

PARAMETER TRANSDUCER - ANALYZER

P10 TYPE

SERVICE MANUAL

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1. APPLICATION

The P10 transducer-analyzer is destined to measure voltages and currents in a three or four-wire power network, in symmetric or asymmetric systems and enables the conversion of network parameters into four standard analog current signals.

The RS-485 interface with the MODBUS transmission protocol makes possible the application of this P10 transducer-analyzer in computer systems.

This transducer enables the measurement of root-mean-square values of voltage and current, active, reactive, apparent power and energy, power factors, frequency, active and average power e.g. 15 min., harmonic distortion coefficients for each phase and harmonic measurement from 1 to 25 th. Moreover, this P10 transducer-analyzer shows the real time and the time of extremal value occurrences.

It has 4 relay outputs and 3 two-state inputs to switch the rate of energy counters.

The P10 transducer-analyzer is destined for producers and distributors of electrical energy and individual users.

Quantities measured and calculated by the P10 transducer-analyzer:

- phase voltages U1, U2, U3,
- phase-to-phase voltages U12, U23, U31,
- average three-phase voltage Us
- average phase-to-phase voltage Umf
- average three-phase current Is
- phase currents I1, I2, I3
- phase active powers P1, P2, P3,
- phase reactive powers Q1, Q2, Q3,
- phase apparent powers S1, S2, S3,
- phase active power factors Pf1, Pf2, Pf3,
- ratio between reactive and active power factors $tg\varphi1, tg\varphi2, tg\varphi3$
- average three-phase power factors Pf, $tg\varphi$
- phase power factors $tg\varphi1, tg\varphi2, tg\varphi3$
- three-phase active, reactive and apparent powers P, Q, S
- average active power, e.g. 15 min. PAV
- three-phase active, reactive and apparent energy in four rates (tariffs) Ept1-4, Eq1 1-4, Est 1-4
- frequency f
- full coefficients of distortion by harmonics for phase voltages and phase currents THDU1, THDU2, THDU3, THDI1, THDI2, THDI3,
- phase voltage and phase current harmonics up to 25th

Maximal and minimal values accessible with the date and time of their occurrence are measured for all quantities. Additionally, there is the possibility to adapt the P10 transducer-analyzer to external measuring transformers. The updating time of all accessible quantities does not exceed 1 second. All quantities and configuring parameters are accessible through the RS-485 interface.

2. DELIVERY SET - OPERATIONAL SAFETY

With the P10 transducer-analyzer we deliver:

- a service manual,
- a guarantee card,
- 3 bolts to fix the transducer on a wall.

In case of the execution with a serial interface, we deliver additionally:

- a service manual of the serial interface,
- a service manual of the WizPar program,
- a diskette named „WizPar Visualization Program“.

When unpacking the P10 transducer-analyzer, please check whether the type and execution code on the data plate correspond to the order.

Symbols located in this service manual mean:



Especially important. One must acquaint with this before connecting the instrument.



Read carefully. One must take note of this when the instrument is working inconsistently to the expectations.

P10 transducer-analyzers are destined to be mounted on panels or walls. In the range of operational safety they are in conformity with the IEC 1010 standard requirements.

Remarks concerning the operator safety:

- The installation and meter connection should be operated by qualified personnel.
- One must take into consideration all accessible protection requirements.
- Before switching the instrument on, one must check the correctness of the network lead connection.
- In case of the protection terminal connection with a separate lead one must remember to connect it before the connection of network leads.
- Do not connect the transducer to the network through an autotransformer.
- Before taking the transducer housing out one must turn the supply off.
- The removal of the transducer housing during the guarantee period may cause its cancellation.

3. INSTALLATION

3.1 Fitting way.

P10 transducer-analyzers are adapted to be installed on a DIN rail or on a wall by means of bolts.

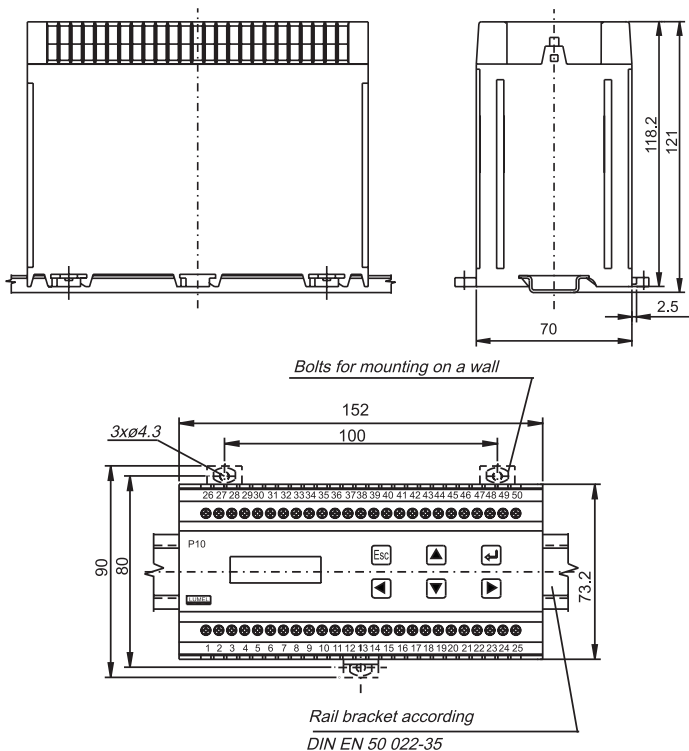
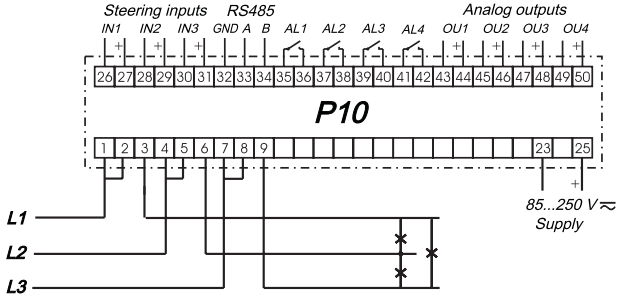


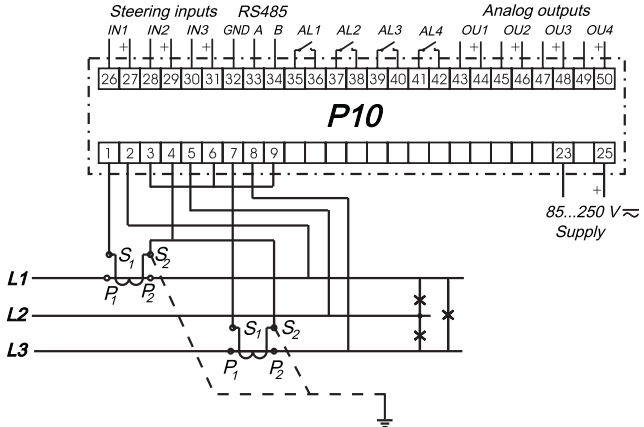
Fig. 1. External dimensions and fitting way on a wall

3.2. External connection diagrams

Direct measurement in a three-phase network



Half-intermediate measurement via 2 current transformers in a three-phase network



Intermediate measurement via 3 current transformers and 2 or 3 voltage transformers in a 3-phase network.

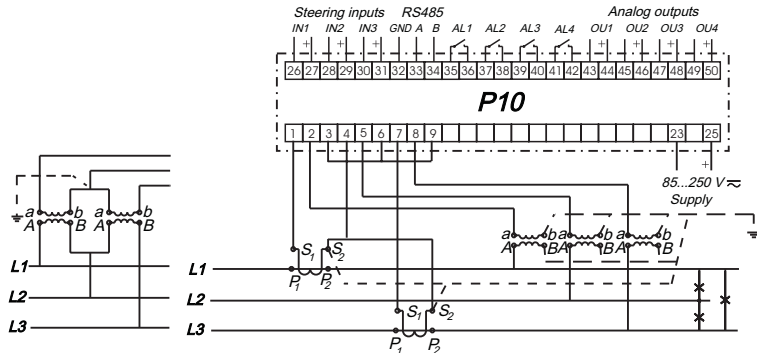
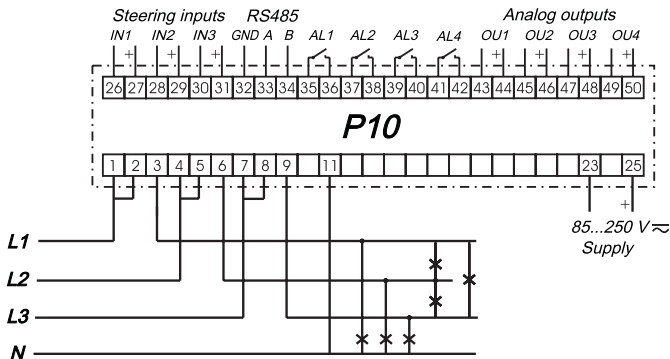
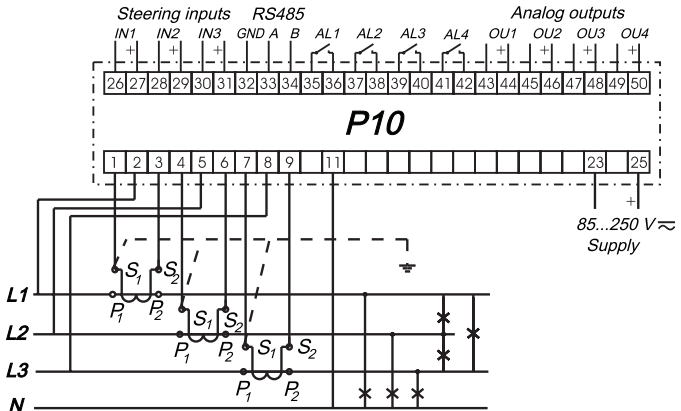


Fig. 2. Connection diagrams of the P10 transducer - analyzer in a three-phase network

Direct measurement in a four-wire network



Half-intermediate measurement in a four-wire network via 3 current transformers



Intermediate measurement via 3 current transformers and 2 or 3 voltage transformers in a four-wire network.

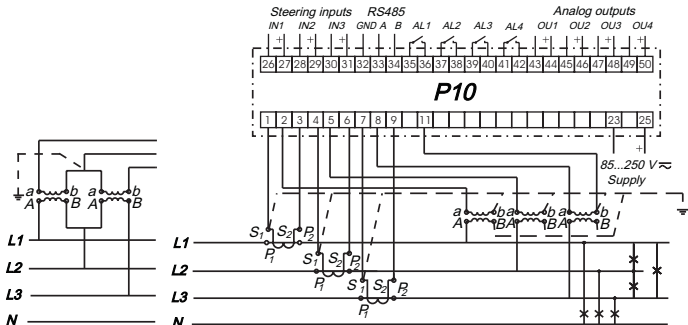
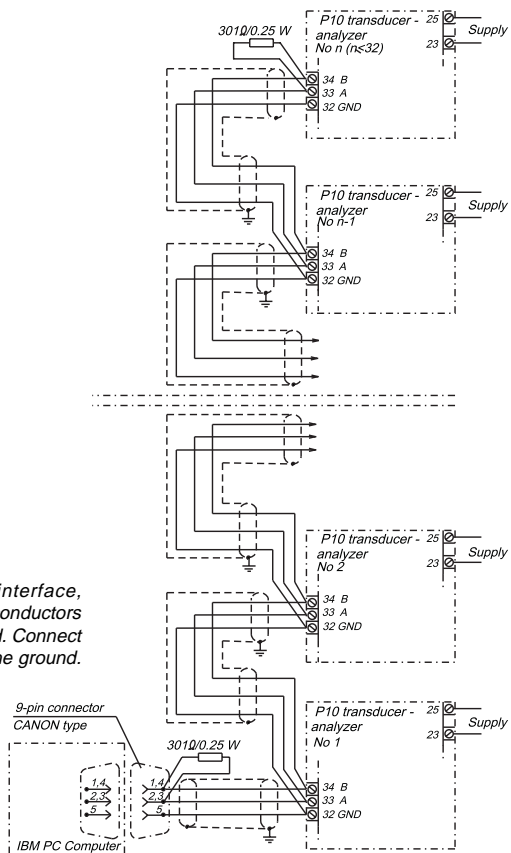


Fig. 3. Connection diagrams of the P10 transducer-analyzer in a four-wire network.



Note:

To connect the RS-485 interface, (a double twisted pair of conductors in a screen is recommended. Connect the screen in one point to the ground.

Fig. 8. Connection way of the RS-485 interface

4. PROGRAMMING







4.1. Faceplate description



Fig. 5. View of the P10 transducer-analyzer

The P10 transducer-analyzer has 6 functional keys and an LCD 2 x 16 character display. Parameter values are compiled in two lines. By means of keys, the user can choose any optional quantity.

The assignment of each key is as follows.

| | |
|---|------------------------------|
|  | Acceptation key - ENTER |
|  | Key to displace to the right |
|  | Key to decrease the value |
|  | Key to increase the value |
|  | Key to displace to the left |
|  | Clearing key - Esc |

- ↵ key - in the programming mode: acceptance of the introduced value.
- ← → keys - in the measurement mode, these keys allow to displace on the two-dimensional parameter table.
 - in the programming mode they enable the position change of the cursor and allow to control the display contrast
- ▼ ▲ keys - in the measurement mode, these keys allow to displace on the two-dimensional parameter table
 - in the programming mode, they serve to change the introduced value
- Esc key - this key enables the resignation in any moment of the operation

In the measurement mode the display has the following view:

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|
| n | n | n | | | | | A | I | | a | a | a | a | | |
| | x | x | x | x | x | | v | v | v | v | v | | | | |

- nnn - name of the quantity acc. the table No 2
- xxxxxx - value
- vvvv - unit
- aaaa - state of relay outputs (— - non active, output number — - active)

4.2 Working modes of P10 transducer-analyzers

The P10 transducer-analyzer has 5 working modes, set down in the table 1.

Working modes

Table 1

| Mode | | Calling | |
|---------------------------|-----------------------|--------------------|--------------------------------------|
| Name | Calling symbol | Input | Output |
| Measuring | | assumptive | Through the input to another mode |
| Clock setting | RTC Time | In SETUP procedure | [Esc], or ← after the last parameter |
| Parameter configuration | Parameters | In SETUP procedure | [Esc], or ← after the last parameter |
| Alarm programming | Alarms | In SETUP procedure | [Esc], or ← after the last parameter |
| Analog output programming | Analog Outputs | In SETUP procedure | [Esc], or ← after the last parameter |

After the transducer-analyzer switching on, the following message is reported.

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| P | 1 | 0 | | v | . | x | x | | | L | U | M | E | L | |
| | y | y | / | m | m | / | d | d | | | h | h | : | m | m |






where:



v.xx - is the number of the current program version

yy/mm/dd - defines the current date

hh:mm - current hour

After making tests, the transducer-analyzer transits into the measuring mode and the last set quantity is indicated

The entry into the SETUP procedure follows after pressing   keys during 3 seconds. The entry into the other modes is carried out by the SETUP procedure. By means of   keys one must choose the suitable mode „RTC Time”, „Parameters”, „Alarms”, „Analog Outputs” and accept the chosen mode by the  key.

The return from other modes to the measuring mode is carried out by the  or  key after the last parameter.

4.2.1. Measuring mode

In the measuring mode the quantity value is displayed according the table settled by the manufacturer.





The quantity change is carried out by means of     keys. Quantities displayed in the measuring mode.




Table 2

| | | | | | | | | | | |
|-----|----|----|------|-----|------|-----|-----|---|-----|-----|
| | | | Pav | | | | | | | |
| U12 | U1 | I1 | P1 | Q1 | S1 | PF1 | tg1 | f | HU1 | HI1 |
| U23 | U2 | I2 | P2 | Q2 | S2 | PF2 | tg2 | f | HU2 | HI2 |
| U31 | U3 | I3 | P3 | Q3 | S3 | PF3 | tg3 | f | HU3 | HI3 |
| UPP | U | I | P | Q | S | PF | tg | f | | |
| | | | Ept1 | Eq1 | Est1 | | | | | |
| | | | Ept2 | Eq2 | Est2 | | | | | |
| | | | Ept3 | Eq3 | Est3 | | | | | |
| | | | Ept4 | Eq4 | Est4 | | | | | |

| Item | Quantity name | Symbol | Unit |
|------|------------------------------------|------------------|-------------|
| 1 | lack of quantity | off | |
| 2 | L1-L2 phase-to-phase voltage | U12 | (M,k)V |
| 3 | L2-L3 phase-to-phase voltage | U23 | (M,k)V |
| 4 | L3-L1 phase-to-phase voltage | U31 | (M,k)V |
| 5 | average phase-to-phase voltage | UPP | (M,k)V |
| 6 | L1 phase voltage | U1 | (M,k)v |
| 7 | L2 phase voltage | U2 | (M,k)V |
| 8 | L3 phase voltage | U3 | (M,k)V |
| 9 | average 3-phase voltage | U | (M,k)V |
| 10 | Current in L1 phase line | I1 | (k)A |
| 11 | Current in L1 phase line | I2 | (k)A |
| 12 | Current in L1 phase line | I3 | (k)A |
| 13 | average 3-phase current | I | (k)A |
| 14 | average active power | P _{av} | (G,M,k)W |
| 15 | active power of L1 phase | P1 | (G,M,k)W |
| 16 | active power of L2 phase | P2 | (G,M,k)W |
| 17 | active power of L3 phase | P3 | (G,M,k)W |
| 18 | 3-phase active power | P | (G,M,k)W |
| 19 | 3-phase active energy - Tariff 1 | E _{pt1} | (G,M,k)Wh |
| 20 | 3-phase active energy - Tariff 2 | E _{pt2} | (G,M,k)Wh |
| 21 | 3-phase active energy - Tariff 3 | E _{pt3} | (G,M,k)Wh |
| 22 | 3-phase active energy - Tariff 4 | E _{pt4} | (G,M,k)Wh |
| 23 | Reactive power of L1 phase | Q1 | (G,M,k)Var |
| 24 | Reactive power of L2 phase | Q2 | (G,M,k)Var |
| 25 | Reactive power of L3 phase | Q3 | (G,M,k)Var |
| 26 | 3-phase reactive power | Q | (G,M,k)Var |
| 27 | 3-phase reactive energy - Tariff 1 | E _{qt1} | (G,M,k)Varh |
| 28 | 3-phase reactive energy - Tariff 2 | E _{qt2} | (G,M,k)Varh |
| 29 | 3-phase reactive energy - Tariff 3 | E _{qt3} | (G,M,k)Varh |
| 30 | 3-phase reactive energy - Tariff 4 | E _{qt4} | (G,M,k)Varh |


| Item | Quantity name | Symbol | Unit |
|------|-------------------------------------|---------|------------|
| 31 | Apparent power of L1 phase | S1 | G,M,k)VA |
| 32 | Apparent power of L2 phase | S2 | (G,M,k)VA |
| 33 | Apparent power of L3 phase | S3 | (G,M,k)VA |
| 34 | 3-phase apperent power | S | (G,M,k)VA |
| 35 | 3-phase apperent energy - Tariff 1 | Est1 | (G,M,k)VAh |
| 36 | 3-phase apperent energy - Tariff 2 | Est2 | (G,M,k)VAh |
| 37 | 3-phase apperent energy - Tariff 3 | Est3 | (G,M,k)VAh |
| 38 | 3-phase apperent energy - Tariff 4 | Est4 | (G,M,k)VAh |
| 39 | L1 phase power factor | PF1 | |
| 40 | L2 phase power factor | PF2 | |
| 41 | L3 phase power factor | PF3 | |
| 42 | 3-phase power factor | PF | |
| 43 | tg ϕ coefficient of L1 phase | tg1 | |
| 44 | tg ϕ coefficient of L2 phase | tg2 | |
| 45 | tg ϕ coefficient of L3 phase | tg3 | |
| 46 | 3-phase tg ϕ coefficient | tg | |
| 47 | THD coefficient of L1 phase voltage | HU1-THD | % |
| 48 | THD coefficient of L2 phase voltage | HU2-THD | % |
| 49 | THD coefficient of L3 phase voltage | HU3-THD | % |
| 50 | THD coefficient of L3 phase cuurent | HI1-THD | % |
| 51 | THD coefficient of L3 phase cuurent | HI2-THD | % |
| 22 | THD coefficient of L3 phase cuurent | HI3-THD | % |
| 53 | frequency | f | Hz |

4.2.1.1. Extreme values

The monitoring of minimal and maximal values is carried out when after pressing the  and  or  keys, the following message is shown on the display:

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| z | | y | y | / | m | m | / | d | d | | h | h | : | m | m |
| | x | x | x | x | x | | v | v | v | v | v | | | | |







z - ↑ maximum sign, ↓ minimum sign
yy/mm/dd - date of extremum occurrence
hh:mm - time of extremum occurrence
xxxxxx - value
vvvv - unit

The clearing of external values follows after pressing the  key during their monitoring.


Note:

The clearing of external values of the Pav parameter follows after zeroing them in the PARAMETERS mode.

4.2.1.2 Measurement of current and voltage harmonics




The choice of harmonics is carried out by pressing  and  during 3 sec. THD coefficients values and harmonic contents from 2 up to 25th can be reviewed by means of     keys moving on the two-dimensional coefficient table.

| | | | | | |
|---------|------------------|------------------|------------------|-----|------------------|
| HU1-THD | | HU1-04 HU1-05 | HU1-06 HU1-07 | ... | HU1-24 HU1-25 |
| HU2-THD | HU2-02 HU2-03 | HU2-04 HU2-05 | HU2-06 HU2-07 | ... | HU2-24 HU2-25 |
| HU3-THD | HU3-02 HU3-03 | HU3-04 HU3-05 | HU3-06 HU3-07 | ... | HU3-24 HU3-25 |
| HI1-THD | HI1-02 HI1-03 | HI1-04 HI1-05 | HI1-06 HI1-07 | ... | HI1-24 HI1-25 |
| HI2-THD | HI2-02 HI2-03 | HI2-04 HI2-05 | HI2-06 HI2-07 | ... | HI2-24 HI2-25 |
| HI3-THD | HI3-02 HI3-03 | HI3-04 HI3-05 | HI3-06 HI3-07 | ... | HI3-24 HI3-25 |

The key  enables the displacement downwards of 3 positions. This function enables simultaneously to follow harmonic values for currents and voltages of the same phase.

4.2.2. Setups of the RTC Time









After the entry into the SETUP procedure one must choose the RTC mode by means of



  keys and press the  key. The following values are displayed:

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| R | T | C | | T | i | m | e | | | | | | | | |
| | y | y | / | m | m | / | d | d | | h | h | : | m | m | |

where:

- yy - year
- mm - month
- dd - day
- hh - hour
- mm - minute

Required parameters can be set up by means of     keys, the quantity by the  or  key, and the digit value by the  or  key.

The active position is signalled by the cursor. One must accept settled values by the  key or resign by pressing the  key and back to the measuring mode.

4.2.3. Configuration of PARAMETERS parameters

This mode serves to settle transducer-analyzer parameters. The entry into the configuration mode is protected by the access code if a code different from zero has been introduced. For the code 0000, the inquiry for the password is omitted. If the access code is different from zero, there is the possibility to review parameters but changes are blocked.

In the configuration mode quantities acc. the table 5 are settled

Set of parameters








Table 5

| Item | Parameter name | Designation | Range | Assumptive value |
|------|---|---------------|--------------------|------------------|
| 1 | Introduction of the access code | Password? | 0000...9999 | 0000 |
| 2 | Setup of transducer manufacturer's parameters | Set Defaults? | Y,N | N |
| 3 | Ratio of the current transformer | I Ratio | 1...20000 | 1 |
| 4 | Ratio of the voltage transformer | U Ratio | 1...4000 | 1 |
| 5 | Cancellation of the counters | Clear E*t? | Y,N | N |
| 6 | Cancellation of the Pav power averaged time (e.g. 15 min), Pav (max and min. value) | Clear Pav | Y,N | N |
| 7 | Averaging time of the Pav power | Pav Time | 15, 30, 60 | 15 |
| 8 | Synchronization of Pav power averaging Pav - through the clock, - through the moving window | Pav Window? | Synchro, Moving | Synchro |
| 9 | Transducer address in the network | Slave Address | 0,1,...,247 | 1 |

| Item | Parameter name | Designation | Range | Assumptive value |
|------|------------------------------|-------------|---|------------------|
| 10 | Serial interface rate | Baud Rate | 600, 1200, 2400, 4800, 9600, 19200 | 19200 |
| 11 | Mode of the MODBUS interface | Modbus Mode | off, 8n1 ASCII, 7e1 ASCII, 7o1 ASCII, 8n2 RTU, 8e1 RTU, 8o1 RTU | 8n2 RTU |
| 12 | Change of access code | Password | 0000, ..., 9999 | 0000 |

Designations :

- n - (no parity), lack of parity
- e - (even parity), bit of parity control
- o - (odd parity), bit of odd parity control.

Required values are settled in the configuration mode by means of     keys. The active position is marked off by the cursor. The settled quantity can be accepted by the  key or cancelled by the  key. The pressure of the  key causes the setup on the successive parameter, and after the last parameter, remembers the set up values and causes the exit from the Parameters mode.

Note: When changing the working mode and the interface baud rate, the transducer reset follows.

4.2.4. Programming of Alarms

Any arbitrary quantity of the group of 41 parameters (table 8) can be assigned to the alarm output.

Moreover, it is possible to:

- set up the switch on thresholds,
- set up the switch off thresholds,
- settle the delay

Alarms mode

Table 6

| Item | Parameter name | Designation | Range | Assumptive value |
|------|---------------------------------------|--------------|-------------------|------------------|
| 1 | Two-state output 1 - quantity | Alarm1 Param | table 8 | I1 |
| 2 | Two-state output 1 - switch on | Alarm1 On | -120...0...120[%] | 101 |
| 3 | Two-state output 1 - switch off value | Alarm1Off | -120...0...120[%] | 99 |
| 4 | Two-state output 2 - quantity | Alarm2 Param | table 8 | I2 |
| 5 | Two-state output 2 - switch on | Alarm2 On | -120...0...120[%] | 101 |
| 6 | Two-state output 1 - switch off value | Alarm2 Off | -120...0...120[%] | 99 |
| 7 | Two-state output 3 - quantity | Alarm3 Param | table 8 | I3 |
| 8 | Two-state output 3 - switch on | Alarm3On | -120...0...120[%] | 101 |
| 9 | Two-state output 3 - switch off value | Alarm3 Off | -120...0...120[%] | 99 |
| 10 | Two-state output 4 - quantity | Alarm4 Param | table 8 | I |
| 11 | Two-state output 4 - switch on | Alarm4 On | -120...0...120[%] | 101 |
| 12 | Two-state output 3 - switch off value | Alarm4 Off | -120...0...120[%] | 99 |
| 13 | Delay in alarm operation | Alarms Delay | 0...100 [s] | 0 |

Example:

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|--|---|---|---|---|---|--|--|--|--|
| A | I | a | r | m | 1 | | P | a | r | a | m | | | | |
| | | | | | | | | | U | 1 | | | | | |

The voltage of phase 1 has been assigned to the 1st relay output

4.2.5. Programming of Analog Outputs

A continuous output current signal can be assigned to any arbitrary measured or calculated quantity from the group of 41 parameters.

Moreover, it is possible to:

- set up the changing window of the input signal,
- choose the current range: 0...20, 4...20, 0...5, 0...10 mA

Set of Analog Outputs mode parameters

Table 7

| Item | Parameter name | Designation | Range | Assumptive value |
|------|--|------------------|----------------|------------------|
| 1 | Quantity on the continuous output No 1 | AnOut1 Param | table 8 | off |
| 2 | Lower value of the input range | AnOut1 Low [%] | -120...0...120 | 0 |
| 3 | Upper value of the input range | AnOut1 Hi [%] | -120...0...120 | 100 |
| 4 | Continuous output type | AnOut1 Zero [mA] | 0, 4, 5, 10 | 4 |
| 5 | Quantity on the continuous output No 2 | AnOut2 Param | table 8 | off |
| 6 | Lower value of the input range | AnOut2 Low [%] | -120...0...120 | 0 |
| 7 | Upper value of the input range | AnOut2 Hi [%] | -120...0...120 | 100 |
| 8 | Continuous output type | AnOut2 Zero [mA] | 0, 4, 5, 10 | 4 |
| 9 | Quantity on the continuous output No 3 | AnOut3 Param | table 8 | Off |
| 10 | Lower value of the input range | AnOut3 Low [%] | -120...0...120 | 100 |
| 11 | Upper value of the input range | AnOut3 Hi [%] | -120...0...120 | 100 |
| 12 | Continuous output type | AnOut3 Zero [mA] | 0, 4, 5, 10 | 4 |
| 13 | Quantity on the continuous output No 4 | AnOut4 Param | table 8 | off |
| 14 | Lower value of the input range | AnOut4 Low [%] | -120...0...120 | 0 |
| 15 | Upper value of the input range | AnOut4 Hi [%] | -120...0...120 | 100 |
| 16 | Continuous output type | AnOut4 Zero [mA] | 0, 4, 5, 10 | 4 |

Note: the analog output type is designed by:

- 0 - defines the current output 0... 20 mA range
- 4 - defines the current output 4... 20 mA range
- 5 - defines the current output 0... 5 mA range
- 10 - defines the current output 0... 10 mA range

| Code | Designation | Quantity |
|------|-------------|--------------------------------------|
| 40 | OFF | lack of quantity |
| 39 | U1 | L1 phase voltage |
| 38 | I1 | current in the L1 phase line |
| 37 | P1 | L1 phase active power |
| 36 | Q1 | L1 phase reactive power |
| 35 | S1 | L1 phase apperent power |
| 34 | PF1 | L1 phase power factor |
| 33 | tg1 | L1 phase $\text{tg}\phi$ coefficient |
| 32 | U2 | L2 phase voltage |
| 31 | I2 | current in the L2 phase line |
| 30 | P2 | L2 phase active power |
| 29 | Q2 | L2 phase reactive power |
| 28 | S2 | L2 phase apperent power |
| 27 | PF2 | L2 phase power factor |
| 26 | tg2 | L2 phase $\text{tg}\phi$ coefficient |
| 25 | U3 | L3 phase voltage |
| 24 | I3 | current in the L3 phase line |
| 23 | P3 | L3 phase active power |
| 22 | Q3 | L3 phase reactive power |
| 21 | S3 | L3 phase apperent power |
| 20 | PF3 | L3 phase power factor |
| 19 | tg3 | L3 phase $\text{tg}\phi$ coefficient |
| 18 | U | average 3-phase voltage |
| 17 | I | average 3-phase current |
| 16 | P | three-phase active power |
| 15 | Q | three-phase reactive power |
| 14 | S | three-phase apperent power |
| 13 | PF | three-phase power factor |

Table 8 (continuation)

| Code | Designation | Quantity |
|------|-------------|---|
| 12 | tg | 3-phase $\text{tg}\varphi$ coefficient |
| 11 | f | frequency |
| 10 | U12 | L1-L2 phase-to-phase voltage |
| 9 | U23 | L2-L3 phase-to-phase voltage |
| 8 | U31 | L3-L1 phase-to-phase voltage |
| 7 | UPP | average phase-to-phase voltage |
| 6 | Pav | average active power |
| 5 | HU1 | THD coefficient by harmonic of L1 phase voltage |
| 4 | HU2 | THD coefficient by harmonic of L2 phase voltage |
| 3 | HU3 | THD coefficient by harmonic of L3 phase voltage |
| 2 | HI1 | THD coefficient by harmonic of L2 phase current |
| 1 | HI2 | THD coefficient by harmonic of L1 phase current |
| 0 | HI3 | THD coefficient by harmonic of L3 phase current |

5. ENTRY TO THE TARIFF CHANGE

Steering inputs to the tariff change have a constant function - the tariff switching. Tariffs are used for the counting of the 3-phase tariff energy (four tariff energy counters, E_{pt_1} , E_{qt_1} , E_{st_1}). When there is a lack of signals on outputs, the energy is counted in E_{pt_1} , E_{qt_1} , E_{st_1} counters. The signal switching on successive outputs causes the switch-over of the counters.

| Input 1 | Input 2 | Input 3 | Tariff |
|---------|---------|---------|----------|
| 0 | 0 | 0 | tariff 1 |
| 1 | 0 | 0 | tariff 2 |
| 0 | 1 | 0 | tariff 3 |
| 0 | 0 | 1 | tariff 4 |

where:

1 - steering voltage: 24 V \pm 50%

0 - lack of steering voltage

Working modes of the P10 transducer-analyzer.

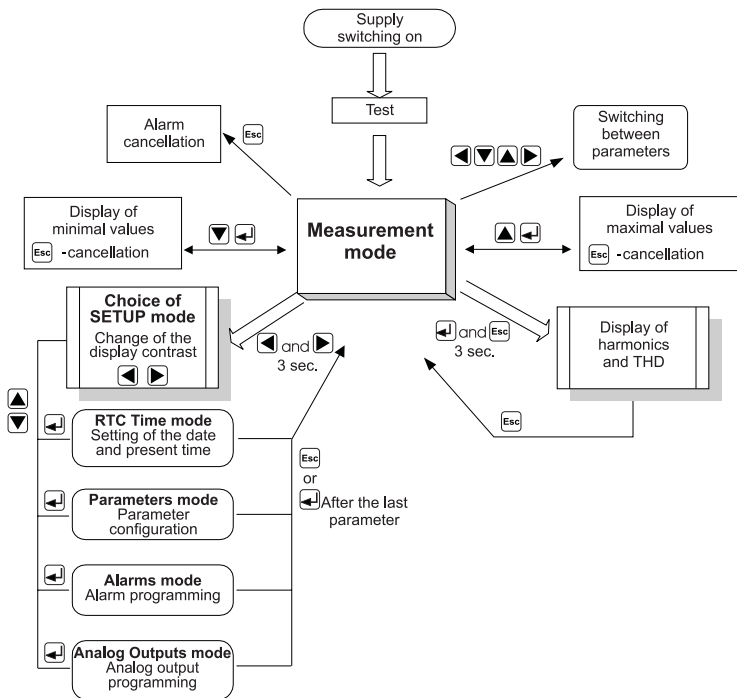


Fig.6. Working modes of the P10 transducer

6. ERROR CODES

During the transducer-analyzer operation, messages about errors can occur. Error causes are described below:

Invalid Value - when during measurementg the voltage or current is too small

| | |
|-----------------|----------------|
| $Pf_i, t\phi_i$ | below 5% U_n |
| | below 5% I_n |
| f | below 5% U_n |

- the full interval of the P_{av} power averaging time is not expired,

Invalid Min - Lack of possibility to define the minimal value.
(lack of current, usually after the transducer switching on or cancellation the extremes).

Invalid Max - Lack of possibility to define the maximal value.
(lack of current, usually after the transducer switching on or cancellation the extremes).

For THD and harmonic measurements

U out of range - voltage under 10% U_n

I out of range - current under 10% I_n

f out of range - frequency out of the 47...52 Hz range

7. TECHNICAL SPECIFICATIONS

Measuring ranges and admissible measuring errors are shown in the table 9.

Table 9

| Measured quantity | Range | Basic error | Remarks |
|---|--|--|--|
| Voltage U_i | 100.0 V ($K_u=1$) 400.0 V ($K_u=1$) for $K_u \neq 1$:...400 kV | $\pm(0.2\% \text{ m.v.} + 0.1\% \text{ of range})$ | $K_u=1...4000$ (max 400 kV) |
| Current I_i | 1.000 A ($K_i=1$) 5.000 A ($K_i=1$) for $K_i \neq 1$:...20.00 kA | $\pm(0.2\% \text{ m.v.} + 0.1\% \text{ of range})$ | $K_i=1...20000$ (max 20 kA) |
| Active power P_i Mean active power P_{AV} Active energy EnP | 0.0...(-)1999.9 (Wh) for $K_u \neq 1, K_i \neq 1$...(-)1999.9 MW (MWh) | $\pm(0.5\% \text{ m.v.} + 0.2\% \text{ of range})$ | |
| Reactive power Q_i Reactive energy EnQ | 0.0...(-)1999.9 (Varh) for $K_u \neq 1, K_i \neq 1$...(-)1999.9 MVar (MVarh) | $\pm(0.5\% \text{ m.v.} + 0.2\% \text{ of range})$ | |
| Apparent power S_i Apparent energy EnS | 0.0...(-)1999.9 (VAh) for $K_u \neq 1, K_i \neq 1$...(-)1999.9 MVA (MVAh) | $\pm(0.5\% \text{ w.m} + 0.2\% \text{ of range})$ | |
| Active power factor Pf_i | -1.00...0.00 ... 1.00 | $\pm 1\% \text{ m.v.} \pm 2c$ | $Pf = \text{Power factor} = P/S$ |
| Coefficient $tg\phi_i$ | -99.99...0...99.99 | $\pm 1\% \text{ m.v.} \pm 2c$ | error in the range -60...0...+60° |
| Frequency f | 20.0...500.0 Hz | $\pm 0.5\% \text{ m.v.}$ | |
| THD U, THD I Harmonics | 0.2...100 % | $\pm 5\% \text{ m.v.} \pm 2c$ | error in the range 10...120% U, I 47...52 Hz |

where:

- Ku - voltage transformer ratio
- Ki - current transformer ratio
- THD U - full coefficient of distortion by voltage harmonics
- THD I - full coefficient of distortion by current harmonics
- m.v. - measured value
- c - the smallest significant digit of the display

Power consumption

- in the supply circuit $\leq 10 \text{ VA}$
- in the voltage circuit $\leq 0.2 \text{ VA}$
- in the current circuit $\leq 0.1 \text{ VA}$

Supply voltage

85...250 V DC or AC, 40...400 Hz

Read-out field

display: LCD 2 x 16 characters

Analog output

4 outputs 0...20 mA, 4...20 mA,
0...5 mA, 0...10 mA
accuracy: 0.2%

Relay outputs

4 relays: voltageless make contacts
load capacity: 250 V~ / 0.5 A~

Steering input

3 inputs 0/24 V DC $\pm 50\%$ to steer
4 energy counter tariffs

Serial interface

RS 485

Transmission protocol

MODBUS

Transducer - analyzer reaction about supply decays and returns:

- preservation of data and transducer state during decays (accumulator support)
- continuation of operation after the supply return

Protection grade ensured by the housing:

- screw terminals IP 20
- housing IP 40

Weight

0.7 kg

Dimensions

152 x 73.2 x 118.2 mm

Fitting

on a 35 mm DIN rail

Maximal lead cross-section

4 mm²

Reference conditions and rating operating conditions

| | |
|---------------------------------------|---|
| - input signal: | $0...0.01...1.2 I_n$; $0...0.01...1.2 U_n$; for voltage, current, power and energy in a 4-wire network |
| | $0...0.01...1.2 I_n$; $0...0.1...1.2 U_n$; for voltage, current, power and energy in a 3-wire network |
| | $0...0.1...1.2 U_n$ for frequency, |
| | $0...0.05...1.2 I_n$; $0...0.05...1.2 U_n$; for Pf and $\tau\phi$ coefficients, frequency <u>45...65</u> ; sinusoidal (THD $\leq 8\%$) |
| | $0.1...1.2 I_n$; $0.1...1.2 U_n$; 47...52 Hz ; for THD U, THD I and harmonics |
| - power factor | -1...0...1 |
| - ambient temperature | 0... <u>23</u> ...55°C |
| - humidity | 25...95% (condensation inadmissible) |
| - supply | 85...250 V DC or AC, 40...400 Hz |
| - admissible peak factor: | |
| - current | 2 |
| - voltage | 2 |
| - storage temperature | -20...85°C |
| - external magnetic field | <u>0...40</u> ...400 A/m |
| - overload of short duration (5 sec.) | |
| - voltage inputs | $2 U_n$ (max.1000 V) |
| - current inputs | $10 I_n$ |
| - working position | optional |
| - heating time | 5 min. |

Additional errors

in % of the basic error

- from ambient temperature
changes:

< 50%/10°C

Standards fulfilled by the transducer-analyzer:

Electromagnetic compatibility:

- immunity acc. EN-50082-2 (1996)
- emission acc. EN50081-2 (1996)
- harmonic measurement acc. EN50160

Security requirements:

in compliance with IEC 1010-1+A1 (1996):

- insulation ensured by the housing: double,
- insulation between circuits: basic,
- installation category: III,
- pollution degree: 2,
- maximal working voltage in relation to the earth: 600 V AC



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