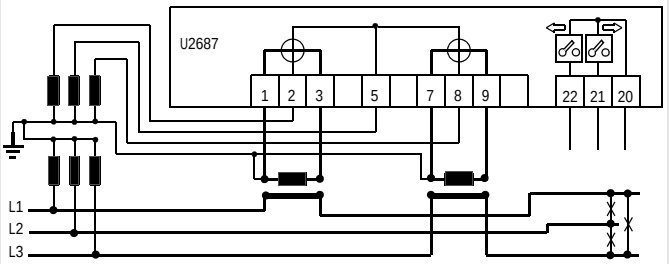
Three-wire, three-phase system unbalanced load (w/o curr. transformer)

U2687 Direct connection 3600
Code: A1X NOC S0



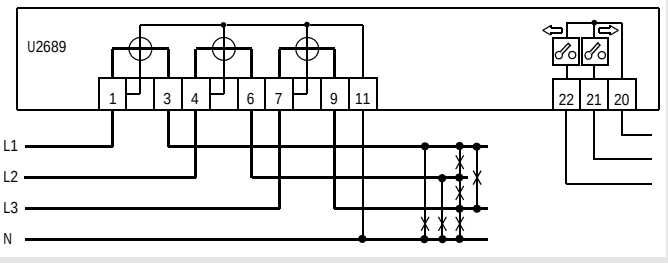
Three-wire, three-phase system unbalanced load (with curr. transformer)

U2687 Connection to transformer 3620.M7
Code: A2X NOC S0



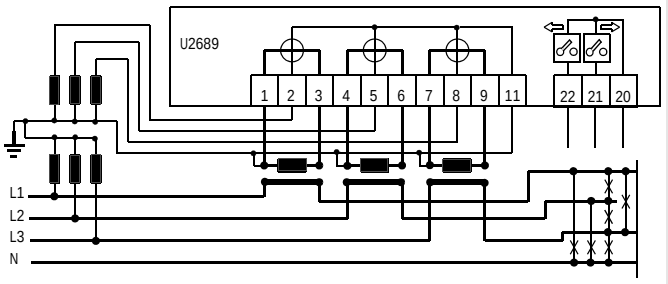
Four-wire, three-phase system unbalanced load (w/o curr. transformer)

U2689 Direct connection 4600
Code: A1X NOC S0



Four-wire, three-phase system unbalanced load (with curr. transformer)

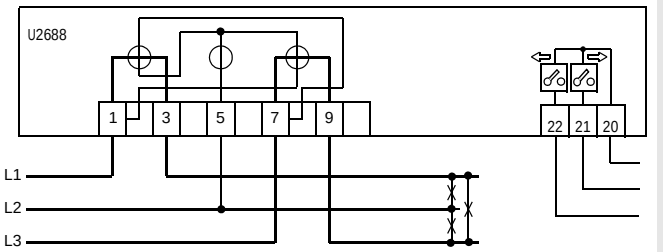
U2689 Connection to transformer 4620.M1
Code: A2X NOC S0



Energy meters for reactive energy

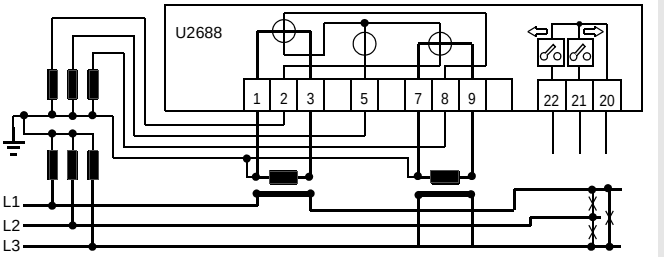
Three-wire, three-phase system unbalanced load (w/o curr. transformer)

U2688 Direct connection 6600
Code: A1X NOC S0



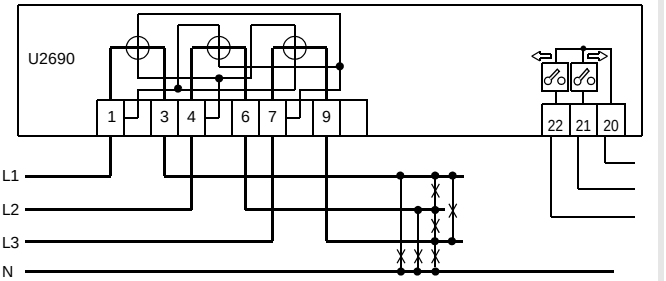
Three-wire, three-phase system unbalanced load (with curr. transformer)

U2688 Connection to transformer 6620
Code: A2X NOC S0



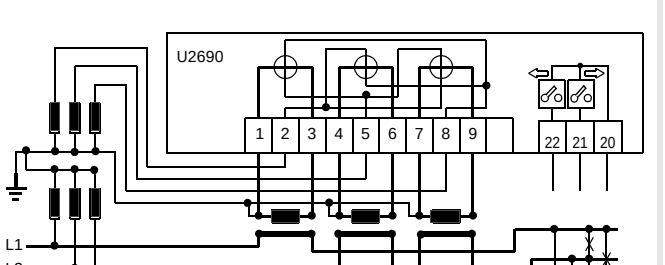
Four-wire, three-phase system unbalanced load (w/o curr. transformer)

U2690 Direct connection 7600
Code: A1X NOC S0



Four-wire, three-phase system unbalanced load (with curr. transformer)

U2690 Connection to transformer 7620
Code: A2X NOC S0



U2681 ... U2690
Energy meter for active and reactive energy

Order code

Connection	Pulses/kWh	Class	PTB mark / certification	Nominal voltage *	Marking	
Energy meter for active energy						
AC system						
Direct 10 (63) A	100	2	No	230 V	U2681 A13 G2 P2 U06	
Direct 10 (63) A	100	1	Yes	230 V	U2681 A13 G1 P1 U06	
Transformer 1 // 5 A	1000	2	No	230 V	U2681 A23 G2 P2 U06	
Transformer 1 // 5 A	1000	1	Yes	230 V	U2681 A23 G1 P1 U06	
Three-wire three-phase system balanced load						
Direct 10 (63) A	100	2	No	400 V	U2683 A13 G2 P2 U07	
Transformer 1 // 5 A	1000	2	No	100 V	U2683 A23 G2 P2 U03	
Transformer 1 // 5 A	1000	2	No	400 V	U2683 A23 G2 P2 U07	
Four-wire three-phase system balanced load						
Transformer 1 // 5 A	1000	2	No	100 V	U2685 A23 G2 P2 U03	
Transformer 1 // 5 A	1000	2	No	400 V	U2685 A23 G2 P2 U07	
Three-wire three-phase system unbalanced load						
Direct 10 (63) A	100	2	No	400 V	U2687 A13 G2 P2 U07	
Direct 10 (63) A	100	1	Yes	400 V	U2687 A13 G1 P1 U07	
Transformer 1 // 5 A	1000	2	No	100 V	U2687 A23 G2 P2 U03	
Transformer 1 // 5 A	1000	1	No	100 V	U2687 A23 G1 P2 U03	
Transformer 1 // 5 A	1000	1	Yes	100 V	U2687 A23 G1 P1 U03	
Transformer 1 // 5 A	1000	2	No	110 V	U2687 A23 G2 P2 U04	
Transformer 1 // 5 A	1000	1	No	110 V	U2687 A23 G1 P2 U04	
Transformer 1 // 5 A	1000	1	Yes	110 V	U2687 A23 G1 P1 U04	
Transformer 1 // 5 A	1000	2	No	400 V	U2687 A23 G2 P2 U07	
Transformer 1 // 5 A	1000	1	No	400 V	U2687 A23 G1 P2 U07	
Transformer 1 // 5 A	1000	1	Yes	400 V	U2687 A23 G1 P1 U07	
Transformer 1 // 5 A	1000	2	No	500 V	U2687 A23 G2 P2 U08	
Four-wire three-phase system unbalanced load						
Direct 10 (63) A	100	2	No	400 V	U2689 A13 G2 P2 U07	
Direct 10 (63) A	100	1	Yes	400 V	U2689 A13 G1 P1 U07	
Transformer 1 // 5 A	1000	2	No	100 V	U2689 A23 G2 P2 U03	
Transformer 1 // 5 A	1000	1	No	100 V	U2689 A23 G1 P2 U03	
Transformer 1 // 5 A	1000	1	Yes	100 V	U2689 A23 G1 P1 U03	
Transformer 1 // 5 A	1000	2	No	110 V	U2689 A23 G2 P2 U04	
Transformer 1 // 5 A	1000	1	No	110 V	U2689 A23 G1 P2 U04	
Transformer 1 // 5 A	1000	1	Yes	110 V	U2689 A23 G1 P1 U04	
Transformer 1 // 5 A	1000	2	No	400 V	U2689 A23 G2 P2 U07	
Transformer 1 // 5 A	1000	1	No	400 V	U2689 A23 G1 P2 U07	
Transformer 1 // 5 A	1000	1	Yes	400 V	U2689 A23 G1 P1 U07	
Transformer 1 // 5 A	1000	2	No	500 V	U2689 A23 G2 P2 U08	
Energy meters for reactive energy						
Three-wire three-phase system unbalanced load						
Transformer 1 // 5 A	1000	2	No	100 V	U2688 A23 U03	
Transformer 1 // 5 A	1000	2	No	400 V	U2688 A23 U07	
Four-wire three-phase system unbalanced load						
Transformer 1 // 5 A	1000	2	No	100 V	U2690 A23 U03	
Transformer 1 // 5 A	1000	2	No	400 V	U2690 A23 U07	

Accessories

Description	Marking	
Door mounting assembly	U270A	

* L1-N for U2681 and L1-L2 for all other energy meters

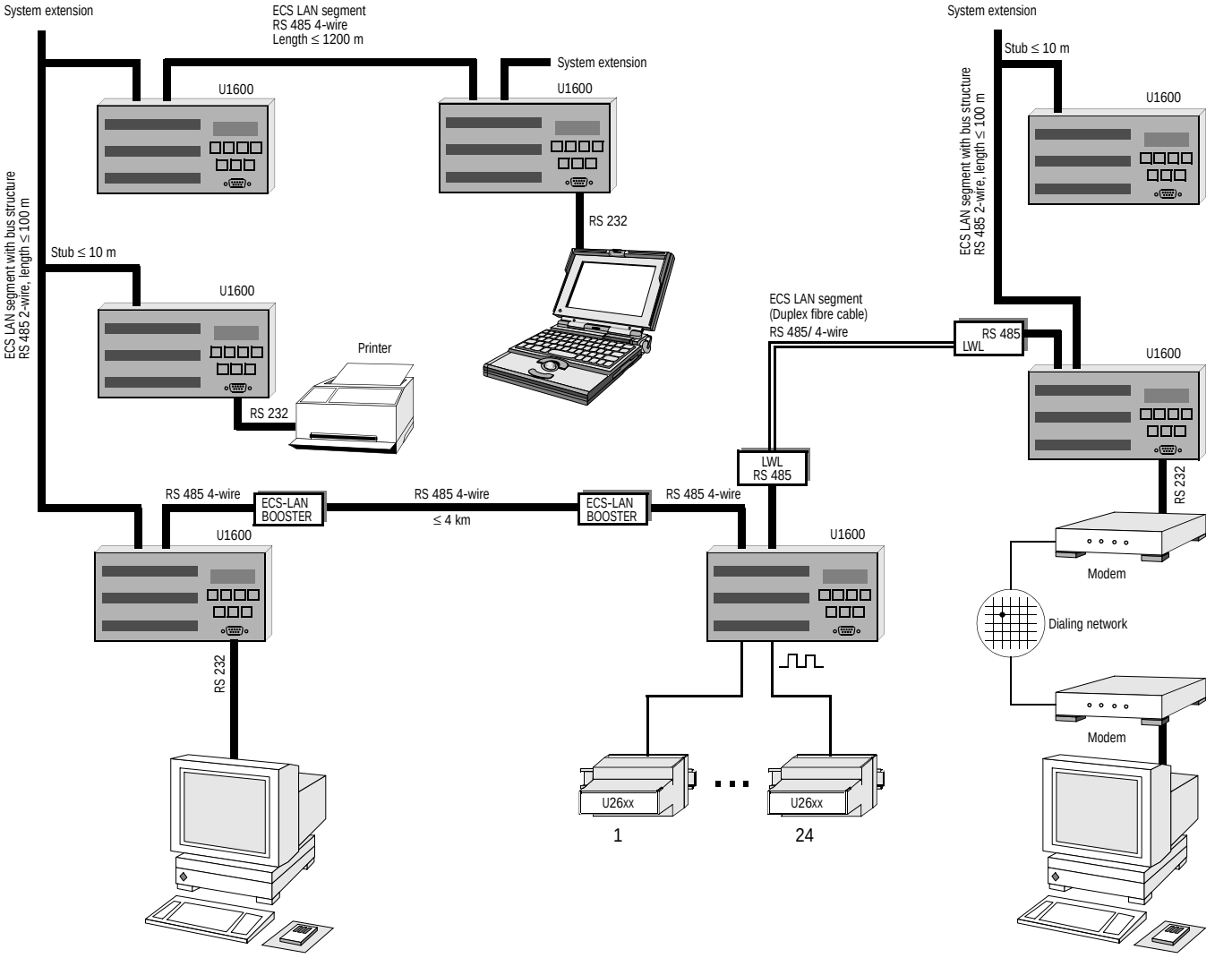
U2681 ... U2690
Energy meter for active and reactive energy

Energie-Control-System ECS

In the industry, in public authorities and in housing areas the costs of electrical energy are normally apportioned according to a standard code.
In view of rising electricity costs, there is a need to continuously measure the exact consumption of a certain cost center, a product, a production group, a department or a tenant.
The energy consumption can best be determined by means of an energy meter which is assigned to the consumer concerned.
The meters can either be read by personnel or centrally evaluated by the Energy Control System ECS.

The Energy Control System ECS at a glance:

- A maximum of 24 energy meters, e.g. U2681 to U2690, can be connected to each summation station.
  A maximum of 6120 energy meters can be acquired, stored and evaluated with the Energy Control System ECS.
- It is possible to have a maximum of 255 participants (summation stations) on the bus
- Cross-linking as open ring or bus structure
- Two-wire and four-wire connetions mixable in segments
- The baud rate can be adapted per segment
- The maximum distance between 2 stations is 1.2 km at 67.5 kbauds (with ECS LAN BOOSTER up to 4 km)



Printed in Germany • Subject to change without notice • 4/11.97 Ordering no. 3-348-881-03

GOSSEN-METRAWATT GMBH
D-90327 Nürnberg

Company address:
Thomas-Mann-Straße 16-20
D-90471 Nürnberg
Telefon +49 911 8602-0
Telefax +49 911 8602-669