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User Manual WH4209

Single Phase Electronic Electricity Meter

for

DIN Rail-Assembling

Date	07.12.2015
Last changes	20.04.2016



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Notice:

This manual describes electricity meters of the type WH4209. It includes all necessary information for assembling, setting into operation and use of the meter.

Used Symbols

	<p>Danger through Electric Voltages The symbol indicates warnings, which may lead to personal injuries or death if it is ignored. Take all necessary precautions to avoid danger!</p>
	<p>Warning The symbol indicates warnings to a possible dangerous situation which may lead to personal injuries or damage to properties. Avoid dangerous situations!</p>
	<p>Attention! „Attention“ indicates warnings, which may lead to damage of properties if not observed.</p>
	<p>Notice „Notice“ indicates important information in the manual.</p>
	<p>The symbol is printed on the nameplate references to further information in an instruction manual prepared for the customer.</p>

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Abbreviations

+A	Import active energy (to customer)
-A	Export active energy (from customer)
dd	day
DIN	German Institut for Standards
EN	European Standard
FNN	Forum Netztechnik/Netzbetrieb im VDE
FIFO	First IN-First OUT
HH or hh	Hour
IEC	International Electrotechnical Commission
Imp/kWh	quantity of pulses each kWh
Imp/kvarh	quantity of pulses each kvarh
IR	Infrared
LCD	Liquid Crystal Display
LED	Light Emitting Diode
MM or mm	Month or Minutes
OBIS	Object Identification System
+P	Import active power
-P	Export active power
PTB	Physikalisch Technische Bundesanstalt
+Q	Import reactive Power
-Q	Export reactive Power
RTC	Real Time Clock
+R	Import reactive energy (inductive)
-R	Export reactive energy (kapacitive)
SS or ss	Seconds
TOU	Time Of Use
Tx	Tariff (z.B. T1 Tariff1, T2 Tariff2, ...)
VDE	Association of Electrotechnic/Elektronik/Informationstechnik e.V.
yyyy	Year

1. Properties

1.1 Common

Welcome to use the single phase Din Rail meter. Let's introduce functions and operations of this product.

This meter is 1 phase –2 wire direct connected electricity meter with one pinch DIN RAIL housing. It adopts the advanced technology of LSI (Large Scale Integrated circuit) and digital signal processing. The craftworks of our product are exquisite and the functions provided are comprehensive and client-oriented. The energy meter is an intelligent instrument equipped with leading technology.

The functionality of the single phase Din Rail energy meter includes active energy, instantaneous measurement for voltage/current/frequency/power factor/power (optional), and active pulse output for test.

1.2 Appropriate Use

The electricity meter WH4209 and all versions of it are allowed to be used for measuring electrical energy only.

1.3 Properties

Type	Single phase meter—DIN RAIL ASSEMBLY 1TE
Voltage	
Nominal voltage U_n	230V _{AC}
Voltage range	0.8 – 1.15 U_n
Frequency	
Nominal frequency f_n	50 Hz
Frequency range	0.98 – 1.02 f_n
Current	
Reference current $I_{ref} = I_b = 10 I_{tr}$	5A
Maximum current I_{max}	45A
Minimum current I_{min}	0.2A
Starting current I_{st}	$\leq 0.004 I_b$
Accuracy	
	Class B in compliance with DIN EN 50470-1,-3
Measuring Active Energy	
One Energy Directions	+A with reverse locking
Meter constant	
LED-Output	1000Imp/kWh

SO-output	
constant	500imp/kWh, configurable(1000, 500, 250, 100)
connector	Terminals 20+, 21-
Display	
LCD	6digits(5+1)
Life cycle	> 12 years
Button (optional)	
Magnetic induction button	to flip the screen (display instantaneous data)
Power Consumption	
Voltage circuit	< 2 W / 10 VA at U_n
Current circuit	< 4 VA at I_b
Temperature Range	
Typical Operation	-25°C to +55°C
Storage	-40°C to +75°C
EMC Properties	
Isolation	4 kV AC, 50 Hz, 1min
High Voltage	10 kV, Impulse 1,2/50 μ s
Housing	
Dimension	DIN Rail 86x17.5x62 mm
Material	fiber-glass reinforced Polycarbonate (flame resistant EN 62053-21, recyclable)
Class of protection	II
Degree of protection	IP 51
Weight	
Weight	appr. 0.1 kg

Tab. 1: Technical Properties

1.4 Technical Standards

- IEC 62053-21: Static meters for active energy (classes 1 and 2)
- IEC 62052-11: Electricity metering equipment (AC)-General requirements, tests and test conditions – part 11: metering equipment
- IEC 62053-31: Electricity metering equipment (AC)- Particular requirements – part 31: Pulse output devices for electromechanical and electronic meters (two wires only)
- EN 50022: Low voltage switchgear and control gear for industrial use; mounting rails, top hat rails, 35 mm wide, for snap-on mounting of equipment

2. Safety

2.1 Responsibility

The owner or provider is responsible for the proper use of the device. The installation, putting into operation and reinstallation of the meter is only allowed to be done by electrically skilled persons, which got knowledge about the contents of this user manual.

2.2 Common safety instructions

For installation, setting into operation and reinstallation of the device the local requirements for safety requirements has to be observed.



Danger

Inappropriate use of parts under high voltage may lead to grave injuries and accidents, which may be fatal even with 230V.

The conductors which are connected to the device must be disconnected to the mains during assembling and installation. It must be used a prevention for being switched on accidentally.

The device is not allowed to be used out of specifications.

2.3 Service- and warranty instructions

Damaged devices can't be repaired by you. The warranty and liability will be terminated with opening the device. The same applies to damages caused by external influences.

For the device no servicing is required.

2.4 Disposal (product end of life information)



This meter was designed and built by DZG to provide many years of service, and is backed by our commitment to provide high quality support. When it eventually reaches the end of its serviceable life, it should be disposed of in accordance with local or national legislation.

2.5 Environment

This meter is designed for indoor use or in a cabinet environment only (avoiding extreme weather conditions) in accordance with IEC 62052-11 and IEC 62053-21, with the terminal cover fitted.

2.6 Service and Warranty

This meter product is warranted against defects in material and workmanship for a period of one year from date of shipment. During the warranty period DZG will at its option, either repair or replace products which prove to be defective. For warranty service or repair, this product must be returned to a service facility designated by DZG. DZG does not warrant that the operation of the meter or firmware will be uninterrupted or error free. Damaged devices can't be repaired by you. The warranty and liability will be terminated with opening the device. The same applies to damages caused by external influences.

For the device no servicing is required.

3. Assembling and installation

3.1 Assembling

The meter constructed for assembling on DIN-rail TH 35-7.5 according to IEC 60715.

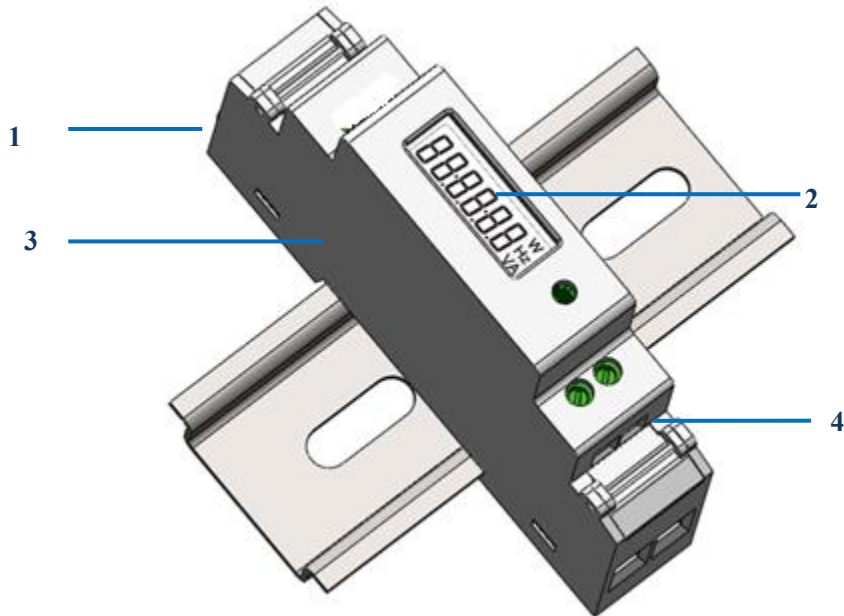


Abb 1: Housing

No.	Element
1	Meter Hook
2	LCD
3	Meter case
4	Terminal Block with cover

Tab. 2: Meter elements

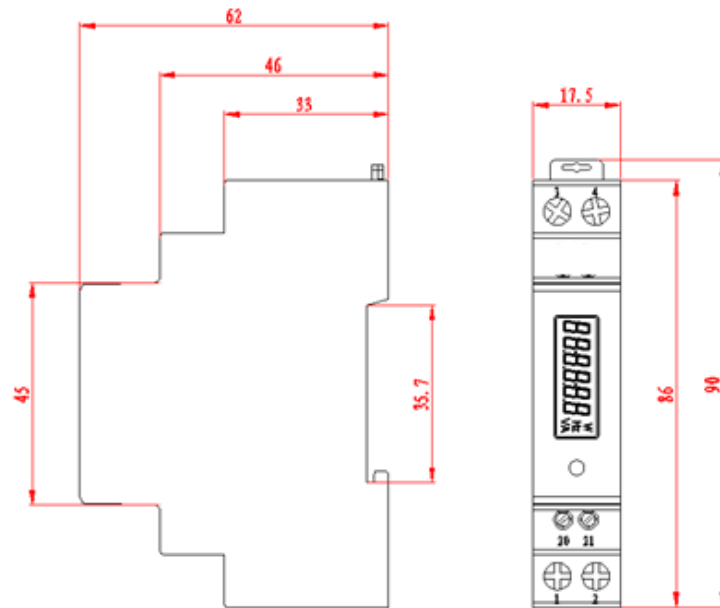


Abb 2: Housing Dimension

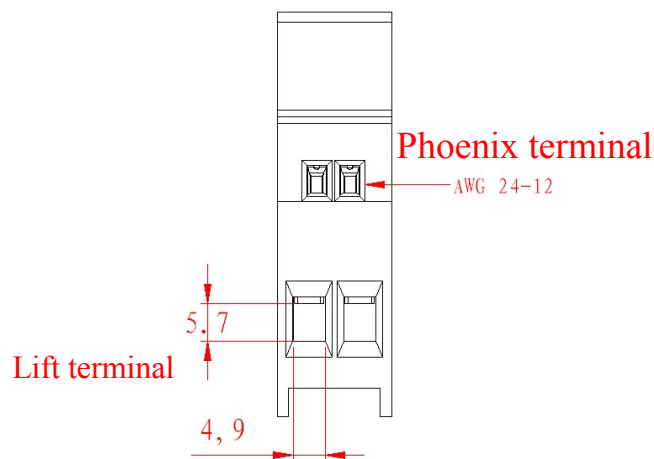


Abb 3: Terminal block

3.2 Installation

The connection diagram printed on the housing needs to be considered connecting the meter to the mains power.



Abb 4: Connection diagramm

Nr	Terminal	Terminal Nr	Terminal-Ø[mm]	Terminal screw	torque M [Nm]
1	Current In	1	5.7	M4 Pozidrive PZ2	M<2,7Nm
2	Current Out	2			
3	Neutral	3,4			
4	S0-Output (pos voltage)	20	M3	AWG 24-12	M<1.5 Nm
5	S0-Output (neg. voltage)	21			

Tab. 3: Terminal block



Warning

The requirements of the net provider need to be fulfilled.
Selective hedges have to be used according requirements of the net providers.

Attention!

Damage of the terminals due to high torque

The specified maximum torques must not be exceeded!

Ensure that the connected lines are fixed with the needed torque compliant to EN 60999 for a safe connection. The needed torque depends on the type of used lines and the maximum current.

4. Nameplate

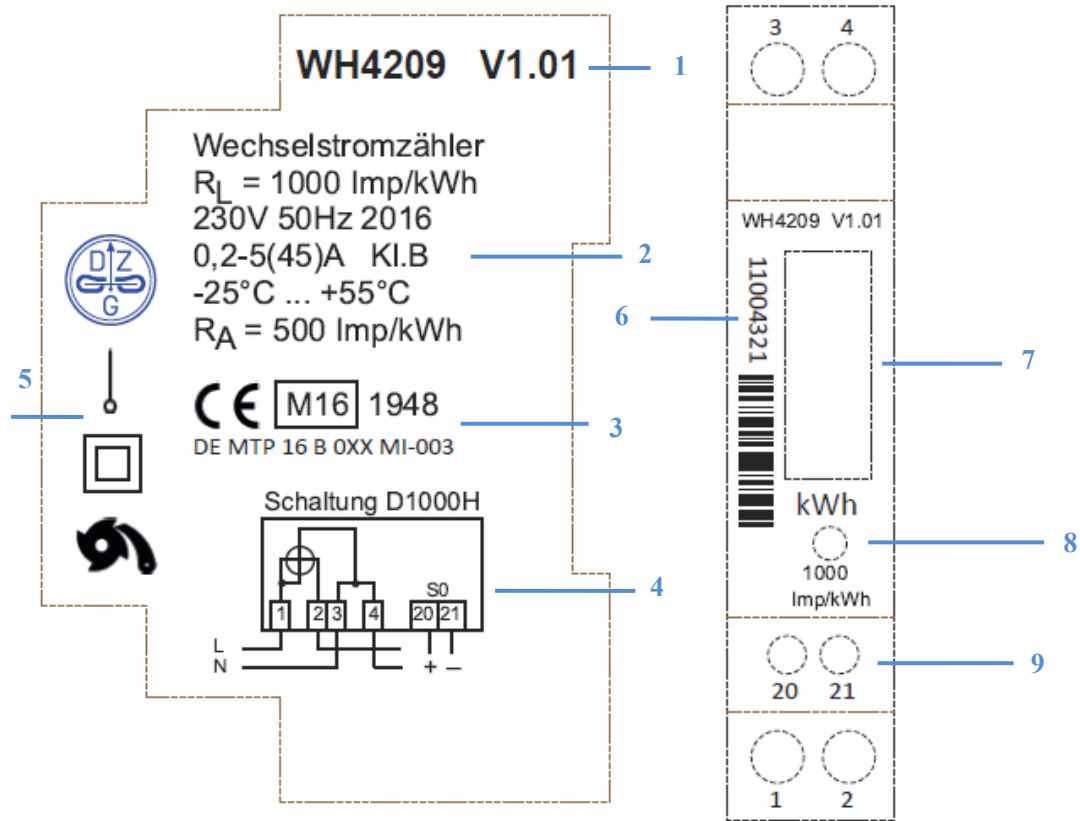


Abb 5: Nameplate

No.	Element	Function
1	Type code, firmware version	WH4209 V1.01
2	electrical characteristics	
3	number approval document	
4	Connection diagram	
5	symbols	single phase, protection class, reverse locking
6	Serial number	Number with Barcode
7	LCD	6 digits with 1 decimal
8	Test LED	test LED 1000 Imp/kWh
9	S0-pulse output	500 Imp/kWh
10	number approval document	

Tab. 4: Description Nameplate

5. LCD-display

The LCD has the following format:

- LCD size: 24mm ×8mm
- Digit size- height: 5.5 mm



Abb 6: LCD

The counter value of energy for +A is displayed. On the right side the unit “kWh” is printed on the housing.

5.1 Display modes

The meter supports three different display modes:

- AUTO Mode (Only display total energy +A, 5+1 digits)
- Magnetic ALT Mode (optional)
- Display without power (optional)

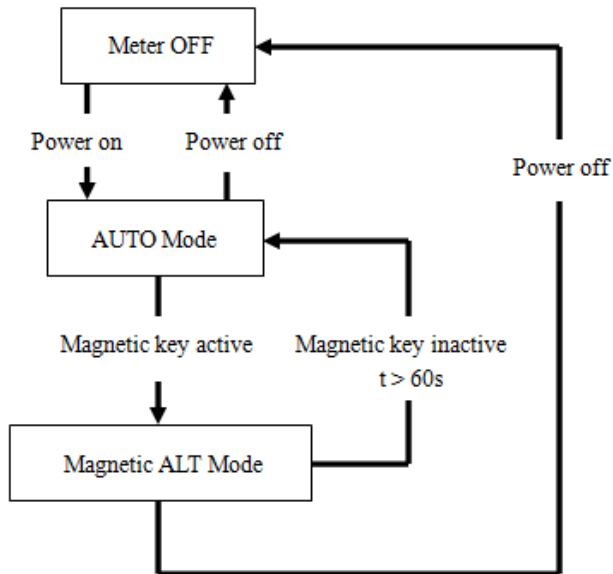
After power on the meter shows for:

1. Self-check status (5s)
2. Firmware version (5s)
3. Checksum (5s)

Then it goes to Auto MODE.

5.2 AUTO Mode and Magnetic ALT Mode

In Auto mode, when use magnetic key it can go to magnetic Alt modes. Without use magnetic key more than 60s, meter goes back to Auto mode.



Display items in Magnetic ALT mode:

	item	Display	unit
1	Total energy +A		
2	Voltage	xxx.x	V
3	Current	xx.xxx	A
4	Power	xxxx.x	W
5	Frequency	xx.xx	Hz
6	Power factor	PF x.xxx	

5.3 Display without power

Display the total energy without power: Using super capacitor for 12 hours.

6. Test LED

The meter has one pulse LED for active energy with constant 1000imp/kWh

7. SO-pulse OUTPUT

The meter provides a pulse output for active energy +A on terminal 20(positive voltage) and 21(negative voltage) according to IEC62053-31; pulse constant 500imp/kWh (default), (configurable 1000imp/kWh, 500imp/kWh, 200imp/kWh, 100imp/kWh).

Maximum voltage: 80 V_{DC} (standard is 27 V)

Maximum current: 60 mA (standard 27 mA)
Pulse constant: 500 Imp/kWh
Pulse duration: 80 ms

8. Functionality

8.1 Measurement

The meter measures single phase active energy for import +A with accuracy class B with DIN EN 50470-1,-3.

The measurement of the energy is based on the measured power according the following calculations:

$$P_{\text{total}} = P_L$$

$P_{\text{total}} > 0$: counting energy for +A

The line current is measured with shunt. The line-voltage is divided with resistors to a voltage level which can be measured by the A/D-converter units.

The voltages of the shunt and voltage divider are measured with an A/D unit which supports the MCU with the real-time digital values for voltage and current.

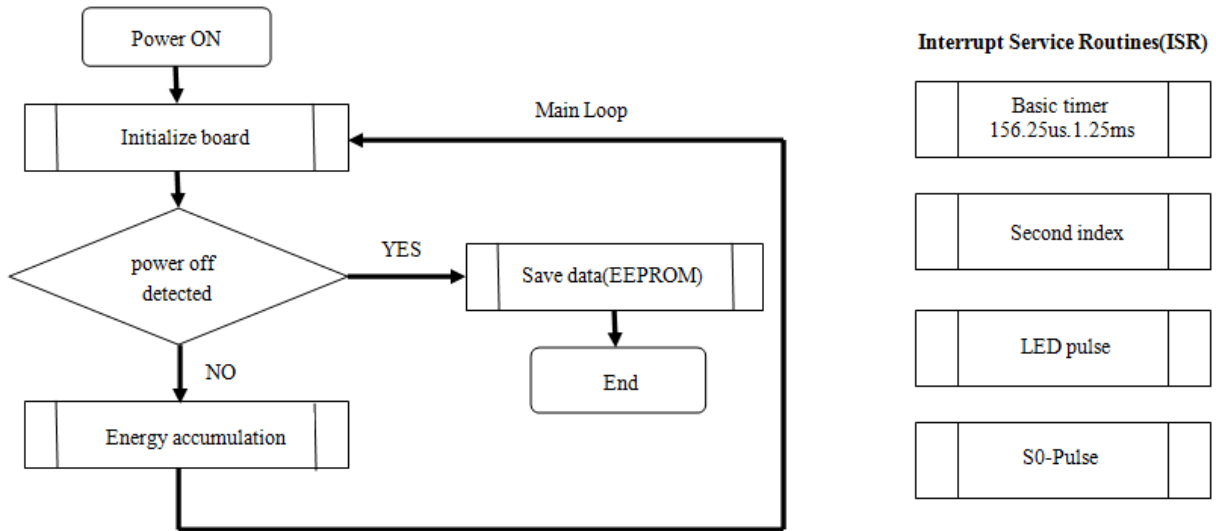
The MCU calculates in real-time active power, active energy based on the converted analog signals for voltage and current.

The energy for +A of active in registers which are stored in nonvolatile memory. This value is displayed on the LCD.

The measured energy is indicated on an LED with 1000 Imp/kWh of active used for testing the accuracy of the meter. Additionally the energy for active +A is put to a S0-puls output with 500 Imp/kWh used for external registration devices.

8.2 Firmware Architecture

The functionality of the meter is periodically processed in the main loop of the application layer. The main loop is interrupted by interrupt service routines based on timer events and asynchronous events.



8.3 Self Monitoring

The meter has an internal software watch dog. If the firmware is running abnormally without feeding the watch dog periodically, the watch dog will reset the main CPU.

The meter has implemented a self-monitoring system. If the meter recognizes no proper operation (measurement, memory check) so that billing relevant values may not be used anymore if displays “FFFFFF“.

8.4 Second index

The second index is a continuously incremented second counter. It is used as time stamp inside the meter, such as time stamp for billing energy etc.

8.5 Accuracy Test

The accuracy of the meter is done with the pulse LEDs. For testing the following quantity of minimum pulses dependant from the load are recommended:

Load(I)	Min. quantity pulses
$I_{st} - I_{tr}$	1
$I_{tr} - I_{ref}$	1
$0.5I_{max}$	4
I_{max}	7

Tab. 5: Quantity of pulses