POWERMETER EPR-04 / EPR-04S

TECHNICAL DATA

Operating Voltage (Un): Please look at the back labels on the device
Operating frequency (f): 45-65 Hz
Auxiliary Supply Power Consumption: < 1VA
Measuring input Power Consumption: 10.300 VAC 45-65Hz (L-N)
10.500 VAC 45-65Hz (L-L)
Input: 0.05 - 5 A
Measuring Range: 0...215 M(Va) VA
Measuring Category: CAT III
Class: 1 x 1.dgt. [%10...110% xFull Scale]
Voltage Transformer Ratio: 0.1...4000.0
Current Transformer Ratio: 1...2000
Max. Clr x Vs: 40.000
Demand Time: 1.400 min. (programmable)
Serial Interface (for EPR-04S): MODBUS RTU (RS 485)
Baud Rate (for EPR-04S): 2400-38400 bps
Address (for EPR-04S): 1-247
Parity (for EPR-04S): No, odd, Even, 8 Data Bits, 2 Stop Bits
Pulse Output: NPN Transistor
Switch Period: Min. 100 msec pulse period
Operation Current: Max. 50 mA
Operation Voltage: 5...24 V DC max. 30 VDC
Ambient Temperature: -15°C...+50°C
Display: Red LED Display
Dimensions: PR-19, PK-26
Equipment Protection Class: Double Insulation Class II (I)
Box Protection Class: IP 40
Box Material: Non-flammable
Installation: Panel Mounted (PR-19), Rail Mounted (PK-26)
Wire Crosssection (for terminal block): 2.5 mm²
Weight: 0.45 kg (PR-19, PK-26)
Installation Category: Class III

Factory Settings

<table>
<thead>
<tr>
<th>Trait</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ctr (Current Transformer Ratio):</td>
<td>0001</td>
</tr>
<tr>
<td>tm (Turn number for CT-25 device):</td>
<td>01</td>
</tr>
<tr>
<td>Utr (Voltage Transformer Ratio):</td>
<td>0001.0</td>
</tr>
<tr>
<td>CAL (Calculation Method):</td>
<td>1</td>
</tr>
<tr>
<td>Pin : 0000 (Not Activated)</td>
<td></td>
</tr>
</tbody>
</table>

RS-485:

- Addr (Address): 1
- Bau (Baud Rate): 9600
- Parity (Parity): no

PREFERENCES FOR INSTALLATION AND SAFE USE

- In CT-25 (10Aa) compliant models, only CT-25 current transformer must be used.
- Never connect the device to the incoming line without proper installation procedures.
- Failure to follow these instructions will result in death or serious injury.
- Disconnect all power before working on equipment.
- When the device is connected to the network, do not remove the front panel.
- Do not try to clean the device with solvents or hot water.
- Only use dry cloth or a soft brush for cleaning.
- Do not entertain or permit the equipment to be damaged by water or other liquid.
- Electrical equipment should be serviced by your company supplier.
- Only for rack panel mounting.
- No responsibility is assumed by the manufacturer or any of its subsidiaries for any consequences arising out of the use of this material.

POWERMETER EPR-04S

**General:**

- EPR-04S is a microprocessor based device which is developed for measuring the power and energy values in an Electrical Networks. Measured parameters are displayed in 4 displays separately EPR-04S has an MODBUS serial communication interface.

- Calculation Methods for Active / Reactive Power Values
  1. Active/Reactive power can be calculated by summing import and export energy values.
  2. Active / Reactive power can be calculated according to direction as import/ export.

- Notes:
  1. The dotted lines of the display (During 2W is displayed) represent those displayed value is export active power value.
  2. Dotted lines of the display (During 2WIA is displayed) represents that displayed value is reactive power value.
  3. The display parameter will not change if power is off after 30 seconds of standby (In kW)

**Measured Parameters:**

- 4W (Active Power)
- 4VAR (Reactive Power)
- 4VA (Apparent Power)
- 4V (Input Voltage)
- 4IA (Input Current)
- 4S (Total Power)
- 4(Q) (Total Reactive Power)
- 4 (Total Active Power)

**FUNCTIONS OF BUTTONS**

1. **When W led lights it shown max power values which are measured instantaneous and it shown total max demand values. Also it is used for moving forwards in the menu.**
2. **When W led lights it shown min.power values which are measured instantaneous and it shown total demand values. Also it is used for moving backwards in the menu.**
3. **It used for passing between parameters such as W, V, VA, kW, kWh, kVAR, cosφ. When it pressed for 3 second, adjustment mode is entered. In adjustment mode it is used for saving parameters and moving to the sub menu.**
4. **In adjustment mode, it is used for entering to the upper menu or it is used for quitting from the adjustment mode without saving the values.**
5. **If user password is activated and set button is pressed for 3 seconds, a pin code is required in order to enter to the menu.**

1. **Saving Parameter Changes**

- How to change various parameters of the device is explained under their respective title. Changing parameters means that these parameters are saved. To save and activate new parameters, follow these steps:
  1. Alter the changed parameter, press the SET button. You will be taken to the upper menu.
  2. Press the SET button until (SAU SE) is displayed on the screen.
  3. When (SAU SE) is displayed on the screen, press the SET button to save your settings. (If you press the ESC button or select ‘no’ option instead of ‘yes’ by using the UP/DOWN buttons when SAU SE is displayed, the new settings will be discarded and old settings will be activated.)

2. **Transformer**

- Current transformer ratio, voltage transformer ratio, reactive energy calculation method and transformer turn number (only for devices with CT-25) can be set by using this menu.

2.1. **Entering Current Transformer Ratio:**

- Current transformer ratio is entered in this menu (This menu isn’t available for devices with CT-25.)
- It can be entered between 1....2000.

![Diagram](image-url)
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Example: If a 30 A / 5 A current transformer is used between the system and EPR-04A/04S, current transformer ratio must be entered as

- 30 A / 5 A = 6

fr Ctr 0 006
Press SET button for 3 seconds (If Fo Ctr menu is displayed).
Press SET button again. rA in Ctr menu is displayed (for devices with rT 26, bt Fo Ctr menu is displayed instead). Find the Fo Ctr menu by using the UP/DOWN button (↑). Press SET button to enter the menu.
First digit of the 4-digit value that is displayed will start to blink. Set the blinking value by using UP/DOWN buttons. Switch to the next digit by using SET button or go back to the previous value by using UP/DOWN button. (Data is entered but it is not activated yet. Please refer to 1. Saving Parameter Changes to activate the changes.)

2.2. Entering Voltage Transformer Ratio:
Voltage transformer ratio is entered in this menu.
It can be entered between 1000:1 - 10000:1.
Example: If a 3.45kV / 110V voltage transformer is used between the system and EPR-04A/04S, voltage transformer ratio must be entered as: 345000:1

fr Utr 03 450
2.3. Reactive Energy Calculation Method Setting
EPR04S has two different methods for calculating reactive energy. Explanation for these methods are given in the table below.
Method for calculating reactive energy from mechanical and digital electric power meters is entered in accordance with the table. You can select a value between 0 and 4.

fr Int 2
Calculated Me
Digital Meter
Reactive Energy
Description

0 Voltage input of reactive power is calculated with current. It is in root and reactive power calculation method.
2
It is the summation of the multiplication of (V x I) and 90° phase difference. This method is recommended for network analyzers.
4 Power Triangle Method: According to this method, (V x I) = Reactive Power, 3. Ignored Power, P: Active Power

Example: If you are using a digital meter and you want to use the voltage shifting method for reactive energy calculation, you must select the value as

fr Int 2

If you are using a digital meter and you want to use the power triangle method for reactive energy calculation, you must select the value as 5.

2.4. Programming the Turn Number:
This menu is available for CT-25 adapted devices. User enter the turn number, which is the number of how many turn the current cable has rounded into the CT-25. Numbers can be selected between 1-120. Greater the number of turn means greater the sensitivity.

fr Tnr

3. Demand Time Setup:
In this menu, demand time is set between 1-60 minutes.

PDE

Press SET button for 3 seconds (If Fo D menu is displayed).
Press SET button again. (If rE is displayed, then press SET button again). Press SET button to enter the menu.
Press SET button (first digit blinks).
Press SET button to enter the value to the first digit.
Press SET button (second digit blinks).
Press SET button to enter the value to the second digit.
Press SET button, ‘(E)’ is displayed. (Data is entered but it is not activated yet. Please refer to 1. Saving Parameter Changes to activate the changes.)

4. Pulse Menu
There are 3 adjustable parameters in this menu as “PUL SE rA’”, “PUL SE rT” and “PUL SE rE”.
When the summation of import and export active energy values become the same as the defined pulse ratio, one pulse is created.

PUL SE
ACI (Export/Import): The defined value to create one pulse (Please refer to Pulse ratio – PUL SE rA) is set for active energy. When the summation of import and export active energy values become the same as the defined pulse ratio, one pulse is created.
A-1 (Active Import): The defined value to create one pulse (Please refer to Pulse ratio – PUL SE rA) is set for active import energy. When the active import energy becomes the same as the defined pulse ratio, one pulse is created.
A-E (Active Export): The defined value to create one pulse (Please refer to Pulse ratio – PUL SE rA) is set for active export energy. When the active export energy becomes the same as the defined pulse ratio, one pulse is created.

rE (Inductive/Capacitive): The defined value to create one pulse (Please refer to Pulse ratio – PUL SE rA) is set for reactive energy. When the summation of import and export reactive energy values become the same as the defined pulse ratio, one pulse is created.
rL (Reactive Inductive): The defined value to create one pulse (Please refer to Pulse ratio – PUL SE rA) is set for reactive inductive energy. When only the reactive inductive energy becomes the same as the defined pulse ratio, one pulse is created.
rC (Reactive Capacitive): The defined value to create one pulse (Please refer to Pulse ratio – PUL SE rA) is set for reactive capacitive energy. When only the reactive capacitive energy becomes the same as the defined pulse ratio, one pulse is created.

PUL SE

4.1. Pulse Rate (PUL SE rA):
The energy value to create one pulse is entered in this menu.
PUL SE rA can be set to one of the options below:

1, 10, 100 (W/VArh): These values are selectable when no LED is lit during parameter changing.
1, 10, 100 (W/VArh): These values are selectable when LED is lit during parameter changing.

1 W/VArh: These values are selectable when LED is lit during parameter changing.

4.2. Pulse Output-1 (Pulse o-1):
Each time the measured energy values increases by the value which is set in the “PUL SE rA” menu, one pulse is created at the PUL 1 output. Please select which energy type will be used to create a pulse when the related energy increases by the adjusted pulse ratio.
ACI (Export/Import), A-1 (Active Import), A-E (Active Export), EA (Inductive/Capacitive), rL (Reactive Inductive), rC (Reactive Capacitive).

4.3. Pulse Output-2 (Pulse o-2):
Each time the measured energy values increases by the value which is set in the “PUL SE rA” menu, one pulse is created at the PUL 2 output. Energy type will be used to create a pulse when the related energy increases by the adjusted pulse ratio.
ACI (Export/Import), A-1 (Active Import), A-E (Active Export), EA (Inductive/Capacitive), rL (Reactive Inductive), rC (Reactive Capacitive).
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**PUL SE At / PUL SE o-1 / PUL SE o-2**

1. Press SET button for 3 seconds (FA Fo menu is displayed).
2. By using UP-DOWN buttons, find “PULSE” menu.
3. Press SET button (“PUL SE At” menu is displayed).
4. By using UP-DOWN buttons, select “PUL SE At” or “PUL SE o-1” or “PUL SE o-2”.
5. Press SET button.
6. By using UP-DOWN buttons, type the required value for selected parameter.
7. Press SET button. (Data is entered but is not activated yet. Please refer to 1. Saving Parameter Changes to activate the changes.)

**5. Energy Counter (Eng Cnt) Menu**

- **PUL SE At** has 4 energy counters:
  - Energy counter 1 (E-1), Energy counter 2 (E-2), E-1 / E-2 have 4 parameters:
    - i1: Activate “E-1” / “E-2” counters for energy counting without depending on the defined rate.
    - i2: Activate “E-1” / “E-2” counters, when digital input 1 is on (i2 = 1).
    - E4: “E-2” does not count when “E-2” is activated (Only for “E-1”)
    - i4: “E-2” does not count when “E-1” is activated (Only for “E-2”)

- **Note:** Counting status is undefined if E-2 is selected on E-1 and E-1 is selected on E-4.

- When the status is defined as above, both energy counters count while digital input is not on (i2 = 0), if either one or both digital inputs are on (i2 = 1) two counters will not count.

1. Press SET button for 3 seconds (FA Fo menu is displayed).
2. By using UP-DOWN buttons, find “Eng Cnt” menu.
3. By using UP-DOWN buttons, select “E-1” or “E-2”.
4. Press SET button.
5. By using UP-DOWN buttons, select “i1”, “i2”, “i4” or “E-1” / “E-2”.
6. Press SET button. (Data is entered but is not activated yet. Please refer to 1. Saving Parameter Changes to activate the changes.)

**7. Serial Communication (Available only for EPR-04S)**

EPR-04S has MODBUS RTU communication protocol which is optical isolated. All measured parameters can be transfer to the computer. Transformer ratio and communication parameters can be set. Saved demand and energy values can be reset.

**7.1. Parameter Settings**

**Address Parameters**: Value can be enter between 001-247. Baud Rate Parameters: Value can be selected as 2400, 4800, 9600, 19200 and 38400 bps. Parity Parameters: “no”, “odd” and “EVEN” can be selected.

1. Press SET button for 3 seconds (FA Fo menu is displayed).
2. By using UP-DOWN buttons, find “RB-Add” menu.
3. Press SET button (“Add ESS” menu is displayed).
4. Find the menu which is programmed in Add ESS / bAU d / Parity menu by scrolling UP-DOWN buttons.
5. Press SET button (“001 / 000 / no” is displayed.)
6. Enter the value of related parameters by scrolling UP-DOWN buttons (001...247 / 2400...38400 bps, EVEN, odd).
7. Press SET button. Add ESS / bAU d / Parity is displayed. (Data is entered but is not activated yet. Please refer to 1. Saving Parameter Changes to activate the changes.)

**MODBUS RTU PROTOCOL (Available only for EPR-04S)**

Standard MODBUS RTU message is shown below.

<table>
<thead>
<tr>
<th>T</th>
<th>ADDRESS 8 BIT</th>
<th>FUNCTION 8 BIT</th>
<th>DATA NO8BIT</th>
<th>CH0H</th>
<th>CNCL</th>
<th>T</th>
</tr>
</thead>
</table>

The T times corresponds to a time in which data must not be exchanged on the communication bus to allow the connected devices to recognize the end of one message and the beginning of another. This time must be at least 3.5 characters at the selected baud rate. Address range (1-247) is address of the connected device. The data field contains data sent to the slave by master or data sent to master by slave.

CRC is a error check method by using MODBUS RTU protocol and consists of 2 bytes.

**Available Modbus Function:**

- 00H READ HOLD REGISTER
- 01H READ SINGLE REGISTER
- 02H READ MULTIPLE REGISTER
- 03H WRITE SINGLE REGISTER
- 04H WRITE MULTIPLE REGISTER

Read/Write (03H) function is used for reading measured values and set value. If any request of reading of a register, excepted mentioned in register table, device will send an error message.
8. User password Setup:
In this menu user passwords is defined and activated. You must define and activate a 4 digit user password for preventing device settings from the illegal usage. There are 2 sub menu under the Pin menu.

8.1. Changing of User Password:
This menu is used for changing the user
Password.
Note: Factory default value for user password is "0000"
For changing the user password in the measurement mode;
Press SET button 3 seconds
(If no menu is displayed);
By using UP-DOWN buttons
find "Pin" menu;
Press SET button (Pin AC) if IE menu is displayed
By using the UP/DOWN buttons
find Pin CH1 reg menu;
By using UP/DOWN SET button enter the old password
By using UP/DOWN SET button enter the new password
By using UP/DOWN SET button reenter the new password
Press SET button, Pin CH1 reg is displayed (Data is entered but not activated yet. Please refer to 1. Saving Parameter Changes to activate the changes.)

8.2. Activating the user password:
This menu is used for activating the user password.
When the user password is activated, while the instant values are observed user password is required in order to enter to the menu. If the wrong user password is entered, user can not enter to the menu.
Note: Factory default value of user password is "0000"
Press SET button for 3 seconds (If A Fo menu is displayed)
By using UP/DOWN buttons, find “Pin” menu
Press SET button ("Pin AC") reg menu is displayed
Press SET button, First digit of the displayed value is blinking.
Enter the blinking digit value by scrolling UP/DOWN buttons.
Switch to the other digits by using SET button, use ESC button to go to previous digit. After you entered the last digit press SET button. "Pin AC off" is displayed, "on" can be selected by scrolling UP/DOWN buttons (Data is entered but not activated yet. Please refer to 1. Saving Parameter Changes to activate the changes.)

Specifications for data cable:
- Less than 24 AWG or thicker
- Nominal characteristic impedance at 100 kHz of 100 ohms
- Less than 0.025Ω/m mutual pair capacitance (Between two wires in a pair)
- Less than 120 pF/m mutual pair capacitance (The capacitance between one wire and all others connected to earth).
- Twisted Pair

ERROR CODES (Available only for EPR-045)
When device (EPR-045) sends error message when receive any missing query.
Error codes are given below.
01 Invalid Function: If any message except given above is used, then 01 error message will be sent.
02 Invalid Register: Error 02 will be sent when a reading of a register is requested, except the registers which mentioned in table.
03 Invalid date: If any different value is been set for dedicated Transformer values and nonzero for demand value, then error message 03 will be sent.