OPERATING MANUAL

RISH *CON*- M

PROGRAMMABLE MULTI-TRANSDUCER

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Contents

1. APPLICATION

The Multi-transducer is a programmable digital instrument destined for the measurement and parameter conversion of 3 or 4-wire three-phase power networks, in balanced and unbalanced systems.

It ensures the measurement and conversion of measured values into standard analog current signals. Relay outputs signal the overflow of selected quantities, and the pulse output can be used for the consumption monitoring of the 3-phase active energy.

Quantities measured and calculated by the transducer:

- phase voltages .... U_1, U_2, U_3
- phase–to-phase voltages .... U_{12}, U_{23}, U_{31}
- 3-phase mean voltage .... U
- phase-to-phase mean voltage .... UPP
- three-phase mean current I
- phase currents .... I_1, I_2, I_3
- phase active powers .... P_1, P_2, P_3
- phase reactive powers .... Q_1, Q_2, Q_3
- phase apparent powers .... S_1, S_2, S_3
- phase active power factors .... Pf_1, Pf_2, Pf_3
- reactive/active ratio of power factors .... $tg\varphi_1$, $tg\varphi_2$,$tg\varphi_3$
- three-phase mean power factors .... Pf, $tg\varphi$
- three-phase active, reactive and apparent powers ... P, Q, S
- active mean power (e.g.15 min.).......................... P_{av}
- voltage values THD .... U_1, U_2, U_3
- current values THD .... I_1, I_2, I_3
- phase values cosφ ....$\cos\varphi_1$,$\cos\varphi_2$, $\cos\varphi_3$
- three-phase values cosφ .... $\cos\varphi$
- phase values φ ....φ_1, φ_3, φ_3
- calculated current in the neutral cunductor wire .. I_n
- three-phase active and reactive energy .... Ept, Eqt,
- frequency .... f
- energy consumption - power guard .... P_{ord}

The transducer possesses an archive, in which 9000 last mean power values, with time marker, suitably synchronized with the clock (15, 30 or 60 minutes) are stored.

Maximal and minimal values are measured for all quantities. Additionally, there is the possibility to accommodate the transducer to external measuring transducers. The transducer has a detection and signaling of incorrect phase sequence. The actualization time of all accessible quantities does not exceed 1 second. All quantities and configuration parameters are accessible through the RS-485 interface and the USB interface.

Transducer output signals are galvanically isolated from the input signals and the supply.

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2. TRANSDUCER SET

The set of the transducer is composed of:

-The Multi-transducer	1 pc
- user's manual	1 pc
- CD disc	1 pc

When unpacking the transducer, please check whether the type and execution code on the data plate correspond to the order.

3. BASIC REQUIREMENTS AND OPERATIONAL SAFETY

In the safety service scope, the transducer meets to requirements of the EN 61010-1 standard.

Observations Concerning the Operational Safety:

- All operations concerning transport, installation, and commissioning as well as maintenance, must be carried out by qualified, skilled personnel, and national regulations for the prevention of accidents must be observed.

- Before switching the transducer on, one must check the correctness of connections to the network.
- The removal of the transducer housing during the guarantee contract period may cause its cancellation.
- The transducer is destined to be installed and used in industrial electromagnetic environment conditions.
- One must remember that in the building installation, a switch or a circuit-breaker should be installed. This switch should be located near the device, easy accessible by the operator, and suitably marked.

4. INSTALLATION

4.1. Fitting

The transducer can be mounted either on top-hat rail or directly on to a wall by mounting plate.The overall drawing and the fitting way are presented on the fig.1.

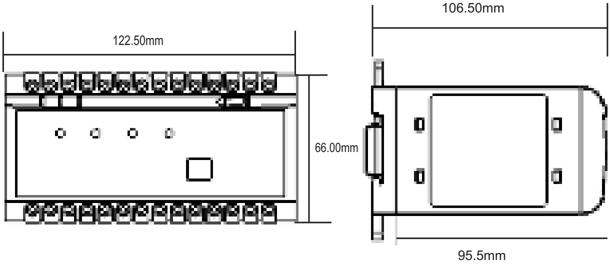


Fig.1 Overall Dimensions and Transducer Fitting Way.

4.2. External Connection Diagrams

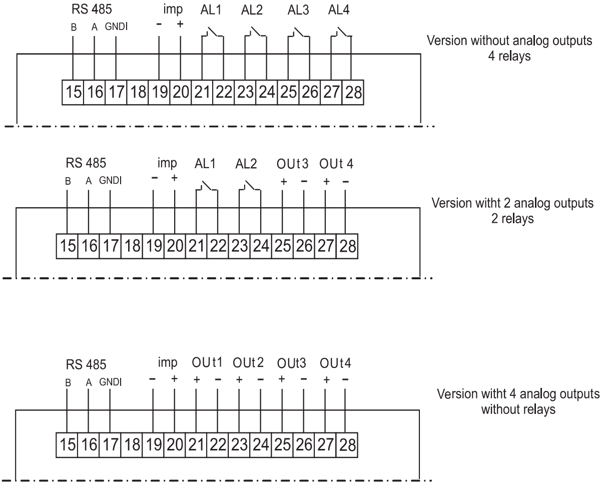
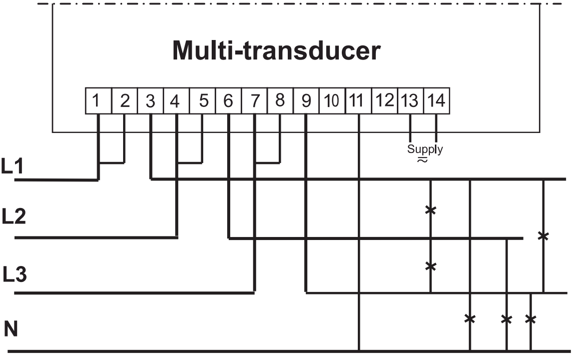
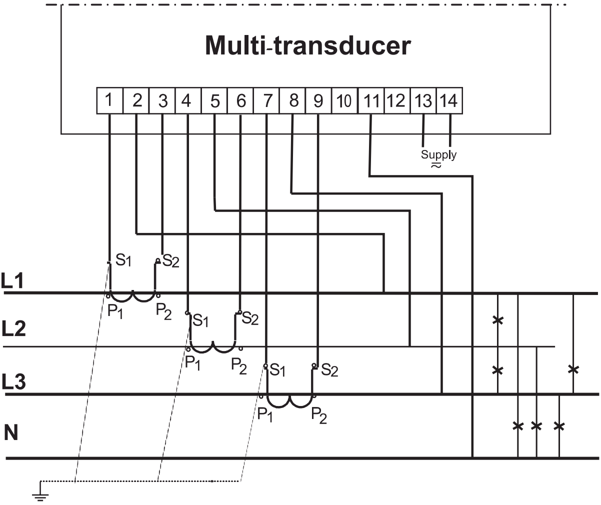


Fig. 2. Connection Diagrams of transducer outputs and Rs485



Direct measurement in a four-wire network.



Measurement with the use of current transformers in a four-wire network.

Indirect measurement with the use of 3 current transformers and 2 or 3 voltage transformers in a four-wire network.

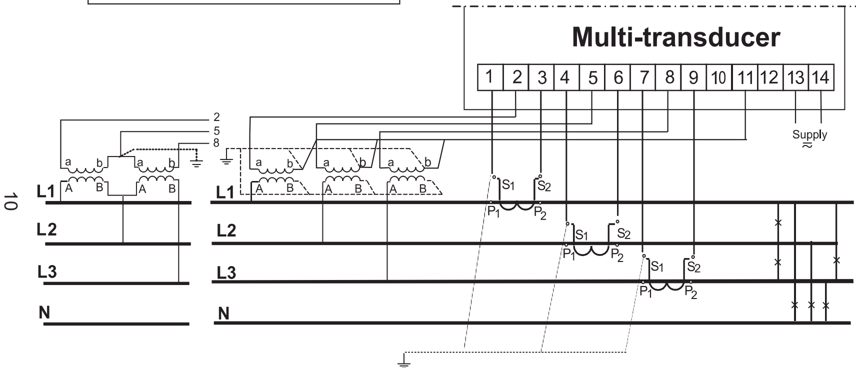
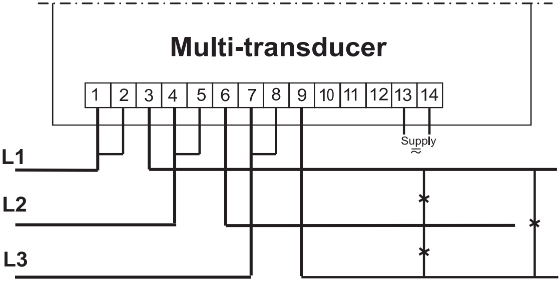
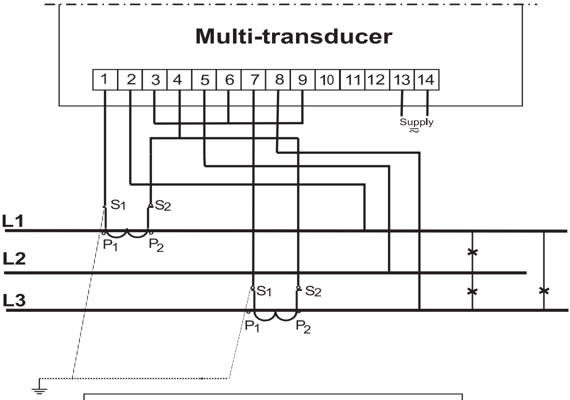


Fig. 3. Connection Diagrams of the Transducer in a Four-wire Network



Direct measurement in a three-wire network.



Semidirect measurement in a three-wire network.

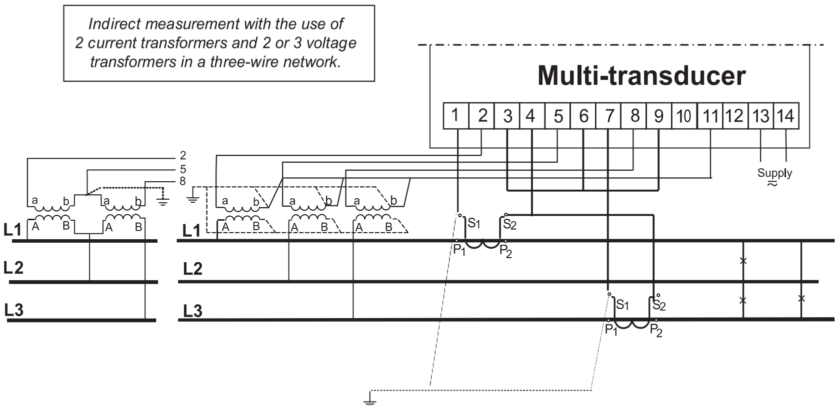


Fig. 3A. Connection Diagrams of the Transducer in a three-wire Network

5. SERVICE

5.1 Frontal Plate Description

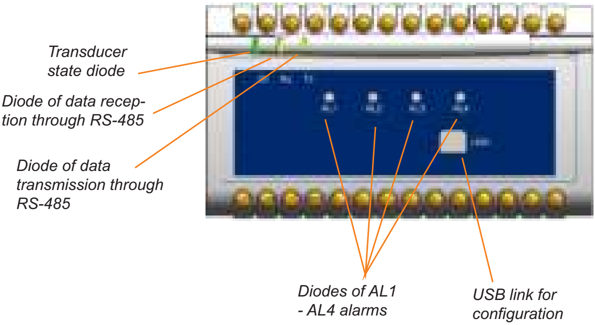


Fig. 4 Front view of the Multi-transducer

5.2 Messages after Switching the Supply on

After switching the supply on, the state diode should light up for a moment in red, and next should light up in green. The recording confirmation in registers is signaled by a short extinction of the state diode.

The incorrect work is signaled by the state diode in the way described in the chapter 7. The data reception through the RS-485 interface is signaled by a pulsing of the Rx diode and the data transmission is signaled by a pulsing of the Tx diode.

The switching of the relay 1 - 4 on causes the lighting of the AL1 - AL4 diode (fig. 4).

5.3 Installation of COM Port Controllers in the Computer

Before configuring the transducer, the driver on the CD should be installed. The transducer makes use of the software, which creates in the system, a device of Universal Serial Bus – **Multi-transducer** and connected to it, the virtual COM port named **Multi-transducer**.

The controller installation in the Windows system causes the addition of a successive serial COM port to the list of ports serviced by the operating system.

After connecting the transducer to the USB port, the operating system informs about the appearance of a new device by means of the message presented on the fig. 5.

The creator to find a new hardware of the Universal Serial Bus will be started automatically. One must act in compliance with the creator suggestions, choosing the installation from the indicated location and giving the path to controllers being in the added CD. Controllers are compatible with following systems: Windows 2000, XP, Server 2003, Vista, server 2008, (x86 and X64). When installing controllers, information about the lack of the controller digital signature can occur. One must ignore this information and carry on the installation.

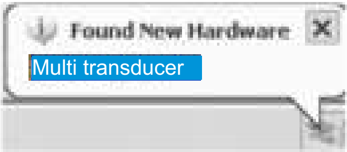


Fig. 5. Message signaling the detection of a new device “Multi-transducer”

After closing the creator, the system detect immediately the successive device – USB Serial Port (fig. 6.). The creator for detection a new hardware will start again.

Fig. 6. Systeme message concerning the detection of a new device

After the successful ending of the installation, the system will inform about the installation of a new device (fig. 7.). Two new devices appear in the device manager – Multi-transducer and Port COM named: Multi-transducer , acc. to the fig. 8.

Fig. 7. Systeme message ending the installation of Multi-transducer controllers

A

Fig. 8. View of the device manager window together with the installed Multi-transducer, which the port COM 05 is assigned to.

5.4 Transducer Configuration by Means of the eCon Software

The eCon software is destined for the configuration of the transducer. One must connect the transducer to a PC computer through the Rs485 converter, if the communication will be performed using RS485 interface or directly through the USB port and after selecting Multi- transducer the configure the connection (fig. 9.). : address 1, baud, rate 9600 kb/s mode RTU 8N2, timeout 1000 ms and the suitable COM port under which the controller of the transducer has been installed.

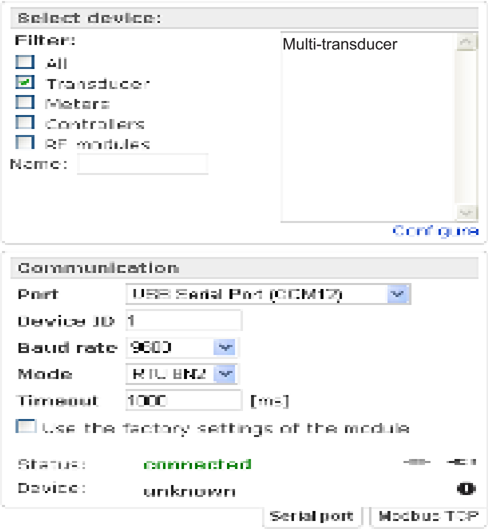


Fig. 9. Configuration of the connection with the Multi-transducer

5.4.1 *Setting of Transmission Parameters*

After choosing the group – **transmission parameters**, it is possible to configure following elements:

a) address – address for the communication with the Multi -transducer through the RS-485 interface from the range 1...247. The value 1 is normally set up by the manufacturer.

b) baud rate – the communication rate through the RS-485 interface from the range (4800, 9600, 19200, 38400 bit/sec.) The value 9600 is set up by the manufacturer.

c) transmission mode – The transmission mode through the RS485 interface from the range (RTU 8N2, RTU 8E1, RTU 8O1, RTU 8N1). The transmission mode is normally set up on RTU 8N2 by the manufacturer.

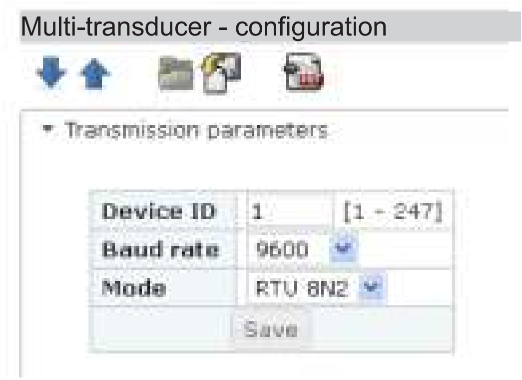


Fig. 10. View of the configuration window of transmission parameters

5.4.2 Setting of Measurement Parameters

After choosing the group: Meter parameters following elements can be configured (fig. 11.):

a) Current transformer ratio. The multiplier is used to recalculate the current in the transformer primary side. It is set up on 1 by the manufacturer.

b) Voltage transformer ratio. The multiplier is used to recalculate the voltage in the transformer primary side. It is set up on 1 by the manufacturer.

c) Way to synchronize the mean power:

- 15 minutes' walking window – mean power PAV will be recalculated for the last 15 minutes, actualized every 15 seconds, i.e. walking window,
- measurement synchronized with the clock every 15, 30 or 60 minutes - mean power PAV will be actualized every 15, 30 or 60 minutes synchronized with the external real clock (fig. 12).

It is set up on the walking window by the manufacturer.

Fig.11. View of the configuration window of measurement parameters

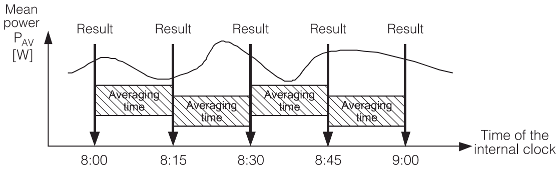


Fig. 12. Measurement of the 15 minutes' active mean power synchronized with the clock.

d) ordered power. Ordered power in percentage of rated power (see chapter 9, example 2).

e) pulse ratio for the pulse output (for active energy).

f) Storing min. and max. values. Choosing of minimal and maximal values storage method: only from measuring range or also overflow error occurance.

g) Reactive energy calculation method: inductive and capacitive or plus and minus.

h) 3 phase measurement mode- 3 and 4 wire measurement.

5.4.3 Erasing of Watt-hour Meters and Extremal Values

After choosing the group: **Service parameters** following commands are possible to carry out(Fig13.) :

a) erasing of watt-hour meters. All watt-hour meters of active and reactive energy are erased.

b) erasing of active mean power.

c) erasing of averaging power archive.

d) erasing of min. and max. values. The currently measured value is copied out to the minimal and maximal value.

e) clock: it is possible to set time and date synchronize the clock with the time on the PC (computer).

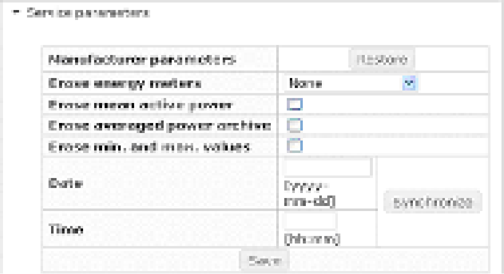


Fig 13. of service parameter configuration window

5.4.4 Setting of alarm parameters

After choosing the group: **alarm 1-4 configuration**, it is possible to configure following alarm parameters (fig. 14):

a) assignment of the alarm output parameter – kind of signal, on which the alarm acc. to the table 1 has to react,

The set of the input quantity for alarms and analog outputs is included in the table 1. The calculation way is shown in examples in the chapter 9.

Table 1

Value in registers 4015, 4023, 4031, 4039, 4047, 4055, 4063, 4072	Kind of quantity	Value for percentage calculation of alarms and output values
00	Lack of quantity /alarm or analog output switched off/	Lack
01	Voltage of phase L1	Un [V] *
02	Current in the wire of phase L1	In [A] *
03	Active power of phase L1	Un x In x cos(0°) [W] *
04	Reactive power of phase L1	Un x In x sin(90°) [var] *
05	Apparent power of phase L1	Un x In [VA] *

06	Coefficient of active power of phase L1	1
07	Coefficient tg φ of phase L1	1
08	Voltage of phase L2	Un [V] *
09	Current in the wire of phase L2	In [A] *
10	Active power of phase L2	Un x In x cos(0°) [W] *
11	Reactive power of phase L2	Un x In x sin(90°) [var] *
12	Apparent power of phase L2	Un x In [VA] *
13	Coefficient of active power of phase L2	1
14	Coefficient tg φ of phase L2	1
15	Voltage of phase 3	Un [V] *
16	Current in the wire of phase L3	In [A] *
17	Active power of phase L3	Un x In x cos(0°) [W] *
18	Reactive power of phase L3	Un x In x sin(90°) [var] *
19	Apparent power of phase L3	Un x In [VA] *
20	Coefficient of active power of phase L3	1
21	Coefficient tg φ of phase L3	1
22	3-phase mean voltage	Un [V] *
23	3-phase mean current	In [A] *
24	3-phase active power	3 x Un x In x cos(0°) [W] *
25	3-phase reactive power	3 x Un x In x sin(90°) [var] *
26	3-phase reactive power	3 x Un x In [VA] *
27	Power factor of 3-phase active power	1
28	3-phase coefficient tg φ	1
29	Frequency	100 [Hz]
30	Phase-to-phase voltage L1-L2	$\sqrt{3}$ Un [V] *
31	Phase-to-phase voltage L2-L3	$\sqrt{3}$ Un [V] *
32	Phase-to-phase voltage L3-L1	$\sqrt{3}$ Un [V] *
33	Phase-to-phase mean voltage	$\sqrt{3}$ Un [V] *

34	mean active power	3 x Un x In x cos(0°) [W] *
35	used active ordered power (used energy)	100 [%]

* Un, In – Rated values of transducer voltage and current

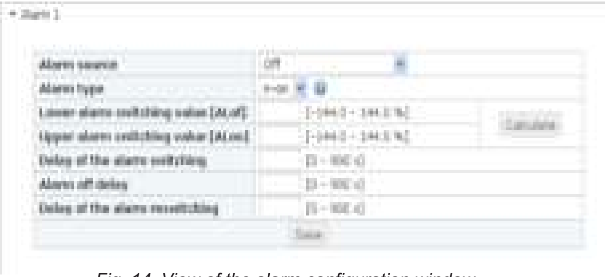


Fig. 14. View of the alarm configuration window.

b) kind of the alarm output operation – choose one from 6 modes n-on, n-off, on, off, h-on and h-off. Working modes have been presented on the fig. 15,
c) lower value of alarm switching – percentage value of the state change of the chosen signal,
d) upper value of alarm switching – percentage value of the state change of the chosen signal,
e) switching delay of the alarm. Delay time in seconds when switching the alarm state,
f) switching off delay of the alarm. Delay time in seconds when switching off the alarm state,
g) deadlock of alarm re-switching. Time, after which the alarm can be switched on again.

Caution! The setup of the value Aoff ≥ Aon causes the alarm switching off.

Caution! In version with analog outputs, alarms with numbers, which equal the analog outputs, control only the alarm diode on the transducer.

Exemplary configuration of alarms 1-4 is presented on the fig. 15.

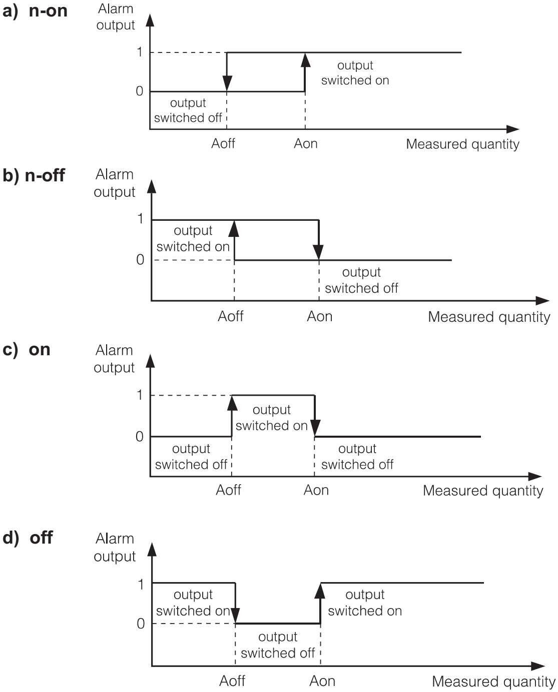


Fig. 15. Alarm types: a) n-on, b) n-off c) on d) off.

Other alarm types: h-on – always switched on; h-off – always switched off.

5.4.5 Setup of analog output parameters

After choosing the group: **output1-4**, it is possible to configure following output parameters:

a) assignment of the parameter to the analog output. Kind of signal, on which the output has to react acc. to the table 1,

b) lower value of the input range. Percentage value of the chosen signal,

c) upper value of the input range. Percentage value of the chosen signal,

d) lower value of the output range. Output signal value in mA,

e) upper value of the output range. Output signal value in mA,

f) working mode of the analog output. Following modes are accessible: normal work lower value, upper value. Both alarms are set up in the normal mode by the manufacturer.

g) value on the output by false input parameter value (1e20) in mA.

An exemplary configuration of the analog output is presented on the fig.16.

Fig. 16. View of the analog output configuration window

Admissible overflow on the analog output: 20% of the lower and upper range value.
Minimal value on the analog output: $-20 \times 1.2 = -24$ mA.
Maximal value on the analog output: $20 \times 1.2 = 24$ mA.

5.4.6 Restoration of Manufacturer Parameters

After choosing the group: **restoration of manufacturer parameters** it is possible to restore following manufacturers parameters set in the table 2:

Table 2

Parameter description	Range/value	Manufac-turer value
Ratio of the current transformer	1...10000	1
Ratio of the voltage transformer	1...4000	1.0
Synchronization of the active mean power:	- 15 minutes' walking window (recording in the archive every 15 minutes); measurement synchronized with the clock every 15, 30 or 60 minutes	walking window
The way of min. and max. value storage	0,1	0 - without errors -1e20, 1e20
The way of passive energy calculation	0,1	0 - inductive and capacitive energy
Ordered power	0...144,0 %	100,0 %
Quantity on the alarm output No 1, 2, 3, 4	0...35 (acc. to the table 1)	24
Output type of the alarm 1, 2, 3, 4	n-on; n-off; on; off; h-on; h-off	n-on

Table 2

Lower value of the alarm 1, 2, 3, 4 switching	-144.0...144.0 %	99.0 %
Upper value of the alarm 1, 2, 3, 4 switching	-144.0...144.0 %	101.0 %
Switching delay of the alarm 1, 2, 3, 4	0...900 seconds	0
Switching-off delay of the alarm 1, 2, 3, 4	0...900 seconds	0
Deadlock of alarm 1,2,3,4 re-switching	0...900 seconds	0
Quantity on the continuous output No 1, 2, 3, 4	0...35 (acc. to the table 1)	24
Lower value of the input range in % of the rated range of the input No 1, 2, 3, 4	-144.0...144.0 %	0.0%
Upper value of the input range in % of the rated range of the input No 1, 2, 3, 4	-144.0...144.0 %	100.0%
Lower value of the output range of the output No 1, 2, 3, 4	-20.00...20.00 mA	0.00 mA
Upper value of the output range of the output No 1	0.01...20.00 mA	20.00 mA
Manual switching of the analog output 1, 2, 3, 4 on:	normal work, the lower value of the output range is set up, the upper value of the output range is set up.	normal work
Pulse quantity for pulse output	5000 - 20000	5000
Address in the MODBUS network	1... 247	1
Transmission mode	8n2, 8e1, 8o1, 8n1	8n2
Baud rate	4800, 9600, 19200, 38400	9600

5.4.7 Measured Values

After choosing the group: - **measured values**, all parameters measured by the transducer are displayed in the form of a list (fig. 17.).

Fig. 17. View of the window of the measured value group

5.4.8 Minimal and Maximal Values

After choosing the group: - **minimal and maximal values**, minimal and maximal values of individual parameters measured by the transducer in the form of a list are displayed (fig. 18.).

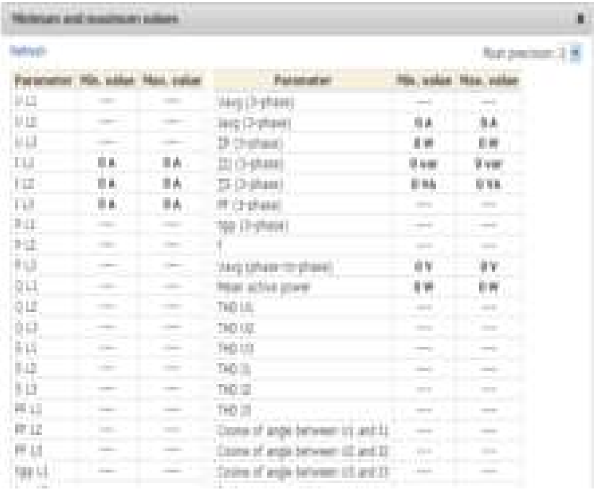


Fig. 18. View of the window of the min. and max. value group

5.4.9 Archive of power profile

After choosing the group: - **archive of power profile**, following information is available -record in archived : from which sample to display and number of records to be read.

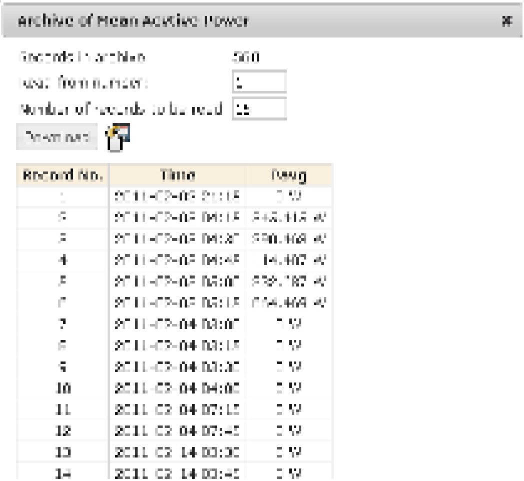


Fig. 19. View of the window of the power profile archive group

The detailed description of archive operation is described in chapter 6.

6. Archive – Power Profile

The transducer is equipped with an archive allowing to store up to 1000 measurements of averaged active power. The averaged active power P_{AV} can be archived with time intervals 15, 30, 60 minutes (synchronized with the internal time clock) according to synchronization type in register 4005.

In case of work in the walking window mode, the arichiving follows in full quarters of an hour, despite the fact, that the step of the walking window lasts 15 seconds and the walking window function can be activated any moment (fig. 12). Direct access to the archive is for 15 records including date, time and value located in the range of addresses 1000 - 1077.

In register 1000 is placed the position of the first (the oldest one) archived sample, and in register 1001 is the position of the last archived sample (the latest one).

In register 1002 is placed the first record of the fifteen available records located in re gisters 1003 - 1077. After writing the first read record (1 - 9000), the data of 15 records for read-out are updated.

Values 1e20 are in registers, in which samples are not written yet.

The archive is organized in a shape of a circular buffer. After writing the nine thousandth value, the next value overwrites the oldest value with the number 0, and successively the next with the number 1, etc. If the value of the register 1000 is higher than 1001, it means, that the buffer at least once was overflowed. For example value 15 in the register 1000 and 14 in register 1001 means, that there was more than nine thousand of samples and the oldest samples are from the record 15 to 9000,next from the record 1 to the latest record with the number 14.

Erasing of average power or change of theaverage time do not erase the archive. Automatic erasing of the archive and average power is made after current or voltage transformer ratio is changed.

7. Error Codes

After connecting the transducer to the network, messages about errors can appear. Causes of errors are presented below:

- the state diode pulsates in red – lack of calibration or the non-volatile memory is damaged. One must return the transducer to the manufacturer,

- the state diode lights in red – inappropriate work parameters; one must configure the transducer again.
- the state diode pulsate alternately in red and green - error of phase connection sequence; one must interchange the connection of phase L2 with the phase L3.

8. Serial Interfaces

8.1. RS-485 Interface – Set of Parameters

- identifier 0xC4 (198)
- transducer address 1...247
- baud rate 4.8, 9.6, 19.2, 38.4 kbit/s
- working mode Modbus RTU
- information unit 8N2, 8E1, 8O1, 8N1
- maximal response time 500 ms
- maximal number registers retriered in a single query: - 56 registers - 4 bytes each
  - 105 registers - 2 bytes each
- implemented functions 03, 16, 17

- 03 readout of registers,
- 16 write of registers,
- 17 device identifying.

Manufacturer's settings: address 1, baud rate 9600, mode RTU 8N2.

8.2. USB Interface – Set of Parameters

- identifier 0xC6 (198)
- transducer address 1
- baud rate 9.6 kbit/s
- working mode Modbus RTU
- information unit 8N2
- maximal response time 500 ms

- maximal number of bytes during the readout/write: - 56 registers - 4 bytes
  - 105 registers - 2 bytes
- implemented functions 03, 16, 17
- 03 readout of registers,
- 16 write of registers,
- 17 device identifying.

8.3. Register Map of theTransducer

In the transducer, data are located in 16-bit and 32-bit registers. Process variables and transducer parameters are located in the register address space in the way depending on the type of the variable value type. Bits in 16-bit register are numbered in the way depending on the variable value type. Bits in 16-bit registers are numbered from the younger to the older (b0-b15). 32-bit registers contain numbers of float type in the IEEE-745 standard. Register ranges are set in the table 3. 16-bit registers are presented in the table 4. 32-bit registers are set in tables 5 and 6. Register addresses in tables 3,4,5,6 are physical addresses.

Table 3

Range of addresses	Type of value	Description
1000 – 1077	Integer (16 bits) Record	Archive of average power profile. Table 9 contains description of registers
4000 – 4105	Integer (16 bits)	Value located in one 16-bit register. The table 3 contains the register description. Registers for write and readout.
6000 – 6335	Float (2x16 bits)	Value located in two successive 16-bit registers. Registers contain the same data as 32-bit registers from the area 7500. Registers for readout. Sequence of byte(0-1-2-3)
7000 – 7335	Float (2x16 bits)	Value located in two successive 16-bit registers. Registers contain the same data as 32-bit registers from the area 7500. Sequence of byte(3-2-1-0)
7500 – 7667	Float (32 bits)	Value located in one 32-bit register. The table 4 contains the description of registers. Registers for readout.

Table 4

Register address 16 bits	Operations	Description
1000	R	Position of the oldest archived mean power
1001	R	Position of the youngest archived mean power
1002	R/W	First available record - NrBL (range 1...9000)
1003	R	Year of archived mean power with the number NrBL + 0
1004	R	Month* 100 + archived day of mean power with the number NrBL + 0
1005	R	Hour* 100 + archived minute of mean power with the number NrBL + 0
1006	R	Archived value of mean power with the number NrBL + 0 of float type - 4 bytes in order 3-2-1-0
1007	R	
1008	R	Archived year of mean power with the number NrBL + 1
1009	R	Archived month, day of mean power with the number NrBL + 1
1010	R	Archived hour, minute of mean power with the number NrBL + 1
1011	R	Archived value of mean power with the number NrBL + 0 of float type - 4 bytes in order 3-2-1-0
1012	R	
...	...	...
1073	R	Archived year of mean power with the number NrBL + 14
1074	R	Archived month, day of mean power with the number NrBL + 14
1075	R	Archived hour, minute of mean power with the number NrBL + 14
1076	R	Archived value of mean power with the number NrBL + 0 of float type - 4 bytes in order 3-2-1-0
1077	R	

Table 5

Register address	Operations	Range	Description	By Default
4000	RW	0	Reserved	0
4001	RW	0	Reserved	0
4002	RW	0	Reserved	0
4003	RW	1...10000	Current transformer ratio	1
4004	RW	1...40000	Voltage transformer ratio x 10	10
4005	RW	0...3	Synchronization of mean active power: 0 –15 minutes' walking window (recording synchronized every 15 min with the clock.) 1 – measurement synchronized every 15 min with the clock. 2 – measurement synchronized every 30 min with the clock. 3 – measurement synchronized every 60 min with the clock.	0
4006	RW	0	Reserved	0
4007	RW	0.1	The way of minimal and maximal value recording 0 -without errors, 1 - with errors	0
4008	RW	0.1	Reserved	0
4009	RW	0...2359	The way of reactive energy calculation 0 -without errors, 1 - with errors	0
4010	RW	0...1440	Ordered power	1000
4011	RW	0..3	Erasing of energy counter: 0 - without changes, 1 - erase active energy, 2 - erase passive energy, 3 - erase all energy	0
4012	RW	0.1	Erasing of mean active power P_{AV}	0
4013	RW	0.1	Erasing of mean active power P_{AV} archive	0
4014	RW	0.1	Erasing of min. and max.	0

4015	RW	0.1...35	Alarm output 1 - quantity on the output (code acc. to table 6)	0
4016	RW	0..5	Alarm output 1 - type: 0 – n-on, 1– n-off, 2 –on, 3 - oFF, 4 – h-on, 5 – h-oFF	0
4017	RW	-1440...0...1440 [$^{o}/_{oo}$]	Alarm output1 - lower alarm switching value of the rated input range	990
4018	RW	-1440...0...1440 [$^{o}/_{oo}$]	Alarm output 1 - upper alarm switching value of the rated input range	1010
4019	RW	0...900 s	Alarm output 1 - switching delay	0
4020	RW	0...900 s	Alarm output 1 - alarm switching-off delay (for ordered power quantity [register 4015 = 35] this parameter is excluded	0
4021	RW	0...900 s	Alarm output 1 - deadlock of re-switching	0
4022	RW	0.1	Reserved	0
4023	RW	0.1...35	Alarm output 2 -quantity on the output (code acc.to the table 6)	24
4024	RW	0...5	Alarm output 2 - type: 0 – n-on, 1– n-off, 2 –on, 3 - oFF, 4 – h-on, 5 – h-oFF	3
4025	RW	-1440...0...1440 [$^{o}/_{oo}$]	Alarm output 2 - lower alarm switching value of the rated input range	990
4026	RW	-1440...0...1440 [$^{o}/_{oo}$]	Alarm output 2 - upper alarm switching value of the rated input range	1010
4027	RW	0...900 s	Alarm output 2 - alarm switching delay	0
4028	RW	0...900 s	Alarm output 2 - alarm switching-off delay (for ordered power quantity [register 4023 = 35] this parameter is excluded)	0
4029	RW	0...900 s	Alarm output 2 - deadlock of re-switching	0
4030	RW	0,1	Reserved	0
4031	RW	0,1...35	Alarm output 3 - quantity on the output (code acc. to table 6)	24

4032	RW	0...5	Alarm output 3 - type: 0 – n-on, 1– n-off, 2 –on, 3 - oFF, 4 – h-on, 5 – h-oFF	0
4033	RW	-1440...0...1440 [°/oo]	Alarm output 3 - lower alarm switching value of the rated input range	990
4034	RW	-1440...0...1440 [°/oo]	Alarm output 3 - upper alarm switching value of the rated input range	1010
4035	RW	0...900 s	Alarm output 3 - alarm switching on delay	0
4036	RW	0...900 s	Alarm output 3 - alarm switching-off delay (for ordered power quantity [register 4023 = 35] this parameter is excluded)	0
4037	RW	0...900 s	Alarm output 3 - deadlock of re-switching	0
4038	RW	0,1	Reserved	0
4039	RW	0,1...35	Alarm output 4 - quantity on the output (code acc. to table 6)	24
4040	RW	0...5	Alarm output 4 - type: 0 – n-on, 1– n-off, 2 –on, 3 - oFF, 4 – h-on, 5 – h-oFF	0
4041	RW	-1440...0...1440 [°/oo]	Alarm output 4 - lower alarm switching value of the rated input range	990
4042	RW	-1440...0...1440 [°/oo]	Alarm output 4 - upper alarm switching value of the rated input range	1010
4043	RW	0...900 s	Alarm output 4 - alarm switching - on delay	0
4044	RW	0...900 s	Alarm output 4 - alarm switching-off delay (for ordered power quantity [register 4039 = 35] this parameter is excluded)	0
4045	RW	0...900 s	Alarm output 3 - deadlock of re-switching	0
4046	RW	0,1	Reserved	0
4047	RW	0...15258	Continuous output 1 - quantity on the output (code acc. to table 6)	24
4048	RW	0...65535	Continuous output 1 - type: 0 - (0 ...20) mA; 1 - (4...20) mA; 2 - (-20...20) mA	2

4049	RW	-1440...0...1440 [‰]	Continuous output 1 - lower value of the input range in [‰] of the rated input range	0
4050	RW	-1440...0...1440 [‰]	Continuous output 1 - upper value of the input range in [‰] of the rated input range	1000
4051	RW	-2400...0...2400 [10 μA]	Continuous output 1 - lower value of the current output range [10 μA]	0
4052	RW	1...2400 [10 μA]	Continuous output 1 - upper value of the current output range [10 μA]	2000
4053	RW	0...2	Continuous output 1 - manual switching on: 0 - normal work, 1- value set from the register 4051, 2 - value made from the register 4052	0
4054	RW	-24...24 [mA]	Continuous output 1 - value on the output by error	24
4055	RW	0,1...35	Continuous output 2 - quantity on the output (code acc. to the tab.6)	24
4056	RW	0...2	Continuous output 2 -type: 0 - (0 ...20) mA; 1 - (4...20) mA; 2 - (-20...20) mA	2
4057	RW	-1440...0...1440 [‰]	Continuous output 2 - lower value of the input range in [‰] of the rated input range	0
4058	RW	-1440...0...1440 [‰]	Continuous output 2 - upper value of the input range in [‰] of the rated input range	1000
4059	RW	-2400...0...2400 [10 μA]	Continuous output 2 - lower value of the current output range [10 μA]	0
4060	RW	1...2400 [10 μA]	Continuous output 2 - upper value of the current output range [10 μA]	2000
4061	RW	0...2	Continuous output 1 - manual switching on: 0 - normal work, 1- value set from the register 4059, 2 -value made from the register 4060	0
4062	RW	-24...24 [mA]	Continuous output 2 - value on the output by error	24
4063	RW	0,1...35	Continuous output 3 - quantity on the output (code acc. to the tab.6)	24

4064	RW	0...2	Continuous output 3 - type: 0 - (0 ...20) mA; 1 - (4...20) mA; 2 - (-20...20) mA	2
4065	RW	-1440...0...1440 [‰]	Continuous output 3 - lower value of the input range in [‰] of the rated input range	0
4066	RW	-1440...0...1440 [‰]	Continuous output 3 - upper value of the input range in [‰] of the rated input range	1000
4067	RW	-2400...0...2400 [10 μA]	Continuous output 3 - lower value of the current output range [10 μA]	0
4068	RW	1..2400 [10 μA]	Continuous output 3 - lower value of the current output range [10 μA]	2000
4069	RW	0...2	Continuous output 1 - manual switching on: 0 - normal work, 1- value set from the register 4067, 2 -value made from the register 4068	0
4070	RW	-24...24 [mA]	Continuous output 1 - value on the output by error	24
4071	RW	0,1...35	Continuous output 4- quantity on the output (code acc. to the tab.6)	24
4072	RW	0...2	Continuous output 4 - type: 0 - (0 ...20) mA; 1 - (4...20) mA; 2 - (-20...20) mA	2
4073	RW	-1440...0...1440 [‰]	Continuous output 4 - lower value of the input range in [‰] of the rated input range	0
4074	RW	-1440...0...1440 [‰]	Continuous output 4 - upper value of the input range in [‰] of the rated input range	1000
4075	RW	-2400...0...2400 [10 μA]	Continuous output 4 - lower value of the current output range [10 μA]	0
4076	RW	1..2400 [10 μA]	Continuous output 4 - lower value of the current output range [10 μA]	2000
4077	RW	0...2	Continuous output 1 - manual switching on: 0 - normal work, 1- value set from the register 4075, 2 -value made from the register 4076	0
4078	RW	-24...24 [mA]	Continuous output 1 - value on the output by error	24

4079	RW	5000...20000	Pulse quantityforpul se output	5000
4080	RW	1...247	Address in the MODBUS network	1
4081	RW	0...3	Transmission mode: 0 -> 8n2, 1 -> 8e1, 2 -> 8o1, 3 -> 8n1	0
4082	RW	0...3	Baud rate: 0 -> 4800, 1 -> 9600, 2 -> 19200, 3 -> 38400	1
4083	RW	0,1	Update the change of transmission parameters	0
4084	RW	0...59	seconds	0
4085	RW	0...2359	Hour*100 + minutes	0
4086	RW	101...1231	Month*100 + minutes	1201
4087	RW	2009...2100	Year	2010
4088	RW	0,1	Record of standard parameters (with zero adjustment of energy, min, max and mean power)	0
4089	R	0...15258	Active input energy, two most significant bytes	0
4090	R	0...65535	Active input energy, twoleast significant bytes	0
4091	R	0...15258	Active output energy, twomost significant bytes	0
4092	R	0...65535	Active output energy, two least significant bytes	0
4093	R	0...15258	Reactive inductive energy, two most significant bytes	0
4094	R	0...65535	Reactive inductive energy, two least significant bytes	0
4095	R	0...15258	Reactive capacitive energy, two most significant bytes	0
4096	R	0...65535	Reactive capacitive energy, two least significant bytes	0
4097	R	0	Reserved	0
4098	R	0	Reserved	0
4099	R	0	Reserved	0
4100	R	0	Reserved	0
4101	R	0... 65535	Status register 1 - description below	-
4102	R	0... 65535	Status register 2 - description below	-
4103	R	0... 65535	Serial number, two older bytes	-
4104	R	0... 65535	Serial number, two younger bytes	-
4105	R	0... 65535	Program version (x 100)	100

4106	R	0... 65535	Reserved	-
4107	R	0... 65535	Reserved	-
4108	RW	0,1	Measurement Mode: 0-3Ph4W 1-3Ph3W	0

In parenthesis [ ]: resolution or unit is suitably placed.

Energies are render accessible in hundreds of Watt-hours (Var-hours) in two 16-bit registers and for this reason when recalculating values of each energy from registers, one must divide them by 10, i.e:

Active input energy = (value of register.4089 * 65536 + value of register 4090) / 10 [kWh]

Active output energy = (value of register.4091 * 65536 + value of register 4092) / 10 [kWh]

Reactive inductive energy = (value of register 4093 * 65536 + value of register 4094) / 10 [kVarh]

Reactive capactive energy = (value of register 4095 * 65536 + value of register 4096) / 10 [kVarh]

Status register 1:

Bit 15 – „1” – damage of non-volatile memory
Bit 14 – „1” – lack of calibration or invalid calibration
Bit 13 – „1” – error of parameter values
Bit 12 – „1” – error of energy values
Bit 11 – „1” – error of phase sequence
Bit 10 – current range 0 – 1 A; 1 – 5 A
Bit 9 – reserved
Bit 8 – Voltage range:
0 - 57.8 V, 1 - 230 V
Bit 7 – „1” – the interval of power averaging has not elapsed
Bit 6 – „1” – bad frequency for THD measurement
Bit 5 – „1” – too low voltage to measure the frequency
Bit 4 – „1” – spent battery
Bit 3 – „1” – capacitive character ΣQ
Bit 2 – „1” – capacitive character Q3
Bit 1 – „1” – capacitive character Q2
Bit 0 – „1” – capacitive character Q1

Status register 2:

Bit 15 – „1” – presence of continuous output 4
Bit 14 – „1” – presence of continuous output 3
Bit 13 – „1” – presence of continuous output 2
Bit 12 – „1” – presence of continuous output 1
Bit 11 – „1” – presence of alarm output 4
Bit 10 – „1” – presence of alarm output 3
Bit 9 – „1” – presence of alarm output 2
Bit 8 – „1” – presence of alarm output 1
Bit 7 – reserved
Bit 6 – reserved
Bit 5 – reserved
Bit 4 – reserved
Bit 3 – „1” – alarm output 4 switched on
Bit 2 – „1” – alarm output 3 switched on
Bit 1 – „1” – alarm output 2 switched on
Bit 0 – „1” – alarm output 1 switched on

Table 6

Address of 16 bit registers	**Address of 32 bit registers**	**Operations**	**Description**	**Unit**	**3Ph4W**	**3Ph3W**
7000/6000	7500	R	Voltage of phase L1	V	√	x
7002/6002	7501	R	Current of phase L1	A	√	√
7004/6004	7502	R	Active power of phase L1	W	√	x
7006/6006	7503	R	Reactive power of phase L1	Var	√	x
7008/6008	7504	R	Apparent power of phase L1	VA	√	x
7010/6010	7505	R	Active power factor of phase L1	-	√	x
7012/6012	7506	R	Reactive power to active power ratio of phase L1	-	√	x
7014/6014	7507	R	Voltage of phase L2	V	√	x

7016/6016	7508	R	Current of phase L2	A	√	x
7018/6018	7509	R	Active power of phase L2	W	√	x
7020/6020	7510	R	Reactive power of phase L2	Var	√	x
7022/6022	7511	R	Apparent power of phase L2	VA	√	x
7024/6024	7512	R	Active power factor of phase L2	-	√	x
7026/6026	7513	R	Reactive power to active power ratio of phase L2	-	√	x
7028/6028	7514	R	Voltage of phase L3	V	√	x
7030/6030	7515	R	Current of phase L3	A	√	√
7032/6032	7516	R	Active power of phase L3	W	√	x
7034/6034	7517	R	Reactive power of phase L3	Var	√	x
7036/6036	7518	R	Apparent power of phase L3	VA	√	x
7038/6038	7519	R	Active power factor of phase L3	-	√	x
7040/6040	7520	R	Reactive power to active power ratio of phase L3	-	√	x
7042/6042	7521	R	Mean 3-phase voltage	V	√	x
7044/6044	7522	R	Mean 3-phase current	A	√	√
7046/6046	7523	R	3-phase active power	W	√	√
7048/6048	7524	R	3-phase reactive power	Var	√	√
7050/6050	7525	R	3-phase apparent power	VA	√	√
7052/6052	7526	R	Mean active power factor	-	√	√
7054/6054	7527	R	Mean ratio of reactive power to active power	-	√	√
7056/6056	7528	R	Frequency	Hz	√	√
7058/6058	7529	R	Phase-to-phase voltage L1-L2	V	√	√
7060/6060	7530	R	Phase-to-phase voltage L2-L3	V	√	√
7062/6062	7531	R	Phase-to-phase voltage L3-L1	V	√	√
70646064	7532	R	Mean phase-to-phase voltage	V	√	√
7066/6066	7533	R	15, 30, 60 minutes' 3-phase act. power (P1+P2+P3)	W	√	√
7068/6068	7534	R	THD U1	%	√	x
7070/6070	7535	R	THD U2	%	√	x
7072/6072	7536	R	THD U3	%	√	x
7074/6074	7537	R	THD I1	%	√	x

7076/6076	7538	R	THD I2	%	√	x
7078/6078	7539	R	THD I3	%	√	x
7080/6080	7540	R	cosinus angle between U1 and I1	-	√	x
7082/6082	7541	R	cosinus angle between U2 and I2	-	√	x
7084/6084	7542	R	cosinus angle between U3 and I3	-	√	x
7086/6086	7543	R	mean 3-phase cosinus	-	√	√
7088/6088	7544	R	angle between U1 and I1	°	√	x
7090/6090	7545	R	angle between U2 and I2	°	√	x
7092/6092	7546	R	angle between U3 and I3	°	√	x
7094/6094	7547	R	Current in neutral lead (evalueted from vectors)	A	√	x
7096/6096	7548	R	3-phase active input energy (number of register 7549 overfills, setting to zero after exceeding 99999999.9 kWh)	100 MWh	√	√
7098/6098	7549	R	3-phase active input energy (watt-hour meter counting to 99999.9 kWh)	kWh	√	√
7100/6100	7550	R	3-phase active output energy (number of register 7551 overfills, setting to zero after exceeding 99999999.9 kWh)	100 MWh	√	√
7102/6102	7551	R	3-phase active output energy (watt-hour meter counting to 99999.9 kWh)	kWh	√	√
7104/6104	7552	R	3-phase reactive inductive energy (number of register 7553 overfills, setting to zero after exceeding 99999999.9 kVarh)	100 MVarh	√	√
7106/6106	7553	R	3-phase reactive inductive energy (watt-hour meter counting to 99999.9 kWh)	kVarh	√	√
7108/6108	7554	R	3-phase active output energy (number of register 7555 overfills, setting to zero after exceeding 99999999.9 kVarh)	100 MVarh	√	√
7110/6110	7555	R	3-phase reactive capacitive energy (watt-hour meter counting to 99999.9 kWh)	kVarh	√	√
7112/6112	7556	R	Reserved		√	√
7114/6114	7557	R	Reserved		√	√
7116/6116	7558	R	Reserved		√	√
7118/6118	7559	R	Reserved		√	√
7120/6120	7560	R	Time - seconds	sec	√	√
7122/6122	7561	R	Time - hours, minutes	-	√	√

7124/6124	7562	R	Date - month, day	-	√	√
7126/6126	7563	R	Date - year	-	√	√
7128/6128	7564	R	Stering up the analog output 1	mA	√	√
7130/6130	7565	R	Stering up the analog output 2	mA	√	√
7132/6132	7566	R	Stering up the analog output 3	mA	√	√
7134/6134	7567	R	Stering up the analog output 4	mA	√	√
7136/6136	7568	R	Energy consumption in percentages in "power guard" modus	%	√	√
7138/6138	7569	R	Reserved	-	√	√
7140/6140	7570	R	Status 1	-	√	√
7142/6142	7571	R	Status 2	-	√	√
7144/6144	7572	R	Voltage L1 min	V	√	X
7146/6146	7573	R	Voltage L1 max	V	√	X
7148/6148	7574	R	Voltage L2 min	V	√	X
7150/6150	7575	R	Voltage L2 max	V	√	X
7152/6152	7576	R	Voltage L3 min	V	√	X
7154/6154	7577	R	Voltage L3 max	V	√	X
7156/6156	7578	R	Current L1 min	A	√	√
7158/6158	7579	R	Current L1 max	A	√	√
7160/6160	7580	R	Current L2 min	A	√	√
7162/6162	7581	R	Current L2 max	A	√	√
7164/6164	7582	R	Current L3 min	A	√	√
7166/6166	7583	R	Current L3 max	A	√	√
7168/6168	7584	R	Active power L1 min	W	√	X
7170/6170	7585	R	Active power L1 max	W	√	X
71726172	7586	R	Active power L2 min	W	√	X
7174/6174	7587	R	Active power L2 max	W	√	X
7176/6176	7588	R	Active power L3 min	W	√	X
7178/6178	7589	R	Active power L3 max	W	√	X
7180/6180	7590	R	Reactive power L1 min	var	√	X
7182/6182	7591	R	Reactive power L1 max	var	√	X
7184/6184	7592	R	Reactive power L2 min	var	√	X
7186/6186	7593	R	Reactive power L2 max	var	√	X
7188/6188	7594	R	Reactive power L3 min	var	√	X

7190/6190	7595	R	Reactive power L3 max	var	√	X
7192/6192	7596	R	Apparent power L1 min	VA	√	X
7194/6194	7697	R	Apparent power L1 max	VA	√	X
7196/6196	7698	R	Apparent power L2 min	VA	√	X
7198/6198	7699	R	Apparent power L2 max	VA	√	X
7200/6200	7600	R	Apparent power L3 min	VA	√	X
7202/6202	7601	R	Apparent power L3 max	VA	√	X
7204/6204	7602	R	Power factor (PF) L1 min	-	√	X
7206/6206	7603	R	Power factor (PF) L1 max	-	√	X
7208/6208	7604	R	Power factor (PF) L2 min	-	√	X
7210/6210	7605	R	Power factor (PF) L2 max	-	√	X
7212/6212	7606	R	Power factor (PF) L3 min	-	√	X
7214/6214	7607	R	Power factor (PF) L3 max	-	√	X
7216/6216	7608	R	Reactive and active power ratio L1 min	-	√	X
7218/6218	7609	R	Reactive and active power ratio L1 max	-	√	X
7220/6220	7610	R	Reactive and active power ratio L2 min	-	√	X
7222/6222	7611	R	Reactive and active power ratio L2 max	-	√	X
7224/6224	7612	R	Reactive and active power ratio L3 min	-	√	X
7226/6226	7613	R	Reactive and active power ratio L3 max	-	√	X
7228/6228	7614	R	Phase to phase voltage L_{1-2} min	V	√	√
7230/6230	7615	R	Phase to phase voltage L_{1-2} max	V	√	√
7232/6232	7616	R	Phase to phase voltage L_{2-3} min	V	√	√
7234/6234	7617	R	Phase to phase voltage L_{2-3} max	V	√	√
7236/6236	7618	R	Phase to phase voltage L_{3-1} min	V	√	√
7238/6238	7619	R	Phase to phase voltage L_{3-1} max	V	√	√
7240/6240	7620	R	3-phase mean voltage min	V	√	√
7242/6242	7621	R	3-phase mean voltage max	V	√	√
7244/6244	7622	R	3-phase mean current min	A	√	√
7246/6246	7623	R	3-phase mean current max	A	√	√
7248/6248	7624	R	3-phase active power min	W	√	√
7250/6250	7625	R	3-phase active power max	W	√	√
7252/6252	7626	R	3-phase reactive power min	var	√	√
7254/6254	7627	R	3-phase reactive power max	var	√	√

7256/6256	7628	R	3-phase apparent power min	VA	√	√
7258/6258	7629	R	3-phase apparent power max	VA	√	√
7260/6260	7630	R	Power factor (PF) min	-	√	√
7262/6262	7631	R	Power factor (PF) max	-	√	√
7264/6264	7632	R	min 3-phase mean reactive and active power ratio	-	√	√
7266/6266	7633	R	max 3-phase mean reactive and active power ratio	-	√	√
7268/6268	7634	R	Frequency min	Hz	√	√
7270/6270	7635	R	Frequency max	Hz	√	√
7272/6272	7636	R	Phase to phase mean volatge min	V	√	√
7274/6274	7637	R	Phase to phase mean volatge max	V	√	√
7276/6276	7638	R	15,30,60 minutes 3-phase active power min	W	√	√
7278/6278	7639	R	15,30,60 minutes 3-phase active power max	W	√	√
7280/6280	7640	R	THD U1 min	%	√	X
7282/6282	7641	R	THD U1 max	%	√	X
7284/6284	7642	R	THD U2 min	%	√	X
7286/6286	7643	R	THD U2 max	%	√	X
72886/288	7644	R	THD U3 min	%	√	X
7290/6290	7645	R	THD U3 max	%	√	X
7292/6292	7646	R	THD I1 min	%	√	X
7294/6294	7647	R	THD I1 max	%	√	X
7296/6296	7648	R	THD I2 min	%	√	X
7298/6298	7649	R	THD I2 max	%	√	X
7300/6300	7650	R	THD I3 min	%	√	X
7302/6302	7651	R	THD I3 max	%	√	X
7304/6304	7652	R	Cosine angle between U1 and I1 min	-	√	X
7306/6306	7653	R	Cosine angle between U1 and I1 max	-	√	X
7308/6308	7654	R	Cosine angle between U2 and I2 min	-	√	X
7310/6310	7655	R	Cosine angle between U2 and I2 max	-	√	X
7312/6312	7656	R	Cosine angle between U3 and I3 min	-	√	X
7314/6314	7657	R	Cosine angle between U3 and I3 max	-	√	X
7316/6316	7658	R	Mean 3-phase cosine min	-	√	√
7318/6318	7659	R	Mean 3-phase cosine max	-	√	√
7320/6320	7660	R	Angle between U1 and I1 min	o	√	X
7322/6322	7661	R	Angle between U1 and I1 max	o	√	X

7324/6324	7662	R	Angle between U2 and I2 min	º	√	X
7326/6326	7663	R	Angle between U2 and I2 max	º	√	X
7328/6328	7664	R	Angle between U3 and I3 min	º	√	X
7330/6330	7665	R	Angle between U3 and I3 max	º	√	X
7332/6332	7666	R	Current in neutral lead min	A	√	X
7334/6334	7667	R	Current in neutral lead max	A	√	X

In case of a lower overflow, the value –1e20 is written in, however in case of an upper overflow or if an error occurs, the value 1e20 is written in.

9. Examples of Transducer Programming

Example 1 – Programming an Alarm 1 with Hysteresis

Program the operation of the alarm 1 in such a way, that at the value 250 V of the phase 1 voltage, the alarm will be switched on, however switched off at the value 210 V.

For the rated U_n = 230 V execution, one must set up values from the table 7.

Table 7

Regi-ster	Value	Meaning
4015	1	1 – voltage of phase 1 (U1)
4016	0	0 – n-on mode
4017	913	913 – 91.3% (percentage value with one place after the decimal point multiplied by 10) of the rated voltage of phase 1 – alarm switched off, (210 V/230 V) x 1000 = 913
4018	1087	1087 – 108.7 % (percentage value with one place after the decimal point multiplied by 10) of the rated voltage of phase 1 – alarm switched on, (250 V/230 V) x 1000 = 1087
4019	0	0 – 0 second delay in the alarm switching
4020	0	0 – 0 second delay in the alarm switching off
4021	0	0 – 0 second deadlock for the alarm re-switching

Example 2 – Configuring alarm of ordered power exceeding

Set the alarm of the earlier warning of ordered power exceeding possibility on 90% level by 15-minutes (900 sec.) calculation. Current transformer 2500 : 5 A, voltage U_n=230 V. Temporary maximal power consumption 1.5 MW.

Calculate:

3-phase rated active power of the transducer : P = 3 x 230 V x 2500 A (500 * 5A) = 1.725 MW (500 * 3450 W) i.e. 100%

Ordered power and rated power ratio = 1 MW / 1.725 ≈ **57.97%** of the tarnsducers rated value (register **4010**).

Hysteresis of alarm work: alarm switching for **90%** of ordered power (register **4018**), switching off for example: by 1% lower - 89% (register **4017**)

Work optimization of power limit function (alarm switch on delay):
delay time of the alarm $t_o = 10\% * [1\ MW * 900\ s / 1.5\ MW] = 60\ s$ (register **4019**).

Figure 20 presents how to take advantage of the parameter showing used ordered power to activate alarm. The alarm delay is switched off (set to 0 sec.) - register 4019.

In the example for the remaining 10% of ordered power under maximal power consumption the devices could work yet 60 seconds without exposing the consumer to penalties. If the delay was set to 60 seconds the alarm would not be activated (register 4019).

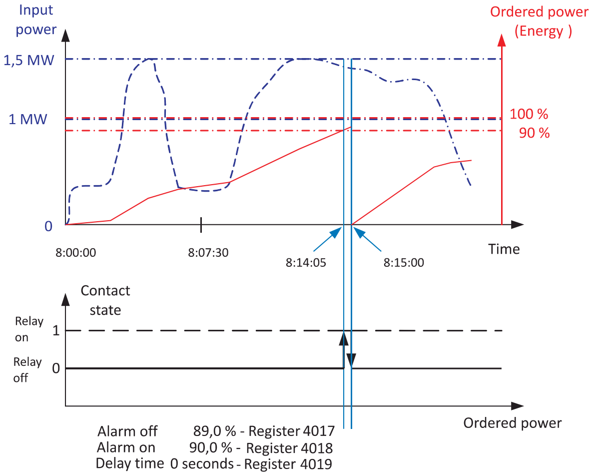


Fig. 20. Measurement of used ordered power, 15-minutes averaging time, synchronization with the clock, alarm set to 90%.

Table 8

Regi-ster	Value	Meaning
4010	579	579 – 57.9 % (percentage value with one place after the decimal point multiplied by 10) percentagevalue of ordered power in relation to the rated power
4015	35	35 – alarm set to the percentage of used active power
4016	0	0 – n-on mode
4017	890	890 – 89.0% (percentage value with one place after the decimal point multiplied by 10) alarm switch off; for the alarm to work the value in the register 4017 should be lower than in the register 4018 (hysteresis), for example: by 1%
4018	900	900 – 90.0% mA (percentage value with one place after the decimal point multiplied by 10) percentage of ordered power - alarm switch on
4019	0 or 60	0 – 0 seconds of alarm switch on delay (without optimiza-tion), 60 with optimization
4020	0	0 – 0 seconds of alarm switch off delay
4021	0	0 – 0 seconds of blockade for alarm re-switching

Example 3 – Programming a Unidirectional Continuous Output 1

Configure the continuous output 1 to have the value 20 mA, when 3-phase average current is 4 A, and to have the value 4 mA when the current is 0 A.

For the rated current I_n = 5 A, one must set values according to the table 9:

Table 9

Regi-ster	Value	Meaning
4048	23	23 – mean 3-phase current (I)
4049	0	0 – 0.0% (percentage value with one place after the decimal point multiplied by 10) the lower value of the rated mean 3-phase current, (0 A/5 A) x 1000 = 0
4050	800	800 – 80.0 % (percentage value with one place after the decimal point multiplied by 10) the upper value of the rated mean 3-phase current, (4 A/5 A) x 1000 = 800

4051	400	400 – 4.00 mA (alue in mA with two places after the deimal point multiplied by 100) lower value of the output current
4052	2000	2000 – 20.00 mA (value in mA with two places after the decimal point multiplied by 100) upper value of the output current. (20.00 mA x 100) = 2000
4053	0	0 – normal mode of the continuous output 1
4054	24	24 – 24 mA on continuous output 1 if the error (-1e20 or 1e20)

Example 4 – Programming a Bidirectional Continuous Output 1

Configure the continuous output 1 to have the value -20 mA, when the three-phase power value 3 x 4 A x 230 V x cos (180°) = -2760 W, and to have the value 20 mA when the three-phase power value is 3 x 4 A x 230 V x cos (0°) = 2760 W.

For the rated execution 3 x 5 A /230 V, one must set values according to the table 10

Table 10

Regi-ster	Value	Meaning
4048	24	24 – mean 3-phase current (I)
4049	-800	-1000 – -100.0% (percentage value with one place after the decimal point multiplied by 10) the lower value of the rated mean 3-phase current, 3 x 4 A x 230 V x cos (180°) / 3 x 5 A x 230 V) x 1000 = -800
4050	800	1000 – 100.0 % (percentage value with one place after the decimal point multiplied by 10) the upper value of the rated mean 3-phase current, 3 x 4 A x 230 V x cos (0°) / 3 x 5 A x 230 V) x 1000 = 800
4051	-2000	-2000 – -20.00 mA (value in mA with two places after the decimal point multiplied by 100) lower value of the output current (-20.00 mA x 100) = -2000
4052	2000	2000 – 20.00 mA (value in mA with two places after the decimal point multiplied by 100) upper value of the output current (20.00 mA x 100) = 2000
4053	0	0 – normal mode of the continuous output 1
4053	24	24 – 24 mA on continuous output 1 if the error (-1e20 or 1e20)

10. TECHNICAL DATA

Table 11

Measured quantity		Measuring range	L1	L2	L3	Σ	Basic error
Current	1A ~ 5A ~	0.002......1.2A ~ 0.01.........6A ~	●	●	●		±0.2%
Voltage L-N	57.7V~ 230.0V~	2.80..70.00 V ~ 10.0....276 V ~	●	●	●		±0.2%
Voltage L-L	100.0V ~ 400.0V ~	5.0... 120 V~ 20.. . 480 V~	●	●	●		±0.5%
Frequency		47.0...63.0 Hz	●	●	●		±0.2%
Active power		-1.65 kW...1.4 W...1.65 kW	●	●	●	●	±0.5%
Reactive power		-1.65 kvar...1.4 var...1.65 kvar	●	●	●	●	±0.5%
Apparent power		1.4 VA...1.65 kVA	●	●	●	●	±0.5%
PF factor		-1...0...1	●	●	●	●	±0.5%
Tangens φ		-1.2...0...1.2	●	●	●	●	±1%
Cosinus φ		-1...1	●	●	●	●	±1%
Angle between U and I		-180 °... 180 °	●	●	●		±0.5%
Input active energy		0...99 999 999.9 kWh				●	±0.5%
Developed active energy		0...99 999 999.9 kvarh				●	±0.5%
Reactive inductive energy		0...99 999 999.9 kWh				●	±0.5%
Reactive capacitive energy		0...99 999 999.9 kvarh				●	±0.5%
THD in the range 10...120% U,I; 48...52 Hz; 58..62 Hz		0...100%	●	●	●	●	±5%

Caution! For correct current measurement, the presence of voltage with the value higher than 0.05 Un is required at least on one phase

Power Consumption:
- in supply circuit ≤ 10 VA
- in voltage circuit ≤ 0.05 VA
- in current circuit ≤ 0.05 VA

Analog Outputs:	0, 2 or 4 programmable outputs: -20...0...+20 mA, R_{load}: 0..250 Ω outputs response time < 2s:,Accuracy 0.2%
Relay Outputs:	0, 2 or 4 relays, voltageless NO contacts load capacity 250 V~/ 0.5 A~
Serial Interface:	**RS-485**: address 1...247; mode: 8N2, 8E1, 8O1, 8N1; baud rate: 4.8, 9.6, 19.2, 38.4 kbit/s,
	USB: 1.1 / 2.0, address 1; mode 8N2; baud rate 9.6 kbit/s,
Transmission Protocol:	Modbus RTU
Response time:	500 ms
Energy Pulse Output:	output of OC type, passive acc. to EN 62053-31
Pulse Constant of OC Type Output:	5000 -20000 imp./kWh, independently on settings ratios Ku, Ki
Ratio of the Voltage Transformer Ku:	0.1... 4000.0
Ratio of the Current Transformer Ki:	1...10000
Protection Degree:	
- for the housing	IP 40
- from terminals	IP 20
Weight:	appro. 0.450 kg
Dimensions:	122.5 x 66.0 x 106.5mm
Fixing Way:	Rail mounting/wall mouting.
Reference and Rated Operating Conditions:	
- supply voltage	85...253 V a.c. 40...400 Hz; 90...320 V d.c.

	or 20...40 V a.c. 40...400 Hz; 20...60 V d.c.
- input signal	0...0.002...1.2 I_n; 0...0.05...1.2 U_n for current, voltage 0...0.002...1.2 I_n ; 0...0.1...1.2 U_n for power factors Pf_i ,$t\varphi_i$ frequency 47...63 Hz sinusoidal (THD $\leq$ 8%)
- power factor	-1...0...1
- analog outputs	-24...-20...0...+20...24 mA
- ambient temperature	-10...23...+55°C
- storage temperature	-30...+70°C
- relative humidity	25...95% (inadmissible condensation)
- admissible peak factor:	
- current	2
- voltage	2
- external magnetic field	0..40...400 A/m
- short duration overload 5 sec.	
- voltage inputs	2Un (max.1000 V)
- current inputs	10 In
- work position	any
- preheating time	5 min.

Additional errors:

in percentage of the basic error:

- from frequency of input signals	< 50%
- from ambient temperature changes	< 50%/10°C
- for THD > 8%	< 100%

Standards Fulfilled by the Meter

Electromagnetic Compatibility:

- noise immunity — acc. to EN 61000-6-2
- noise emission — acc. to EN 61000-6-4

Safety Requirements:

According to EN 61010-1 standard

- isolation between circuits basic(DC)
- installation category III,
- pollution level 2,
- maximal phase-to-hearth voltage
  - for supply and measurement circuit 300 V
  - for other circuits 50 V
- altitude above sea level < 2000 m,

NOTE

NOTE

NOTE

The Information contained in these installation instructions is for use only by installers trained to make electrical power installations and is intended to describe the correct method of installation for this product. However, 'manufacturer' has no control over the field conditions which influence product installation.
It is the user's responsibility to determine the suitability of the installation method in the user's field conditions. 'manufacturer' only obligations are responsibility to determine the suitability of the installation method in the user's field conditions. 'manufacturer' only obligations are those in 'manufacturer' standard Conditions of Sale for this product and in no case will 'manufacturer' be liable for any other incidental, indirect or consequential damages arising from the use or misuse of the products.