

# MULTIMETER

## EPM-07 / EPM-07S

### Technical Data

Operating Voltage (Un)	: Please look behind the device.
Operating frequency (f)	: 45-65 Hz
Auxiliary supply Power Consumption:	< 4 VA
Measuring Input Power Consumption:	< 1VA
V <sub>In</sub>	: 10-300 V AC 45-65 Hz. (L-N) : 10-500 V AC 45-65 Hz. (L-L)
I <sub>In</sub>	: 0.05 - 5.5 A~ : 2-120 A~ (for CT-25)
Measuring Range	: 10V...200 kV AC : 0...215 M (W, VAr, VA) : 9999999999.9 kWh, kVArh
Class	: 1% ± 1 digit [(10%-110%) xFull Scale]
Voltage Transformer Ratio (Vtr)	: 0,1 ... 4000,0
Current Transformer Ratio (Ctr)	: 1 ... 2000
Max. Ctr x Vtr	: 40.000
Demand Time	: 1-60 min. (programmable)
Serial Interface (for EPM-07S)	: MODBUS RTU (RS 485) Optically Isolated, programmable
Baud Rate (for EPM-07S)	: 2400-38400 bps
Address (for EPM-07S)	: 1-247
Parity (for EPM-07S)	: No, Odd, Even, 8 Data bits, 2 Stop Bits
Pulse Output	: NPN Transistor
Switch Period	: Min. 100 msec pulse period 80 msec pulse width
Operation Current	: Max. 50 mA
Operation Voltage	: 5...24 V DC, max. 30 VDC
Input	: 12...48 V AC / DC
Ambient Temperature	: -5°C; +50°C
Display	: Red LED Display
Dimensions	: PR-19, PK-26
Equipment Protection Class	: Double Insulation-Class II (□)
Box Protection Class	: IP 40 (front panel)
Box Material	: Non-flammable
Installation	: Panel Mounted (PR-19) Rail Mounted (PK-26)
Wire Crosssection (for terminal)	: 2.5 mm <sup>2</sup>
Weight	: 0.54 kg (PR-19) 0.50 kg (PK-26)
Installation Category	: Class III

### Factory Settings

#### Trafo (Transformer) :

Ctr (Current Transformer Ratio) : 0001  
trn (Turn number for CT-25 device) : 01  
Utr (Voltage Transformer Ratio) : 0001.0  
CAL (Calculation Method) : 1

#### Eng Cnt :

E-1 (Energy Counter 1) : on  
E-2 (Energy Counter 2) : on

#### PULSE :

rAt io (Ratio) : 1  
o-1 (Output 1) : A-I  
o-2 (Output 2) : r-L

#### Pin :

0000 (Not Activated)

#### RS-485 :

Adr (Address) : 1  
Bau (Baud Rate) : 9600  
PAr (Parity) : no

#### dEtt (Demand Time) : 15

### Precautions For Installation and Safe Use

**⚠ In CT-25 (120A) compliant models, only CT-25 current transformer must be used. Other type of CT's have a high risk to damage to device.**

Failure to follow those 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 solvent or the like. Only clean with dry cloth.
- Verify correct terminal connections when wiring.
- Electrical equipment should be serviced only by your component seller.
- No responsibility is assumed by manufacturer or any of its subsidiaries for any consequences arising out of the use of this material.
- Only for rack panel mounting.
- Fuse must be F type and limit value doesn't exceed 1A.

**⚠ No responsibility is assured by the manufacturer or any of its subsidiaries for any consequences arising out of the use of this material.**

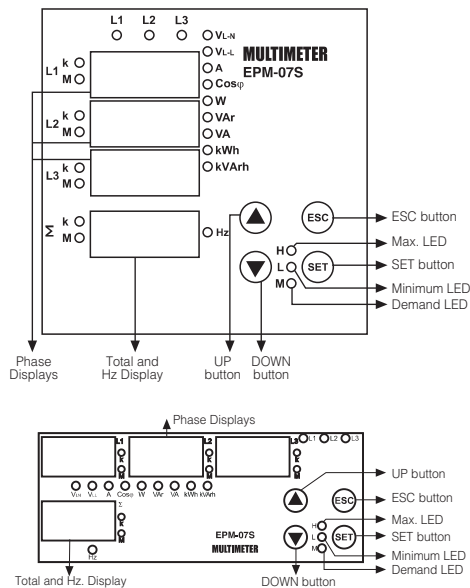


# MULTIMETER

## EPM-07 / EPM-07S

### General

EPM-07/07S is a microprocessor based device which was developed for measuring the parameters in an electrical network. Measured parameters are displayed in 4 displays separately. EPM-07S has a MODBUS serial communication interface.



### Using of EPM-07/07S:

Parameters (V<sub>LN</sub>, V<sub>LL</sub>, A, W, VAr, VA, Cosφ, kWh, kVArh, THD) are monitored in L-1, L-2, L-3 displays by pressing UP/DOWN buttons. Total Active (ΣW), Total Reactive Power (ΣVAr), Total Apparent Power (ΣVA) and Frequency (Hz) values and average values of these parameters are monitored in 4th display.

**Note:** V<sub>LN</sub> or V<sub>LL</sub> should be selected for displaying the frequency value.

#### Digital Inputs

EPM-07/07S has 2 digital inputs. Digital inputs have 2 functions:  
- When a remote device has activated, situation of this device which is connected to the digital input, can be monitored according to data register (Battery, thermostat, circuit breaker and motor position).  
- When the digital inputs have activated in Energy Count menu, device will control the Energy Counters (**Example:** It is used for measuring of energy separately at the using of network and generator).

#### Energy Pulse Outputs

EPM-07/07S has 2 Energy Pulse Outputs. These outputs give the pulses only for E-1 (Energy Counter).

**Pul1 and Pul2:** In "o-1 (Pulse1)", "o-2 (Pulse2)" menus which are in the pulse menu, device give pulse according to selected energy parameters as [Active energy (A-Ct, A-I, A-E), Reactive energy (rEA, r-L, r-C)].  
Please refer to the pulse menu for the coefficients of energies.

#### Monitoring Min.- Max. and Max. Demand Values:

Min. and Max. values are defined for V<sub>LN</sub>, V<sub>LL</sub>, A, W, VAr, VA, ΣW, ΣVAr, ΣVA. Demand values are defined for A, W, VAr, VA, ΣW, ΣVA, ΣVAr. If measured instant value is smaller than min. value which was stored before, it is stored as new min. value. If measured instant value is greater than max. value which was stored before, it is stored as new max. value. Demand value is the average value of the measured values in demand time (15 minutes).

If one of defined parameters is displayed (ie. "W") when demand button is pressed min., max or max. demand values are displayed. When an undefined parameter is displayed (ie. "Cosφ") if demand button is pressed, instant value is continued to display.

#### H-L-M LEDs

H-L-M LEDs are dedicated to displaying the min., max. and max. demand values according to selected parameters.

H: Maximum Value, L: Minimum Value, M: Max. Demand Value

### Calculation Methods for Active / Reactive Power Values

If the LED on the most right side blinks it represents that active power's / reactive power's direction is negative.

There are two methods for calculating total active and total reactive powers :

- 1) Active / Reactive power can be calculated by summing import and export values and displaying as a single value.
- 2) Active / Reactive power can be calculated according to direction as import / export.

#### Note :

- 1) The dot at the most right digit of the fourth display (During ΣW is displayed) represents that displayed value is export active power value. Vice versa, displayed value is import active power value.
- 2) The dot at the most right digit of the fourth display (During ΣVAr is displayed) represents that displayed value is capacitive reactive power value. Vice versa, displayed value is inductive reactive power value.
- 3) The displayed parameter will not change if power is off after 30 seconds of stand-by (ie. W).

#### Measured Parameters:

V <sub>LN</sub> (Phase Voltage)	Cosφ	Hz (Frequency)
V <sub>LL</sub> (Phase to Phase Voltage)	AI ( kWh) (Import Active Energy I)	I <sub>N</sub> (Neutral Current)
A (Phase Current)	AE ( kWh) (Export Active Energy)	ΣW (Total Active Power)
W (Active Power)	rI (kVArh) (Import Reactive Energy)	ΣVAr (Total Reactive Power)
VAr (Reactive Power)	rE(kVArh) (Export Reactive Energy)	ΣVA (Total Apparent Power)
VA (Apparent Power)		

### FUNCTIONS OF BUTTONS

**▲** In the monitoring mode, it is used to pass between (V<sub>LN</sub>, V<sub>LL</sub>, A, W, VAr, VA, Cosφ, kWh, kVArh) parameters. At the programming mode, it provides to increase value of desired parameter and pass to the next menu.

**▼** In the monitoring mode, it is used to pass between (V<sub>LN</sub>, V<sub>LL</sub>, A, W, VAr, VA, Cosφ, kWh, kVArh) parameters. At the programming mode, it provides to decrease value of desired parameter and pass to the previous menu.

**SET** It is used for passing between the instant values such as. When it is pressed for 3 second, programming mode is entered. In the programming mode it is used for saving parameters and moving the sub menu.

**ESC** In displaying mode, it is used for; passing the instant values which are displayed for min., max. and demand values in displaying mode, turn back to the previous menu turn back to the previous digit, when changing the numerical values and quitting the programming mode without saving.

**⚠** 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.

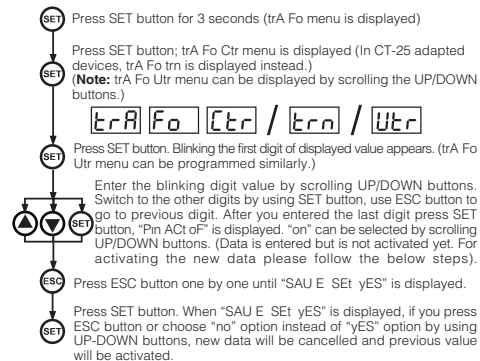
### Current Transformer Ratio Setup

(This menu is not available in the devices which are adapted with CT-25.)

In this menu, current transformer ratio is set between 1 - 2000.

**Note:** If the current transformer is not used between the system and EPM-07/07S, current transformer ratio is entered as "1".

**Example:** If a current transformer which has a ratio of 250/5A is used between the system and EPM-07/07S; Current transformer ratio is entered as "50" (250/5).



# MULTIMETER EPM-07 / EPM-07S

## trA 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 tour the current cable has rounded into the CT-25. Numbers can be selected between 1-20. Greater the number of turn means greater the sensitivity.

trn	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
min(A)	2.00	1.00	0.66	0.50	0.40	0.33	0.28	0.24	0.20	0.18	0.16	0.15	0.14	0.13	0.12	0.11	0.10	0.10	0.10	0.10
max(A)	120	60.0	40.0	30.0	24.0	20.0	17.1	15.0	13.3	12.0	10.9	10.0	9.23	8.57	8.00	7.50	7.06	6.66	6.31	6.00

## Voltage Transformer Ratio Setup

In this menu, voltage transformer ratio is set between 0000,1 - 4000,0.

**trA** Note: If the voltage transformer is not used between the system and EPM-07/07S, voltage transformer ratio is entered as '1'.  
**Fo** **Example:** If a voltage transformer which has a ratio of 34.5KV/100V is used between the system and EPM-07/07S, Voltage transformer ratio is entered as 345. (34500/100)

## Reactive Energy Calculation Method Setting

**CAL** Three different methods exist for reactive energy calculation in EPM-07/07S. Brief informations about these methods are explained in below table.  
**CLT** Related values which must be entered in the menu are also indicated in the table in order to select reactive power calculation method for mechanical and digital energymeters.

Mechanical Energymeter (Vectorial summation of 3 phase)	Digital Energymeter (Each phase separately)	Reactive Energy (Q)	Description
0	1	90° rotation of voltage vector and multiply with current	It is the most preferred reactive power calculation method.
2	3	$\sum V_n \cdot I_n \cdot \sin(\varphi_n)$	Total value of the multiplication of $V_n$ and $I_n$ values up to 19 th harmonics. This calculation method is mostly preferred for network analysers.
4	5	Power Triangle Methode : According to this methode; $Q = S \cdot \sin \phi$ (Q : Reactive power, S : Apparent power, P : Active power)	

- Press SET button for 3 seconds (trA Fo menu is displayed)
- Press SET button (trA Fo Ctr menu is displayed)
- By using UP-DOWN buttons, find "CAL CLT" menu.
- Press SET button.
- By using UP-DOWN buttons, select energy calculation method.
- Press SET button.
- Press ESC button one by one until "SAU E SET yES" is displayed.
- Press SET button. When "SAU E SET yES" is displayed, if you press ESC button or choose "no" option instead of "yES" option by using UP-DOWN buttons, new data will be cancelled and previous value will be activated.

## Demand Time Setup:

**dE** In this menu, demand time is set between 1-60 minutes.

- Press SET button for 3 seconds (trA Fo menu is displayed)
- By using UP-DOWN buttons find "dE t1" menu.
- Press SET button (First digit blinks.)
- By using UP-DOWN buttons, enter the value to the first digit.
- Press SET button (Second digit blinks)
- By using UP-DOWN buttons, enter the value to the second digit.
- Press SET button, "dE t1" is displayed. (Data is entered but is not activated yet. For activating the new data please follow the below steps).
- Press ESC button one by one until "SAU E SET yES" is displayed.
- Press SET button. When "SAU E SET yES" is displayed, if you press ESC button or choose "no" option instead of "yES" option by using UP-DOWN buttons, new data will be cancelled and previous value will be activated.

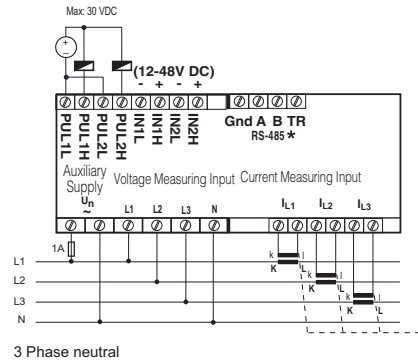
## Monitoring and Erasing of minimum, maximum and energy values:

**rES** In this menu, values of min., max. or energy counters are erased. It saves the instantaneously measured min. and max. values of EPM-07/07S into its memory. Please kindly look at to the section of **FUNCTIONS OF BUTTONS** for min. and max. values.  
**Et** **Note :** Measured electrical parameters which are saved to the memory are not affected from the electric interruptions. In the "rESEt" menu; when you quit from all menus, if you confirm the changes, min. and max. values of all parameters or energy counter values are erased at the same time.

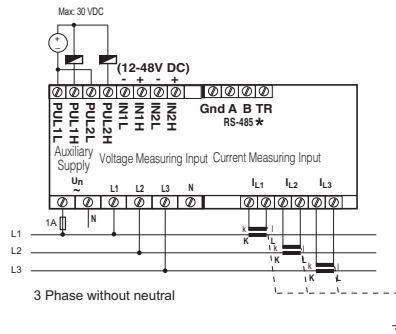
- For erasing the values of min. and max. or energy counter, In the measurement mode :**
- Press SET button for 3 seconds (trA Fo menu is displayed)
  - By using UP-DOWN buttons, find "rES Et" menu.
  - Press SET button. ("rESEt HL" menu is displayed)
  - By using UP-DOWN buttons, select which parameter you want to reset.
  - Press SET button
  - By using UP-DOWN buttons, if you want to delete the parameter select "yES" option otherwise select "no" option.
  - Press SET button. ("rES Et" is displayed)
  - Press ESC button one by one until "SAU E SET yES" is displayed.
  - Press SET button. When "SAU E SET yES" is displayed, if you press ESC button or choose "no" option instead of "yES" option by using UP-DOWN buttons, new data will be cancelled and previous value will be activated.

# MULTIMETER EPM-07 / EPM-07S

## PK 26 Box Connection Diagram



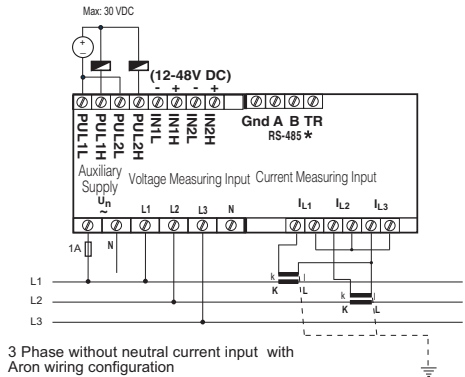
3 Phase neutral



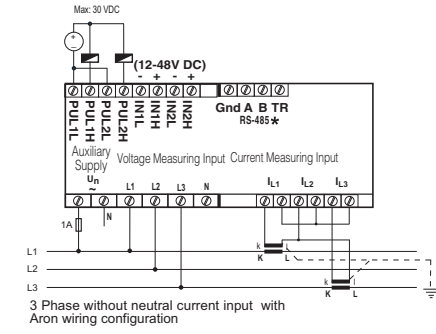
3 Phase without neutral

\*Available only for EPM-07S

**Note: For CT-25 models:**  
**k:** When CT-25 is used, Red cable is connected to k terminal.  
**I:** When CT-25 is used, Black cable is connected to I terminal.



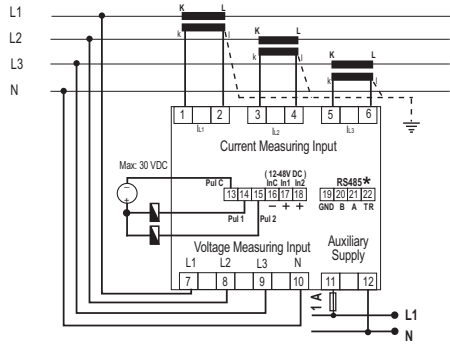
3 Phase without neutral current input with Aron wiring configuration



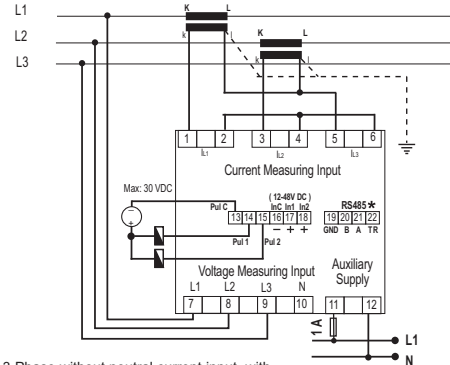
3 Phase without neutral current input with Aron wiring configuration

# MULTIMETER EPM-07 / EPM-07S

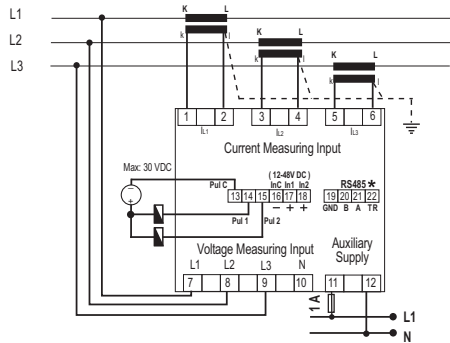
## PR 19 Box Connection Diagram



3 Phase neutral



3 Phase without neutral current input with Aron wiring configuration



3 Phase without neutral

\*Available only for EPM-07S

**Note: For CT-25 models:**

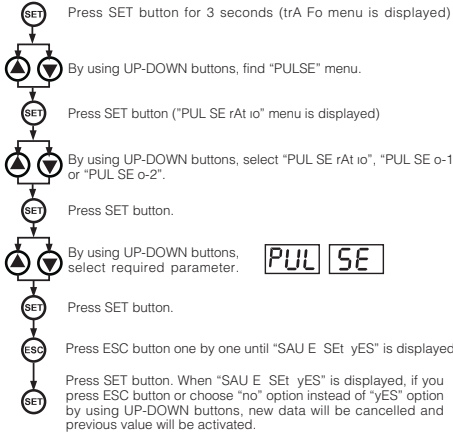
**k:** When CT-25 is used, Red cable is connected to k terminal.  
**l:** When CT-25 is used, Black cable is connected to l terminal.

# MULTIMETER EPM-07 / EPM-07S

## Pulse Menu

In this menu, three parameters can be selected: "PUL SE rAt io", "PUL SE o-1", "PUL SE o-2"  
**PUL SE** : Pulse ratio can be set as : 1, 10, 100 (wh/VArh); 1, 10, 100 (kwh/kVArh); 1 Mwh/MVArh.

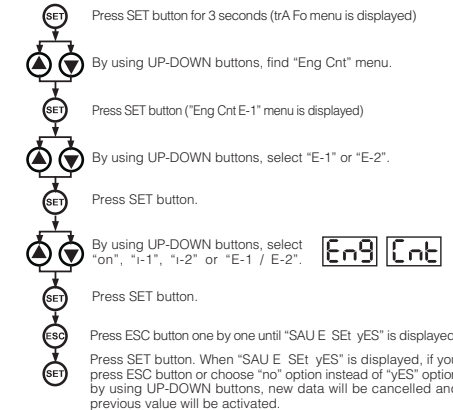
**PUL SE o-1** : If this parameter is selected, in every increase in output 1, one pulse is counted. Output 1 parameter can be set as : ACt (Export/Import), A-I (Active Import), A-E (Active Export), rEA (Inductive / Capacitive), r-L (Reactive Inductive), r-C (Reactive Capacitive).  
**PUL SE o-2** : If this parameter is selected, in every increase in output 2, one pulse is counted. Output 2 parameter can be set as : ACt (Export/Import), A-I (Active Import), A-E (Active Export), rEA (Inductive / Capacitive), r-L (Reactive Inductive), r-C (Reactive Capacitive).



## Energy Counter (Eng Cnt) Menu

EPM-07/07S has 2 energy counters :  
Energy counter 1 (E-1), Energy counter 2 (E-2).  
E-1 / E-2" have 4 parameters :  
on : Activate "E-1 / E-2" counters for energy counting without depending on any parameter.  
i-1 : Activate "E-1 / E-2" counters, when digital input 1 is on (=1).  
i-2 : Activate "E-1 / E-2" counters, when digital input 2 is on (=1).  
E-2 : "E-1" does not count when "E-2" is activated. (Only for "E-1")  
E-1 : "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 if E-1 is selected on E-2. When the status is defined as above, both energy counters count while digital input is not on (=1), but if either one or both digital inputs are on (=1) then counters will not count.



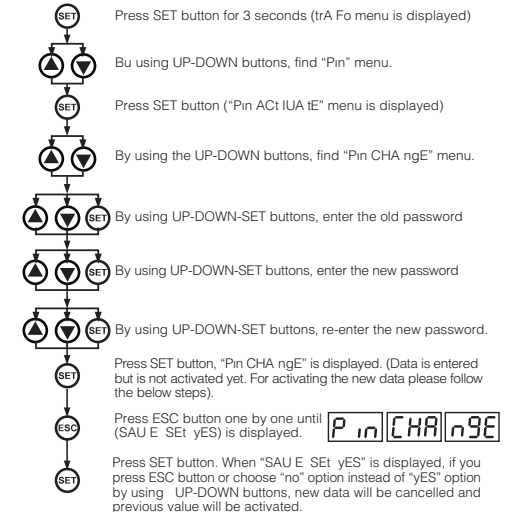
## User password Setup:

**Pin** In this menu user password 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 menus under the "Pin" menu.

### Changing of User Password:

This menu is used to change the user password .  
**Note:** Factory default value for user password is "0000"

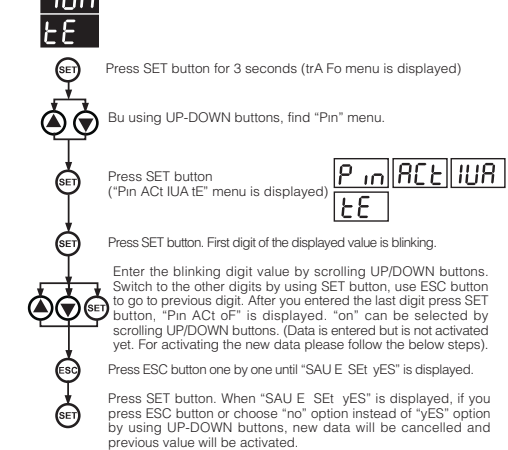
To change the user password, in the monitoring mode :



## Activating the user password:

This menu is used for activating the user password. After 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"



# MULTIMETER EPM-07 / EPM-07S

## Serial Communication (Available only for EPM-07S)

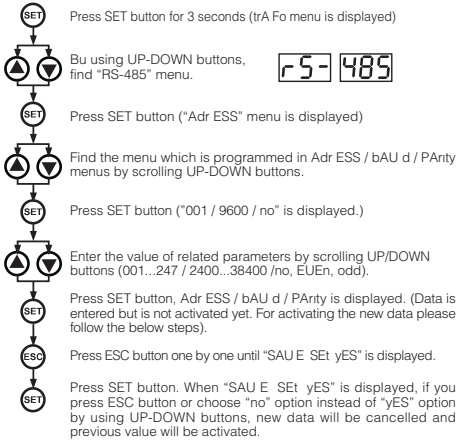
EPM-07S has MODBUS RTU communication protocol which is optically isolated. All measured parameters can be transferred to the computer. Transformer ratios and communication parameters can be set. Saved demand and energy values can be reset.

### 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 "EUn" can be selected.



## MODBUS RTU PROTOCOL (Available only for EPM-07S)

Standart MODBUS RTU message is shown below.

T	ADDRESS 8 BIT	FUNCTION 8 BIT	DATA NX8BIT	CRCH	CRCL	T
---	------------------	-------------------	----------------	------	------	---

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:

03H	READ HOLD REGISTERS
06H	PRESET SINGLE REGISTER
10H	PRESET MULTIPLE REGISTERS

Read Hold (03) 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. For example to read phase1 voltage by sending a message to the device.

```
01 03 00 00 00 02 XX XX
01 Device address
03 Function
00 MSB address
00 LSB address
00 Register number MSB
02 Register number LSB
XX CRC MSB
XX CRC LSB
```

Preset Single Register (06) function is used for writing the setting values, erasing the energy counter or resetting the min., max., demand values. Current transformers ratio can be set 0-2000, voltage transformer ratio can be set 1-40000. Min., Max. and Demand values can be only clear. If sent value is outside of this range device responds with an error message.

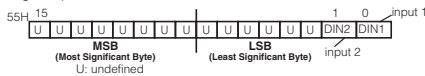
**Example.** Setting CT as 100;  
01 06 80 02 00 64 XX XX  
01 Device address  
06 Function  
80 MSB address  
02 LSB address  
00 Data MSB  
64 Data LSB  
XX CRC MSB  
XX CRC LSB

Preset Multiple Register(10H) is used to set more then one register at same time.

**Example.** Setting CT as 100, Ut as 20.0;  
01 10 80 00 00 02 04 00 C8 00 64 XX XX  
01 Device Address  
10 Function  
80 MSB address  
00 LSB address  
00 Register number MSB  
02 Register number LSB  
04 Byte count  
00 Data MSB  
C8 Data LSB  
00 Data MSB  
64 Data LSB  
XX CRC MSB  
XX CRC LSB

## Digital Inputs (Available only for EPM-07S)

Digital input are sent in 16 bit hexadecimal format as below:



If 12-48 V AC / DC is applied to In1 (Input 1), 0 (zero) bit of DIN register is set as "1". Otherwise, 0 (zero) bit is set as "0".  
If 12-48 V AC / DC is applied to In2 (Input 2), 1st bit of DIN register is set as "1". Otherwise, 1st bit is set as "0".

The Parameters are sent in 32bit Hexadecimal format. For Example, 230.0V voltage will be sent as 000008FCH. Cosφ values shall be divided to 1000.  
0.980 Cosφ will be sent as 000003D4H. Energy values are sent in 64 bytes.  
1234567890123456789 Wh = AB 54 A9 8C EB 1F 0A D2 Wh

### Specifications for data cable :

- 24 AWG or thicker
- Less than 100 ohm/ km
- Nominal characteristic impedance at 100 kHz of 100 ohms
- Less than 60 pF/m mutual 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 EPM-07S)

Slave device (EPM-07S) 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 messages will be sent.

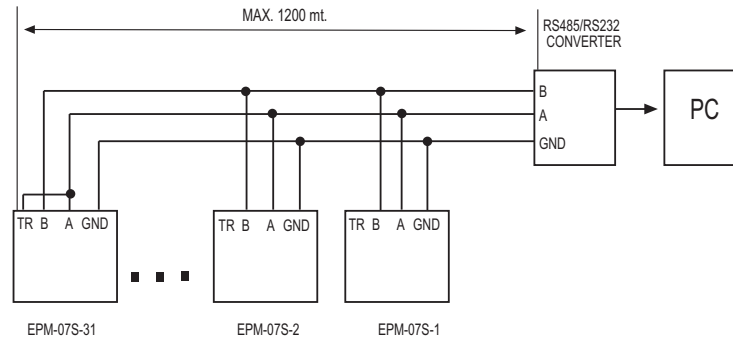
**02 Invalid Register:** Error 02 will be send when a reading of a register is requested, except the registers which mentioned in table.

**03 Invalid data:** If any different value is been set for dedicated Transformer values and nonzero for demand value, then error message 03 will be sent.

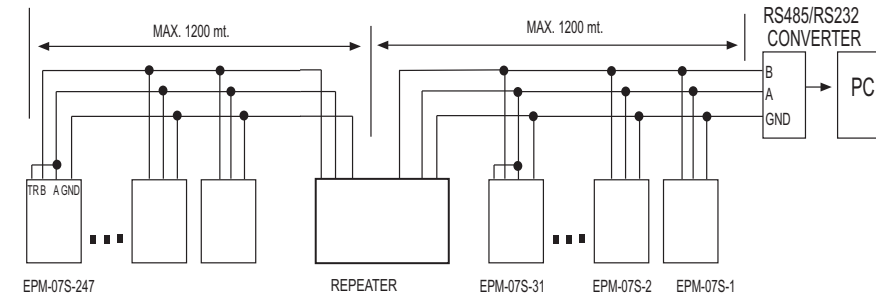
# MULTIMETER EPM-07 / EPM-07S

## EPM-07S COMPUTER CONNECTION

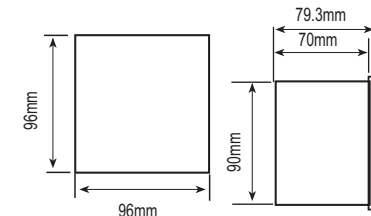
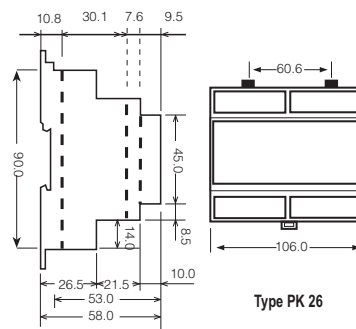
31 DEVICES CAN BE CONNECTED AT THE SAME LINE



MAX. 247 DEVICES CAN BE CONNECTED AT SAME LINE BY USING REPEATER.

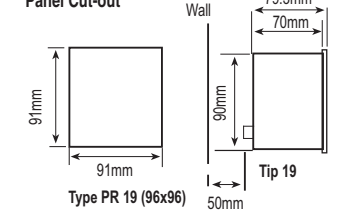


## Dimensions



Type PR 19

### Panel Cut-out



Type PR 19 (96x96)